

# Secondary Two Express Examination Papers

*2014*

## Mathematics

<b>1</b>	<b>Nanyang Girls' School</b>	<b>SA1</b>	
<b>2</b>	<b>Beatty Secondary School</b>	<b>SA1</b>	<b>SA2</b>
<b>3</b>	<b>Dunearn Secondary School</b>	<b>SA1</b>	
<b>4</b>	<b>Geylang Methodist School</b>	<b>SA1</b>	
<b>5</b>	<b>Holy Innocents' High School</b>	<b>SA1</b>	
<b>6</b>	<b>MacPherson Secondary School</b>		<b>SA2</b>
<b>7</b>	<b>Northland Secondary School</b>	<b>SA1</b>	
<b>8</b>	<b>Yishun Secondary School</b>	<b>SA1</b>	
<b>9</b>	<b>Fairfield Methodist School</b>		<b>SA2</b>
<b>10</b>	<b>HillGrove Secondary School</b>		<b>SA2</b>

*Click on the above hyperlinks for easy searching*

Class	Register Number	Name
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南洋女子中学校  
NANYANG GIRLS' HIGH SCHOOL

Mid-Year Examination 2014  
Secondary Two

**INTEGRATED MATHEMATICS**

1 hour

Paper 1

Monday

12 May 2014

0845 - 0945

**READ THESE INSTRUCTIONS FIRST**

**INSTRUCTIONS TO CANDIDATES**

1. Write your name, register number and class in the spaces at the top of this page.
2. Answer all the questions.
3. Write your answers and working in the spaces provided on the question paper.
4. All working must be written in dark blue or black ink.
5. Omission of essential working will result in loss of marks.
6. Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
7. The use of calculators is allowed for this paper.

**INFORMATION FOR CANDIDATES**

1. The number of marks is given in brackets [ ] at the end of each question or part question.
2. The total number of marks for this paper is 40.
3. You are reminded of the need for clear presentation in your answers.

This document consists of 9 printed pages.

Setter: C Poon & L Lioe

NANYANG GIRLS' HIGH SCHOOL

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1. Solve the following equations:

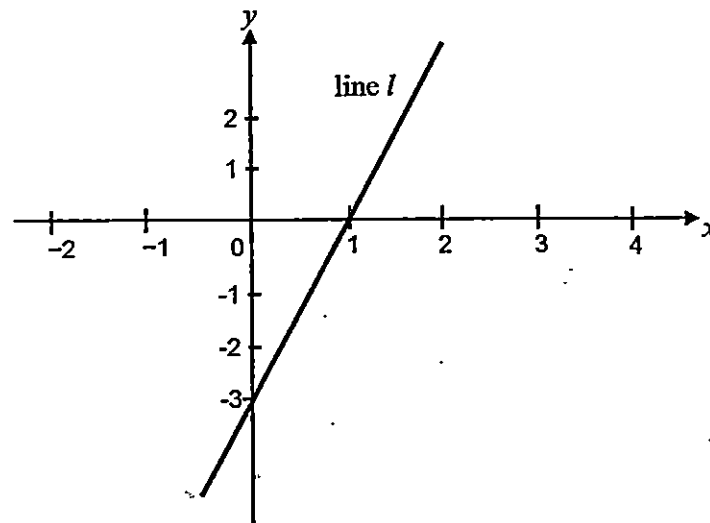
(a)  $3y^2 = 5y$ ,

(b)  $(2x+1)(x-3) = (x+3)(x-3)$ .

Answer : (a)  $y = \underline{\hspace{2cm}}$  . [2]

(b)  $x = \underline{\hspace{2cm}}$  [3]

2.

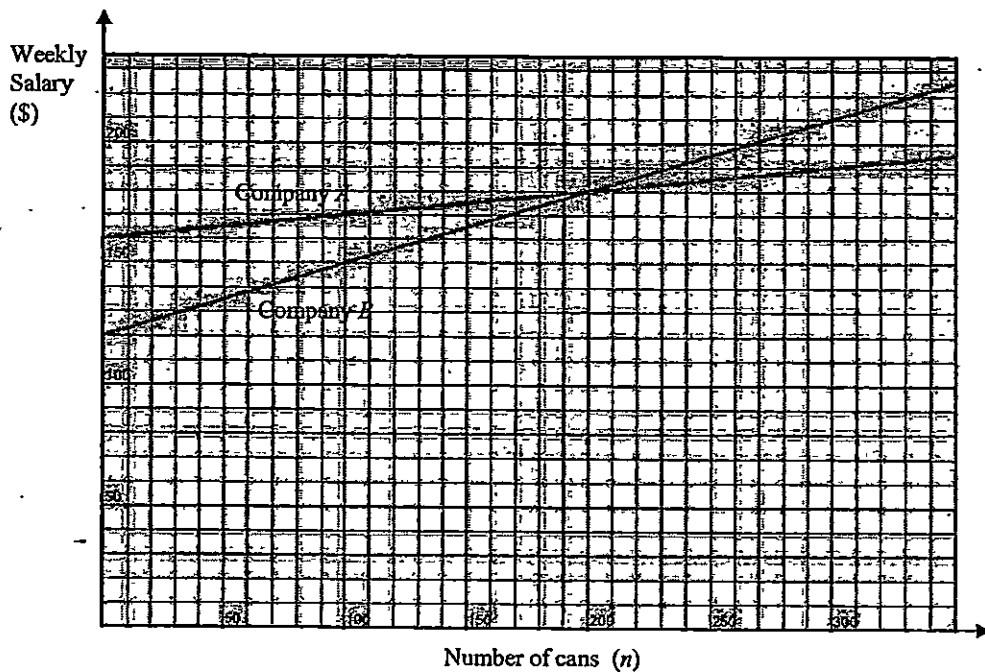


- (a) Show that the equation of line  $l$  can be written as  $3x - y = 3$ . [2]
- (b)  $(8, p)$  is a point on line  $l$ . Find the value of  $p$ .
- (c) Find the equation of line  $k$  that is parallel to line  $l$  and passes through  $(-2, 1)$ .

Answer : (b)  $p =$  \_\_\_\_\_ [1]

(c) \_\_\_\_\_ [2]

3.



The graphs above show the amount of weekly salary offered by two different canned food companies, Company A and Company B, based on the number of cans sold. The weekly salary offered by Company B is represented by the equation  $S = kn + p$ , where  $S$  is the amount of salary in dollars and  $n$  is the number of cans sold.

- State the value of  $p$  and explain its significance.
- Calculate the value of  $k$  and explain its significance.
- Mandy is interested to be a sales promoter in either Company A or B. In her previous company, she consistently sells at least 210 cans per week. Which company would you recommend Mandy to apply for the job? State your reason clearly.

Answer : (a)  $p =$  \_\_\_\_\_ ; Significance: \_\_\_\_\_ [2]

(b)  $k =$  \_\_\_\_\_ ; Significance: \_\_\_\_\_ [2]

(c) \_\_\_\_\_ [2]

4. Make  $x$  the subject of the following formulae:

(a)  $\frac{1}{y} - \frac{2}{x} = 1,$

(b)  $(y+1)^2 = 2 - 3(x-a)^2.$

Answer : (a)  $x =$  \_\_\_\_\_ [3]

(b)  $x =$  \_\_\_\_\_ [4]

5. Express  $x$  in terms of  $t$ .

$$\sqrt{\frac{x^2 + 15t - 3}{x^2}} = 5t, \text{ where } t \geq 0, x \neq 0.$$

Answer:  $x =$  \_\_\_\_\_ [4]



6. Simplify the following and express as a single fraction.

(a)  $(-2bc + 8b) \times \frac{(-2a^3b)^2}{a^5b(c-4)^2},$

(b)  $3(ab)^2 \div \frac{2a^4 - 32b^4}{a^2 - ab - 2b^2} \times \frac{(a+2b)^2}{9a^4b^2}.$

Answer :(a) \_\_\_\_\_ [3]

(b) \_\_\_\_\_ [5]

7. Solve the following pair of simultaneous equations.

$$2y^2 - xy + 2x = 3$$

$$2x + 1 = 3y$$

Answer:  $x = \underline{\hspace{2cm}}$ ,  $y = \underline{\hspace{2cm}}$

or  $x = \underline{\hspace{2cm}}$ ,  $y = \underline{\hspace{2cm}}$  [5]

**End of Paper 1**



Class	Register Number	Name
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**南洋女子中學校**  
**NANYANG GIRLS' HIGH SCHOOL**

**Mid-Year Examination 2014**  
**Secondary Two**

**INTEGRATED MATHEMATICS**

**1 hour**

**Paper 2**

**Thursday**

**8 May 2014**

**1030 - 1130**

**READ THESE INSTRUCTIONS FIRST**

**INSTRUCTIONS TO CANDIDATES**

1. Write your name, register number and class in the spaces at the top of this page.
2. Answer all the questions.
3. Write your answers and working on the separate answer paper provided.
4. All working must be written in dark blue or black ink.
5. Omission of essential working will result in loss of marks.
6. Write your name, register number and class on each separate sheet of paper that you use and fasten the separate sheets together with the string provided. Do not staple your answer sheets together.
7. Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
8. The use of calculators is allowed for this paper.

**INFORMATION FOR CANDIDATES**

1. The number of marks is given in brackets [ ] at the end of each question or part question.
2. The total number of marks for this paper is 40.
3. You are reminded of the need for clear presentation in your answers.

This document consists of 5 printed pages.

**Setter: L Lioe & C Poon**

**NANYANG GIRLS' HIGH SCHOOL**

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- 1 (a) Sketch the following graphs on the **same axes**. Label your graphs and the intercepts (if any) clearly.

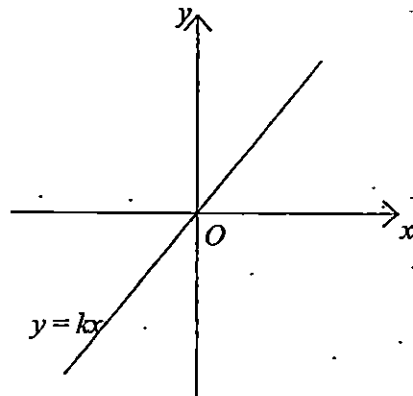
(i)  $x = -3$ , [1]

(ii)  $y = 2$ , [1]

(iii)  $y = 2x + 1$ , [2]

(iv)  $2y - x + 11 = 0$ . [2]

- (b) The graph of  $y = kx$ , where  $k > 0$ , is shown below. Copy the graph onto your answer script and sketch  $y = 2kx + c$ , where  $c < 0$ , on the same axes. Label your graphs and the intercepts (if any) clearly. [2]



- 2 (a) Given the expression

$$\frac{4-x}{-2x^2+9x-4}, \quad x \neq 4,$$

state another value of  $x$  that makes the equation invalid. [1]

- (b) Simplify the above expression. [2]

- (c) Hence, solve the following equation:

$$\frac{4-x}{-2x^2+9x-4} + \frac{4}{4x-2} = \frac{x+4}{x^2-16} \quad [4]$$

- 3  $(a, 1)$  is a solution of the following simultaneous equations,  $ax = 7 + by$  and  $ay = 3b - x$ . Find the values of  $a$  and  $b$ . [5]

[Turn Over]

- 4 Paul wanted to buy  $x$  kg of coffee powder that would cost him \$60.
- Write down an expression, in terms of  $x$ , for the cost price of 1 kg of coffee powder. [1]
  - He decided to buy tea leaves instead after he realised that he could get an extra 3 kg of tea leaves for the same amount of money. Write down an expression, in terms of  $x$ , for the cost price of 1 kg of tea leaves. [1]
  - The cost price of 1 kg of coffee powder is \$4.50 more than that of 1 kg of tea leaves. Form an equation in  $x$  and show that it reduces to  $x^2 + 3x - 40 = 0$ . [3]
  - Solve the equation in (c). [2]
  - Hence, find the cost price of 1 kg of tea leaves. [1]

5 Answer the whole of this question on a sheet of graph paper.

The variables  $x$  and  $y$  are connected by the equation  $y = 2x^2 + 3x - 1$ . The following table shows some corresponding values of  $x$  and  $y$ .

$x$	-5	-4	-3	-2	-1	0	1	2	3
$y$	34	$a$	8	1	-2	-1	4	$b$	26

- Calculate the values of  $a$  and  $b$ . [2]
- Using a scale of 2 cm to represent 1 unit, draw a horizontal  $x$ -axis for  $-5 \leq x \leq 3$ . Using a scale of 2 cm to represent 5 units, draw a vertical  $y$ -axis for  $-5 \leq y \leq 35$ . Plot the graph of  $y = 2x^2 + 3x - 1$ , for  $-5 \leq x \leq 3$ . [3]
- From your graph, find
  - the value of  $y$  when  $x = 2.2$ , [1]
  - the values of  $x$  when  $y = 20$ , [2]
  - the coordinates of the point where  $y$  is the minimum. [1]
- State the equation of the line of symmetry. [1]
- By drawing a suitable straight line on the same axes, use your graphs to solve the following equation  $2x^2 + 3x - 11 = 0$  for the range  $-5 \leq x \leq 3$ . [2]

**Bonus Question**

6

A complex number  $z$  can be represented as  $z = x + yi$ , where  $x$  and  $y$  are both real number, and  $i = \sqrt{-1}$  and  $i^2 = -1$ . Show that two complex numbers,  $z = \frac{3}{2} \pm \frac{i}{2}$ , are solutions of the quadratic equation  $2z^2 - 6z + 5 = 0$ .

[2]

**End of Paper 2**







## Sec 2 MYE 2014 Solutions (Paper 1)

1a	$3y^2 = 5y$ $y(3y - 5) = 0$ $y = 0$ or $y = 1\frac{2}{3}$
1b	$(2x+1)(x-3) = (x+3)(x-3)$ $(x-3)(2x+1-x-3) = 0$ $(x-3)(x-2) = 0$ $x = 3$ or $x = 2$  or  $(2x+1)(x-3) = (x+3)(x-3)$ $2x^2 - 5x - 3 = x^2 - 9$ $x^2 - 5x + 6 = 0$ $(x-3)(x-2) = 0$ $x = 3$ or $x = 2$
2a	Using two points (0, -3) and (1, 0), $\text{gradient} = \frac{0 - (-3)}{1 - 0}$ $= 3$ $y\text{-intercept} = -3$  Equation of the line: $y = 3x - 3$ $3x - y = 3$
2b	$p = 21$
2c	The equation of line $k$ is $y = 3x + C$ Sub $x = -2, y = 1$ into the equation. $1 = 3(-2) + C$ $C = 7$ The equation is $y = 3x + 7$

3a	$p = 120$ The fixed amount of salary  <u>Other accepted answers:</u> Basic salary, minimum/lowest salary, salary when no can is sold.
3b	$k = 0.3$ For every additional 1 can sold, the salary increases by \$0.30 (or 30 cents)
3c	Company B. When the number of cans sold is greater than 200, company B offer higher salary than company A, OR when $n = 210$ , company B offers higher salary (\$185) than company A (\$180).
4a	$\frac{1}{y} - \frac{2}{x} = 1$ $\frac{2}{x} = \frac{1}{y} - 1$ $\frac{2}{x} = \frac{1-y}{y}$ $2y = x(1-y)$ $x = \frac{2y}{1-y}$
4b	$(y+1)^2 = 2 - 3(x-a)^2$ $2 - (y+1)^2 = 3(x-a)^2$ $(x-a)^2 = \frac{2 - (y+1)^2}{3}$ $x-a = \pm \sqrt{\frac{2 - (y+1)^2}{3}}$ $x = a \pm \sqrt{\frac{2 - (y+1)^2}{3}}$

5	$\sqrt{\frac{x^2 + 15t - 3}{x^2}} = 5t$ $\frac{x^2 + 15t - 3}{x^2} = 25t^2$ $x^2 + 15t - 3 = 25x^2t^2$ $x^2 - 25x^2t^2 = 3 - 15t$ $x^2(1 - 25t^2) = 3 - 15t$ $x^2 = \frac{3 - 15t}{1 - 25t^2}$ $x^2 = \frac{3(1 - 5t)}{(1 + 5t)(1 - 5t)}$ $x = \pm \sqrt{\frac{3}{1 + 5t}}$
6a	$(-2bc + 8b) \times \frac{(-2a^3b)^2}{a^5b(c-4)^2}$ $= [-2b(c-4)] \times \frac{4a^6b^2}{a^5b(c-4)^2}$ $= \frac{-8ab^2}{c-4}$
6b	$3(ab)^2 \div \frac{2a^4 - 32b^4}{a^2 - ab - 2b^2} \times \frac{(a+2b)^2}{9a^4b^2}$ $= 3a^2b^2 \times \frac{(a-2b)(a+b)}{2(a^2 + 4b^2)(a-2b)(a+2b)} \times \frac{(a+2b)^2}{9a^4b^2}$ $= \frac{(a+2b)(a+b)}{6a^2(a^2 + 4b^2)}$

7

$$2y^2 - xy + 2x = 3 \text{ --- (1)}$$

$$2x + 1 = 3y \text{ --- (2)}$$

From (2)

$$2x = 3y - 1$$

$$x = \frac{3y-1}{2} \text{ --- (2a)}$$

Sub (2a) into (1)

$$2y^2 - y\left(\frac{3y-1}{2}\right) + 3y - 1 = 3$$

$$2y^2 - \frac{3y^2 - y}{2} + 3y - 1 = 3$$

$$4y^2 - 3y^2 + y + 6y - 2 = 6$$

$$y^2 + 7y - 8 = 0$$

$$(y+8)(y-1) = 0$$

$$y = -8 \text{ or } y = 1$$

$$\therefore x = -12\frac{1}{2}, y = -8 \text{ or } x = 1, y = 1$$



## Sec 2 MYE 2014 Solution (Paper 2)

1a	
1b	
2a	$x = 0.5$
2b	$\frac{4-x}{-2x^2+9x-4}$ $= \frac{4-x}{(-2x+1)(x-4)}$ $= \frac{1}{2x-1}$
2c	$\frac{4-x}{-2x^2+9x-4} + \frac{4}{4x-2} = \frac{x+4}{x^2-16}$ $\frac{1}{2x-1} + \frac{4}{2(2x-1)} = \frac{x+4}{(x+4)(x-4)}$ $\frac{1}{2x-1} + \frac{2}{2x-1} = \frac{1}{x-4}$ $\frac{3}{2x-1} = \frac{1}{x-4}$ $3x-12 = 2x-1$ $x=11$

3	<p>At (a,1),</p> $a^2 = 7 + b \text{ --- (1)}$ $a = 3b - a$ $2a - 3b = 0 \text{ --- (2)}$ <p>From (2),</p> $b = \frac{2}{3}a \text{ --- (2a)}$ <p>Sub (2a) into (1)</p> $a^2 = 7 + \frac{2}{3}a$ $3a^2 - 2a - 21 = 0$ $(3a + 7)(a - 3) = 0$ $a = -\frac{7}{3} \text{ or } a = 3$ <p>Sub <math>a = -\frac{7}{3}</math> into (2a):</p> $b = \frac{-14}{9}$ <p>Sub <math>a = 3</math> into (2a):</p> $b = 2$ <p><math>\therefore a = 3, b = 2</math> or <math>a = -\frac{7}{3}, b = -\frac{14}{9}</math></p>
4a	$\frac{60}{x}$
4b	$\frac{60}{x+3}$
4c	$\frac{60}{x} = \frac{60}{x+3} + 4.5$ $\frac{60x + 180 - 60x}{x(x+3)} = 4.5$ $180 = 4.5x^2 + 13.5x$ $4.5x^2 + 13.5x - 180 = 0$ $x^2 + 3x - 40 = 0 \text{ (shown)}$
4d	$(x+8)(x-5) = 0$ $x = -8 \text{ or } x = 5$
4e	$\text{Cost} = \frac{60}{5+3}$ $= \$7.50$

## 6. [BONUS]

Substitute  $z = \frac{3}{2} + \frac{i}{2}$  into the LHS of the equation:

$$\begin{aligned}\text{LHS} &= 2\left(\frac{3}{2} + \frac{i}{2}\right)^2 - 6\left(\frac{3}{2} + \frac{i}{2}\right) + 5 \\ &= 2\left(\frac{9}{4} + \frac{3i}{2} - \frac{1}{4}\right) - 9 - 3i + 5 \\ &= 4 + 3i - 9 - 3i + 5 \\ &= 0 \\ &= \text{RHS}\end{aligned}$$

Therefore,  $z = \frac{3}{2} + \frac{i}{2}$  is a solution.

Substitute  $z = \frac{3}{2} - \frac{i}{2}$  into the LHS of the equation:

$$\begin{aligned}\text{LHS} &= 2\left(\frac{3}{2} - \frac{i}{2}\right)^2 - 6\left(\frac{3}{2} - \frac{i}{2}\right) + 5 \\ &= 2\left(\frac{9}{4} - \frac{3i}{2} - \frac{1}{4}\right) - 9 + 3i + 5 \\ &= 4 - 3i - 9 - 3i + 5 \\ &= 0 \\ &= \text{RHS}\end{aligned}$$

Therefore,  $z = \frac{3}{2} - \frac{i}{2}$  is a solution



Name

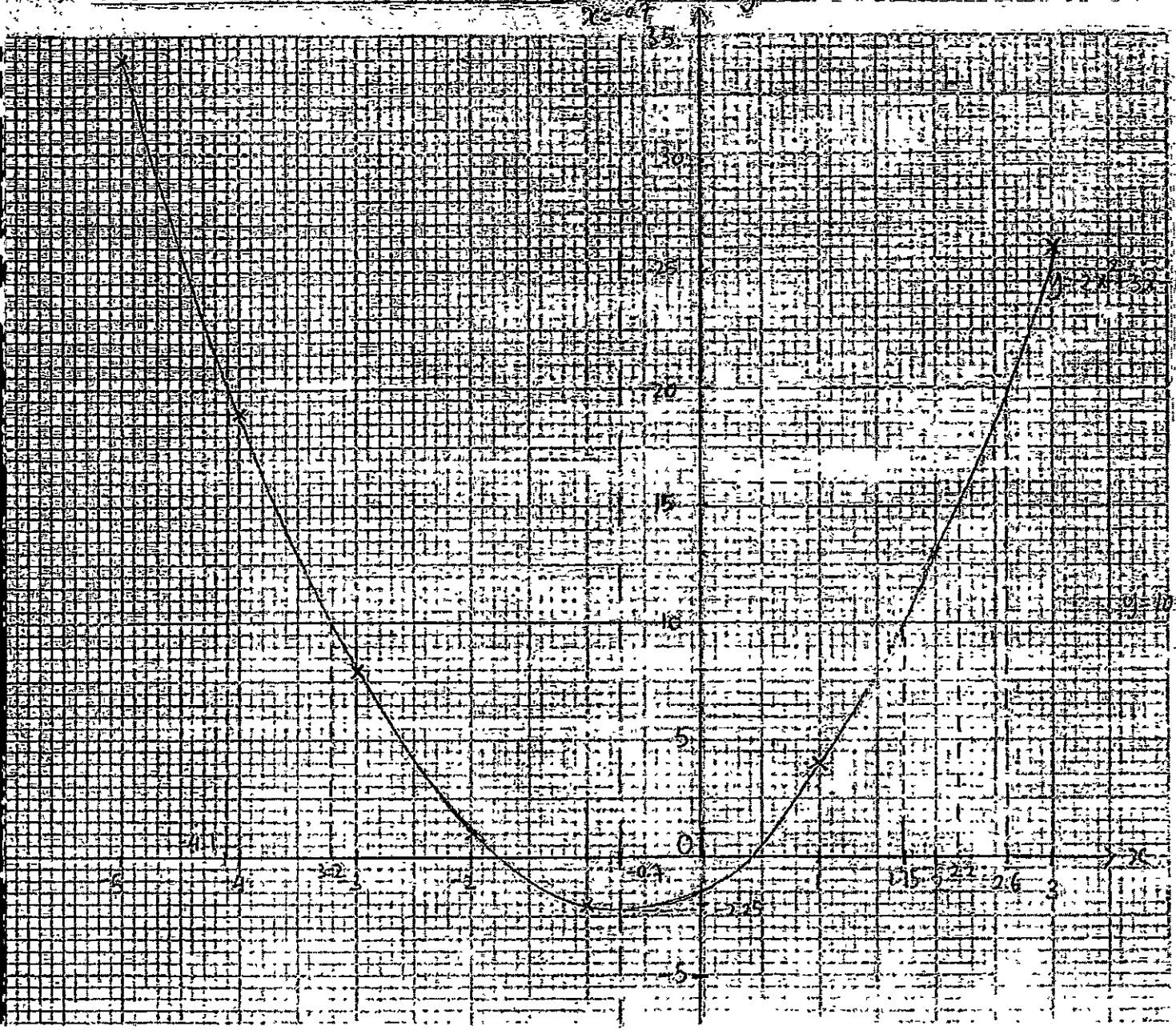
Index No.

Subject

Class

7

Date



(a)  $a = 19$ ,  $b = 13$

(b) see the graph

(c) (i)  $y = 15$

(ii)  $x = -4.1$  or  $x = 2.6$

(iii)  $(-0.7, -2.25)$

(d)  $x = -0.7$

(e) Line to be drawn:  $y = 10$

$x = -3.2$  or  $x = 1.75$



**BEATTYSECONDARY SCHOOL  
MID-YEAR EXAMINATION 2014**

**SUBJECT : Mathematics**

**LEVEL : Sec 2 Express**

**PAPER : 1**

**DURATION : 1 hour 15 minutes**

**SETTER : Mrs Rose Ang**

**DATE :16May 2014**

<b>CLASS :</b>	<b>NAME :</b>	<b>REG NO :</b>
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**READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number in the spaces on the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in loss of marks.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

<b>For Examiner's Use</b>
<b>50</b>

This paper consists of 9 printed pages (including this cover page)

[Turn over

For  
Examiner's  
Use

For  
Examiner's  
Use

1 Expand and simplify

(a)  $(2x-5)(x^2+5)$

(b)  $3(x-3y)^2$

Answer : (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [2]

2 Factorise completely.

(a)  $3x^2+7x-6$

(b)  $162-128y^2$

(c)  $1-a^2-ab-b$

Answer : (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

(c) \_\_\_\_\_ [2]

For  
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Use

3 Simplify each of the following.

For  
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Use

(a)  $\frac{5a^2b \times 6(ab)^2}{15ab^2}$

(b)  $\frac{3x+9}{x+1} \div \frac{(x+3)^2}{x^2+4x+3}$

(c)  $\frac{1}{x-1} + \frac{x-1}{1-x^2}$

Answer : (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [2]

(c) \_\_\_\_\_ [3]

For  
Examiner's  
Use

For  
Examiner's  
Use

4 Solve each of the following equations.

(a)  $(2x+1)(x-3)=0$

(b)  $(x+2)^2-2x=7$

Answer : (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [3]

5 Solve the simultaneous equations.

$$2x+3y=-2.5$$

$$3x-4y+25=0$$

Answer :  $x =$  \_\_\_\_\_ ,  $y =$  \_\_\_\_\_ [3]

For  
Examiner's  
Use

For  
Examiner's  
Use

6 (a) Make  $s$  the subject of the formula  $\frac{1}{r} + \frac{1}{s} = \frac{1}{t}$ .

(b) Given that  $\sqrt{a^2 + b} = c + 1$ , —

(i) express  $a$  in terms of  $b$  and  $c$ .

(ii) Hence, find the exact value of  $a$  when  $b = -5$  and  $c = 3$ .

Answer : (a) \_\_\_\_\_ [3]

(bi) \_\_\_\_\_ [2]

(bii) \_\_\_\_\_ [1]

For  
Examiner's  
Use

For  
Examiner's  
Use

7 A map is drawn to a scale of 1 : 5000.

- (a) A rectangular car park has a length of 10.5 cm on the map. Find the actual length of the car park in metres.
- (b) A circular pond has an actual area of  $1\,500\pi$  square metres. Find the area of this circular pond on the map, giving your answer in terms of  $\pi$ .

Answer : (a) \_\_\_\_\_ m [2]

(b) \_\_\_\_\_  $\text{cm}^2$  [3]

8 Rachel threw a ball upwards from the ground.

Given that the height of the ball,  $h$  metres, from the ground after  $t$  seconds is given by the equation  $h = 30t - 6t^2$ , find the time taken for the ball to hit the ground.

Answer : \_\_\_\_\_ s [3]

For  
Examiner's  
Use

For  
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Use

9  $p$  is inversely proportional to the cube of  $q$ .

(a) Given that when  $p = 5$ ,  $q = 2$ , express  $p$  in an equation in terms of  $q$ .

(b) It is known that  $p = \theta$  for a particular value of  $q$ .

Find the value of  $p$  in terms of  $\theta$ , when this value of  $q$  is halved.

Answer : (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

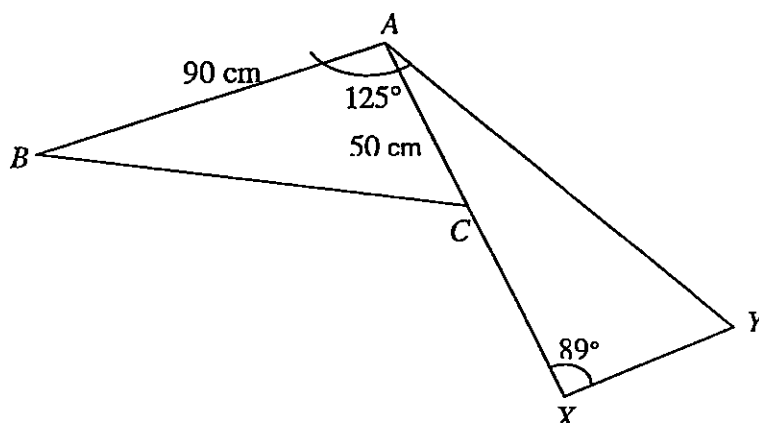
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For  
Examiner's  
Use

- 10 In the figure below,  $\triangle ABC \cong \triangle XAY$ ,  $AB = 90$  cm,  $AC = 50$  cm,  $\angle AXY = 89^\circ$  and  $\angle BAY = 125^\circ$

For  
Examiner's  
Use



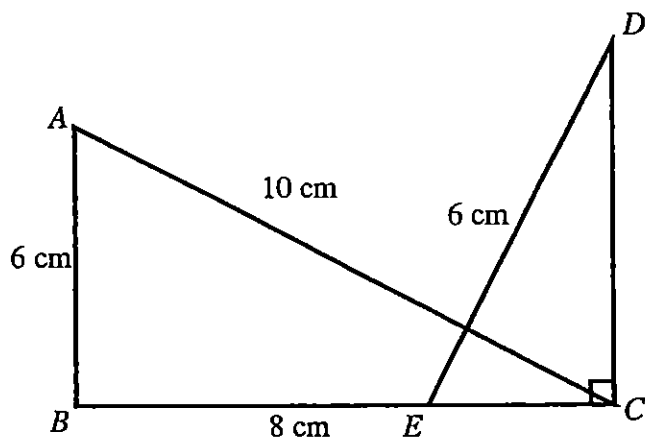
- Write down the length of  $XY$ .
- Find  $\angle XAY$ , stating your reason clearly.
- Find  $AC : CX$ .

Answer : (a) \_\_\_\_\_ cm [1]  
 (b) \_\_\_\_\_ [2]  
 (c) \_\_\_\_\_ [2]

For  
Examiner's  
Use

- 11 In the figure below,  $\triangle BAC$  is similar to  $\triangle CED$ .  
Given that  $AC = 10$  cm,  $DE = 6$  cm,  $AB = 6$  cm and  $\angle DCE = 90^\circ$ . Find

For  
Examiner's  
Use



- (a) Find  $\angle ABC$ .
- (b) Calculate
- the length of  $EC$ ,
  - the area of  $\triangle CED$ .

Answer : (a) \_\_\_\_\_  $^\circ$  [1]

(bi) \_\_\_\_\_ cm [2]

(bii) \_\_\_\_\_  $\text{cm}^2$  [2]

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## Answer Key

1a	$2x^3 - 5x^2 + 10x - 25$	1b	$3x^2 - 18xy + 27y^2$		
2a	$(3x - 2)(x + 3)$	2b	$2(9 + 8y)(9 - 8y)$	2c	$(a + 1)(1 - a - b)$
3a	$2a^3b$	3b	3	3c	$\frac{2}{(x+1)(x-1)}$
4a	$x = -\frac{1}{2}$ or $x = 3$	4b	$x = -3$ or $x = 1$		
5	$x = -5, y = 2.5$				
6a	$s = \frac{rt}{r-t}$	6bi	$a = \pm\sqrt{(c+1)^2 - b}$	6bii	$a = \pm\sqrt{21}$
7a	525 m	7b	$\frac{3\pi}{5} \text{ cm}^2$		
8	$t = 5$	9a	$p = \frac{40}{q^3}$	9b	$p = 8\theta$
10a	50 cm	10b	$\angle XAY = 125^\circ - 89^\circ = 36^\circ$	10c	5 : 4
11a	$90^\circ$	11bi	3.6 cm	11bii	$8.64 \text{ cm}^2$



## BEATTYSECONDARY SCHOOL MID-YEAR EXAMINATION 2014

### Marking Scheme

**SUBJECT : Mathematics**

**LEVEL : Sec 2 Express**

**PAPER : 1**

**DURATION : 1 hour 15 minutes**

**SETTER : Mrs Rose Ang**

**DATE : 16 May 2014**

<b>CLASS :</b>	<b>NAME :</b>	<b>REG NO :</b>
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### READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in loss of marks.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

<b>For Examiner's Use</b>
 50

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This paper consists of 9 printed pages (including this cover page)

[Turn over

For  
Examiner's  
UseFor  
Examiner's  
Use**1 Expand and simplify**

(a)  $(2x-5)(x^2+5)$

(b)  $3(x-3y)^2$

$$(a) \quad (2x-5)(x^2+5) \\ = 2x^3 - 5x^2 + 10x - 25 \quad [B1]$$

$$(b) \quad 3(x-3y)^2 \\ = 3(x^2 - 6xy + 9y^2) \text{ or } (3x-9y)(x-3y) \quad [M1] \\ = 3x^2 - 18xy + 27y^2 \quad [A1]$$

Answer : (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [2]

**2 Factorise completely.**

(a)  $3x^2 + 7x - 6$

(b)  $162 - 128y^2$

(c)  $1 - a^2 - ab - b$

$$(a) \quad 3x^2 + 7x - 6 \\ = (3x-2)(x+3) \quad [M1, A1] \text{ or } [A2]$$

$$(b) \quad 162 - 128y^2 \\ = 2(81 - 64y^2) \quad [M1] \\ = 2(9+8y)(9-8y) \quad [A1]$$

$$(c) \quad 1 - a^2 - ab - b \\ = (1+a)(1-a) - b(a+1) \quad [M1] \\ = (a+1)(1-a-b) \quad [A1]$$

Answer : (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

(c) \_\_\_\_\_ [2]

For  
Examiner's  
Use

For  
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Use

3 Simplify each of the following.

(a)  $\frac{5a^2b \times 6(ab)^2}{15ab^2}$

(b)  $\frac{3x+9}{x+1} \div \frac{(x+3)^2}{x^2+4x+3}$

(c)  $\frac{1}{x-1} + \frac{x-1}{1-x^2}$

(a)  $\frac{5a^2b \times 6(ab)^2}{15ab^2} = 2a^3b$  [B1]

(b)  $\frac{3x+9}{x+1} \div \frac{(x+3)^2}{x^2+4x+3}$   
 $= \frac{3(x+3)}{x+1} \times \frac{(x+3)(x+1)}{(x+3)^2}$  [M1]  
 $= 3$  [A1]

(c)  $\frac{1}{x-1} + \frac{x-1}{(1+x)(1-x)}$   
 $= \frac{1}{x-1} - \frac{x-1}{(1+x)(x-1)}$  [M1- change of sign]  
 $= \frac{x+1-x+1}{(x+1)(x-1)}$  [M1-common denominator]  
 $= \frac{2}{(x+1)(x-1)}$  [A1]

Answer : (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [2]

(c) \_\_\_\_\_ [3]

For  
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Use

4

For  
Examiner's  
Use

4 Solve each of the following equations.

(a)  $(2x+1)(x-3)=0$

(b)  $(x+2)^2 - 2x = 7$

(a)  $x = -\frac{1}{2}$  or  $x = 3$  [B1]

(b)  $(x+2)^2 - 2x = 7$   
 $x^2 + 2x - 3 = 0$  [M1]  
 $(x+3)(x-1) = 0$  [M1]  
 $x = -3$  or  $x = 1$  [A1]

Answer : (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [3]

5 Solve the simultaneous equations.

$$2x + 3y = -2.5$$

$$3x - 4y + 25 = 0$$

$$2x + 3y = -2.5 \text{ ----- (1)}$$

$$3x - 4y = -25 \text{ ----- (2)}$$

$$(1) \times 3, \quad 6x + 9y = -7.5 \text{ ----- (3)}$$

$$(2) \times 2, \quad 6x - 8y = -50 \text{ ----- (4)}$$

$$(3) - (4), \quad 17y = 42.5$$

$$y = 2.5$$

Sub  $y = -2.5$  into (1),

$$2x + 3(2.5) = -2.5$$

$$x = -5$$

Answer :  $x =$  \_\_\_\_\_ ,  $y =$  \_\_\_\_\_ [3]

For  
Examiner's  
Use

5

For  
Examiner's  
Use

6 (a) Make  $s$  the subject of the formula  $\frac{1}{r} + \frac{1}{s} = \frac{1}{t}$ .

(b) Given that  $\sqrt{a^2 + b} = c + 1$ ,

(i) express  $a$  in terms of  $b$  and  $c$ .

(ii) Hence, find the exact value of  $a$  when  $b = -5$  and  $c = 3$ .

$$\begin{aligned} \text{(a)} \quad \frac{1}{r} + \frac{1}{s} &= \frac{1}{t} \\ \frac{1}{s} &= \frac{1}{t} - \frac{1}{r} \quad [\text{M1}] \\ \frac{1}{s} &= \frac{r-t}{rt} \quad [\text{M1}] \\ s &= \frac{rt}{r-t} \quad [\text{A1}] \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \sqrt{a^2 + b} &= c + 1 \\ \text{(i)} \quad a^2 + b &= (c + 1)^2 \quad [\text{M1}] \\ a^2 &= (c + 1)^2 - b \end{aligned}$$

$$a = \pm \sqrt{(c + 1)^2 - b} \quad [\text{A1}]$$

$$\text{(ii)} \quad a = \pm \sqrt{(3 + 1)^2 + 5} = \pm \sqrt{21} \quad [\text{B1}]$$

Answer : (a) \_\_\_\_\_ [3]

(bi) \_\_\_\_\_ [2]

(bii) \_\_\_\_\_ [1]



7 A map is drawn to a scale of 1 : 5000.

- (a) A rectangular car park has a length of 10.5 cm on the map. Find the actual length of the car park in metres.
- (b) A circular pond has an actual area of  $1\,500\pi$  square metres. Find the area of this circular pond on the map, giving your answer in terms of  $\pi$ .

(a) 1 cm ----- 5 000 cm  
 1 cm ----- 50 m [M1]  
 10.5 cm ----- 525 m [A1]

(b)  $1\text{ cm}^2$  -----  $2\,500\text{ m}^2$  [M1]

$$\frac{\pi \times 1500}{2500} \text{ cm}^2 \text{ ----- } 1\,500\pi \text{ m}^2 \text{ [M1]}$$

$$= \frac{3\pi}{5} \text{ cm}^2 \quad \text{[A1]}$$

Answer : (a) \_\_\_\_\_ m [2]

(b) \_\_\_\_\_  $\text{cm}^2$  [3]

8 Rachel threw a ball upwards from the ground.

Given that the height of the ball,  $h$  metres, from the ground after  $t$  seconds is given by the equation  $h = 30t - 6t^2$ , find the time taken for the ball to hit the ground.

$$h = 6t(5 - t) = 0 \text{ [M1]}$$

$$t = 0 \text{ (rej) or } t = 5 \text{ [M1]}$$

$$t = 5 \text{ [A1]}$$

Answer : \_\_\_\_\_ s [3]

9  $p$  is inversely proportional to the cube of  $q$ .

- (a) Given that when  $p = 5$ ,  $q = 2$ , express  $p$  in an equation in terms of  $q$ .  
 (b) It is known that  $p = \theta$  for a particular value of  $q$ . Find the value of  $p$  in terms of  $\theta$ , when this value of  $q$  is halved.

(a)  $p = \frac{k}{q^3}$

$$5 = \frac{k}{2^3} \Rightarrow k = 40 \quad [\text{M1}]$$

$$p = \frac{40}{q^3} \quad [\text{A1}]$$

(b) When  $q = a$ ,  $p = \theta \Rightarrow \theta = \frac{40}{a^3}$

$$\text{When } q = \frac{1}{2}a, \quad p = \frac{40}{\left(\frac{1}{2}a\right)^3} \quad [\text{M1}]$$

$$p = 8\left(\frac{40}{a^3}\right) = 8\theta \quad [\text{A1}]$$

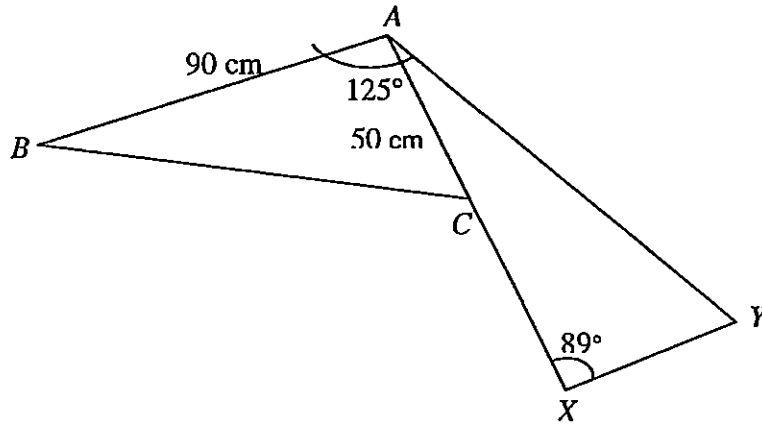
Answer : (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

For  
Examiner's  
Use

- 10 In the figure below,  $\triangle ABC \equiv \triangle XAY$ ,  $AB = 90$  cm,  $AC = 50$  cm,  $\angle AXY = 89^\circ$  and  $\angle BAY = 125^\circ$

For  
Examiner's  
Use



- (a) Write down the length of  $XY$ .  
 (b) Find  $\angle XAY$ , stating your reason clearly.  
 (c) Find  $AC : CX$ .

(a)  $XY = 50$  cm [B1]

(b)  $\angle BAC = \angle AXY = 50^\circ$  [M1]  
 $\angle XAY = 125^\circ - 50^\circ = 75^\circ$  [A1]

(c)  $AX = AB = 90$  cm [M1]  
 $CX = 90 - 50 = 40$  cm  
 $AC : CX = 5 : 4$  [A1]

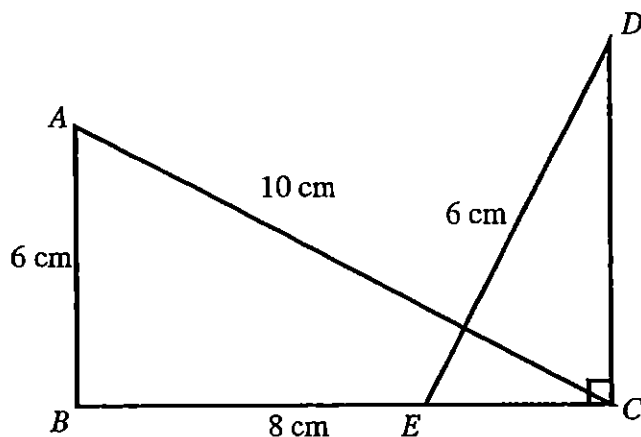
Answer : (a) \_\_\_\_\_ cm [1]

(b) \_\_\_\_\_ [2]

(c) \_\_\_\_\_ [2]

For  
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- 11 In the figure below,  $\triangle BAC$  is similar to  $\triangle CED$ .  
Given that  $AC = 10$  cm,  $DE = 6$  cm,  $AB = 6$  cm and  $\angle DCE = 90^\circ$ . Find



- (a) Find  $\angle ABC$ .  
(b) Calculate  
(i) the length of  $EC$ ,  
(ii) the area of  $\triangle CED$ .

(a)  $\angle ABC = 90^\circ$  [B1]

(b) (i)  $\frac{EC}{AB} = \frac{DE}{AC}$   
 $\frac{EC}{6} = \frac{6}{10}$  [M1]  
 $EC = 3.6$  cm [A1]

(ii)  $\frac{DC}{8} = \frac{6}{10}$  [M1]  
 $DC = 4.8$  cm

Area of  $\triangle CED = \frac{1}{2} \times 3.6 \times 4.8 = 8.64$  cm<sup>2</sup> [A1]

Answer : (a) \_\_\_\_\_ ° [1]

(bi) \_\_\_\_\_ cm [2]

(bii) \_\_\_\_\_ cm<sup>2</sup> [2]



**BEATTY SECONDARY SCHOOL  
MID-YEAREXAMINATION 2014**

**SUBJECT : Mathematics**

**LEVEL : Sec 2Express**

**PAPER : 2**

**DURATION : 1 hour 30 minutes**

**SETTER : MrsKajen**

**DATE : 19May 2014**

<b>CLASS :</b>	<b>NAME :</b>	<b>REG NO :</b>
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At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

1. The area of a reservoir is  $180000 \text{ m}^2$ . It is represented on a map by an area of  $2 \text{ cm}^2$ .
  - (a) Express the scale in the form  $1 : n$ . [2]
  - (b) Given that the shoreline of the reservoir is  $5.4 \text{ km}$ . What is the shoreline on the map? [2]
  
2. (a) Two quantities,  $y$  and  $x^2$ , are in inverse proportion.  
 If the difference in the values of  $y$  when  $x = 5$  and when  $x = 10$  is  $1.2$ , find
  - (i) an equation connecting  $x$  and  $y$ , [2]
  - (ii) the value of  $y$  when  $x = -2$ . [1]
- (b) Two quantities,  $p$  and  $\sqrt{q}$ , are in direct proportion. When  $q$  is increased by  $h\%$ , the percentage increase in  $p$  is  $200\%$ . Find the value of  $h$ . [2]
  
3. Expand and simplify the following.
  - (a)  $(3x - 5)(3x + 5)$  [1]
  - (b)  $(3 - y)(7 + 4y)$  [2]
  
4. Factorise the following completely.
  - (a)  $12x^3y - 18x^2y^2 + 6xy^3$  [2]
  - (b)  $16 - (c + 2d)^2$  [2]
  
5. (a) Factorise  $2x^2 + 13x + 15$  [1]
- (b) Hence, write down the factors of  $21315$ . [2]
  
6. Given  $y = \frac{6x - 2z}{3z - x}$ 
  - (a) If  $z = -3$  and  $y = 2$ , find  $x$ . [2]
  - (b) Express  $z$  in terms of  $y$  and  $x$ . [2]

7. Simplify the following.

(a)  $\frac{3}{4x+2} - \frac{x}{2x^2-3x-2}$  [3]

(b)  $\left[ \frac{x-6}{x^2-x-6} - 1 \right] \div \frac{x^2}{4-x^2}$  [3]

8. It is given that  $x = 5$  is a root of the equation  $4x^2 + kx - 15 = 0$ , where  $k$  is a constant. Find,

(a) the value of  $k$ , [2]

(b) the other root of the equation. [2]

9. The area of a rectangle is four times the area of a square of side  $(x + 1)$  cm. The length and breadth of the rectangle are  $(3x + 5)$  cm and  $(3x - 1)$  cm respectively.

(a) Form an equation in  $x$  and show that it reduces to  $5x^2 + 4x - 9 = 0$ . [2]

(b) Solve the equation. [2]

(c) Hence find the area of the rectangle. [2]

10. The radius of a small circle is  $(p - 2q)$  cm and the radius of a big circle is  $(5p - 12q)$  cm. The radius of the big circle is twice the radius of the small circle.

(a) Write down and simplify a linear equation connecting  $p$  and  $q$ . [1]

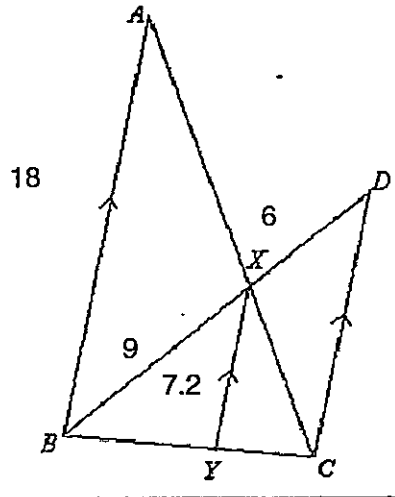
(b) If the sum of the circumference of the two circles is  $16\pi$  cm. [2]

Write down and simplify another linear equation connecting  $p$  and  $q$ .

(c) (i) Find the values of  $p$  and  $q$ . [3]

(ii) Hence, find the radii of the small circle. [1]

11. In the diagram below,  $AB$ ,  $DC$  and  $XY$  are parallel to each other.  $AC$  and  $BD$  meet at  $X$ . It is given that triangle  $ABX$  is similar to triangle  $CDX$ .



Given that  $AB = 18$  cm,  $DX = 6$  cm,  $XB = 9$  cm and  $XY = 7.2$  cm, find

- (a) the length of  $CD$ , [2]
- (b)  $\frac{\text{Area of } \triangle CXY}{\text{Area of trapezium } XABY}$  [2]

~~~End of Paper~~~





## Answers

|    |                                |     |                                            |
|----|--------------------------------|-----|--------------------------------------------|
| 1a | 30 000 cm                      | 6a  | -3                                         |
| 1b | 18 cm                          | 6b  | $z = \frac{x(6+y)}{3y+2}$                  |
| 2a | (i) $y = \frac{40}{x^2}$       | 7a  | $\frac{x-6}{2(2x+1)(x-2)}$                 |
|    | (ii) 10                        | 7b  | $= \left[ \frac{(2-x)^2}{x(x-3)} \right]$  |
| 2b | 800                            |     |                                            |
|    |                                | 8a  | $k = -17$                                  |
| 3a | $9x^2 - 25$                    | 8b  | $x = -\frac{3}{4}$                         |
| 3b | $21 + 5y - 4y^2$               |     |                                            |
|    |                                | 9b  | $x = -\frac{9}{5} \text{ or } x = 1$       |
| 4a | $6xy(2x-y)(x-y)$               | 9c  | $16 \text{ cm}^2$                          |
| 4b | $[4 - (c - 2d)][4 + (c - 2d)]$ |     |                                            |
|    |                                | 10a | $3p - 8q = 0$                              |
| 5a | $(2x+3)(x+5)$                  | 10b | $3p - 7q = 4 \text{ (2)}$                  |
| 5b | $21315 = (203)(105)$           | 10c | (i) $p = 10\frac{2}{3} \text{ and } q = 4$ |
|    |                                |     | (ii) $2\frac{2}{3}$                        |
|    |                                | 11a | 12cm                                       |
|    |                                | 11b | $\frac{4}{21}$                             |



## BEATTY SECONDARY SCHOOL MID-YEAREXAMINATION 2014

**SUBJECT : Mathematics**

**LEVEL : Sec 2Express**

**PAPER : 2**

**DURATION : 1 hour 30 minutes**

**SETTER : MrsKajen**

**DATE : 19May 2014**

|                |               |                 |
|----------------|---------------|-----------------|
| <b>CLASS :</b> | <b>NAME :</b> | <b>REG NO :</b> |
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The total number of marks for this paper is 50.

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This paper consists of 4 printed pages (including this cover page)

|    |                                                                                                               |                                                                                             |
|----|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1. | The area of a reservoir is $180\,000\text{ m}^2$ . It is represented on a map by an area of $2\text{ cm}^2$ . |                                                                                             |
|    | (a)                                                                                                           | Express the scale in the form $1 : n$ . [2]                                                 |
|    | (b)                                                                                                           | Given that the shoreline of the reservoir is 5.4 km. What is the shoreline on the map ? [2] |

|  |     |                                                                                                                                                                        |
|--|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (a) | $2\text{ cm}^2 = 180\,000\text{ m}^2$<br>$1\text{ cm}^2 = 90\,000\text{ m}^2$<br>$1\text{ cm} = \sqrt{90\,000}$ [M1]<br>$= 300\text{ m}$<br>$= 30\,000\text{ cm}$ [A1] |
|  | (b) | Shoreline on map $= \frac{5.4 \times 1000 \times 100}{30\,000}$ [M1]<br>$= 18\text{ cm}$ [A1]                                                                          |

|    |      |                                                                                                                                                                                                                                                                   |     |
|----|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 2. | (a)  | Two quantities, $y$ and $x^2$ , are in inverse proportion.<br>If the difference in the values of $y$ when $x = 5$ and when $x = 10$ is 1.2, find                                                                                                                  |     |
|    | (i)  | an equation connecting $x$ and $y$ ,<br>$y = \frac{k}{x^2}$<br>$\frac{k}{5^2} - \frac{k}{10^2} = 1.2$ [M1]<br>$\frac{k}{25} - \frac{k}{100} = 1.2$<br>$\frac{4k - k}{100} = 1.2$<br>$\frac{3k}{100} = 1.2$<br>$3k = 120$<br>$k = 40$<br>$y = \frac{40}{x^2}$ [A1] | [2] |
|    | (ii) | the value of $y$ when $x = -2$ .<br>$y = \frac{40}{(-2)^2}$<br>$= 10$ [B1]                                                                                                                                                                                        | [1] |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <p>(b) Two quantities, <math>p</math> and <math>\sqrt{q}</math> are in direct proportion. When <math>q</math> is increased by <math>h\%</math>, the percentage increase in <math>p</math> is 200%. Find the value of <math>h</math>. [2]</p> <p><math>p = k\sqrt{q}</math></p> <p><math>3p = k\sqrt{\frac{100+h}{100}}q</math> [M1]</p> <p><math>3p = k\sqrt{q}\sqrt{\frac{100+h}{100}}</math></p> <p><math>3p = p\sqrt{\frac{100+h}{100}}</math></p> <p><math>3 = \sqrt{\frac{100+h}{100}}</math></p> <p><math>9 = \frac{100+h}{100}</math></p> <p><math>900 = 100 + h</math></p> <p><math>h = 900 - 100</math></p> <p><math>= 800</math> [A1]</p> |  |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|    |                                                                                                                                       |  |
|----|---------------------------------------------------------------------------------------------------------------------------------------|--|
| 3. | Expand and simplify the following.                                                                                                    |  |
|    | <p>(a) <math>(3x - 5)(3x + 5)</math> [1]</p> <p><math>= 9x^2 - 25</math> [B1]</p>                                                     |  |
|    | <p>(b) <math>(3 - y)(7 + 4y)</math> [2]</p> <p><math>= 21 + 12y - 7y - 4y^2</math> [M1]</p> <p><math>= 21 + 5y - 4y^2</math> [A1]</p> |  |

|    |                                                                                                                                                      |  |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 4. | Factorise the following completely.                                                                                                                  |  |
|    | <p>(a) <math>12x^3y - 18x^2y^2 + 6xy^3</math> [2]</p> <p><math>= 6xy(2x^2 - 3xy + y^2)</math> [M1]</p> <p><math>= 6xy(2x - y)(x - y)</math> [A1]</p> |  |
|    | <p>(b) <math>16 - (c - 2d)^2</math> [2]</p> <p><math>= 4^2 - (c - 2d)^2</math> [M1]</p>                                                              |  |

|  |  |                                       |  |
|--|--|---------------------------------------|--|
|  |  | $= [4 - (c - 2d)][4 + (c - 2d)]$ [A1] |  |
|--|--|---------------------------------------|--|

|    |     |                                                                                                                                         |     |
|----|-----|-----------------------------------------------------------------------------------------------------------------------------------------|-----|
| 5. | (a) | Factorise $2x^2 + 13x + 15$<br>$= (2x + 3)(x + 5)$ [B1]                                                                                 | [1] |
|    | (b) | Hence, write down the factors of 21315.<br>$21315 = 2(10\ 000) + 13(100) + 15$ [M1]<br>$= [2(100) + 3][100 + 5]$<br>$= (203)(105)$ [A1] | [2] |

|    |                                    |                                                                                                                                                                                                                                                   |     |
|----|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 6. | Given $y = \frac{6x - 2z}{3z - x}$ |                                                                                                                                                                                                                                                   |     |
|    | (a)                                | If $z = -3$ and $y = 2$ , find $x$ .<br>$y = \frac{6x - 2z}{3z - x}$<br>$2 = \frac{6x - 2(-3)}{3(-3) - x}$ [M1]<br>$2 = \frac{6x + 6}{-9 - x}$<br>$2(-9 - x) = 6x + 6$<br>$-18 - 6 = 6x + 2x$<br>$-24 = 8x$<br>$x = \frac{-24}{8}$<br>$= -3$ [A1] | [2] |
|    | (b)                                | Express $z$ in terms of $y$ and $x$ .<br>$y = \frac{6x - 2z}{3z - x}$                                                                                                                                                                             | [2] |

|  |                                                                                                                                        |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------|--|
|  | $y(3z - x) = 6x - 2z$<br>$3yz - xy = 6x - 2z$ [M1]<br>$3yz + 2z = 6x + xy$<br>$z(3y + 2) = x(6 + y)$<br>$z = \frac{x(6+y)}{3y+2}$ [A1] |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------|--|

|     |                                                                                                                                                                                                                                                                                                              |     |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 7.  | Simplify the following.                                                                                                                                                                                                                                                                                      |     |
| (a) | $\frac{3}{4x+2} - \frac{x}{2x^2-3x-2}$ $= \frac{3}{2(2x+1)} - \frac{x}{(2x+1)(x-2)}$ [M1] $= \frac{3(x-2) - 2x}{2(2x+1)(x-2)}$ [M1] $= \frac{3x - 6 - 2x}{2(2x+1)(x-2)}$ $= \frac{x-6}{2(2x+1)(x-2)}$ [A1]                                                                                                   | [3] |
| (b) | $= \left[ \frac{x-6}{(x-3)(x+2)} - 1 \right] \div \frac{x^2}{4-x^2}$ [M1] $= \left[ \frac{x-6-(x^2-x-6)}{(x-3)(x+2)} \right] \times \frac{4-x^2}{x^2}$ $= \left[ \frac{x-6-x^2+x+6}{(x-3)(x+2)} \right] \times \frac{(2+x)(2-x)}{x^2}$ [M1] $= \left[ \frac{2x-x^2}{(x-3)} \right] \times \frac{(2-x)}{x^2}$ | [3] |

|  |  |                                                                                                                     |  |
|--|--|---------------------------------------------------------------------------------------------------------------------|--|
|  |  | $= \left[ \frac{x(2-x)}{(x-3)} \right] \times \frac{2-x}{x^2} = \left[ \frac{(2-x)^2}{x(x-3)} \right] \text{ [A1]}$ |  |
|--|--|---------------------------------------------------------------------------------------------------------------------|--|

|     |                                                                                                                                                                                  |     |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 8.  | It is given that $x = 5$ is a root of the equation $4x^2 + kx - 15 = 0$ , where $k$ is a constant. Find,                                                                         |     |
| (a) | the value of $k$ ,<br><br>$4x^2 + kx - 15 = 0$<br>$4(5^2) + k(5) - 15 = 0$ [M1]<br>$100 - 15 + 5k = 0$<br>$85 + 5k = 0$<br>$5k = -85$<br>$k = -17$ [A1]                          | [2] |
| (b) | the other root of the equation.<br><br>$4x^2 - 17x - 15 = 0$<br>$(4x + 3)(x - 5) = 0$<br>$(4x + 3) = 0$ or $(x - 5) = 0$ [M1]<br>$4x = -3$ or $x = 5$<br>$x = -\frac{3}{4}$ [A1] | [2] |

|     |                                                                                                                                                                                                                                         |     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 9.  | The area of a rectangle is four times the area of a square of side $(x + 1)$ cm. The length and breadth of the rectangle are $(3x + 5)$ cm and $(3x - 1)$ cm respectively.                                                              |     |
| (a) | Form an equation in $x$ and show that it reduces to $5x^2 + 4x - 9 = 0$<br><br>$4(x + 1)^2 = (3x + 5)(3x - 1)$ [M1]<br>$4(x^2 + 2x + 1) = 9x^2 - 3x + 15x - 5$<br>$4x^2 + 8x + 4 = 9x^2 + 12x - 5$ [M1]<br>$5x^2 + 4x - 9 = 0$ [proven] | [2] |

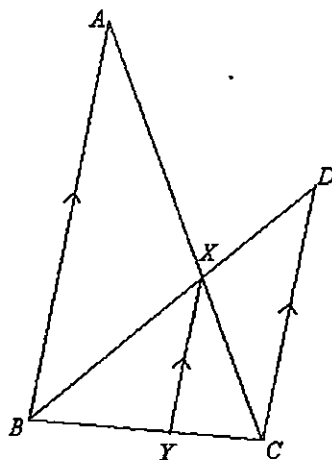
|  |                                                                                                                                                                                                                                                        |     |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | <p>(b) Solve the equation and find the area of the rectangle</p> $5x^2 + 4x - 9 = 0$ $(5x + 9)(x - 1) = 0 \quad [\text{M1}]$ $(5x + 9) = 0 \text{ or } (x - 1) = 0$ $5x = -9 \text{ or } x = 1$ $x = -\frac{9}{5} \text{ or } x = 1 \quad [\text{A1}]$ | [2] |
|  | <p>(c) Find the area of the rectangle.</p> $\text{Area of rectangle} = 4(1 + 1)^2 \quad [\text{M1}]$ $= 16 \text{ cm}^2 \quad [\text{A1}]$                                                                                                             | [2] |

|     |                                                                                                                                                                                                                                                                                                                                                                                     |     |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 10. | The radius of a small circle is $(p - 2q)$ cm and the radius of a big circle is $(5p - 12q)$ cm. The radius of the big circle is twice the radius of the small circle.                                                                                                                                                                                                              |     |
|     | <p>(a) Write down and simplify a linear equation connecting <math>p</math> and <math>q</math>.</p> $2(p - 2q) = 5p - 12q$ $2p - 4q = 5p - 12q$ $3p - 8q = 0 \quad (1) \quad [\text{A1}]$                                                                                                                                                                                            | [1] |
|     | <p>(b) If the sum of the circumference of the two circle is <math>16\pi</math> cm.</p> <p>Write down the pair of simultaneous linear equations connecting <math>p</math> and <math>q</math>.</p> $2\pi(p - 2q) + 2\pi(5p - 12q) = 16\pi$ $2\pi[(p - 2q) + (5p - 12q)] = 2\pi(8) \quad [\text{M1}]$ $p - 2q + 5p - 12q = 8$ $6p - 14q = 8$ $3p - 7q = 4 \quad (2) \quad [\text{A1}]$ | [2] |
|     | <p>(c) (i) Find the values of <math>p</math> and <math>q</math>.</p> $\text{Eqn (1)} - \text{Eqn (2)}$ $-8q - (-7q) = 0 - 4 \quad [\text{M1}]$                                                                                                                                                                                                                                      | [3] |



|  |      |                                                                                                                                                                            |     |
|--|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  |      | $-q = -4$<br><br>$q = 4$<br><br>Substitute $q = 4$ into equation 1 [M1]<br>$3p - 8(4) = 0$<br>$3p - 32 = 0$<br>$3p = 32$<br>$p = \frac{32}{3}$<br>$p = 10\frac{2}{3}$ [A1] |     |
|  | (ii) | Hence, find the radii of the small circle.<br><br>Radius of small circle<br>$= p - 2q$<br>$= 10\frac{2}{3} - 2(4)$<br>$= 2\frac{2}{3}$ [B1]                                | [1] |

11. In the diagram,  $AB$ ,  $DC$  and  $XY$  are parallel to each other.  $AC$  and  $BD$  meet at  $X$ . It is given that  $\triangle ABX$  is similar to  $\triangle CDX$ .



Given that  $AB = 18$  cm,  $DX = 6$  cm,  $XB = 9$  cm and  $XY = 7.2$  cm, find

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|  | <p>(a) the length of <math>CD</math>,</p> $\frac{AB}{CD} = \frac{BX}{DX}$ $\frac{18}{CD} = \frac{9}{6} \text{ [M1]}$ $18 \times 6 = 9 \times CD$ $CD = 12 \text{ [A1]}$                                                                                                                                                                                                                                                                                                                  | [2] |
|  | <p>(b)</p> $\frac{\text{Area of } \triangle CXY}{\text{Area of trapezium } XABY}$ $= \frac{7.2^2}{18^2 - 7.2^2} \text{ [M1]}$ $= \frac{4}{21}$ <p>[A1]</p> <p>Or</p> $\frac{\text{Area of } \triangle CXY}{\text{Area of } \triangle CAB} = \left(\frac{7.2}{18}\right)^2$ $\frac{\text{Area of } \triangle CXY}{\text{Area of } \triangle CAB} = \left(\frac{4}{25}\right) \text{ [M1]}$ $\frac{\text{Area of } \triangle CXY}{\text{Area of } XABY} = \frac{4}{25 \div 4}$ <p>[A1]</p> | [2] |

~~~End of Paper~~~

Register

Class

Number

Name :

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# DUNEARN SECONDARY SCHOOL

## Mid-Year Examination 2014

### Mathematics

### Paper 1

## Secondary 2 Express

Monday

19May 2014

0800 - 0900

1 hour

### INSTRUCTIONS TO CANDIDATES

Write your name, class and register number in the spaces at the top of this page.

Answer **all** questions.

Write your answers on the question paper.

All working must be shown. Omission of essential working will result in loss of marks.

**Do not use any highlighters, correction fluid or correction tape for the paper.**

### INFORMATION FOR CANDIDATES

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 40.

The use of an electronic calculator is expected where appropriate.

You are reminded of the need for clear presentation in your answers.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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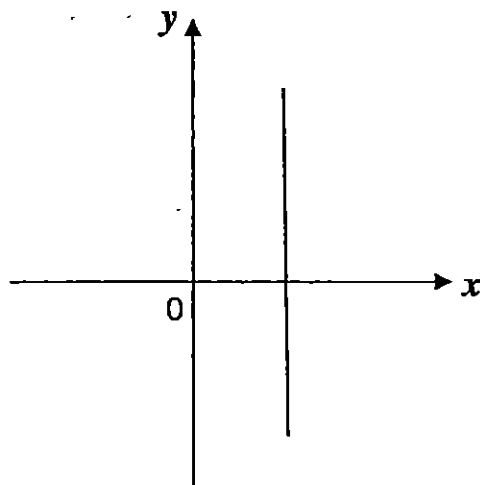
Setter: Mrs Yeo Poh Leng

This question paper consists of 9 printed pages, including this cover page.

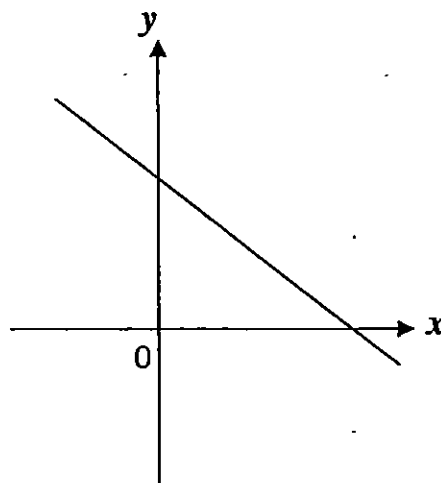
1 Which of the graphs below could be the graph of

(a)  $x = 3$ ,

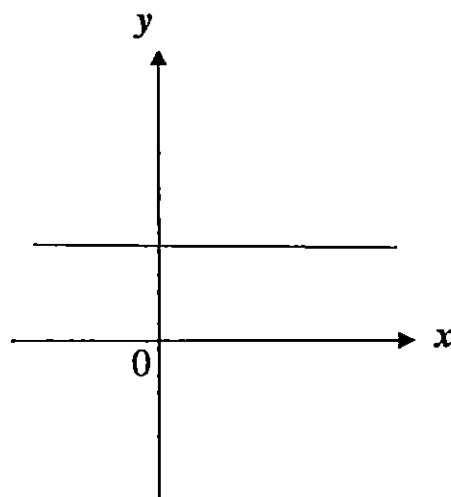
(b)  $y = 3$ .



Graph 1



Graph 2



Graph 3

Answer: (a) Graph \_\_\_\_\_ [1]

(b) Graph \_\_\_\_\_ [1]

2 The diagram shows the graph of the straight line  $y - x = -4$ .

(a) Another line  $2x + y = 2$  passes through the points  $(0, 2)$  and  $(1, 0)$ .

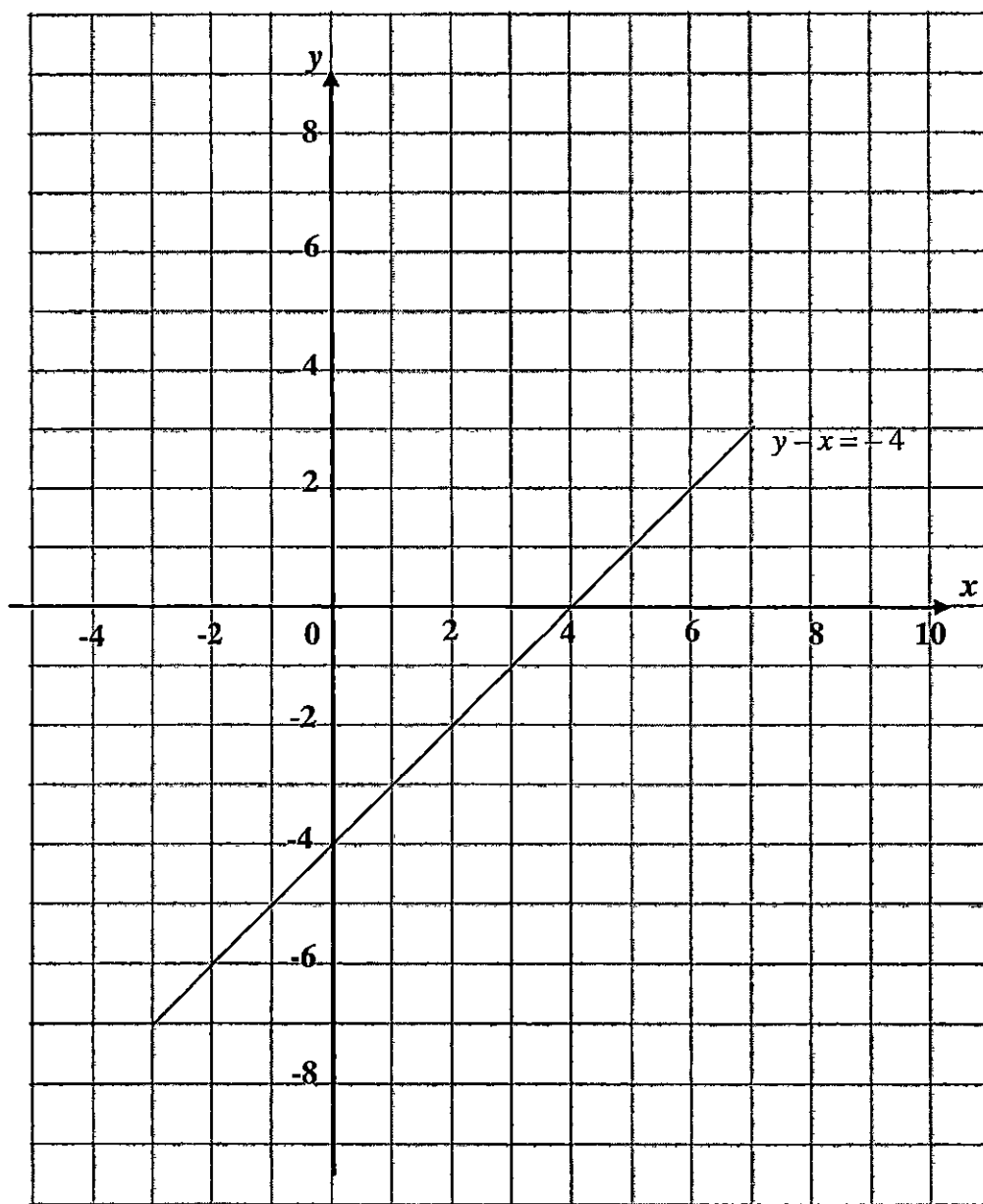
|     |   |     |
|-----|---|-----|
| $x$ | 0 | 3   |
| $y$ | 2 | $a$ |

Find  $a$  and use the values on the above table to draw the line  $2x + y = 2$ .

[1]

(b) Use your graph to solve the simultaneous equations  $y - x = -4$  and  $2x + y = 2$ .

Answer(a)



Answer: (b)  $x =$  \_\_\_\_\_  $y =$  \_\_\_\_\_ [1]

3 (a) Factorise  $x^2 - 2xy + y^2$ .

(b) Hence, evaluate  $42 \times 42 - 168 + 4$ .

You must show your working clearly.

*Answer:* (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [2]

4 Given that  $x + y = 3$  and  $x^2 - y^2 = 45$ , find the value of  $8x - 8y$ .

*Answer:* \_\_\_\_\_ [3]

- 5 Given that  $v = \sqrt{\frac{wx}{x+w}}$ , express  $w$  in terms of  $v$  and  $x$ .

*Answer:* \_\_\_\_\_ [3]

- 6 It is given that  $y$  is directly proportional to  $x^2$ . If  $y = 20$  when  $x = 1$ , find
- (a)  $y$  when  $x$  is doubled,
- (b)  $x$  when  $y = 80$ .

*Answer:* (a)  $y =$  \_\_\_\_\_ [2]  
(b)  $x =$  \_\_\_\_\_ [2]



- 7 (a) Factorise completely  $3a(r + s) - r - s$ .
- (b) Expand and simplify  $(3x + 2y)(x - 5y)$ .

*Answer:* (a) \_\_\_\_\_ [2]  
(b) \_\_\_\_\_ [2]

- 8 (a) Factorise  $x^2 - 9$ .
- (b) Use **your answer in part (a)** to find two factors of 9991, other than 1 and 9991. You must show your working.

*Answer:* (a) \_\_\_\_\_ [1]  
(b) \_\_\_\_\_ [3]

- 9    Melvin stands at the edge of a cliff and throws a ball vertically upwards. The height of the ball above the top of the cliff after  $t$  seconds is  $h$  metres such that  $h = t(8 - 5t)$ .

- (a)    Find  $h$  when  $t = 1$ .
- (b)    (i)    Find  $h$  when  $t = 5$ .  
           (ii)    Explain the significance of your answer.
- (c)    Find the time taken in seconds when the ball is at the same level as the top of the cliff.

*Answer:*    (a)    \_\_\_\_\_ m    [1]

                  (bi)    \_\_\_\_\_ m    [1]

(bii)    \_\_\_\_\_ [1]

                  (c)    \_\_\_\_\_ s    [2]

**10** Simplify

(a)  $\frac{(2x-5y)^2}{10x^2-25xy}$ ,

(b)  $\frac{x^2-16y^2}{x^2+10xy+24y^2}$ .

*Answer:* (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [3]

**11** Solve the following equations.

(a)  $6x^2 + 7x - 24 = 0$

(b)  $(3y+1)^2 = 196$

*Answer:* (a)  $x =$  \_\_\_\_\_ or \_\_\_\_\_ [2]

(b)  $y =$  \_\_\_\_\_ or \_\_\_\_\_ [3]

**End of Paper**



## Answers (Sec 2EMaths 2014 Mid-Year Exam Paper 1)

|          |            |                |         |           |     |
|----------|------------|----------------|---------|-----------|-----|
|          |            | <b>ANSWERS</b> |         |           |     |
| <b>1</b> | <b>(a)</b> | Graph 1        | $x = 3$ | <b>B1</b> | 1   |
|          | <b>(b)</b> | Graph 3        | $y = 3$ | <b>B1</b> | 1 2 |

2 (a)

|              |   |    |
|--------------|---|----|
| $2x + y = 2$ |   |    |
| $x$          | 0 | 3  |
| $y$          | 2 | -4 |

$a = -4$   
Correct line drawn on grid passing through (2, -2)

(b)

$x = 2,$   
 $y = -2$

|   |     |   |    |     |
|---|-----|---|----|-----|
| 3 | (a) | $(x-y)^2$                               | B1 | 1   |
|   | (b) | $42^2 - 168 + 4$                        |    |     |
|   |     | $= (42-2)^2$ or $42^2 - 2(42)(2) + 2^2$ | M1 |     |
|   |     | $= 40^2$<br>$= 1600$                    | A1 | 2 3 |

|   |  |                              |
|---|--|------------------------------|
| 4 | $x^2 - y^2 = 45$<br>$(x+y)(x-y) = 45$<br>$x-y = 45 \div 3 = 15$<br>$8x-8y = 8(x-y)$<br>$= 8 \times 15 = 120$ | M1<br>M1<br>A1      3      3 |
|---|--|------------------------------|

|   |  |    |   |   |
|---|--|----|---|---|
| 5 | $v = \sqrt{\frac{wx}{x+w}}$                              |    |   |   |
|   | $v^2 = \frac{wx}{x+w}$                                   | M1 |   |   |
|   | $v^2x + v^2w = wx$                                       |    |   |   |
|   | $wp^2 - wx = -v^2x$                                      | M1 |   |   |
|   | $w = -\frac{v^2x}{v^2-x} \text{ or } \frac{v^2x}{x-v^2}$ | A1 | 3 | 3 |

|   |     |   |    |   |   |
|---|-----|---|----|---|---|
| 6 | (a) | $y = kx^2$<br>$k = 20$  | M1 |   |   |
|   | (b) | $y = 20x^2$<br>$y = 20(2)^2$<br>$= 80$<br>$y = 20x^2$<br>$80 = 20x^2$ | A1 | 2 |   |
|   |     | $x^2 = 4$   | M1 |   |   |
|   |     | $x = \pm 2$   | A1 | 2 | 4 |
|   |     |   |    |   |   |

|   |     |   |    |   |   |
|---|-----|---|----|---|---|
| 7 | (a) | $3a(r+s) - r - s$<br>$= 3a(r+s) - (r+s)$<br>$= (r+s)(3a-1)$                 | M1 |   |   |
|   | (b) | $(3x+2y)(x-5y)$<br>$= 3x^2 - 15xy + 2xy - 10y^2$<br>$= 3x^2 - 13xy - 10y^2$ | A1 | 2 |   |
|   |     |   | M1 |   |   |
|   |     |   | A1 | 2 | 4 |

|   |     |   |    |   |   |
|---|-----|---|----|---|---|
| 8 | (a) | $x^2 - 9 = (x+3)(x-3)$  | B1 | 1 |   |
|   | (b) | $x^2 - 9 = 9991$<br>$x^2 = 10000 \text{ or } x^2 - 10000 = 0$<br>$x = \pm\sqrt{10000}$<br>$= 100$<br>$(x+3)(x-3) = (100+3)(100-3)$<br>The factors are 103 and 97. | M1 |   |   |
|   |     |   | M1 |   |   |
|   |     |   | A1 | 3 | 4 |
|   |     |   |    |   |   |

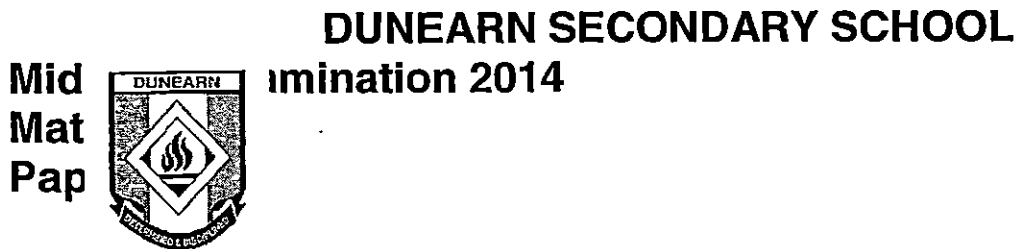
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|---|-------|---|----|---|---|
| 9 | (a)   | $t = 1,$<br>$h = 8 - 5$<br>$= 3 \text{ m}$  | B1 | 1 |   |
|   | (bi)  | $t = 5,$<br>$h = 8(5) - 5(5)^2$<br>$= -85 \text{ m}$  | B1 |   |   |
|   | (bii) | The ball is 85 m below the top of the cliff   |    | 1 |   |
|   | (c)   | $t(8 - 5t) = 0$<br><br>$t = 0 \text{ (reject) or } t = \frac{8}{5}$<br><br>Time is $\frac{8}{5} \text{ s}$ or $1.6 \text{ s}$ | B1 | 1 |   |
|   |       |   | M1 | 1 |   |
|   |       |   | A1 | 1 | 5 |

|    |     |   |    |   |   |
|----|-----|---|----|---|---|
| 10 | (a) | $\frac{(2x-5y)^2}{10x^2 - 25xy}$<br><br>$= \frac{(2x-5y)^2}{5x(2x-5y)}$<br><br>$= \frac{2x-5y}{5x}$ | M1 |   |   |
|    | (b) | $\frac{(x+4y)(x-4y)}{(x+4y)(x+6y)}$<br><br>$= \frac{(x-4y)}{(x+6y)}$                                | A1 | 2 |   |
|    |     |   | M1 |   |   |
|    |     |   | M1 |   |   |
|    |     |   | A1 | 3 | 5 |

|    |     |   |    |   |   |
|----|-----|---|----|---|---|
| 11 | (a) | $6x^2 + 7x - 24 = 0$<br>$(2x - 3)(3x + 8) = 0$  | M1 |   |   |
|    |     | $x = 1\frac{1}{2} \text{ or } -2\frac{2}{3}$  | A1 | 2 |   |
|    | (b) | $(3y+1)^2 = 196$<br>$3y+1 = \pm 14$<br>$3y+1 = 14 \text{ or } 3y+1 = -14$<br>$y = 4\frac{1}{3} \text{ or } -5$<br><b>OR</b>           | M1 |   |   |
|    |     |   | M1 |   |   |
|    |     |   | A1 | 3 | 5 |
|    |     | $(3y+1)^2 = 196$<br>$9y^2 + 6y + 1 - 196 = 0$<br>$9y^2 + 6y - 195 = 0$<br>$(9y - 39)(y + 5) = 0$<br>$y = 4\frac{1}{3} \text{ or } -5$ | M1 |   |   |
|    |     |   | M1 |   |   |
|    |     |   | A1 |   |   |
|    |     |   |    |   |   |
|    |     |   |    |   |   |

| Name : | Register |        |
|--------|----------|--------|
|        | Class    | Number |
|        |          |        |

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### Secondary 2 Express

**Thursday                      8 May 2014                      0800 - 0930                      1hr 30 mins**

#### INSTRUCTIONS TO CANDIDATES

Write your name, class and register number in the spaces at the top of this page.  
Answer **all** questions.  
Write your answers on the writing paper or graph paper provided.  
All working must be shown. Omission of essential working will result in loss of marks.  
**Do not use any highlighters, correction fluid or correction tape for the paper.**

#### INFORMATION FOR CANDIDATES

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.  
At the end of the examination, fasten all your work securely together.  
The number of marks is given in brackets [ ] at the end of each question or part question.  
The total number of marks for this paper is 60.  
The use of an electronic calculator is expected where appropriate.  
You are reminded of the need for clear presentation in your answers.  
For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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| FOR EXAMINER'S<br>USE   |
| <div style="border-bottom: 1px solid black; height: 40px; width: 100%;"></div> <div style="text-align: right; font-size: 24px; font-weight: bold;">60</div> |

**Setter: Mrs Yeo Poh Leng**

This question paper consists of 4 printed pages, including this cover page.

- 1 It is given that one of the solutions to the equation  $3x^2 = 6 - bx$  is 3. Find
- (a) the value of  $b$ , [1]
- (b) the other solution of the equation. [2]
- 2 The speed of a bullet fired from a gun is inversely proportional to the square root of its mass. When the mass is 64 g, the speed is 560 m/s.  
Using  $s$  to represent speed in m/s and  $m$  to represent mass in grams with  $k$  as the constant,
- (a) write an equation connecting  $s$  and  $m$ , [3]
- (b) use the equation to find its mass when its speed is 400 m/s. [2]
- 3 There are 2 queues at the bus stop during peak hours. The number of people in the first and second queues are  $p$  and  $q$  respectively. The value of  $p$  is greater than  $q$ .
- (a) If the difference in the numbers of people in these queues is 18, form an equation connecting  $p$  and  $q$ . [1]
- (b) If the number of people in the first queue is three times the number of people in the second queue, form another equation connecting  $p$  and  $q$ . [1]
- (c) Solve the simultaneous equations using substitution method.  
Hence, find the total number of people in the two queues. [3]
- 4 (a) Factorise  $16x^2 - 24xy + 9y^2$ . [2]
- (b) Given that  

$$x^2 + y^2 = 19$$
and  $xy = 3$ ,  
find the value of  $(x + y)$  when both  $x$  and  $y$  are positive. [3]
- 5 Expand and simplify each of the following algebraic expressions.
- (a)  $7(x - 3)(x + 2)$  [2]
- (b)  $(x - 1)[x^2 - (x + 1)]$  [3]



- 6 Sue is  $x$  years old. Carol is one year older than Sue and Niki is one year younger than Sue. The product of Carol's and Niki's ages is 264 times the difference of their ages.

(a) Use this information to form an equation, in terms of  $x$ , and show that it reduces to  $x^2 - 529 = 0$ . [2]

(b) Solve the equation for all possible values of  $x$ . [2]

(c) Hence, write down Niki's age. [1]

- 7 Simplify the following expressions.

(a)  $\frac{2x^2 - 2}{x^2 + 2x + 1} \div \frac{1}{x + 1}$  [3]

(b)  $\frac{6ab + cd - 2ad - 3bc}{3b - d}$  [3]

- 8 (a) Given that  $x = a + b^2$ ,

(i) make  $b$  the subject of the formula, [2]

(ii) hence, find the values of  $b$  when  $x = 240$  and  $a = 71$ . [2]

(b) Express  $\frac{3}{x - y} - \frac{4}{4y^2 - 4x^2} + \frac{5}{x + y}$  as a single fraction. [4]

- 9 (a) Factorise completely  $x^2y^2 - x^2 - 1 + y^2$ . [3]

(b) Solve  $\frac{p}{25} = \frac{1}{7p}$  giving your answer correct to 3 significant figures. [3]

(c) Mrs Chan bought  $x$  eggs at  $(x - 9)$  cents each and  $(x - 2)$  sausages at  $(x - 3)$  cents each. Write down and simplify an algebraic expression for the amount of money Mrs Chan spent. [3]

**10 Answer the whole question on a sheet of graph paper.**

The table of values for the quadratic equation  $y = 5 - x - x^2$  as shown below.

|     |    |    |     |   |   |     |
|-----|----|----|-----|---|---|-----|
| $x$ | -3 | -2 | -1  | 0 | 1 | 2   |
| $y$ | -1 | 3  | $p$ | 5 | 3 | $q$ |

- (a) Find
- (i)  $p$ ,
  - (ii)  $q$ . [2]
- (b) Using a scale of 2 cm to 1 unit for both  $x$ -axis and  $y$ -axis, draw the graph of  $y = 5 - x - x^2$  for  $-3 \leq x \leq 2$ . [3]
- (c) Use your graph to find
- (i) the equation of the line of symmetry, [1]
  - (ii) the maximum value of  $y$ , [1]
  - (iii) the values of  $x$  that satisfy the equation  $5 - x - x^2 = 3$ . [2]

**End of Paper**



## Answers (Sec 2E Maths 2014 Mid-Year Exam Paper 2)

|   |     | ANSWERS  |                |     |
|---|-----|--|----------------|-----|
| 1 | (a) | $3x^2 + bx - 6 = 0$<br>When $x = 3$ ,<br>$3(3)^2 + b(3) - 6 = 0$<br>$3b + 21 = 0$<br>$b = -7$  | B1             | 1   |
|   | (b) | $3x^2 - 7x - 6 = 0$<br>$(3x + 2)(x - 3) = 0$<br>$\therefore x = -\frac{2}{3}$ or $x = 3$<br>The other solution is $x = -\frac{2}{3}$ | M1<br>A1       | 2 3 |
| 2 | (a) | $s = \frac{k}{\sqrt{m}}$<br>$k = s\sqrt{m}$<br>$= 560 \times 8$<br>$= 4480$<br>$s = \frac{4480}{\sqrt{m}}$                           | M1<br>M1<br>A1 | 3   |
|   | (b) | $400 = \frac{4480}{\sqrt{m}}$<br>$m = \left(\frac{4480}{400}\right)^2$<br>$= 125.44 \text{ g}$                                       | M1<br>A1       | 2 5 |
| 3 | (a) | $p - q = 18$   | B1             | 1   |
|   | (b) | $p = 3q$   | B1             | 1   |
|   | (c) | $3q - q = 18$<br>$2q = 18$<br>$q = 9$<br>$p = 27$<br>total number of people in both queue = 36                                       | M1<br>M1<br>A1 | 3 5 |

|   |     |   |                        |   |     |
|---|-----|---|------------------------|---|-----|
| 4 | (a) | $16x^2 - 24xy + 9y^2 = (4x)^2 - 2(4x)(3y) + (3y)^2$<br>$= (4x - 3y)^2$ . or multiplication frame  | M1<br>A1               | 2 | cao |
|   | (b) | Given $x^2 + y^2 = 19$ and $xy = 3$ ,<br>$x^2 + y^2 + 2(xy) = 19 + 2(3)$<br>$x^2 + 2xy + y^2 = 25$<br>$(x + y)^2 = 25$<br>$(x + y) = \pm 5$<br>Since both $x$ and $y$ are positive,<br>$(x + y)$ cannot be $-5$ .<br>Hence, $(x + y) = 5$ . | M1<br><br>M1<br><br>A1 |   | 3   |

|   |     |   |                |   |   |
|---|-----|---|----------------|---|---|
| 5 | (a) | $7(x-3)(x+2) = 7(x^2 - x - 6)$<br>$= 7x^2 - 7x - 42$  | M1<br>A1       | 2 |   |
|   | (b) | $(x-1)[x^2 - (x+1)]$<br>$= (x^3 - x(x+1) - x^2 + (x+1))$ or $(x-1)[x^2 - x - 1]$<br>$= (x^3 - x^2 - x - x^2 + x + 1)$<br>$= x^3 - 2x^2 + 1$ | M1<br>M1<br>A1 | 3 | 5 |

|   |     |  |              |   |   |
|---|-----|--|--------------|---|---|
| 6 | (a) | Let $x$ years old be Sue's age.<br>Let $(x + 1)$ years old be Carol's age.<br>Let $(x - 1)$ years old be Niki's age.<br>$(x + 1)(x - 1) = 264[(x + 1) - (x - 1)]$<br>$(x^2 - 1) = 264(2)$<br>$x^2 - 529 = 0$ (shown) | M1<br><br>A1 | 2 |   |
|   | (b) | $x^2 - 529 = 0$<br>$x^2 - 23^2 = 0$<br>$(x + 23)(x - 23) = 0$<br>$x = -23$ or $23$ .   | M1<br><br>A1 | 2 |   |
|   | (c) | 22   | B1           | 1 | 5 |

|   |     |   |                        |   |  |
|---|-----|---|------------------------|---|--|
| 7 | (a) | $\frac{2x^2 - 2}{x^2 + 2x + 1} \div \frac{1}{x + 1}$<br>$= \frac{2(x^2 - 1)}{(x + 1)^2} \times \frac{x + 1}{1}$<br>$= \frac{2(x - 1)(x + 1)}{(x + 1)^2} \times \frac{x + 1}{1}$<br>$= 2(x - 1)$ or $2x - 2$ | M1<br><br>M1<br><br>A1 | 3 |  |
|---|-----|---|------------------------|---|--|

|     |   |          |    |   |
|-----|---|----------|----|---|
| (b) | $\frac{6ab + cd - 2ad - 3bc}{3b - d}$     |          |    |   |
|     | $= \frac{6ab - 3bc + cd - 2ad}{3b - d}$   | M1       |    |   |
|     | $= \frac{3b(2a - c) + d(c - 2a)}{3b - d}$ | } either | M1 |   |
|     | $= \frac{3b(2a - c) - d(2a - c)}{3b - d}$ |          |    |   |
|     | $= \frac{(3b - d)(2a - c)}{3b - d}$       |          |    |   |
|     | $= 2a - c$                                | A1       | 3  | 6 |

|   |       |   |    |   |   |
|---|-------|---|----|---|---|
| 8 | (ai)  | $x = a + b^2$   |    |   |   |
|   |       | $b^2 = x - a$   |    |   |   |
|   |       | $b = \pm\sqrt{x - a}$   | M1 |   |   |
|   |       |   | A1 | 2 |   |
|   | (aii) | $b = \pm\sqrt{240 - 71}$  |    |   |   |
|   |       | $= +13$   | M1 |   |   |
|   |       | or -13  | A1 | 2 |   |
|   | (b)   | $\frac{3}{x - y} - \frac{4}{4y^2 - 4x^2} + \frac{5}{x + y}$       |    |   |   |
|   |       | $= \frac{3}{x - y} - \frac{4}{4(y + x)(y - x)} + \frac{5}{x + y}$ | M1 |   |   |
|   |       | $= \frac{3}{x - y} + \frac{4}{4(x + y)(x - y)} + \frac{5}{x + y}$ | M1 |   |   |
|   |       | $= \frac{3(x + y) + 1 + 5(x - y)}{(x + y)(x - y)}$                | M1 |   |   |
|   |       | $= \frac{8x - 2y + 1}{(x + y)(x - y)}$                            | A1 | 4 | 8 |

|   |     |  |                      |   |     |
|---|-----|--|----------------------|---|-----|
| 9 | (a) | $x^2y^2 - x^2 - 1 + y^2$ $= x^2(y^2 - 1) - (1 - y^2) \text{ or } x^2(y^2 - 1) + (-1 + y^2)$ $= x^2(y^2 - 1) + (y^2 - 1) = (x^2 + 1)(y^2 - 1)$ $= (x^2 + 1)(y^2 - 1)$ $= (x^2 + 1)(y + 1)(y - 1)$ | M1<br>M1<br>A1       | 3 |     |
|   | (b) | $\frac{p}{25} = \frac{1}{7p}$ $7p^2 = 25$ $p^2 = \frac{25}{7}$ $p = \pm \sqrt{\frac{25}{7}}$ $= \pm 1.89$  | M1<br>M1             |   |     |
|   | (c) | $x(x - 9) + (x - 3)(x - 2)$ $= x^2 - 9x + x^2 - 5x + 6$ $= 2(x^2 - 7x + 3) \text{ or } 2x^2 - 14x + 6$   | A1<br>M1<br>M1<br>A1 | 3 | 3 9 |

10 (ai)

|     |    |    |          |   |   |           |
|-----|----|----|----------|---|---|-----------|
| $x$ | -3 | -2 | -1       | 0 | 1 | 2         |
| $y$ | -1 | 3  | <u>5</u> | 5 | 3 | <u>-1</u> |

$p = 5$

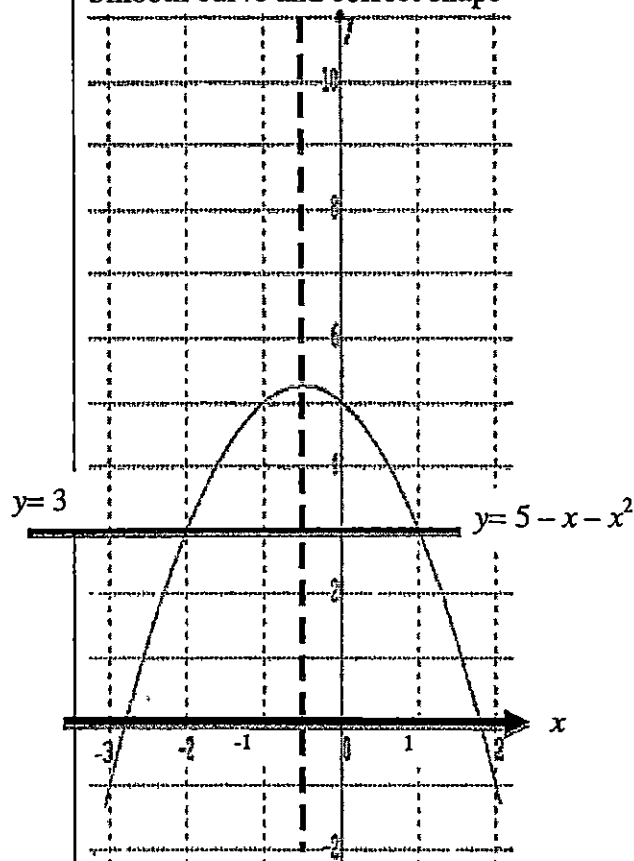
$q = -1$

(b)

Correct scale

Correct axes

Smooth curve and correct shape



Line of symmetry,  $y = -0.5$

(ci)

$x = -0.5 \pm 0.5$

(cii)

$5.25 \pm 0.5$

(ciii)

1 or  $-2 \pm 0.5$

B2 2

D1

D1

D1 3

D1 1

B1 1

B1 1

B1

for

both 1 9



# Geylang Methodist School (Secondary) Mid-Year Examination 2014

Candidate  
Name

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Class

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Index Number

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## MATHEMATICS

Paper 1

2 Express

Candidates answer on the Question Paper.

1 hour

Setter : Ms Grace Yap

16 May 2014

### READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in the loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to 3 significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

|   |
|---|
| For Examiner's Use  |
| <div style="text-align: right; font-size: 2em; font-weight: bold;">50</div> |



Total Score: [50 marks]

Answer ALL questions in this paper.

1 Express 4.905378 correct to

- (a) the nearest integer,
- (b) two decimal places,
- (c) four significant figures.

Answer: (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [1]

(c) \_\_\_\_\_ [1]

2 Consider the number pattern.

$$\frac{2}{1 \times 2 \times 3} = \frac{1}{1} - \frac{2}{2} + \frac{1}{3}$$

$$\frac{2}{2 \times 3 \times 4} = \frac{1}{2} - \frac{2}{3} + \frac{1}{4}$$

$$\frac{2}{3 \times 4 \times 5} = \frac{1}{3} - \frac{2}{4} + \frac{1}{5}$$

(a) Write down the eighth line in the pattern.

(b) Find the value of  $\frac{1}{30} - \frac{2}{31} + \frac{1}{32}$ .

Answer: (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [2]

3 If  $y$  is directly proportional to  $\frac{1}{2}x^2 + 5$  and  $y = 14$  when  $x = 2$ ,

- (a) find an equation connecting  $x$  and  $y$ ,
- (b) find the value of  $y$  when  $x = 5$ ,
- (c) calculate the values of  $x$  when  $y = 26$ .

Answer: (a) \_\_\_\_\_ [2]

(b)  $y =$  \_\_\_\_\_ [1]

(c)  $x =$  \_\_\_\_\_ or \_\_\_\_\_ [2]

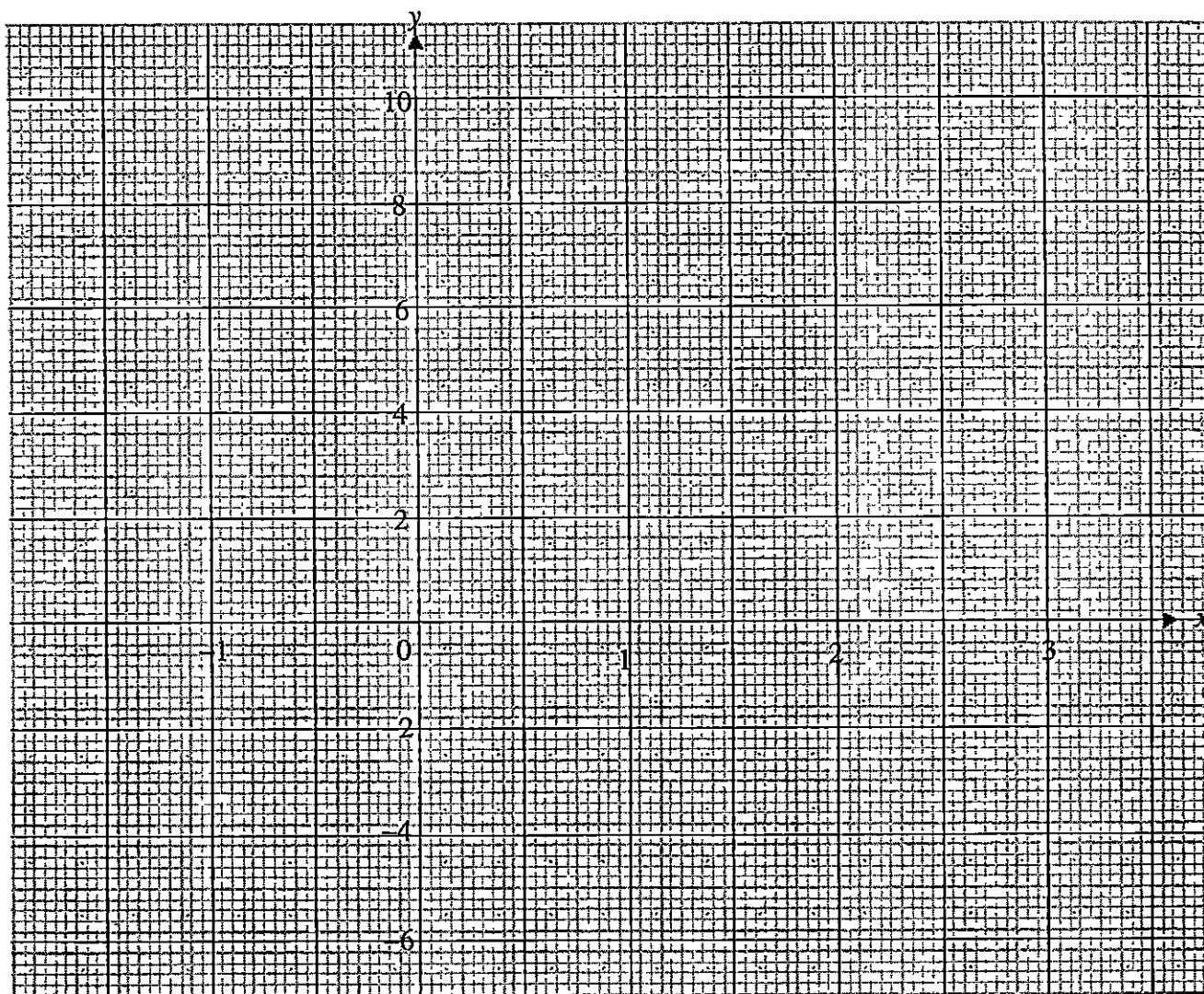
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- 4 The variables  $x$  and  $y$  are connected by the equation  $y - 3x = -2$ .

Some values of  $x$  and the corresponding values of  $y$  are given in the table.

|     |      |      |     |
|-----|------|------|-----|
| $x$ | $-1$ | $0$  | $2$ |
| $y$ | $p$  | $-2$ | $q$ |

- (a) Find the value of  $p$  and of  $q$ .
- (b) Draw the graph of  $y - 3x = -2$  on the axes given below. [1]
- (c) On the same axes, draw and label the line  $x = 2$ . [1]
- (d) Find the area of the figure bounded by the lines  $y - 3x = -2$ ,  $x = 2$  and  $y = -2$ .



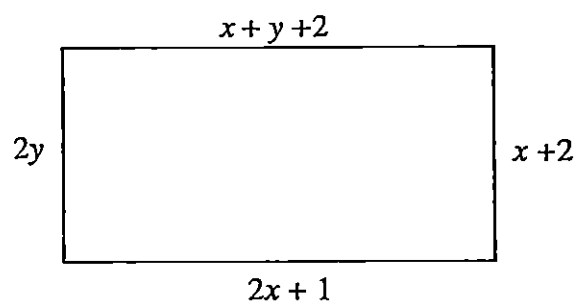
Answer: (a)  $p = \underline{\hspace{1cm}}$   $q = \underline{\hspace{1cm}}$  [2]

(d)  $\underline{\hspace{2cm}}$  units<sup>2</sup> [1]

- 5 The figure shows a rectangle with its sides as indicated. The sides are given in centimetres.

Find

- (a) the value of  $x$  and of  $y$ ,  
(b) the area of the rectangle.



Answer: (a)  $x =$  \_\_\_\_\_

$y =$  \_\_\_\_\_ [3]

(b) \_\_\_\_\_  $\text{cm}^2$  [2]

**6** Expand and simplify each of the following expressions.

**(a)**  $(6w + y^3)(3w - 2y^3)$

**(b)**  $3x(x - 6) - (2x + 5)(-x + 3)$

*Answer:* (a) \_\_\_\_\_[2]

(b) \_\_\_\_\_[4]

- 7 Expand and simplify each of the following expressions using suitable special algebraic identities.

(a)  $(-3a - 7b)^2$

(b)  $2(ab + 3)^2 - 9$

Answer: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [3]

---

8 (a) Simplify  $x^2 - (x - a)(x + a)$ .

- (b) Using your answer to (a), write down the value of  $17948^2 - 17945 \times 17951$  without using a calculator.

Answer: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

---

9 Simplify the following algebraic expressions.

(a)  $\frac{18a^4b^5}{81a^2b^8}$

(b)  $\frac{h^2 - 1}{h^2 - 3h + 2} \div \frac{3h + 6}{h - 2}$

Answer: (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [3]

**10** Factorise fully the following expression.

(a)  $ab + 4a + 3b + 12$

(b)  $9x^2 - \frac{4}{81}y^2$

(c)  $8x^2 + 4x - 60$

*Answer:* (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

(c) \_\_\_\_\_ [2]



11 Given that  $\sqrt{\frac{1-s}{s+r}} = p$ ,

- (a) express  $s$  in terms of  $p$  and  $r$ ,  
(b) find the value of  $s$  if  $p = 1$  and  $r = 2$ .

*Answer:* (a) \_\_\_\_\_ [3]

(b) \_\_\_\_\_ [1]

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----- End of Paper -----



GMS(S)/Math/P1/MYE2014/2E

## Answer Keys (Paper 1)

|    |                             |     |  |
|----|-----------------------------|-----|--|
| 1a | 5                           | 8a  | $a^2$                                    |
| 1b | 4.90                        | 8b  | 9  |
| 1c | 4.900                       | 9a  | $\frac{2a^2}{9b^3}$                      |
| 2a | 40                          | 9b  | $\frac{h+1}{3(h+2)}$                     |
| 2b | $\frac{1}{14880}$           | 10a | $(a+3)(a+4)$                             |
| 3a | $y = 2(\frac{1}{2}x^2 + 5)$ | 10b | $(3x - \frac{2}{9}y)(3x + \frac{2}{9}y)$ |
| 3b | $y = 35$                    | 10c | $4(2x - 5)(x + 3)$                       |
| 3c | $x = \pm 4$                 | 11a | $s = \frac{1-p^2r}{p^2+1}$               |
| 4a | $p = -5, q = 4$             | 11b | $s = -\frac{1}{2}$                       |
| 4d | 6 units <sup>2</sup>        |     |  |
| 5a | $x = 4, y = 3$              |     |  |
| 5b | 54cm <sup>2</sup>           |     |  |
| 6a | $18w^2 - 9wy^3 - 2y^6$      |     |  |
| 6b | $5x^2 - 19x - 15$           |     |  |
| 7a | $9a^2 + 42a + 29a^2$        |     |  |
| 7b | $2a^2b^2 + 12ab + 9$        |     |  |



## Marking Scheme (Paper 1)

| Qn | Workings / Answers  | Marks  | Remarks                        |
|----|---|--------|--------------------------------|
| 1a | 5   | 1      |                                |
| 1b | 4.91  | 1      |                                |
| 1c | 4.905   | 1      |                                |
| 2a | $\frac{2}{8 \times 9 \times 10} = \frac{1}{8} - \frac{2}{9} + \frac{1}{10}$   | 1      |                                |
| 2b | $\frac{2}{30 \times 31 \times 32} = \frac{2}{29760}$<br>$= \frac{1}{14880}$   | 1<br>1 |                                |
| 3a | $k = \frac{y}{\frac{1}{2}x^2 + 5}$<br>$k = \frac{14}{\frac{1}{2}(2)^2 + 5}$<br>$k = 2$<br>$y = 2\left(\frac{1}{2}x^2 + 5\right) \text{ or } 2 = \frac{y}{\frac{1}{2}x^2 + 5}$ | 1<br>1 |                                |
| 3b | $2 = \frac{y}{\frac{1}{2}x^2 + 5}$<br>$y = 2\left[\frac{1}{2}(25) + 5\right]$<br>$y = 35$   | 1      |                                |
| 3c | $y = 2\left(\frac{1}{2}x^2 + 5\right)$<br>$26 = 2\left(\frac{1}{2}x^2 + 5\right)$<br>$\frac{1}{2}x^2 + 5 = 13$<br>$\frac{1}{2}x^2 = 8$<br>$x^2 = 16$<br>$x = \pm 4$           | 1,1    | 1 for $\pm$ sign, 1 for answer |
| 4a | $p = -5$<br>$q = 4$   | 1<br>1 |                                |
| 4b | Refer to graph  |        |                                |
| 4c | Refer to graph  |        |                                |

|    |   |                     |  |
|----|---|---------------------|--|
| 4d | Area = $\frac{1}{2} \times 2 \times 6$<br>= 6 units <sup>2</sup>  | 1                   |  |
| 5a | $x + y + 2 = 2x + 1$<br>$1 = x - y$ -----(1)<br><br>$2y = x + 2$<br>$2y - 2 = x$ -----(2)<br><br>sub (2) into (1)<br><br>$1 = 2y - 2 - y$<br>$3 = y$<br><br>sub $y = 3$ into (2)<br><br>$2(3) - 2 = x$<br>$4 = x$ | 1<br><br>1<br><br>1 |  |
| 5b | Area = $(2x + 1)(x + 2)$<br>= $[2(4) + 1][4 + 2]$<br>= $54\text{cm}^2$  | 1<br>1              |  |
| 6a | $(6w + y^3)(3w - 2y^3)$<br>= $18w^2 - 12wy^3 + 3wy^3 - 2y^6$<br>= $18w^2 - 9wy^3 - 2y^6$  | 1<br>1              |  |
| 6b | $3x(x - 6) - (2x + 5)(-x + 3)$<br>= $3x^2 - 18x - [-2x^2 + 6x - 5x + 15]$<br>= $3x^2 - 18x + 2x^2 - x - 15$<br>= $5x^2 - 19x - 15$  | 1,1<br>1<br>1       |  |
| 7a | $(-3a - 7b)^2$<br>= $(-3a)^2 - 2(-3a)(7b) + (7b)^2$<br>= $9a^2 + 42ab + 49b^2$  | 1<br>1              |  |
| 7b | $2(ab + 3)^2 - 9$<br>= $2[(ab)^2 + 2(ab)(3) + (3)^2] - 9$<br>= $2a^2b^2 + 12ab + 18 - 9$<br>= $2a^2b^2 + 12ab + 9$  | 1<br>1<br>1         |  |
| 8a | $x^2 - (x - a)(x + a)$<br>= $x^2 - [x^2 - a^2]$<br>= $x^2 - x^2 + a^2$<br>= $a^2$   | 1<br>1              |  |
| 8b | $17948^2 - 17945 \times 17951$<br>= $17948^2 - [17948^2 - 3^2]$<br>= $3^2$<br>= 9   | 1<br>1              |  |

|     |   |                                 |  |
|-----|---|---------------------------------|--|
| 9a  | $\frac{18a^4b^5}{81a^2b^8} = \frac{2a^2}{9b^3}$   | 1                               |  |
| 9b  | $\frac{h^2-1}{h^2-3h+2} \div \frac{3h+6}{h-2}$ $= \frac{(h+1)(h-1)}{(h-2)(h-1)} \times \frac{h-2}{3(h+2)}$ $= \frac{h+1}{3(h+2)}$           | 1,1<br><br>1                    |  |
| 10a | $ab+4a+3b+12$ $= a(b+4)+3(b+4)$ $= (a+3)(b+4)$  | 1<br>1                          |  |
| 10b | $9x^2 - \frac{4}{81}y^2$ $= (3x)^2 - \left(\frac{2}{9}y\right)^2$ $= \left(3x - \frac{2}{9}y\right)\left(3x + \frac{2}{9}y\right)$          | 1<br><br>1                      |  |
| 10c | $8x^2+4x-60$ $= 4(2x^2+x-15)$ $= 4(2x-5)(x+3)$  | 1<br>1                          |  |
| 11a | $\sqrt{\frac{1-s}{s+r}} = p$ $\frac{1-s}{s+r} = p^2$ $1-s = p^2s + p^2r$ $1-p^2r = p^2s + s$ $s(p^2+1) = 1-p^2r$ $s = \frac{1-p^2r}{p^2+1}$ | <br><br>1<br><br><br>1<br><br>1 |  |
| 11b | $s = \frac{1-p^2r}{p^2+1}$ $s = \frac{1-(1)^2(2)}{1^2+1}$ $s = -\frac{1}{2}$  | <br><br><br>1                   |  |



# **Geylang Methodist School (Secondary)**

## **Mid – Year Examination 2014**

### **MATHEMATICS**

Paper 2

**2 Express**

Additional materials : Writing Papers  
One sheet of graph paper

**1 hour 30 minutes**

**Setter :** Mr Cheng Xin Jin

**15 May 2014**

#### **READ THESE INSTRUCTIONS FIRST**

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen in both sides of the paper.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in the loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to 3 significant figures. Give answers in degrees to one decimal place.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

Total Score: [50 marks]

Answer ALL questions in this paper.

- 1 (a) Find the lowest number  $k$ , such that  $224k$  is a perfect square. [2]

- (b) 3 bells toll at intervals of 12, 15, 42 minutes respectively. If the bells toll together at 2pm on Monday, when will be the next time the bells toll together? [3]

- 2 Solve the simultaneous equations.

$$\frac{1}{2}x - \frac{1}{3}y - 1 = 0,$$

$$x + 6y + 8 = 0. \quad [4]$$

- 3 (a) Factorise completely  $81m^4 - 16n^4$ . [3]

- (b) Simplify  $\frac{4u^2 - 36 - u^2t + 9t}{u^2 + 4u - 21}$ . [4]

- (c) Expand and simplify  $\left(\frac{1}{2}x + 4\right)^2 - x\left(4 - \frac{9}{x}\right)$ . [4]

- 4 It is given that  $y$  is directly proportional to  $(x - 2)^3$  and  $x = 7$  when  $y = 375$ . Find

- (a) an equation connecting  $x$  and  $y$ , [2]

- (b) the value of  $y$  when  $x = 5$ , [1]

- (c) the value of  $x$  when  $y = 24$ . [2]

5 If  $p = \frac{6}{3x+2}$  and  $pq = \frac{2}{9x^2-4}$ , find  $q$  in terms of  $x$ . [3]

- 6 The speed of a bullet from a gun is inversely proportional to the square root of its mass. When the mass is 36g, the speed is 640 m/s.
- (a) Express the speed  $S$ , of the bullet in terms of its mass  $m$ . [3]
- (b) Find the mass of the bullet when the speed is 420 m/s. Leave your answer in 3 significant figures. [2]

- 7 Subscribers to a Cable TV service pay a monthly subscription rate of \$18.00 and an additional amount for every channel that they subscribe according to the table shown below. For the first five channels subscribed, they need to pay \$8.50 for each channel. Thereafter, for each additional channel, they need to pay \$6.50.

|                               | 1 to 5 channels | 6 or more channels |
|-------------------------------|-----------------|--------------------|
| Monthly cost for each channel | \$8.50          | \$6.50             |

- (a) Rita subscribed to eight channels. Calculate her total monthly bill. [1]
- (b) Marilyn's total monthly bill was \$119. Find the number of channels she subscribed to. [2]
- (c) The number of viewers for one of the channels, Cinemax, was 245,000 in August.
- (i) In September, the number of viewers increased to 298,000. [1]  
Calculate the percentage increase in viewership.
- (ii) The number of viewers in August is a 25% increase of July's [1]  
figure. Calculate the number of viewers in July.



- 8 Two numbers are chosen at random. When 5 times of the first number is added to 3 times of the second number, I get 31. When 19 is added to the second number, I obtain a number that is twice the first number. Find the two numbers. [4]

- 9 Answer the whole of this question on a graph paper.

The table below gives some values of  $x$  and the corresponding values of  $y$ , where  $2y = x + 4$  for  $0 \leq x \leq 6$ .

|     |   |   |     |
|-----|---|---|-----|
| $x$ | 0 | 2 | 5   |
| $y$ | 2 | 3 | $a$ |

- (a) Find the value of  $a$ . [1]
- (b) Using a scale of 2 cm to 1 unit on the  $x$  axis, and 2 cm to 1 unit on the  $y$  axis, plot the graph of  $2y = x + 4$ . [3]
- (c) On the same axis, draw the graph of  $y = 2x - 4$ . [2]
- (d) Hence, by using your graphs, solve the simultaneous equations

$$4 + x = 2y,$$

$$2x - 4 - y = 0. \quad [2]$$

**End of paper**





## Exam Solutions

1a)  $2^5 \times 7 \times 2 \times 7 = 2^6 \times 7^2$  (perfect square) [M1]

$2 \times 7 = 14$  [A1]

1b)  $2 \mid 12 \ 15 \ 42$  [M1]

$3 \mid 6 \ 15 \ 21$

$2 \mid 2 \ 5 \ 7$

$5 \mid 1 \ 5 \ 7$

$7 \mid 1 \ 1 \ 7$

$1 \ 1 \ 1$

$\text{LCM} = 2^2 \times 3 \times 5 \times 7 = 420 \text{ mins} = 7 \text{ hrs}$  [M1]

Time is 9pm [A1]

2)  $\frac{1}{2}x - \frac{1}{3}y - 1 = 0$

$3x - 2y = 6$  ----- (1)

$x + 6y + 8 = 0$

$x = -6y - 8$  ----- (2)

Sub (2) in (1)

$3(-6y - 8) - 2y = 6$  [M1]

$y = -1.5$  [A1]

Sub  $y = -1.5$  into (2) [M1]

$x = 9 - 8 = 1$  [A1]

3a)  $81m^4 - 16n^4 = (9m^2 + 4n^2)(9m^2 - 4n^2)$  [M1]

$= (9m^2 + 4n^2)(3m + 2)(3m - 2)$  [A2]

$$3b) \frac{4u^2 - 36 - u^2t + 9t}{u^2 + 4u - 21} = \frac{(4-t)(u^2 - 9)}{(u+7)(u-3)} \quad [\text{M2}]$$

$$= \frac{(4-t)(u-3)(u+3)}{(u+7)(u-3)} \quad [\text{M1}]$$

$$= \frac{(4-t)(u+3)}{u+7} \quad [\text{A1}]$$

$$3c) \left(\frac{1}{2}x + 4\right)^2 - x\left(4 - \frac{9}{x}\right) = \frac{1}{4}x^2 + 4x + 16 - 4x + 9 \quad [\text{M3}] \text{ 2 marks for first expression}$$

$$= \frac{1}{4}x^2 + 25 \quad [\text{A1}]$$

$$4a) y = k(x-2)^3$$

$$375 = k(7-2)^3 \quad k = 3 \quad [\text{M1}]$$

$$y = 3(x-2)^3 \quad [\text{A1}]$$

$$4b) y = 3(5-2)^3 \quad y = 81 \quad [\text{A1}]$$

$$4c) 24 = 3(x-2)^3$$

$$(x-2)^3 = 8$$

$$x-2 = 2 \quad [\text{M1}]$$

$$x = 4 \quad [\text{A1}]$$

$$5a) \text{If } p = \frac{6}{3x+2} \text{ and } pq = \frac{2}{9x^2-4}, \text{ find } q \text{ in terms of } x.$$

$$p = \frac{2}{q(9x^2-4)}$$

$$\frac{2}{q(9x^2-4)} = \frac{6}{3x+2} \quad [\text{M1}]$$

$$3q = \frac{3x+2}{(3x+2)(3x-2)} \quad [\text{M1}]$$

$$q = \frac{1}{3(3x-2)} \quad [\text{A1}]$$

$$6a) s = \frac{k}{\sqrt{m}} \quad [\text{M1}]$$

$$k = 3840 \quad [\text{M1}]$$

$$s = \frac{3840}{\sqrt{m}} \quad [\text{A1}]$$

$$6b) 420 = \frac{3840}{\sqrt{m}}$$

$$\sqrt{m} = \frac{3840}{420} \quad [\text{M1}]$$

$$m = 83.6g \text{ (3 sig fig)} \quad [\text{A1}]$$

$$7a) \$80 \quad [\text{A1}]$$

$$7b) 119 - 18 = 101$$

$$\frac{101 - 42.5}{6.50} = 9 \quad [\text{M1}]$$

$$9 + 5 = 14 \text{ channels} \quad [\text{A1}]$$

$$7ci) \frac{53000}{245000} \times 100\% = 21.6\% \quad [\text{A1}]$$

$$7cii) 125\% = 245000$$

$$100\% = 196000 \quad [\text{A1}]$$

8. First number  $\rightarrow x$

2<sup>nd</sup> number  $\rightarrow y$

$$5x + 3y = 31 \text{ ----- (1)}$$

$$y = 2x - 19 \text{ ----- (2)} \quad [\text{M1}]$$

$$5x + 3(2x - 19) = 31 \quad [\text{M1}]$$

$$x=8 \quad y=-3$$

[A2]

-

Answer **all** the questions.

- 1 The estimated number of voters in an election, rounded off to 3 significant figures, is 23200.

Write down

- (a) the smallest possible number of voters,  
(b) the largest possible number of voters.

Answer (a) ..... [1]

(b) ..... [1]

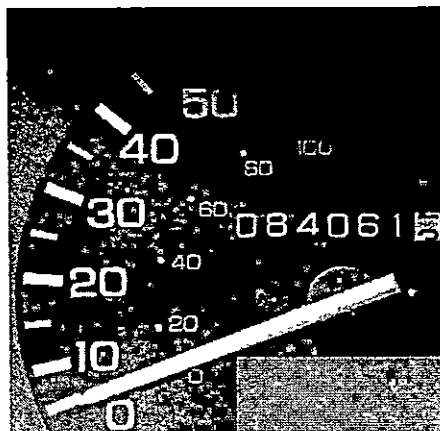
- 
- 2 Evaluate

$$6900 \left( 1 + \frac{2.75}{100} \right)^3,$$

leaving your answer correct to 2 decimal places.

Answer ..... [2]

- 3 (a) The diagram shows part of an odometer in a car, used to track the distance travelled by the car.  
The initial reading shows 084061 km.



Harrydrove the car from Singapore to Kuala Lumpur.  
He stopped at Kuala Lumpur and noticed that the odometer reading has changed to 084415 km.

Calculate the distance he had travelled in metres.

- (b) Harry visited Perdana Botanical Garden in Kuala Lumpur.  
The area of the garden is 918 000 m<sup>2</sup>.

Calculate the area of the garden in square kilometres.

Answer (a) ..... m [1]

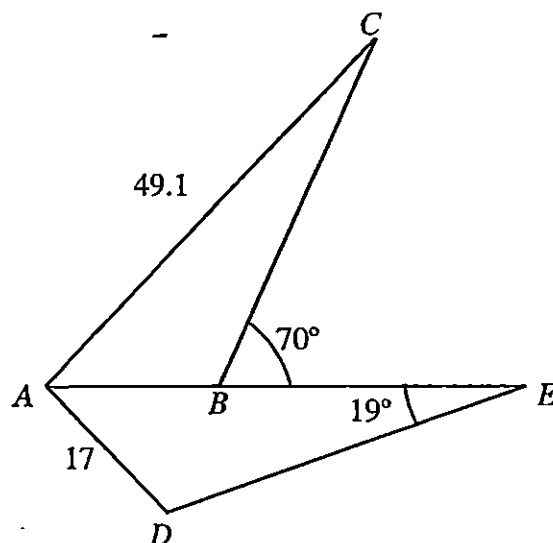
(b) ..... km<sup>2</sup> [1]



- 4 In the diagram,  $\triangle ABC \equiv \triangle ADE$ .  
 $AC = 49.1$  cm,  $AD = 17$  cm,  $\angle DEB = 19^\circ$  and  $\angle EBC = 70^\circ$ .

Find

- (a) the length of  $BE$ ,  
 (b)  $\angle CAB$ .

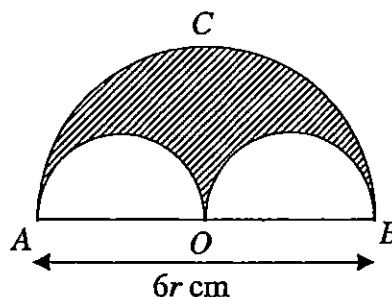


Answer (a)  $BE = \dots\dots\dots$  cm [1]

(b)  $\angle CAB = \dots\dots\dots^\circ$  [1]

- 5 In the diagram,  $ABC$  represents a semicircular card with centre  $O$  and diameter  $6r$  cm. Two equal semicircles were cut away such that what remains of the card is the shaded region as shown. It is given that the area of the shaded region is  $36\pi$  cm<sup>2</sup>.

Calculate the value of  $r$ .



Answer  $r = \dots\dots\dots$  [3]

6 (a) Solve the inequality  $\frac{x+3}{12} \geq \frac{2x-5}{4}$ .

(b) Write down all positive integer values of  $x$  such that  $x$  satisfies  $\frac{x+3}{12} \geq \frac{2x-5}{4}$ .

Answer (a) ..... [2]

(b) ..... [1]

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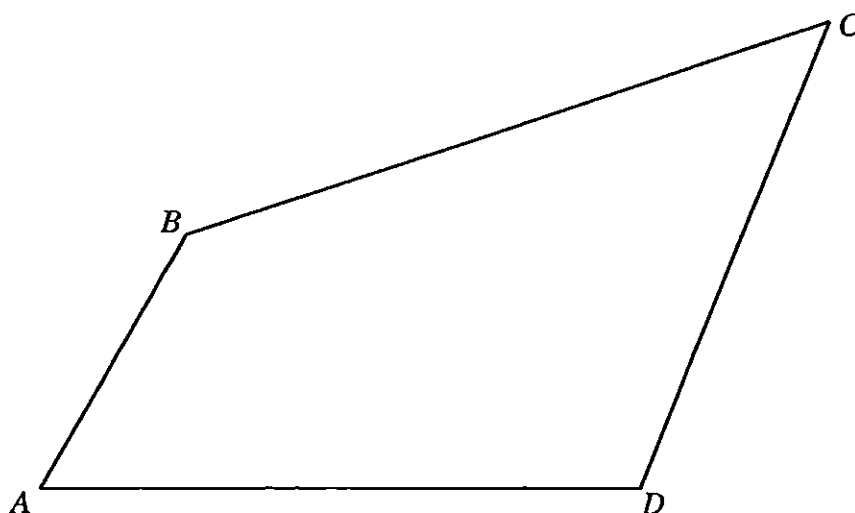
7 Express as a single fraction in its simplest form

$$\frac{-6x}{(2x-3)(2x+3)} - \frac{x}{3-2x}$$

Answer ..... [3]

- 8 The quadrilateral  $ABCD$  is drawn in the answer space below.

Answer (a) and (b)



- (a) Construct
- (i) the perpendicular bisector of  $BC$ , [1]
  - (ii) the bisector of  $\angle BAD$ . [1]
- Label all your constructions clearly.
- (b) The point  $Q$  is a point in the quadrilateral  $ABCD$  such that  $Q$  is equidistant from the lines  $AB$  and  $AD$  and nearer to point  $C$  than to point  $B$ .
- Mark a possible position for point  $Q$ . [1]

9 Jennifer saw the following online advertisement from Booking.com.

|   |  |  |
|---|--|--|
| <b>Hilton On The Park Melbourne</b>   |  | <b>Only 2 rooms left<br/>at this price</b> |
| ★★★★★   |  | <b>\$150</b>                               |
| In the heart of East Melbourne-main sports and entertainment district, contemporary furnishing with large opening windows |  | per night                                  |
| Most Popular! 23 people booked this hotel in the last 48 hours  |  | Sponsored Listing                          |

The price of renting a hotel room displayed on the advertisement is  $37\frac{1}{2}\%$  less than the normal price.

- Calculate the normal price of renting a hotel room per night.
- Jennifer paid a total of \$517.50, inclusive of breakfast, for a 3-night stay. Calculate the amount she paid for the breakfast each day.

Answer (a) \$ ..... [2]

(b) \$ ..... [2]

- 10 The cost of a gold bracelet, \$ $C$ , changes with its mass,  $m$  grams. The table below gives some corresponding values of  $C$  and  $m$ .

|                   |        |      |      |
|-------------------|--------|------|------|
| Cost (\$ $C$ )    | 312.50 | 1152 | 1800 |
| Mass ( $m$ grams) | 25     | 48   | 60   |

- (a) Show that  $C$  is directly proportional to  $m^2$ .
- (b) Anna bought a gold bracelet of mass  $P$  grams for \$242. Brenda brought a \$1000 dollar note to buy a similar gold bracelet with mass 200% more than that of Anna's. Do you think Brenda will have enough cash to buy the bracelet? Show your working clearly.

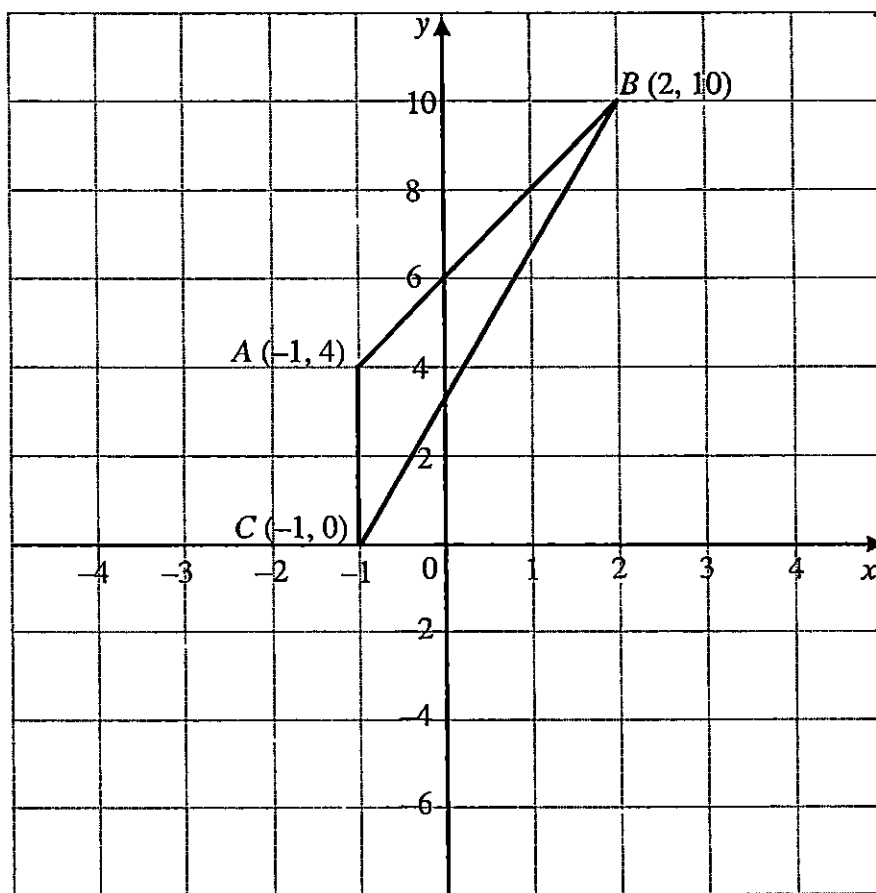
Answer (a) .....

[2]

(b) .....

[2]

- 11 The diagram shows a triangle  $ABC$ .  
 $A$  is the point  $(-1, 4)$ ,  $B$  is the point  $(2, 10)$  and  $C$  is the point  $(-1, 0)$ .



- (a) Write down the gradient of the line  $AB$ .
- (b) A line  $l$ , parallel to  $AB$ , passes through the point  $(-2, 4)$ .  
Write down the equation of the line  $l$ .
- (c)  $ABDC$  is a trapezium with  $AC$  parallel to  $BD$ .  
The area of the trapezium is  $18 \text{ units}^2$ .  
Find the coordinates of point  $D$ .

Answer (a) ..... [1]

(b) ..... [1]

(c)  $D$  (....., ..... ) [2]

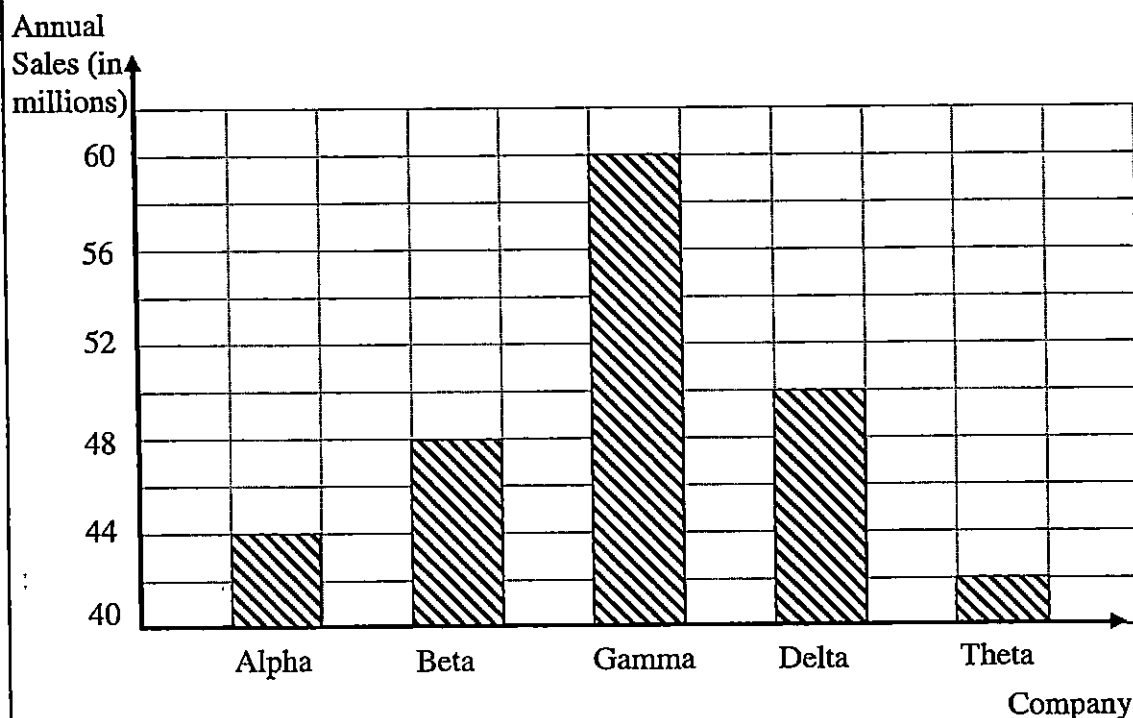
12 (a) Given that  $(2x - y)^2 = 40$  and  $x^2 - xy = -26$ , find the possible values of  $y$ .

(b) Given that  $4a^2 - 13ab + 9b^2 = 0$  and  $a \neq b$ , find the value of  $\frac{4a + 9b}{2a + 3b}$ .

Answer (a)  $y = \dots\dots\dots$  or  $\dots\dots\dots$  [2]

(b)  $\dots\dots\dots$  [3]

13 The bar graph shows the annual sales of five branches of a company.

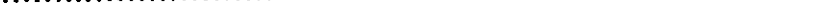


- Find the ratio of the annual sales for Alpha to that of Beta branch.
- Gamma claimed that its annual sales are twice that of Delta branch. Do you agree with the statement? Explain your answer.
- Express the annual sales of Theta as a percentage of the total annual sales for all the five branches.
- The manager wants to plan the manpower allocation for next year. Explain why representing the above information in a pie chart will help him do this planning better.

*Answer (a)* ..... : ..... [1]

(b) ..... [1]

(c) ..... % [2]

(d) 



14 (a) Solve  $5 - (6 - y)^2 = 1$ .

(b) (i) Solve  $3p^2 = 8p$ .

(ii) Hence solve the equation  $6(1 - 3x)^2 - 16(1 - 3x) = 0$ .

Answer (a)  $y = \dots\dots\dots$  or  $\dots\dots\dots$  [2]

(b)(i)  $p = \dots\dots\dots$  or  $\dots\dots\dots$  [2]

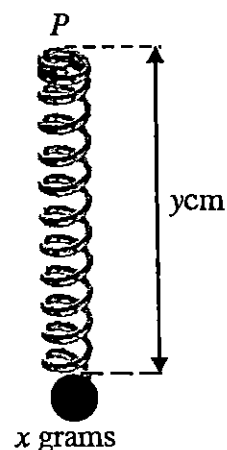
(ii)  $x = \dots\dots\dots$  or  $\dots\dots\dots$  [2]

- 15 A spring was suspended from a fixed point  $P$ .  
When an object of mass  $x$  grams is attached to its lower end, the  
spring is stretched so that its length is  $y$  cm, as shown in the diagram.

It is given that  $x$  and  $y$  are connected by the equation  $y = ax + b$ ,  
where  $a$  and  $b$  are constants.

The table below shows the results of two experiments.

|                   |    |    |
|-------------------|----|----|
| Mass ( $x$ grams) | 40 | 80 |
| Length ( $y$ cm)  | 38 | 42 |



- (a) Using the information in the table above Keith came out with the equation  
 $38 = 40a + b$ .  
 Write down another equation in terms of  $a$  and  $b$ .
- (b) Solve the two equations to find the value of  $a$  and the value of  $b$ .
- (c) Find the mass of the object attached to the spring when its length is 47 cm.
- (d) What does the value of  $b$  represent?

Answer (a) ..... [1]

(b)  $a =$  .....,  $b =$  ..... [3]

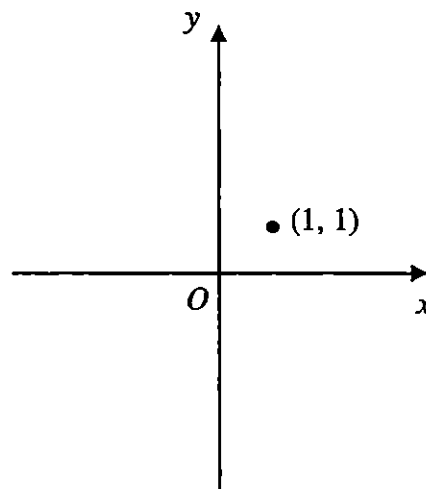
(c) ..... g [1]

(d) ..... [1]

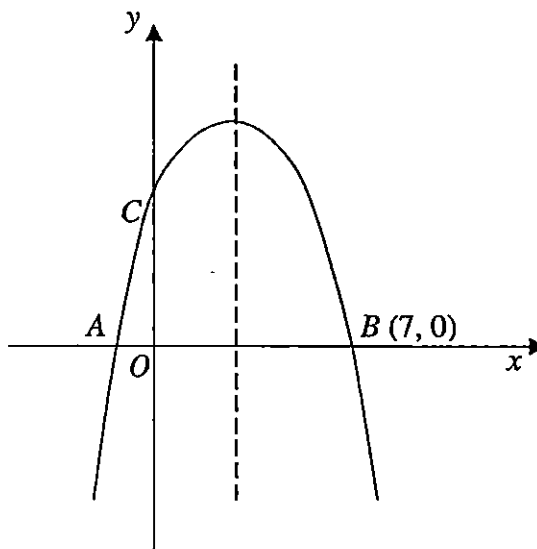
- 16 (a) The point (1, 1) is marked on the diagram below.  
Sketch the graph of  $y = 1 + 2x^2$  in the answer space provided.

Answer (a)

[2]



- (b) The sketch of the graph  $y = -x^2 + px + q$  is shown in the diagram below.  
The graph cuts the  $x$ -axis at points A and B(7, 0), and cuts the  $y$ -axis at point C.  
 $x = 3$  is the line of symmetry of the graph.



- (i) Write down the coordinates of the point A.  
(ii) Find the value of  $p$  and  $q$ .  
(iii) Write down the coordinates of the point C.

Answer (b)(i) A(....., .....)

[1]

(ii)  $p = \dots\dots\dots, q = \dots\dots\dots$ 

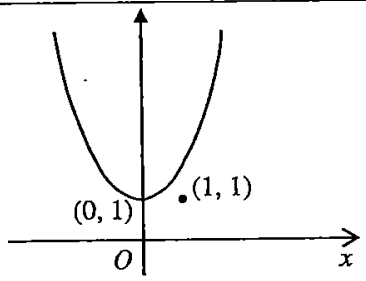
[2]

(iii) C (....., .....)

[1]



## Answer Key

|       |   |            |  |
|-------|---|------------|--|
| 1(a)  | 23 150  | 12(a)      | $y = \pm 12$   |
| 1(b)  | 23 249  | 12(b)      | 2.4  |
| 2     | 7485.05 (2 dp)  | 13(a)      | 11 : 12  |
| 3(a)  | 354 000 m   | 13(b)      | No, as the ratio of gamma : theta is 60 : 50 which is 6 : 5 and not 2 : 1  |
| 3(b)  | 0.918 km <sup>2</sup>   | 13(c)      | 17.2% (3 sf)   |
| 4(a)  | 32.1 cm   | 13(d)      | Using pie chart the manager is able to obtain the proportion of the annual sales of each branch compared to the total annual sales of the company. |
| 4(b)  | 51°   | 14(a)      | $y = 4$ or $y = 8$   |
| 5     | 4   | 14(b)(i)   | $p = 0$ or $p = 2\frac{2}{3}$  |
| 6(a)  | $x \leq 3\frac{3}{5}$   | 14(b)(ii)  | $x = \frac{1}{3}$ or $x = -\frac{5}{9}$  |
| 6(b)  | 3, 2, 1, 0, -1, ...   | 15(a)      | $42 = 80a + b$   |
| 7     | $\frac{x}{(2x+3)}$  | 15(b)      | $a = \frac{1}{10}$ , $b = 34$  |
| 8     | See construction attached   | 15(c)      | 130 g  |
| 9(a)  | \$240   | 15(d)      | $b$ represents the original length of the spring   |
| 9(b)  | \$22.50   | 16(a)      |    |
| 10(a) | $\frac{C}{m^2} = \frac{312.5}{25^2} = \frac{1152}{48^2} = \frac{1800}{60^2} = 0.5$<br>$\therefore \frac{C}{m^2}$ is a constant, $C$ and $m^2$ are in direct proportion. | 16(b)(i)   | $A(-1, 0)$   |
| 10(b) | $C = \$2178$<br>$\therefore$ she won't have enough cash to buy the bracelet.  | 16(b)(ii)  | $p = 6$ , $q = 7$  |
| 11(a) | 2   | 16(b)(iii) | $C(0, 7)$  |
| 11(b) | $y = 2x + 8$  |            |  |
| 11(c) | $D(2, 2)$   |            |  |



## Mid Year Examination 2014 Marking Scheme Sec 2 Express Mathematics Paper 1

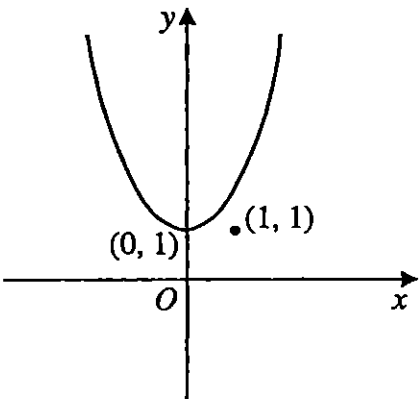
| Question No. | Marking Point  | Marks Awarded      | Total Marks | Remarks   |
|--------------|--|--------------------|-------------|---|
| 1 (a)        | 23 150   | B1                 | 1           | Working need not be shown                               |
| (b)          | 23 249   | B1                 | 1           |   |
| 2            | 7485.05 (2 dp)   | B2                 | 2           | Working need not be shown<br>B1 for 7485... seen        |
| 3 (a)        | Distance travelled<br>= 84 415 – 84 061<br>= 354 km<br>= 354 000 m   | B1                 | 1           |   |
| (b)          | 918 000 m <sup>2</sup><br>= 0.918 km <sup>2</sup>  | B1                 | 1           |   |
| 4 (a)        | AB = AD = 17 cm<br>AE = AC = 49.1 cm<br>BE = 49.1 – 17 = 32.1 cm   | B1                 | 1           |   |
| (b)          | ∠ACB = ∠AED = 19°<br>∠CAB = 70° – 19° = 51°  | B1                 | 1           | <u>Alternative method</u><br>180° – 110° – 19°<br>= 51° |
| 5            | $\frac{\pi(3r)^2}{2} - \pi\left(\frac{3}{2}r\right)^2 = 36\pi$<br>$\frac{9\pi r^2}{2} - \frac{9\pi r^2}{4} = 36\pi$<br>$\frac{9\pi r^2}{4} = 36\pi$<br>$r^2 = 16$<br>$r = 4$ | M1<br><br>M1<br>A1 | 3           |   |
| 6 (a)        | $\frac{x+3}{12} \geq \frac{2x-5}{4}$<br>$x+3 \geq 3(2x-5)$<br>$x+3 \geq 6x-15$<br>$5x \leq 18$<br>$x \leq 3\frac{3}{5}$ or $x \leq 3.6$                                      | M1<br><br>A1       | 2           | Allow M1 for answer without the inequality sign         |
| (b)          | 1, 2, 3  | B1                 | 1           |   |
| 7            | $= \frac{-6x}{(2x-3)(2x+3)} + \frac{x}{2x-3}$  | M1                 |             |   |

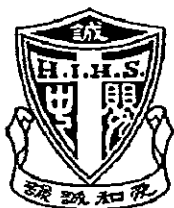
| Question No | Marking Point  | Marks Awarded                    | Total Marks | Remarks   |
|-------------|--|----------------------------------|-------------|---|
|             | $= \frac{-6x + x(2x+3)}{(2x-3)(2x+3)}$ $= \frac{-6x + 2x^2 + 3x}{(2x-3)(2x+3)}$ $= \frac{2x^2 - 3x}{(2x-3)(2x+3)}$ $= \frac{x(2x-3)}{(2x-3)(2x+3)}$ $= \frac{x}{(2x+3)}$ | M1<br><br><br><br><br><br><br>A1 | 3           |   |
| 8 (a)       | See construction attached  | B2                               | 2           | B1 for correct and accurate construction of perpendicular bisector  |
| (b)         | See construction attached<br>Point Q marked on the diagram   | B1                               | 1           | B1 for correct and accurate construction of angle bisector  |
| 9 (a)       | Let x be the normal price of the hotel<br>$\frac{62.5}{100} \times x = 150$  | M1                               |             |   |
|             | $x = 150 \times \frac{100}{62.5}$<br>= \$240   | A1                               | 2           |   |
| (b)         | Total amount = 517.50 - 3(150)<br>(for breakfast) = 67.50<br>Amount for breakfast each day<br>= 67.50 ÷ 3 = \$22.50  | M1<br><br>A1                     |             |   |
| 10 (a)      | $\frac{C}{m^2} = \frac{312.5}{25^2} = \frac{1152}{48^2} = \frac{1800}{60^2} = 0.5$<br>$\therefore \frac{C}{m^2}$ is a constant, C and $m^2$ are in direct proportion.    | M1<br><br>A1                     | 2           |   |
| (b)         | When the mass is increased by 200%,<br>new mass = 3P<br>$C = 0.5(3P)^2$<br>$C = 9(0.5P^2)$<br>$C = 9 \times 242$<br>= \$2178   | M1                               |             | <u>Alternative method</u><br>$C = 0.5m^2$<br>$242 = 0.5m^2$<br>$m = 22 \text{ g}$<br>$\frac{300}{100} \times 22 = 66 \text{ g}$<br>$C = 0.5(66)^2 = \$2178$ |

| Question No. | Marking Point   | Marks Awarded            | Total Marks | Remarks  |
|--------------|---|--------------------------|-------------|--|
|              | $\therefore$ she won't have enough cash to buy the bracelet.  | A1                       | 2           | Must show working  |
| 11 (a)       | Gradient of $AB = \frac{10-4}{3} = 2$   | B1                       | 1           | Answer may be obtained either by calculation or drawing the line   |
| (b)          | $y = 2x + 8$  | B1                       | 1           |  |
| (c)          | Let $y$ be the distance of the unknown parallel side<br>$\frac{1}{2}(4+y)3 = 18$<br>$4 + y = 12$<br>$y = 8$<br>$D(2, 2)$        | M1<br><br><br><br>A1     |             |  |
| 12 (a)       | $(2x - y)^2 = 40$<br>$4x^2 - 4xy + y^2 = 40$<br>$4(x^2 - xy) + y^2 = 40$<br>$4(-26) + y^2 = 40$<br>$y^2 = 144$<br>$y = \pm 12$  | M1<br><br><br><br><br>A1 | 2           | Alternative method<br>$\frac{9b+9b}{\frac{9}{2}b+3b}$<br>$= \frac{18b}{\left(\frac{15}{2}b\right)}$<br>$= 2.4$ |
| (b)          | $4a^2 - 13ab + 9b^2 = 0$<br>$(4a - 9b)(a - b) = 0$<br>$a - b = 0$ or $4a - 9b = 0$<br>(rejected $4a = 9b$<br>since $a \neq b$ ) | M1                       |             |  |
|              | $\frac{4a+9b}{2a+3b}$<br>$= \frac{4a+4a}{2a+\frac{4}{3}a}$<br>$= \frac{8a}{\left(\frac{10}{3}a\right)}$<br>$= 2.4$              | M1<br><br><br>A1         | 3           |  |
| 13 (a)       | $44 : 48 = 11 : 12$   | B1                       | 1           |  |
| (b)          | No, as the ratio of gamma : theta is $60 : 50$ which is $6 : 5$ and not $2 : 1$   | B1                       | 1           |  |

| Question No | Marking Point   | Marks Awarded | Total Marks | Remarks  |
|-------------|---|---------------|-------------|--|
| (c)         | Total sales = $44 + 48 + 60 + 50 + 42$<br>Percentage = $\frac{42}{244} \times 100\%$<br>$= 17.2\%$ (3 sf)   | M1<br>A1      | 2           |  |
| (d)         | Using pie chart the manager is able to obtain the proportion of the annual sales of each branch compared to the total annual sales of the company.  | B1            | 1           |  |
| 14 (a)      | $5 - (6 - y)^2 = 1$<br>$(6 - y)^2 = 4$<br>$6 - y = 2$ or $6 - y = -2$<br>$y = 4$ or $y = 8$   | M1<br>A1      | 2           | A1 for both answers  |
| (b) (i)     | $3p^2 - 8p = 0$<br>$p(3p - 8) = 0$<br>$p = 0$ or $3p - 8 = 0$<br>$p = 2\frac{2}{3}$   | M1<br>A1      | 2           | A1 for both answers  |
| (ii)        | $6(1 - 3x)^2 - 16(1 - 3x) = 0$<br>$2[3(1 - 3x)^2 - 8(1 - 3x)] = 0$<br>From (i), $p = 0$ or $p = 2\frac{2}{3}$<br>$1 - 3x = 0$ or $1 - 3x = 2\frac{2}{3}$<br>$x = \frac{1}{3}$ or $x = -\frac{5}{9}$ | M1<br>A1      | 2           | A1 for both answers  |
| 15 (a)      | $42 = 80a + b$  | B1            | 1           |  |
| (b)         | $38 = 40a + b$ -----(1)<br>$42 = 80a + b$ -----(2)<br>(2) - (1),<br>$4 = 40a$<br>$a = \frac{1}{10}$ , $b = 38 - 4 = 34$ cm  | M1<br>A2      | 3           | M1 – substitution / elimination method<br>A1 each for correct value of $a$ and $b$ |
| (c)         | $47 = \frac{1}{10}x + 34$<br>$x = (47 - 34)10 = 130$ g  | B1            | 1           |  |
| (d)         | $b$ represents the original length of the spring  | B1            | 1           |  |



| Question No | Marking Point   | Marks Awarded    | Total Marks | Remarks                                     |
|-------------|---|------------------|-------------|---|
| 16 (a)      |            | B2               | 2           | B1 – minimum curve<br>B1 – cuts y-axis at 1 |
| (b) (i)     | $A(-1, 0)$  | B1               | 1           |   |
| (ii)        | $-(x+1)(x-7)=0$<br>$-(x^2 - 6x - 7)=0$<br>$-x^2 + 6x + 7 = 0$<br>$\Rightarrow p = 6, q = 7$ | M1<br><br><br>A1 |             |   |
| (iii)       | $C(0, 7)$   | B1               | 1           |   |



聖嬰中學  
HOLY INNOCENTS' HIGH SCHOOL

MID-YEAR EXAMINATION 2014  
SECONDARY 2 EXPRESS

MATHEMATICS

4016/02

Paper 2

Name : \_\_\_\_\_

Date : 14 May 2014

Register No : \_\_\_\_\_

Duration : 1 h 30 min

Class : \_\_\_\_\_

Additional Materials: 4 sheets of Writing Paper  
1 sheet of Graph Paper

INSTRUCTIONS TO STUDENTS

Write your index number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in loss of marks.

*Calculators should be used where appropriate.*

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

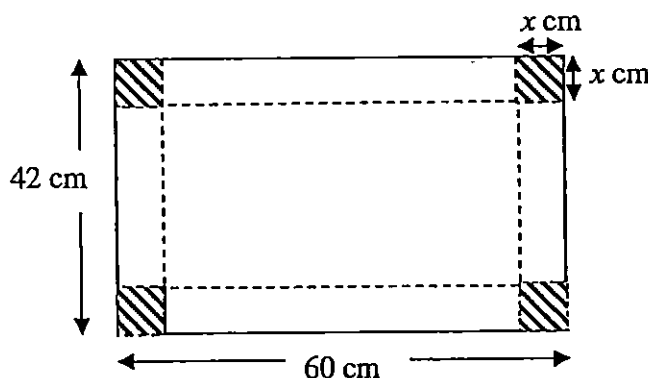
The total marks for this paper is 60.

Setter: Mrs Lo Sock Kui

**Answer all the questions**

- 1 On 1 January 2010, Mr Wong exchanged Malaysian Ringgit (MYR) 50 000 for Singapore dollars (SGD) at a rate of SGD 35.58 = MYR 100.
- (a) Calculate the sum of money in Singapore dollars that he received for the MYR 50 000. [1]
- (b) He then deposited this sum of money in a bank which paid a simple interest of 2.5% per annum for a year.  
On 1 January 2011, he withdrew all the money and exchanged them for Malaysian Ringgit at a rate of SGD 38.61 = MYR 100.
- (i) Calculate the sum of money that Mr Wong received in Malaysian Ringgit. [3]
- (ii) Calculate the percentage change in the amount of money owned by Mr Wong, in Malaysian Ringgit, from 1 January 2010 to 1 January 2011. [2]
- 

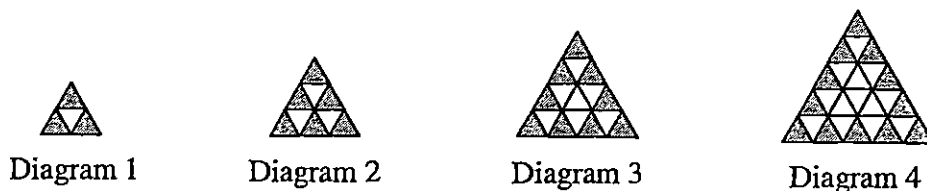
- 2 A rectangular sheet of metal is 60 cm long and 42 cm wide.  
The four shaded squares of sides  $x$  cm are cut from the four corners and the remaining metal sheet is folded up at the ends to form an open rectangular box.



- (a) Write down the dimensions of the base of the open box in terms of  $x$ . [1]
- (b) The area of the base of the box constructed is  $2128 \text{ cm}^2$ .  
Write down an equation in  $x$  to represent this information, and show that it reduces to  $x^2 - 51x + 98 = 0$ . [3]
- (c) Solve the equation  $x^2 - 51x + 98 = 0$ . [2]
- (d) Find the volume of the open rectangular box. [1]

- 3 (a) A map is drawn to a scale of 1 : 40 000.
- This scale can be expressed as 1 cm represents  $n$  km.  
Find the value of  $n$ . [1]
  - The distance between two towns on the map is 30 cm.  
Find the actual distance, in kilometres, between the two towns. [1]
  - A park is represented by an area of  $24 \text{ cm}^2$  on the map.  
Find, in square centimetres, the area representing the park on another map whose scale is 1 : 25 000. [2]
- (b) The height of the water,  $h$  cm, in a cylinder is inversely proportional to the square of its diameter,  $d$  cm.
- When the diameter is 5 cm, the height of the water is 14 cm.  
Find the formula connecting  $h$  and  $d$ . [2]
  - Find the height when the diameter is 7 cm. [1]

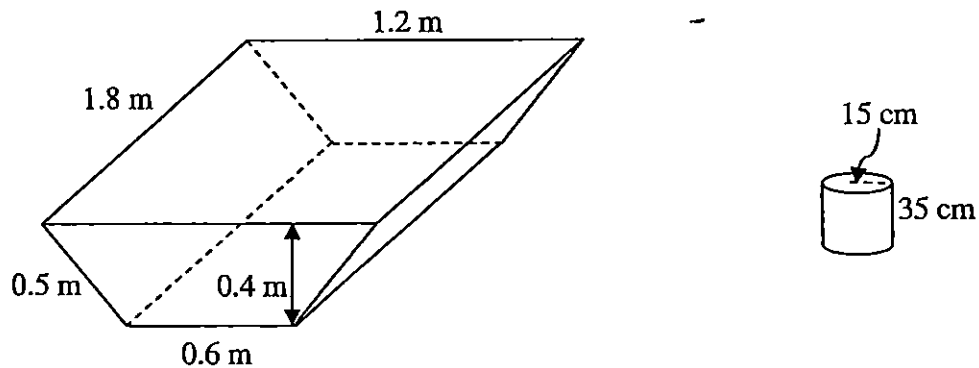
- 4 A sequence of diagrams consisting of black and white small triangles is shown below.



| Diagram                   | 1 | 2 | 3  | 4   | $n$ |
|---------------------------|---|---|----|-----|-----|
| Total number of triangles | 4 | 9 | 16 | 25  | $x$ |
| Number of black triangles | 3 | 6 | 9  | $p$ | $y$ |
| Number of white triangles | 1 | 3 | 7  | $q$ | $z$ |

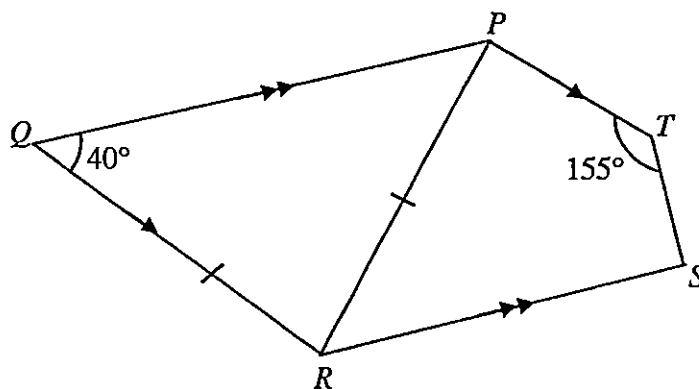
- Write down the values of  $p$  and  $q$ . [2]
- Find, in terms of  $n$ , expressions for  $x$ ,  $y$  and  $z$ . [3]
- Diagram  $k$  contains a total of 2304 triangles. Find the value of  $k$ . [2]

- 5 The figure shows a tray shaped as a trapezoidal prism with the dimensions given in metres.



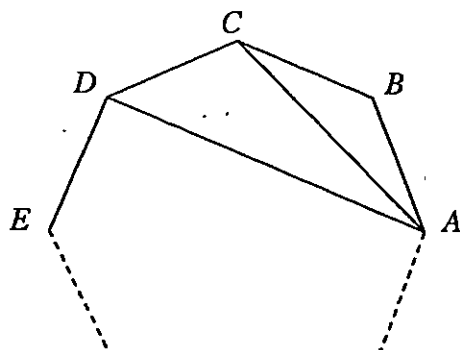
- (a) Calculate the volume of the tray in  $\text{cm}^3$ . [2]
- (b) Water is poured into the tray using a cylindrical container of radius 15 cm and height 35 cm.
- Calculate the minimum number of times the container is used to fill the tray completely with water. [3]
- (c) Calculate the total surface area of the tray in contact with the water when it is completely filled. [3]

- 6 (a) In the diagram,  $QP$  is parallel to  $RS$ ,  $QR$  is parallel to  $PT$  and  $QR = PR$ .  
 $\angle PTS = 155^\circ$  and  $\angle PQR = 40^\circ$ .



Calculate

- (i)  $\angle RPT$ , [1]  
 (ii) reflex  $\angle SRQ$ , [1]  
 (iii)  $\angle TSR$ . [2]
- (b)  $ABCDE\dots$  represents part of a regular octagon.



Calculate

- (i)  $\angle ABC$ , [2]  
 (ii)  $\angle ACD$ . [2]

7 Answer the whole of this question on a sheet of graph paper.

The variables  $x$  and  $y$  are connected by the equation  $y = x^2 + x - 3$ .

Some corresponding values of  $x$  and  $y$  are given in the table below.

|     |    |    |     |    |    |   |   |
|-----|----|----|-----|----|----|---|---|
| $x$ | -3 | -2 | -1  | 0  | 1  | 2 | 3 |
| $y$ | 3  | -1 | $p$ | -3 | -1 | 3 | 9 |

- (a) Calculate the value of  $p$ . [1]
- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal  $x$ -axis for  $-3 \leq x \leq 3$ .  
Using a scale of 2 cm to represent 2 units, draw a vertical  $y$ -axis for  $-4 \leq y \leq 10$ .  
  
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (c) Use your graph to find
- (i) the least value of  $y$ , [1]
- (ii) the solution of  $x^2 + x - 3 = 0$ , [2]
- (iii) the equation of the line of symmetry. [1]

- 8 (a) It is given that  $V = \frac{1}{3}\pi r^2 h$ ,  $r > 0$ .
- (i) Evaluate  $V$  when  $r = 6$ ,  $h = 14$  and  $\pi = 3.142$ . [1]
- (ii) Express  $r$  in terms of  $V$ ,  $h$  and  $\pi$ . [2]
- (b) (i) Factorise completely  $4mn^2 - 8pn^2 - m + 2p$ . [3]
- (ii) Simplify  $\frac{2x^2}{y} \div \frac{4xy^3}{3}$ . [1]
- (c) Solve the equation  $\frac{2}{x} = \frac{7}{x-5}$ . [2]

END OF PAPER



## Sec 2 Express MYE 2014 Paper 2 (Answers)

| Qn    | Answer   | Qn    | Answer                                  |
|-------|--|-------|---|
| 1a    | SGD 177 90   | 5a    | $648000\text{cm}^3$                     |
| 1bi   | MYR 47228.05 (Money is corrected to 2 dec. pl)   | 5b    | 27                                      |
| 1bii  | 5.5439% (exact answer)<br>or 5.54 % (to 3 sig fig)   | 5c    | $36000\text{ cm}^2$ or $3.6\text{ m}^2$ |
| 2a    | Dimensions are<br>$(60 - 2x)\text{ cm}$ by $(42 - 2x)\text{ cm}$ .<br>or<br>$(60 - 2x)\text{ cm} \times (42 - 2x)\text{ cm}$ .<br>or<br>length = $(60 - 2x)\text{ cm}$ and breadth = $(42 - 2x)\text{ cm}$ . | 6ai   | $100^\circ$                             |
|       |  | 6aii  | $220^\circ$                             |
|       |  | 6aiii | $65^\circ$                              |
|       |  | 6bi   | $135^\circ$                             |
|       |  | 6bii  | $112.5^\circ$                           |
| 2b    | $(60 - 2x)(42 - 2x) = 2128$<br>$\vdots$<br>$x^2 - 51x + 98 = 0$ (shown)  | 7a    | $P = -3$                                |
|       |  | 7ci   | $-3.2 \pm 0.1$                          |
|       |  | 7cii  | -2.3 and 1.3                            |
|       |  | 7ciii | $x = -\frac{1}{2}$                      |
| 2c    | $x = 2$ or $x = 49$ (rej)  | 8ai   | 527.856 or 528                          |
| 2d    | $4256\text{ cm}^3$   | 8aii  | $Rr = \sqrt{\frac{3V}{\pi h}}$          |
| 3ai   | $n = 0.4$  |       |   |
| 3aii  | 12 km  |       |   |
| 3aiii | $61.44\text{ cm}^2$  |       |   |
| 3bi   | $hd^2 = 350$<br>height = $7\frac{1}{7}\text{ cm}$ or 7.14 cm (to 3 sig. fig.)  | 8bi   | $(2n-1)(2n+1)(m-2p)$                    |
|       |  | 8bii  | $\frac{3x}{2y^4}$                       |
| 4a    | $p = 12$ , $q = 13$  | 8c    | $x = -2$                                |
| 4b    | $x = (n+1)^2$ or $n^2 + 2n + 1$<br>$y = 3n$<br>$z = (n+1)^2 - 3n$ or $n^2 - n + 1$   |       |   |
| 4c    | $k = 47$   |       |   |



## Sec 2 Express MYE 2014 Paper 2

## Marking Scheme

|      |   |
|------|---|
| 1a   | SGD $(50\,000 \div 100) \times 35.58$<br>= SGD 177 90 [B1]  |
| 1bi  | Int = SGD $17790 \times \frac{2.5}{100}$<br>= SGD 444.75 [M1] OR Amt = SGD $17790 \times \frac{102.5}{100}$ [M1]<br>= SGD 18234.75<br><br>MYR $\frac{17790 + 444.75}{38.61} \times 100$ [M1]<br>= MYR 47228.05 [A1] |
| 1bii | Percentage change<br>= $\frac{50\,000 - 47228.05}{50\,000} \times 100\%$ [ecf M1 for showing computation of the amt changed]<br>= 5.5439 % (exact answer.) [A1]   |
| 2a   | Dimensions are $(60 - 2x)$ cm by $(42 - 2x)$ cm. [B1]<br>OR length = $(60 - 2x)$ cm and breadth = $(42 - 2x)$ cm. [B1]  |
| 2b   | $(60 - 2x)(42 - 2x) = 2128$ [B1]<br>$2520 - 120x - 84x + 4x^2 = 2128$<br>$4x^2 - 204x + 392 = 0$ [M1]<br>$x^2 - 51x + 98 = 0$ (shown) [A1]  |
| 2c   | $x^2 - 51x + 98 = 0$<br>$(x - 49)(x - 2) = 0$ [M1]<br>$x = 49$ (rej) or $x = 2$ [A1]  |
| 2d   | Vol<br>= $2128 \times 2$<br>= $4256 \text{ cm}^3$ [B1]  |
| 3ai  | $n = 0.4$ [B1]  |
| 3aii | Actual dist = $30 \times 0.4$   |

|       |  |
|-------|--|
|       | $= 12 \text{ km}$ [B1]   |
| 3aiii | <p>Actual area <math>= 24 \times 0.16</math><br/> <math>= 3.84 \text{ km}^2</math> [M1]</p> <p>Area on map <math>= 3.84 \div 0.0625</math><br/> <math>= 61.44 \text{ cm}^2</math> [A1]</p> |
| 3bi   | <p><math>hd^2 = k</math></p> <p><math>14(5)^2 = k</math></p> <p><math>k = 350</math> [M1]</p> <p><math>hd^2 = 350</math> [A1]</p>  |
| 3bii  | <p><math>h(7)^2 = 350</math></p> <p><math>h = 7\frac{1}{7} \text{ cm}</math> [B1] OR: <math>h = 7.14 \text{ cm}</math></p>   |
| 4a    | $p = 12, \quad q = 13$ [B1 each]   |
| 4b    | <p><math>x = (n + 1)^2</math> or <math>x = n^2 + 2n + 1</math> [B1]</p> <p><math>y = 3n</math> [B1]</p> <p><math>z = (n + 1)^2 - 3n</math> or <math>z = n^2 - n + 1</math> [B1]</p>        |
| 4c    | <p><math>(k + 1)^2 = 2304</math> [M1]</p> <p><math>k + 1 = 48</math></p> <p><math>k = 47</math> [A1]</p>   |
| 5a    | <p>Vol of tray</p> <p><math>= \frac{1}{2} \times 40 \times (120 + 60) \times 180</math> [M1]</p> <p><math>= 648000 \text{ cm}^3</math> [A1]</p>  |
| 5b    | Vol of cylindrical can   |

|       |  |
|-------|--|
|       | $= \pi \times 15^2 \times 35$ OR<br>$= 7875\pi \text{ cm}^3$ [M1] OR: $24743.25 \text{ cm}^3$ if using $\pi = 3.142$<br><br>Min no. of times<br>$= \frac{648000}{7875\pi}$ [ecf M1]<br>$= 26.19$<br>$\approx 27$ [A1]  |
| 5c    | Surface area in contact with water<br>$= 2 \times \frac{1}{2} \times 0.4 \times (1.2 + 0.6) + 0.6 \times 1.8 + 2 \times 0.5 \times 1.8$ [M2 for any two of the computation shown]<br><br>$= 3.6 \text{ m}^2$ [A1]<br><br>or $36000 \text{ cm}^2$ [A1] (if computed using measurements in cm) |
| 6ai   | $\angle RPT = 180^\circ - 2 \times 40^\circ$ (Int $\angle$ s)<br>$= 100^\circ$ [B1]  |
| 6aai  | $\angle QRS = 180^\circ - 40^\circ$ (int $\angle$ s)<br>$= 140^\circ$<br>Reflex $\angle SRQ = 360^\circ - 140^\circ$<br>$= 220^\circ$ [B1]   |
| 6aiii | $\angle TSR = 360^\circ - 100^\circ - 40^\circ - 155^\circ$ [M1]<br>$= 65^\circ$ [A1]<br>Or<br>$\angle TSR = 25^\circ + 40^\circ$ (int $\angle$ s) [M1]<br>$= 65^\circ$ [A1]   |
| 6bi   | Ext $\angle$ of octagon $= 360^\circ \div 8$<br>$= 45^\circ$ [M1]<br>$\angle ABC = 180^\circ - 45^\circ$<br>$= 135^\circ$ [A1]   |
| 6bii  | $\angle BCA = 45^\circ \div 2$ (ext $\angle$ of $\Delta$ )<br>$= 22.5^\circ$ [M1]<br>$\angle ACD = 135^\circ - 22.5^\circ$<br>$= 112.5^\circ$ [A1]   |
| 7a    | $p = -3$ [B1]  |

|       |  |
|-------|--|
| 7b    | <p>Refer to graph.</p> <p>*Draw axes and plot all points given. [P2]</p> <p>[P1 if there are more than 3 errors]</p> <p>Draw smooth curve through all points [C1]</p> <p>[-1 m] If axes/graph not labelled or wrong scale is used.</p> <p>*No marks to be awarded if graph is not drawn.</p> |
| 7ci   | Least value of $y = -3.2 \pm 0.1$ [B1]   |
| 7cii  | $x = -2.3$ or $1.3$ [B1 each]  |
| 7ciii | $x = -\frac{1}{2}$ [B1]  |
| 8ai   | $V = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}(3.142)(6)^2(14)$ $= 527.856$ [B1]  |
| 8aai  | $V = \frac{1}{3}\pi r^2 h$ $3V = \pi r^2 h$ $r^2 = \frac{3V}{\pi h} \quad [M1] \quad \text{or} \quad r^2 = \frac{V}{\frac{1}{3}\pi h} \quad [M1]$ $r = \sqrt{\frac{3V}{\pi h}} \quad [A1]$   |
| 8bi   | $4mn^2 - 8pn^2 - m + 2p$ $= 4n^2(m - 2p) - (m - 2p) \quad [M1]$ $= (4n^2 - 1)(m - 2p) \quad [M1]$ $= (2n - 1)(2n + 1)(m - 2p) \quad [A1]$  |
| 8bii  | $\frac{2x^2}{y} \div \frac{4xy^3}{3}$ $= \frac{2x^2}{y} \times \frac{3}{4xy^3}$ $= \frac{3x}{2y^4} \quad [B1]$   |

|    |  |
|----|--|
| 8c | $\frac{2}{x} = \frac{7}{x-5}$<br>$2(x-5) = 7x$<br>$2x - 10 = 7x$ [M1]<br>$-5x = 10$<br>$x = -2$ [A1] |
|----|--|

|      |                 |       |
|------|-----------------|-------|
| Name | Register Number | Class |
|------|-----------------|-------|



# MACPHERSON SECONDARY SCHOOL

## MATHEMATICS

### Paper 1

October 2012

1 hour

### END-OF-YEAR EXAMINATION

### SECONDARY TWO EXPRESS

#### READ THESE INSTRUCTIONS FIRST

**Do not open this booklet until you are told to do so.**

Write your name, register number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

Show all your workings on the same page as the rest of the answer.

Omission of essential working will result in loss of marks.

The total marks for this paper is 50.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

| For Examiner's Use |           |
|--------------------|-----------|
| <b>Total</b>       | <b>50</b> |

1 Factorise each of the following completely

(a)  $16x^2 - y^2$

(b)  $3x^2 + 4x - 15$

Answers: (a) ..... [2]

(b) ..... [2]

---

2 Simplify the following:

(a)  $\frac{1}{x-1} - \frac{2x}{x^2-1}$

(b)  $\frac{x^2-36y^2}{3x+4y} \div \frac{x-6y}{12x+16y}$

Answers: (a) ..... [2]

(b) ..... [2]

---

- 3 The scale of a map is 1 : 40 000 . A rectangular plot of land is represented by a rectangle of width 4 cm and length 8 cm on the map.

(a) Find, in km, the actual length of the land.

[Hint: 100 000 cm = 1 km]

(b) Find, in  $\text{km}^2$ , the actual area of the land.

Answers: (a) ..... [2]

(b) ..... [2]

---

4

It is given that  $s = ut + \frac{at^2}{2}$ .

(a) Express  $a$  in terms of  $s$ ,  $u$  and  $t$ .

(b) Find the value of  $a$  if  $s = 200$ ,  $u = 5$  and  $t = 4$ .

Answers: (a) ..... [2]

(b) ..... [2]

---



- 5 Solve the simultaneous equations  $5x + 3y = 14$  and  $3x + 5y = 18$ .

Answer: ..... [2]

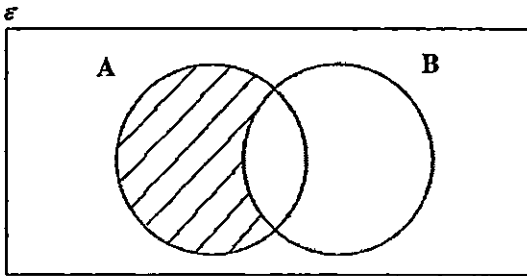
- 6 It is given that  $y$  is inversely proportional to  $(x^2 + 3)$ . When  $x = 2$ ,  $y = 1$ .
- (a) Find the equation connecting  $x$  and  $y$ .
- (b) Find the value of  $x$  when  $y = 2\frac{1}{3}$ .

Answers: (a) ..... [2]

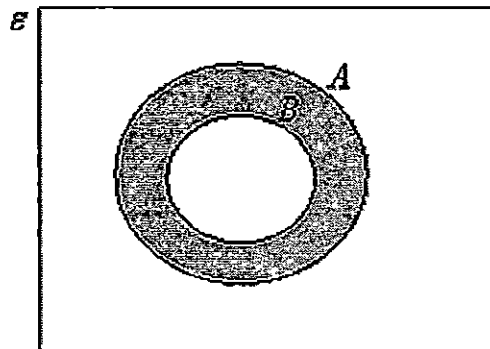
(b) ..... [1]

- 7 In the Venn diagram below, state the region represented by the shaded area.

(a)



(b)



Answer: (a) ..... [1]

(b) ..... [1]

- 8 Solve the following:

(a)  $(x - 2)^2 = 49$

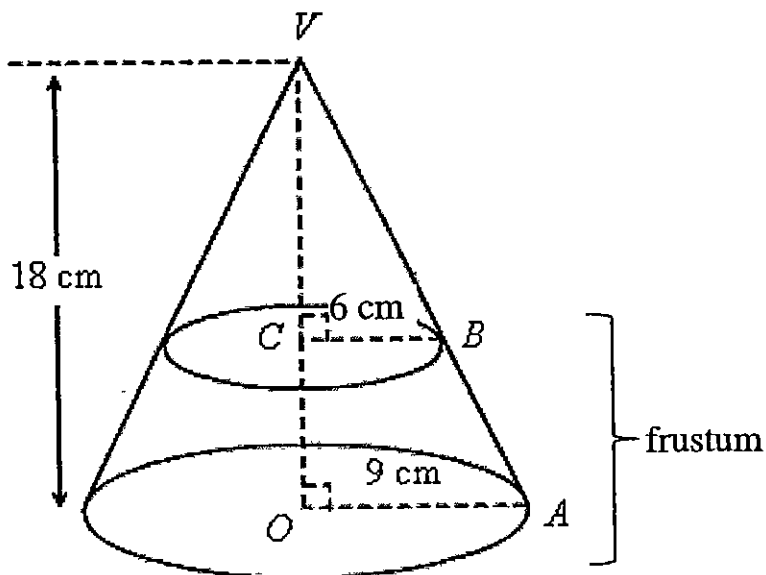
(b)  $(3x + 7)(2 - x) = 0$

Answers: (a) ..... [2]

(b) ..... [1]

- 9 The upper part of a solid wooden right circular cone is cut off leaving the frustum shown in the diagram. The height of the original cone,  $VO$  is 18 cm and the base radius,  $OA$  is 9 cm. The radius,  $BC$ , of the base of the upper part is 6 cm. Take  $\pi$  to be 3.142.

- (a) Name the two similar triangles in the figure below.  
 (b) Hence, show that  $VC = 12$  cm.  
 (c) Hence, calculate the volume of the frustum, correct to 3 significant figures.

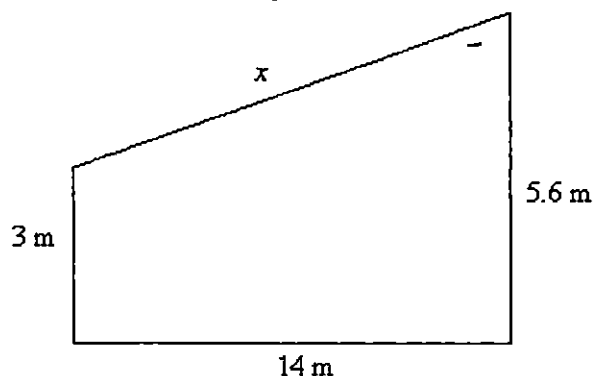


Answers: (a)  $\Delta \dots\dots\dots$  and  $\Delta \dots\dots\dots$  [1]

(b) Show working above [2]

(c) Volume =  $\dots\dots\dots \text{cm}^3$  [3]

- 10 Two vertical posts are 14 m apart. One is 3 m high and the other 5.6 m high. Find  $x$ , the distance between the tops of the two posts, giving your answer in metres, correct to 3 significant figures.

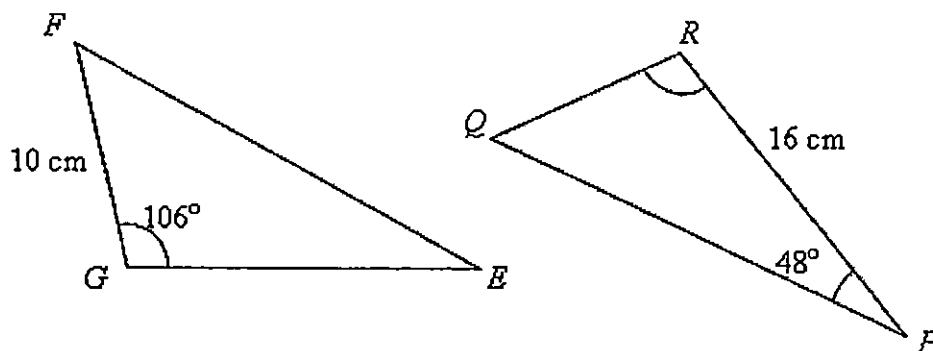


Answer: ..... [3]

- 11 In the figure below,  $\triangle EFG$  is congruent to  $\triangle PQR$ .  
Given that  $FG = 10$  cm,  $PR = 16$  cm,  $\angle G = 106^\circ$  and  $\angle P = 48^\circ$ , find

(a)  $QR$

(b)  $\angle Q$



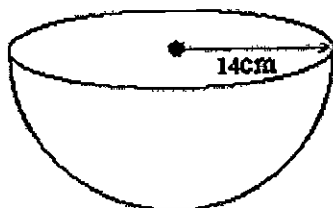
Answers: (a) ..... [1]

(b) ..... [2]

- 12 A solid hemisphere has a radius of 14 cm. Taking  $\pi = \frac{22}{7}$ , find

- (a) its volume,  
(b) its total surface area.

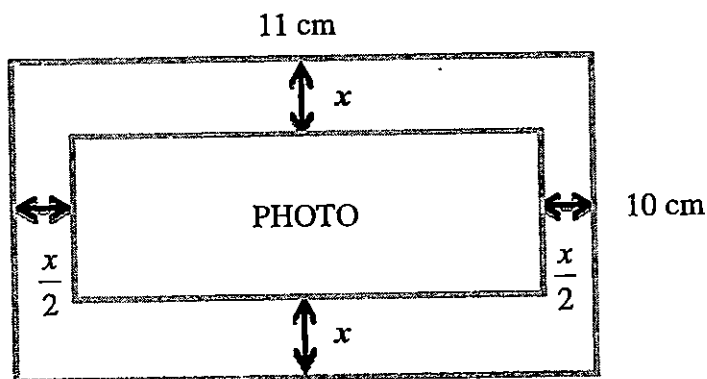
$$\left[ \text{Volume of a Sphere} = \frac{4}{3}\pi r^3, \quad \text{Surface Area of a Sphere} = 4\pi r^2 \right]$$



Answers: (a) ..... [2]

(b) ..... [2]

- 13 A photo of area  $54 \text{ cm}^2$  is placed on a photo frame of 10 cm by 11 cm with a border shown in the diagram below.



- (a) Write down an expression, in terms of  $x$ , for the area of the photo.  
(b) Show that  $x^2 - 16x + 28 = 0$ .

Answers: (a) ..... [2]

(b) Show working above [2]

- 14 The stem-and-leaf diagram shows the mathematics test marks of 9 students.

| Stem and Leaf Diagram |   |   |   |   |
|-----------------------|---|---|---|---|
| 4                     | 1 | 3 | 6 |   |
| 5                     | 5 | 5 | 8 | 9 |
| 6                     | 0 | 8 |   |   |

Key : 4 | 9 represent 49 marks

Find

- (a) the modal mark,
- (b) the median mark.
- (c) the mean mark

**Note: Leaving out important working will result in loss of marks.**

Answers: (a) ..... [1]

(b) ..... [1]

(c) ..... [2]



## Solutions to 2012 2E Maths EOY P1

| Qn | Solution  | Marks          | Remarks   |
|----|---|----------------|---|
| 1a | $(4x)^2 - y^2$<br>$(4x+y)(4x-y)$  | M1<br>A1       | Allow A2 if only last step is given.  |
| 1b | $  \begin{array}{r l}  \begin{array}{rr}  3x & -5 \\  x & +3 \\  \hline  3x^2 & -15  \end{array}  &  \begin{array}{l}  -5x \\  9x \\  \hline  +4x  \end{array}  \end{array}  $ $3x^2 + 4x - 15 = (3x - 5)(x + 3)$ | M1<br><br>A1   |   |
| 2a | $  \begin{aligned}  &= \frac{x+1-2x}{x^2-1} = \frac{-(x-1)}{(x-1)(x+1)} \\  &= \frac{-1}{x+1}  \end{aligned}  $   | M1<br>A1       | For correct first step in converting fractions to denominator of $\frac{1}{x^2-1}$ including expansion if any in the individual numerators. |
| 2b | $  \begin{aligned}  &= \frac{x^2 - 36y^2}{3x + 4y} \times \frac{12x + 16y}{x - 6y} \\  &= \frac{(x-6y)(x+6y)}{3x+4y} \times \frac{4(3x+4y)}{x-6y} \\  &= 4(x+6y) \text{ or } 4x+24y  \end{aligned}  $             | M1<br><br>A1   |   |
| 3a | 1cm : 40 000cm<br>1cm : 0.4 km<br>Actual Length = $8 \times 0.4 = 3.2$ km   | M1<br>A1       |   |
| 3b | $1\text{cm}^2 : 0.16 \text{ km}^2$<br>Actual Area = $(4 \times 8) \times 0.16$<br>= $5.12 \text{ km}^2$   | M1<br>M0<br>A1 | Awarded provided working above presented.   |

|    |   |                                  |  |
|----|---|----------------------------------|--|
| 4a | $s - ut = at^2/2$<br>$2(s - ut) = at^2$<br>$a = 2(s - ut)/t^2$  | M1<br>A1                         |  |
| 4b | $a = 2(200 - 5(4))/4^2 \leftarrow \text{allow ecf from 4a}$<br>$= 22.5$   | M1<br>A1                         | Alternative method:<br>substitution into<br>$s = ut + \frac{at^2}{2}$ and solving for $a$ .                            |
| 5  | $5x + 3y = 14$ ----- (1)<br>$3x + 5y = 18$ ----- (2)<br><br>(1) $\times 3: 15x + 9y = 42$ ----- (3)<br>(2) $\times 5: 15x + 25y = 90$ ----- (4)<br>(4) - (3): $16y = 48$<br>$y = 3$<br><br>Substituting $y = 3$ into (2),<br>$3x + 5(3) = 18$<br>$3x = 3$<br>$x = 1$<br>$\therefore x = 1, y = 3$ | M1<br><br><br><br><br><br><br>A1 | Alternatively, if $x$ is solved first – that becomes the M1 mark.<br><br>Same mark allocation for substitution method. |
| 6a | $y = \frac{k}{x^2 + 3}$<br>when $x = 2, y = 1$ thus:<br>$1 = \frac{k}{2^2 + 3}$<br>$k = 1(4 + 3) = 7$<br>$y = \frac{7}{x^2 + 3}$  | M1<br>A1                         |  |
| 6b | when $y = 2\frac{1}{3} = \frac{7}{3}$ ,<br>$\frac{7}{3} = \frac{7}{x^2 + 3}$<br>Hence $x = 0$   | B1                               |  |
| 7a | $A \cap B'$   | B1                               |  |

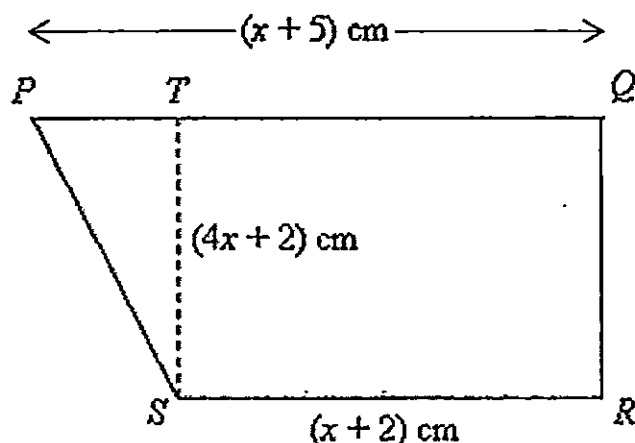


|     |  |                |  |
|-----|--|----------------|--|
| 7b  | $A \cap B'$  | B1             |  |
| 8a  | Method 1<br>$x - 2 = \pm 7$<br>$x = 2 \pm 7$<br>$x = -5$ or $9$  | M0<br>A2       |  |
|     | Method 2<br>$x^2 - 4x + 4 = 49$<br>$x^2 - 4x - 45 = 0$<br>$(x + 5)(x - 9) = 0$<br>Either $x = -5$ or $9$                                     | M0<br>A2       |  |
| 8b  | Either $3x + 7 = 0$ or $2 - x = 0$<br>$x = -7/3$ or $x = 2$  | B1             | No ½ mark awarded.                                     |
| 9a  | $\Delta VCB$ and $\Delta VOA$  | B1             |  |
| 9b  | $\frac{VC}{VO} = \frac{BC}{AO}$<br>$VC = \frac{BC}{AO} \times VO$<br>$= \frac{6}{9} \times 18$<br>$= 12$                                     | M1<br>A1       | *order of alphabets can be ignored.                    |
| 9c  | Volume of frustum<br>$= \frac{1}{3} \pi (9)^2 (18) - \frac{1}{3} \pi (6)^2 (12)$<br>$= 1074.564$<br>$\approx 1070 \text{ cm}^3$ (to 3 s.f.)  | M2<br>A1       | M1: correct equation<br>M1: correct substitution       |
| 10  | Relevant height = $5.6 - 3$<br>$= 2.6 \text{ m}$<br>$x = \sqrt{14^2 + 2.6^2}$<br>$= \sqrt{202.76}$<br>$= 14.239$<br>$\approx 14.2 \text{ m}$ | M1<br>M1<br>A1 | Any statement of Pythagoras theorem with substitution. |
| 11a | $QR = 10 \text{ cm}$   | B1             |  |
| 11b | $\angle Q = 180 - 106 - 48$<br>$= 26^\circ$  | M1<br>A1       |  |
| 12a | Volume<br>$= \frac{1}{2} \times \frac{4}{3} \times \frac{22}{7} (14)^3$<br>$= 5749 \frac{1}{3} \text{ cm}^3$                                 | M1<br>A1       | 5750 $\text{cm}^3$ (to 3sf accepted)                   |
| 12b | Total Surface Area<br>$= \frac{1}{2} \times 4 \times \frac{22}{7} (14)^2 + \frac{22}{7} (14)^2$  | M1             | M1 awarded for first term.                             |

|     |  |    |  |
|-----|--|----|--|
|     | $= 1848 \text{ cm}^2$  | A1 |  |
| 13a | $(11-x)(10-2x)$  | B2 | B1 awarded per factor.<br>[-1] if equation written instead of expression and/or multiplication sign not omitted. |
| 13b | $110 - 22x - 10x + 2x^2 = 54$<br>$2x^2 - 32x + 110 = 54$<br>$2x^2 - 32x + 110 - 54 = 0$<br>$2x^2 - 32x + 56 = 0$<br>$x^2 - 16x + 28 = 0$ | M1 | Expansion  |
|     |  | A1 | Division by 2 of correct expn.   |
| 14a | 55   | B1 |  |
| 14b | 55   | B1 |  |
| 14c | $\frac{41 + 43 + 46 + 55 + 55 + 58 + 59 + 60 + 68}{9}$<br><br>$= 53.9 \text{ (to 3 s.f.)}$   | M1 | Or any indication of<br><u>sum of marks</u><br><u>no. of students</u>  |
|     |  | A1 |  |

Answer all the questions

- 1 The diagram shows a trapezium  $PQRS$  where  $PQ = (x + 5)$  cm,  $SR = (x + 2)$  cm,  $TS = QR$  and  $TS = (4x + 2)$  cm.



- Write down an expression, in terms of  $x$ , for the area of the trapezium  $PQRS$ . Show that it simplifies to  $(2x + 7)(2x + 1)$ . [2]
- Given that the area of the trapezium is  $27 \text{ cm}^2$ , show that it simplifies to  $x^2 + 4x - 5 = 0$  [2]
- Hence, find the value(s) of  $x$  which gives reasonable lengths for the trapezium. [2]

- 2 The speed of a bullet fired from a rifle is inversely proportional to the square root of its mass. When the mass is 49 g, the speed is 640 m/s.

- Express the speed,  $S$  of the bullet in terms of its mass  $m$ . [2]
- Find, correct to 3 significant figures,
  - the speed when its mass is 45 g. [1]
  - the mass when the speed is 360 m/s. [2]

- 3 A survey was conducted to find out the number of people living in each of 50 flats in an HDB block. The results are shown in the table below.

| No. of people | 1 | 2 | 3 | 4  | 5   | 6 | 7 | 8 |
|---------------|---|---|---|----|-----|---|---|---|
| No. of flats  | 2 | 5 | 8 | 15 | $x$ | 7 | 3 | 1 |

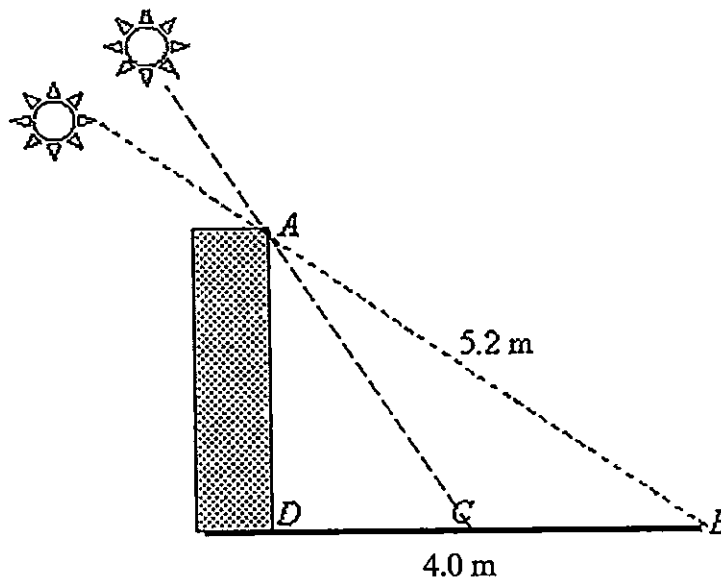
- If the mean of the distribution is 4.24, show that the value of  $x$  is 9. [3]
- Find the median of the distribution. [2]

- 4 If  $a^2 + b^2 = 13$  and  $ab = 6$ , find the value of

(a)  $(a + b)^2$  [2]

(b)  $(a - b)^2$  [2]

- 5 The diagram shows a vertical wall  $AD$  and its shadow  $DC$  at 1 pm in the afternoon. At 2 pm, it was found that the shadow has lengthened to 4.0 m which was twice its length at 1 pm. The length  $AB$  is 5.2 m.



Find, correct to 3 significant figures,

(a) the height of the wall  $AD$ , [2]

(b) the length  $AC$ . [3]

6  $\mathcal{E} = \{x : x \text{ is an integer and } 1 < x \leq 13\}$

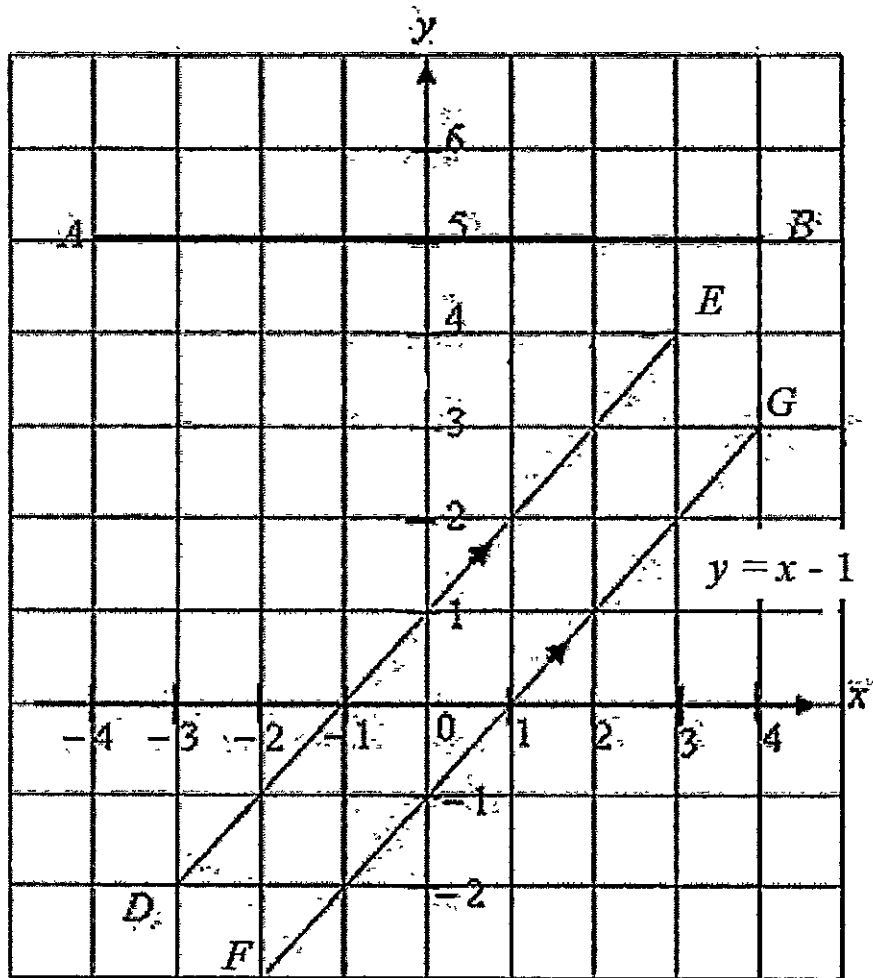
$S = \{x : x \text{ is a multiple of } 2\}$

$T = \{2, 5, 10\}$

- (a) Draw a Venn Diagram to represent the relationship of  $\mathcal{E}$ ,  $S$  and  $T$  and their elements. [3]

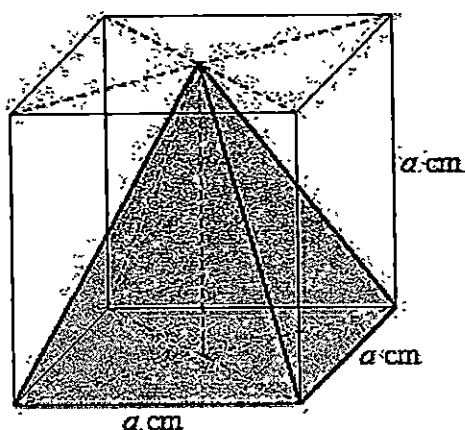
- (b) Hence by shading in the diagram the area representing  $(S \cap T')$ , find  $n(S \cap T')$ . [2]

- 7 In the diagram below, line DE is parallel to line FG.



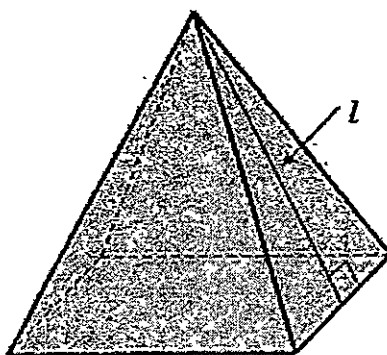
- (a) Write down the equation of the line AB. [1]
- (b) It is given that the equation of line FG is  $y = x - 1$ .
- (i) State the gradient of line DE. [1]
- (ii) State the y-intercept of line DE. Hence, write down the equation of the line. [2]

- 8 A solid square pyramid toy fits exactly into a cubic gift box, measuring  $a$  cm by  $a$  cm by  $a$  cm, as shown in the diagram.



Given that the volume of the pyramid toy is  $243\text{cm}^3$ .

- (a) Find the value of  $a$ . [3]
- (b) Find the slant height  $l$  of the toy pyramid. Hence, find the total surface area of the pyramid. [4]



9 **Answer the whole of this question on a sheet of graph paper.**

A ball is thrown upwards from the edge of the top of a vertical building. Its position during its flight is represented by the equation  $h = -x^2 + 9x + 12$ , where  $h$  metres is the height of the ball above the ground and  $x$  metres is its horizontal distance from the foot of the building.

- (a) Some corresponding values of  $x$  and  $h$  are given in the following table.

|     |    |    |    |    |     |    |    |    |    |    |
|-----|----|----|----|----|-----|----|----|----|----|----|
| $x$ | 0  | 1  | 2  | 3  | 4   | 5  | 6  | 7  | 8  | 9  |
| $h$ | 12 | 20 | 26 | 30 | $p$ | 32 | 30 | 26 | 20 | 12 |

- (i) Find the value of  $p$ . [2]

- (ii) Using a scale of 2 cm to 1 unit,  
draw a horizontal  $x$ -axis for  $0 \leq x \leq 9$ .  
Using a scale of 4 cm to 5 units,  
draw a vertical  $h$ -axis for  $10 \leq h \leq 35$ .

On your axes, plot the points given in the table and join them with a smooth curve. [3]

- (b) Use your graph to find

- (i) the greatest height reached by the ball, [1]  
(ii) how far the ball has travelled horizontally when it **first** reaches the height of 25 metres. [1]

- (c) A tree of height  $k$  metres is located 8.4 metres from the foot of the building. Given that the ball passes 3 metres above the top of the tree, use your graph to estimate the value of  $k$ . [2]

End of paper



## Solutions to 2012 2E Maths EOY P2

| Qn     | Solution   | Marks            | Remarks   |
|--------|--|------------------|---|
| 1a     | $\text{Area} = \frac{1}{2}(x+5+x+2)(4x+2)$ $= (2x+7)\frac{4x+2}{2}$ $= (2x+7)(2x+1)$   | M1<br><br><br>A1 | Any correct attempt at first formulation of area.   |
| 1b     | $(2x+7)(2x+1) = 27$ $4x^2 + 2x + 14x + 7 = 27$ $4x^2 + 16x - 20 = 0$ $x^2 + 4x - 5 = 0$  | M1<br><br><br>A1 |   |
| 1c     | $(x+5)(x-1) = 0$ <p>Either <math>x+5 = 0</math> or <math>x-1 = 0</math></p> <p>Either <math>x = -5</math> (rejected) or <math>x = 1</math></p> | M1<br><br><br>A1 | With cross method shown<br><br>1 mark for both answers. Not awarded if $x = -5$ not rejected. |
| 2a     | $S = \frac{k}{\sqrt{m}}$ $640 = \frac{k}{\sqrt{49}}$ $k = 640 \times 7$ $= 4480$ $S = \frac{4480}{\sqrt{m}}$                                   | M1<br><br><br>A1 | Allow for "reversed awarding" of marks if this equation is ever expressed in part (b).        |
| 2b(i)  | $S = \frac{4480}{\sqrt{45}} = 667.8 \approx 668 \text{ m/s}$   | B1               |   |
| 2b(ii) | $m = \left(\frac{4480}{S}\right)^2$  | M1               | Either symbolic or numerical methods of making $m$ the subject of formula                     |



|    |  |                        |                                    |
|----|--|------------------------|------------------------------------|
|    | $= \left( \frac{4480}{360} \right)^2$ $= 154.9 \text{ g}$ $\approx 155 \text{ g}$  | A1                     | accepted.                          |
| 3a | $\frac{1 \times 2 + 2 \times 5 + 3 \times 8 + 4 \times 15 + 5 \times x + 6 \times 7 + 7 \times 3 + 8 \times 1}{50} = 4.24$ $\frac{167 + 5x}{50} = 4.24$ $167 + 5x = 212$ $x = \frac{212 - 167}{5}$ $= 9$ | M1<br><br>M1<br><br>A1 |                                    |
| 3b | <p>Middle position = <math>\frac{50+1}{2} = 25.5</math></p> <p>Median = Mean of 25<sup>th</sup> and 26<sup>th</sup> position</p> $= \frac{4+4}{2} = 4$   | M1<br><br>A1           |                                    |
| 4a | $(a+b)^2$ $= a^2 + 2ab + b^2$ $= 13 + 2(6)$ $= 25$   | M1<br>A1               | For expansion without substitution |
| 4b | $(a+b)^2$ $= a^2 - 2ab + b^2$ $= 13 - 2(6)$ $= 1$  | M1<br>A1               | For expansion without substitution |
| 5a | $AD = \sqrt{5.2^2 - 4.0^2}$ $= 3.323 \approx 3.32 \text{ m}$   | M1<br>A1               |                                    |
| 5b | $DC = 2.0 \text{ m}$ $AC = \sqrt{3.32^2 + 2.0^2}$ $= 3.878 \approx 3.88 \text{ m}$   | M1<br>M1<br>A1         |                                    |



|     |  |                               |   |
|-----|--|-------------------------------|---|
|     | $l^2 = \frac{5(9)^2}{4}$ $l = \sqrt{101.25} = 10.0623... \approx 10.1 \text{ cm (to 3sf)}$ <p>Surface area of pyramid = <math>9^2 + 4(1/2 \times 9 \times 10.1)</math></p> $= 262.12$ $\approx 262 \text{ cm}^2$ | <p>M1</p> <p>M1</p> <p>A1</p> | <p>Awarded with/without rounding to 3sf</p> <p>Awarded with/without rounding to 3sf</p> |
| 9ai | $p = -(4)^2 + 9(4) + 12$ $= 32$  | <p>M1</p> <p>A1</p>           |   |
|     | The rest of Q9 pls see attached.   |                               |   |

|                  |                 |            |                |                      |
|------------------|-----------------|------------|----------------|----------------------|
| Name :           |                 | Index No : | Class :        | Calculator Model :   |
| Expected Grade : | Marks Awarded : | 50         | Actual Grade : | Parent's Signature : |



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| MID YEAR EXAMINATION 2014        |                              |
|----------------------------------|------------------------------|
| Subject : MATHEMATICS            | Paper: 1                     |
| Level : Secondary 2 Express      | Date: 14 May 2014            |
| Setter : Mr. Tan Wei Jia Jackson | Duration : 1 hour 15 minutes |
| Vetter : Mrs Cindy Toh           | Time : 09 00 – 10 15         |

**READ THESE INSTRUCTIONS FIRST**

Write your name, index number, class and calculator model in the spaces at the top of the page.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **ALL** questions.

If working is needed for any question it must be shown **neatly and clearly** in the space below the question.

Omission of essential working will result in loss of marks.

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For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is **50**.

| For Examiner's Use |
|--------------------|
|                    |

Answer ALL questions.

1. Written as the product of its prime factors  $240 = 2^4 \times 3 \times 5$ .

For  
Examiner's  
Use

- (a) Express 168 as the product of its prime factors.
- (b) Find the LCM of 240 and 168, giving your answer as the product of its prime factors.
- (c) Given that  $240k$  is a perfect cube, find the smallest possible value of  $k$ .
- (d) En Qi needs to pack 168 blue pens and 240 red pens into identical bags so that the pens are equally distributed among the bags. Find the largest number of bags that can be packed.

Answer: (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [1]

(c) \_\_\_\_\_ [1]

(d) \_\_\_\_\_ bags [1]

2. (a) In the number 64  $X61$ ,  $X$  is a composite number. If the value, correct to 3 significant figures is 65 000, find the maximum value of  $X$ .
- (b) A glass block has a mass of 53 grams, correct to the nearest gram. Find the least possible mass of the glass block.

Answer: (a)  $X =$  \_\_\_\_\_ [1]

(b) \_\_\_\_\_ g [1]

3. The following table shows the temperature of four cities in United States at 11 00 on a particular day.

| Miami | Chicago | Washington | Minneapolis |
|-------|---------|------------|-------------|
| 25 °C | -2 °C   | 8 °C       | -10 °C      |

- (a) Find the difference in temperature between the warmest and coldest cities.
- (b) Find the average temperature for these four cities.
- (c) It was found that the temperature of Chicago decreased by 0.3 °C every hour after 11 00. Find the temperature at 15 00.

Answer: (a) \_\_\_\_\_ °C [1]

(b) \_\_\_\_\_ °C [1]

(c) \_\_\_\_\_ °C [2]

4. Solve the simultaneous equations.

$$x - 2y = -3,$$

$$4x - 3y = 8.$$

*Answer:*

$$x = \underline{\hspace{2cm}}$$

$$y = \underline{\hspace{2cm}} \quad [3]$$

5. (a) Lester bought an antique watch for \$450.  
When he sold it he made a profit of 160% of the cost.  
Calculate the selling price.
- (b) The length of each side of a square is increased by 30%.  
Find the percentage increase in the area of the square.

*Answer:* (a) \$                      [2]

(b)                      % [2]

6.  $x$  is directly proportional to  $y^3$ .  
 $x = 108$  when  $y = 3$ .  
Find

- (a) an equation connecting  $x$  and  $y$ ,  
(b) the value of  $x$  when  $y = 5$ .

Answer: (a) \_\_\_\_\_ [2]

(b)  $x =$  \_\_\_\_\_ [1]

7. A sum of money was divided between  $A$ ,  $B$  and  $C$  in the ratio 5: 6: 7.  
If, instead, this money had been divided equally between them,  $A$  would have received an extra \$5.  
What was the total sum of money?

Answer: \$ \_\_\_\_\_ [2]



8. Factorise each of the following expressions completely.

(a)  $xy - 3x + 2y - 6$

(b)  $3m^2n + 15mn + 18n$

Answer: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

9. (a) Expand  $\left(10r - \frac{1}{5}q\right)\left(10r + \frac{1}{5}q\right)$

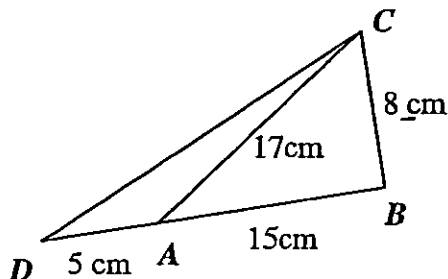
(b) Express  $\frac{3}{(x+2)^2} - \frac{4}{x+2}$  as a single fraction in its simplest form.

Answer: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

10. In triangle  $ABC$ ,  $AB = 15$  cm,  $BC = 8$  cm and  $AC = 17$  cm

- (a) Explain why angle  $ABC$  is a right angle.
- (b)  $BA$  is produced to  $D$  and  $AD = 5$  cm.  
Find the length of  $DC$ .



Answer: (a) \_\_\_\_\_ [1]

Answer: (b) \_\_\_\_\_ cm [2]

11. (a) Solve the equation  $3(x - 5) - 2 = 7 - (1 - x)$ .
- (b) Solve the equation  $3x^2 - 14x + 8 = 0$

Answer: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [2]

12. Given that  $m = \sqrt{\frac{4q}{n-3}}$ .

- (a) Find the value of  $m$  when  $q = 12$  and  $n = 6$ .
- (b) Express  $q$  in terms of  $m$  and  $n$ .

Answer: (a)  $m =$  \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [2]

13. In a 6-sided polygon, 3 of the interior angles are  $85^\circ$ ,  $95^\circ$  and  $105^\circ$ .  
The size of each remaining interior angle of the polygon is  $x^\circ$ .  
Find

- (a) the sum of the interior angles of the 6-sided polygon,
- (b) the value of  $x$ .

Answer: (a) \_\_\_\_\_  $^\circ$  [1]

(b)  $x =$  \_\_\_\_\_ [2]

14. (a) Construct triangle  $ABC$  where  $BC = 7.5$  cm and  $AC = 8$  cm.  
 $AB$  has already been drawn for you.

[1]

- (b) Construct


i) the bisector of angle  $ABC$ ,

[1]

ii) the perpendicular bisector of  $AB$ .

[1]

- (c) These two bisectors meet at  $Z$ .  
Complete the statement below.

$A$    $B$

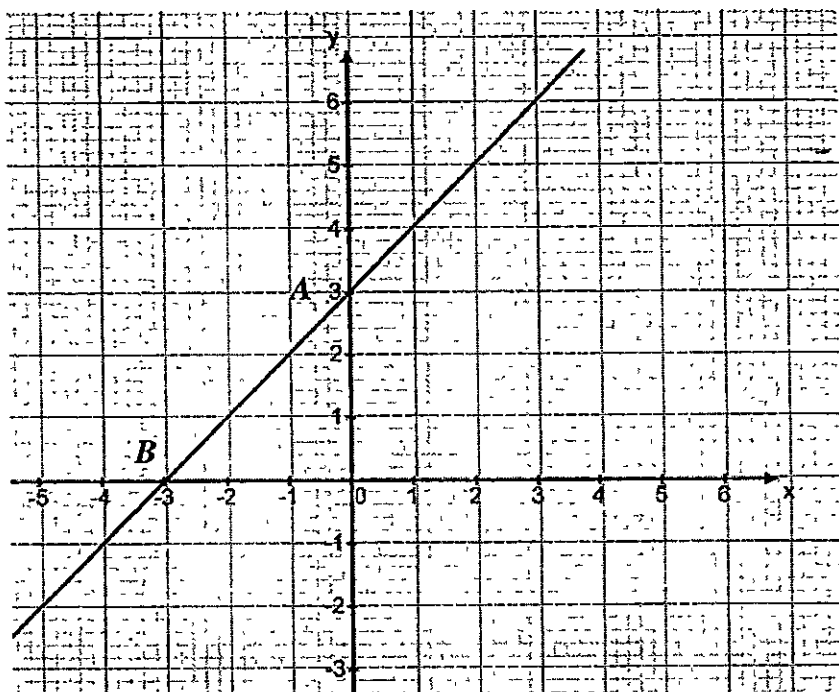
Answer:

- (d) The point  $Z$  is equidistant from the lines \_\_\_\_\_ and \_\_\_\_\_ and  
equidistant from the points \_\_\_\_\_ and \_\_\_\_\_.

[1]

15. The diagram shows a straight line which intersects the  $y$ -axis at  $A$  and  $x$ -axis at  $B$ .

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- (a) Find the gradient of the line.
- (b) Write down the equation for this line.

Answer: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [1]

- END OF PAPER -



|                  |                 |            |                |                      |
|------------------|-----------------|------------|----------------|----------------------|
| Name :           |                 | Index No : | Class :        | Calculator Model :   |
| Expected Grade : | Marks Awarded : | 50         | Actual Grade : | Parent's Signature : |



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The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is **50**.

**For Examiner's Use**

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This paper consists of **10** printed pages including the cover page and graph paper



Answer ALL questions.

| 1.  | Written as the product of its prime factors $240 = 2^4 \times 3 \times 5$ .   | For Examiner's Use |
|-----|---|--------------------|
| (a) | Express 168 as the product of its prime factors.  |                    |
| (b) | Find the LCM of 240 and 168, giving your answer as the product of its prime factors.  |                    |
| (c) | Given that $240k$ is a perfect cube, find the smallest possible value of $k$ .  |                    |
| (d) | En Qi needs to pack 168 blue pens and 240 red pens into identical bags so that the pens are equally distributed among the bags. Find the largest number of bags that can be packed.   |                    |
|     | <p>a) <math>168 = 2^3 \times 3 \times 7</math> [B1]</p> <p>b) <math>LCM = 2^4 \times 3 \times 5 \times 7</math> [B1]</p> <p>c)</p> $240k = 2^6 \times 3^3 \times 5^3$ $(2^4 \times 3 \times 5)k = 2^6 \times 3^3 \times 5^3$ $k = \frac{2^6 \times 3^3 \times 5^3}{(2^4 \times 3 \times 5)}$ $k = 2^2 \times 3^2 \times 5^2$ $k = 900$ [B1] <p>d) <math>HCF = 2^3 \times 3</math></p> $= 24$ [B1] |                    |
|     | Answer:   | (a) _____ [1]      |
|     |   | (b) _____ [1]      |
|     |   | (c) _____ [1]      |
|     |   | (d) _____ bags [1] |

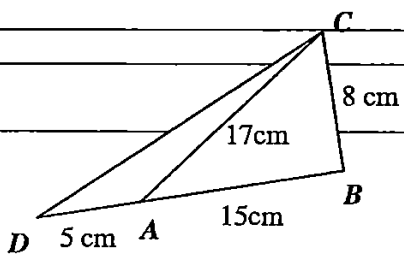
|       |         |   |                    |         |            |             |       |       |      |        |  |
|-------|---------|---|--------------------|---------|------------|-------------|-------|-------|------|--------|--|
| 2.    | (a)     | In the number 64 X61, X is a composite number. If the value, correct to 3 significant figures is 65 000, find the maximum value of X.                               | For Examiner's Use |         |            |             |       |       |      |        |  |
|       | (b)     | A glass block has a mass of 53 grams, correct to the nearest gram. Find the least possible mass of the glass.   |                    |         |            |             |       |       |      |        |  |
|       | a)      | maximum value of $X = 9$ [B1]   |                    |         |            |             |       |       |      |        |  |
|       | b)      | least possible mass = 52.5 [B1]   |                    |         |            |             |       |       |      |        |  |
|       |         | Answer: (a) $X =$ [1]   |                    |         |            |             |       |       |      |        |  |
|       |         | (b) _____ g [1]   |                    |         |            |             |       |       |      |        |  |
| 3.    |         | The following table shows the temperature of four cities in United States at 11 00 on a particular day.   |                    |         |            |             |       |       |      |        |  |
|       |         | <table> <tr> <td>Miami</td><td>Chicago</td><td>Washington</td><td>Minneapolis</td></tr> <tr> <td>25 °C</td><td>-2 °C</td><td>8 °C</td><td>-10 °C</td></tr> </table> | Miami              | Chicago | Washington | Minneapolis | 25 °C | -2 °C | 8 °C | -10 °C |  |
| Miami | Chicago | Washington  | Minneapolis        |         |            |             |       |       |      |        |  |
| 25 °C | -2 °C   | 8 °C  | -10 °C             |         |            |             |       |       |      |        |  |
|       | (a)     | Find the difference in temperature between the warmest and coldest cities.  |                    |         |            |             |       |       |      |        |  |
|       | (b)     | Find the average temperature for these four cities.   |                    |         |            |             |       |       |      |        |  |
|       | (c)     | It was found that the temperature of Chicago decreased by 0.3 °C every hour after 11 00. Find the temperature at 15 00.   |                    |         |            |             |       |       |      |        |  |
|       | a)      | $25 - (-10) = 35$ °C [B1]   |                    |         |            |             |       |       |      |        |  |
|       | b)      | Average temperature $= \frac{25 + (-2) + (8) + (-10)}{4}$<br>$= \frac{21}{4}$<br>$= 5.25$ °C [B1]   |                    |         |            |             |       |       |      |        |  |
|       | c)      | 11 00 to 15 00 $\Rightarrow$ 4 hours<br>Temperature at 15 00 $= -2 - 4 (0.3)$ [M1]<br>$= -3.2$ °C [A1]  |                    |         |            |             |       |       |      |        |  |
|       |         | Answer: (a) _____ °C [1]  |                    |         |            |             |       |       |      |        |  |
|       |         | (b) _____ °C [1]  |                    |         |            |             |       |       |      |        |  |
|       |         | (c) _____ °C [2]  |                    |         |            |             |       |       |      |        |  |



|    |  |  |     |             |     |
|----|--|--|-----|-------------|-----|
| 4. | Solve the simultaneous equations.  |  |     |             |     |
|    | $x - 2y = -3,$ $4x - 3y = 8.$  |  |     |             |     |
|    | <u>Elimination method</u><br>$x - 2y = -3 \dots(1)$<br>$4x - 3y = 8 \dots(2)$<br><br>$(1) \times 4: 4x - 8y = -12 \dots(3)$<br><br>$(3) - (2):$<br>$4x - 8y - (4x - 3y) = -12 - 8$ [M1]<br>$-8y + 3y = -20$<br>$-5y = -20$<br>$y = 4$ [A1]<br><br>Sub $y = 4$ into (1),<br>$x - 2(4) = -3$<br>$x = 5$ [A1] | <u>Substitution method</u><br>$x - 2y = -3$<br>$x = -3 + 2y \dots(1)$<br>$4x - 3y = 8 \dots(2)$<br><br>Sub (1) into (2),<br>$4(-3 + 2y) - 3y = 8$ [M1]<br>$-12 + 8y - 3y = 8$<br>$5y = 20$<br>$y = 4$ [A1]<br><br>Sub $y = 4$ into (1),<br>$x - 2(4) = -3$<br>$x = 5$ [A1] |     |             |     |
|    |  | Answer:  |     | $x =$ _____ |     |
|    |  |  |     |             |     |
|    |  |  |     | $y =$ _____ | [3] |
|    |  |  |     |             |     |
| 5. | (a)  | Lester bought an antique watch for \$450.<br>When he sold it he made a profit of 160% of the cost.<br>Calculate the selling price.   |     |             |     |
|    | (b)  | The length of each side of a square is increased by 30%.<br>Find the percentage increase in the area of the square.  |     |             |     |
|    | a)   | Selling price = $\frac{450}{100} \times 260$ [M1]<br>= \$1170 [A1]   |     |             |     |
|    | b)   | Let the original length of the square be $x$ ,<br>New length = $1.3x$<br><br>New Area = $1.3x \times 1.3x$ [M1]<br>= $1.69x^2$<br><br>percentage increase = $\frac{0.69x^2}{x^2} \times 100\%$<br>= 69% [A1]   |     |             |     |
|    |  | Answer:  | (a) | \$ _____    | [2] |
|    |  |  |     |             |     |
|    |  |  | (b) | _____ %     | [2] |
|    |  |  |     |             |     |

|    |  |                                      |     |             |     |                          |
|----|--|--------------------------------------|-----|-------------|-----|--------------------------|
| 6. | $x$ is directly proportional to $y^3$ .<br>$x = 108$ when $y = 3$ .<br>Find  |                                      |     |             |     | For<br>Examiner's<br>Use |
|    |  |                                      |     |             |     |                          |
|    | (a)  | an equation connecting $x$ and $y$ , |     |             |     |                          |
|    |  |                                      |     |             |     |                          |
|    | (b)  | the value of $x$ when $y = 5$ .      |     |             |     |                          |
|    |  |                                      |     |             |     |                          |
|    | $x = ky^3$<br>When $x = 108$ and $y = 3$ ,<br>$(108) = k(3)^3$<br>$k = \frac{108}{27}$<br>$k = 4$ [B1]<br>$x = 4y^3$ [B1]<br><br>$x = 4y^3$<br>$x = 4(5)^3$<br>$x = 500$ [B1]  |                                      |     |             |     |                          |
|    |  | Answer:                              | (a) | _____       | [2] |                          |
|    |  |                                      |     |             |     |                          |
|    |  |                                      | (b) | $x =$ _____ | [1] |                          |
|    |  |                                      |     |             |     |                          |
| 7. | A sum of money was divided between A, B and C in the ratio 5: 6: 7.<br>If, instead, this money had been divided equally between them, A would have received an extra \$5.<br>What was the total sum of money?  |                                      |     |             |     |                          |
|    | $5 \text{ units} + 6 \text{ units} + 7 \text{ units} = 18 \text{ units}$<br>$18 \text{ units} \div 3 = 6 \text{ units}$ [M1]<br>$6 \text{ units} - 5 \text{ units} = 1 \text{ unit}$<br>$1 \text{ unit} \Rightarrow \$5$<br>$18 \text{ units} \Rightarrow \$5 \times 18$<br>$\Rightarrow \$ 90$ [A1] |                                      |     |             |     |                          |
|    |  | Answer:                              |     | \$ _____    | [2] |                          |
|    |  |                                      |     |             |     |                          |

| 8.  | Factorise each of the following expressions completely.  | For<br>Examiner's<br>Use |
|-----|--|--------------------------|
| (a) | $xy - 3x + 2y - 6$   |                          |
| (b) | $3m^2n + 15mn + 18n$   |                          |
|     | $  \begin{aligned}  xy - 3x + 2y - 6 &= x(y - 3) + 2(y - 3) && \text{[M1]} \\  &= (x + 2)(y - 3) && \text{[A1]}  \end{aligned}  $<br>$  \begin{aligned}  3m^2n + 15mn + 18n &= 3n(m^2 + 5m + 6) && \text{[M1]} \\  &= 3n(m + 2)(m + 3) && \text{[A1]}  \end{aligned}  $  |                          |
|     | Answer:  | (a) _____ [2]            |
|     |  | (b) _____ [2]            |
| 9.  | (a) Expand $\left(10r - \frac{1}{5}q\right)\left(10r + \frac{1}{5}q\right)$  |                          |
| (b) | Express as $\frac{3}{(x+2)^2} - \frac{4}{x+2}$ a single fraction in its simplest form.   |                          |
|     | $  \begin{aligned}  \left(10r - \frac{1}{5}q\right)\left(10r + \frac{1}{5}q\right) &= (10r)^2 - \left(\frac{1}{5}q\right)^2 && \text{[M1]} \\  &= 100r^2 - \frac{q^2}{25} && \text{[A1]}  \end{aligned}  $<br>$  \begin{aligned}  \frac{3}{(x+2)^2} - \frac{4}{x+2} &= \frac{3 - 4(x+2)}{(x+2)^2} && \text{[M1]} \\  &= \frac{3 - 4x - 8}{(x+2)^2} \\  &= \frac{-4x - 5}{(x+2)^2} && \text{[A1]}  \end{aligned}  $ |                          |
|     | Answer:  | (a) _____ [2]            |
|     |  | (b) _____ [2]            |

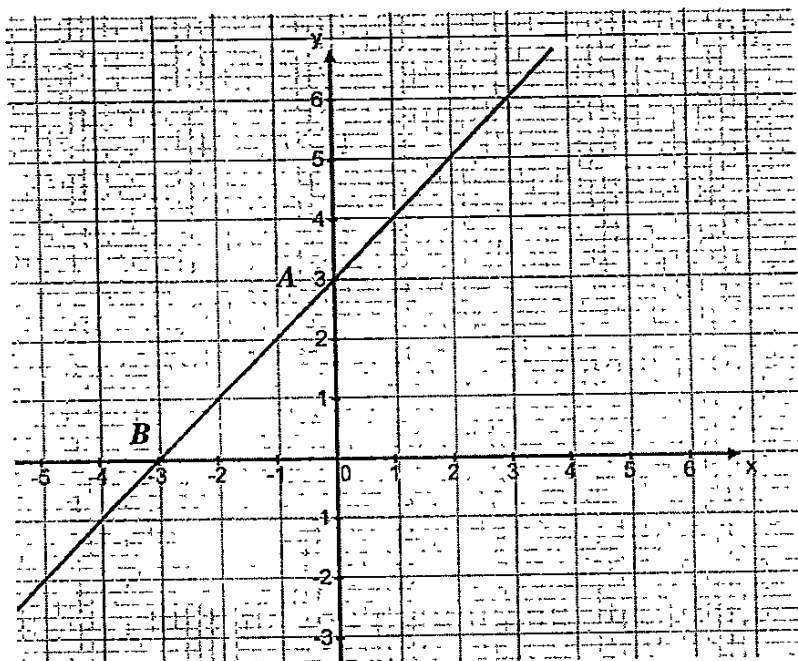
|     |  |   |   |          |                          |  |
|-----|--|---|---|----------|--------------------------|--|
| 10. | In triangle $ABC$ , $AB = 15$ cm, $BC = 8$ cm and $AC = 17$ cm   |   |   |          | For<br>Examiner's<br>Use |  |
| (a) | Explain why angle $ABC$ is a right angle.  |   |   |          |                          |  |
| (b) | $BA$ is produced to $D$ and $AD = 5$ cm.<br>Find the length of $DC$ .  |   |   |          |                          |  |
|     | <div><math display="block">AC^2 = 17^2</math><math display="block">= 289</math><math display="block">AB^2 + CB^2 = 15^2 + 8^2</math><math display="block">= 289</math><math display="block">DC^2 = DB^2 + CB^2</math><math display="block">= 20^2 + 8^2</math><math display="block">= 464</math><math display="block">DC = 21.540659</math><math display="block">\approx 21.5 \text{ (to 3 s.f.)}</math></div> <div></div>                     |   |   |          |                          |  |
|     | Answer:  | (a)   | Since $AC^2 = AB^2 + CB^2$ , therefore by Pythagoras theorem, |          |                          |  |
|     |  |   | $\triangle ABC$ is a right angle triangle.                    |          | [1]                      |  |
|     |  |   |   |          |                          |  |
|     |  | Answer:                                       | (b)   | _____ cm | [2]                      |  |
|     |  |   |   |          |                          |  |
| 11. | (a)  | Solve the equation $3(x-5) - 2 = 7 - (1-x)$ . |   |          |                          |  |
|     | (b)  | Solve the equation $3x^2 - 14x + 8 = 0$       |   |          |                          |  |
|     | <div><math display="block">3(x-5) - 2 = 7 - (1-x)</math><math display="block">3x - 15 - 2 = 7 - 1 + x</math><math display="block">3x - 17 = 6 + x</math><math display="block">2x = 23</math><math display="block">x = 11.5</math></div> <div><math display="block">3x^2 - 14x + 8 = 0</math><math display="block">(3x-2)(x-4) = 0</math><math display="block">(3x-2) = 0 \quad \text{or} \quad (x-4) = 0</math><math display="block">3x = 2 \quad \text{or} \quad x = 4</math><math display="block">x = \frac{2}{3}</math></div> |   |   |          |                          |  |
|     |  | Answer:                                       | (a)   | _____    | [2]                      |  |
|     |  |   | (b)   | _____    | [2]                      |  |

|  |  |                          |
|--|--|--------------------------|
| 12.  | Given that $m = \sqrt{\frac{4q}{n-3}}$ .   | For<br>Examiner's<br>Use |
| (a)  | Find the value of $m$ when $q = 12$ and $n = 6$ .  |                          |
| (b)  | Express $q$ in terms of $m$ and $n$ .  |                          |
| <p>a)</p> <p>When <math>n = 6</math> and <math>q = 12</math>,</p> $m = \sqrt{\frac{4(12)}{6-3}}$ $= \sqrt{\frac{48}{3}} \quad [\text{M1}]$ $= \sqrt{16}$ $= 4 \quad [\text{A1}]$   | <p>b)</p> $m = \sqrt{\frac{4q}{n-3}}$ $m^2 = \frac{4q}{n-3} \quad [\text{M1}]$ $m^2(n-3) = 4q$ $q = \frac{m^2(n-3)}{4} \quad [\text{A1}]$  |                          |
|  | Answer: (a) $m =$ _____ [1]  |                          |
|  | (b) $n =$ _____ [2]  |                          |
| 13.  | In a 6-sided polygon, 3 of the interior angles are $85^\circ$ , $95^\circ$ and $105^\circ$ .<br>If the size of each remaining interior angle of the polygon is $x^\circ$ .<br>Find |                          |
| (a)  | the sum of the interior angles of the 6-sided polygon,   |                          |
| (b)  | the value of $x$ .   |                          |
| <p>Sum of the interior angles <math>= (n-2) \times 180^\circ</math></p> $= 4 \times 180^\circ$ $= 720^\circ \quad [\text{B1}]$<br>$720^\circ = 85^\circ + 95^\circ + 105^\circ + 3x^\circ \quad [\text{M1}]$ $720^\circ = 285^\circ + 3x^\circ$ $435^\circ = 3x^\circ$ $x = 145 \quad [\text{A1}]$ |  |                          |
|  | Answer: (a) _____ [1]  |                          |
|  | (b) $x =$ _____ [2]  |                          |



15. The diagram shows a straight line which intersects the y-axis at A and x-axis at B.

For  
Examiner's  
Use



(a) Find the gradient of the line.

(b) Write down the equation for this graph.

a)

$$\text{gradient of the line, } m = \frac{(3) - (0)}{(0) - (-3)} \quad [\text{M1}]$$

$$= 1 \quad [\text{A1}]$$

b)

$$y = mx + c$$

$$y = 1x + 3$$

$$y = x + 3$$

[B1]

Answer: (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [1]

- END OF PAPER-

|                  |                 |            |                  |                      |
|------------------|-----------------|------------|------------------|----------------------|
| Name :           |                 | Index No : | Class :          | Calculator Model :   |
| Expected Grade : | Marks Awarded : | 50         | Actual Grade : _ | Parent's Signature : |



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| MID YEAR EXAMINATION 2014   |                              |
|-----------------------------|------------------------------|
| Subject : MATHEMATICS       | Paper: 2                     |
| Level : Secondary 2 Express | Date: 14 May 2014            |
| Setter : Mr. Jackson Tan    | Duration : 1 hour 15 minutes |
| Vetter : Mrs. Cindy Toh     | Time : 11 30 – 12 45         |

**READ THESE INSTRUCTIONS FIRST**

Write your index number and name on all the work you hand in.  
 Write in dark blue or black pen on both sides of the paper.  
 You may use a pencil for any diagrams or graphs.  
 Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **ALL** questions on the writing paper provided.  
 If working is needed for any question it must be shown with the answer.  
 Omission of essential working will result in loss of marks.  
 Calculators should be used where appropriate.  
 If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.  
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At the end of the examination, fasten all your work securely together.  
 The number of marks is given in brackets [ ] at the end of each question or part question.  
 The total of the marks for this paper is **50**.

|                           |
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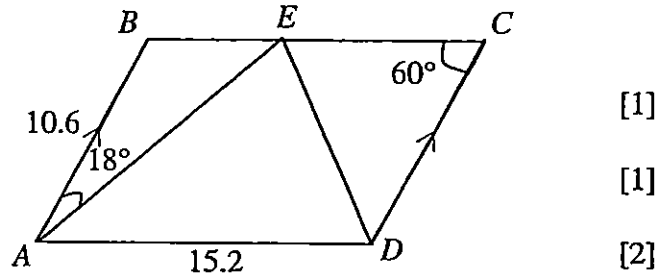


Answer all questions.

1. (a) 15 blacksmiths can make 30 identical knives. Assuming all the blacksmiths work at the same rate, find the number of identical knives 8 blacksmiths can make. [2]
- (b) Urlwin runs 2.2km in 9 minutes and walks 200 m at an average speed of 4 km/h. Calculate
- (i) the time, in minutes, he takes to walk the 200 m, [1]
- (ii) his average speed for the whole journey in kilometres per hour. [2]
2. (a) A two-digit number is such that the sum of its digits is  $\frac{1}{4}$  of the number. [4]  
When the digits of the number are reversed and the number is subtracted from the original number, the result obtained is  $-27$ .  
Find the original number.
- (b) (i) Write down the next two terms in the sequence 1, 3, 6, 10, 15 ... . [1]
- (ii) Write down an expression, in terms of  $n$ , for the  $n$ th term in the sequence. [2]  
1, 3, 6, 10, 15 ... .
3. The length of  $x$  m of a basketball court has a perimeter of 50 m.
- (a) Find an expression, in terms of  $x$ , for the breadth of the basketball court. [1]
- (b) It was given that the area of the basketball court is  $150 \text{ m}^2$ . [1]  
Write down an equation in  $x$  to represent this information, and show that it reduces to  $x^2 - 25x + 150 = 0$ .
- (c) Solve the equation  $x^2 - 25x + 150 = 0$ . [2]
- (d) Find the breadth of the basketball court. [1]
4. (a) Simplify  $\frac{24x^2}{y} \div \frac{6x^3}{y^2}$  [2]
- (b) (i) Factorise  $7p^2 - 28$  completely. [2]
- (ii) Hence, simplify  $\frac{7p^2 - 28}{p^2 + 2p}$ . [2]

5. (a) Solve the inequality  $2x - 25 \geq 18 + 8x$ . [2]
- (b) Hence write down the greatest odd integer value of  $x$  which satisfies  $2x - 25 \geq 18 + 8x$ . [1]
- (c) A boat can ferry a maximum of 25 passengers across the river. Find the minimum number of trips that a boat must make to ferry 243 passengers. [2]

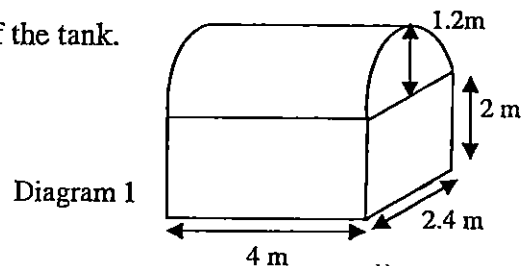
6.  $ABCD$  is a parallelogram with  $AB = 10.6$  cm and  $AD = 15.2$  cm.  $\angle BAE = 18^\circ$  and  $\angle ECD = 60^\circ$ .  
Find



- (a)  $\angle ABC$ , [1]
- (b)  $\angle DAE$ , [1]
- (c) the area of parallelogram  $ABCD$ , given that its height is 9 cm. [2]

7. Diagram 1 shows an oil tank which is made up of half of a cylinder of radius 1.2 m joined to a cuboid of side 4 m by 2.4 m by 2 m.

- (a) Calculate the total surface area of the outside of the tank. [4]



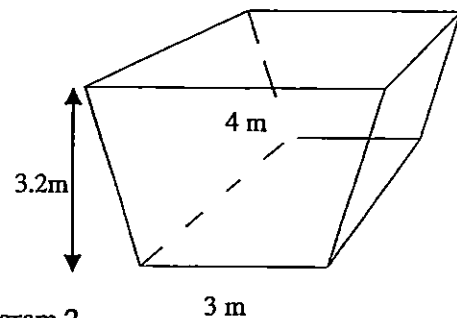
- (b) The tank is filled with petrol.
- (i) Calculate the amount of petrol needed to fill the tank in  $\text{m}^3$ . [3]
- (ii) All of the petrol from the tank will fill up an underground storage tank completely. [3]

The storage tank as shown in Diagram 2 is a prism whose cross-section is a trapezium.

The lengths of the parallel sides of the trapezium are 4 m and 3 m.

The depth of the storage tank is 3.2 m

Calculate the length of the underground tank.



8. *Answer the whole of this question on a sheet of graph paper.*

Stevie kicks a soccer ball vertically upwards.

The height,  $h$  metres, of the ball at  $t$  seconds after it leave the ground is given by the formula

$$h = 24t - 4t^2.$$

The table below shows some values of  $t$  and the corresponding values of  $h$ .

|     |   |    |    |     |    |    |
|-----|---|----|----|-----|----|----|
| $t$ | 0 | 1  | 2  | 3   | 4  | 5  |
| $h$ | 0 | 20 | 32 | $m$ | 32 | 20 |

- (a) Find the value of  $m$ .

[1]

- (b) Using a scale of 2 cm to represent 1 second, draw a horizontal  $t$ -axis for  $0 \leq t \leq 6$ .  
Using a scale of 2 cm to represent 5 metres, draw a vertical  $h$ -axis for  $0 \leq h \leq 40$ .

[3]

On your axes, plot the points given in the table and join them with a smooth curve.

- (c) Use your graph to find

- (i) the greatest height of the ball above the ground,  
(ii) the length of time for which the ball was more than 20 metres above the ground,  
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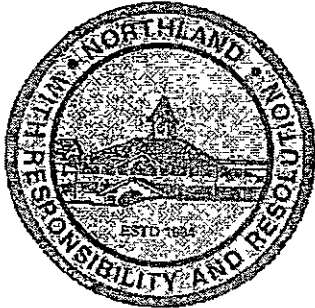
[1]

[2]

[1]

– END OF PAPER –

|                  |                 |            |                |                      |
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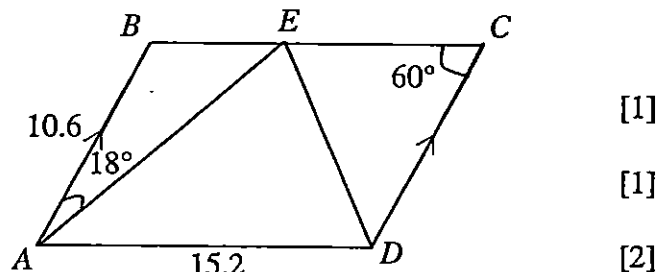
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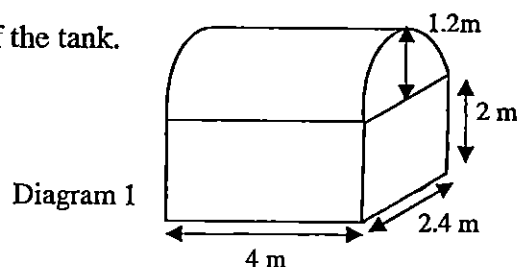
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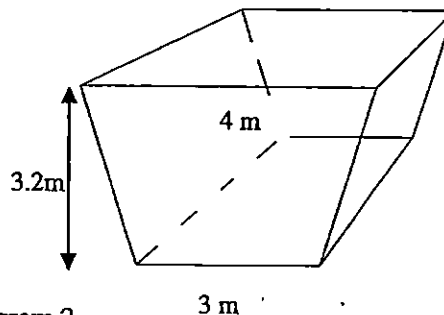
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| $h$ | 0 | 20 | 32 | $m$ | 32 | 20 |

(a) Find the value of  $m$ . [1]

(b) Using a scale of 2 cm to represent 1 second, draw a horizontal  $t$ -axis for  $0 \leq t \leq 6$ . [3]  
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- (c) Use your graph to find
- (i) the greatest height of the ball above the ground, [1]
  - (ii) the length of time for which the ball was more than 20 metres above the ground, [2]
  - (iii) the time taken for the ball to hit the ground again. [1]

– END OF PAPER –



## Sec 2 Express Mathematics Mid-Year Examination 2014

### Paper 2 Marking Scheme

| Qn No | Working  | Marks  |
|-------|--|--|
| 1(a)  | <p>15 carpenters <math>\Rightarrow</math> 30 knives</p> <p>1 carpenter <math>\Rightarrow</math> 2 knives [M1]</p> <p>8 carpenters <math>\Rightarrow 2 \times 8</math></p> <p><math>= 16</math> knives [A1]</p> <p>OR</p> <p>Let <math>C</math> represent the number of carpenters and <math>x</math> represent the number of knives made</p> <p>Number of carpenters (<math>C</math>) is directly proportional to the number of knives made (<math>x</math>).</p> <p><math>C = kx</math></p> <p><math>15 = k(30)</math></p> <p><math>k = 0.5</math> [M1]</p> <p><math>C = 0.5x</math></p> <p><math>(8) = 0.5x</math></p> <p><math>x = 16</math> [A1]</p> | <p>M1 for 1 carpenter <math>\Rightarrow</math> 2 knives</p> <p>A1 for 16</p> <p>M1 for <math>k = 0.5</math></p> <p>A1 for 16</p> |
| 1(b)  | <p>Time taken <math>= \frac{0.2}{4}</math></p> <p><math>= 0.05</math> h</p> <p><math>= 3</math> minutes [B1]</p> <p>Total distance <math>= 2.4</math> km</p> <p>Total time taken <math>= 12</math> min</p> <p><math>= 0.2</math> hours</p> <p>Average speed <math>= \frac{2.4}{0.2}</math> [M1]</p> <p><math>= 12</math> km/h [A1]</p>   | <p>B1 for 3 minutes</p> <p>M1 for <math>\frac{2.4}{0.2}</math></p> <p>A1 for 12 km/h</p>   |
| 2(a)  | <p>Let the tens digit of the original number be <math>x</math> and its ones digit be <math>y</math>.</p> <p>Then the original number is <math>10x + y</math>,</p> <p>The number obtained when the digits of the original number are reversed is <math>10y + x</math>.</p> <p><math>x + y = \frac{1}{4}(10x + y)</math></p> <p><math>4(x + y) = 10x + y</math></p> <p><math>4y - y = 10x - 4x</math></p> <p><math>3y = 6x</math></p> <p><math>y = 2x \dots (1)</math> [M1]</p> <p><math>(10x + y) - (10y + x) = -27</math></p>  | <p>M1 for <math>y = 2x</math></p>  |



|          |   |   |
|----------|---|---|
|          | $9x - 9y = -27 \dots (2)$ [M1]<br>Substitute (1) into (2),<br>$9x - 9(2x) = -27$ [M1]<br>$-9x = -27$<br>$x = 3$<br>Substitute $x = 3$ into (1),<br>$y = 2(3)$<br>$y = 6$ [A1] | M1 for $9x - 9y = -27$<br>M1 for $9x - 9(2x) = -27$<br>A1 for $y = 6$     |
| 2(b)(i)  | 13 <sup>th</sup> term in the sequence $= 38 - 12(4)$<br>$= -10$ [B1]  | B1 for $-10$  |
| 2(b)(ii) | $\frac{n(n+1)}{2}$ [B2]   | B2 for $\frac{n(n+1)}{2}$   |
| 3(a)     | Breadth of the court $= \frac{50 - 2x}{2}$<br>$= 25 - x$ [B1]   | B1 for $25 - x$   |
| 3(b)     | Area of the basketball court $= \text{length} \times \text{breadth}$<br>$150 = x(25 - x)$<br>$150 = 25x - x^2$<br>$x^2 - 25x + 150 = 0$ [B1]                                  | B1 for $x^2 - 25x + 150 = 0$  |
| 3(c)     | $x^2 - 25x + 150 = 0$<br>$(x - 10)(x - 15) = 0$ [M1]<br>$x - 10 = 0$ or $x - 15 = 0$<br>$x = 10$ $x = 15$ [A1]  | M1 for $(x - 10)(x - 15) = 0$<br>A1 for $x = 15$                          |
| 3(d)     | Breadth of the court $= 25 - (15)$<br>$= 10$ [B1]   | B1 for 10   |
| 4(a)     | $\frac{24x^2}{y} \div \frac{6x^3}{y^2} = \frac{24x^2}{y} \times \frac{y^2}{6x^3}$ [M1]<br>$= \frac{4}{1} \times \frac{y}{x}$<br>$= \frac{4y}{x}$ [A1]                         | M1 for $\frac{24x^2}{y} \times \frac{y^2}{6x^3}$<br>A1 for $\frac{4y}{x}$ |
| 4(b)     | $7p^2 - 28 = 7(p^2 - 4)$ [M1]<br>$= 7(p + 2)(p - 2)$ [A1]   | M1 for $7(p^2 - 4)$   |

|      |  |   |
|------|--|---|
|      |  | A1 for $7(p+2)(p-2)$  |
| 4(c) | $\frac{7p^2 - 28}{p^2 + 2p} = \frac{7(p-2)(p+2)}{p(p+2)} \quad [\text{M1}]$ $= \frac{7(p-2)}{p}$ $= 7 - \frac{2}{p} \quad [\text{A1}]$   | <p>M1 for <math>\frac{7(p-2)(p+2)}{p(p+2)}</math></p> <p>A1 for <math>7 - \frac{2}{p}</math></p>  |
| 5(a) | $2x - 25 \geq 18 + 8x \quad \text{or} \quad 2x - 25 \geq 18 + 8x$<br>$-25 - 18 \geq 8x - 2x \quad -6x \geq 43 \quad [\text{M1}]$<br>$-43 \geq 6x \quad [\text{M1}] \quad x \leq \frac{-43}{6} \quad [\text{A1}]$<br>$\frac{-43}{6} \geq x \quad [\text{A1}]$ | <p>M1 for <math>-43 \geq 6x</math> or <math>-6x \geq 43</math></p> <p>A1 for <math>\frac{-43}{6} \geq x</math> or <math>x \leq \frac{-43}{6}</math></p> |
| 5(b) | $x \leq \frac{-43}{6}$<br>$x \leq -7.1666$<br>greatest odd integer value of $x = -9 \quad [\text{B1}]$   | B1 for $x = -9$   |
| 5(c) | Let the number of trips be $x$ ,<br>$25x > 243 \quad [\text{M1}]$<br>$x > \frac{243}{25}$<br>$x > 9.72$<br>minimum value of $x = 10 \quad [\text{A1}]$   | <p>M1 for <math>25x &gt; 243</math></p> <p>A1 for <math>x = 10</math></p>   |
| 6(a) | $\angle ABC = 180^\circ - \angle BCD$<br>$= 180^\circ - 60^\circ$<br>$= 120^\circ \quad [\text{B1}]$   | B1 for $\angle ABC = 120^\circ$   |
| 6(b) | $\angle DAE = \angle BAD - 18^\circ$<br>$= 60^\circ - 18^\circ$<br>$= 42^\circ \quad [\text{B1}]$  | B1 for $\angle DAE = 42^\circ$  |
| 6(c) | Area of parallelogram $ABCD = 15.2 \times 9$<br>$= 136.8$  | <p>M1 for <math>25x &gt; 243</math></p> <p>A1 for 136.8</p>   |

|          |   |   |  |
|----------|---|---|--|
| 7(a)     | <p>Surface Area of the cuboid</p> $A = 2(2.4 \times 2) + 2(4 \times 2) + (4 \times 2.4)$ $A = 9.6 + 8 + 9.6$ $A = 27.2$ <p>Surface Area of the half cylinder</p> $A = \frac{1}{2}(2.4 \times \pi \times 4) + \pi(1.2)^2$ $A = 6.24\pi$ <p>Total Surface area = <math>27.2 + 19.604</math><br/> <math>= 46.804</math><br/> <math>= 46.8</math> (to 3 s.f.)</p>               | <p>[M1]</p> <p>[M2]</p> <p>[A1]</p>                         | <p>M1 for <math>A = 2(2.4 \times 2) + 2(4 \times 2) + (4 \times 2.4)</math></p> <p>M1 for <math>A = \frac{1}{2}(2.4 \times \pi \times 4)</math><br/> M1 for <math>A = \pi(1.2)^2</math></p> <p>A1 for 46.8</p>                                       |
| 7(b)(i)  | <p>Volume of the cuboid</p> $V = 2 \times 2.4 \times 4$ $V = 19.2$ <p>Volume of the half cylinder</p> $V = \frac{1}{2}\pi(1.2)^2 \times 4$ $V = 2.88\pi$ <p>Volume of the tank</p> $V = 19.2 + 2.88\pi$ $V = 28.2$ (to 3 s.f.) <p>Or</p> <p>Volume of the tank</p> $V = \left[ (2.4 \times 2) + \frac{1}{2}\pi(1.2)^2 \right] \times 4$ $V = 28.248$ $V = 28.2$ (to 3 s.f.) | <p>[M1]</p> <p>[M1]</p> <p>[A1]</p> <p>[M2]</p> <p>[A1]</p> | <p>M1 for <math>V = 2 \times 2.4 \times 4</math></p> <p>M1 for <math>V = \frac{1}{2}\pi(1.2)^2 \times 4</math></p> <p>A1 for 28.2</p> <p>M2 for <math>V = \left[ (2.4 \times 2) + \frac{1}{2}\pi(1.2)^2 \right] \times 4</math><br/> A1 for 28.2</p> |
| 7(b)(ii) | <p>Area of trapezium</p> $A = \frac{1}{2}(3 + 4) \times 3.2 = 11.2$ <p><math>h = 28.248 \div 11.2</math><br/> <math>= 2.52</math> m</p>   | <p>[M1]</p> <p>[M1]</p> <p>[A1]</p>                         | <p>M1 for <math>A = \frac{1}{2}(3 + 4) \times 3.2</math></p> <p>M1 for <math>h = 28.248 \div 11.2</math><br/> A1 for 46.8</p>  |
| 8(a)     | <p>When <math>t = 3</math>,</p> $h = 24(3) - 4(3)^2$ $h = 36$   |   | B1 for $m = 36$  |
| 7(b)     |   |   |  |
| 7(c)(i)  | $t = 3$ and $h = 36$  |   | B1 for both correct answer   |
| 7(c)(ii) | Length of time = $5 - 1$  |   | B2   |

|           |                   |    |
|-----------|-------------------|----|
|           | $= 4 \text{ sec}$ |    |
| 7(c)(iii) | $t = 6$           | B1 |



# YISHUN SECONDARY SCHOOL

*We Seek, We Strive, We Soar*

## MID-YEAR EXAMINATION

Name: \_\_\_\_\_ Reg. No: \_\_\_\_\_ Class: \_\_\_\_\_

Calculator Model: \_\_\_\_\_

**Sec 2 Express**

**Date: 14 May 2014**

**MATHEMATICS**

**Part 2**

**Duration: 1hr 30min**

**MAX MARKS: 60**

### READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 60.

Answer all questions.

- 1 Consider the first 3 lines of the following number pattern.

$$2^3 - 2 = 6 = 1 \times 2 \times 3$$

$$3^3 - 3 = 24 = 2 \times 3 \times 4$$

$$4^3 - 4 = 60 = 3 \times 4 \times 5$$

$\vdots$

- (i) Write down the 6<sup>th</sup> line of this sequence. [1]
- (ii) Express  $n^3 - n$  as a product of 3 consecutive algebraic expressions. [1]
- (iii) Ronald believes that the number 70 359 will not be part of the number pattern. State whether you agree with Ronald or not, and explain why. [1]

- 2 (a) Express  $1 - \frac{v-3}{5v}$  as a single fraction. [2]

- (b) Simplify  $\frac{r+4}{p-3r} \div \frac{2r^2+r-28}{3r^2-pr}$ . [3]

- 3 (a) (i) Make  $m$  the subject of the formula  $x = \sqrt[3]{\frac{5K}{4m-3}}$ . [3]

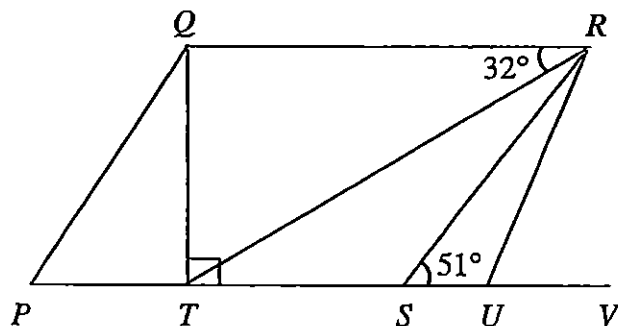
- (ii) Hence, find the value of  $m$  when  $x = 2$  and  $K = 40$ . [2]

- (b) Factorise  $4ab - 10c + 2a^2b - 5ac$  completely. [2]

- 4 (a) Consider a regular  $n$ -sided polygon.  
The size of each interior angle is three times the size of each exterior angle.  
Find the value of  $n$ . [2]

- (b) In a class test, Beniah drew a rhombus  $ABCD$ .  
Using a protractor, he found that  $\angle ABC = 82^\circ$ , while  $\angle BCD = 98^\circ$ .  
He got worried and decided to redraw his rhombus.  
Should Beniah have gotten worried? State your reason(s) clearly. [2]

5



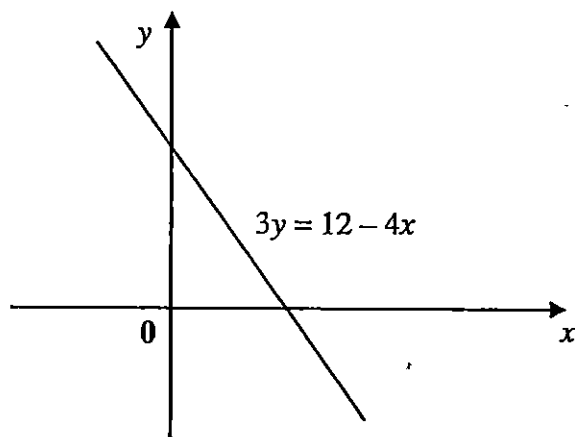
In the diagram,  $PQRS$  is a parallelogram.

It is known that  $\angle QTS = 90^\circ$ ,  $\angle QRT = 32^\circ$ ,  $\angle RSU = 51^\circ$ , and  $TU = UR$ .

Clearly stating your reasons, find

- (i)  $\angle TRS$ , [1]
- (ii)  $\angle PQR$ , [1]
- (iii)  $\angle RUV$ . [2]

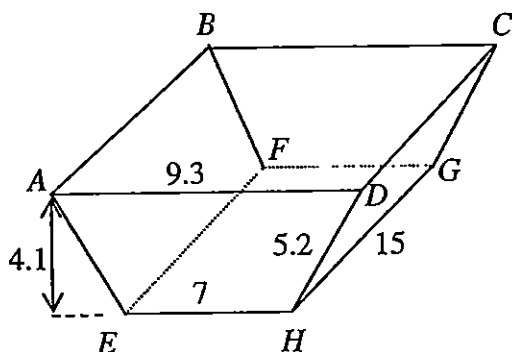
- 6 A line has an equation given by  $3y = 12 - 4x$ .



- (a) Explain clearly whether the point  $(6, -10)$  lies on the line. [1]
- (b)
  - (i) State the coordinates of the point where the line intersects the  $x$ -axis. [1]
  - (ii) State the coordinates of the point where the line intersects the  $y$ -axis. [1]
  - (iii) Hence or otherwise, find the gradient of the line. [2]

- 7 A farmer rears  $x$  horses and  $y$  chickens on his farm.  
The animals have 448 legs in total, and there are 5 times as many chickens as horses.
- Formulate a pair of simultaneous equations in  $x$  and  $y$ . [2]
  - Solve the 2 simultaneous equations in (i), and hence find the number of horses on the farm. [2]
  - After a disease struck the farm, 95 chickens died.  
Express the remaining number of chickens as a percentage of the original number of chickens. [2]

8



The figure above shows a gold bar.  
The gold bar is a prism whose cross-section is a trapezium where  $AD = 9.3$  cm,  $AE = DH = 5.2$  cm and  $EH = 7$  cm.  
The vertical height and length of the gold bar are 4.1 cm and 15 cm respectively.

- Find the total surface area of the gold bar. [3]
- Find the volume of the gold bar. [2]
  - The gold bar is then melted down.  
The liquid gold is placed into a cylindrical mould of radius 8 cm.  
Calculate the height of the liquid gold in the mould. [2]
  - State one assumption made in (b)(ii). [1]



- 9 Mira and Alan participated in a cross country hike.  
They each hiked a distance of 80 km.
- (i) Mira hiked at a constant speed of  $x$  km/h.  
Write down an expression, in terms of  $x$ , for the time she took to complete the hike. [1]
- (ii) Alan hiked at a constant speed which was 4 km/h less than Mira's speed.  
Write down an expression, in terms of  $x$ , for the time he took to complete the hike. [1]
- (iii) Given that Mira and Alan finished their respective hikes 10 hours apart, form an equation in  $x$ , and show that it reduces to  $x^2 - 4x - 32 = 0$ . [3]
- (iv) Solve the equation  $x^2 - 4x - 32 = 0$ . [2]
- (v) Hence, calculate how long Alan took to complete the hike. [2]

**Note: Q10 is on page 6**

**10 Answer the whole of this question on a sheet of graph paper.**

The variables  $x$  and  $y$  are connected by the equation  $y = 15 - 3x - x^2$ .

The table below shows some values of  $x$  and the corresponding values of  $y$ .

|     |     |    |    |    |    |   |    |
|-----|-----|----|----|----|----|---|----|
| $x$ | -3  | -2 | -1 | 0  | 1  | 2 | 3  |
| $y$ | $a$ | 17 | 17 | 15 | 11 | 5 | -3 |

- (i) Find the value of  $a$ . [1]
- (ii) Using a scale of 2 cm to 1 unit, draw a horizontal  $x$ -axis for  $-3 \leq x \leq 3$ .  
Using a scale of 1 cm to 1 unit, draw a vertical  $y$ -axis for  $-4 \leq y \leq 18$ .  
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (iii) Use your graph to
- (a) estimate the maximum value of the graph  $y = 15 - 3x - x^2$ , [1]
- (b) write down the coordinates of the point where the graph cuts the positive  $x$ -axis, [1]
- (c) find the values of  $x$  when  $y = 16$ , [2]
- (d) find the equation of the line of symmetry of the graph. [1]

**End of Paper**  
**Please check your work thoroughly! ☺**



## Answers to P2

|          |  |           |  |
|----------|--|-----------|--|
| 1(i)     | $7^3 - 7 = 336 = 6 \times 7 \times 8$                                | 6(a)      | Does not lie on the line.  |
| 1(ii)    | $(n-1)(n)(n+1)$  | 6(b)(i)   | (3,0)  |
| 1(iii)   | Agree. The sequence always yields an even number, but 70 359 is odd. | 6(b)(ii)  | (0,4)  |
| 2(a)     | $\frac{4v+3}{5v}$  | 6(b)(iii) | $-\frac{4}{3}$   |
| 2(b)     | $\frac{r}{7-2r}$ or $-\frac{r}{2r-7}$                                | 7(i)      | $4x + 2y = 448$<br>$y = 5x$  |
| 3(a)(i)  | $\frac{5K}{4x^3} + \frac{3}{4}$                                      | 7(ii)     | $x = 32$   |
| 3(a)(ii) | 7  | 7(iii)    | 40.625% or $40\frac{5}{8}\%$   |
| 3(b)     | $(2+a)(2ab-5c)$  | 8(a)      | 467.33 cm <sup>2</sup>   |
| 4(a)     | $n = 8$  | 8(b)(i)   | 501.225 cm <sup>3</sup> or $501\frac{9}{40}$ cm <sup>3</sup>   |
| 4(b)     | No. The angles should add up to 180°.                                | 8(b)(ii)  | 2.49 cm  |
| 5(i)     | 19°  | 8(b)(iii) | Volume remains constant / No air bubbles formed when gold is poured into mould / any other reasonable answer |
| 5(ii)    | 129°   | 9(i)      | $\frac{80}{x}$   |
| 5(iii)   | 64°  | 9(ii)     | $\frac{80}{x-4}$   |
|          |  | 9(iv)     | $x = -4$ , or $x = 8$  |
|          |  | 9(v)      | 20 h   |
|          |  | 10(i)     | 15   |



**BEATTY SECONDARY SCHOOL  
END-OF-YEAREXAMINATION 2014**

**SUBJECT : Mathematics**

**LEVEL : Sec 2 Express**

**PAPER : 1**

**DURATION : 1 hour 15 minutes**

**SETTER : Mr Cheong Boon Wee**

**DATE : 3 October 2014**

|                |               |                 |
|----------------|---------------|-----------------|
| <b>CLASS :</b> | <b>NAME :</b> | <b>REG NO :</b> |
|----------------|---------------|-----------------|

.....  
**READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number in the spaces on the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in loss of marks.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to

three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is **50**.

|   |
|---|
| <b>For Examiner's Use</b>                                       |
| <div style="text-align: right; font-size: 2em;"><b>50</b></div> |

This paper consists of **11** printed pages (including this cover page)

[Turn over

Answer **all** the questions.

For  
Examiner's  
Use

- 1 (a) Simplify  $4a^2 - (2a + 5)(2a - 5) + a$ .

Answer : (a) \_\_\_\_\_ [2]

- (b) Express  $\frac{1}{4m^2 - 16m - 20} + \frac{m}{m - 5}$  as a fraction in its simplest form.

Answer : (b) \_\_\_\_\_ [3]

2 Expand and simplify

(a)  $(2m+3)(m-2)-(m+4)(m-3)$ .

Answer : (a) \_\_\_\_\_ [3]

(b) Hence, solve the equation  $(2m+3)(m-2)-(m+4)(m-3)=21$

Answer : (b)  $m=$  \_\_\_\_\_ [3]

- 3 Solve the simultaneous equations.

$$\frac{3x+y}{11} = \frac{1}{2}$$

$$x+y=3$$

*For  
Examiner's  
Use*

*Answer :*  $x=$  \_\_\_\_\_

$y=$  \_\_\_\_\_ [3]

- 4 (a) Factorise  $4b^2 - 4c^2$ .

For  
Examiner's  
Use

Answer : (a) \_\_\_\_\_ [2]

- (b) Given that  $4b^2 - 4c^2 = 224$ ,  $b + c = 7$  and  $bc = -\frac{15}{4}$ ,

- (i) find the value of  $b - c$ ,

Answer : (b)(i) \_\_\_\_\_ [1]

- (ii) find the value of  $b^2 + c^2$ .

Answer : (b)(ii) \_\_\_\_\_ [2]

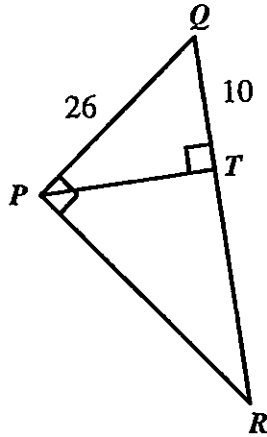


5

In the diagram, triangle  $PQR$  is similar to triangle  $TQP$ .

$PQ = 26$  cm,  $QT = 10$  cm,  $\angle QPR = 90^\circ$  and  $\angle PTQ = 90^\circ$ .

For  
Examiner's  
Use



(a) Calculate  $PT$ .

Answer: (a)  $PT =$  \_\_\_\_\_ cm [2]

(b) Calculate  $\angle QPT$ .

Answer: (b)  $\angle QPT =$  \_\_\_\_\_  $^\circ$  [2]

(c) Calculate  $PR$ .

Answer: (c)  $PR =$  \_\_\_\_\_ cm [2]

- 6 The time needed to complete a project is inversely proportional to the number of students involved.  
5 students can complete the project in 9 hours.  
(a) Calculate the number of students needed to complete the project in 3 hours.

*For  
Examiner's  
Use*

*Answer :* (a) \_\_\_\_\_ [2]

- (b) Calculate the time taken for 8 students to complete the project.  
Leave your answer to the nearest minute.

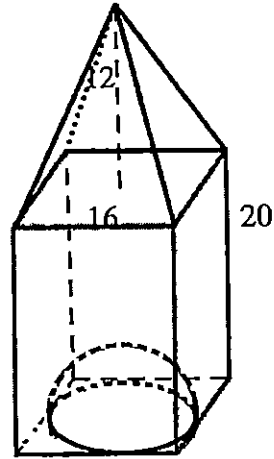
*Answer :* (b) \_\_\_\_\_ minutes [2]

- 7 A solid pyramid has a square base of side 16 cm and height 12 cm.  
A cuboid has a square base of side 16 cm and height 20 cm.  
A metal toy is made by attaching the bases of the pyramid and the cuboid.  
A hemisphere of diameter 16 cm is then carved out from the bottom of the cuboid.

[ Surface area of a sphere =  $4\pi r^2$  ]

[ Volume of a sphere =  $\frac{4}{3}\pi r^3$  ]

- (a) Calculate the volume of the toy.



Answer : (a) Volume = \_\_\_\_\_ cm<sup>3</sup> [3]

- (b) Calculate the surface area of the toy.

Answer : (b) Surface Area = \_\_\_\_\_ cm<sup>2</sup> [4]

8

In a bag, there are 32 red balls and some yellow balls.  
The probability that one yellow ball is chosen at random is  $\frac{5}{13}$ .

*For  
Examiner's  
Use*

- (a) Find the probability that one red ball is chosen at random.

Answer : (a) \_\_\_\_\_ [1]

- (b) Find the total number of red and yellow balls in the bag.

Answer : (b) \_\_\_\_\_ [1]

- (c)  $(x-3)$  yellow balls are removed from the bag.

The new probability that one yellow ball is chosen at random is  $\frac{1}{3}$ .

Find the value of  $x$ .

Answer : (c)  $x =$  \_\_\_\_\_ [2]

- 9 A survey was carried out to find the number of minutes spent on computer games in a day by a group of students.  
The result of this survey is shown in the frequency table below.

For  
Examiner's  
Use

| Number of minutes ( $n$ minutes ) | Frequency ( $f$ ) |
|-----------------------------------|-------------------|
| $0 \leq n < 20$                   | 15                |
| $20 \leq n < 40$                  | 8                 |
| $40 \leq n < 60$                  | 34                |
| $60 \leq n < 80$                  | 23                |

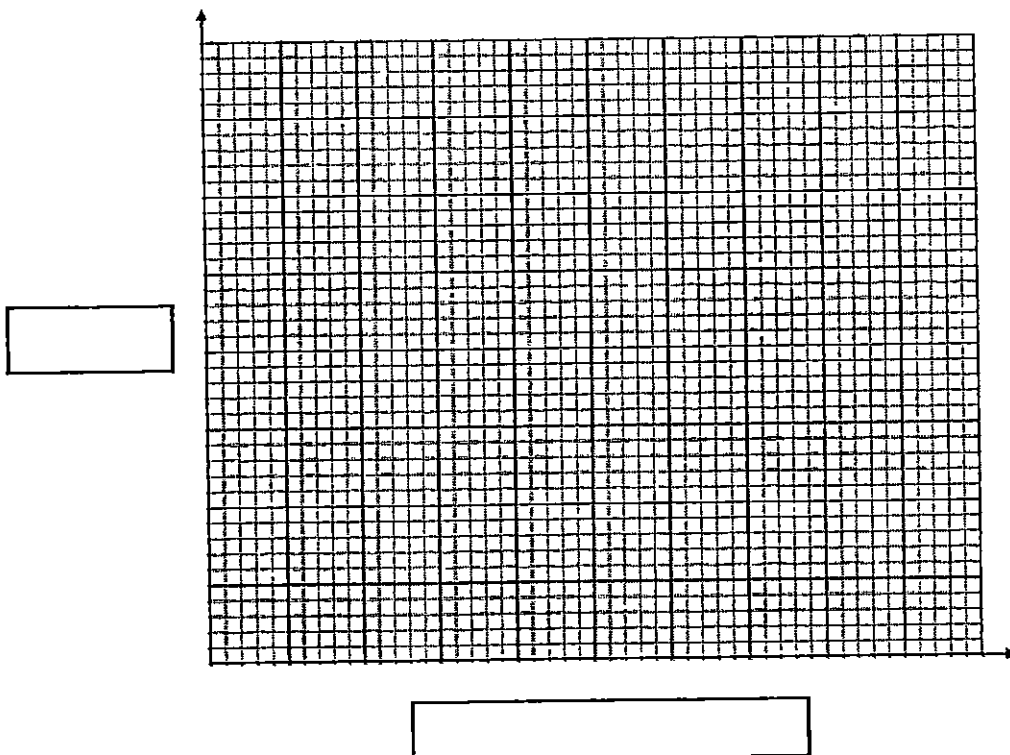
- (a) Calculate the total number of students surveyed.

Answer : (a) \_\_\_\_\_ [1]

- (b) Find the mean time spent on playing computer games.

Answer : (b) \_\_\_\_\_ minutes [2]

- (c) Draw a histogram on the grids below to illustrate the information.  
You are required to label the axes clearly.



[3]

- 10 Ten boys and ten girls recorded their total walking distance in one week.

The results are shown in the stem-and-leaf diagram.

| Boys |   |   |   | Girls |   |     |
|------|---|---|---|-------|---|-----|
|      | 4 | 3 | 2 | 1     | 7 | 8   |
|      |   | 2 | 3 | 2     | 4 | 5 5 |
|      | 5 | 5 | 4 |       |   |     |
| 8    | 8 | 2 | 5 | 4     | 5 | 8   |
|      | 6 | 4 | 6 |       |   |     |

Key (Boys)

3 | 2 means 23 km

Key (Girls)

2 | 1 means 21 km

- (a) Write down the median distance of the boys.

Answer : (a) \_\_\_\_\_ km [1]

- (b) Write down the mode of the boys and girls.

Answer : (b) \_\_\_\_\_ km [1]

- (c) If one more girl is included into the data, the mean distance of the girls will be 38. Calculate the distance travelled by this girl.

Answer : (c) \_\_\_\_\_ km [2]



12

## Answers

1(a)  $a + 25$

1(b)  $\frac{(1+2m)^2}{8m^2-36m-20}$

2(a)  $m^2 - 2m + 6$

2(b)  $m = 5$  or  $m = -3$

3  $x = \frac{5}{4}, y = \frac{7}{4}$

4(a)  $4(b+c)(b-c)$

4(b)  
(i) 224

(ii)  $\frac{113}{2}$

5(a) 24

5(b)  $22.6^\circ$

5(c) 62.4 cm

6(a) 338

6(b) 15

7(a) 5070

7(b) 2200

8(a)  $\frac{8}{13}$

8(b) 52

8(c) 7

9(a)  $46\frac{1}{4}$

9(b)  $46\frac{1}{4}$

10(a) 48.5

10(b) 58

10(c) 39

Answer **all** the questions.

1 (a) Simplify  $4a^2 - (2a + 5)(2a - 5) + a$ .

$$= 4a^2 - (4a^2 - 25) + a \quad [\text{M1}]$$

$$= a + 25 \quad [\text{A1}]$$

Answer : (a)  $a + 25$  [2]

(b) Express  $\frac{1}{4m^2 - 16m - 20} + \frac{m}{m - 5}$  as a fraction in its simplest form.

$$= \frac{1}{4(m^2 - 4m - 5)} + \frac{m}{m - 5}$$

$$= \frac{1}{4(m - 5)(m + 1)} + \frac{m}{m - 5} \quad [\text{M1}]$$

$$= \frac{4m(m + 1) + 1}{4(m - 5)(m + 1)} \quad [\text{M1}]$$

$$= \frac{4m^2 + 4m + 1}{4(m - 5)(m + 1)} \quad [\text{A1}]$$

or

$$\frac{(1 + 2m)^2}{4(m - 5)(m + 1)}$$

Answer : (b)  $\frac{(1 + 2m)^2}{4(m - 5)(m + 1)}$  [3]



## 2 Expand and simplify

(a)  $(2m+3)(m-2)-(m+4)(m-3).$

$$= (2m^2 - 4m + 3m - 6) - (m^2 + m - 12) \quad [\text{M1} - \text{expansion}]$$

$$= 2m^2 - 4m + 3m - 6 - m^2 - m + 12 \quad [\text{M1} - \text{correct removal of brackets}]$$

$$= m^2 - 2m + 6 \quad [\text{A1}]$$

$$\text{Answer : (a) } \underline{m^2 - 2m + 6} \quad [3]$$

(b) Hence, solve the equation  $(2m+3)(m-2)-(m+4)(m-3)=21$

$$m^2 - 2m + 6 = 21$$

$$m^2 - 2m - 15 = 0 \quad [\text{M1}]$$

$$(m-5)(m+3)=0 \quad [\text{M1} - \text{correct factorisation}]$$

$$m=5 \text{ or } m=-3 \quad [\text{A1}]$$

$$\text{Answer : (b) } m = \underline{m=5 \text{ or } m=-3} \quad [3]$$

3 Solve the simultaneous equations.

$$\frac{3x+y}{11} = \frac{1}{2} \text{ -----(1)}$$

$$x+y=3 \text{ -----(2)}$$

From (2):  $x=3-y \text{ -----(3)}$

Sub (3) into (1):  $\frac{3(3-y)+y}{11} = \frac{1}{2}$   
 $\frac{9-3y+y}{11} = \frac{1}{2}$  [M1 – substitution / elimination method]

$$\frac{9-2y}{11} = \frac{1}{2}$$

$$9-2y = \frac{11}{2}$$

$$y = \frac{7}{4} \text{ [A1]}$$

Sub  $y = \frac{7}{4}$  into (3):  $x = 3 - \frac{7}{4} = \frac{5}{4}$  [A1]

Answer :  $x = \frac{5}{4}$   
 $y = \frac{7}{4}$  [3]

4 (a) Factorise  $4b^2 - 4c^2$ .

$$= 4(b^2 - c^2) \quad [\text{M1}]$$

$$= 4(b+c)(b-c) \quad [\text{A1}]$$

$$\text{Answer: (a)} \quad 4b^2 - 4c^2 = \underline{4(b+c)(b-c)} \quad [2]$$

(b) Given that  $4b^2 - 4c^2 = 224$ ,  $b+c=7$  and  $bc = -\frac{15}{4}$ ,

(i) find the value of  $b-c$ ,

$$4(7)(b-c) = 224$$

$$b-c = 8 \quad [\text{B1}]$$

$$\text{Answer: (b)(i)} \quad b-c = \underline{8} \quad [1]$$

(ii) find the value of  $b^2 + c^2$ .

$$(b+c)^2 = b^2 + 2bc + c^2$$

$$7^2 = b^2 + c^2 - 2\left(-\frac{15}{4}\right) \quad [\text{M1}]$$

$$b^2 + c^2 = 49 + \frac{15}{2}$$

$$= \frac{113}{2} \quad [\text{A1}]$$

or

$$(b-c)^2 = b^2 - 2bc + c^2$$

$$8^2 = b^2 + c^2 - 2\left(-\frac{15}{4}\right) \quad [\text{M1}]$$

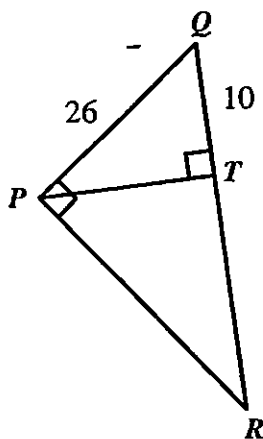
$$b^2 + c^2 = 64 - \frac{15}{2}$$

$$= \frac{113}{2} \quad [\text{A1}]$$

$$\text{Answer: (b)(ii)} \quad b^2 + c^2 = \underline{\frac{113}{2}} \quad [2]$$

- 5 In the diagram, triangle  $PQR$  is similar to triangle  $TQP$ .

$PQ = 26$  cm,  $QT = 10$  cm,  $\angle QPR = 90^\circ$  and  $\angle PTQ = 90^\circ$ .



- (a) Calculate  $PT$ .

*By Pythagoras' Theorem*

$$PT = \sqrt{26^2 - 10^2} \quad [\text{M1}]$$

$$= 24 \quad [\text{A1}]$$

Answer: (a)  $PT =$  24 cm [2]

- (b) Calculate  $\angle QPT$ .

$$\sin \angle QPT = \frac{10}{26} \quad [\text{M1} - \text{can use other basic trigo ratios}]$$

$$\begin{aligned} \angle QPT &= \sin^{-1}\left(\frac{10}{26}\right) \\ &= 22.6^\circ \text{ (1 d.p.)} \quad [\text{A1}] \end{aligned}$$

Answer: (b)  $\angle QPT =$  22.6  $^\circ$  [2]

- (c) Calculate  $PR$ .

$$\frac{PR}{24} = \frac{26}{10} \quad [\text{M1} \checkmark - \text{or alternative methods}]$$

$$\begin{aligned} PR &= \frac{26}{10} \times 24 \\ &= 62.4 \text{ cm} \quad [\text{A1}] \end{aligned}$$

Answer: (c)  $PR =$  62.4 cm [2]

- 6 The time needed to complete a project is inversely proportional to the number of students involved.

5 students can complete the project in 9 hours.

- (a) Calculate the number of students needed to complete the project in 3 hours.

Let  $t$  be the time taken in hours, and  $s$  be the number of students.

$$t = \frac{k}{s}, \text{ where } k \text{ is a constant.}$$

$$9 = \frac{k}{5} \quad [\text{M1}]$$

$$k = 45$$

$$t = \frac{45}{s}$$

When  $t = 3$

$$3 = \frac{45}{s} \quad [\text{M1}]$$

$$s = 15 \quad [\text{A1}]$$

Answer : (a) 15 [3]

- (b) Calculate the time taken for 8 students to complete the project.

Leave your answer to the nearest minute

When  $s = 8$ ,

$$t = \frac{45}{8} \quad [\text{M1}]$$

$$t = 5.625 \text{ hours}$$

$$t = 5.625 \times 60$$

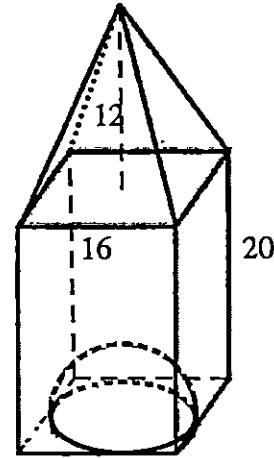
$$= 338 \text{ minutes (3 s.f.)} \quad [\text{A1}]$$

Answer : (b) 338 minutes [2]

- 7 A solid pyramid has a square base of side 16 cm and height 12 cm.

A cuboid has a square base of side 16 cm.

A metal toy is made by attaching the bases of the pyramid and the cuboid. A hemisphere of diameter 16 cm is then carved out of the cuboid.



$$[ \text{ Surface area of a sphere} = 4\pi r^2 ]$$

$$[ \text{ Volume of a sphere} = \frac{4}{3}\pi r^3 ]$$

- (a) Calculate the volume of the toy.

$$\begin{aligned} \text{Volume of pyramid} &= \frac{1}{3} \times 16^2 \times 12 \\ &= 1024 \text{ cm}^3 \quad [\text{M1}] \end{aligned}$$

$$\begin{aligned} \text{Volume of cuboid} &= 16^2 \times 20 \\ &= 5120 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Volume of hemisphere} &= \frac{1}{2} \left( \frac{4}{3} \pi \times 8^3 \right) \quad [\text{M1}] \\ &= 341\frac{1}{3} \pi \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Volume of toy} &= 1024 + 5120 - 341\frac{1}{3} \pi \\ &= 5070 \text{ cm}^3 \text{ (3 s.f.)} \quad [\text{A1}] \end{aligned}$$

Answer : (a) Volume = 5070 cm<sup>3</sup> [3]

- (b) Calculate the surface area of the toy.

$$\begin{aligned} \text{Surface area of slant faces} &= 4 \times \left( 16 \times \sqrt{12^2 + 8^2} \times \frac{1}{2} \right) \quad [\text{M1}] \\ &= 461.510 \text{ cm}^2 \end{aligned}$$

Surface area of rectangular faces and base of cuboid (carved)

$$\begin{aligned} &= [4 \times (16 \times 20)] + (16^2 - 8^2 \times \pi) + \frac{1}{2} [4\pi \times 8^2] \quad [\text{M1}] \\ &= 1737.0619 \text{ cm}^2 \quad [\text{M1} - \text{interior curved surface of hemisphere}] \end{aligned}$$

Total surface area

$$\begin{aligned} &= 461.510 + 1737.0619 \\ &= 2198.57 \\ &= 2200 \text{ cm}^2 \text{ (3 s.f.)} \quad [\text{A1}] \end{aligned}$$

Answer : (b) Surface Area = 2200 cm<sup>2</sup> [4]

8 In a bag, there are 32 red balls and some yellow balls.

The probability that one yellow ball is chosen is  $\frac{5}{13}$ .

(a) Find the probability that one red ball is chosen at random.

$$\begin{aligned} P(\text{red ball}) &= 1 - \frac{5}{13} \\ &= \frac{8}{13} \quad [\text{B1}] \end{aligned}$$

Answer : (a)  $\frac{8}{13}$  [1]

(b) Find the total number of red and yellow balls in the bag.

Number of yellow balls

$$= 32 \times \left( \frac{5}{13} \div \frac{8}{13} \right)$$

$$= 32 \times \frac{5}{8}$$

$$= 20$$

Total red & yellow balls or

$$= 32 + 20$$

$$= 52 \quad [\text{B1}]$$

$$8 \text{ units} = 32 \text{ balls}$$

$$13 \text{ units} = 13 \times \frac{32}{8}$$

$$= 52 \text{ balls} \quad [\text{B1}]$$

Answer : (b) 52 [1]

- (c)  $(x-3)$  yellow balls are removed from the bag.

The new probability that one yellow ball is chosen is  $\frac{1}{3}$ .

Find the value of  $x$ .

$$\begin{aligned} n(S) &= 52 - (x-3) \\ &= 55 - x \end{aligned}$$

$$\begin{aligned} n(\text{yellow balls}) &= 20 - (x-3) \\ &= 23 - x \end{aligned}$$

$$\frac{23-x}{55-x} = \frac{1}{3} \quad [\text{M1}]$$

$$69 - 3x = 55 - x$$

$$2x = 14$$

$$x = 7 \quad [\text{A1}]$$

$$P(\text{red balls}) = \frac{2}{3}$$

$$2 \text{ units} = 32 \text{ balls}$$

$$1 \text{ unit} = 16 \text{ balls}$$

Number of yellow balls removed

$$= 20 - 16 \quad [\text{M1}]$$

$$= 4$$

$$x - 3 = 4$$

$$x = 7 \quad [\text{A1}]$$

Answer : (c)  $x = \underline{\quad 7 \quad}$  [2]

- 9 A survey was carried out to find the number of minutes spent on computer games in a day by a group of students.

The result of this survey is shown in the frequency table below.

| Number of minutes ( $n$ minutes) | Frequency ( $f$ ) |
|----------------------------------|-------------------|
| $0 \leq n < 20$                  | 15                |
| $20 \leq n < 40$                 | 8                 |
| $40 \leq n < 60$                 | 34                |
| $60 \leq n < 80$                 | 23                |

- (a) Calculate the total number of students surveyed.

$$= 15 + 8 + 34 + 23$$

$$= 80 \quad [\text{B1}]$$

Answer : (a)  $\underline{\quad 80 \quad}$  [1]

- (b) Find the mean time spent on playing computer games.

| Mid-value ( $n$ ) | ( $f$ ) |
|-------------------|---------|
| 10                | 15      |
| 30                | 8       |
| 50                | 34      |
| 70                | 23      |

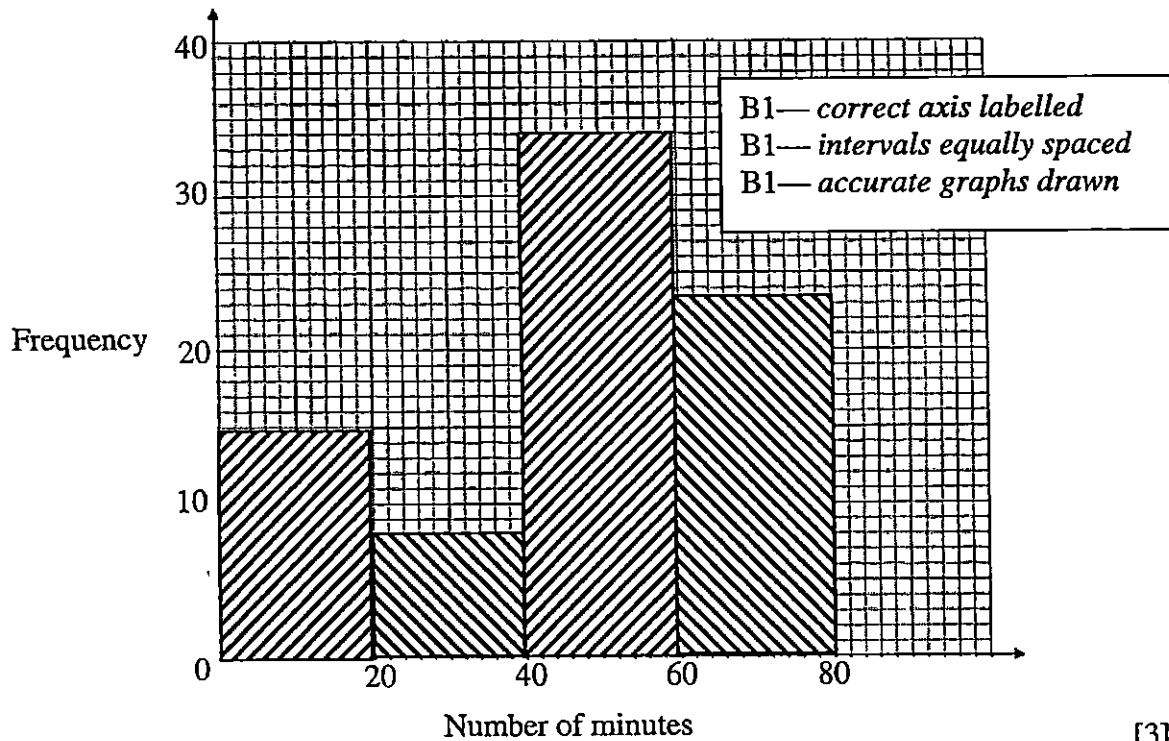
$$\text{Mean} = \frac{10(15) + 30(8) + 50(34) + 70(23)}{80} \quad [\text{M1}]$$

$$= 46.25 \text{ or } 46\frac{1}{4} \text{ minutes} \quad [\text{A1}]$$

Answer : (b)  $\underline{\quad 46\frac{1}{4} \quad}$  minutes [2]



(c) Draw a histogram on the grids below to illustrate the information.



[3]

10 Ten boys and ten girls recorded their total walking distance in one week.

The results are shown in the stem-and-leaf diagram.

| Boys |   |   |   | Girls |   |   |
|------|---|---|---|-------|---|---|
|      | 4 | 3 | 2 | 1     | 7 | 8 |
|      |   | 2 | 3 | 2     | 4 | 5 |
|      | 5 | 5 | 4 |       |   |   |
| 8    | 8 | 2 | 5 | 4     | 5 | 8 |
|      | 6 | 4 | 6 |       |   |   |

Key (Boys)

3 | 2 means 23 km

Key (Girls)

2 | 1 means 21 km

(a) Write down the median distance of the boys.

23, 24, 32, 45, 45, 52, 58, 58, 64, 66

$$\frac{45 + 52}{2} = 48.5 \quad [\text{B1}]$$

Answer: (a) 48.5 km [1]

- (b) Write down the mode of the boys and girls.

58 [B1]

Answer : (b) 58 km [1]

- (c) If one more girl is included into the data, the mean distance of the girls will be 38. Calculate the distance travelled by this girl.

Let  $x$  be the distance travelled by the girl.

Using mean,

$$\frac{21+27+28+32+34+35+35+54+55+58+x}{11} = 38 \quad [\text{M1}]$$

$$\frac{379+x}{11} = 38$$

$$x = 418 - 379$$

$$x = 39 \quad [\text{A1}]$$

Answer : (c) 39 km [2]

~End of Paper~



**BEATTY SECONDARY SCHOOL  
END-OF-YEAR EXAMINATION 2014**

**SUBJECT : Mathematics**

**LEVEL : Sec 2 Express**

**PAPER : 2**

**DURATION : 1 hour 30 minutes**

**SETTER : Mdm See Huey Yi**

**DATE : 09 Oct 2014**

|                |               |                 |
|----------------|---------------|-----------------|
| <b>CLASS :</b> | <b>NAME :</b> | <b>REG NO :</b> |
|----------------|---------------|-----------------|

**READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number in the spaces on the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to

three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

At the end of the examination, fasten all your work securely together.

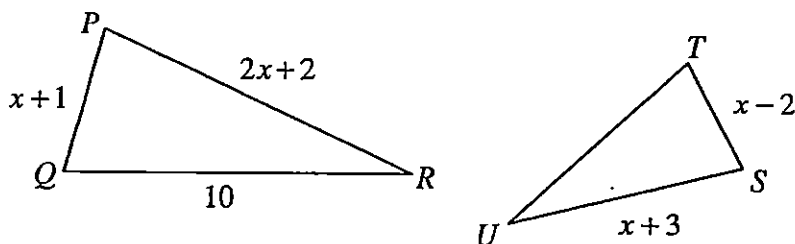
The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

- 1 (a) The scale of map  $X$  is 1 cm : 0.2 km and the scale of map  $Y$  is 1 : 50 000.  
Given that the area of a park on map  $X$  is  $5.5 \text{ cm}^2$ , find the area, in  $\text{cm}^2$ , of the same park on map  $Y$ . [3]
- (b)  $p$  is directly proportional to the square of  $q$ . It is known that  $p = 14$  for a particular value of  $q$ . When  $q$  is increased to 200%, find the percentage increase in  $p$ . [3]
- 2 (a) Expand  $2(3x - 5)(-x + 4)$ . [2]
- (b) Express  $\frac{x-2}{4x^2-9} \div \frac{3x^2-4x-4}{2x-3}$  in its simplest form. [3]
- (c) Given that  $\frac{2a}{5} = \frac{b}{4} + \frac{3}{bc^2}$ , make  $c$  the subject of the formula. [3]
- 3 (5, -1) and (-2, 6) are 2 points on a linear function  $py = qx - 2$ .
- (a) Form a pair of simultaneous equations to represent the above information and show that the equations can be simplified to
- $$p + 5q = 2$$
- $$3p + q = -1$$
- [2]
- (b) Solve the simultaneous equations in part (a). [3]

- 4 In the figure below,  $\Delta PQR$  is similar to  $\Delta STU$ .

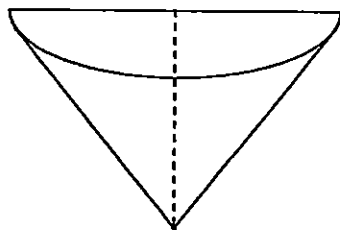
It is given that  $PQ = (x+1)$  cm,  $PR = (2x+2)$  cm,  $QR = 10$  cm,  $US = (x+3)$  cm and  $TS = (x-2)$  cm.



- (a) Form an equation in terms of  $x$  and show that it reduces to  $x^2 - 6x - 7 = 0$ . [2]
- (b) Solve  $x^2 - 6x - 7 = 0$ . [2]
- (c) Hence, find the perimeter of  $\Delta PQR$ . [1]
- 5 The figure shows a semicircular solid cone. The radius of the base is half its slant height. The curved surface area of the semicircular cone is  $36.8 \text{ cm}^2$ .

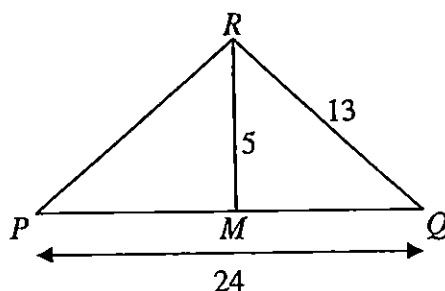
[Curved surface area of cone =  $\pi r l$ ]

[Volume of cone =  $\frac{1}{3} \pi r^2 h$ ]



- (a) Find the radius of the semicircular cone. [2]
- (b) Hence, find the volume of the semicircular cone. [3]

- 6 (a) The diagram shows a triangle  $PQR$  where  $QR = 13$  cm and  $PQ = 24$  cm.  $M$  is the midpoint of  $PQ$  and  $RM = 5$  cm.



- (i) Show that  $\triangle RMQ$  is a right-angled triangle. [2]
- (ii) Calculate  $\angle PRQ$ . [2]
- (b) A 3-digit number is formed at random using the digits 1, 3 and 6 without repetition of the digits.
- (i) Write down the sample space. [1]
- (ii) Find the probability that the 3-digit number formed is greater than 700. [1]
- (iii) Find the probability that the 3-digit number formed is an even number. [1]

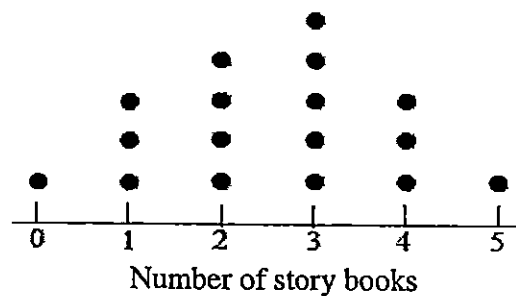
- 7 (a) A survey was conducted to find the number of hours a group of students spend on surfing the internet on a particular day. The results are shown in the table below.

|                    |   |    |     |   |   |   |
|--------------------|---|----|-----|---|---|---|
| Number of hours    | 1 | 2  | 3   | 4 | 5 | 6 |
| Number of students | 2 | 11 | $x$ | 5 | 8 | 4 |

If the median is 3, find the smallest possible value of  $x$ .

[1]

- (b) The dot diagram shows the number of story books read by a group of students in a particular week.



- (i) Find the modal number of story books read. [1]
- (ii) Find the mean number of story books read. [2]
- (iii) If two students are removed from the group, the mean number of story books read is 2.4. Calculate the total number of story books these two students read. [2]

**8 Answer the whole of this question on a sheet of graph paper.**

The table below gives some values of  $x$  and the corresponding values of  $y$ , where  $y = -2x^2 - x + 6$ .

|     |    |     |    |   |   |    |     |
|-----|----|-----|----|---|---|----|-----|
| $x$ | -3 | -2  | -1 | 0 | 1 | 2  | 3   |
| $y$ | -9 | $a$ | 5  | 6 | 3 | -4 | -15 |

- (a) Find the value of  $a$ . [1]
- (b) Using a scale of 2 cm to represent 1 unit on the  $x$ -axis and 1 cm to represent 1 unit on the  $y$ -axis, draw the graph of  $y = -2x^2 - x + 6$  for  $-3 \leq x \leq 3$ . [3]
- (c) Use your graph to
- (i) find the coordinates of the turning point, [1]
- (ii) find the equation of the line of symmetry, [1]
- (iii) find the negative value of  $x$  when  $y = 4$ , [1]
- (iv) solve  $2x^2 + x - 6 = 0$ . [1]



**Answer (BTY EOY 2E(P2) 2014**

- 1(a)  $0.88 \text{ cm}^2$   
 (b)  $300\%$
- 2(a)  $-6x^2 + 34x - 40$   
 (b)  $\frac{1}{(2x+3)(3x+2)}$   
 (c)  $c = \pm \sqrt{\frac{60}{b(8a-5b)}}$  or  $c = \pm \sqrt{\frac{60}{8ab-5b^2}}$
- 3(a)  $p(-1) = q(5) - 2$   
 $p(6) = q(-2) - 2$   
 (b)  $p = -0.5$  and  $q = 0.5$
- 4(a)  $\frac{x+1}{x-2} = \frac{2x+2}{x+3}$   
 (b)  $x = -1$  or  $7$   
 (c)  $34 \text{ cm}$
- 5(a)  $3.42 \text{ cm}$   
 (b)  $36.4 \text{ cm}^3$
- 6(a)  $134.8^\circ$   
 (bi)  $\{136, 163, 316, 361, 613, 631\}$   
 (bii)  $0$   
 (biii)  $\frac{1}{3}$
- 7(a)  $5$   
 (bi)  $3$   
 (bii)  $2\frac{9}{17}$  or  $2.53$   
 (biii)  $7$
- 8(a)  $0$   
 (ci)  $(-0.25, 6.2)$  [Note :  $-0.3 \leq x \leq -0.2$ ,  $6.1 \leq y \leq 6.3$ ]  
 (cii)  $x = -0.25$   
 (ciii)  $x = -1.3 (\pm 0.1)$   
 (civ)  $x = -2$  or  $x = 1.5 (\pm 0.1)$



## End of Year Examination

**Sec 2 Express 2014**

## Mathematics

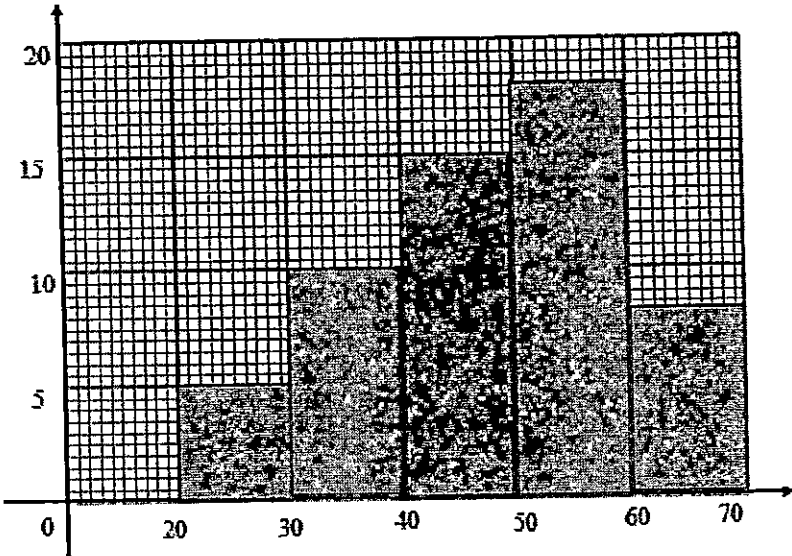
## Paper 2

### Marking Scheme

[illegible]

| No   | Working   | Allocation of Marks  |
|------|---|--|
| 5(a) | $0.9 + 0.25x \leq 5$ or $90 + 25x \leq 500$   | B1   |
| 5(b) | $0.9 + 0.25x \leq 5$ or $90 + 25x \leq 500$<br>$x \leq \frac{5 - 0.90}{0.25}$ $x \leq \frac{500 - 90}{25}$<br>$x \leq 16.4$ $x \leq 16.4$   | B1   |
| 5(c) | Maximum words = 16  | B1 / FT1   |
| 6    | $p = \sqrt{\frac{w}{2w - 3x}}$<br>$p^2 = \frac{w}{2w - 3x}$<br>$p^2(2w - 3x) = w$<br>$2p^2w - 3p^2x = w$<br>$2p^2w - w = 3p^2x$<br>$w(2p^2 - 1) = 3p^2x$<br>$w = \frac{3p^2x}{2p^2 - 1}$  | M1 remove square root<br><br><br><br><br><br><br><br>M1 Factorize w<br><br>A1  |
| 7(a) | $9x + 4 = 3x - (7 - 2x)$<br>$9x + 4 = 3x - 7 + 2x$<br>$9x - 3x - 2x = -7 - 4$<br>$4x = -11$<br>$x = -\frac{11}{4}$ or $-3.25$   | M1 remove bracket correctly (+ x)<br><br><br><br><br>A1  |
| 7(b) | $(z - 6)^2 = 121$<br>$z - 6 = \pm\sqrt{121}$<br>$z - 6 = 11$ or $z - 6 = -11$<br>$z = 17$ or $z = -5$<br><br>Or<br>$(z - 6)^2 = 121$<br>$z^2 - 12z + 36 = 121$<br>$z^2 - 12z - 85 = 0$<br>$(z - 17)(z + 5) = 0$<br>$z = 17$ or $z = -5$ | M1 (square root)<br><br>A1 (for both answers)<br><br><br><br><br>M1 (Factorization) / expand and simplify<br>A1 (both answers) |
| 8a   | 1 : 600 000<br>1 cm represent 6 km<br>8 cm represent 48 km.   | B1   |
| 8b   | 1 cm represent 6 km<br>1 cm <sup>2</sup> represent 36 km <sup>2</sup><br>36 km <sup>2</sup> represent 1 cm <sup>2</sup><br>900 km <sup>2</sup> represent $\frac{1}{36} \times 900 = 25$ cm <sup>2</sup>                                 | M1 (Area scale)<br><br><br><br>A1  |

| No                  | Working   | Allocation of Marks   |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
|---------------------|---|---|-----------|--------------|------------------|----|---|------------------|----|----|------------------|----|----|------------------|----|----|------------------|----|---|---|
| 9                   | $2(x - y)^2 = 128$ and $xy = 20$<br>$(x - y)^2 = 64$<br>$x^2 - 2xy + y^2 = 64$<br>$x^2 + y^2 = 64 + 2(20)$<br>$x^2 + y^2 = 104$<br>$(x + y)^2 = 104 + 2(20)$<br>$(x + y)^2 = 144$<br>$5(x + y)^2 = 720$   | <br><br><br><br><br><br><br><br><br>M1 find $x^2 + y^2$ value<br>M1 for $(x + y)^2$<br><br>A1   |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
| 10                  | Height of tree + Height of cliff = x<br>Height of Cliff = h<br>$\tan 58^\circ = \frac{x}{85}$<br>$x = \tan 58^\circ \times 85$<br>$\tan 43^\circ = \frac{h}{85}$<br>$h = \tan 43^\circ \times 85$<br>Height of tree = $\tan 58^\circ \times 85 - \tan 43^\circ \times 85$<br>= 56.8 m (3 s.f.)  | <br><br><br><br><br><br><br><br><br>M1 (Use tangent ratio to find either height of cliff or height of cliff and tree)<br><br>M1<br>A1 |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
| 11(a)               | <table border="1"> <thead> <tr> <th>Masses (m) in grams</th><th>Mid-value</th><th>Frequency, f</th></tr> </thead> <tbody> <tr> <td><math>20 &lt; m \leq 30</math></td><td>25</td><td>5</td></tr> <tr> <td><math>30 &lt; m \leq 40</math></td><td>35</td><td>10</td></tr> <tr> <td><math>40 &lt; m \leq 50</math></td><td>45</td><td>15</td></tr> <tr> <td><math>50 &lt; m \leq 60</math></td><td>55</td><td>18</td></tr> <tr> <td><math>60 &lt; m \leq 70</math></td><td>65</td><td>7</td></tr> </tbody> </table> | Masses (m) in grams   | Mid-value | Frequency, f | $20 < m \leq 30$ | 25 | 5 | $30 < m \leq 40$ | 35 | 10 | $40 < m \leq 50$ | 45 | 15 | $50 < m \leq 60$ | 55 | 18 | $60 < m \leq 70$ | 65 | 7 | <br><br><br><br><br><br><br><br><br>B1 for all values to be correct |
| Masses (m) in grams | Mid-value   | Frequency, f  |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
| $20 < m \leq 30$    | 25  | 5   |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
| $30 < m \leq 40$    | 35  | 10  |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
| $40 < m \leq 50$    | 45  | 15  |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
| $50 < m \leq 60$    | 55  | 18  |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
| $60 < m \leq 70$    | 65  | 7   |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |
| 11(b)               | <p>Frequency</p> <p>Mass (m) in grams</p>   | <br><br><br><br><br><br><br><br><br>Labelling of axis correctly B1<br>Draw the bars correctly B1<br>Minus 1 for any error             |           |              |                  |    |   |                  |    |    |                  |    |    |                  |    |    |                  |    |   |   |

| No         | Working   | Allocation of Marks  |
|------------|---|--|
| 11b        | <p style="text-align: center;">Alternative drawing</p> <p>Frequency</p>  <p style="text-align: center;">Mass (m) in grams</p>   | <p>Labelling of axis correctly B1<br/>           Draw the bars correctly B1<br/>           Minus 1 for any error</p> |
| 11c        | <p>Estimated mean</p> $= \frac{(25 \times 5) + (35 \times 10) + (45 \times 15) + (55 \times 18) + (65 \times 7)}{(5 + 10 + 15 + 18 + 7)}$ $= \frac{2595}{55}$ $= 47.2 \text{ (3 s.f.) or } 47\frac{2}{11}$  | <p>M1</p> <p>A1 or B2</p>  |
| 12(a)(i)   | $x = k + 1, y = k + 5, z = k + 6$   | <p>B1 all three correct</p>  |
| 12(a)(ii)  | $xy - kz$<br>$= (k + 1)(k + 5) - k(k + 6)$<br>$= k^2 + 6k + 5 - k^2 - 6k$<br>$= 5$  | <p>M1Expansion or either bracket correctly</p> <p>A1 answer</p>  |
| 12(a)(iii) | <p>The difference between them is 5.<br/> <math>kz = k^2 + 6k; xy = (k^2 + 6k) + 5.</math><br/>           Since the difference between them is 5, therefore, they must lie in the same column.</p>  | <p>B1</p>  |
| 12(b)      | $k = 5n - 1$ or $4 + 5(n - 1)$  | <p>B1</p>  |
| 13(a)      | <p>Volume of cone <math>= \frac{1}{3} \times 6^2 \times 8 \times \pi = 96\pi \text{ cm}^3</math></p> <p>Volume of cylinder <math>= \pi \times 9^2 \times 12 = 972\pi \text{ cm}^3</math></p> <p>Volume of solid <math>= 972\pi - 96\pi</math></p> <p><math>= 876\pi \text{ cm}^3</math></p> | <p>M1 (vol. of cone)</p> <p>M1(Vol. of cylinder – Vol. of cone)</p> <p>A1</p>  |
|            |   |  |

| No        | Working  | Allocation of Marks  |
|-----------|--|--|
| 13(b)(i)  | <i>By Pythagoras Theorem,</i><br>$Slant\ height = \sqrt{6^2 + 8^2}$<br>$= 10\ cm$<br><i>Surface area of cone to be painted</i><br>$= curved\ surface\ area\ of\ cone$<br>$= \pi \times 6 \times 10$<br>$= 60\pi\ cm^2$   | <br><br>B1<br><br>AG1  |
| 13(b)(ii) | <i>Area of ring to be painted</i> $= \pi \times (9^2 - 6^2) = 45\pi\ cm^2$<br><i>Curved surface of cylinder</i> $= 2 \times \pi \times 9 \times 12 = 216\pi\ cm^2$<br><i>Base of ornament</i> $= \pi \times 9^2 = 81\pi\ cm^2$<br><i>Total surface area to be painted</i> $= 60\pi + 45\pi + 216\pi + 81\pi$<br>$= 402\pi\ cm^2 = 1260\ cm^2\ (3\ s.f.)\ or\ 1263.084\ cm^2$ | M1 (Area of ring)<br>M1 / FT1 (if slant height is wrong)<br><br>A1 (No FT1 if slant height is wrong) |
| 13(c)     | <i>Volume of solid</i> $= 876\pi\ cm^3$<br><i>Volume of sphere</i> $= 876\pi\ cm^3$<br>$\frac{4}{3}\pi r^3 = 876\pi$<br>$r = \sqrt[3]{\frac{876 \times 3}{4}}$<br>$r = 8.69337$<br>$r = 8.69\ cm$  | <br><br><br><br>Make $r$ the subject with cube root, M1<br><br>A1                                    |
| 14(a)     | $S\$ \frac{2100}{x}$   | B1   |
| 14(b)     | $S\$ \frac{2100}{x+3}$   | B1   |
| 14(c)(i)  | $\frac{2100}{x} - \frac{2100}{x+3} = 9$<br>$\frac{2100(x+3) - 2100x}{x(x+3)} = \frac{9(x)(x+3)}{x(x+3)}$<br>$2100x + 6300 - 2100x = 9x^2 + 27x$<br>$9x^2 + 27x - 6300 = 0$<br>$9(x^2 + 3x - 700) = 0$<br>$x^2 + 3x - 700 = 0$  | M1 (correct equation, any form)<br><br><br>AG1 (correct simplification if wrong, no marks)           |
| 14(c)(ii) | $(x-25)(x+28) = 0$<br>$x = 25\ or\ x = -28$  | M1<br>A1   |
| 14(d)     | <i>Exchange rate in 2012</i> $= (25 + 3) = 28\ VND$  | B1   |
| 15(a)     | $p = -5$   | B1   |
| 15(b)     | Curve<br>Points<br>(Refer to graph)  | C1<br>P2<br>If scale is error / any error minus 1 mark   |
| 15(c)     | <i>When</i> $y = 3$ , $x = 0.45$ or $x = -4.6\ (\pm 0.1)$  | B1 (for both answer)   |
| 15(d)     | <i>Equation of line of symmetry:</i> $x = 2.5$   | B1   |

NAME: \_\_\_\_\_ (     )

CLASS: \_\_\_\_\_



## FAIRFIELD METHODIST SCHOOL (SECONDARY)

END-OF-YEAR EXAMINATION 2014  
SECONDARY 2 EXPRESS

### MATHEMATICS

#### Paper 1

Date: 7 October 2014

Duration: 1 hour 30 minutes

Candidates answer on the Question Paper.

---

#### READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [   ] at the end of each question or part question.

The total number of marks for this paper is 60.

| For Examiner's Use |      |
|--------------------|------|
| Paper 1            | / 60 |
| Paper 2            | / 60 |
| Total              | %    |

Setter: Ms Michelle Tan

This question paper consists of 15 printed pages including the cover page.

Name: \_\_\_\_\_ (     )                      Class: \_\_\_\_\_

Answer **all** the questions.

- 1 Estimate the value of  $\frac{1.9889 \times 7.002}{\sqrt[3]{511}}$ , without the use of a calculator.

Answer..... [1]

---

- 2 Arrange the following numbers in ascending order.

$$\frac{1}{6}$$

$$-2$$

$$\sqrt[3]{-27}$$

$$\pi$$

$$0.\overline{16}$$

Answer....., ....., ....., ..... [1]

---

- 3 Iris bought a digital camera at a discount of 20% and paid \$560 for it. What was the original price of the digital camera?

Answer\$..... [2]



Name: \_\_\_\_\_ (     )                      Class: \_\_\_\_\_

- 4     (a)   Express 1440 as a product of its prime factors, giving your answer in index notation.

*Answer(a)* ..... [1]

- (b)   Given that  $4200 = 2^3 \times 3 \times 5^2 \times 7$ , find the lowest common multiple of 1440 and 4200, giving your answer in index notation.

*Answer(b)* ..... [1]

- (c)   Given that  $4200k$  is a perfect square, write down the smallest possible integer value of  $k$ .

*Answer(c)*..... [1]

- 5     The volume of air,  $V \text{ cm}^3$ , inside a bicycle pump is inversely proportional to the cube root of the air pressure,  $P$  units. It is given that the air pressure is 1728 units when  $15 \text{ cm}^3$  of air is pumped. Find

(a)   an equation connecting  $V$  and  $P$ ,

*Answer(a)* ..... [1]

(b)   the volume of air that is pumped when the pressure is 216 units,

*Answer(b)* .....  $\text{cm}^3$  [1]

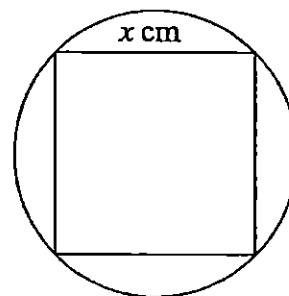
(c)   the air pressure when  $25 \text{ cm}^3$  of air is pumped.

*Answer(c)* ..... units [1]

Name: \_\_\_\_\_ (    )

Class: \_\_\_\_\_

- 6 The diagram shows a square with length  $x$  cm, inscribed in a circle. Given that the radius of the circle is 8 cm, find the value of  $x$ .



Answer..... [2]

---

- 7 A solid paper weight in the shape of a hemisphere has a total surface area of  $84.834 \text{ cm}^2$ .  
[Take  $\pi$  to be 3.142]

(a) Show that the radius of the hemispheric paper weight is 3 cm.

€

Answer (a)

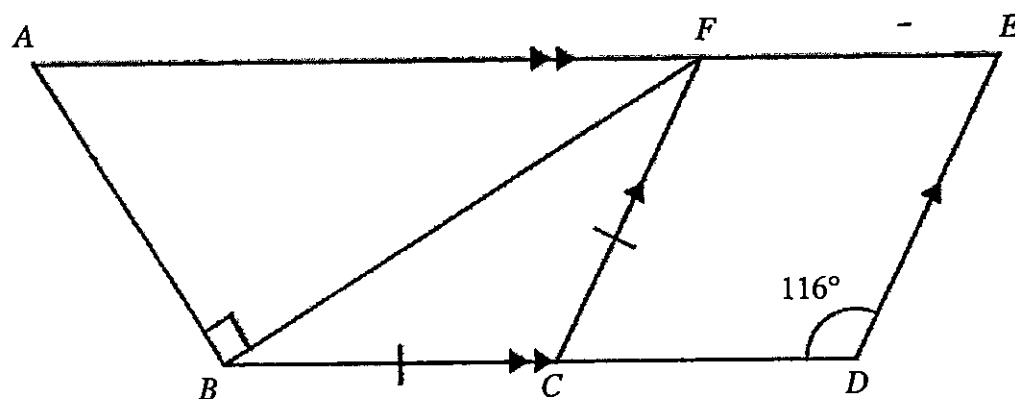
[2]

(b) Find the volume of the hemispheric paper weight.

Answer(b).....cm<sup>3</sup> [1]

- 8 In the diagram,  $ABDE$  is a trapezium and  $CDEF$  is a parallelogram.

Given that  $BC = CF$  and  $\angle CDE = 116^\circ$ , stating with reasons, find



- (a)  $\angle CBF$ ,

Answer(a) .....<sup>o</sup> [2]

- (b)  $\angle BFE$ ,

Answer(b).....<sup>o</sup> [1]

- (c)  $\angle BAF$ .

Name: \_\_\_\_\_ (     )     Class: \_\_\_\_\_

Answer(c).....°[1]

9 Simplify the following expressions.

(a)  $\frac{5a^2b}{c^2} \div \frac{16b^3}{3abc}$

Answer(a) ..... [2]

(b)  $\frac{4x}{x^2-36} + \frac{1}{x-6} - \frac{x}{x+6}$

Name: \_\_\_\_\_ (    )                      Class: \_\_\_\_\_

*Answer(b) ..... [3]*

- 10** A truck and a car were 480 km apart. They started travelling towards each other at uniform speed at 1200 h and passed each other at 1430 h. The speed of the truck was 85 km/h. Find the speed of the car.

*Answer .....km/h [2]*

---

- 11** A car travels 504 km on 60 litres of petrol. The price of the petrol consumed was \$79.56.

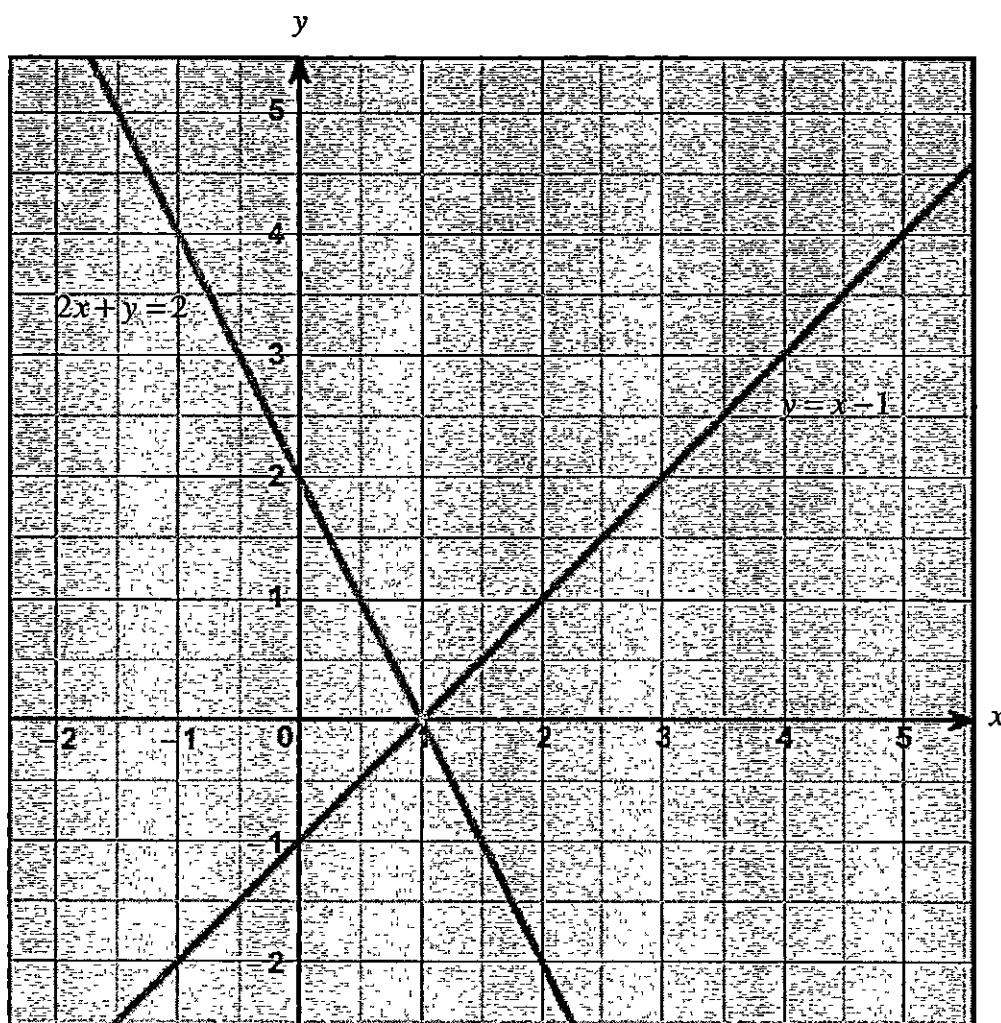
(a) Find the rate of petrol consumption in km/litre.

*Answer (a) .....km/litre [1]*

(b) What was the price of the petrol per litre? Leave your answer to the nearest cent.

Answer (b) \$ ..... [1]

- 12 The graph below shows the lines  $y = x - 1$  and  $2x + y = 2$ .



- (a) State the solution of the simultaneous equations  $y = x - 1$  and  $2x + y = 2$ .

€ €  
Answer (a)  $x = \dots\dots\dots y = \dots\dots\dots$  [1]

- (b) On the same grid above, draw and label clearly the line  $y = 4$ . [1]

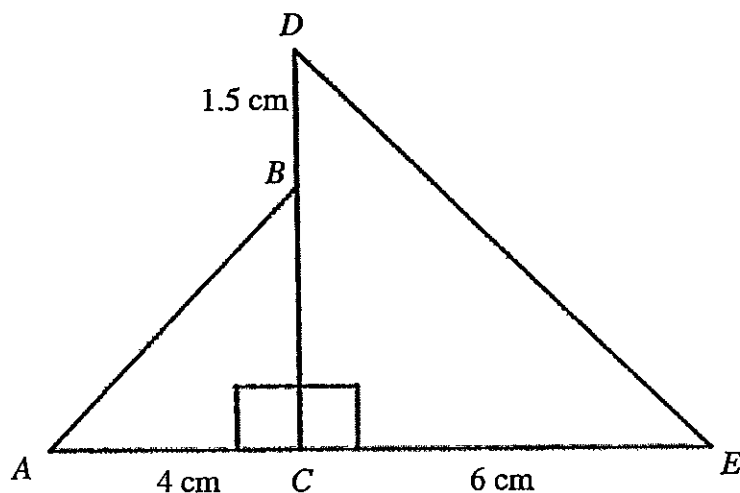
- (c) Find the area of the polygon enclosed by the 3 lines,  $y = x - 1$ ,  $2x + y = 2$  and  $y = 4$ . Leave your answer in square units.

€ €

€

Answer(c).....units<sup>2</sup> [1]

- 13 In the figure,  $ABC$  and  $EDC$  are similar triangles.  $AC = 4$  cm,  $BD = 1.5$  cm,  $CE = 6$  cm.



- (a) Find length  $BC$ .

Answer(a) .....cm [2]

- (b) Calculate the value of  $\cos \angle BAC$ .

€

Answer (b) ..... [2]

- (c) Find  $\angle CED$ .

€



Name: \_\_\_\_\_ (     )                      Class: \_\_\_\_\_

*Answer (c) .....° [1]*

**14** Factorise each of the following expressions completely.

(a)  $a - 14bc - 2b + 7ac$

-

*Answer(a) ..... [2]*

(b)  $4k^2 - 14kh + 6h^2$

*Answer(b) ..... [2]*

---

**15** A bag contains 8 yellow balls, 5 white balls and 2 pink balls. One ball is drawn from the bag at random. Find the probability that

(a) the ball is yellow,

*Answer(a) ..... [1]*

(b) the ball is non-white.

Name: \_\_\_\_\_ (    )

Class: \_\_\_\_\_

*Answer(b)*..... [1]

16 Solve the equation  $\frac{1+2f}{3-2f} + \frac{5}{2f-3} = 4$ .

Name: \_\_\_\_\_ (     )                      Class: \_\_\_\_\_

*Answerf* = ..... [3]

**17** Solve the following simultaneous equations.

$$n + \frac{m}{2} = 8$$

$$3n - \frac{m}{5} = 7$$

Answer = \_\_\_\_\_,  $n =$  \_\_\_\_\_ [3]

- 18 The stem and leaf diagram shows the heights of 16 students obtained during a health check.

| Stem | Leaf                |
|------|---------------------|
| 15   | 3 5 6 6             |
| 16   | 0 0 0 1 1 3 4 5 5 8 |
| 17   | 2 3                 |

Key: 15|5 means 155 cm

From the data above, find

- (a) (i) the median height,

Answer(a)(i).....cm [1]

- (ii) the modal height,

Answer(a)(ii).....cm [1]

- (iii) the mean height.

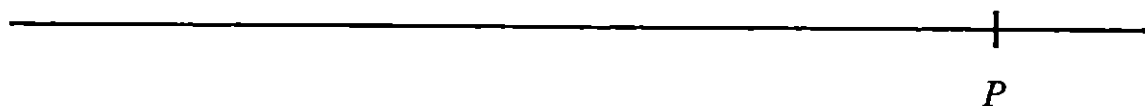
Answer(a)(iii).....cm [1]

- (b) Shannon was absent on the day of the health check. When she returned, her height was taken and added into the data above. The new mean height was 161.5 cm. Find Shannon's height.

*Answer(b)* .....cm [2]

- 19 (a) Construct a quadrilateral  $PQRS$ , given that  $PQ = 10$  cm,  $\angle PQR = 105^\circ$ ,  $QR = 7$  cm,  $PS = 9$  cm and the diagonal  $QS = 11$  cm, using ruler, protractor and compasses only. [3]
- (b) On the same diagram, construct, using ruler and compasses only, the perpendicular bisector of  $RS$ . [1]
- (c) On the same diagram, construct, using ruler and compasses only, the angle bisector of  $\angle PQR$ . [1]
- (d) The perpendicular bisector of  $RS$  meets the angle bisector of  $\angle PQR$  at point  $K$ . Measure and write down the length of  $KQ$ .
- (e) Measure and write down the size of  $\angle QPS$ .

*Answer (a), (b), (c)*



*Answer (d)* .....cm [1]

(e) .....° [1]

~End of Paper~



Name: \_\_\_\_\_ ( )

Class: \_\_\_\_\_

**Fairfield Methodist School (Secondary)**  
**Sec 2 Express 2014 EOY Examination**  
**Mathematics Paper 1**  
**Answer Key**

| No. | Answer                                      | No.    | Answer              |
|-----|---|--------|---------------------|
| 1   | $\frac{7}{4}$ or 1.75 or $1\frac{3}{4}$     | 17     | $m = 10$<br>$n = 3$ |
| 2   | $\sqrt[3]{-27}, -2, 0.16, \frac{1}{6}, \pi$ | 18ai   | 161 cm              |
| 3   | \$700                                       | 18aii  | 160cm               |
| 4a  | $2^5 \times 3^2 \times 5$                   | 18aiii | 162 cm              |
| 4b  | $2^5 \times 3^2 \times 5^2 \times 7$        | 18b    | 153.5cm             |
| 4c  | $k = 42$                                    | 19d    | 5.3 (+/-0.1)        |
| 5a  | $V = \frac{180}{\sqrt[3]{P}}$               | 19e    | 70° (+/-1°)         |
| 5b  | 30 cm <sup>3</sup>                          |        |                     |
| 5c  | 373.248                                     |        |                     |
| 6   | $x = 11.3$ cm                               |        |                     |
| 7b  | 56.556 cm <sup>3</sup>                      |        |                     |
| 8a  | 32°   |        |                     |
| 8b  | 148°  |        |                     |
| 8c  | 58°   |        |                     |
| 9a  | $\frac{15a^3}{16bc}$                        |        |                     |
| 9b  | $\frac{11x - x^2 + 6}{x^2 - 36}$            |        |                     |
| 10  | 107 km/h                                    |        |                     |
| 11a | 8.4 km/litre                                |        |                     |
| 11b | \$1.33                                      |        |                     |
| 12a | $x = 1, y = 0$                              |        |                     |
| 12c | 12 units <sup>2</sup>                       |        |                     |
| 13a | 3 cm  |        |                     |
| 13b | $\frac{4}{5}$                               |        |                     |
| 13c | 36.9°                                       |        |                     |
| 14a | $(a - 2b)(7c + 1)$                          |        |                     |
| 14b | $2(2k - h)(k - 3h)$                         |        |                     |
| 15a | $\frac{8}{15}$                              |        |                     |
| 15b | $\frac{2}{3}$                               |        |                     |
| 16  | $f = 1.6$                                   |        |                     |

NAME: \_\_\_\_\_ (     )

CLASS: \_\_\_\_\_



## FAIRFIELD METHODIST SCHOOL (SECONDARY)

END-OF-YEAR EXAMINATION 2014  
SECONDARY 2 EXPRESS

### MATHEMATICS

#### Paper 2

Date: 8 October 2014

Duration: 1 hour 30 minutes

Candidates answer on Question Paper.

Additional Material :        Graph paper (1 sheet)

---

#### READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [   ] at the end of each question or part question.

The total number of marks for this paper is 60.

At the end of the examination, fasten all your work securely together.

| For Examiner's Use |      |
|--------------------|------|
| Paper 2            | / 60 |

Setter: Miss Lee CP

This question paper consists of 15 printed pages including the cover page.

Name: \_\_\_\_\_ (    )

Class: \_\_\_\_\_

Answer **all** the questions.

- 1 The ratio of lengths of the 3 sides of triangle  $DEF$  is  $DE : EF : FD$  is  $2 : 3 : 4$ . The length of  $DE$  is 5 cm. Find the perimeter of the triangle. —

*Answer* .....cm [1]

---

- 2 Given that  $m$  is directly proportional to  $n^3$ . It is known that  $m = 52$  for a particular value of  $n$ . Find the value of  $m$  when this value of  $n$  is halved.

*Answer*  $m =$  ..... [2]



Name: \_\_\_\_\_ (     )                      Class: \_\_\_\_\_

- 3     Seven interior angles of a decagon are  $(x + 22)^\circ$  each, while the remaining interior angles are  $144^\circ$  each. Find the value of  $x$ .

Answer  $x =$  ..... [2]

---

- 4     (a)     Factorize  $2y^2 + 11y - 6$ .

Answer (a) ..... [1]

- (b)     Simplify  $\frac{2y^2 + 11y - 6}{4y^2 - 1}$ .

Answer (b) ..... [2]

- 5    The total cost of an advertisement in a newspaper is obtained by adding together a fixed charge of 90 cents and a charge of 25 cents per word.

Thomas does not want to spend more than \$5.00 on the cost of an advertisement.

- (a)    Form an inequality in terms of  $x$ , where  $x$  is the number of words to represent the information.

*Answer (a)* ..... [1]

- (b)    Solve the inequality in (a).

*Answer (b)* ..... [1]

- (c)    Hence, state the maximum number of words that Thomas can use.

*Answer (c)* .....words [1]

Name: \_\_\_\_\_ (    )

Class: \_\_\_\_\_

- 6    Given that  $p = \sqrt{\frac{w}{2w-3x}}$ , express  $w$  in terms of  $p$  and  $x$ .

*Answer* ..... [3]

---

- 7    Solve the following equations.

(a)     $9x + 4 = 3x - (7 - 2x)$

*Answer (a)*     $x =$ ..... [2]

Name: \_\_\_\_\_ (     )                      Class: \_\_\_\_\_

7     (b)      $(z - 6)^2 = 121$

*Answer(b)*    $z =$ ..... or .....     [2]

---

8     A map is drawn to a scale of 1 : 600 000.

(a)     Find the actual distance, in kilometres, represented by 8 centimetres on the map.

*Answer (a)* .....km     [1]

(b)     A city covers an area of 900 square kilometres. Find, in square centimetres, the area representing the city on the map.

*Answer (b)* .....cm<sup>2</sup>     [2]

Name: \_\_\_\_\_ (     )

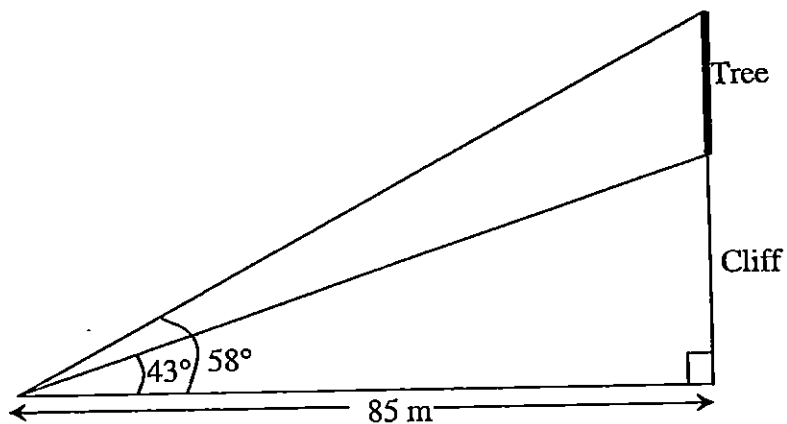
Class: \_\_\_\_\_

- 9 If  $2(x - y)^2 = 128$  and  $xy = 20$ , find the value of  $5(x + y)^2$ .

*Answer* ..... [3]

---

- 10** A tree stands on top of a cliff. At a distance of 85m from the foot of the cliff which is at ground level, the angles of elevation of the top of the tree and the top of the cliff are  $58^\circ$  and  $43^\circ$  respectively. Find the height of the tree.



Answer .....m     [3]

Name: \_\_\_\_\_ (    )      Class: \_\_\_\_\_

- 11 (a) The table below that show the distribution of masses of 55 rubber balls. Complete the table below.

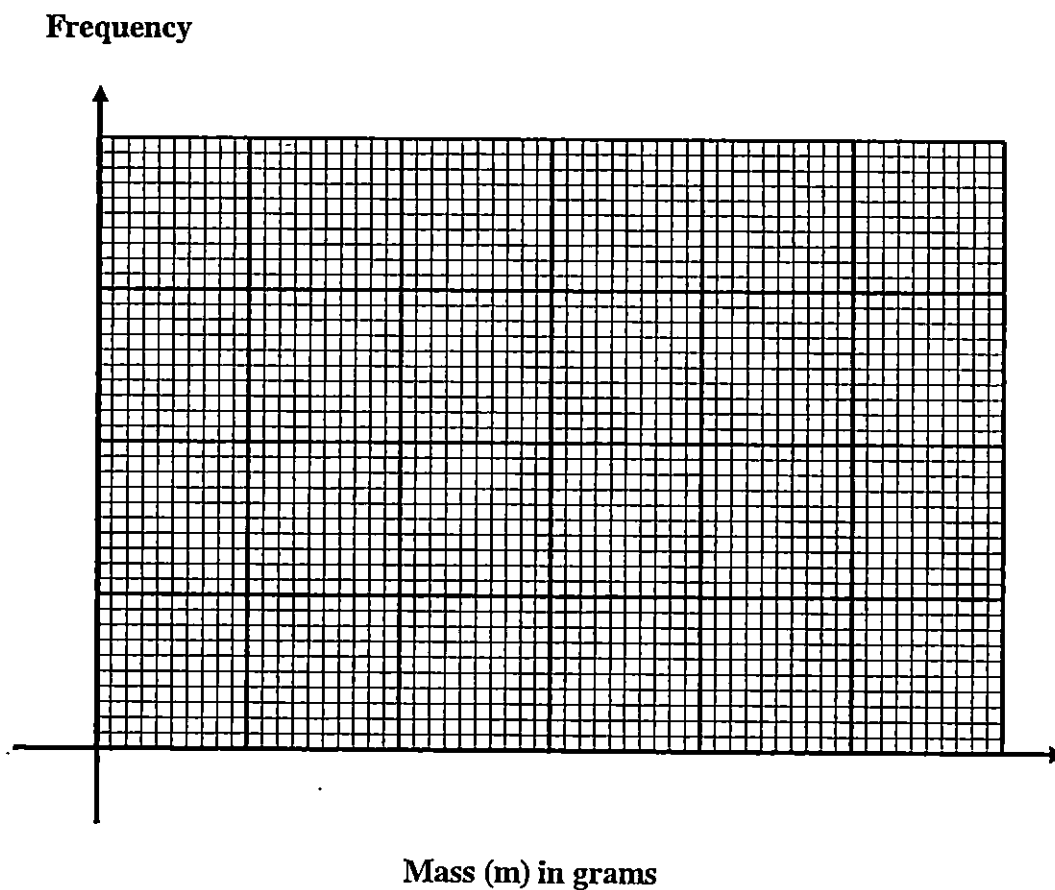
[1]

| Masses (m) in grams | Mid-value | Frequency, $f$ |
|---------------------|-----------|----------------|
| $20 < m \leq 30$    |           | 5              |
| $30 < m \leq 40$    |           | 10             |
| $40 < m \leq 50$    |           | 15             |
| $50 < m \leq 60$    |           | 18             |
| $60 < m \leq 70$    |           | 7              |

- (b) Draw a histogram to represent the distribution.

[2]

*Answer*



Name: \_\_\_\_\_ (     )                      Class: \_\_\_\_\_

- 11    (c)    Calculate an estimate for the mean mass of the rubber balls.

*Answer (c)* ..... g    [2]

---



- 12 The numbers are written out in five columns to make the following pattern.

|             | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ |
|-------------|-------|-------|-------|-------|-------|
| Row 1       | 2     | 3     | 4     | 5     | 6     |
| Row 2       | 7     | 8     | 9     | 10    | 11    |
| Row 3       | 12    | 13    | 14    | 15    | 16    |
| Row 4       | 17    | 18    | 19    | 20    | 21    |
|             |       |       |       |       |       |
| Row $n$     |       |       | $k$   | $x$   |       |
| Row $n + 1$ |       |       | $y$   | $z$   |       |

The four numbers,  $k$ ,  $x$ ,  $y$  and  $z$  are next to each other in the pattern as shown in the diagram.

- (a) (i) Using the patterns in the table above, express  $x$  in terms of  $k$ ,  $y$  in terms of  $k$  and  $z$  in terms of  $k$ .

Answer (a)(i)  $x = \dots\dots\dots$

$y = \dots\dots\dots$

$z = \dots\dots\dots$  [1]

- (ii) Find and simplify  $xy - kz$ .

Answer (a)(ii)

Answer (a)(ii)  $\dots\dots\dots$  [2]

It is noticed that the products  $2 \times 8 = 16$  and  $3 \times 7 = 21$  both lie in column  $C_5$ .

- (iii) Explain why  $xy$  and  $kz$  lie in the same column.

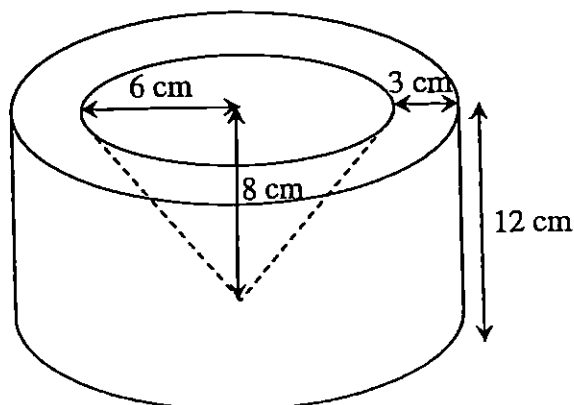
Answer(a)(iii).....

..... [1]

- (b) The number  $k$  is in Row  $n$  of Column  $C_3$ . Find an expression for  $k$  in terms of  $n$ .

Answer(b)  $\dots\dots\dots$  [1]

- 13 A solid metal ornament consists of a cylinder with a base radius of 9 cm and a height of 12 cm where a right cone with a base radius of 6 cm and a vertical height of 8 cm is sculpted out from it.



- (a) Calculate the total volume of solid, leaving your answer in terms of  $\pi$ .

Answer (a) .....cm<sup>3</sup> [3]

- (b) If every part of the surface area of the ornament is to be painted in blue.

- (i) Show that the curved surface area of the cone is  $60\pi$  cm<sup>2</sup>.

Answer (b)(i)

[2]

Name: \_\_\_\_\_ (     )     Class: \_\_\_\_\_

- 13    (b)    (ii)    Calculate the surface area that is required to be painted.

*Answer (b)(ii)* .....cm<sup>2</sup>    [3]

- (c)    If the solid metal ornament is later melted and its metal is used to make a sphere,  
find the radius of the sphere.

*Answer (c)* .....cm    [2]

- 14 In 2010, Mr Tan changed 2100 Vietnamese Dong(VND) into Singapore dollars (S\$) when the rate of exchange was  $x \text{ VND} = \text{S\$}1.00$

(a) Write down an expression, in terms of  $x$ , for the number of Singapore dollars he received.

*Answer (a)* S\$..... [1]

In 2012, he again changed 2100 VND into Singapore dollars. The exchange rate was  $(x + 3) \text{ VND} = \text{S\$}1.00$ .

(b) Write down an expression, in terms of  $x$ , for the number of Singapore dollars he received this time.

*Answer (b)* S\$..... [1]

(c) Given that he received S\$9.00 less in 2012 than he received in 2010.

(i) Form an equation in  $x$  and show that it reduces to  $x^2 + 3x - 700 = 0$ .

*Answer (c)(i)* [2]

- 14    (c)    (ii)    Solve the equation  $x^2 + 3x - 700 = 0$ .

*Answer (c)(ii)* ..... [2]

- (d)   Find the exchange rate in 2012.

*Answer (d)*   S\$ 1.00 = .....VND            [1]

- 15    **Answer the whole of this question on a sheet of graph paper.**

The variables  $x$  and  $y$  are connected by the equation  $y = 1 + 5x - x^2$ . The table below shows the corresponding values of  $x$  and  $y$  for the equation.

|     |     |   |   |   |   |   |   |
|-----|-----|---|---|---|---|---|---|
| $x$ | -1  | 0 | 1 | 2 | 3 | 4 | 5 |
| $y$ | $p$ | 1 | 5 | 7 | 7 | 5 | 1 |

- (a)   Find the value of  $p$ . [1]
- (b)   Using a scale of 2 cm to represent 1 unit on the  $x$ -axis and 1 cm to represent 1 unit on the  $y$ -axis, plot the graph of  $y = 1 + 5x - x^2$  for the range  $-1 \leq x \leq 5$ . [3]
- (c)   Using your graph, find the value(s) of  $x$  when  $y = 3$ . [1]
- (d)   State the equation of the line of symmetry. [1]

~ End of Paper ~



## Fairfield Methodist School (Secondary)

### End of Year Examination

#### Sec 2 Express 2014

#### Mathematics

#### Paper 2

#### Answer Key

1 22.5 cm

2  $m = \frac{13}{2}$  or 6.5

3 122

4(a)  $(2y-1)(y+6)$

4(b)  $\frac{y+6}{2y+1}$

5(a)  $0.9 + 0.25x \leq 5$  or  $90 + 25x \leq 500$

5(b)  $x \leq 16.4$

5(c) 16 words

6  $w = \frac{3p^2x}{2p^2-1}$

7(a)  $x = -\frac{11}{4}$  or  $-3.25$

7(b)  $z = 17$  or  $z = -5$

8(a) 48 km

8(b)  $25 \text{ cm}^2$

9 720

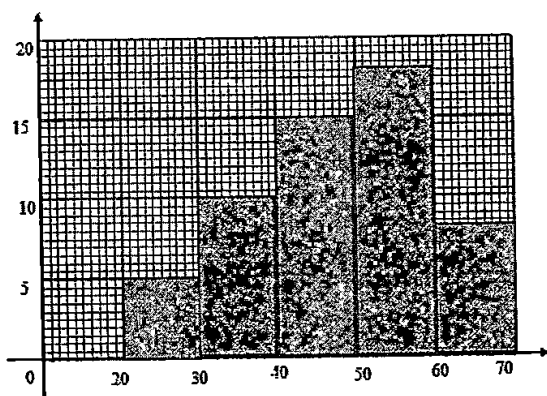
10 56.8 m (3 s.f.)

11(a)

| Masses (m) in grams | Mid-value | Frequency, $f$ |
|---------------------|-----------|----------------|
| $20 < m \leq 30$    | 25        | 5              |
| $30 < m \leq 40$    | 35        | 10             |
| $40 < m \leq 50$    | 45        | 15             |
| $50 < m \leq 60$    | 55        | 18             |
| $60 < m \leq 70$    | 65        | 7              |

11(b)

Frequency



Mass (m) in grams

11(c) 47.2 (3 s.f.) or  $47\frac{2}{11}$

12(a)(i)  $x = k+1, y = k+5, z = k+6$

12(a)(ii) 5

12(a)(iii) The difference between them is 5

12(b)  $k = 5n - 1$  or  $4 + 5(n-1)$

13(a)  $876\pi \text{ cm}^3$

13(b)(i)  $60\pi \text{ cm}^2$

13(b)(ii)  $1260 \text{ cm}^2$  (3 s.f.) or  $1263.084 \text{ cm}^2$

13(c) 8.69 cm

14(a)  $S\$ \frac{2100}{x}$

14(b)  $S\$ \frac{2100}{x+3}$

14(c)(i)  $\frac{2100}{x} - \frac{2100}{x+3} = 9$

14(c)(ii)  $x = 25$  or  $x = -28$

14(d) 28 VND

15(a)  $p = -5$

15(c)  $x = 0.45$  or  $x = -4.6$  ( $\pm 0.1$ )

15(d)  $x = 2.5$

## END-OF-YEAR EXAMINATION 2014

Secondary 2 Express

### MATHEMATICS

Paper 1

1 October 2014

Time: 7.50 a.m. — 8.50 a.m.

Duration: 1 hour

#### INSTRUCTIONS TO STUDENTS:

Write your name, index number and class on the question paper.  
Write in dark blue or black pen.  
You may use a pencil for any diagrams or graphs.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in the spaces provided in the question paper.  
If working is needed for any question, it must be shown in the space below the question.  
Omission of essential working will result in loss of marks.  
You are expected to use a scientific calculator to evaluate explicit numerical expressions.  
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.  
For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.  
The total number of marks for this paper is 50.

Name of Student: \_\_\_\_\_ ( )

Class/Band: \_\_\_\_\_ / \_\_\_\_\_

Parent's Signature: \_\_\_\_\_

| Marks |  |
|-------|--|
|       |  |
|       |  |
| 50    |  |

**Setter:** Mrs Quek -AngXue Si

---

**This question paper consists of 9 printed pages including the cover page.**

**[Turn over**

**Answer all the questions.**

- 1** Convert 38 m/s to km/h.

*Answer* \_\_\_\_\_ km/h [1]

---

- 2** Expand and simplify the following expressions.

**(a)**  $g(h-2e)-h(-g+3e)$ ,

*Answer* (a) \_\_\_\_\_ [1]

**(b)**  $(5-3x)(-2x+1)$ .

*Answer* (b) \_\_\_\_\_ [2]

---

- 3** Factorise the following completely.

**(a)**  $9a^2+27ab-6b-2a$ ,

*Answer* (a) \_\_\_\_\_ [2]

**(b)**  $8x^2-50y^2$ .

*Answer* (b) \_\_\_\_\_ [2]

---



4 Expressed as a product of its prime factors,  $1188 = 2^2 \times 3^3 \times 11$ .

(a) Express 4200 as a product of its prime factors, leaving your answers in index notation.

Answer (a)  $4200 =$  \_\_\_\_\_ [2]

(b) Find the smallest integer  $m$  such that  $1188m$  is a multiple of 4200.

Answer (b)  $m =$  \_\_\_\_\_ [2]

(c) Find the smallest positive integer  $p$  such that  $1188p$  is a square number.

Answer (c)  $p =$  \_\_\_\_\_ [1]

---

5 (a) Factorise  $6c^2 - 19c - 7$ .

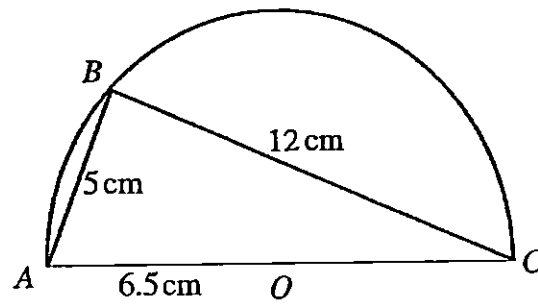
Answer (a) \_\_\_\_\_ [2]

(b) Hence, simplify  $\frac{4c-14}{6c^2-19c-7}$ .

Answer (b) \_\_\_\_\_ [1]

---

- 6 The diagram below shows a semi-circle centred at  $O$ , the radius of the semi-circle is  $6.5\text{ cm}$ ,  $AB = 5\text{ cm}$  and  $BC = 12\text{ cm}$ .



- (a) Prove that  $\triangle ABC$  is a right-angled triangle.

Answer (a)

[2]

- (b) Find the perimeter of the semi-circle  $ABCO$ .

Answer (b) \_\_\_\_\_ cm [1]

- 7 There are 7 red balls and  $y$  black balls in a bag. Given that the probability of drawing a black ball is  $\frac{3}{4}$ , find the total number of balls in the bag.

Answer \_\_\_\_\_ balls [2]

8 Simplify  $\frac{2}{m^2 - mn} \times \frac{m - n}{4m - 2n}$ .

Answer \_\_\_\_\_ [2]

---

- 9 Five of the interior angles of a  $n$  sided polygon are  $126^\circ$ ,  $143^\circ$ ,  $147^\circ$ ,  $161^\circ$  and  $167^\circ$ . The remaining interior angles are  $168^\circ$  each.

(a) Find the size of the largest exterior angle of this polygon.

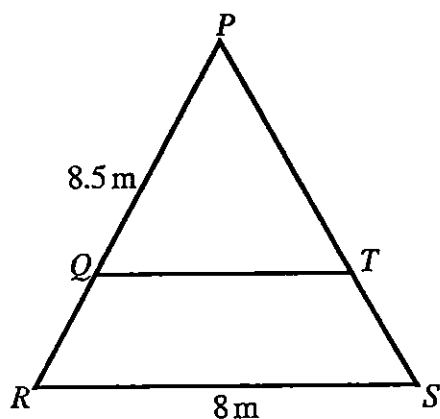
Answer (a) \_\_\_\_\_  $^\circ$  [1]

(b) Find the value of  $n$ .

Answer (b)  $n =$  \_\_\_\_\_ [2]

---

- 10  $\triangle PQT$  is similar to  $\triangle PRS$ ,  $PQ = 8.5$  m and  $RS = 8$  m.



Given that the ratio of the length of  $QT : RS$  is  $13 : 20$ , find

- (a) the length of  $QT$ ,

Answer (a) \_\_\_\_\_ m [1]

- (b) the length of  $QR$ ,

Answer (b) \_\_\_\_\_ m [2]

- 
- 11 Given that  $2a - b = \sqrt{3v}$ ,  
(a) express  $v$  in terms of  $a$  and  $b$ ,

Answer (a)  $v =$  \_\_\_\_\_ [2]

- (b) find the value of  $v$  when  $a = 8$  and  $b = 2$ .

Answer (b)  $v =$  \_\_\_\_\_ [2]

- 12 Raymond just purchased a 4-room flat and he wants to renovate it. He went to an interior designer who drew the scale drawing of his house using a scale of  $1:n$ . Raymond measured the actual width of the living room of his flat and found that it was 3.2m. On the scale drawing, the width of the living room is only 8 cm.
- (a) Find the value of  $n$ .

Answer (a)  $n =$  \_\_\_\_\_ [1]

- (b) Raymond wants to put a fish tank in his flat. According to his measurements, the fish tank takes up an area of  $0.72 \text{ m}^2$ . Find in square centimetres, the area representing the fish tank on the scale drawing that the interior designer drew.

Answer (b) \_\_\_\_\_  $\text{cm}^2$  [2]

- 
- 13 The data below shows the weekly pocket money (\$) of 20 teenagers.

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 15 | 30 | 24 | 27 | 33 | 25 | 38 | 37 | 17 | 23 |
| 16 | 25 | 30 | 17 | 39 | 29 | 46 | 30 | 24 | 19 |

- (a) Represent the data using an ordered stem-and-leaf diagram. [2]

- (b) Calculate the mean pocket money of the teenagers.

Answer (b) \$ \_\_\_\_\_ [1]

- (c) Calculate the median pocket money of the teenagers.

Answer (c) \$ \_\_\_\_\_ [1]

- (d) If one student is selected at random, find the probability that the pocket money of this student is greater than or equals to \$33.

Answer (d) \_\_\_\_\_ [1]

14 A group of  $x$  teachers and  $y$  students watched a musical at the Esplanade Concert Hall.

- (a) Given that a total of 28 teachers and students went for the concert, form an equation involving  $x$ ,  $y$  and 28.

Answer (a) \_\_\_\_\_ [1]

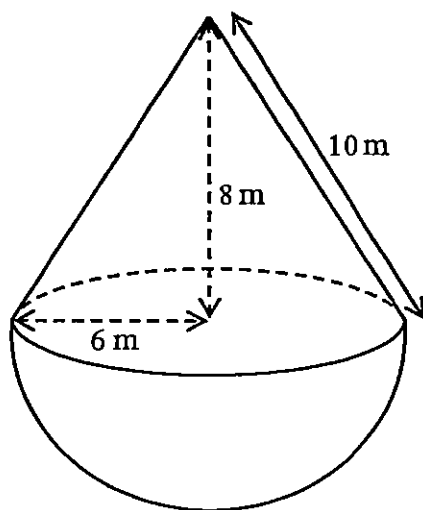
- (b) A ticket for teacher costs \$20 while a ticket for student costs \$15. Given that the total cost of all tickets is \$435, form an equation in  $x$  and  $y$ . Show that it reduces to  $4x + 3y = 87$ . [1]

- (c) Using the equations in (a) and (b), find the values of  $x$  and  $y$ .

Answer (c)  $x =$  \_\_\_\_\_  
 $y =$  \_\_\_\_\_ [2]

---

- 15 A contractor has been tasked to construct the structure as given in the diagram below. The structure is made up of a hemisphere and a cone. The vertical height of the cone is 8 m, the slant height of the cone is 10 m and the radius of the cone is 6 m.  
[ Surface area of sphere =  $4\pi r^2$ , curved surface area of cone =  $\pi rl$  ]



- (a) Find the outer surface area of the structure.

Answer (a) \_\_\_\_\_  $\text{m}^2$  [3]

- (b) The contractor is asked to paint the outer surface of the structure red. A can of paint can be used to paint an area of  $30\text{m}^2$ . What is the minimum number of cans of paint needed to paint this structure?

Answer (b) \_\_\_\_\_ cans [2]

---

END OF PAPER



## Answer Key

| Qns No.                                   | Answer  | Qns No.                                   | Answer   |      |              |   |           |   |               |   |               |   |   |
|---|---|---|--|------|--------------|---|-----------|---|---------------|---|---------------|---|---|
| 1   | 136.8   | 10a                                       | 5.2  |      |              |   |           |   |               |   |               |   |   |
| 2a  | $2gh - 2eg - 3he$   | 10b                                       | $4\frac{15}{26}$   |      |              |   |           |   |               |   |               |   |   |
| 2b  | $6x^2 - 13x + 5$  | 11a                                       | $v = \frac{(2a-b)^2}{3}$   |      |              |   |           |   |               |   |               |   |   |
| 3a  | $(9a - 2)(a + 3b)$  | 11b                                       | $v = 65\frac{1}{3}$  |      |              |   |           |   |               |   |               |   |   |
| 3b  | $2(2x - 5y)(2x + 5y)$   | 12a                                       | $n = 40$   |      |              |   |           |   |               |   |               |   |   |
| 4a  | $4200 = 2^3 \times 3 \times 5^2 \times 7$   | 12b                                       | 4.5  |      |              |   |           |   |               |   |               |   |   |
| 4b  | $m = 350$   | 13a                                       | <table><tr><th>Stem</th><th>Leaf</th></tr><tr><td>1</td><td>5 6 7 7 9</td></tr><tr><td>2</td><td>3 4 4 5 5 7 9</td></tr><tr><td>3</td><td>0 0 0 3 7 8 9</td></tr><tr><td>4</td><td>6</td></tr></table> | Stem | Leaf         | 1 | 5 6 7 7 9 | 2 | 3 4 4 5 5 7 9 | 3 | 0 0 0 3 7 8 9 | 4 | 6 |
| Stem                                      | Leaf  |   |  |      |              |   |           |   |               |   |               |   |   |
| 1   | 5 6 7 7 9   |   |  |      |              |   |           |   |               |   |               |   |   |
| 2   | 3 4 4 5 5 7 9   |   |  |      |              |   |           |   |               |   |               |   |   |
| 3   | 0 0 0 3 7 8 9   |   |  |      |              |   |           |   |               |   |               |   |   |
| 4   | 6   |   |  |      |              |   |           |   |               |   |               |   |   |
| 4c  | $p = 33$  | 13b                                       | \$27.20  |      |              |   |           |   |               |   |               |   |   |
| 5a  | $(2c - 7)(3c + 1)$  | 13c                                       | \$26   |      |              |   |           |   |               |   |               |   |   |
| 5b  | $\frac{2}{3c + 1}$  | 13d                                       | $\frac{1}{4}$  |      |              |   |           |   |               |   |               |   |   |
| 6a  | <table><tr><td><math>AC^2</math><br/><math>= (6.5 \times 2)^2</math><br/><math>= 169</math></td><td><math>BC^2 + AB^2</math><br/><math>= (5^2 + 12^2)</math><br/><math>= 169</math></td></tr></table> | $AC^2$<br>$= (6.5 \times 2)^2$<br>$= 169$ | $BC^2 + AB^2$<br>$= (5^2 + 12^2)$<br>$= 169$   | 14a  | $x + y = 28$ |   |           |   |               |   |               |   |   |
| $AC^2$<br>$= (6.5 \times 2)^2$<br>$= 169$ | $BC^2 + AB^2$<br>$= (5^2 + 12^2)$<br>$= 169$  |   |  |      |              |   |           |   |               |   |               |   |   |
|   | Since $AC^2 = BC^2 + AB^2$ , by the converse of Pythagoras' Theorem, $\Delta ABC$ is a right-angled triangle.   | 14c                                       | $x = 3$ and $y = 25$   |      |              |   |           |   |               |   |               |   |   |
| 6b  | 33.4  | 15a                                       | 415  |      |              |   |           |   |               |   |               |   |   |
| 7   | 28  | 15b                                       | 14   |      |              |   |           |   |               |   |               |   |   |
| 8   | $\frac{1}{m(2m - n)}$   |   |  |      |              |   |           |   |               |   |               |   |   |
| 9a  | $54^\circ$  |   |  |      |              |   |           |   |               |   |               |   |   |
| 9b  | $n = 22$  |   |  |      |              |   |           |   |               |   |               |   |   |



**END-OF-YEAR EXAMINATION 2014**

Secondary 2 Express

**MATHEMATICS**

Paper 2

**24 September 2014**

Additional Material: Graph Paper

Time: 7.50 a.m. —9.05 a.m.

Duration: 1 hour and 15 minutes

**INSTRUCTIONS TO STUDENTS:**

Write your name, index number and class on the question paper.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in the spaces provided in the question paper.

If working is needed for any question, it must be shown in the space below the question.

Omission of essential working will result in loss of marks.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

Name of Student: \_\_\_\_\_ ( )

Class/Band: \_\_\_\_\_/\_\_\_\_\_

Parent's Signature: \_\_\_\_\_

| Marks |
|-------|
| 50    |

**Setter:** Mrs Quek -AngXue Si

---

**This question paper consists of 8 printed pages, including the cover page.****[Turn over**

**Answer all the questions.**

**1** The first four terms of a sequence are 1, 8, 27 and 64.

**(a)** Write down the 8<sup>th</sup> term of the sequence. [1]

**(b)** Find an expression, in terms of  $n$ , for the  $n^{\text{th}}$  term of the sequence. [1]

**(c)** Hence, or otherwise, find an expression, in terms of  $n$ , for the  $n^{\text{th}}$  term of another sequence whose first four terms are 3, 10, 29 and 66. [1]

---

**2** Express the following as a single fraction in its simplest form.

**(a)**  $\frac{3(x-1)}{4x^2} - \frac{5}{x^2}$ , [2]

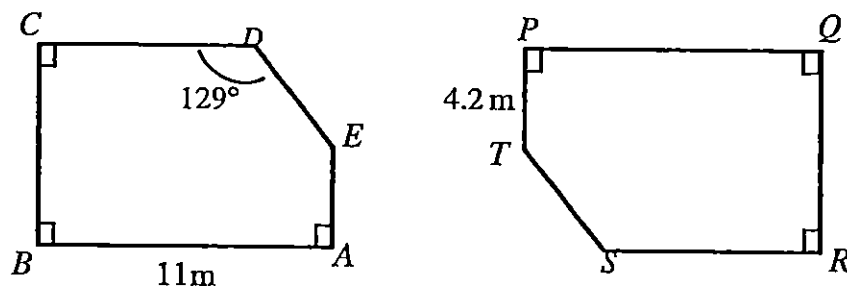
**(b)**  $\frac{5}{(p+2q)^2} + \frac{3}{2(p+2q)}$ . [2]

- 3 All the hearts are removed from a standard pack of 52 playing cards. A card is drawn at random from the remaining cards. Find the probability that the card drawn is

- (a) a black card,  
(b) an ace of heart.

[1]  
[1]

- 4  $ABCDE$  is congruent to  $PQRST$ . Obtuse  $\hat{CDE} = 129^\circ$ ,  $AB = 11$  m,  $TP = 4.2$  m.  
 $\hat{ABC} = \hat{BCD} = \hat{EAB} = \hat{QRS} = \hat{PQR} = \hat{TPQ} = 90^\circ$ .



- (a) Find the length of  $PQ$ .  
(b) Find reflex  $\hat{RST}$ .  
(c) Given that the perimeter of  $ABCDE$  is 45 m, Damien says that the total length of  $QR$ ,  $RS$  and  $ST$  is 29.8 m. Do you agree with him? Explain your answer.

[1]  
[1]  
[2]

5 It is given that  $t$  is proportional to the cube of  $s$  and  $t = 6$  when  $s = 2$ .

(a) Write an equation connecting  $t$  and  $s$ .

[2]

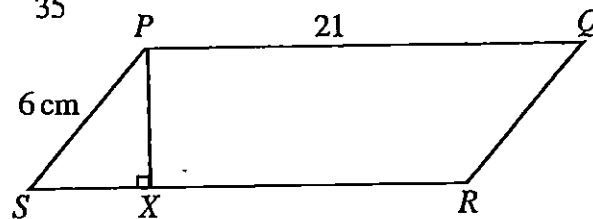
(b) Find the value of  $s$  when  $t = 30$ .

[2]

---

6 The area of the parallelogram  $PQRS$  is  $100.8 \text{ cm}^2$ .

The length of  $XS$  is  $\frac{6}{35}$  of the length of  $RS$ .



(a) Show that the length of  $PX = 4.8 \text{ cm}$ .

[1]

(b) Calculate

[2]

(i)  $\cos \hat{RSP}$ , leaving your answer as a fraction in its simplest form,

[2]

(ii)  $\hat{SPX}$ .

7 (a) Solve the following equations.

(i)  $y^2 - 8y = 0$ ,

[1]

(ii)  $2p^2 + p = 55$ .

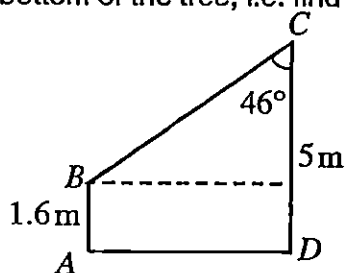
[2]

(b) If  $a - b = -8$  and  $ab = 33$ , find the value of  $a^2 + b^2$ .

[2]

- 
- 8 Marianne is 1.6 m tall. She stood directly in front of a 5 m tall tree. In the diagram below,  $AB$  represents Marianne's height while  $CD$  represents the height of the tree. The line  $BC$  shows Marianne's line of sight when she looks at the top of the tree. Calculate how far away is Marianne from the bottom of the tree, i.e. find the distance  $AD$ .

[2]



- 9 The weights, in kg, of 40 students are given in the table below.

| Weight,<br>$w$ (kg)      | $40 \leq w < 50$ | $50 \leq w < 60$ | $60 \leq w < 70$ | $70 \leq w < 80$ | $80 \leq w < 90$ |
|--------------------------|------------------|------------------|------------------|------------------|------------------|
| Number<br>of<br>Students | 15               | $x$              | 7                | 4                | 1                |

- (a) Calculate the value of  $x$ . [1]  
(b) State the modal class interval for the weight of the students. [1]  
(c) Calculate the estimated mean weight of the students. [2]  
(d) Why is the answer calculated in (c) an estimated mean? [1]

- 10 The pyramid  $ABCDE$  has a square base of length 10 cm. The vertical height of the pyramid is 12 cm.

(a) Show that the slant height,  $EG$ , of the pyramid is 13 cm. [1]

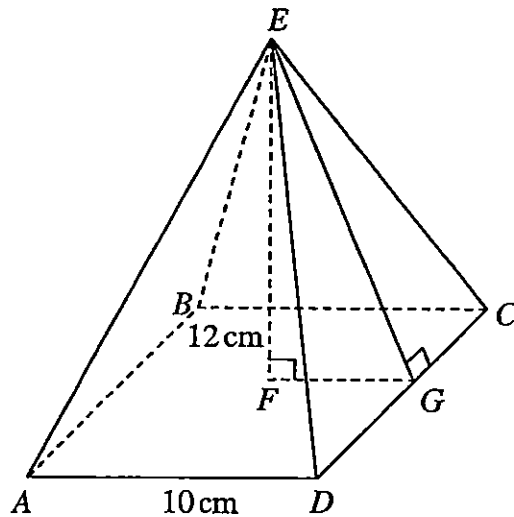
(b) Calculate

(i) the surface area of the pyramid, [2]

(ii) the volume of the pyramid. [2]

(c) The pyramid  $ABCDE$  is melted and remoulded into spheres of radius 2 cm.

Assuming there is no wastage of materials in the process of melting and remoulding, what is the maximum number of such spheres that can be created? [2]



11 30 workers can paint 16 houses in 28 days.

(a) How many days would it take 12 workers to paint 24 houses?

[2]

(b) The workers draw an hourly wage of \$15 and they work for the same duration daily. If the boss paid a total of \$151200 to the 12 workers for painting the 24 houses, how many hours does each worker work daily?

[2]

---

Answer the whole of this question on a sheet of graph paper.

12 Benny kicks a soccer ball vertically upwards. The height,  $h$  metres, of the ball from the ground after  $t$  seconds is given by  $h = 7t - t^2$ . The table below shows the values of  $h$  for the values of  $t$  from 0 to 7.

|     |   |   |    |    |       |    |    |   |   |
|-----|---|---|----|----|-------|----|----|---|---|
| $t$ | 0 | 1 | 2  | 3  | 3.5   | 4  | 5  | 6 | 7 |
| $h$ | 0 | 6 | 10 | 12 | 12.25 | 12 | 10 | 6 | 0 |

(a) Using a scale of 2 cm to 1 unit, draw a horizontal  $t$ -axis for  $0 \leq t \leq 7$ .

Using a scale of 2 cm to 2 units, draw a vertical  $h$ -axis for  $0 \leq h \leq 14$ .

On your axes, plot the points given in the table and join them with a smooth curve.

[3]

(b) Use your graph to find

(i) the maximum height reached by the ball,

[1]

(ii) the second time when the ball reached a height of 8 m above the ground.

[1]

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END OF PAPER





## Answer Key

| Qns. No | Answer                               | Qns. No | Answer                |
|---------|--------------------------------------|---------|-----------------------|
| 1a      | 512                                  | 7aii    | $p = -5.5$ or $p = 5$ |
| 1b      | $n^{\text{th}}\text{term} = n^3$     | 7b      | $a^2 + b^2 = 130$     |
| 1c      | $n^{\text{th}}\text{term} = n^3 + 2$ | 8       | 3.52m                 |
| 2a      | $\frac{3x-23}{4x^2}$                 | 9a      | $x = 13$              |
| 2b      | $\frac{10+3p+6q}{2(p+2q)^2}$         | 9b      | $40 \leq w < 50$      |
| 3a      | $\frac{2}{3}$                        | 9c      | 55.75 kg              |
| 3b      | 0                                    | 10bi    | $360 \text{ cm}^2$    |
| 4a      | 11m                                  | 10bii   | $400 \text{ cm}^3$    |
| 4b      | $231^\circ$                          | 10c     | 11                    |
| 5a      | $t = \frac{3}{4}s^3$                 | 11a     | 105 days              |
| 5b      | $s \approx 3.42$                     | 11b     | 8 hours               |
| 6bi     | $\frac{3}{5}$                        | 12bi    | 12.25 m               |
| 6bii    | $36.9^\circ$                         | 12bii   | $t = 5.6 \text{ s}$   |
| 7ai     | $y = 0$ or $y = 8$                   |         |                       |



## END-OF-YEAR EXAMINATION 2014

Secondary 2 Express

**MATHEMATICS**

Paper 1

**1 October 2014**

Time: 7.50 a.m. — 8.50 a.m.

Duration: 1 hour

### INSTRUCTIONS TO STUDENTS:

Write your name, index number and class on the question paper.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions in the spaces provided in the question paper.

If working is needed for any question, it must be shown in the space below the question.

Omission of essential working will result in loss of marks.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

Name of Student: \_\_\_\_\_ ( )

Class/Band: \_\_\_\_\_ / \_\_\_\_\_

Parent's Signature: \_\_\_\_\_

| Marks |  |
|-------|--|
|       |  |
|       |  |
| 50    |  |

**Setter:** Mrs Quek - Ang Xue Si

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This question paper consists of 9 printed pages including the cover page.

[Turn over



Answer all the questions.

- 1 Convert 38 m/s to km/h.

$$\begin{aligned} 38 \text{ m/s} &= \frac{38 \text{ m}}{1 \text{ s}} \\ &= \frac{(38 \div 1000) \text{ km}}{(1 \div 3600) \text{ h}} \\ &= 136.8 \text{ km/h} \end{aligned}$$

Answer  $\frac{136.8 \text{ (A1)}}{(\text{Accept } 136\frac{4}{5})} \text{ km/h [1]}$

- 2 Expand and simplify the following expressions.

(a)  $g(h-2e) - h(-g+3e)$ ,

$$\begin{aligned} &= gh - 2eg + hg - 3he \\ &= 2gh - 2eg - 3he \end{aligned}$$

Answer (a)  $\underline{2gh - 2eg - 3he \text{ (A1)}} [1]$

(b)  $(5-3x)(-2x+1)$ .

$$\begin{aligned} &= -10x + 5 + 6x^2 - 3x \text{ (M1) (any 2 out of 4 terms)} \\ &= 6x^2 - 13x + 5 \end{aligned}$$

Answer (b)  $\underline{6x^2 - 13x + 5 \text{ (A1)}} [2]$

- 3 Factorise the following completely.

(a)  $9a^2 + 27ab - 6b - 2a$ ,

$$\begin{aligned} &= 9a(a+3b) - 2(a+3b) \text{ (M1)} \\ &= (9a-2)(a+3b) \end{aligned}$$

Answer (a)  $\underline{(9a-2)(a+3b) \text{ (A1)}} [2]$

(b)  $8x^2 - 50y^2$ .

$$\begin{aligned} &= 2(4x^2 - 25y^2) \text{ (M1)} \\ &= 2(2x-5y)(2x+5y) \end{aligned}$$

Answer (b)  $\underline{2(2x-5y)(2x+5y) \text{ (A1)}} [2]$

4 Expressed as a product of its prime factors,  $1188 = 2^2 \times 3^3 \times 11$ .

(a) Express 4200 as a product of its prime factors, leaving your answers in index notation.

$$\begin{array}{r}
 2 \overline{) 4200} \\
 2 \overline{) 2100} \\
 2 \overline{) 1050} \\
 5 \overline{) 525} \\
 5 \overline{) 105} \\
 3 \overline{) 21} \\
 7 \overline{) 7}
 \end{array}$$

mark is not awarded if students extract non-prime factors

Answer (a)  $4200 = 2^3 \times 3 \times 5^2 \times 7$  [2] [M1]

(b) Find the smallest integer  $m$  such that  $1188m$  is a multiple of 4200.

Method 1:

$$\begin{aligned}
 \text{Lcm of } 1188 \text{ and } 4200 &= 2^3 \times 3^3 \times 5^2 \times 7 \times 11 \\
 &= 415800 \text{ [M1]}
 \end{aligned}$$

$$1188m = 415800$$

$$m = 350$$

Method 2:

$$\begin{aligned}
 m &= 2 \times 5^2 \times 7 \text{ [M1]} \\
 &= 350
 \end{aligned}$$

Answer (b)  $m = 350$  [A1] [2]

(c) Find the smallest positive integer  $p$  such that  $1188p$  is a square number.

$$\begin{aligned}
 p &= 3 \times 11 \\
 &= 33
 \end{aligned}$$

Answer (c)  $p = 33$  [A1] [1]

5 (a) Factorise  $6c^2 - 19c - 7$ .

$$6c^2 - 19c - 7 = (2c - 7)(3c + 1)$$

$$\begin{array}{r|l}
 2c & -7 \\
 3c & \times +1 \\
 \hline
 6c^2 & -7 \\
 & +2c \\
 & -19c
 \end{array}$$

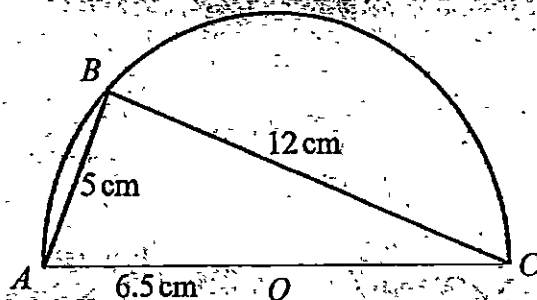
Answer (a)  $(2c - 7)(3c + 1)$  [A1] [2]

(b) Hence, simplify  $\frac{4c - 14}{6c^2 - 19c - 7}$ .

$$\begin{aligned}
 \frac{4c - 14}{6c^2 - 19c - 7} &= \frac{2(2c - 7)}{(2c - 7)(3c + 1)} \\
 &= \frac{2}{3c + 1}
 \end{aligned}$$

Answer (b)  $\frac{2}{3c + 1}$  [A1] [1]

- 6 The diagram below shows a semi-circle centred at  $O$ , the radius of the semi-circle is 6.5 cm,  $AB = 5$  cm and  $BC = 12$  cm.



- (a) Prove that  $\triangle ABC$  is a right-angled triangle.

Answer (a)

[2]

$$AC = 6.5 \times 2$$

$$= 13$$

$$AC^2 = 13^2$$

$$= 169$$

$$BC^2 + AB^2 = 5^2 + 12^2$$

$$= 169$$

Either  $AC^2$  or  $BC^2 + AB^2$   
calculation, award [M1]

\*NOTE: Do not award if students equate  $AC^2 = BC^2 + AB^2$  straightaway.

By converse of Pythagoras' theorem, since  $AC^2 = BC^2 + AB^2$ ,  $\triangle ABC$  is a right-angled triangle. [A1]

- (b) Find the perimeter of the semi-circle  $ABCO$ .

$$\text{Perimeter of } ABCO = \frac{\pi \times 13}{2} + 13$$

$$= 33.42035225$$

$$\approx 33.4 \text{ cm (3sf)}$$

$$17\pi = 3.142$$

↓

$$33.423 \text{ [A1]}$$

Answer (b) 33.4 or 33.423 cm [1]

- 7 There are 7 red balls and  $y$  black balls in a bag. Given that the probability of drawing a black ball is  $\frac{3}{4}$ , find the total number of balls in the bag.

$$P(\text{black ball}) = \frac{3}{4}$$

$$\frac{y}{y+7} = \frac{3}{4} \text{ [M1]}$$

$$4y = 3y + 21$$

$$y = 21$$

$$\text{Total no. of balls} = 7 + 21$$

Answer

$$28 \text{ [A1]}$$

balls [2]

$$= 28$$

8

Simplify  $\frac{2}{m^2 - mn} \times \frac{m-n}{4m-2n}$ .

$$\begin{aligned}
 & \frac{2}{m^2 - mn} \times \frac{m-n}{4m-2n} \\
 = & \frac{2}{m(m-n)} \times \frac{m-n}{2(2m-n)} \quad [M1] \\
 = & \frac{2}{2m(2m-n)} \\
 = & \frac{1}{m(2m-n)}
 \end{aligned}$$

factorisation of either

$$m^2 - mn = m(m-n)$$

$$\text{or } 4m - 2n = 2(2m - n)$$

Answer

$$\frac{1}{m(2m-n)} \quad [A1] \quad [2]$$

- 9 Five of the interior angles of a  $n$  sided polygon are  $126^\circ$ ,  $143^\circ$ ,  $147^\circ$ ,  $161^\circ$  and  $167^\circ$ . The remaining interior angles are  $168^\circ$  each.

(a) Find the size of the largest exterior angle of this polygon.

$$\begin{aligned}
 \text{Size of largest ext. } \angle &= 180^\circ - 126^\circ \\
 &= 54^\circ \text{ (adj. } \angle \text{ s on str. line)}
 \end{aligned}$$

Answer (a) 54 [A1] [1]

(b) Find the value of  $n$ .

Method 1:

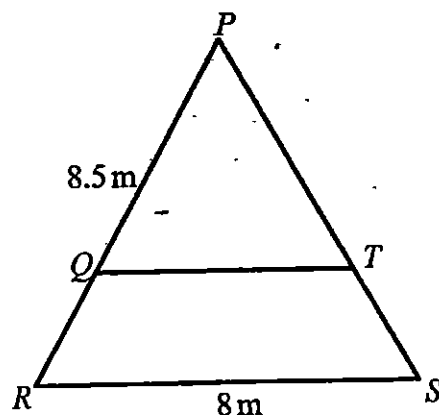
$$\begin{aligned}
 +126^\circ + 143^\circ + 147^\circ + 161^\circ + (n-5) \times 168^\circ &= (n-2) \times 180^\circ \text{ (MI)} \\
 744 + 168n - 840 &= 180n - 360 \\
 180n - 168n &= 744 - 840 + 360 \\
 n &= 22
 \end{aligned}$$

Method 2:

$$\begin{aligned}
 54 + 37 + 33 + 19 + 13 + (n-5) \times 12 &= 360 \text{ (MI)} \\
 156 + 12n - 60 &= 360 \\
 12n &= 360 - 96 \\
 n &= \frac{264}{12} \\
 &= 22
 \end{aligned}$$

Answer (b)  $n =$  22 [A1] [2]

- 10  $\triangle PQT$  is similar to  $\triangle PRS$ ,  $PQ = 8.5$  m and  $RS = 8$  m.



Given that the ratio of the length of  $QT : RS$  is  $13 : 20$ , find

- (a) the length of  $QT$ ,

$$\frac{\text{Length of } QT}{RS} = \frac{13}{20}$$

$$QT = \frac{13(8)}{20} = 5.2 \text{ m.}$$

Answer (a)  $\frac{5.2 \text{ [A1]}}{\text{Accept } 5\frac{1}{5}} \text{ m [1]}$

- (b) the length of  $QR$ ,

$$\frac{PQ}{PR} = \frac{QT}{RS}$$

$$\frac{8.5}{PR} = \frac{5.2}{8} \text{ [M1]}$$

$$PR = \frac{8(8.5)}{5.2} = 13\frac{1}{3}$$

$$QR = 13\frac{1}{3} - 8.5 = 4\frac{15}{26} \text{ m}$$

Answer (b)  $\frac{4\frac{15}{26} \text{ [A1]}}{\text{(cannot accept rounded off) answer}} \text{ m [2]}$

- 11 Given that  $2a - b = \sqrt{3v}$ ,

- (a) express  $v$  in terms of  $a$  and  $b$ ,

$$2a - b = \sqrt{3v}$$

$$(2a - b)^2 = 3v \text{ [M1]}$$

$$v = \frac{(2a - b)^2}{3}$$

Answer (a)  $v = \frac{(2a - b)^2}{3} \text{ [A1] [2]}$

- (b) find the value of  $v$  when  $a = 8$  and  $b = 2$ .

Method 1:

$$v = \frac{(2(8) - 2)^2}{3} \text{ [M1]}$$

$$= 65\frac{1}{3}$$

Method 2:

$$2a - b = \sqrt{3v}$$

$$2(8) - 2 = \sqrt{3v} \text{ [M1]}$$

$$14^2 = 3v$$

Answer (b)  $v = 65\frac{1}{3} \text{ [A1] [2]}$

- 12 Raymond just purchased a 4-room flat and he wants to renovate it. He went to an interior designer who drew the scale drawing of his house using a scale of  $1:n$ . Raymond measured the actual width of the living room of his flat and found that it was 3.2 m. On the scale drawing, the width of the living room is only 8 cm.

(a) Find the value of  $n$ .

$$n = \frac{3.2 \times 100}{8} = 40$$

$$\text{OR } \begin{array}{l} 8 \text{ cm} : 3.2 \text{ m} \\ 8 \text{ cm} : 320 \text{ cm} \\ 1 : 40 \end{array}$$

$$n = 40 \quad \text{Answer (a)} \quad n = \underline{40} \quad \text{[A1]} \quad [1]$$

- (b) Raymond wants to put a fish tank in his flat. According to his measurements, the fish tank takes up an area of  $0.72 \text{ m}^2$ . Find in square centimetres, the area representing the fish tank on the scale drawing that the interior designer drew.

$$8 \text{ cm} : 3.2 \text{ m}$$

$$(8 \text{ cm})^2 : (3.2 \text{ m})^2 \quad \text{[M1]}$$

$$64 \text{ cm}^2 : 10.24 \text{ m}^2$$

$$4.5 \text{ cm}^2 : 0.72 \text{ m}^2$$

award for indication of conversion to scale of area  
eg  $(1 \text{ cm})^2 : (0.4 \text{ m})^2$  or  $(1 \text{ cm})^2 : (40 \text{ cm})^2$

$$\text{Area representing fish tank on layout} = \underline{4.5 \text{ cm}^2} \quad \text{Answer (b)} \quad \underline{4.5 \text{ cm}^2} \quad \text{[A1]} \quad [2]$$

- 13 The data below shows the weekly pocket money (\$) of 20 teenagers.

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 15 | 30 | 24 | 27 | 33 | 25 | 38 | 37 | 17 | 23 |
| 16 | 25 | 30 | 17 | 39 | 29 | 46 | 30 | 24 | 19 |

- (a) Represent the data using an ordered stem-and-leaf diagram.

[2]

| Stem | Leaf          |
|------|---------------|
| 1    | 5 6 7 7 9     |
| 2    | 3 4 4 5 5 7 9 |
| 3    | 0 0 0 3 7 8 9 |
| 4    | 6             |

1m:  $\leq 5$  mistakes

for leaf

2m: All 20 leaf stated correctly.

key: 4|6 means \$46.

- (b) Calculate the mean pocket money of the teenagers. \*note: key is encouraged.

$$\begin{aligned} \text{Mean pocket money} &= (15 + 16 + 17 \times 2 + 19 + 23 + 24 \times 2 + 25 \times 2 + 27 + 29 + 30 \times 3 + 33 + \\ &\quad 37 + 38 + 39 + 46) \div 20 \\ &= \$27.20 \end{aligned}$$

$$\text{Answer (b)} \quad \$ \underline{27.20} \quad \text{[A1]} \quad [1]$$

(cannot accept 27.2)

- (c) Calculate the median pocket money of the teenagers.

$$\begin{aligned} \text{Median} &= \frac{25 + 27}{2} \\ &= \$26 \end{aligned}$$

$$\text{Answer (c)} \quad \$ \underline{26} \quad \text{[B1]} \quad [1]$$

- (d) If one student is selected at random, find the probability that the pocket money of this student is greater than or equals to \$33.

$$\begin{aligned} P(\text{pocket money greater than or equal to } \$33) &= \frac{5}{20} \\ &= \frac{1}{4} \end{aligned}$$

$$\text{Answer (d)} \quad \underline{\frac{1}{4}} \quad \text{[B1]} \quad [1]$$



14 A group of  $x$  teachers and  $y$  students watched a musical at the Esplanade Concert Hall.

- (a) Given that a total of 28 teachers and students went for the concert, form an equation involving  $x$ ,  $y$  and 28.

Answer (a)  $x + y = 28$  [21] [1]

- (b) A ticket for teacher costs \$20 while a ticket for student costs \$15. Given that the total cost of all tickets is \$435, form an equation in  $x$  and  $y$ . Show that it reduces to  $4x + 3y = 87$ . [1]

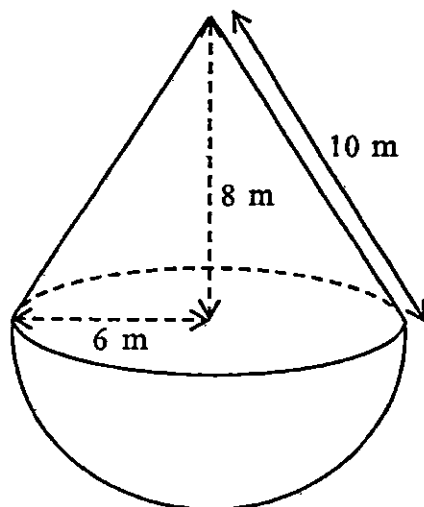
$$\begin{aligned} 20x + 15y &= 435 \\ 5(4x + 3y) &= 5(87) \\ 4x + 3y &= 87 \text{ (shown) [A1]} \end{aligned}$$

- (c) Using the equations in (a) and (b), find the values of  $x$  and  $y$ .

$$\begin{aligned} x + y &= 28 \quad \text{--- (1)} \\ 4x + 3y &= 87 \quad \text{--- (2)} \\ \text{(1) } \times 3 & \\ \text{(3) - (2)} & \\ (3x + 3y) - (4x + 3y) &= 84 - 87 \quad \text{[m1: either substitution or elimination method]} \\ -x &= -3 \\ x &= 3 \\ \text{Sub } x=3 \text{ into (1)} & \\ 3 + y &= 28 \\ y &= 28 - 3 \\ &= 25 \end{aligned}$$

Answer (c)  $x = 3$  } [A1] for both  
 $y = 25$  } [2]

- 15 A contractor has been tasked to construct the structure as given in the diagram below. The structure is made up of a hemisphere and a cone. The vertical height of the cone is 8 m, the slant height of the cone is 10 m and the radius of the cone is 6 m.  
[ Surface area of sphere =  $4\pi r^2$ , curved surface area of cone =  $\pi rl$  ]



- (a) Find the outer surface area of the structure.

$$\begin{aligned}\text{Outer surface area of cone} &= \pi rl \\ &= \pi (6)(10) \text{ [m]} \\ &= 60\pi\end{aligned}$$

$$\begin{aligned}\text{Outer surface area of hemisphere} &= \frac{4\pi r^2}{2} \\ &= 2\pi (6)^2 \text{ [m]} \\ &= 72\pi\end{aligned}$$

$$\begin{aligned}\text{Outer surface area of structure} &= 60\pi + 72\pi \\ &= 132\pi \\ &\approx 415 \text{ m}^2\end{aligned}$$

$$\begin{aligned}\text{or } 414.744 \text{ if } \pi = 3.142 \\ 414 \frac{93}{125}\end{aligned}$$

$$\approx 415 \text{ m}^2 \quad \text{Answer (a)} \quad 415 \text{ [A1]} \text{ m}^2 \text{ [3]}$$

- (b) The contractor is asked to paint the outer surface of the structure red. A can of paint can be used to paint an area of  $30 \text{ m}^2$ . What is the minimum number of cans of paint needed to paint this structure?

$$\begin{aligned}\text{No. of cans needed} &= \frac{132\pi}{30} \quad \text{or} \quad \frac{414.744}{30} \quad \text{or} \quad 414 \frac{93}{125} \div 30 \text{ [M1]} \\ &= 13.82300768 \quad \text{or} \quad 13.8248\end{aligned}$$

$$\text{Minimum no. of cans needed} = 14$$

$$\text{Answer (b)} \quad 14 \text{ [A1]} \text{ cans [2]}$$

END OF PAPER



## END-OF-YEAR EXAMINATION 2014

Secondary 2 Express

### MATHEMATICS

Paper 2

24 September 2014

Additional Material: Graph Paper

Time: 7.50 a.m. — 9.05 a.m.

Duration: 1 hour and 15 minutes

### INSTRUCTIONS TO STUDENTS:

Write your name, index number and class on the question paper.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions in the spaces provided in the question paper.

If working is needed for any question, it must be shown in the space below the question.

Omission of essential working will result in loss of marks.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

Name of Student: \_\_\_\_\_ ( )

Class/Band: \_\_\_\_\_ / \_\_\_\_\_

Parent's Signature: \_\_\_\_\_

| Marks |  |
|-------|--|
|       |  |
|       |  |
| 50    |  |

Setter: Mrs Quek - Ang Xue Si

This question paper consists of 8 printed pages, including the cover page.

[Turn over

**Answer all the questions.**

- 1 The first four terms of a sequence are 1, 8, 27 and 64.

(a) Write down the 8<sup>th</sup> term of the sequence. [1]

(b) Find an expression, in terms of  $n$ , for the  $n^{\text{th}}$  term of the sequence. [1]

(c) Hence, or otherwise, find an expression, in terms of  $n$ , for the  $n^{\text{th}}$  term of another sequence whose first four terms are 3, 10, 29 and 66. [1]

$$(a) 8^{\text{th}} \text{ term} = 512 \text{ [B1]}$$

$$(b) n^{\text{th}} \text{ term} = n^3 \text{ [B1]}$$

$$(c) n^3 + 2 \text{ [B1]}$$

- 2 Express the following as a single fraction in its simplest form.

$$(a) \frac{3(x-1)}{4x^2} - \frac{5}{x^2} \text{ [2]}$$

$$(b) \frac{5}{(p+2q)^2} + \frac{3}{2(p+2q)} \text{ [2]}$$

$$\begin{aligned} (a) \quad & \frac{3(x-1)}{4x^2} - \frac{5}{x^2} \\ &= \frac{3(x-1)}{4x^2} - \frac{5(4)}{4x^2} \text{ [M1]} \\ &= \frac{3x - 3 - 20}{4x^2} \\ &= \frac{3x - 23}{4x^2} \text{ [A1]} \end{aligned}$$

$$\begin{aligned} (b) \quad & \frac{5}{(p+2q)^2} + \frac{3}{2(p+2q)} \\ &= \frac{5(2) + 3(p+2q)}{2(p+2q)^2} \text{ [M1]} \\ &= \frac{10 + 3p + 6q}{2(p+2q)^2} \text{ [A1]} \end{aligned}$$

- 3 All the hearts are removed from a standard pack of 52 playing cards. A card is drawn at random from the remaining cards. Find the probability that the card drawn is

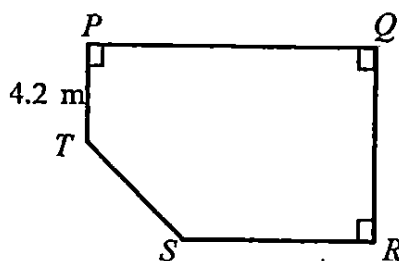
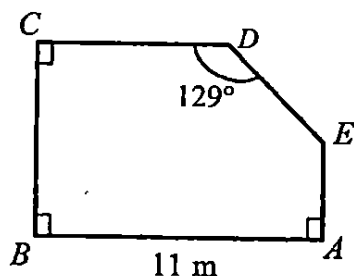
- (a) a black card,  
(b) an ace of heart.

[1]  
[1]

$$\begin{aligned} \text{(a) } P(\text{black card}) &= \frac{26}{52} \\ &= \frac{1}{2} \quad [1] \end{aligned}$$

$$\text{(b) } P(\text{an ace of heart}) = 0. \quad [1]$$

- 4  $ABCDE$  is congruent to  $PQRST$ . Obtuse  $\hat{CDE} = 129^\circ$ ,  $AB = 11$  m,  $TP = 4.2$  m.  
 $\hat{ABC} = \hat{BCD} = \hat{EAB} = \hat{QRS} = \hat{PQR} = \hat{TPQ} = 90^\circ$ .



- (a) Find the length of  $PQ$ .  
(b) Find reflex  $\hat{RST}$ .  
(c) Given that the perimeter of  $ABCDE$  is 45 m, Damien says that the total length of  $QR$ ,  $RS$  and  $ST$  is 29.8 m. Do you agree with him? Explain your answer.

[1]  
[1]  
[2]

$$\begin{aligned} \text{(a) Length of } PQ &= \text{Length of } AB \\ &= 11 \text{ m} \quad [1] \end{aligned}$$

$$\text{(b) obtuse } \hat{RST} = 129^\circ$$

$$\begin{aligned} \text{Reflex } \hat{RST} &= 360^\circ - 129^\circ \quad (\angle \text{ at a point}) \\ &= 231^\circ \quad [1] \end{aligned}$$

$$\text{(c) Yes I agree.} \quad [1]$$

corresponding lengths are equal, i.e.  
 $ABCDE$  is congruent to  $PQRST$ , hence  $QR = BC$ ,  $RS = CD$ ,  
 $ST = DE$  and  $AE = PT = 4.2$  m.

$$\begin{aligned} BC + CD + DE &= 45 - 11 - 4.2 \\ &= 29.8 \text{ m.} \end{aligned}$$

$$\therefore QR + RS + ST = 29.8 \text{ m} \quad [1].$$

- 5 It is given that  $t$  is proportional to the cube of  $s$  and  $t=6$  when  $s=2$ .

(a) Write an equation connecting  $t$  and  $s$ .

[2]

(b) Find the value of  $s$  when  $t=30$ .

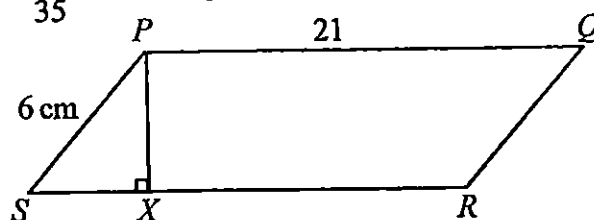
[2]

$$\begin{aligned} (a) \quad t &\propto s^3 \\ t &= ks^3 \\ (6) &= k(2)^3 \text{ [M1]} \\ k &= \frac{6}{8} \\ &= \frac{3}{4} \\ t &= \frac{3}{4} s^3 \text{ [M1]} \end{aligned}$$

$$\begin{aligned} (b) \quad t &= \frac{3}{4} s^3 \\ 30 &= \frac{3}{4} s^3 \\ s^3 &= 30 \div \frac{3}{4} \text{ [M1]} \\ s &= \sqrt[3]{40} \\ &= 3.419951893 \\ &\approx 3.42 \text{ (3sf) [M1]} \end{aligned}$$

- 6 The area of the parallelogram  $PQRS$  is  $100.8 \text{ cm}^2$ .

The length of  $XS$  is  $\frac{6}{35}$  of the length of  $RS$ .



(a) Show that the length of  $PX = 4.8 \text{ cm}$ .

[1]

(b) Calculate

[2]

(i)  $\cos \hat{RSP}$ , leaving your answer as a fraction in its simplest form,

[2]

(ii)  $\hat{SPX}$ .

$$\begin{aligned} (a) \quad \text{Area of } \parallel\text{gram} &= PX \times SR \\ 100.8 &= PX \times 21 \\ PX &= 100.8 \div 21 \\ &= 4.8 \text{ cm (shown) [M1]} \end{aligned}$$

$$\begin{aligned} (b) \quad (i) \quad SX &= \frac{6}{35} \times 21 \quad \text{or} \\ &= 3.6 \text{ cm [M1]} \quad \left. \begin{aligned} SX^2 &= 6^2 - 4.8^2 \text{ [M1]} \\ SX &= \sqrt{6^2 - 4.8^2} \\ &= 3.6 \text{ cm} \end{aligned} \right\} \\ \cos \hat{RSP} &= \frac{SX}{PS} \\ &= \frac{3.6}{6} = \frac{3}{5} \text{ [M1]} \end{aligned}$$

$$\begin{aligned} (b) \quad (ii) \quad \cos \hat{SPX} &= \frac{4.8}{6} \text{ [M1]} \\ \hat{SPX} &= \cos^{-1}\left(\frac{4.8}{6}\right) \\ &\approx 36.9^\circ \text{ (1dp) [M1]} \\ \text{or} \quad \sin \hat{SPX} &= \frac{3.6}{6} \text{ [M1]} \\ \hat{SPX} &\approx 36.9^\circ \text{ [M1]} \\ \text{or} \quad \tan \hat{SPX} &= \frac{3.6}{4.8} \text{ [M1]} \\ \hat{SPX} &\approx 36.9^\circ \text{ [M1]} \end{aligned}$$

7 (a) Solve the following equations.

(i)  $y^2 - 8y = 0$ ,

[1]

(ii)  $2p^2 + p = 55$ .

[2]

(b) If  $a - b = -8$  and  $ab = 33$ , find the value of  $a^2 + b^2$ .

[2]

(a) (i)  $y^2 - 8y = 0$

$y(y - 8) = 0$

$y = 0$  or  $y = 8$  [A1]

(b)  $(a - b)^2 = a^2 - 2ab + b^2$

$(a - b)^2 = (-8)^2$  [m1]  
 $= 64$

(ii)  $2p^2 + p = 55$

$2p^2 + p - 55 = 0$  [m1]

$(2p + 11)(p - 5) = 0$

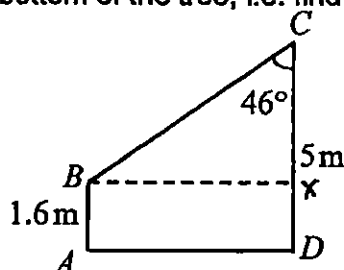
$2p = -11$  or  $p = 5$

$p = -5\frac{1}{2}$  or  $p = 5$  [A1 for both]

$a^2 + b^2 = (a - b)^2 + 2ab$   
 $= 64 + 2(33)$   
 $= 130$  [A1]

8 Marianne is 1.6 m tall. She stood directly in front of a 5 m tall tree. In the diagram below,  $AB$  represents Marianne's height while  $CD$  represents the height of the tree. The line  $BC$  shows Marianne's line of sight when she looks at the top of the tree. Calculate how far away is Marianne from the bottom of the tree, i.e. find the distance  $AD$ .

[2]



$\tan 46^\circ = \frac{BX}{(5 - 1.6)}$  [m1]

$BX = 3.4 \tan 46^\circ$

$AD \approx 3.52 \text{ m (3sf)}$  [A1]

- 9 The weights, in kg, of 40 students are given in the table below.

| Weight,<br>$w$ (kg)      | $40 \leq w < 50$ | $50 \leq w < 60$ | $60 \leq w < 70$ | $70 \leq w < 80$ | $80 \leq w < 90$ |
|--------------------------|------------------|------------------|------------------|------------------|------------------|
| Number<br>of<br>Students | 15               | $x$              | 7                | 4                | 1                |

- (a) Calculate the value of  $x$ .  
 (b) State the modal class interval for the weight of the students.  
 (c) Calculate the estimated mean weight of the students.  
 (d) Why is the answer calculated in (c) an estimated mean?

[1]  
 [1]  
 [2]  
 [1]

$$(a) \quad x = 40 - 15 - 7 - 4 - 1 \\ = 13 \quad [B1]$$

(b) Modal class interval:  $40 \leq w < 50$  [B1]

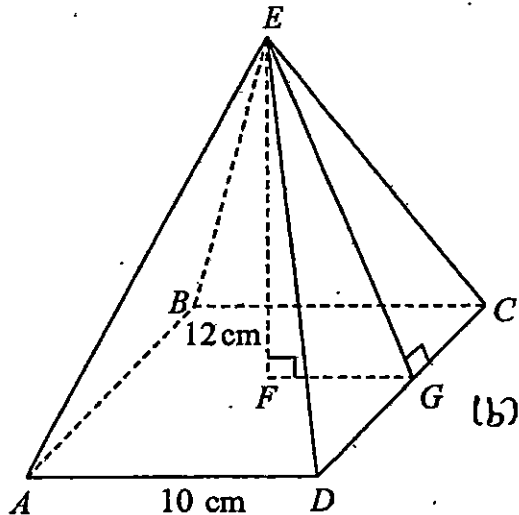
$$(c) \quad \begin{aligned} \text{Estimated mean weight} &= \frac{45 \times 15 + 55 \times 13 + 65 \times 7 + 75 \times 4 + 85 \times 1}{40} \quad [M1] \text{ or } \frac{2230}{40} \\ &= 55.75 \text{ kg (or } 55\frac{3}{4} \text{ kg)} \quad [A1] \end{aligned}$$

- (d) It is calculated based on mid values of weight of each class interval, that the answer in (c) is an estimated mean. [B1].



- 10 The pyramid  $ABCDE$  has a square base of length 10 cm. The vertical height of the pyramid is 12 cm.

- (a) Show that the slant height,  $EG$ , of the pyramid is 13 cm. [1]  
 (b) Calculate [2]  
 (i) the surface area of the pyramid, [2]  
 (ii) the volume of the pyramid. [2]  
 (c) The pyramid  $ABCDE$  is melted and remoulded into spheres of radius 2 cm. Assuming there is no wastage of materials in the process of melting and remoulding, what is the maximum number of such spheres that can be created? [2]



(a) By Pythagoras' Theorem,

$$EG^2 = EF^2 + FG^2$$

$$EG^2 = 12^2 + 5^2$$

$$EG = \sqrt{12^2 + 5^2} = 13 \text{ cm (shown) [A1]}$$

(b) (i) Surface area of each slant triangular face =  $\frac{1}{2} \times 13 \times 10$  [M1]  
 = 65

Surface area of pyramid =  $10 \times 10 + 4 \times 65$   
 =  $360 \text{ cm}^2$  [A1]

(b) (ii) Vol. of pyramid =  $\frac{1}{3} \times (10 \times 10) \times 12$  [M1]  
 =  $400 \text{ cm}^3$  [A1]

(c) Vol. of one sphere =  $\frac{4}{3} \pi r^3$   
 =  $\frac{4}{3} \pi (2)^3$  [M1]  
 =  $10\frac{2}{3} \pi$

No. of spheres that can be created =  $400 \div 10\frac{2}{3} \pi$   
 = 1193662073

Maximum no. of spheres = 11 [A1]

- [2]

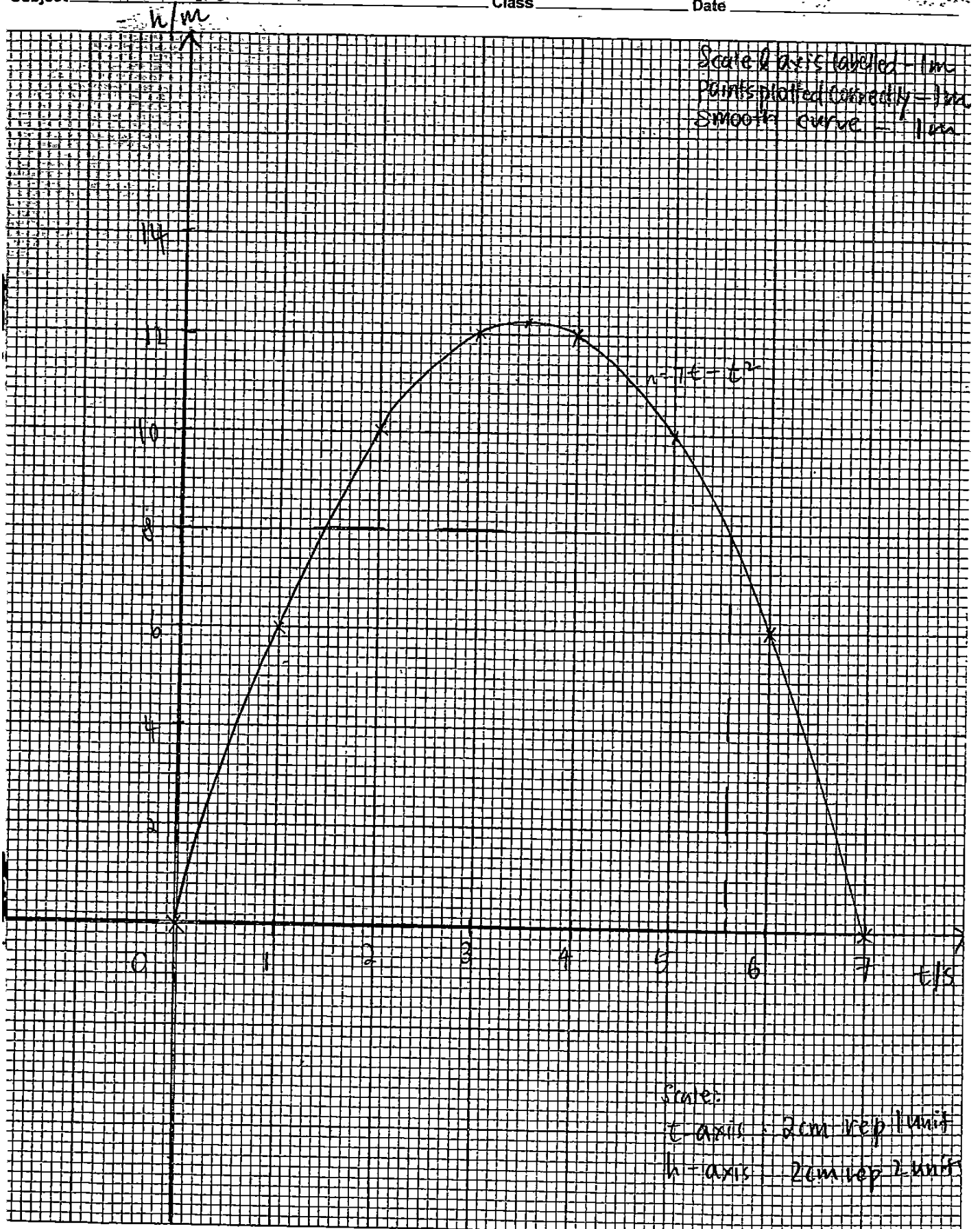
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Index No. \_\_\_\_\_

Subject \_\_\_\_\_

Class \_\_\_\_\_

Date \_\_\_\_\_



(b) (i)  $h = 12.25 \text{ m}$  [B1]

(ii)  $t = 5.6 \text{ s}$  [B1] (Accept:  $5.5 \text{ s}, 5.55 \text{ s},$   
 $5.65 \text{ s}, 5.7 \text{ s}$ )