



BEATTY SECONDARY SCHOOL  
MID-YEAR EXAMINATION 2015

SUBJECT : Mathematics

LEVEL : Secondary 2 Express

PAPER : 1

DURATION : 1 hour 15 minutes

SETTER : Mr Anthony Goh

DATE : 15 May 2015

CLASS :	NAME :	REG NO :
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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.

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

Answer **all** questions.

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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
50

This paper consists of 11 printed pages (including this cover page)

[Turn over

Answer all questions.

1 (a) Expand and simplify  $(a+3)(2a-3)$ .

(b) Simplify  $(-4x^2)(4x)^2$ .

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

(b) ..... [2]

2 Solve each of the following equations.

(a)  $(2p+3)(p-5) = 0$ ,

(b)  $x^2 = 7x$ .

Answer (a)  $p =$  ..... [1]

(b)  $x =$  ..... [2]

Factorise **completely** each of the following expressions.

(a)  $5w^2 - 23w + 12$

(b)  $50c^2 - 98d^2$

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

(b) ..... [2]

4 Solve  $\frac{2}{5z-1} = -\frac{3}{4}$ .

Answer  $z =$  ..... [2]

2

[Turn Over

5 A map has a scale of 1:400 000.

- (a) Given that the actual distance between two locations  $A$  and  $B$  is 14 km, find the distance, in cm, between  $A$  and  $B$  on the map.
- (b) Given that the area of a garden on the map is  $1.5 \text{ cm}^2$ , calculate its actual area in  $\text{km}^2$ .

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

*(b)* .....  $\text{km}^2$  [2]

6 The kinetic energy,  $E$  joules, of a particular object is directly proportional to the square of its velocity  $v$  m/s. Given that  $E = 75$  joules when  $v = 2.5$  m/s, find

- (a) the equation connecting  $E$  and  $v$ ,
- (b) the value of  $v$ , in m/s, when  $E = 432$  joules.

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

(b)  $v =$  ..... m/s [2]

7 (a) Factorize  $x^2 - 9$ .

(b) Hence, find 2 factors of 2491, other than 1 and 2491.

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

(b) ..... [2]

8 4 workers can complete an assignment in 15 days. Assuming all the workers work at the same rate, find

- (a) the number of days taken by 3 workers to complete the assignment,
- (b) the number of additional workers needed if the assignment is to be completed in 10 days.

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

*(b)* ..... additional workers [2]

9 (a) Express  $\frac{1}{2x+1} + \frac{2}{3x-2}$  as a single fraction in its simplest form.

(b) Simplify  $\frac{a^3b^2c^3}{24c^4} \div \frac{a^3b}{8c}$ .

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

(b) ..... [2]

4

[Turn Over

10 Simplify each of the following expressions.

(a)  $\frac{2n^2 + 3n}{16n + 24}$ ,

(b)  $\frac{e^4 f^2 - e^3 f^3}{e^2 f^4 - e^3 f^3}$ .

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

(b) ..... [2]

11 Solve  $(x+3)(x-5) = 20$ .

Answer  $x =$  ..... [3]

12 Given that  $p = \sqrt{\frac{2-q}{3+q}}$ ,

(a) find the value of  $p$  when  $q = -\frac{5}{2}$ ,

(b) express  $q$  in terms of  $p$ .

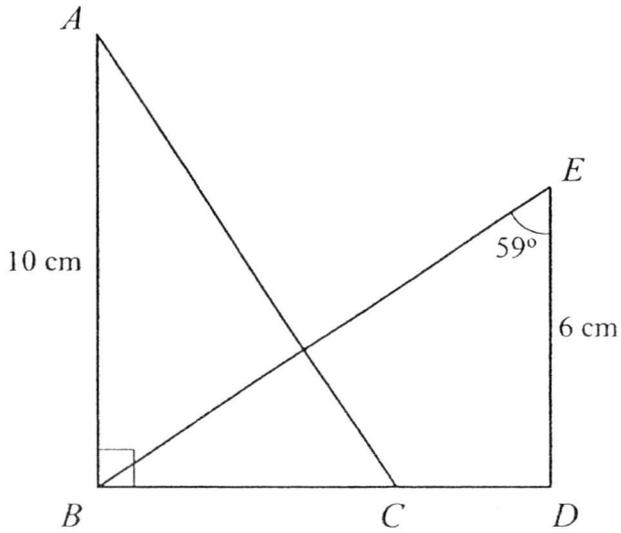
Answer (a)  $p = \dots\dots\dots$  [2]

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

- 13 In the figure below,  $\triangle ABC$  is congruent to  $\triangle BDE$ ,  
 $\angle ABC = 90^\circ$ ,  $\angle BED = 50^\circ$ ,  $AB = 10$  cm and  $DE = 6$  cm.

Find

- (a)  $\angle BAC$ ,  
 (b) the length of  $CD$ .



Answer (a)  $\angle BAC = \dots\dots\dots$  [2]

(b)  $CD = \dots\dots\dots$  cm [2]

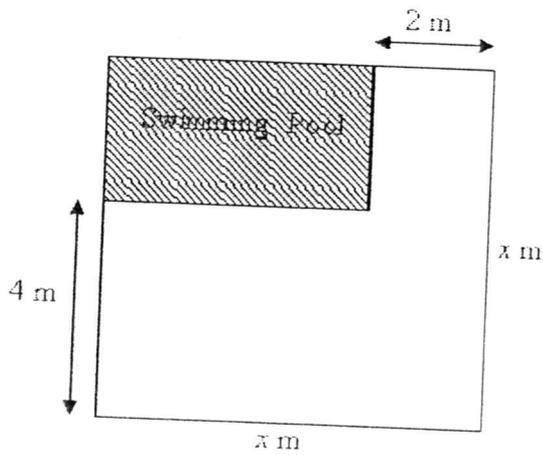
14 Ahmad decided to build a swimming pool in his house on a square plot of land of side  $x$  metres.

(a) Write down an expression, in terms of  $x$ , for the area of the swimming pool.

(b) The area of the swimming pool was found to be  $80 \text{ m}^2$ .

Show that  $x^2 - 6x - 72 = 0$ .

(c) Hence, find the value of  $x$ .



Answer (a) Area = .....  $\text{m}^2$  [1]

(b) Answer to be shown above [1]

(c)  $x =$  ..... [2]

End of Paper

6

## ANSWER KEY

1. a) $2a^2 + 3a - 9$ b) $-64x^4$	2. a) $p = -\frac{3}{2}$ or 5 b) $x = 0$ or 7	3. a) $(5w-3)(w-4)$ b) $2(5c+7d)(5c-7d)$
4. $z = -\frac{1}{3}$	5. a) 3.5 cm b) $24 \text{ km}^2$	6. a) $E = 12v^2$ b) $v = \pm 6$
7. a) $(x+3)(x-3)$ b) 47 and 53	8. a) 20 days b) 2 additional workers	9. a) $\frac{7x}{(2x+1)(3x-2)}$ b) $\frac{b}{3}$
10. a) $\frac{n}{8}$ b) $-\frac{e}{f}$	11. $x = 7$ or $-5$	12. a) 3 b) $\frac{2-3p^2}{p^2+1}$
13. a) $31^\circ$ b) 4 cm	14. a) $(x-2)(x-4)$ c) 12	



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Marking  
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Answer all questions.

1 (a) Expand and simplify  $(a+3)(2a-3)$

(b) Simplify  $(-4x^2)(4x)^2$

(a)  $(a+3)(2a-3) = 2a^2 - 3a + 6a - 9$   
 $= 2a^2 + 3a - 9$  [B1]

(b)  $(-4x^2)(4x)^2 = (-4x^2)(16x^2)$  [M1]  
 $= -64x^4$  [A1]

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

(b) ..... [2]

2 Solve each of the following equations.

(a)  $(2p+3)(p-5) = 0$

(b)  $x^2 = 7x$

(a)  $(2p+3)(p-5) = 0$   
 $2p+3 = 0$  OR  $p-5 = 0$   
 $p = -\frac{3}{2}$   $p = 5$  [B1]

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

Answer (a)  $p =$  ..... [1]

(b)  $x =$  ..... [2]

Factorise **completely** each of the following expressions.

(a)  $5w^2 - 23w + 12$

(b)  $50c^2 - 98d^2$

(a)  $5w^2 - 23w + 12 = (5w - 3)(w - 4)$  [B1]

(b)  $50c^2 - 98d^2 = 2(25c^2 - 49d^2)$  [M1]  
 $= 2(5c + 7d)(5c - 7d)$  [A1]

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

(b) ..... [2]

4 Solve  $\frac{2}{5z-1} = -\frac{3}{4}$

$\frac{2}{5z-1} = -\frac{3}{4}$   
 $15z - 3 = -8$  [M1]  
 $15z = -5$

$z = -\frac{1}{3}$  [A1]

Answer  $z =$  ..... [2]

5 A map has a scale of 1:400 000.

- (a) Given that the distance between two locations  $A$  and  $B$  is 14 km, find the distance, in cm, between  $A$  and  $B$  on the map.
- (b) Given that the area of a garden on the map is  $1.5 \text{ cm}^2$ , calculate its actual area in  $\text{km}^2$ .

(a) Map scale = 1 cm : 400 000 cm  
= 1 cm : 4 km  
=  $\frac{1}{4}$  cm : 1 km

$$\begin{aligned} \text{Distance on map} &= 14 \times \frac{1}{4} && \text{[M1]} \\ &= 3.5 \text{ cm} && \text{[A1]} \end{aligned}$$

(b) Map scale = 1 cm : 4 km  
Area scale =  $1 \text{ cm}^2$  :  $16 \text{ km}^2$

$$\begin{aligned} \text{Actual area} &= 1.5 \times 16 && \text{[M1]} \\ &= 24 \text{ km}^2 && \text{[A1]} \end{aligned}$$

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

(b) .....  $\text{km}^2$  [2]

6 The kinetic energy,  $E$  joules, of a particular object is directly proportional to the square of its velocity  $v$  m/s. Given that  $E = 75$  joules when  $v = 2.5$  m/s, find

- (a) the equation connecting  $E$  and  $v$ ,
- (b) the value of  $v$ , in m/s, when  $E = 432$  joules.

$$E = kv^2$$

When  $E = 75$ ,  $v = 2.5$ ,

(a)  $75 = k(2.5)^2$  [M1]

$$k = 12$$

$$\therefore E = 12v^2$$
 [A1]

$$432 = 12v^2$$
 [M1]

(b)  $v^2 = 36$

$$v = 6$$
 [A1]

Accept  $v = -6$  as well, as it is not obvious to the students whether  $v$  can be positive or negative.

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

(b)  $v =$  ..... m/s [2]

7 (a) Factorize  $x^2 - 9$ .

(b) Hence, find 2 factors of 2491, other than 1 and 2491.

(a)  $x^2 - 9 = (x+3)(x-3)$  [B1]

$$2491 = 2500 - 9$$
 [M1]

$$= 50^2 - 3^2$$

(b)  $= (50 - 3)(50 + 3)$

$$= (47)(53)$$

$\therefore$  the other 2 factors are 47 and 53. [A1]

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

(b) ..... [2]

8 4 workers can complete an assignment in 15 days. Assuming all the workers work at the same rate, find

- (a) the number of days taken by 3 workers to complete the assignment,  
 (b) the number of additional workers needed if the assignment is to be completed in 10 instead of 15 days.

(a)	Workers	Days	
	4	15	
	1	$15 \times 4 = 60$	[M1]
	3	$60 \div 3 = 20$	[A1]

(b)	Workers	Days	
	$3 \times 2 = 6$	$20 \div 2 = 10$	[M1]
	$\therefore (6-4) = 2$ extra workers are needed.		[A1]

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

(b) ..... [2]

9 (a) Express  $\frac{1}{2x+1} + \frac{2}{3x-2}$  as a single fraction in its simplest form.

(b) Simplify  $\frac{a^3b^2c^3}{24c^4} \div \frac{a^3b}{8c}$

$$\frac{1}{2x+1} + \frac{2}{3x-2} = \frac{(3x-2)}{(2x+1)(3x-2)} + \frac{2(2x+1)}{(2x+1)(3x-2)} \quad \text{[M1]}$$

$$\begin{aligned} \text{(a)} \quad &= \frac{3x-2+4x+2}{(2x+1)(3x-2)} \\ &= \frac{7x}{(2x+1)(3x-2)} \quad \text{[A1]} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \frac{a^3b^2c^3}{24c^4} \div \frac{a^3b}{8c} &= \frac{a^3b^2c^3}{24c^4} \times \frac{8c}{a^3b} \quad \text{[M1]} \\ &= \frac{b}{3} \quad \text{[A1]} \end{aligned}$$

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

(b) ..... [2]

10 Simplify each of the following expressions.

(a)  $\frac{2n^2 + 3n}{16n + 24}$

(b)  $\frac{e^4 f^2 - e^3 f^3}{e^2 f^4 - e^3 f^3}$

(a)  $\frac{2n^2 + 3n}{16n + 24} = \frac{n(2n + 3)}{8(2n + 3)}$  [M1]

$= \frac{n}{8}$  [A1]

$\frac{e^4 f^2 - e^3 f^3}{e^2 f^4 - e^3 f^3} = \frac{e^3 f^2 (e - f)}{e^2 f^3 (f - e)}$  [M1]

(b)  $= -\frac{e(e - f)}{f(e - f)}$   
 $= -\frac{e}{f}$  [A1]

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

(b) ..... [2]

11 Solve  $(x + 3)(x - 5) = 20$ .

$(x + 3)(x - 5) = 20$

$x^2 - 2x - 15 = 20$  [M1]

$x^2 - 2x - 35 = 0$

$(x - 7)(x + 5) = 0$  [M1]

$x = 7$  or  $-5$  [A1]

Answer  $x =$  ..... [3]

12 Given that  $p = \sqrt{\frac{2-q}{3+q}}$ ,

(a) find the value of  $p$  when  $q = -\frac{5}{2}$ ,

(b) express  $q$  in terms of  $p$ .

$$p = \sqrt{\frac{2 - \left(-\frac{5}{2}\right)}{3 + \left(-\frac{5}{2}\right)}}$$

(a)  $= \sqrt{\frac{\frac{9}{2}}{\frac{1}{2}}}$  [M1]

$= 3$  [A1]

$$p = \sqrt{\frac{2-q}{3+q}}$$

$$p^2 = \frac{2-q}{3+q}$$
 [M1]

$$p^2(3+q) = 2-q$$

(b)  $3p^2 + p^2q = 2 - q$

$$p^2q + q = 2 - 3p^2$$
 [M1]

$$q(p^2 + 1) = 2 - 3p^2$$

$$q = \frac{2 - 3p^2}{p^2 + 1}$$
 [A1]

Answer (a)  $p = \dots\dots\dots$  [2]

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

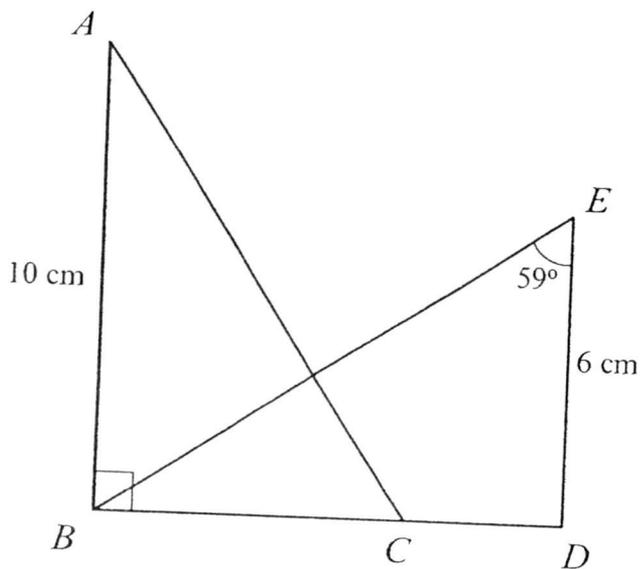
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$\angle ABC = 90^\circ$ ,  $\angle BED = 50^\circ$ ,  $AB = 10$  cm and

$DE = 6$  cm.

Find

- (a)  $\angle BAC$ ,  
(b) the length of  $CD$ .



(a)  $\angle DBE = 180^\circ - 90^\circ - 59^\circ$  ( $\angle$  sum of  $\Delta$ )  
 $= 31^\circ$

[M1]

$\angle BAC = \angle DBE = 31^\circ$

[A1]

(b)  $\triangle ABC$  is congruent to  $\triangle BDE$  (given).

$BD = AB = 10$  cm

$BC = DE = 6$  cm

[M1]

$CD = BD - BC$

$= 10 - 6$

$= 4$  cm

[A1]

Answer (a)  $\angle BAC = \dots\dots\dots$  [2]

(b)  $CD = \dots\dots\dots$  cm [2]

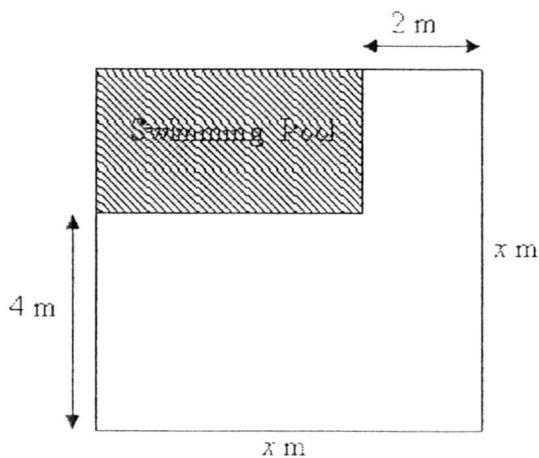
14 Ahmad decided to build a swimming pool in his house on a square plot of land of side  $x$  metres.

(a) Write down an expression, in terms of  $x$ , for the area of the swimming pool.

(b) The area of the swimming pool was found to be  $80 \text{ m}^2$ .

Show that  $x^2 - 6x - 72 = 0$ .

(c) Hence, find the value of  $x$ .



(a) 
$$\begin{aligned} \text{Area} &= (x-2)(x-4) \\ &= x^2 - 6x + 8 \end{aligned} \quad [\text{B1}]$$

(b) 
$$\begin{aligned} x^2 - 6x + 8 &= 80 \\ x^2 - 6x - 72 &= 0 \end{aligned} \quad [\text{B1}]$$

(c) 
$$\begin{aligned} x^2 - 6x - 72 &= 0 \\ (x-12)(x+6) &= 0 && [\text{M1}] \\ x &= 12 \text{ or } -6 \text{ (reject)} \\ &= 12 && [\text{A1}] \end{aligned}$$

Note: Award 1 Answer mark only if they reject  $x = -6$

Answer (a) Area = .....  $\text{m}^2$  [1]

(b) Answer to be shown above [1]

(c)  $x =$  ..... [2]

End of Paper





BEATTY SECONDARY SCHOOL  
MID-YEAR EXAMINATION 2015

SUBJECT : Mathematics

LEVEL : Sec 2 Express

PAPER : 2

DURATION : 1 hour 30 minutes

SETTER : Mrs Samsol

DATE : 18 May 2015

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

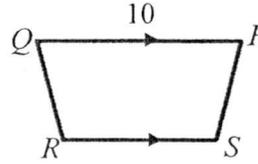
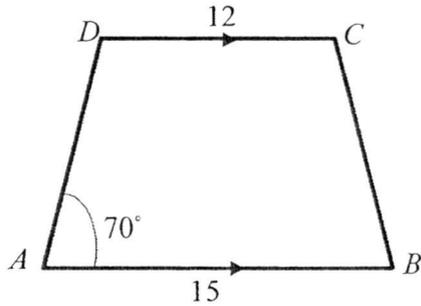
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---

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- 1 Trapezium  $ABCD$  is similar trapezium  $PQRS$ .  
 Given that  $AB = 15$  cm,  $DC = 12$  cm,  $PQ = 10$  cm and  $\angle DAB = 70^\circ$ .



- (a) Identify the side in trapezium  $ABCD$  that corresponds to the side  $QR$  in trapezium  $PQRS$ . [1]
- (b) Find
- (i)  $\angle PSR$ , [1]
- (ii) the length of  $RS$ . [2]
- 
- 2 A park has an area of  $6.4 \text{ km}^2$ . It is represented by an area of  $0.4 \text{ cm}^2$  on map A.
- (a) Find the scale of the map in the form  $1 : n$ . [2]
- (b) The length of a road on map A is 11 cm. Find its actual length in km. [1]
- (c) Find the area, in  $\text{cm}^2$ , of the park drawn on map B whose scale is  $1 : 50\,000$ . [2]
- 
- 3 (a) Car A travels at a speed of  $(4u^2 + 3u)$  km/h for 2.5 hours.  
 Car B travels at a speed of  $(u^2 + 6u - 1)$  km/h for 2 hours.  
 Find an expression in terms of  $u$ , for the total distance travelled by cars A and B.  
 Simplify your answer. [3]
- (b) Given the formula  $P = \frac{5b - a}{2a + 1}$ , make  $a$  the subject. [3]
-

4 (a) It is given that  $x = 3$  is a root of the equation  $5x^2 + kx - 6 = 0$ , where  $k$  is a constant.  
 (i) Find the value of  $k$ . [2]

(ii) Find the other root of the equation. [2]

(b) Express  $\frac{x-1}{x^2-x-6} - \frac{2}{x+2}$  as a single fraction. [3]

---

5 (a) Factorise fully

(i)  $36x^2 - 16$ , [2]

(ii)  $2pq - 8p - 20 + 5q$ . [2]

(b) Given that  $a^2 - b^2 = 24$  and  $a + b = 8$ , find the value of  $3a - 3b$ . [3]

---

6 (a) It is given that  $A$  is directly proportional to the cube of  $r$ .  
 Describe the change in the value of  $A$  when the value of  $r$  is doubled.  
 Show working to support your answer. [2]

(b)  $d$  is inversely proportional to  $x^n$ . The table below shows some values of  $x$  and the corresponding values of  $d$ .

$x$	1	2	5
$d$	40	10	$a$

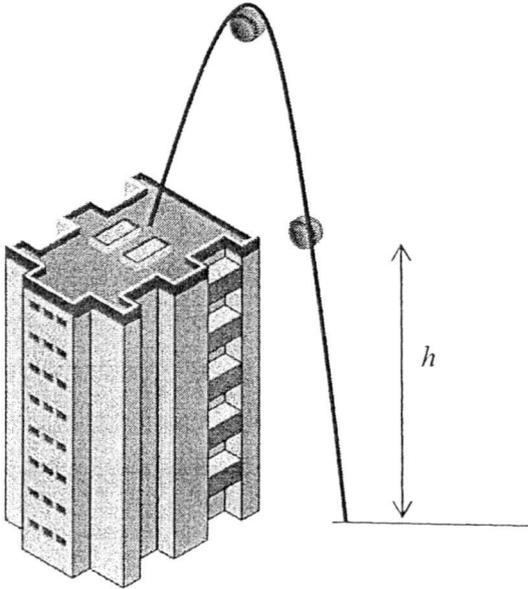
Find the value of  $n$  and of  $a$ . [3]

---

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

A ball is thrown from the top of a building.

Its vertical height  $h$ , in metres, above the ground at time  $t$  seconds during the flight is represented by the equation  $h = 20 + 5t - t^2$ .



Some corresponding values of  $t$  and  $h$  are given in the following table.

$t$	0	1	2	3	4	5	6	7
$h$	20	24	26	$p$	24	20	14	6

(a) Calculate the value of  $p$ . [1]

(b) Using a scale of 2 cm to represent 1 second, draw a horizontal  $t$ -axis for  $0 \leq t \leq 8$ .

Using a scale of 1 cm to represent 2 m, draw a vertical  $h$ -axis for  $0 \leq h \leq 30$ .

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

(c) Use your graph to estimate

(i) the maximum height of the ball from the ground, [1]

(ii) the time when the ball is 18 m above the ground. [1]

(d) Explain how you can use your graph to estimate the time when the ball hits the ground. [1]

(e) State the equation of the line of symmetry of the curve. [1]

8 (a) Expand and simplify  $3\left(\frac{1}{2}x + 5\right)^2 - 2\left(\frac{1}{3}x - 2\right)$ . [3]

(b) Simplify

(i)  $\frac{5a^3b}{9b^2c} \div \frac{10a}{3b}$ , [2]

(ii)  $\frac{2pq + 3q}{q^2} \times \frac{2p^2 - p - 3}{4p^2 - 9}$ . [3]

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~ End of Paper ~

Answer Key

1(a) BC

1(b)(i)  $110^\circ$  (ii) 8 cm2(a) 1 : 400 000 (b) 44 km (c)  $25.6 \text{ cm}^2$ 3(a)  $(12u^2 + 19.5u - 2) \text{ km}$  (b)  $a = \frac{5b - P}{2P + 1}$ 4(a)(i)  $k = -13$  (ii)  $x = -\frac{2}{5}$ (b)  $\frac{5 - x}{(x - 3)(x + 2)}$ 5(a)(i)  $4(3x + 2)(3x - 2)$  (ii)  $(q - 4)(2p + 5)$ 

(b) 9

6(a)  $A$  increases by 8 times of the original value.

(b) 1.6

7(a) 26 (c)(i) 26.1 to 26.3 (ii) 5.3 to 5.5 (d) 7.5 to 7.7 (e)  $x = 2.5$ 8(a)  $\frac{3}{4}x^2 + \frac{43}{3}x + 79$ (b)(i)  $\frac{a^2}{6c}$ (ii)  $\frac{p + 1}{q}$

Mark Scheme

**Deduct 1 mark overall for no units given for 1(b)(i), 3(a) , 7(c)(i),7(c)(ii)**

No	Workings	Marks	Remarks
1(a)	BC	B1	B0 if CB is given
1(b)(i)	$\angle PSR = \angle ADC = 180^\circ - 70^\circ \text{ int } \angle s)$ $= 110^\circ$	B1	<b>B0 if sum of quad is used.</b> <b>B0 if incorrect corresponding angle is stated even if answer given is <math>110^\circ</math></b>
1(b)(ii)	$\frac{RS}{CD} = \frac{PQ}{AB}$ $\frac{RS}{12} = \frac{10}{15}$ $RS = \frac{10}{15} \times 12$ $= 8 \text{ cm}$	M1  A1	
2(a)	$0.4 \text{ cm}^2 : 6.4 \text{ km}^2$ $1 \text{ cm}^2 : 16 \text{ km}^2$ $1 \text{ cm} : 4 \text{ km}$ $1 \text{ cm} : 400\,000 \text{ cm}$ $1 : 400\,000$	M1  A1	
2(b)	Actual length = $11 \times 4$ = 44 km	B1	B0 if no units or wrong units
2(c)	Map B : $1 \text{ cm} : 50\,000 \text{ cm}$ $1 \text{ cm} : 0.5 \text{ km}$ $1 \text{ cm}^2 : 0.25 \text{ km}^2$ Map area = $\frac{6.4}{0.25}$ $= 25.6 \text{ cm}^2$	M1  A1	A0 if no units or wrong units

3(a)	Total distance $= 2.5(4u^2 + 3u) + 2(u^2 + 6u - 1)$  $= 10u^2 + 7.5u + 2u^2 + 12u - 2$  $= (12u^2 + 19.5u - 2) \text{ km}$	M1  M1  A1	
3(b)	$P = \frac{5b - a}{2a + 1}$  $P(2a + 1) = 5b - a$ $2aP + P = 5b - a$ $2aP + a = 5b - P$ $a(2P + 1) = 5b - P$ $a = \frac{5b - P}{2P + 1}$	M1  M1 (factorisation)  A1	
4(a)(i)	$5(3)^2 + 3k - 6 = 0$ $3k = -39$ $k = -13$	M1  A1	
4(a)(ii)	$5x^2 - 13x - 6 = 0$ $(5x + 2)(x - 3) = 0$  $x = -\frac{2}{5} \text{ or } x = 3 \text{ (reject)}$	M1  A1	If $k = 13$ , give M1√ for correct factorisation
4(b)	$\frac{x-1}{x^2-x-6} - \frac{2}{x+2}$ $= \frac{x-1}{(x-3)(x+2)} - \frac{2}{x+2}$ $= \frac{x-1-2(x-3)}{(x-3)(x+2)}$ $= \frac{x-1-2x+6}{(x-3)(x+2)}$  $= \frac{5-x}{(x-3)(x+2)}$	M1 (factorise)  M1 (Correct expansion)  A1	

5(a)(i)	$36x^2 - 16$ $= 4(9x^2 - 4)$ $= 4(3x+2)(3x-2)$	M1 A1	
5(a)(ii)	$2pq - 8p - 20 + 5q$ $= 2p(q-4) - 5(4-q)$ $= 2p(q-4) + 5(q-4)$ $= (q-4)(2p+5)$	M1  A1	Rearranging may be done at the first step : $2pq - 8p + 5q - 20$ $= 2p(q-4) + 5(q-4)$ M1 Give M0 if $2p(q-4)[-5(4-q)]$ is seen
5(b)	$a^2 - b^2 = 24$ $(a+b)(a-b) = 24$ $8(a-b) = 24$ $a-b = 3$ $3a-3b = 3(a-b)$ $= 3(3)$ $= 9$	M1  M1  A1	
6(a)	Let $A = k r^3$ $A = k (2r)^3$ $A = 8kr^3$  $A$ is 8 times of the original value. or $A$ increases by 700% or increases by 7 times .	M1  A1	
6(b)	Let $d = d = \frac{k}{x^n}$ $40 = \frac{k}{1}$ $k = 40$ Sub $x = 2$ and $d = 10$ $10 = \frac{40}{2^n}$ $2^n = 4 = 2^2$ $n = 2$ $a = \frac{40}{5^2} = \frac{8}{5}$ or 1.6	B1  B1  B1	

7(a)	$p = 26$	B1	
7(b)	Refer to graph	G1:Correct scale and <b>correct label of both axes</b> G1:All points plotted correctly G1:Smooth curve	
7(c)(i)	26.25 m ( Accept 26.1 to 26.5)	B1	
7(c)(ii)	5.4 s (Accept 5.3 to 5.5)	B1	
7(d)	Extend the graph until it meets the t-axis. The t-value is the time required.	B1	
7(e)	$t = 2.5$	B1	
8(a)	$3\left(\frac{1}{2}x + 5\right)^2 - 2\left(\frac{1}{3}x - 2\right)$ $= 3\left(\frac{1}{4}x^2 + 5x + 25\right) - \frac{2}{3}x + 4$ $= \frac{3}{4}x^2 + 15x + 75 - \frac{2}{3}x + 4$ $= \frac{3}{4}x^2 + \frac{43}{3}x + 79$	M1  M1  A1	
8(b)(i)	$\frac{5a^3b}{9b^2c} \div \frac{10a}{3b}$ $= \frac{5a^3b}{9b^2c} \times \frac{3b}{10a}$ $= \frac{a^2}{6c}$	M1  A1	
8(b)(ii)	$\frac{2pq + 3q}{q^2} \times \frac{2p^2 - p - 3}{4p^2 - 9}$ $= \frac{q(2p + 3)}{q^2} \times \frac{(2p - 3)(p + 1)}{(2p + 3)(2p - 3)}$ $= \frac{p + 1}{q}$	M1 (factorization of numerator) M1 (factorization of numerator)  A1	

1. Express 112% as  
 (a) a decimal,  
 (b) a mixed number in the lowest term,  
 (c) an improper fraction in the lowest term.

Answer (a) \_\_\_\_\_ [ 1 ]  
 (b) \_\_\_\_\_ [ 1 ]  
 (c) \_\_\_\_\_ [ 1 ]

2. Solve the equation  $\frac{x+3}{4} = \frac{2x-3}{5}$ .

Answer  $x =$  \_\_\_\_\_ [ 2 ]

3. Consider the pattern

$$\begin{aligned}
 1^2 - 0^2 &= 1 \\
 2^2 - 1^2 &= 3 \\
 3^2 - 2^2 &= 5 \\
 4^2 - 3^2 &= 7 \\
 &\vdots \\
 &\vdots \\
 &\vdots \\
 x^2 - y^2 &= 101 \\
 &\vdots \\
 &\vdots \\
 &\vdots
 \end{aligned}$$

- (a) Write down the seventh line in the pattern.  
 (b) Find the integer values of  $x$  and  $y$  which satisfy the equation  $x^2 - y^2 = 101$ .

Answer (a) \_\_\_\_\_ [ 1 ]  
 (b)  $x =$  \_\_\_\_\_,  $y =$  \_\_\_\_\_ [ 2 ]

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4. (a) Round off the following numbers correct to 3 significant figures.  
 (i) 1.998  
 (ii) 3.002
- (b) Hence, estimate the value of  $\frac{1.998 \times 3.002}{\sqrt[3]{217}}$ .

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

(ii) \_\_\_\_\_ [ 1 ]

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

5. A map is drawn to a scale of 1 : 250 000. A city covers an area of  $700 \text{ km}^2$ . Find, in  $\text{cm}^2$ , the area representing the city on the map.

Answer \_\_\_\_\_  $\text{cm}^2$  [ 2 ]

6. Simplify  $\frac{20n^3}{3m^3} \times \frac{6m^2n}{25n^4}$ , giving your answer in the lowest terms.

Answer \_\_\_\_\_ [ 2 ]

7. 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) \_\_\_\_\_ [ 2 ]

- (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  $22.5 \text{ cm}^3$  of air is pumped.

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

8. Express  $\frac{3}{x+1} - \frac{2}{3x+2}$  as a single fraction in its simplest form

Answer \_\_\_\_\_ [ 2 ]

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9. Given that  $A = \frac{1}{2}h(a + b)$ ,
- (a) find the value of  $A$  when  $h = 4$ ,  $a = 5$  and  $b = 7$ ,
- (b) express  $h$  in terms of  $A$ ,  $a$  and  $b$ .

Answer (a)  $A =$  \_\_\_\_\_ [ 1 ]

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

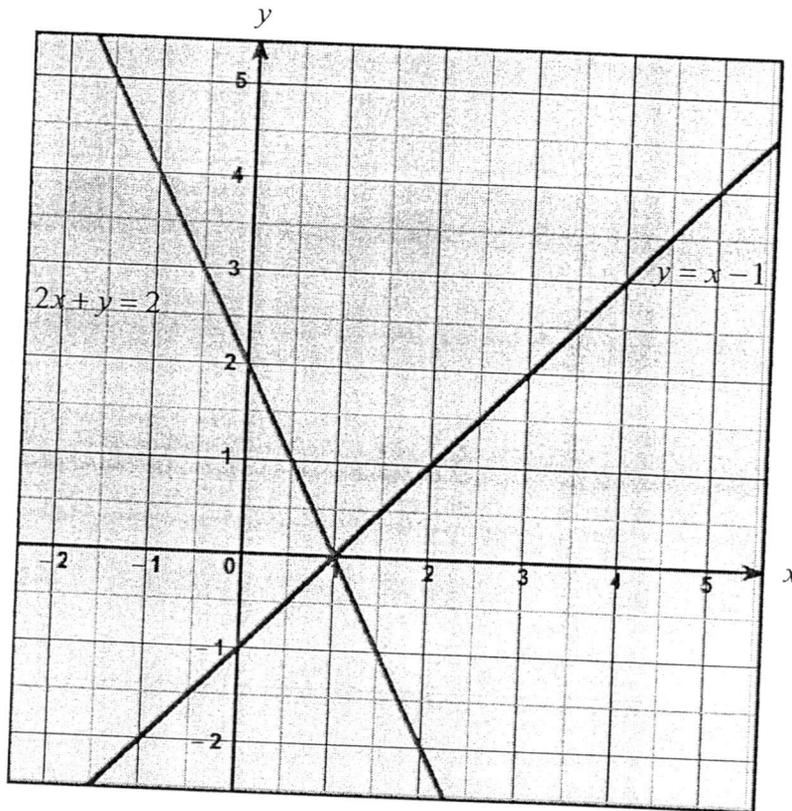
10. (a) Factorize  $w^2 - 13w + 36$ .
- (b) (i) Factorize  $u^2 - v^2$ .
- (ii) Given that  $u - v = 8$  and  $u^2 - v^2 = 28$ , find the value of  $u + v$ .

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

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

(ii) \_\_\_\_\_ [ 2 ]

11. 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)  $x = \underline{\hspace{1cm}}$ ,  $y = \underline{\hspace{1cm}}$  [ 2 ]

- (b) On the same grid above, draw and label clearly the line  $y = 2$ . [ 1 ]

- (c) Find the area of the polygon enclosed by the 3 lines,  $y = x - 1$ ,  $2x + y = 2$  and  $y = 2$ . Leave your answer in square units.

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

12. Solve  $2x + y = 5$  and  
 $x + 2y = 7$ .

Answer  $x = \underline{\hspace{1cm}}$ ,  $y = \underline{\hspace{1cm}}$  [ 3 ]

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13. Solve the following equations.

(a)  $(x - 5)^2 = 100$

(b)  $y^2 + 3y - 700 = 0$

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

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

14. If 5 men take 6 days to complete a task,

(a) how many days would 3 men take,

(b) how many men would be needed to complete the task in 2 days?

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

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

15. Expand and simplify

(a)  $(2a + 3)^2 + 4a(1 - a)$

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

(b)  $\left(\frac{x^2}{3} - 3\right)^2$

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

(c)  $(2y - 1)^2 - (3y + 1)(4y - 1)$

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

End of paper

## Answer key

1a.	1.12
1b.	$1\frac{3}{25}$
1c.	$\frac{28}{25}$
2.	9
3a.	$7^2 - 6^2 = 13$
3b.	$x = 51, y = 50$
4a.	(i) 2.00 (ii) 3.00
4b.	1
5.	$112 \text{ cm}^2$
6.	$\frac{8}{5m}$
7a.	$V = \frac{180}{\sqrt[3]{P}}$
7b.	$30 \text{ cm}^3$
7c.	512 units
8.	$\frac{7x+4}{(x+1)(3x+2)}$
9a.	24
9b.	$h = \frac{2A}{a+b}$
10a.	$(w-4)(w-9)$
10b.	(i) $(u-v)(u+v)$ (ii) 3.5
11a.	$x = 1, y = 0$

11c.	$3 \text{ units}^2$
12.	$x = 1, y = 3$
13a.	$x = 15 \text{ or } -5$
13b.	$y = 25 \text{ or } -28$
14a.	10
14b.	15
15a.	$16a + 9$
15b.	$\frac{x^4}{9} - 2x^2 + 9$
15c.	$-8y^2 - 5y + 2$

Calculator Model :

Class

Full Name

Index Number



# MID YEAR EXAMINATION 2015



4016/02

## MATHEMATICS

### Paper 2

Secondary 2 Express  
14<sup>th</sup> May 2015

1 hour 15 min

Additional Materials: Writing Papers  
Graph Paper (1 sheet)

### READ THESE INSTRUCTIONS FIRST

Write your register number, class 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.

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.

**DO NOT OPEN THIS PAPER UNTIL YOU ARE TOLD TO DO SO**

For Examiner's Use
50

Setter: Mrs Iszal

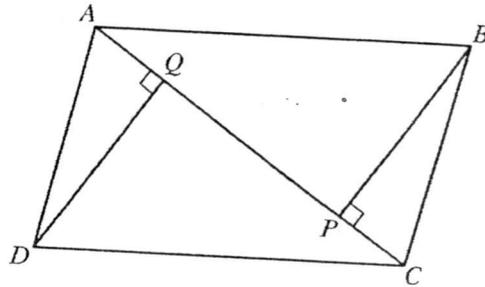
This document consists of 4 printed pages, including this cover page.

## ANSWER ALL QUESTIONS

- 1 The scale of a map is 1 : 50 000.
- (a) This scale can be written in the form 1 cm :  $h$  km. Find  $h$ . [1]
- (b) The distance between two railway stations is 8 cm on the map.  
Find, in kilometers, the actual distance between the stations. [1]
- 2 Factorise each of the following completely.
- (a)  $w^3 - w^2 - wz^2 + z^2$ , [2]
- (b)  $4x^3 - 25xy^2$ . [2]
- 3 Solve the simultaneous equations
- $$x = 1 - 2y$$
- $$3x - 4y = -7$$
- [3]
- 4 (a) If  $x + y = 9$  and  $xy = -27$ , calculate the value of  $\frac{1}{x} + \frac{1}{y}$ . [2]
- (b) Given that  $r = 2\pi\sqrt{\frac{K}{w}}$ , express  $w$  in terms of  $r$ ,  $h$ ,  $\pi$  and  $K$ . [2]
- 5 (a) Expand  $(x^3 - x^2 + 4)(-x + 4)$ . [2]
- (b) It is given that  $x = 9$  is a root of the equation  $x^2 - kx - 63 = 0$ , where  $k$  is a constant. Find
- (i) the value of  $k$ . [2]
- (ii) the other root of the equation. [1]
- 6  $y$  is directly proportional to  $x^2$ . Given that  $y = 144$  when  $x = 4$ , find
- (a) an expression for  $y$  in terms of  $x$ , [2]
- (b) the value(s) of  $x$  when  $y = 2025$ , [1]
- (c) the percentage increase or decrease in the value of  $y$  when  $x$  is doubled. [2]

7 In the diagram, ABCD is a parallelogram. The points P and Q lie on the diagonal AC such that  $\angle DQA = \angle BPC = 90^\circ$ ,  $BP = DQ = 6$  cm, AC is 11 cm. and  $AQ = CP = 3$  cm.

- (a) State two pairs of congruent triangles. [1]
- (b) If  $\angle ADQ = 26.6^\circ$ , find  $\angle BCP$ . [1]
- (c) Find the length of QP. [1]
- (d) Find the area of ABCD. [1]



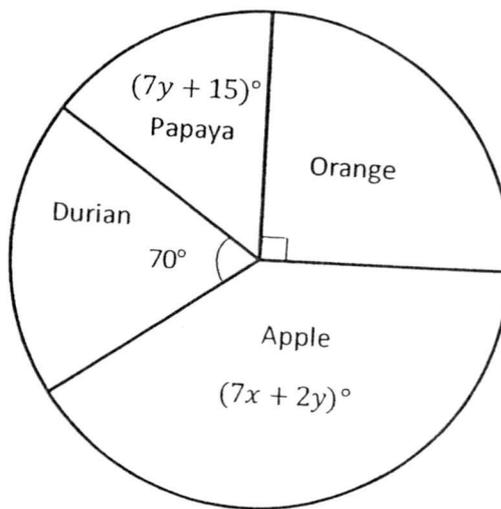
8 Simplify each of the following.

- (a)  $\frac{3}{x^2 - 6x + 8} \div 2\left(\frac{3}{x - 2}\right)$  [3]
- (b)  $\frac{2y + 2}{y^2 - 1} + \frac{5}{1 - y}$  [3]

9 In a survey, some students were asked to name their favourite fruit. The pie chart below shows the results of the survey. The number of students who chose apple is equal to the number of students who chose both papaya and orange.

- (a) form two simultaneous equations in  $x$  and  $y$ , [2]
- (b) solve the simultaneous equations. [3]

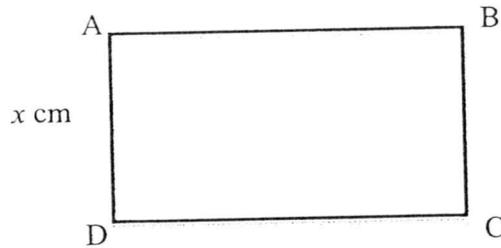
**Favourite Fruit**



24

10

The perimeter of a tennis court ABCD is 64 m. The length of AD is  $x$  m.



- (a) Express the length of AB in terms of  $x$ . [1]
- (b) If its area is  $192 \text{ m}^2$ , show that  $x^2 - 32x + 192 = 0$ . [2]
- (c) Solve the equation  $x^2 - 32x + 192 = 0$ . [2]
- (d) Find the length of DC. [1]

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

11

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

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

$x$	-4	-3	-2	-1	0	1	2	3
$y$	-21	$p$	-1	3	3	-1	-9	-21

- (a) Calculate the value of  $p$ . [1]
- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal  $x$ -axis for  $-5 \leq x \leq 4$ .  
Using a scale of 2 cm to represent 5 units, draw a vertical  $y$ -axis for  $-25 \leq y \leq 10$ .  
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (c) State the maximum point. [1]
- (d) State the equation of the line of symmetry. [1]

**END OF PAPER**

1)	(a)	$1 \text{ cm} : 50\,000 \text{ cm}$ $= 1 \text{ cm} : 0.5 \text{ km}$ $h = 0.5 \text{ ----- A1}$
	(b)	$\text{Actual distance} = 8 \times 0.5$ $= 4 \text{ km} \text{ -----A1}$
2)	(a)	$w^2 - w - wz^2 + z^2$ $= w(w-1) - z^2(w-1) \text{ ---- M1}$ $= (w - z^2)(w-1) \text{ ---- A1}$
	(b)	$4x^3 - 25xy^2$ $= x(4x^2 - 25y^2) \text{ ---- M1}$ $= x(2x - 5y)(2x + 5y) \text{ ---- A1}$
3)	(a)	$x = 1 - 2y \text{ ---- (1)}$ $3x - 4y = -7 \text{ ---- (2)}$ <p>Substitute (1) into (2),</p> $3(1 - 2y) - 4y = -7 \text{ ---- M1}$ $3 - 6y - 4y = -7$ $-10y = -10$ $y = 1 \text{ -----A1}$ <p>Substitute <math>y = 1</math> into (1),</p> $x = 1 - 2(1)$ $= -1 \text{ ---- A1}$
4	(a)	$\frac{1}{x} + \frac{1}{y} = \frac{y+x}{xy} \text{ -----M1}$ $= \frac{9}{-27}$ $= -\frac{1}{3} \text{ ---- A1}$

	(b)	$r = 2\pi\sqrt{\frac{K}{w}}$ $\frac{r}{2\pi} = \sqrt{\frac{k}{w}} \quad \text{---- } M1$ $\left(\frac{r}{2\pi}\right)^2 = \frac{k}{w}$ $w = k\left(\frac{2\pi}{r}\right)^2 \quad / \quad w = \frac{4\pi^2 k}{r^2} \quad \text{---- } A1$
5	(a)	$(x^3 + 4 - x^2)(4 - x)$ $= 4(x^3 + 4 - x^2) - x(x^3 + 4 - x^2) \quad \text{---- } M1$ $= 4x^3 + 16 - 4x^2 - x^4 - 4x + x^3$ $= -x^4 + 5x^3 - 4x^2 - 4x + 16 \quad \text{---- } A1$
	(b)	<p>(i)</p> $9^2 - 9k - 63 = 0 \quad \text{---- } M1$ $18 - 9k = 0$ $-9k = -18$ $k = 2 \quad \text{---- } A1$
		<p>(ii)</p> $x^2 - 2x - 63 = 0$ $(x - 9)(x + 7) = 0$ $x = 9 \text{ or } x = -7$ <p>The other solution is <math>x = -7</math>. ----A1</p>
6	(a)	$y = kx^2$ $144 = k(4^2)$ $16k = 144$ $k = 9 \quad \text{---- } M1$ $\therefore y = 9x^2 \quad \text{---- } A1$
	(b)	$y = 9x^2$ $2025 = 9x^2$ $x^2 = 225$ $x = \pm 15 \quad \text{---- } A1$

	(c)	$\begin{aligned} \text{New value of } y &= 9(2x)^2 \quad \text{--- M1} \\ &= 9(4x^2) \\ &= 4(9x^2) \\ &= 4y \quad \text{--- M1} \\ \text{Percentage change} &= (4y - y) \times 100\% \\ &= 300\% \quad \text{--- A1} \end{aligned}$
7)	(a)	$\begin{aligned} \triangle DAQ &\equiv \triangle BCP \\ \triangle BAC &\equiv \triangle DCA \\ \triangle ABP &\equiv \triangle CDQ \\ \text{(Any pair correct A1)} \end{aligned}$
	(b)	$\begin{aligned} \angle BCP &= 90^\circ - 26.6^\circ \\ &= 63.4^\circ \quad \text{--- A1} \end{aligned}$
	(c)	$\begin{aligned} QP &= 11 - 3 - 3 \\ &= 5 \text{ cm} \quad \text{--- A1} \end{aligned}$
	(d)	$\begin{aligned} \text{Area of } ABCD &= 2 \left( \frac{1}{2} \times 6 \times 11 \right) \\ &= 66 \text{ cm}^2 \quad \text{--- A1} \end{aligned}$
8)	(a)	$\begin{aligned} &\frac{3}{x^2 - 6x + 8} \div 2 \left( \frac{3}{x - 2} \right) \\ &= \frac{3}{(x - 4)(x - 2)} \times \frac{(x - 2)}{6} \quad \text{--- M1} \\ &= \frac{1}{2(x - 4)} \quad \text{--- A1} \end{aligned}$

8	(b)	$\frac{2y+2}{y^2-1} + \frac{5}{1-y}$ $= \frac{2y+2}{(y-1)(y+1)} - \frac{5(y+1)}{(y-1)(y+1)} \quad \text{--- M1}$ $= \frac{2y+2-5y-5}{(y-1)(y+1)}$ $= \frac{-3y-3}{(y-1)(y+1)} \quad \text{--- M1}$ $= \frac{-3(y+1)}{(y-1)(y+1)}$ $= \frac{-3}{y-1} \quad \text{--- A1}$
9	(a)	$7x + 2y + 70 + 7y + 15 + 90 = 360$ $7x + 9y = 185 \quad \text{--- A1}$ $7x + 2y - (7y + 15) = 90$ $7x - 5y = 105 \quad \text{--- A1}$
	(b)	$7x + 2y + 70 + 7y + 15 + 90 = 360$ $7x + 9y = 185 \quad \text{--- 1}$ $7x + 2y - (7y + 15) = 90$ $7x - 5y = 105 \quad \text{--- 2}$ $1 - 2, \quad (7x + 9y) - (7x - 5y) = 185 - 105$ $14y = 80$ $y = 5\frac{5}{7} \quad \text{--- A1}$ <p><i>Substitute</i> <math>y = 5\frac{5}{7}</math> into 1,</p> $7x + 9\left(5\frac{5}{7}\right) = 185$ $x = 19\frac{4}{49} \quad \text{--- A1}$ <p><i>Correct method and presentation shown, award 1 mark.</i></p>

10	(a)	$AB = DC = \frac{1}{2}(64 - 2x)$ $= 32 - x \quad \text{-----} A1$
	(b)	$x(32 - x) = 192 \text{-----} M1$ $32x - x^2 = 192$ $-x^2 + 32x = 192$ $x^2 - 32x + 192 = 0(\text{shown}) \text{---} A1$
	(c)	$x^2 - 32x + 192 = 0$ $(x - 24)(x - 8) = 0 \text{---} M1$ $x = 24 \text{ or } x = 8 \text{---} A1$
	(d)	$DC = \frac{1}{2}[64 - 2(24)]$ $= 8 \text{ m}(\text{rejected})$ $DC = \frac{1}{2}[64 - 2(8)]$ $= 24 \text{ m---} A1$
11		Graph

Class	Register No	Name
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**Bukit Merah Secondary School  
Mid-Year Examination 2015  
Secondary 2 Express**

**E**

**MATHEMATICS**

**Paper 1**

**11 May 2015**

Candidates answer on the Question Paper.

**1 hour 15 minutes**

**READ THESE INSTRUCTIONS FIRST**

Write your class, register 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 when 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.

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**.

**Calculator Model:**

**For Examiner's Use**

This document consists of **12** printed pages.

28

**|TURN OVER**

Answer **all** the questions

*For  
Examiner's  
use*

**1**

Written as a product of its prime factors,  $15750 = 2 \times 3^2 \times 5^3 \times 7$ .

- (a) Express 1800 as the product of its prime factors.
- (b) Hence write down
- (i) the Lowest Common Multiple of both 1800 and 15750,
  - (ii) the Highest Common Factor of both 1800 and 15750.

*For  
Examiner  
use*

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

(b) (i) ..... [1]

(ii) ..... [1]

[TURN OVER

2

3

Use a calculator to evaluate the following correct to the number of decimal places or significant figures required

(a)  $\frac{14.32^2 - \sqrt{25.781}}{\sqrt[3]{981}}$  [2 decimal places]

(b)  $\left(-\frac{2}{7}\right)^3 + \sqrt{7-1\frac{4}{9}} + \left(9.4 \times \frac{11}{13}\right)$  [3 significant figures]

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

(b) ..... [1]

3

Alvin's present age is 5 years less than  $\frac{1}{2}$  times the present age of Bobby.

If Bobby is  $x$  years old now, express, in terms of  $x$ , Alvin's present age.

Answer .....years old [1]

For  
Examiner's  
use

For  
Examiner  
use

4 Suppose that 4 cm on a map represents an actual distance of 6 km.

- (a) Express the scale in the form 1 :  $r$ .
- (b) If the distance between two towns on the map is 9.2 cm, find their actual distance apart in km.
- (c) The actual area of a town is 15.3 km<sup>2</sup>. Find its area on the map.

Answer (a) ..... [1]  
 (b) ..... [1]  
 (c) ..... [2]

[TURN OVER

For  
Examiner's  
use

5

It is given that  $y$  is directly proportional to  $(2x - 1)$ . When  $x = 10$ ,  $y = 15.2$ .

- (i) Find the equation connecting  $x$  and  $y$ .
- (ii) Find the value of  $y$  when  $x = 26$ .

For  
Examiner  
s use

(i) ..... [2]

(ii) ..... [1]

30 [TURN OVER

For  
Examiner's  
use

For  
Examiner  
s use

6 (a) Expand and simplify the following expressions.

(i)  $-5(2x^2 - 1) + 2x(-3 - x)$

(ii)  $(4y - 7)^2 + 6y$

(b) Factorise the following expressions completely.

(i)  $5q^2 - 23q + 12$

(ii)  $a^3 - 25ab^2$

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

(ii) ..... [2]

(b) (i) ..... [2]

(ii) ..... [2]

[TURN OVER

7 (a) Simplify each of the following.

(i)  $\frac{4c^2 - d^2}{(d - 2c)}$

(ii)  $\frac{2a}{3bc} \div \frac{4ba^2}{abc^2}$

(b) Express  $\frac{5}{6pq} + \frac{3}{4p^2}$  as a single fraction in its simplest form.

Answer (a) (i) ..... [2]  
(ii) ..... [2]  
(b) ..... [2]

For  
Examiner's  
use

8 Solve each of the following equations.

For  
Examiner  
use

(a)  $(x + 3)(3x - 8) = 0$

(b)  $5x^2 - 8x = 0$

(c)  $4x^2 - 19x + 12 = 0$

Answer (a) ..... [1]  
(b) ..... [2]  
(c) ..... [2]

[TURN OVER

For  
Examiner's  
use

9

Given the equation of the line  $3x + 4y = 10$ ,

- (a) (i) find the gradient of the line.
- (ii) find the  $y$ -intercept of the line.
- (b) Is  $(8, -3.5)$  a solution of the equation  $3x + 4y = 10$ ?  
Show your working clearly.

[1]

For  
Examiner  
use

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

32 [TURN OVER

For  
Examiner's  
use

10

Solve the simultaneous linear equations,

$$8x - 3y = 10$$

$$3x - 4y = 21$$

For  
Examiner  
use

Answer  $x = \dots\dots\dots$ ,  $y = \dots\dots\dots$  [3]

11

The scale drawing of a car is 4 cm to 0.8 m.

The length of the car on the drawing is 21 cm.

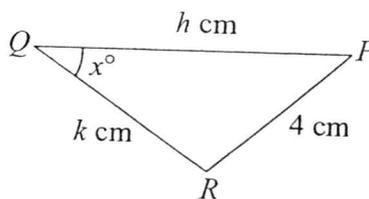
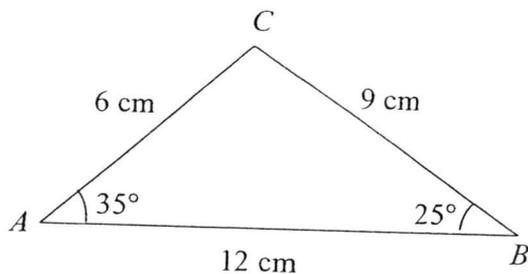
- (a) Find the actual length of the car.
- (b) If the scale of the drawing is changed to  $\frac{1}{30}$ , find the length of the car on the new drawing.

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

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

[TURN OVER

- 12 In the figure below,  $\triangle ABC$  is similar to  $\triangle PQR$ .



- (a) Given that  $\triangle PQR$  is a reduction of  $\triangle ABC$ , find the scale factor of the reduction.
- (b) Find the unknowns  $x$ ,  $h$  and  $k$ .

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

(b)  $x =$  .....

$h =$  .....

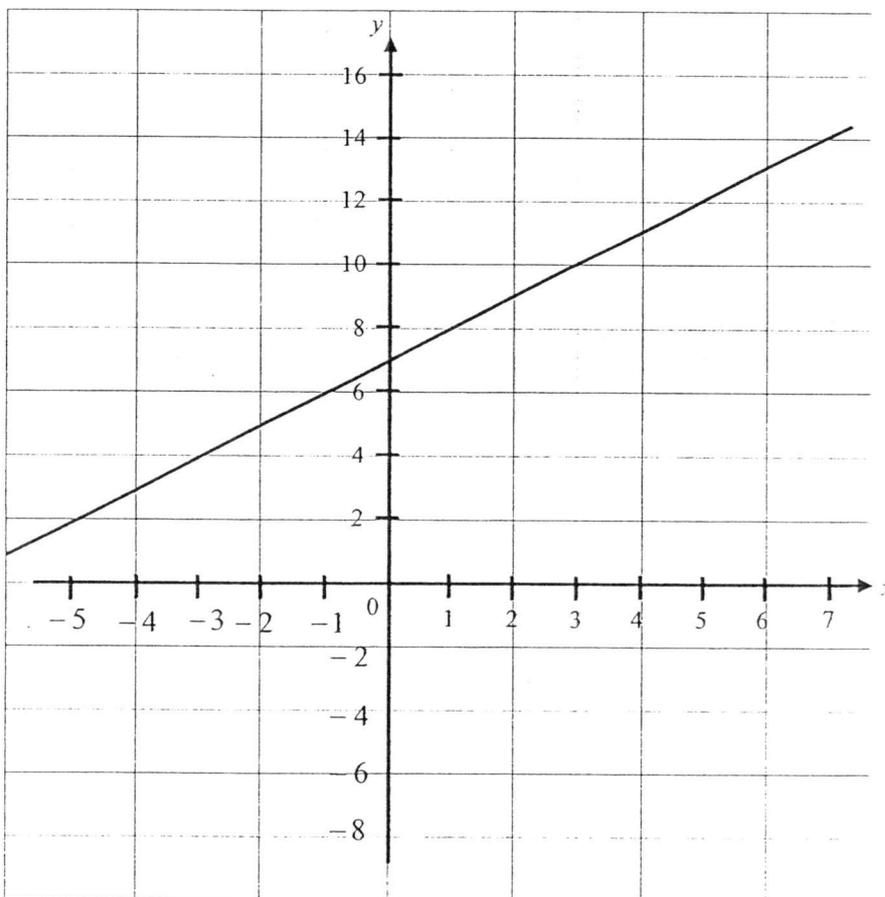
$k =$  ..... [3]

For  
Examiner's  
use

13

The graph of the straight line  $y = x + 7$  is shown in the grid below.

For  
Examiner  
s use



- (a) Complete the table of values for the equation  $y = -2x + 10$ . [1]

$x$	-2		4
$y$	14	6	2

- (b) Draw and label the graph of the straight line  $y = -2x + 10$  on the same grid above. [2]
- (c) Hence, write down the point of intersection of these two straight line graphs.

Answer (c) (....., .....)

[1]

End-of-Paper 1

**Bukit Merah Secondary School**  
**Mid Year Examination 2015**  
**Secondary 2 Express**  
**(Mathematics Paper 1) – Marking Scheme**

1	a	$2^3 \times 3^2 \times 5^2$	B1	
	b(i)	LCM = $2^3 \times 3^2 \times 5^3 \times 7$ = 63 000	B1	
	b(ii)	HCF = $2 \times 3^2 \times 5^2$ = 450	B1	
2	a	20.13 (2 d.p)	B1	
	b	10.3 (3 s.f)	B1	
3		$\left(\frac{1}{2}x - 5\right)$	B1	
4	a	1 : 150000	B1	
	b	13.8 km	B1	
	c	$1\text{cm}^2 : 2.25\text{km}^2$ $15.3 \div 2.25 = 6.8\text{cm}^2$	M1 A1	
5	(i)	$15.2 = k(19)$ $k = 0.8$ $y = 0.8(2x - 1)$	M1 A1	
	(ii)	40.8	B1	
6	a(i)	$-10x^2 + 5 - 6x - 2x^2$ $= -12x^2 - 6x + 5$	M1 A1	
	a(ii)	$(4y)^2 - 2(4y)(7) + (7)^2 + 6y$ $= 16y^2 - 56y + 49 + 6y$ $= 16y^2 - 50y + 49$	M1 A1	
	b(i)	Factorisation working $(5q - 3)(q - 4)$	M1 A1	
	b(ii)	$a(a^2 - 25b^2)$ $= a(a + 5b)(a - 5b)$	M1 A1	
7	a(i)	$\frac{(2c + d)(2c - d)}{d - 2c}$ $= \frac{(2c + d)(-(d - 2c))}{(d - 2c)}$ $= -(2c + d)$	M1 for factorisation A1	

	a(ii)	$\frac{2a}{3bc} \times \frac{abc}{4ba^2}$ $= \frac{c}{6b}$	B1 for 'c' B1 for '6b'	
	b	$\frac{5(2p)}{12p^2q} + \frac{3(3q)}{12p^2q}$ $= \frac{10p+9q}{12p^2q}$	M1 A1	
8	a	$x = -3 \text{ or } x = 2\frac{2}{3}$	B1 for both	
	b	$x(5x-8) = 0$ $x = 0 \text{ or } x = 1.6$	M1 A1 for both	
	c	$(4x-3)(x-4) = 0$ $x = \frac{3}{4} \text{ or } x = 4$	M1 A1 for both	
9	a(i)	-0.75	B1	
	a(ii)	2.5	B1	
	b	$y = -\frac{3}{4}(8) + \frac{10}{4}$ $= -3.5$	B1 must show substitution step	
10		$23x = -23$ $x = -1$ $8(-1) - 3y = 10$ $-3y = 18$ $y = -6$	M1 for correct elimination or substitution A1 A1	
11	a	$21 \times 0.2$ $= 4.2m$	M1 A1	
	b	$4.2m \div 0.3$ $= 14cm$	M1 A1	
12	a	$\frac{2}{3}$	B1	
	b	$k = 6cm$ $h = 8$ $x = 25$	B1 B1 B1	

13	a	$x = 2$		
	b	Draw a straight line with pencil, Line passes through all the points Label the line	B1	
	c	(1, 8)	B1	
			B1	

Class	Register No	Name
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**Bukit Merah Secondary School  
Mid-Year Examination 2015  
Secondary 2 Express**

**E**

**MATHEMATICS**

**Paper 2**

**14 May 2015**

Candidates answer on the Question Paper.

**1 hour 30 minutes**

**READ THESE INSTRUCTIONS FIRST**

Write your class, register 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 when 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.

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**.

**Calculator Model:**

**For Examiner's Use**

This document consists of 5 printed pages.

36

[TURN OVER

Answer **all** the questions

- 1 (a) A region of area  $3 \text{ cm}^2$  on the map is represented by its actual area of  $48 \text{ km}^2$ .  
Find the scale of the map in the form  $\frac{1}{r}$ . [3]

- (b) The following table shows some corresponding values of two quantities,  $c$  and  $d$ .

$c$	2	4	8
$d$	20	5	1.25

- (i) Is  $d$  inversely proportional to  $c^2$ ? Show all working clearly. [1]
- (ii) Hence, find the equation connecting  $d$  and  $c$ . [1]
- (iii) Find the value of  $d$  when  $c = -\frac{1}{2}$ . [1]
- (iv) Find the change in the value of  $d$  when the value of  $c$  is multiplied by 4. [2]

- 2 A list of numbers is shown below.

$$\sqrt{12.25}, \quad -1\frac{5}{12}, \quad \sqrt[3]{125}, \quad 3.\dot{5}, \quad -1.42, \quad \sqrt{5}$$

- (a) From the list, write down the
- (i) prime number (s), [1]
- (ii) irrational numbers (s). [1]
- (b) Write down the numbers in ascending order. [2]

- 3 (a) Expand and simplify  $(x - 6y)(2x + y)$ . [2]
- (b) Factorise the following expressions completely.
- (i)  $24p^2 - 8pq$  [1]
- (ii)  $2x^3 - 72x$  [2]
- (iii)  $20ac - 12bc - 15bd + 25ad$  [2]
- (c) Given that  $x^2 + y^2 = 19$  and  $xy = -6$ , find the value of  $(x - y)^2$ . [2]

[TURN OVER

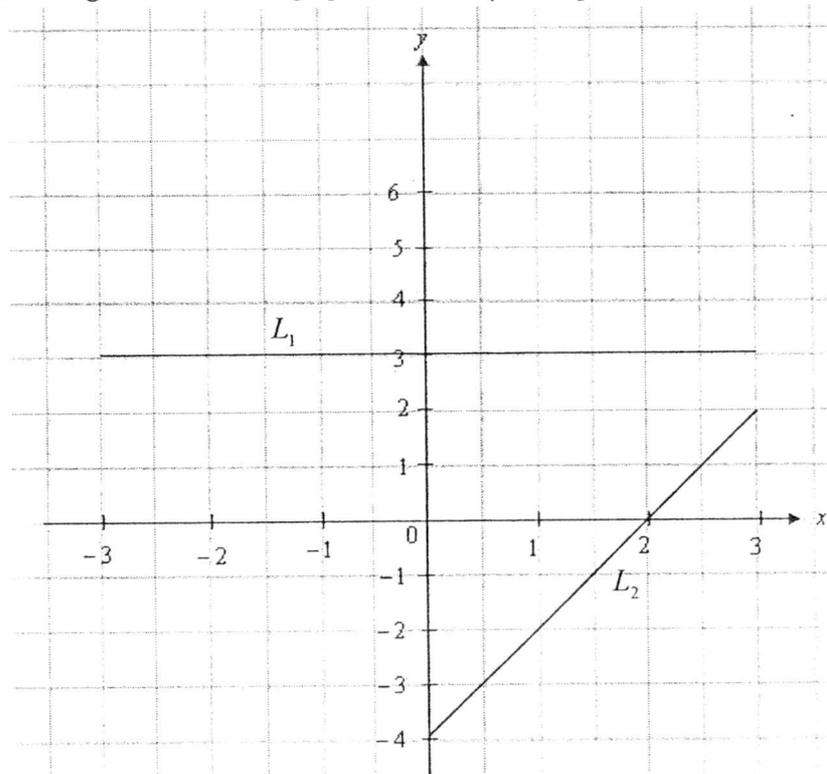
- 4 (a) Simplify  $\frac{x^2 + 3x - 10}{2x^2 - 4x} \times \frac{3x}{(x+5)^2}$  [3]
- (b) Express  $\frac{3}{2x-5} - \frac{4}{x-4}$  as a single fraction in its simplest form. [2]
- (c) A formula is given as  $p = \frac{-2x + 5r}{7 - 3x}$ .
- (i) Find the value of  $p$  when  $x = 4$  and  $r = -10$ , [1]
- (ii) Make  $x$  the subject of the formula. [3]

- 5 (a) Solve the equation,  $(5x + 2)(x - 1) = 14x + 10$  [3]
- (b) There are two consecutive positive even integers.  
Twice the square of the smaller number is greater than the square of the larger number by 188.
- (i) By letting the smaller integer be  $x$ , form an equation in  $x$  and show that it reduces to  $x^2 - 4x - 192 = 0$  [2]
- (ii) Hence, solve for  $x$  and find the larger number. [2]

- 6 Jane has 102 coins, in 20-cent and 50-cent coin denominations.  
Let the number of 20-cent coins and 50-cent coins be  $x$  and  $y$  respectively.
- (a) Form an equation connecting  $x$  and  $y$ . [1]
- The total value of the coins is \$34.20.
- (b) Form another equation connecting  $x$  and  $y$ . [1]
- (c) Hence, find the number of 20-cent and 50-cent coins. [3]

7

The diagram shows the graph of lines  $L_1$  and  $L_2$ .



Find the gradient of line

(a)  $L_1$ ,

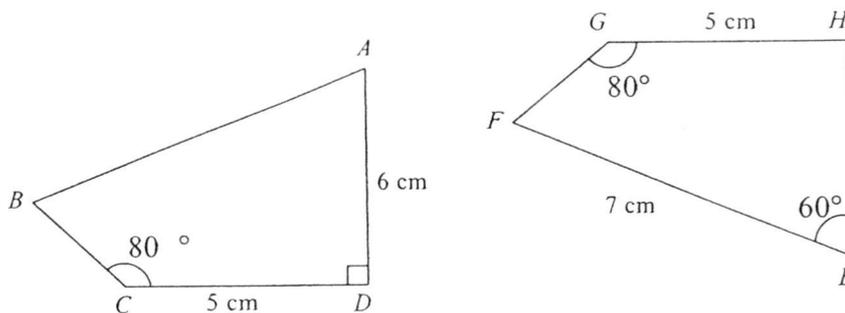
[1]

(b)  $L_2$ .

[2]

8

In the diagram,  $ABCD \cong EFGH$ .  
The perimeter of  $ABCD$  is 21 cm.



(i) Find the length of  $AB$ .

[1]

(ii) Find the length of  $FG$ .

[1]

(iii) Find  $\angle GHE$ .

[1]

[TURN OVER

9

5

If Amy buys 9 mangoes, she will have \$4 left in her pocket.  
 If she buys 6 mangoes, she will have \$9.40 left in her pocket.  
 Find the amount of money in her pocket.

[2]

10

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

The variables  $x$  and  $y$  are connected by the equation  $y = -x^2 + x + 6$ .

The table of values is as shown below.

$x$	-2	-1	0	1	2	3
$y$	0	$p$	6	6	4	$q$

- (a) Find the values of  $p$  and  $q$ . [2]
- (b) Using 2 cm to represent 1 unit along the horizontal  $x$ -axis and vertical  $y$ -axis, draw the graph of  $y = -x^2 + x + 6$  for  $-2 \leq x \leq 3$ . [4]
- (c) From your graph,
- (i) find the value of  $y$  when  $x = 2.5$ , [1]
- (ii) find the values of  $x$  when  $y = 1$ . [1]
- (iii) write the coordinates of the maximum point. [1]
- (iv) write down the equation of the line of symmetry. [1]

**Bukit Merah Secondary School**  
**Mid-Year Examination 2015**  
**Secondary 2 Express**  
**(Mathematics Paper 2) – Marking Scheme**

1	a	$1cm : 4km$ $1cm : 400000cm$ Scale is $\frac{1}{400000}$	M1 M1	
	b(i)	Show there is a constant 80 for $dc^2$ in all cases.	A1	
	b(ii)	$dc^2 = 80$	B1	
	b(iii)	320	B1	
	b(iv)	<i>use</i> $c = 2$ <i>new</i> $c = 8$ $new\ d = \frac{80}{8^2}$ $= 1.25$ <i>change is</i> $= \frac{1.25}{20}$ $= \frac{1}{16}$ <i>times</i>	M1 when found new d A1	
2	a(i)	$\sqrt[3]{125}$	B1	
	a(ii)	$\sqrt{5}$	B1	
	b	$-1.42, -1\frac{5}{12}, \sqrt{5}, \sqrt{12.25}, 3.\dot{5}, \sqrt[3]{125}$	B1 for any 3 in order B1 for the remaining 3 in order	
3	a	$(x - 6y)(2x + y)$ $= x(2x + y) - 6y(2x + y)$ $= 2x^2 + xy - 12xy - 6y^2$ $= 2x^2 - 11xy - 6y^2$	M1 A1	
	b(i)	$8p(3p - q)$	B1	
	b(ii)	$2x(x^2 - 36)$ $= 2x(x + 6)(x - 6)$	M1 A1	
	b(iii)	$4c(5a - 3b) - 5d(3b - 5a)$ $= 4c(5a - 3b) + 5d(-3b + 5a)$ $= (5a - 3b)(4c + 5d)$	M1 A1	

	c	$(x - y)^2 = x^2 - 2xy + y^2$ $= x^2 + y^2 - 2xy$ $= 19 - 2(-6)$ $= 31$	M1  A1	
4	a	$\frac{(x+5)(x-2)}{2x(x-2)} \times \frac{3x}{(x+5)^2}$ $= \frac{3}{2(x+5)}$	M1 for $(x+5)(x-2)$ , M1 for $2x(x-2)$ A1	
	b	$\frac{3(x-4)}{(2x-5)(x-4)} - \frac{4(2x-5)}{(2x-5)(x-4)}$ $= \frac{3x-12-8x+20}{(2x-5)(x-4)}$ $= \frac{8-5x}{(2x-5)(x-4)}$	M1  A1	
	c(i)	11.6	B1	
	c(ii)	$p(7-3x) = -2x+5r$ $7p-3px = -2x+5r$ $2x-3px = 5r-7p$ $x = \frac{5r-7p}{2-3p}$	M1 after expansion M1 with all terms with $x$ on one side A1	
5	a	$(5x+2)(x-1) = 14x+10$ $5x^2 - 5x + 2x - 2 = 14x + 10$ $5x^2 - 3x - 2 - 14x - 10 = 0$ $5x^2 - 17x - 12 = 0$ $(5x+3)(x-4) = 0$ $x = -0.6 \text{ or } 4$	M1 M1  A1	
	b(i)	$2(x)^2 = (x+2)^2 + 188$ $2x^2 = x^2 + 2(x)(2) + 2^2 + 188$ $x^2 - 4x - 192 = 0$	M1  A1	
	b(ii)	$(x-16)(x+12) = 0$ $x = 16 \text{ or } -12$ <p>larger number is <math>16 + 2 = 18</math></p>	M1  A1	
6	a	$x + y = 102$	B1	
	b	$20x + 50y = 3420$	B1	
	c	Correct substitution or elimination 56 20-cent coins 46 50-cent coins	M1 A1 A1	
7	a	Gradient = 0	B1	

	b	$\frac{6\text{units}}{3\text{units}}$ $= 2$	M1	
8	(i)	7cm	A1	
	(ii)	3cm	B1	
	(iii)	$90^\circ$	B1	
9		One mango cost 1.8 He has \$20.20	B1	
10	a	$p = 4, q = 0$	M1 A1	
	b	Plotting Scaling Smoothness of curve and curve pass through every point accurately	B1 B1 P1 S1 C1	
	c(i)	$2.25 (\pm 0.15)$	B1	
	(ii)	-1.8 2.8 $(\pm 0.15)$	B1 B1	
	(iii)	$(0.5, 6.25)$ the y-coordinate $\pm 0.15$	B1	
	(iv)	$x = 0.5$	B1	

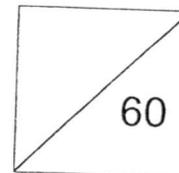


聖嬰中學  
HOLY INNOCENTS' HIGH SCHOOL

Name of Student

Class

Index Number



MID-YEAR EXAMINATION 2015  
SECONDARY 2 EXPRESS  
MATHEMATICS PAPER 1

4048/01

Date: 12 May 2015

Duration: 1 h 30 min

Students answer on Question Paper.

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.  
You may use an HB pencil for any diagrams or graphs.  
Do not use paper clips, glue or correction tape/fluid.

Answer **ALL** questions.

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

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.

The total of the marks for this paper is **60**.

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.

Set by: Ms Lua Bee Hian

Vetted by: Mdm Hayati & Ms Goh Lay Ching

*This document consists of 13 printed pages (including cover page).*

41

Answer **all** the questions.

For  
Examiner's  
Use

For  
Examiner's  
Use

- 1 (a) Calculate  $\frac{6 + \sqrt{71 - 9 \times 3 \times (-2)}}{5}$ .  
Write down the first five digits on your calculator display.
- (b) Write your answer to part (a) correct to two decimal places.

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

(b) ..... [1]

- 2 Given that  $1 < x < 5$  and  $-3 \leq y \leq 2$ , and  $x$  and  $y$  are integers, find

- (a) the greatest possible value of  $x - y$ ,
- (b) the least possible value of  $xy^2$ .

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

(b) ..... [1]

3 It is given that  $V = \frac{1}{3}\pi r^2 h$ .

- (a) Find  $V$  when  $r = 15$  and  $h = 8$ . Leave your answer in terms of  $\pi$ .
- (b) Express  $r$  in terms of  $V$ ,  $h$  and  $\pi$ .

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

(b) ..... [2]

4 The area of a rectangle is  $(36 - a^2)$  cm<sup>2</sup>, where  $a > 0$ .

One of its sides is  $(12 - 2a)$  cm.

Find an expression in terms of  $a$  for the length of the other side of the rectangle.

Answer ..... cm [3]

42

For  
Examiner's  
Use

For  
Examiner's  
Use

5 The diagram shows a point  $A$  and the line  $l_1$ .

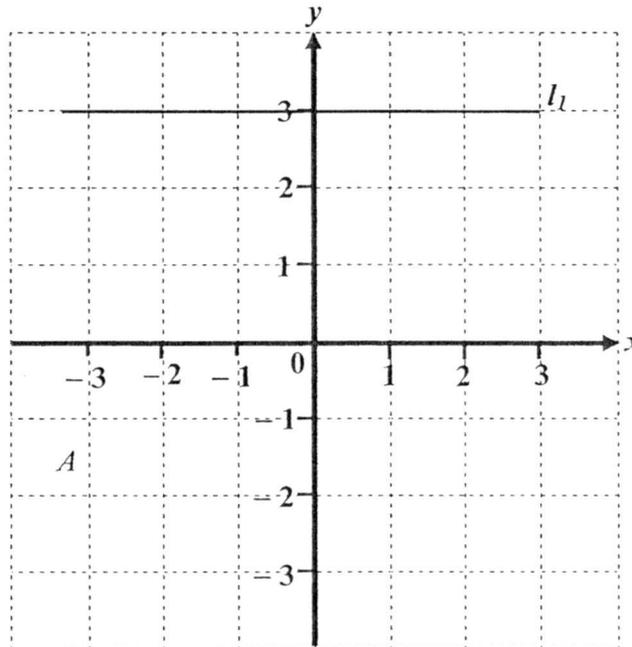
- (a) Write down the coordinates of point  $A$ .
- (b) Write down the equation of the line  $l_1$ .
- (c) On the axes below, draw a line with gradient 1.5 and passes through point  $A$ .

Answer (a)  $A$  (....., .....) [1]

(b) ..... [1]

Answer (c)

[1]



6 Given that  $a + b = 8$  and  $ab = 15$ , find the value of

- (a)  $(a + b)^2$ ,
- (b)  $a^2 + b^2$ .

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

(b) ..... [2]

7

Dion's mass is  $x$  kg.  
Ethan is 2 kg heavier than Dion.  
Samuel is 1.5 times heavy as Ethan.

- (a) Write down an expression, in terms of  $x$ , for the total mass of Dion, Ethan and Samuel.
- (b) Hence write down an inequality if their total mass is not more than 180 kg.
- (c) Solve the inequality and find the largest possible mass of Dion.

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

(b) ..... [1]

(c) ..... kg [2]

43

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Use

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Use

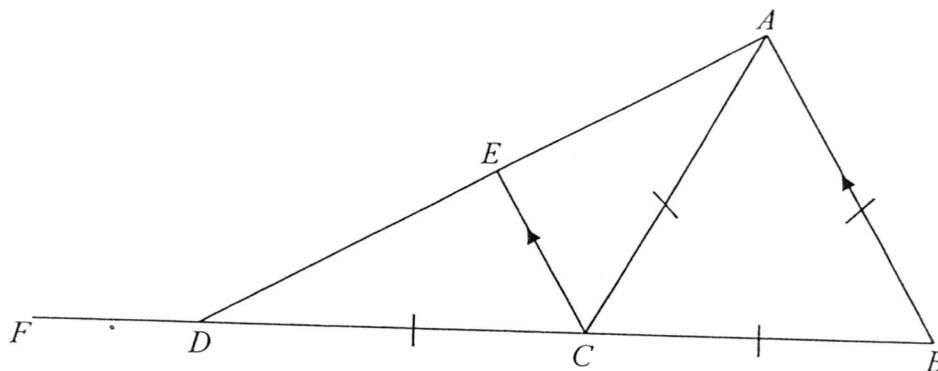
- 8 (a) Express 720 as the product of its prime factors.
- (b) Find the highest common factor of 105 and 720.
- (c) Red beads are sold in packs of 720.  
White beads are sold in packs of 105.  
Lynn buys the same number of red beads as the white beads.  
Find the least number of packs of red beads that she bought.

Answer (a)  $720 = \dots\dots\dots$  [1]

(b)  $\dots\dots\dots$  [1]

(c)  $\dots\dots\dots$  [2]

- 9 Triangle  $ABC$  is an equilateral triangle.  
Triangle  $ACD$  is an isosceles triangle.  
 $AB$  is parallel to  $EC$ .



- (a) Find
- (i) angle  $ACE$ ,
  - (ii) angle  $ADF$ .
- (b) What is the name of the triangle  $ABD$ ?

Answer (a) (i) angle  $ACE = \dots\dots\dots^\circ$  [1]

(ii) angle  $ADF = \dots\dots\dots^\circ$  [2]

(b)  $\dots\dots\dots$  [1]

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10 Expand and simplify

(a)  $(3x - 4)^2 - 7x$ ,

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

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

(b) ..... [2]

11 Solve

(a)  $\frac{5 + 2y}{2} = \frac{3y - 1}{6}$ ,

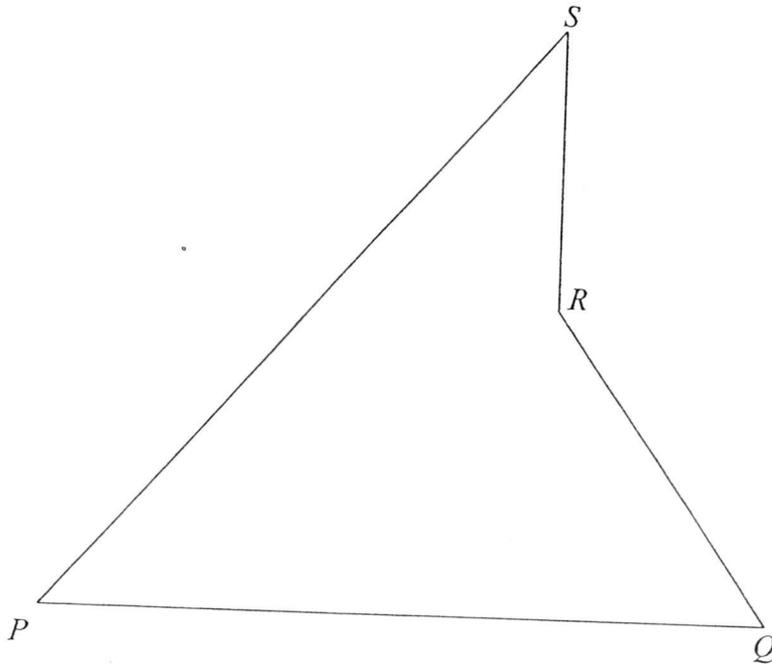
(b)  $q^2 + 7q = 0$ .

Answer (a)  $y =$  ..... [2]

(b)  $q =$  ..... or ..... [2]

12 The quadrilateral  $PQRS$  is drawn in the answer space below.

Answer (b) and (c)



- (a) Measure the reflex angle in  $PQRS$ .
- (b) Construct
  - (i) the perpendicular bisector of  $PS$ , [1]
  - (ii) the bisector of angle  $SPQ$ . [1]Label all your constructions clearly.
- (c) The point  $A$  is a point in the quadrilateral  $PQRS$  such that  $A$  is equidistant from the lines  $PQ$  and  $PS$  and nearer to point  $P$  than to point  $S$ .  
Mark a possible position for point  $A$ . [1]

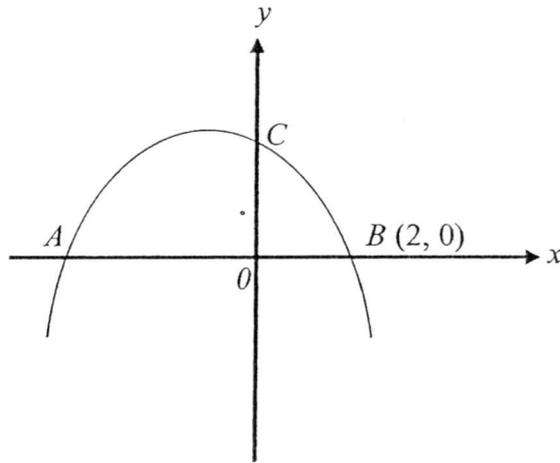
Answer (a) .....° [1]

- 13 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  $B(2, 0)$ .

The graph also cuts the  $y$ -axis at point  $C$ .

$x = -1$  is the line of symmetry of the graph.



- Write down the coordinates of the point  $A$ .
- Find the values of  $p$  and  $q$ .
- Write down the coordinates of the point  $C$ .

Answer (a)  $A$  (....., .....) [1]

(b)  $p =$ .....,  $q =$ ..... [2]

(c)  $C$  (....., .....) [1]

14 Jynn wants to make 35 strawberry cookies.

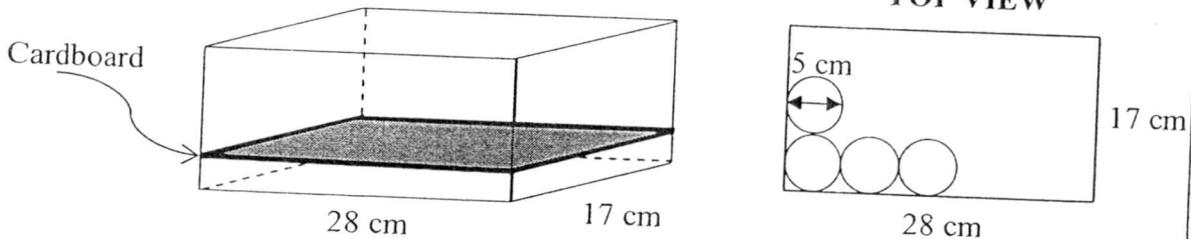
Strawberry cookie recipe

35 grams of sugar  
 400 grams of flour  
 5 grams of baking soda  
 3 grams of salt  
 1 box of strawberry



Makes 14 cookies

- (a) How many grams of baking soda will she use?
- (b) Each box of strawberry cost \$8.  
How much will Jynn spend on buying strawberries?
- (c) Each cookie has a diameter of approximately 5 cm.  
She packed the cookies into a box with a rectangular base of dimension 17 cm by 28 cm. She used cardboards as partitions to separate layers of cookies. How many cardboards will she need to use as partitions to stack up the cookies?



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

(b) \$..... [1]

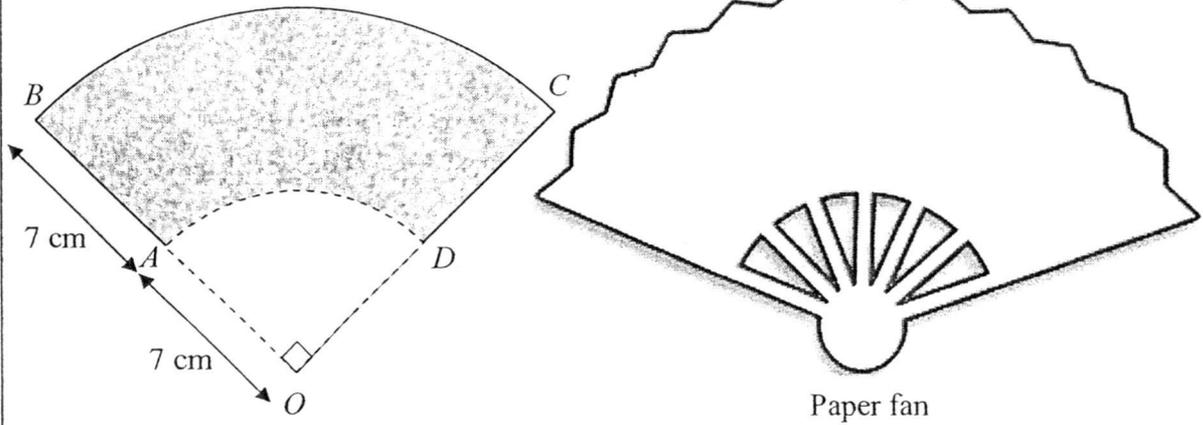
(c) ..... [2]

46

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- 15 The shaded region  $ABCD$  is cut out from a quadrant  $OBC$  to decorate a paper fan.  
 $OA = AB = OD = DC = 7$  cm.  
 [Take  $\pi = 3.142$ ]



- (a) Find the area of the shaded region.
- (b) Jenny has some laces. Each lace is 5 cm long.  
 How many of such laces will she need to glue around the perimeter of the shaded region?

Answer (a) .....cm<sup>2</sup> [2]

(b) ..... [3]

- 16 (a)  $p$  is inversely proportional to the cube of  $v$ .
- (i) It is known that  $p = 4$  for a particular value of  $v$ .  
What is the value of  $p$  when  $v$  is doubled?
  - (ii) Given that  $p = 1$  and  $v = 2$ , write down a formula connecting  $p$  and  $v$ .
  - (iii) Hence find the value of  $v$  when  $p = 125$ .
- (b) Four men can paint a school hall in six days.

Assuming that each man works the at same rate, how long would it take for 3 men to paint the school hall?

Answer (a) (i)  $p = \dots\dots\dots$  [2]

(ii)  $\dots\dots\dots$  [2]

(iii)  $v = \dots\dots\dots$  [1]

(b)  $\dots\dots\dots$  [1]

~ End of paper ~

47

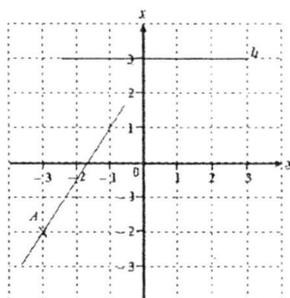
1 (a) 3.4360  
 (b) 3.44

2 (a) 7  
 (b) 0

3 (a)  $600\pi$   
 (b)  $r = \pm \sqrt{\frac{3v}{\pi h}}$

4  $\frac{6+a}{2}$

5 (a)  $(-3, -2)$   
 (b)  $y = 3$   
 (c)



6 (a) 64  
 (b) 34

7 (a)  $3.5x + 5$  or  $\frac{7}{2}x + 5$   
 (b)  $3.5x + 5 \leq 180$   
 (c)  $x \leq 50$   
 The largest possible mass of Dion is 50 kg.

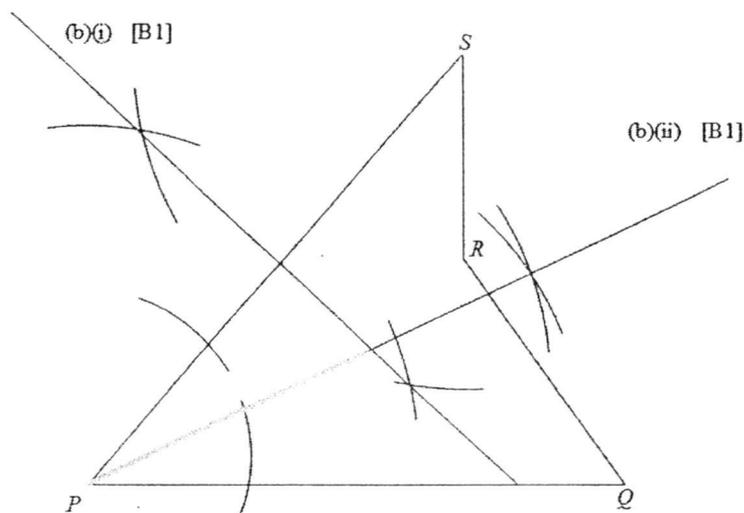
8 (a)  $2^4 \times 3^2 \times 5$   
 (b) 15  
 (c) 7

9 (a) (i) angle  $ACE = 60^\circ$   
 (Alternate angles)  
 (ii) angle  $ADF = 150^\circ$   
 (b) Right angled triangle

10 (a)  $9x^2 - 31x + 16$   
 (b)  $6x^2 + x - 2$

11 (a)  $y = -5\frac{1}{3}$   
 (b)  $q = 0$  or  $q = -7$

12. (a)  $215^\circ$   
 (b) and (c)



(c) [B1] anywhere on the highlighted line but not point of intersection between the two bisectors

13. (a)  $A(-4, 0)$   
 (b)  $p = -2$  and  $q = 8$   
 (c)  $C(0, 8)$

14 (a) 12.5 grams  
 (b) \$24  
 (c) Per layer can put 15 cookies. Therefore, 35 cookies will need **three layers** (one base and two cardboard). Hence she will need **two cardboards**.

15 (a)  $115.4685 \text{ cm}^2$   
 (b) No. of laces needed = 10

16 (a) (i)  $p = \frac{1}{2}$   
 (ii)  $p = \frac{8}{v^3}$  or  $pv^3 = 8$   
 (iii)  $v = 0.4$   
 (b) 3 men took **8 days**

1 (a) 3.4360 [B1]

(b) 3.44 [B1]

2 (a)  $4 - (-3) = 7$  [B1]

(b) 0 [B1]

3 (a)  $v = \frac{1}{3}\pi 15^2(8)$   
 $= 600\pi$  [B1]

(b)  $v = \frac{1}{3}\pi r^2 h$   
 $\frac{3v}{\pi h} = r^2$  [M1, o.e.]

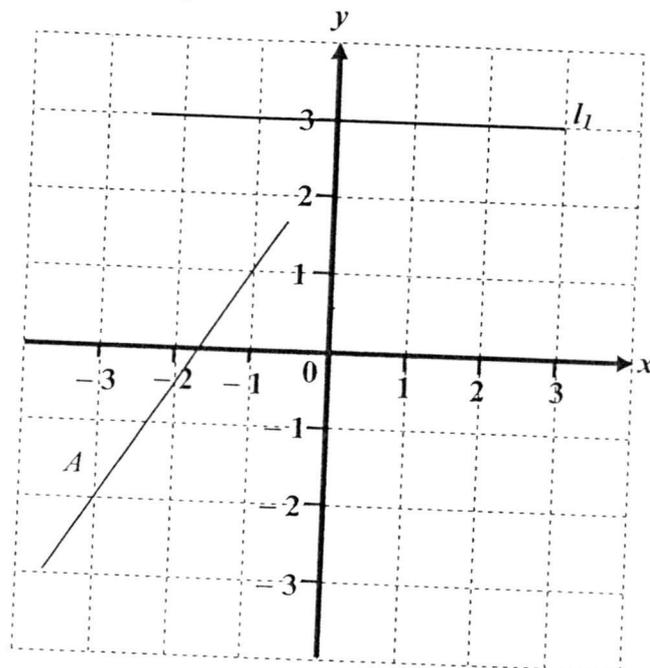
$r = \pm \sqrt{\frac{3v}{\pi h}}$  [A1]

4  $\frac{36 - a^2}{12 - 2a}$   
 $= \frac{(6+a)(6-a)}{2(6-a)}$  [M1 each for factorise numerator and denominator]  
 $= \frac{6+a}{2}$  [A1]

5 (a)  $(-3, -2)$  [B1]

(b)  $y = 3$  [B1]

(c) [B1]



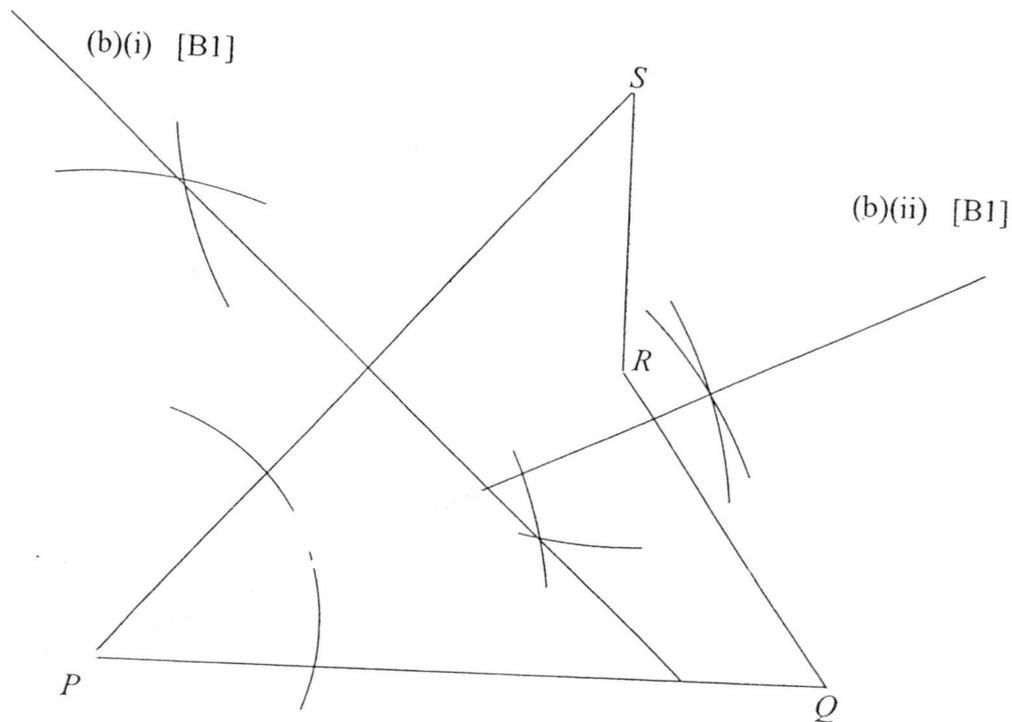
48

- 6 (a)  $8^2 = 64$  [B1]  
(b)  $(a+b)^2 = a^2 + 2ab + b^2$   
 $a^2 + b^2 = (a+b)^2 - 2ab$  [M1]  
 $= 64 - 2(15)$   
 $= 34$  [A1]
- 7 (a) Accept either  $x + x + 2 + 1.5(x + 2)$  or  $3.5x + 5$  [B1]  
(b) Accept either  $x + x + 2 + 1.5(x + 2) \leq 180$  or  $3.5x + 5 \leq 180$  [B1]  
(c)  $3.5x \leq 175$  [M1]  
 $x \leq 50$   
The largest possible mass of Dion is 50 kg. [A1]
- 8 (a)  $2^4 \times 3^2 \times 5$  [B1]  
(b)  $105 = 3 \times 5 \times 7$   
H.C.F. =  $3 \times 5$   
 $= 15$  [B1]  
(c) LCM =  $2^4 \times 3^2 \times 5 \times 7$  [M1]  
 $= 5040$   
Number of packs of red beads =  $5040 \div 720$   
 $= 7$  [A1]
- 9 (a) (i) angle  $ACE = 60^\circ$  (Alternate angles) [B1]  
(ii) angle  $ECD = 60^\circ$  (corresponding angles) [M1]  
angle  $ADC = \frac{180^\circ - 120^\circ}{2} = 30^\circ$  (isos. angles)  
angle  $ADF = 180^\circ - 30^\circ = 150^\circ$  [A1]  
(b) Right angled triangle [B1]
- 10 (a)  $9x^2 - 24x + 16 - 7x$  [M1]  
 $= 9x^2 - 31x + 16$  [A1]  
(b)  $(2x-1)(3x+2)$   
 $= 2x(3x+2) - (3x+2)$   
 $= 6x^2 + 4x - 3x - 2$  [M1]  
 $= 6x^2 + x - 2$  [A1]

11 (a)  $\frac{5+2y}{2} = \frac{3y-1}{6}$   
 $15+6y = 3y-1$  [M1]  
 $3y = -16$   
 $y = -5\frac{1}{3}$  [A1]

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

12. (a)  
 (b) and (c)



(c) [B1] anywhere on the highlighted line but not point of intersection between the two bisectors

13. (a)  $A(-4,0)$  [B1]

(b)  $-(x+4)(x-2) = 0$   
 $-(x^2 + 2x - 8) = 0$   
 $-x^2 - 2x + 8 = 0$   
 Therefore,  $p = -2$  and  $q = 8$  [B1 each]

(c)  $C(8,0)$  [B1]

14 (a) 14 cookies uses 5 grams of baking soda  
 35 cookies uses  $\frac{5}{14} \times 35 = 12.5$  grams of baking soda  
 [M1] [A1]

(b) amount of money spent on strawberries =  $3 \times \$8$   
 = \$24 [B1]

(c) No. of cookies that can be put across the length =  $28 \div 5$   
 $\approx 5$   
 No. of cookies that can be put across the width =  $17 \div 5$   
 $\approx 3$  } [M1]

Per layer can put 15 cookies.  
 Therefore, 35 cookies will need **three layers** (one base and two cardboard).  
 Hence she will need **two cardboards**. [A1]

15 (a) area of shaded region  
 $= \frac{1}{4}(3.142)(14^2 - 7^2)$  [M1, subst. in correct value into formula for area of quad.]  
 $= 115.4685 \text{ cm}^2$  [A1]

(b) Perimeter of shaded region  
 $= \frac{1}{4}(2)(3.142)(14 + 7) + 7(2)$  [M1, subst. in correct value into formula for arc length of quad.]  
 $= 46.991 \text{ cm}$  [A1]

16 (a) (i)  $p_1(v_1)^3 = p_2(v_2)^3$   
 $4(v)^3 = p(2v)^3$   
 $4 = 8p$   
 $p = \frac{1}{2}$  [B1]

(ii)  $p = \frac{k}{v^3}$   
 When  $p = 1$  and  $v = 2$ ,  $1 = \frac{k}{2^3}$   
 $k = 8$   
 Therefore,  $p = \frac{8}{v^3}$ . [B1]

(iii) when  $p = 125$ ,  $125 = \frac{8}{v^3}$   
 $v = \sqrt[3]{\frac{8}{125}}$   
 $v = 0.4$  [B1]

(b) 4 men took 6 days  
 1 men took 24 days  
 3 men took **8 days** [B1]



聖嬰中學  
HOLY INNOCENTS' HIGH SCHOOL

Name of Student

Class

Index Number

MID-YEAR EXAMINATION 2015  
SECONDARY 2 EXPRESS  
MATHEMATICS PAPER 2

4048/02

Date: 15 May 2015

Duration: 1 h 30 min

Additional Materials: 4 Sheets of Writing Paper  
1 Sheet of Graph Paper

**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.  
You may use an HB pencil for any diagrams or graphs.  
Do not use paper clips, glue or correction tape/fluid.

Answer **ALL** questions.

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

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.

The total of the marks for this paper is **60**.

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.

Set by: Mr Lin WeiDing

Vetted by: Mdm Hayati/Ms Goh Lay Ching

*This document consists of 7 printed pages (including cover page).*

50

## Answer all the questions

1 (a) Factorise  $mn - m^2 - pn + pm$ . [2]

(b) Solve the simultaneous equations [3]

$$4y + 6x = -13,$$

$$3x - 2y = 11.$$

2 A survey was conducted on a class of 25 pupils to find out the number of hours each pupil spent on using computer daily.

The results are shown in the table below.

4	2	3	2	3
2	3	1	2	3
1	3	4	1	2
2	2	1	3	3
1	4	3	3	3

(a) Copy and complete the table below. [1]

Number of hours spent on computer usage	Tally	Frequency
1		5
2		
3		
4		3

(b) Calculate the average number of hours of computer usage per student. Give your answer in hours. [2]

(c) Students are recommended to spend a maximum of  $1\frac{1}{2}$  hours on the computer daily. Find the percentage of students who follow the recommended usage hours. [2]

(d) If the information is represented on a pie chart, what is the angle representing students with computer usage less than 3 hours? [2]

- 3 Jaclyn used objects in the shape of triangle and star to make a series of pattern. The first three patterns are as shown below.



Pattern 1



Pattern 2



Pattern 3

The number of objects used in the above patterns are tabulated in the table shown below.

Pattern Number ( $n$ )	Number of stars ( $s$ )	Number of triangles ( $t$ )	Total number of objects ( $T$ )
1	1	6	7
2	4	10	14
3	9	14	23
4	$a$	$b$	$c$

- (a) Write down the values of  $a$ ,  $b$  and  $c$ . [3]
- (b) Write down an equation connecting  $n$  and  $s$ . [1]
- (c) Write down an equation connecting  $n$  and  $t$ . [1]
- (d) Express  $T$  in terms of  $n$ . [1]
- (e) Hence or otherwise, find the pattern number that uses a total of 119 objects. [2]

- 4 (a) An island of area  $51.2 \text{ km}^2$  is represented on a map by an area of  $0.8 \text{ cm}^2$ .
- (i) Express the scale of the map in the form  $1 : n$ . [2]
- (ii) Two points on the island are  $0.9 \text{ cm}$  apart on the map.  
Calculate the actual distance between these two points in metres. [1]
- (iii) Calculate the area of the island represented on another map with a scale of  $1 \text{ cm}$  to  $5 \text{ km}$ . [2]
- (b) There are 800 students in a school.
- (i) On a particular day, 18% of the students were late for a school event.  
Calculate the number of students who were early. [2]
- (ii) In a particular semester, 35 international students joined the school.  
Calculate the percentage increase in the number of students. [1]

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

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

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

$x$	-3	-2	-1	0	1	2	3	4
$y$	10	$p$	0	-2	-2	0	4	$q$

- (a) Write down the values of  $p$  and  $q$ . [1]
- (b) Using a scale of  $2 \text{ cm}$  to represent 1 unit, draw a horizontal  $x$ -axis for  $-3 \leq x \leq 4$ .  
Using a scale of  $1 \text{ cm}$  to represent 1 unit, draw a vertical  $y$ -axis for  $-2 \leq y \leq 10$ .
- 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  $x^2 - x - 2 = 8$ , [2]
- (iii) the equation of the line of symmetry. [1]

6 The advertisement below shows an online promotion on the admission pass to Sentosa.

**Sentosa** THE STATE OF FUN  
online store

Quick Find

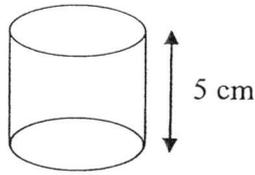
<b>PLAY UP TO 20 attractions</b>		<b>ADULT \$79.00</b> <small>(U.P. \$329.80)</small>	<b>CHILD \$69.00</b> <small>(U.P. \$270.90)</small>
<b>PLAY 5 out of 20 attractions</b>		<b>ADULT \$59.00</b> <small>(U.P. \$120.00)</small>	<b>CHILD \$49.00</b> <small>(U.P. \$113.00)</small>
<b>PLAY 3 out of 20 attractions</b>		<b>ADULT \$44.00</b> <small>(U.P. \$80.00)</small>	<b>CHILD \$39.00</b> <small>(U.P. \$65.00)</small>

- (a) (i) Mr and Mrs Chin plan to bring their two children to Sentosa for one day to visit 20 attractions.  
What is the total cost of the Day Fun Pass for the family of four? [2]
- (ii) The total cost of the pass is inclusive of 7% GST.  
Calculate the GST payable for the amount spent on the Day Fun Pass. [2]
- (iii) The family decided to go for only 5 attractions.  
How much money can they save now? [2]

Pricing			
Option 1	One Day Pass (Ticket + FunVee Transfers)	Adult (SGD)	Child (SGD)
	One Day Pass + 1 way hotel pick-up service from major city hotels + 2 ways Shuttle Service to & from Universal Studios™ Singapore	<b>\$74</b>	<b>\$54</b>
			<b>Book Now</b>
Option 2	2-DAY FUN PASS		
	1 day access for up to 20 attractions under the DAY FUN PASS One-Day Pass to Universal Studios Singapore (opens at 10am daily)		
	<b>ADULT \$139.00</b> <small>(U.P. \$403.90)</small>	<b>CHILD \$99.00</b> <small>(U.P. \$324.90)</small>	

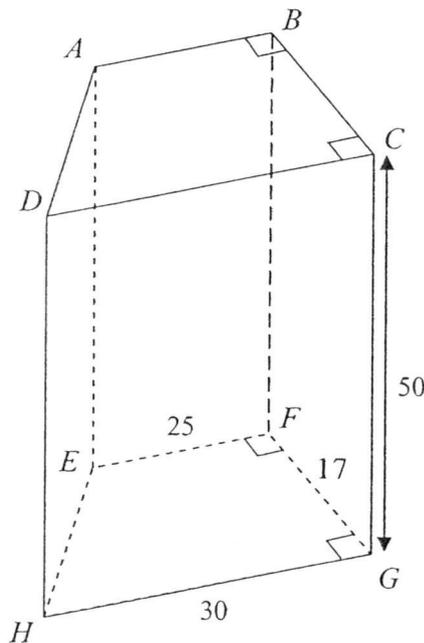
- (b) Mr and Mrs Lee with their 2 children plan to spend 2 days in Sentosa. They can choose to buy the pass from the above 2 options. Mrs Lee claims that it is more worthwhile to choose Option 2. Do you agree with her? Explain your answer by showing clear working. [2]

- 7 **Figure 1** shows a solid cylinder with height 5 cm.  
[Take  $\pi = 3.142$ ]



**Figure 1**

- (a) The volume of the cylinder is  $45\pi \text{ cm}^3$ .  
Show that the diameter of the cylinder is 6 cm. [2]
- (b) Find the total surface area of the cylinder to the nearest  $\text{cm}^2$ . [2]



**Figure 2**

**Figure 2** shows an open empty tank in the shape of a prism.  
The cross-section of the prism is a trapezium  $EFGH$ .  
 $EF = 25 \text{ cm}$ ,  $FG = 17 \text{ cm}$ ,  $HG = 30 \text{ cm}$  and  $CG = 50 \text{ cm}$ .

- (c) 5 cylinders in part (a) are melted into liquid and poured into the tank.  
The liquid fills the empty tank up to a height  $h \text{ cm}$ .  
Calculate the value of  $h$ . [2]
- (d) The empty tank needs to be filled to the brim with liquid from the melted cylinder.  
Calculate the maximum number of cylinders that should be melted and poured into the tank without overflowing. [2]

- 8 A factory packages thumb drives into paper boxes or plastic boxes.
- (a) It takes  $m$  minutes to package a thumb drive into a paper box.  
Write down, in terms of  $m$ , an expression for the number of thumb drives that can be packaged into paper boxes in an hour. [1]
- (b) The process will take 1 minute longer if the thumb drive is packaged into a plastic box.  
Write down an expression, in terms of  $m$ , for the number of thumb drives that can be packaged into plastic boxes in an hour. [1]
- (c) Thumb drives are packaged into paper and plastic boxes at the same time.  
A total of 50 thumb drives can be packaged in an hour.  
Form an equation in terms of  $m$  and show that it reduces to  $5m^2 - 7m - 6 = 0$ . [3]
- (d) Solve the equation to find the value of  $m$ . [2]
- (e) Hence find the number of thumb drives that can be packaged into plastic boxes in an hour. [1]
- 

END OF PAPER

**Sec 2 Express MYE 2015 Paper 2 (Answers)**

Qn	Answer	Qn	Answer															
1a	$(m - p)(n - m)$	5ci	Least value of $y = -2.25 \pm 0.1$															
1b	$x = \frac{3}{4}$ and $y = -4\frac{3}{8}$	5cii	$x = -2.7 \pm 0.1$ or $3.7 \pm 0.1$															
		5ciii	$x = 0.5$															
2a	<table border="1"> <thead> <tr> <th>Number of hours spent on computer usage</th> <th>Tally</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>   </td> <td>5</td> </tr> <tr> <td>2</td> <td>      </td> <td>7</td> </tr> <tr> <td>3</td> <td>       </td> <td>10</td> </tr> <tr> <td>4</td> <td>   </td> <td>3</td> </tr> </tbody> </table>	Number of hours spent on computer usage	Tally	Frequency	1		5	2		7	3		10	4		3	6ai	\$296
Number of hours spent on computer usage	Tally	Frequency																
1		5																
2		7																
3		10																
4		3																
		6aia	\$19.36															
2b	2.44 or $2\frac{11}{25}$ hours	6aiii	\$80															
2c	20%	6b	I agree with Mrs Lee. Total cost for Option 2 is less than the one from Option 1.															
2d	$172.8^0$	7a	6cm															
3a	$a = 16$ $b = 18$ $c = 34$	7b	$151 \text{ cm}^2$ (nearest $\text{cm}^2$ )															
3b	$s = n^2$	7c	1.51 cm															
3c	$t = 4n + 2$	7d	165 cylinders															
3d	$T = n^2 + 4n + 2$	8a	$\frac{60}{m}$															
3e	9	8b	$\frac{60}{m+1}$															
4ai	1 : 800000	8c	$5m^2 - 7m - 6 = 0$															
4aia	7200 m	8d	$m = 2$															
4aiaa	Area = $2.048 \text{ cm}^2$	8e	20															
4bi	656																	
4bia	4.375%																	
5a	$p = 4$ and $q = 10$																	
5b	Draw axes and plot all points given. Draw smooth curve through all points [-1 m] If axes/graph not labelled or wrong scale is used. *No marks to be awarded if graph is not drawn.																	

**Sec 2 Express MYE 2015 Paper 2 (Answers)**

Qn	Answer	Qn	Answer															
1a	$(m-p)(n-m)$	5ci	Least value of $y = -2.25 \pm 0.1$															
1b	$x = \frac{3}{4}$ and $y = -4\frac{3}{8}$	5cii	$x = -2.7 \pm 0.1$ or $3.7 \pm 0.1$															
		5ciii	$x = 0.5$															
2a	<table border="1"> <thead> <tr> <th>Number of hours spent on computer usage</th> <th>Tally</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>   </td> <td>5</td> </tr> <tr> <td>2</td> <td>      </td> <td>7</td> </tr> <tr> <td>3</td> <td>       </td> <td>10</td> </tr> <tr> <td>4</td> <td>   </td> <td>3</td> </tr> </tbody> </table>	Number of hours spent on computer usage	Tally	Frequency	1		5	2		7	3		10	4		3	6ai	\$296
Number of hours spent on computer usage	Tally	Frequency																
1		5																
2		7																
3		10																
4		3																
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4aaii	7200 m	8d	$m = 2$															
4aaiii	Area = $2.048 \text{ cm}^2$	8e	20															
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5b	<p>Draw axes and plot all points given.            Draw smooth curve through all points            [-1 m] If axes/graph not labelled or wrong scale is used.            *No marks to be awarded if graph is not drawn.</p>																	

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2a	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Number of hours spent on computer usage</th> <th style="width: 20%;">Tally</th> <th style="width: 20%;">Frequency</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">HHH</td> <td style="text-align: center;">5</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">HHH II</td> <td style="text-align: center;">7</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">HHH HHH</td> <td style="text-align: center;">10</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">III</td> <td style="text-align: center;">3</td> </tr> </tbody> </table>	Number of hours spent on computer usage	Tally	Frequency	1	HHH	5	2	HHH II	7	3	HHH HHH	10	4	III	3	B1 (All must be correct)
Number of hours spent on computer usage	Tally	Frequency															
1	HHH	5															
2	HHH II	7															
3	HHH HHH	10															
4	III	3															
2b	<p>Average number of hours</p> $= \frac{5(1) + 7(2) + 10(3) + 3(4)}{25}$ $= 2.44 \text{ or } 2\frac{11}{25} \text{ hours}$	M1  A1															
2c	<p>Required Percentage</p> $= \frac{5}{25} \times 100$ $= 20\%$	M1  A1															
2d	<p>Required Angle</p> $= \frac{12}{25} \times 360$ $= 172.8^\circ$	M1  A1															
3a	$a = 16$ $b = 18$ $c = 34$	B1 B1 B1															
3b	$s = n^2$	B1															
3c	$t = 4n + 2$	B1															
3d	$T = n^2 + 4n + 2$	B1															
3e	$n^2 + 4n + 2 = 119$ $n^2 + 4n - 117 = 0$ $(n - 9)(n + 13) = 0$ $n = 9$	M1 A1															

4ai	Map: Actual Area $0.8 \text{ cm}^2 : 51.2 \text{ km}^2$ $1 \text{ cm}^2 : 64 \text{ km}^2$ $1 \text{ cm} : 8 \text{ km}$ $1 : 800000$	M1 A1
4aii	Actual distance $= 0.9 \times 800\,000$ $= 7200 \text{ m}$	B1
4aiii	Map: Actual Area $1 \text{ cm} : 5 \text{ km}$ $1 \text{ cm}^2 : 25 \text{ km}^2$  Actual Area : Map $25 \text{ km}^2 : 1 \text{ cm}^2$ $1 \text{ km}^2 : \frac{1}{25} \text{ cm}^2$ $51.2 \text{ km}^2 : \frac{1}{25} \times 51.2 \text{ cm}^2$  Area = $2.048 \text{ cm}^2$	M1 A1
4bi	Number of students who were early $= \frac{82}{100} \times 800$ $= 656$	M1 A1
4bii	Percentage increase $= \frac{35}{800} \times 100$ $= 4.375\%$ (exact answer.)	B1
5a	$p = 4$ and $q = 10$	B1
5b	Refer to graph. *Draw axes and plot all points given. [P1 if there are more than 3 errors] Draw smooth curve through all points [-1 m] If axes/graph not labelled or wrong scale is used. *No marks to be awarded if graph is not drawn.	(Both must be correct) P2 C1
5ci	Least value of $y = -2.25 \pm 0.1$	B1
5cii	$x = -2.7 \pm 0.1$ or $3.7 \pm 0.1$	B1 and B1
5ciii	$x = 0.5$	B1

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6ai	$\text{Total cost} = (79 \times 2 + 69 \times 2)$ $= \$296$	M1 A1
6aii	$\text{GST} = \frac{296}{107} \times 7$ $= \$19.36$	M1 A1
6aiii	<p>Total cost for 5 attractions  <math>= (59 \times 2 + 49 \times 2)</math>  <math>= \\$216</math>  Amount saved = <math>296 - 216</math>  <math>= \\$80</math></p> <p><u>Alternative method</u>  Amount saved for each adult = \$20  Amount saved for each child \$20  Total amount saved  <math>= 20 \times 4</math>  <math>= \\$80</math></p>	M1 A1
6b	<p><u>Option 1</u>  Total cost = <math>2(74 \times 2 + 54 \times 2)</math>  <math>= \\$512</math></p> <p><u>Option 2</u>  Total cost = <math>(2 \times 139 + 2 \times 99)</math>  <math>= \\$476</math></p> <p>I agree with Mrs Lee as the total cost for Option 2 is less than the one from Option 1.</p> <p><b>Note:</b>  Accept also answer that says Option 1 is more worthwhile because of the extra transport service which is not available from Option 2.</p>	M1 A1

7a	$\pi r^2 h = 45\pi$ $5r^2 = 45$ $r^2 = 9$ $r = 3 \text{ cm}$ Diameter = 6cm (Shown)	M1  A1
7b	Total surface area of cylinder $= 2\pi r^2 + 2\pi r h$ $= 2(3.142)(3)^2 + 2(3.142)(3)(5)$ $= 150.816$ $= 151 \text{ cm}^2$ (nearest $\text{cm}^2$ )	M1  A1
7c	New water level be $h$ cm $\frac{1}{2}(25 + 30)(17)(h) = 5(3.142)(3)^2(5)$ $h = \frac{706.95}{467.5}$ $h = 1.51219$  $h = 1.51 \text{ cm}$  <u>Alternative Method</u>  New water level be $h$ cm $467.5(h) = 5(45\pi)$ $h = \frac{5(45\pi)}{467.5}$ $h = 1.51219$  $h = 1.51 \text{ cm}$	M1    A1    M1    A1

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7d	<p>Number of cylinders be <math>x</math></p> $(3.142)(3)^2(5)(x) \leq \frac{1}{2}(25+30)(17)(50)$ $x \leq \frac{\frac{1}{2}(25+30)(17)(50)}{(3.142)(3)^2(5)}$ $x \leq \frac{23375}{141.39}$ $x \leq 165.322$ <p>Maximum number of cylinders = 165</p> <p><u>Alternative Method</u></p> <p>Volume of prism</p> $= \frac{1}{2}(25+30)(17)(50)$ $= 23375$ <p>Number of cylinders</p> $= \frac{23375}{45\pi}$ $= 165.322$ $= 165$	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>
8a	<p>Number of thumb drive</p> $= \frac{60}{m}$	B1
8b	<p>Number of thumb drive</p> $= \frac{60}{m+1}$	B1
8c	$\frac{60}{m} + \frac{60}{m+1} = 50$ $\frac{60m + 60 + 60m}{m(m+1)} = 50$ $120m + 60 = 50m^2 + 50m$ $50m^2 - 70m - 60 = 0$ $5m^2 - 7m - 6 = 0$	<p>M1</p> <p>M1</p> <p>A1</p>

8d	$5m^2 - 7m - 6 = 0$ $(5m + 3)(m - 2) = 0$ $m = -\frac{3}{5} \quad m = 2$ $m = 2$	M1 A1
8e	$m = -\frac{3}{5} \text{ (rejected)}$ <p>Number of thumb drive</p> $= \frac{60}{2+1}$ $= 20$	B1

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O	Class	Index No	Name
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**Jurongville Secondary School  
Mid Year Examination 2015  
Secondary 2 Express**

**Mathematics**

Paper 1

**Marking Scheme**

**4048/01**

13 May 2015 (Wed)

1 hour 15 minutes

Candidates answer on the Question Paper.

*\*Observe our school values of Integrity and Excellence by not cheating and doing your best in this paper*

**READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number in the spaces on all the work you hand in.  
Write in dark blue or black pen.

You may use pencil for drawing 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.

All working must be written step-wise and shown clearly in **INK**.

**CAUTION:** Any working or answer not written in ink will NOT be marked.

The total marks for this paper is 50.

The number of marks is given in brackets [ ] at the end of each question or part question.  
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 3 significant figures. Give answers in degrees to 1 decimal place.

For  $\pi$ , use either your calculator value or 3.142.

**INSTRUCTIONS FOR SUBMISSION:**

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

**DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO**

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

Setter: Mr Justin Ho

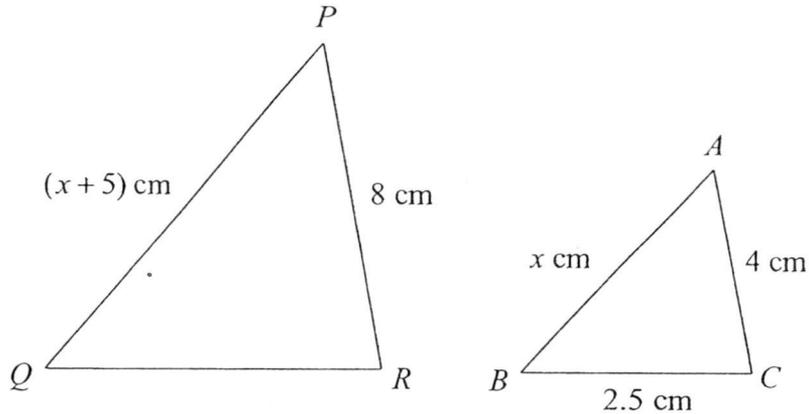
This document consists of 10 printed pages.

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[Turn over

## Answer ALL Questions

- 1  $\triangle ABC$  is similar to  $\triangle PQR$ ,  $BC = 2.5$  cm,  $PQ = (x+5)$  cm,  $AC = 4$  cm,  $AB = x$  cm and  $PR = 8$  cm.



Find

- (a)  $QR$ ,

$$\begin{aligned} \text{(a) } QR &= 2.5 \times 2 \\ &= 5 \text{ cm} \quad [\text{B1}] \end{aligned}$$

Answer (a) 5 cm [1]

- (b)  $PQ$ .

$$\begin{aligned} \text{(b) } \frac{x+5}{x} &= 2 \\ x+5 &= 2x \quad [\text{M1}] \\ x &= 5 \\ \therefore PQ &= 5+5 \\ &= 10 \quad [\text{A1}] \end{aligned}$$

Answer (b) 10 cm [2]

- 2 An actual area of a plot of land is  $125 \text{ m}^2$  is represented by  $5 \text{ cm}^2$  on a map.  
Calculate

(a) the scale of the map in the form  $1 : n$ ,

$$(a) \quad 5 \text{ cm}^2 : 125 \text{ m}^2$$

$$1 \text{ cm}^2 : 25 \text{ m}^2$$

$$1 \text{ cm} : \sqrt{25} \text{ m}$$

$$1 \text{ cm} : 5 \text{ m} \quad [\text{M1}]$$

$$1 : 500 \quad [\text{A1}]$$

Answer (a) 1:500 [2]

(b) the length of a line on the map, in cm, which represents a path 13 m long.

$$\text{Length of line} = \frac{13}{5} \quad [\text{M1}]$$

$$= 2.6 \text{ cm} \quad [\text{A1}]$$

Answer (b) 2.6 cm [1]

- 3 (a) Simplify  $(4s - 2s^2) + (8 - 9s^2)$ .

$$(4s - 2s^2) + (8 - 9s^2)$$

$$= -11s^2 + 4s + 8 \quad [\text{B1}]$$

Answer (a)  $-11s^2 + 4s + 8$  [1]

- (b) Simplify  $-2(-x^2 + 3) - 3x^2$ .

$$-2(-x^2 + 3) - 3x^2$$

$$= -2x^2 - 6 - 3x^2 \quad [\text{M1}]$$

$$= -x^2 - 6 \quad [\text{A1}]$$

Answer (b)  $-x^2 - 6$  [2]

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6 Express each of the following as a single fraction in its simplest form.

$$(a) \quad 1 + \frac{1}{p+q}$$

$$1 + \frac{1}{p+q}$$

$$= \frac{p+q+1}{p+q} \quad [\text{B1}]$$

$$\text{Answer (a)} \quad \frac{p+q+1}{p+q} \quad [1]$$

$$(b) \quad \frac{-a}{a-b} - \frac{b+a}{b-a}$$

$$\frac{-a}{a-b} - \frac{b+a}{b-a}$$

$$= \frac{-a}{a-b} - \frac{b+a}{-(a-b)} \quad [\text{M1}]$$

$$= \frac{-a}{a-b} + \frac{b+a}{a-b}$$

$$= \frac{-a+b+a}{a-b} \quad [\text{M1}]$$

$$= \frac{b}{a-b} \quad [\text{A1}]$$

$$\text{Answer (b)} \quad \frac{b}{a-b} \quad [3]$$

7 (a) Factorise fully  $x^2y - 9xy + 20y$ .

$$x^2y - 9xy + 20y$$

$$= y(x^2 - 9x + 20) \quad [\text{M1}]$$

$$= y(x-5)(x-4) \quad [\text{A1}]$$

**M1** for cross method working

$$\text{Answer (a)} \quad \frac{y(x-5)(x-4)}{\quad} \quad [3]$$

(b) Factorise fully  $81r^2 - 49t^2$ .

$$81r^2 - 49t^2$$

$$= (9r^2) - (7t)^2 \quad [\text{M1}]$$

$$= (9r+7t)(9r-7t) \quad [\text{A1}]$$

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$$\text{Answer (b)} \quad \frac{(9r+7t)(9r-7t)}{\quad} \quad [2]$$

- 8  $x$  is directly proportional to  $(y-3)^2$  and  $y$  is positive.  
The table below shows some corresponding values of  $x$  and  $y$ .

$x$	$a$	2	72
$y$	1.2	5	$b$

Find

- (a) the equation connecting  $x$  and  $y$ ,

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

$$2 = k(5-3)^2$$

$$k = 0.5 \quad [\text{M1}]$$

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

Answer (a)  $x = \frac{1}{2}(y-3)^2$  [2]

---

- (b) the value of  $a$ ,

$$(b) a = 0.5(1.2-3)^2$$

$$= 1.62 \quad [\text{B1}]$$

Answer (b)  $a = 1.62$  [1]

---

- (c) the value of  $b$ .

$$(c) 72 = 0.5(b-3)^2$$

$$144 = (b-3)^2$$

$$\pm \sqrt{144} = b-3 \quad [\text{M1}]$$

$$\pm 12 = b-3$$

$$b = 15 \quad [\text{A1}] \quad \text{or} \quad b = -9 \quad (\text{rejected as } q \text{ is } + \text{ve})$$

Answer (c)  $b = 15$  [2]

---

- 9 Josh and Amir are bringing their families to the Esplanade for a concert.  
One adult ticket cost \$y and one child ticket cost \$x.
- (a) Josh bought 2 adult tickets and 3 child tickets and paid \$135 in total.  
Form an equation in terms of x and y.  
 $3x + 2y = 135$  [B1]

*Answer (a)*  $3x + 2y = 135$  [1]

- (b) Amir bought 1 adult tickets and 2 child ticket for \$79.  
Form an equation in terms of x and y.  
 $2x + y = 79$  [B1]

*Answer (b)*  $2x + y = 79$  [1]

- (c) Find the cost of 1 adult ticket and 1 child ticket.

$$3x + 2y = 135 \text{ ----- (1)}$$

$$2x + y = 79 \text{ ----- (2)}$$

$$(2) \times 2,$$

$$4x + 2y = 158 \text{ ----- (3)}$$

$$(3) - 1,$$

$$(4x + 2y) - (3x + 2y) = 158 - 135 \quad \text{[M1]}$$

$$x = 23 \quad \text{[A1]}$$

Sub  $x = 23$  into (2)

$$2(23) + y = 79$$

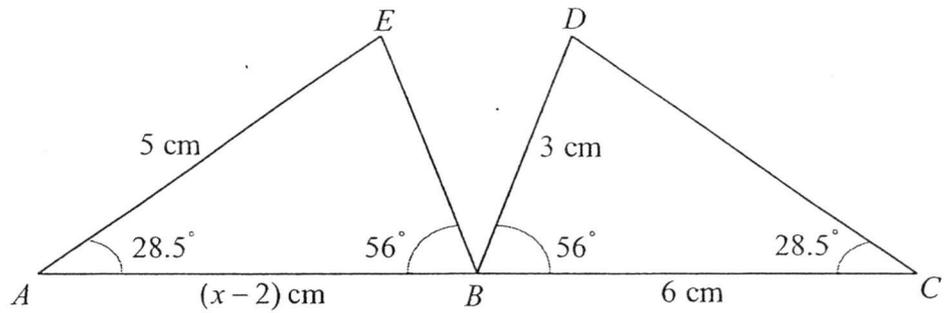
$$y = 33 \quad \text{[A1]}$$

*Answer (c)* Adult ticket = \$ 33

Child ticket = \$ 23 [3]

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- 10 Given that  $\triangle ABE$  and  $\triangle CBD$  are congruent.



Find

- (a) the length of  $CD$ ,

$$CD = 5 \text{ cm} \quad [\text{B1}]$$

Answer (a) 5 cm [1]

- (b) the value of  $x$ ,

$$x - 2 = 6 \quad [\text{M1}]$$

$$x = 8 \quad [\text{A1}]$$

Answer (b)  $x = 8$  [2]

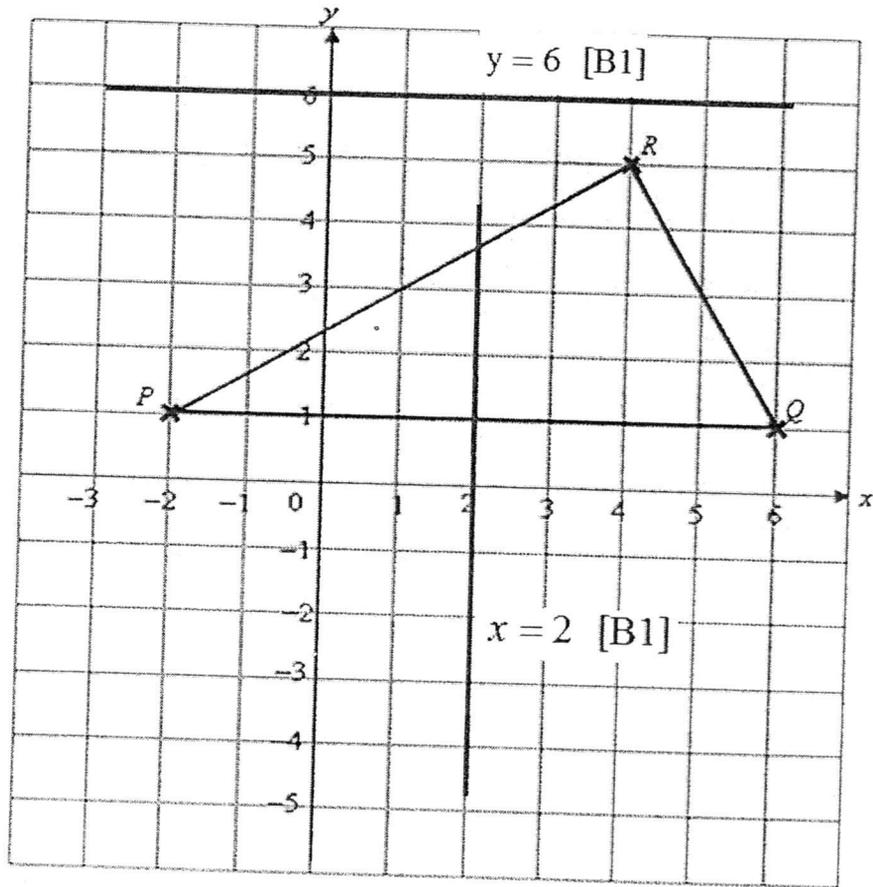
- (c)  $\angle DBE$ .

$$\angle DBE = 180^\circ - 2(56^\circ) \quad [\text{M1}]$$

$$= 68^\circ \quad [\text{A1}]$$

Answer (c)  $\angle DBE = 68^\circ$  [2]

11 The grid below shows triangle  $PQR$ .



- (a) On the grid, draw and label the graphs  $x = 2$  and  $y = 6$ . [2]  
 (b) Find the gradient of  $PQ$ .

Answer (a) 0 [B1] [1]

- (c) Find the gradient of  $RQ$ .

$$\text{Gradient of } RQ = \frac{5-1}{4-6} \quad [\text{M1}]$$

$$= \frac{4}{-2} \quad [\text{A1}]$$

$$= -2$$

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Answer (b) -2 [2]

12 For the following number sequence:

5, 8, 11, 14, 17, .....

find

(a) the next two terms,

(a) 20[B1] and 23[B1]

Answer (a) 20 and 23 [2]

(b) the  $n^{\text{th}}$  term,

$$(b)T_1 = 5 = 3(1) + 2$$

$$T_2 = 8 = 3(2) + 2$$

$$T_3 = 11 = 3(3) + 2$$

[M1] for showing the pattern

.

;

$$T_n = 3n + 2$$

[A1]

Answer (b)  $T_n = 3n + 2$  [2]

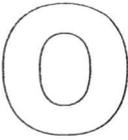
(c) the 91<sup>st</sup> term.

$$(c)T_{91} = 3(91) + 2$$

$$= 275$$

[B1]

Answer (c) 275 [1]

	Class	Index No	Name
			<u>Marking Scheme</u>



**Jurongville Secondary School**  
**Mid Year Examination 2015**  
**Secondary 2 Express**

**Mathematics**

Paper 2

Additional Materials:      Writing Paper  
    Graph Paper (1 sheet)

**4048/02**  
**11 May 2015**  
**1 h 15 min**

*\*Observe our school values of **Integrity** and **Excellence** by not cheating and doing your best in this paper\**

**READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number in the spaces on all the work you hand in.  
 Write in dark blue or black pen on both sides of the paper.  
 You may use pencil for drawing 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.  
 All working must be written step-wise and shown clearly in **INK**.

**CAUTION:** Any working or answer not written in ink will NOT be marked.

The total marks for this paper is 50.  
 The number of marks is given in brackets [ ] at the end of each question or part question  
 If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to 3 significant figures. Give answers in degrees to 1 decimal place.  
 For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

**INSTRUCTIONS FOR SUBMISSION:**  
 Hand in the Question Paper separately.

**DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO**

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

Setter: Mr Jayce Lim

This document consists of 4 printed pages.

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[Turn over

## Answer ALL the questions.

- 1 (a) Two quantities,  $(x + 1)$  and  $(y - 2)$  are in inverse proportion. Values of  $x$  and  $y$  are shown in the table below.

$x$	1	3	$b$
$y$	10	$a$	30

- (i) Find the equation connecting  $(x + 1)$  and  $(y - 2)$ . [ 3 ]
- (ii) Hence, find the values of  $a$  and  $b$ . [ 4 ]

**Solution:****(i)**

Since  $(x + 1)$  and  $(y - 2)$  are in inverse proportion,  $(x + 1)(y - 2) = k$ , .....M1  
where  $k$  is a constant.

From the table, when  $x = 1, y = 10$ .

$$(1 + 1)(10 - 2) = k \dots\dots\dots \text{M1}$$

$$\therefore k = 2 \times 8$$

$$= 16$$

$$\therefore (x + 1)(y - 2) = 16 \quad \text{or}$$

$$y - 2 = \frac{16}{x + 1} \dots\dots\dots \text{A1}$$

**(ii)**

When  $x = 3$ ,

$$y - 2 = \frac{16}{3 + 1} \dots\dots\dots \text{M1}$$

$$y = 4 + 2$$

$$= 6$$

$$\therefore a = 6 \dots\dots\dots \text{A1}$$

When  $y = 30$ ,

$$30 - 2 = \frac{16}{x + 1} \dots\dots\dots \text{M1}$$

$$28(x + 1) = 16$$

$$28x + 28 = 16$$

$$28x = -12$$

$$x = -\frac{12}{28}$$

$$= -\frac{3}{7}$$

$$\therefore b = -\frac{3}{7} \dots\dots\dots \text{A1}$$

- (b) The kinetic energy of a moving object,  $E$  joules, is directly proportional to the square of its speed,  $v$  m/s. If the speed of the moving object is halved, calculate the new kinetic energy of the object as a ratio of its original kinetic energy. [ 3 ]

**Solution:**

Since  $E$  is directly proportional to the square of  $v$ ,  $E = kv^2$ , where  $k$  is a constant.

If  $v$  is halved,

$$E = k\left(\frac{v}{2}\right)^2 \dots\dots\dots \text{M1}$$

$$= \frac{1}{4}kv^2$$

$$\therefore \text{required ratio} = \frac{1}{4}kv^2 : kv^2 \dots\dots\dots \text{M1}$$

$$= \frac{1}{4} : 1$$

$$= 1 : 4 \dots\dots\dots \text{A1}$$

- 2 (a) There are chickens and cows in a farm. If there is a total of 30 heads and 94 legs, find the number of the chickens and cows in the farm. [ 5 ]

**Solution:**

Let  $x$  be the number of chicken and  $y$  be the number of cows.

$$x + y = 30$$

$$x = 30 - y \dots\dots\dots (1)$$

$$2x + 4y = 94$$

$$x + 2y = 47 \dots\dots\dots (2) \dots\dots\dots \text{B1 (correct equations)}$$

Substitute (1) into (2),

$$30 - y + 2y = 47 \dots\dots\dots \text{M1}$$

$$y = 47 - 30$$

$$y = 17 \dots\dots\dots \text{A1}$$

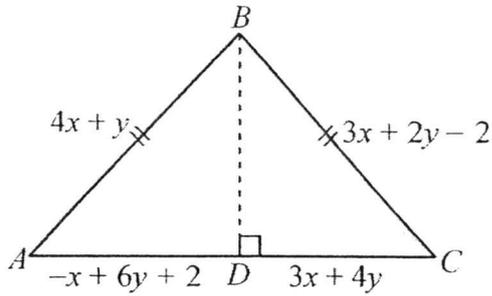
Substitute  $y = 17$  into (1),

$$x = 30 - 17 \dots\dots\dots \text{M1}$$

$$x = 13 \dots\dots\dots \text{A1}$$

There are 13 chicken and 17 cows in the farm.

- (b) The diagram shows an isosceles triangle  $ABC$  with  $BD$  perpendicular to  $AC$ . The dimensions given are in cm. [ 5 ]



- (i) Find the values of  $x$  and  $y$ . [ 3 ]
- (ii) Find the perimeter of  $\triangle ABC$ . [ 2 ]

**Solution:**

- (i) Since  $AB = BC$  (sides of isos.  $\Delta$ )

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

$$x - y = -2 \text{ ----- (1) .....B1}$$

$$AD = DC \text{ (}\perp\text{ bisector)}$$

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

$$2y - 4x = -2$$

$$y - 2x = -1 \text{ ----- (2) .....B1}$$

$$(1) + (2): -x = -3$$

$$x = 3$$

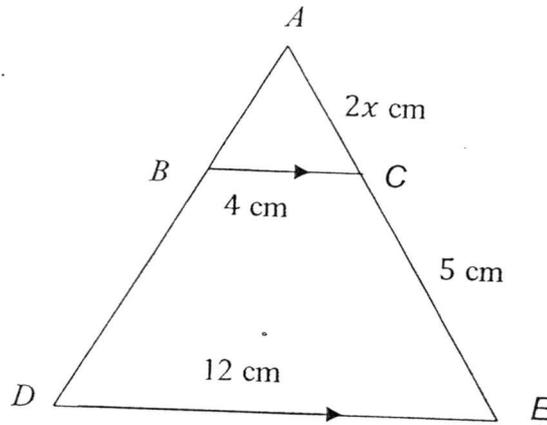
Substituting  $x = 3$  into (2),

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

$$y = 5 \text{ .....A1 (correct } x \text{ and } y \text{ values)}$$

- (ii) Perimeter of  $\triangle ABC = 4x + y + 3x + 2y - 2 + 3x + 4y + 6y + 2 - x$
- $$= 9x + 13y \text{ .....M1}$$
- $$= 9(3) + 13(5)$$
- $$= 92 \text{ cm .....A1}$$

- 3 (a)  $\triangle ABC$  is similar to  $\triangle ADE$ . Given that  $BC = (x + 4)$  cm,  $DE = (4x - 5)$  cm,  $AC = 2x$  cm and  $CE = (2x - 5)$  cm. Find the value of  $x$ . [ 4 ]



**Solution:**

$$\frac{BC}{DE} = \frac{AC}{AE}$$

$$\frac{4}{12} = \frac{2x}{2x+5} \dots\dots\dots \text{M1 (correct ratio)}$$

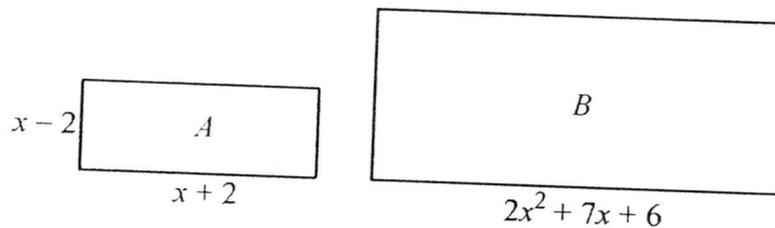
$$2x(12) = 4(2x + 5) \dots\dots\dots \text{M1 (correct cross-multiply)}$$

$$24x = 8x + 20$$

$$16x = 20$$

$$x = \frac{20}{16} = \frac{5}{4} = 1.25 \text{ cm} \dots\dots\dots \text{A1}$$

- (b) In the diagram, rectangle  $B$  is an enlargement of rectangle  $A$ . The dimensions given are in cm.



- (i) Find the scale factor of the enlargement in terms of  $x$ . [ 2 ]
- (ii) Hence, calculate the length of the unknown side of rectangle  $B$  in terms of  $x$ . [ 1 ]
- (iii) Express  $\frac{\text{area of rectangle } B}{\text{area of rectangle } A}$  in terms of  $x$ . [ 3 ]
- (iv) Hence, find area of rectangle  $B$  : area of rectangle  $A$  if  $x = 3$ . [ 1 ]

**Solution:**

- (i) Scale factor =  $\frac{2x^2 + 7x + 6}{x + 2}$  .....M1  
 $= \frac{(2x + 3)(x + 2)}{x + 2}$   
 $= 2x + 3$  .....A1
- (ii) Length of unknown side of rectangle  $B = (2x + 3)(x - 2)$   
 $= (2x^2 - x - 6)$  cm .....B1
- (iii)  $\frac{\text{area of rectangle } B}{\text{area of rectangle } A} = \frac{(2x^2 + 7x + 6)(2x^2 - x - 6)}{(x - 2)(x + 2)}$  .....M1  
 $= \frac{(2x + 3)(x + 2)(2x + 3)(x - 2)}{(x - 2)(x + 2)}$  .....M1 (factorize)  
 $= (2x + 3)^2$  .....A1
- (iv) If  $x = 3$ , area of rectangle  $B$  : area of rectangle  $A = [2(3) + 3]^2 : 1$   
 $= (9)^2 : 1$   
 $= 81 : 1$  .....B1

4 It is given that  $x = \frac{1+t}{1-t}$  and  $y = \frac{1-t}{1+t}$ .

(a) Find, in terms of  $t$ , (giving each answer as fraction in its simplest form) an expression for

(i)  $x - y$ , [ 2 ]

(ii)  $x + y$ , [ 2 ]

(iii) Hence, or otherwise, find  $x^2 - y^2$ . [ 3 ]

(b) Express  $x$  in terms of  $y$  only. [ 3 ]

**Solution:**

(a) (i)  $x - y = \frac{1+t}{1-t} - \frac{1-t}{1+t}$   
 $= \frac{(1+t)^2 - (1-t)^2}{(1-t)(1+t)}$  .....M1 (manipulation of fraction)  
 $= \frac{(1+t+1-t)(1+t-1+t)}{1-t^2}$   
 $= \frac{2(2t)}{1-t^2}$   
 $= \frac{4t}{1-t^2}$  .....A1

$$(ii) \quad x + y = \frac{1+t}{1-t} + \frac{1-t}{1+t}$$

$$\begin{aligned} x + y &= \frac{(1+t)^2 + (1-t)^2}{(1+t)(1-t)} \dots\dots\dots M1 \text{ (manipulation of fraction)} \\ &= \frac{1+2t+t^2+1-2t+t^2}{1-t^2} \\ &= \frac{2+2t^2}{1-t^2} \dots\dots\dots A1 \end{aligned}$$

$$\begin{aligned} \therefore x^2 - y^2 &= (x+y)(x-y) \dots\dots\dots M1 \\ &= \left( \frac{2+2t^2}{1-t^2} \right) \left( \frac{4t}{1-t^2} \right) \dots\dots\dots M1 \text{ (correct manipulation)} \\ &= \frac{8t(1+t^2)}{(1-t^2)^2} \text{ or } \frac{8t+8t^3}{1-2t^2+t^4} \dots\dots\dots A1 \end{aligned}$$

**Method 1:**

$$(b) \quad y = \frac{1-t}{1+t}$$

$$y + yt = 1 - t$$

$$yt + t = 1 - y$$

$$t = \frac{1-y}{1+y}$$

$$x = \frac{1 + \frac{1-y}{1+y}}{1 - \frac{1-y}{1+y}}$$

$$= \frac{1+y+1-y}{1+y} \times \frac{1+y}{1+y-1+y}$$

$$= \frac{2}{2y}$$

$$\therefore x = \frac{1}{y}$$

**Method 2:**

$$(b) \quad y = \frac{1-t}{1+t}$$

$$= \frac{1}{\left( \frac{1+t}{1-t} \right)} \dots\dots\dots M1$$

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$$= \frac{1}{x} \dots\dots\dots \text{M1}$$

$$\therefore x = \frac{1}{y} \dots\dots\dots \text{A1}$$

- 5 (a) The points  $(4, a)$ ,  $(b, -2)$  are some points on the graph of  $y = 2x + 7$ . Find without plotting the graph,
- (i) the value of  $a$ , [ 2 ]
- (ii) the value of  $b$ . [ 2 ]

**Solution:**

(a)

- (i) Since the point  $(4, a)$  lies on the graph, the coordinates of the point satisfy the equation  $y = 2x + 7$ .

$\therefore$  we substitute  $x = 4$  into  $y = 2x + 7$ .

When  $x = 4$ ,

$$y = 2(4) + 7 \dots\dots\dots \text{M1}$$

$$= 15$$

$$\therefore a = 15 \dots\dots\dots \text{A1}$$

- (ii) When  $y = -2$ ,

$$-2 = 2x + 7 \dots\dots\dots \text{M1}$$

$$2x = -9$$

$$x = -\frac{9}{2}$$

$$\therefore b = -\frac{9}{2} \text{ or } b = -4\frac{1}{2} \dots\dots\dots \text{A1}$$

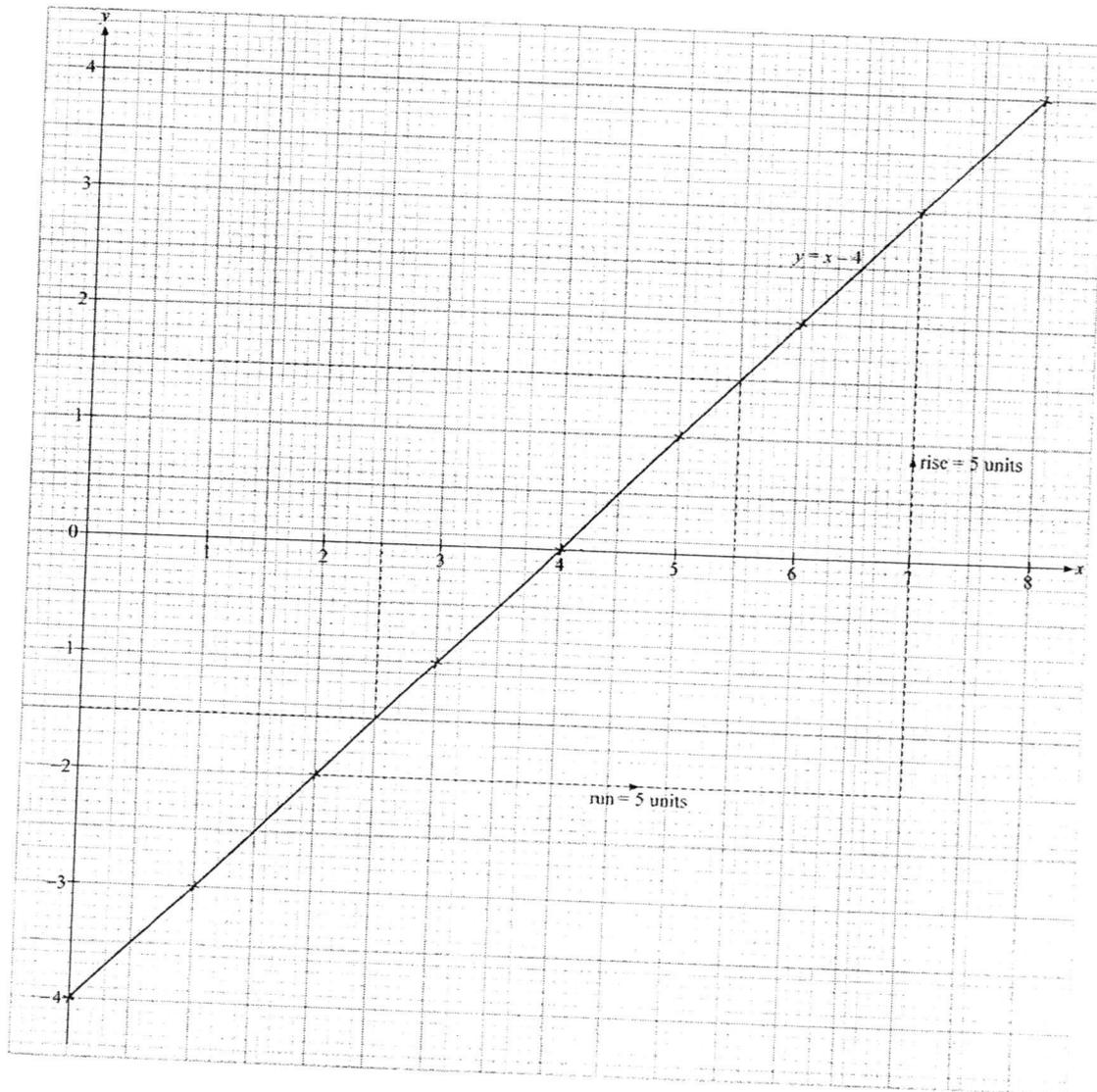
- (b) Answer this part on the graph paper. Given the following table

$x$	0	1	2	3	4	5	6
$y = x - 4$	-4	-3	-2	-1	0	1	2

- (i) Using a scale of 2 cm to 1 unit on both axes, draw the graph of  $y = x - 4$  for values of  $x$  from 0 to 6. [ 3 ]
- (ii) Find the gradient of the graph. [ 2 ]
- (iii) From the graph, find the value of  $y$  when  $x = 2.5$ . [ 1 ]

**Solution:**

(b)(i)



Correct Plotted points -----P1

Smooth Straight line .....C1

Correct scale, with axis label, equation of line label, scale markings .....B1

b)(ii)

$$\text{Gradient of the graph} = \frac{\text{rise}}{\text{run}}$$

$$= \frac{5}{5} \dots\dots\dots\text{M1}$$

$$= 1 \dots\dots\dots\text{A1 (range } \pm 0.1)$$

(iii) From the graph,

when  $x = 2.5, y = -1.5 \dots\dots\dots$  B1 (range  $\pm 0.1$ )

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**END OF PAPER**

Name

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Class



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# 2EX

## MATHEMATICS

[ 80 marks ]

### SEMESTER ONE EXAMINATION

Thursday, 14 May 2015

2 hours

Candidates answer on the Question Paper for section A

Additional material: Electronic Calculator  
Geometrical Instruments  
Answer Paper

### INSTRUCTIONS TO CANDIDATES

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, glue or correction fluid.

Answer **ALL** questions.

For **Section A**, write your answers in the spaces provided on the question paper.

For **Section B**, write your answers in the spaces on the separate answer 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.

Write the brand and model of your calculator in the space provided below.

### INFORMATION FOR CANDIDATES

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

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  $\pi$ .

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 **80**.

Brand & Model of Calculator

For Examiner's Use	
Section A	40
Section B	40
<b>Total</b>	<b>80</b>

This question paper consists of 12 printed pages.

Setter: Mr. Gabriel Cheow

Vetter: Mr. Chio Kah Leong

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For  
Examiner's  
Use**Section A (40 marks)**For  
Examiner's  
UseAnswer **all** the questions.**1** A map is drawn to a scale of 1 : 25 000.**(a)** This scale represents 1 cm :  $n$  km. Find  $n$ .*Answer (a)*  $n = \dots\dots\dots$  [1]**(b)** The distance between two towns on the map is 30 cm.  
Find the actual distance, in kilometres, between the two towns.*Answer (b)*  $\dots\dots\dots$  km [1]**(c)** A lake has an actual area of  $2.5 \text{ km}^2$ .  
Find the area, in square centimetres, of the lake on the map.*Answer (c)*  $\dots\dots\dots$   $\text{cm}^2$  [2]

[Turn over

2  $y$  is directly proportional to  $x^3$   
It is also given that  $y = 24$  when  $x = 2$ .

(a) Find the equation connecting  $y$  and  $x$ .

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

(b) Hence, find the value of  $y$  when  $x = 3$ .

Answer (b) ..... [1]

3 The force of attraction,  $F$  newtons, between two magnets is inversely proportional of the square of the distance,  $d$  centimetres, between them.

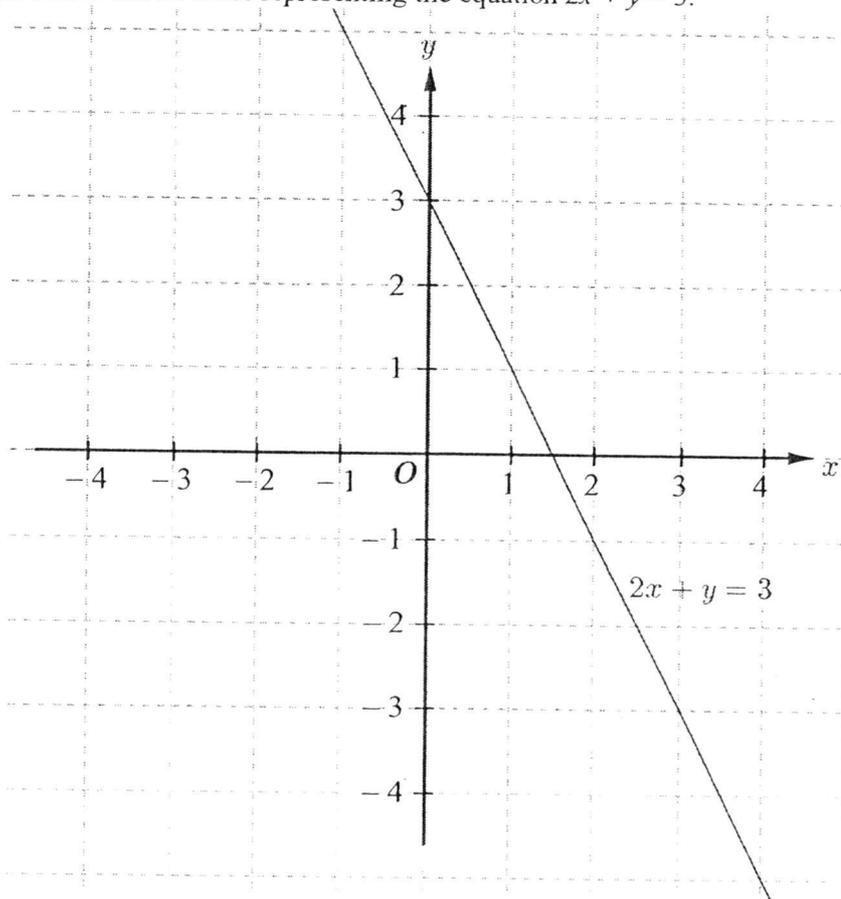
When the magnets are at a certain distance apart, the force is 1.25 newtons.

Find the force when the distance is halved.

Answer ..... newtons [2]

For  
Examiner's  
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- 4 The graph below shows a line representing the equation  $2x + y = 3$ .



- (a) Draw and label the line representing the equation  $y = \frac{1}{2}x - 2$  on the same diagram above. [1]
- (b) Hence, solve the simultaneous linear equation.

$$2x + y = 3$$

$$y = \frac{1}{2}x - 2$$

Answer (b)  $x = \dots\dots\dots$ ,  $y = \dots\dots\dots$  [1]

- (c) Write down the equation of a line that passes through the origin and is parallel to the line  $2x + y = 3$ .

Answer (c)  $y = \dots\dots\dots$  [2]

5 Solve the following equations

(a)  $2(x+3) - 5(1-x) = 7,$

(b)  $\frac{x-2}{2x+1} = \frac{1}{4}.$

Answer (a)  $x = \dots\dots\dots$  [2]

Answer (b)  $x = \dots\dots\dots$  [2]

6 (a) Factorise  $x^2 + 5x - 6.$

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

(b) Hence, using your result in (a), factorise  $(y-4)^2 + 5(y-4) - 6.$

Answer (b)  $\dots\dots\dots$  [1]

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[Turn over

For  
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7 Solve the following simultaneous linear equation.

$$3x - 2y = 8$$

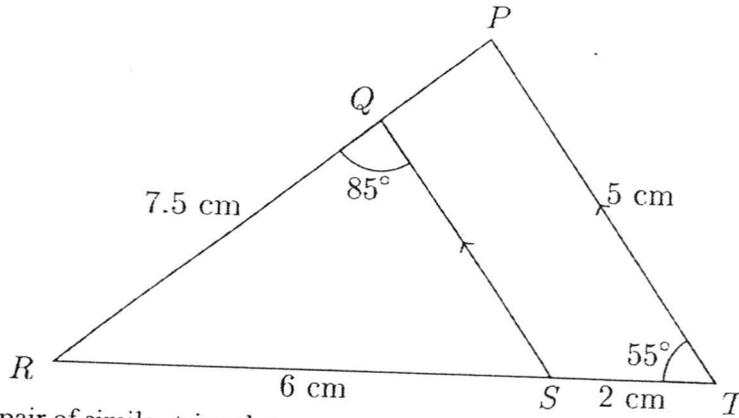
$$4x + 3y = 5$$

For  
Examiner's  
Use

Answer  $x = \dots\dots\dots$ ,  $y = \dots\dots\dots$  [3]

[Turn over

- 8 In the diagram below, line  $TP$  is parallel to line  $SQ$ ,  $QR$  is 7.5 cm,  $RS$  is 6 cm,  $ST$  is 2 cm and  $TP$  is 5 cm,  $\angle RQS = 85^\circ$  and  $\angle RTP = 55^\circ$ .



- (a) Name a pair of similar triangles.

Answer (a)  $\Delta$ ..... and  $\Delta$ ..... [1]

- (b) Find  $\angle PRT$ .

Answer (b)  $\angle PRT =$  ..... $^\circ$  [2]

- (c) Find the length of  $SQ$ .

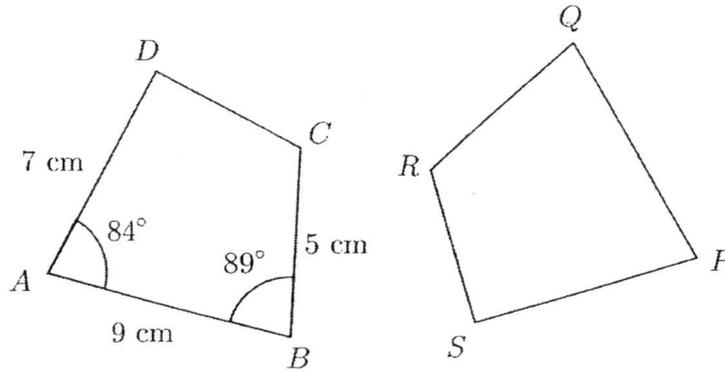
Answer (c)  $SQ =$  ..... cm [2]

- (d) Find  $\frac{\text{area of } \Delta PRT}{\text{area of } \Delta RQS}$ .

Answer (d) ..... [2]

For  
Examiner's  
Use

- 9 The quadrilaterals  $ABCD$  and  $PQRS$  are congruent (not drawn to scale).



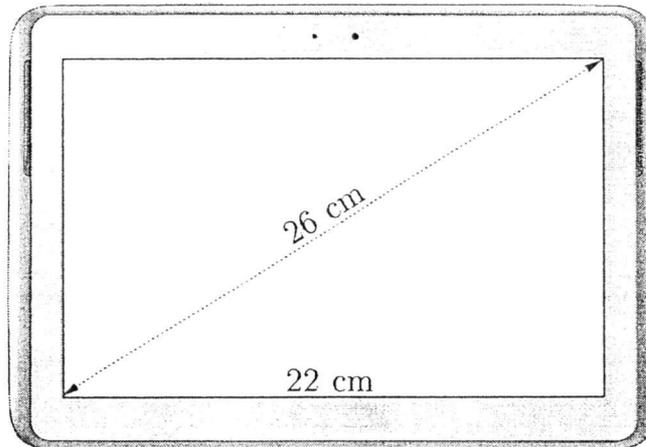
- (a) Write down the length of  $PQ$ .

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

- (b) Write down  $\angle PQR$ .

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

- 10 The figure below is an electronic tablet.  
Some of the dimensions for its rectangular screen are shown below.



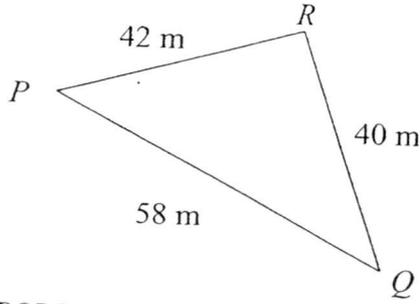
Find the height of the screen.

Answer  $\dots\dots\dots$  cm [2]

For  
Examiner's  
Use

[Turn over

- 11 The diagram shows a triangular piece of land  $PQR$  with the dimensions  $PQ = 58$  m,  $QR = 40$  m and  $RP = 42$  m.



- (a) Prove that triangle  $PQR$  is a right-angled triangle.

[2]

- (b) Find the area of the piece of land.

Answer (b) ..... m<sup>2</sup> [2]

- (c) Find the shortest distance from  $R$  to  $PQ$ .

Answer (c) ..... m [2]

**Section B (40 marks)**

Answer **all** the questions on the separate answer paper provided.

12 Expand and simplify the following

(a)  $2(x^2 - 3x + 2) - 3(x^2 + x - 2)$ , [1]

(b)  $(2x - 3)(x^2 - 2x - 4)$ , [2]

(c)  $3x^2 + 1 - 2(x + 1)^2$ . [3]

---

13 (a) (i) Expand  $(a - b)^2$ . [1]

(ii) Hence, using your result in (a)(i), evaluate  $98^2$ . [2]

(b) If  $(x - y)^2 = 57$  and  $xy = 4$ , find the value of  $(x + y)^2$ . [2]

---

14 Factorise the following completely

(a)  $2n^2 - 18$ , [2]

(b)  $pq - 2q + 2 - p$ . [2]

---

[Turn over

15 Express the following as a single fraction in its simplest form

(a)  $\frac{4}{3x} + \frac{1}{2+x}$ , [2]

(b)  $\frac{3xy^3}{8z^2} \div \frac{9y^2}{10xz}$ , [2]

(c)  $\frac{3}{2x-1} - \frac{6x-1}{(2x-1)^2}$ . [3]

---

16 (a) Express  $\frac{1}{x-2} \times \frac{6-x-x^2}{1-x}$  as a single fraction. [2]

(b) Hence, or otherwise, solve the equation  $\frac{1}{x-2} \times \frac{6-x-x^2}{1-x} = 5$ . [2]

---

17 It is given that  $Q = \sqrt{\frac{3P-1}{2P+1}}$ .

(a) If  $P = 2$ , find the value of  $Q$ . [2]

(b) Make  $P$  the subject of the formula. [3]

(c) Hence, or otherwise, find the value of  $P$  when  $Q = 2$ . [2]

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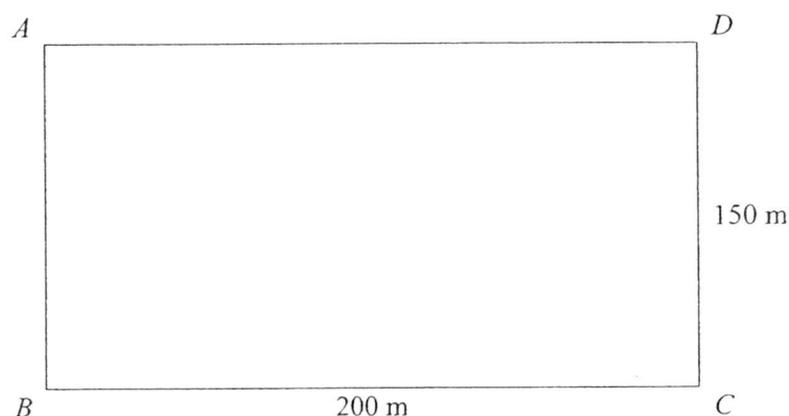
[Turn over

- 18 The time taken,  $t$  minutes, to pack all the Examination Care Packs is inversely proportional to the number of students,  $N$ , involved in the packing.

If a team of 3 students take 50 minutes to pack all the Examination Care Packs, how many **more** students are needed if the packing must be completed 20 minutes earlier? [3]

---

- 19 The diagram below shows a rectangular field  $ABCD$  (not drawn to scale) with dimensions 200 m by 150 m.



- (a) Find the distance from point  $A$  to point  $C$ . [2]
- (b) Mr. Cheow bought a new remote-controlled helicopter drone, and wants to fly it by standing at point  $A$ . The remote control has a maximum range of 225 m. Can the maximum range cover the whole field from where he stands? Explain why.

[2]

Name

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Class

**MARK SCHEME**

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**2EX****MATHEMATICS**

[ 80 marks ]

**SEMESTER ONE EXAMINATION**

Thursday, 14 May 2015

**2 hours**

Candidates answer on the Question Paper for section A

Additional material: Electronic Calculator  
 Geometrical Instruments  
 Answer Paper

**INSTRUCTIONS TO CANDIDATES**

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, glue or correction fluid.

Answer **ALL** questions.For **Section A**, write your answers in the spaces provided on the question paper.For **Section B**, write your answers in the spaces on the separate answer 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.

Write the brand and model of your calculator in the space provided below.

**INFORMATION FOR CANDIDATES**

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

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  $\pi$ .

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 **80**.

Brand &amp; Model of Calculator

For Examiner's Use	
Section A	40
Section B	40
<b>Total</b>	<b>80</b>

This question paper consists of 13 printed pages.

Setter: Mr. Gabriel Cheow

Vetter: Mr. Chio Kah Leong

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**Section A (40 marks)**Answer **all** the questions.**1** A map is drawn to a scale of 1: 25 000.**(a)** This scale represents 1 cm :  $n$  km. Find  $n$ .

$$\begin{aligned} 1: 25000 &= 1 \text{ cm} : 25000 \text{ cm} \\ &= 1 \text{ cm} : 250 \text{ m} \\ &= 1 \text{ cm} : 0.25 \text{ km} \end{aligned}$$

*Answer (a)  $n = 0.25 \dots$  [B1] [1]***(b)** The distance between two towns on the map is 30 cm.  
Find the actual distance, in kilometres, between the two towns.

$$\begin{aligned} 1 \text{ cm} &: 0.25 \text{ km} \\ &= 30 \text{ cm} : 30 \times 0.25 \text{ km} \\ &= 30 \text{ cm} : 7.5 \text{ km} \end{aligned}$$

*Answer (b) 7.5 ... [B1] km [1]***(c)** A lake has an actual area of  $2.5 \text{ km}^2$ .  
Find the area, in square centimetres, of the lake on the map.

$$\begin{aligned} \text{Ratio of area} &= \text{square of map scale} \\ &= (1 \text{ cm})^2 : (0.25 \text{ km})^2 \\ &= 1 \text{ cm}^2 : 0.0625 \text{ km}^2 \dots \dots \dots \text{ [M1]} \\ &= 16 \text{ cm}^2 : 1 \text{ km}^2 \\ &= 2.5 \times 16 \text{ cm}^2 : 2.5 \text{ km}^2 \\ &= 40 \text{ cm}^2 : 2.5 \text{ km}^2 \end{aligned}$$

*Answer (c) 40 ... [A1]  $\text{cm}^2$  [2]*

- 2  $y$  is directly proportional to  $x^3$   
It is also given that  $y = 24$  when  $x = 2$ .

(a) Find the equation connecting  $y$  and  $x$ .

$$y \propto x^3$$

$$y = kx^3$$

$$24 = k(2)^2$$

$$24 = 8k$$

$$k = 3 \dots \dots \dots [M1]$$

$$\therefore y = 3x^3$$

Answer (a)  $y = 3x^3 \dots [A1] [2]$

(b) Hence, find the value of  $y$  when  $x = 3$ .

$$\text{Let } x = 3 \text{ in } y = 3x^3$$

$$y = 3(3)^3$$

$$= 81$$

Answer (b) 81 ... [B1] [1]

- 3 The force of attraction,  $F$  newtons, between two magnets is inversely proportional of the square of the distance,  $d$  centimetres, between them.

When the magnets are at a certain distance apart, the force is 1.25 newtons.

Find the force when the distance is halved.

$$F \propto \frac{1}{d^2}$$

$$F = \frac{k}{d^2}$$

$$\text{When } d = a, F = 1.25$$

$$1.25 = \frac{k}{a^2}$$

$$\text{When } d = \frac{1}{2}a,$$

$$F = \frac{k}{\left(\frac{1}{2}a\right)^2} \dots \dots [M1]$$

$$= \frac{k}{\frac{1}{4}a^2}$$

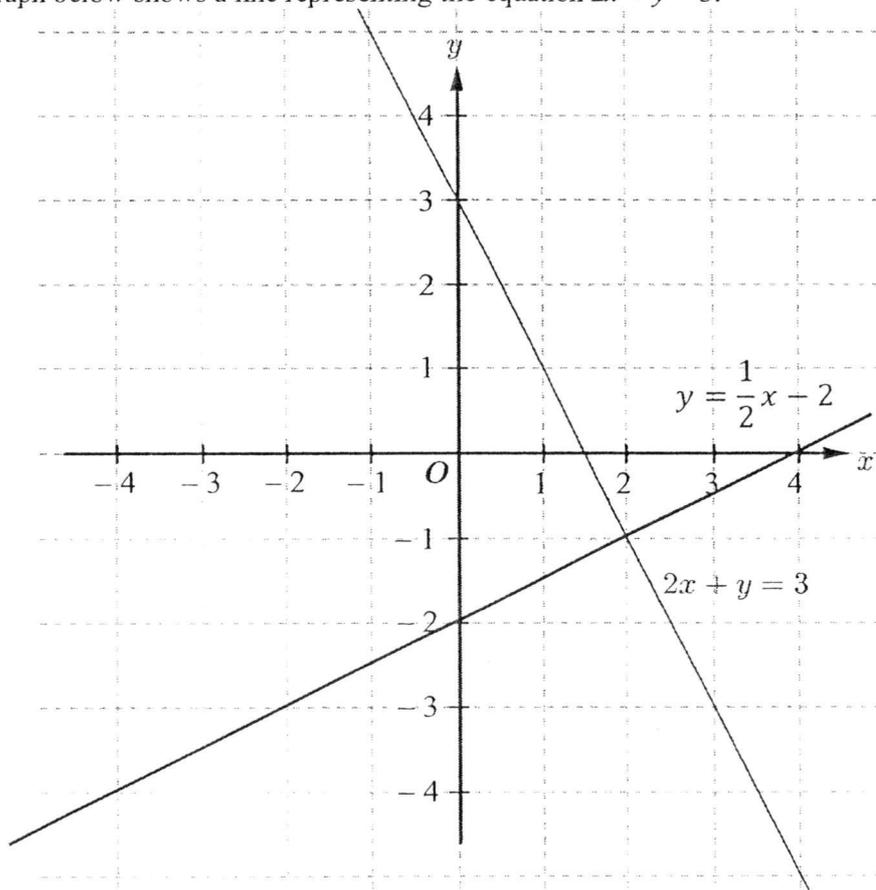
$$= 4 \times \frac{k}{a^2}$$

$$= 4 \times 1.25$$

$$= 5$$

Answer 5 ... [A1] newtons [2]

- 4 The graph below shows a line representing the equation  $2x + y = 3$ .



- (a) Draw and label the line representing the equation  $y = \frac{1}{2}x - 2$  on the same diagram above. [1]
- (b) Hence, solve the simultaneous linear equation.

$$\begin{aligned} 2x + y &= 3 \\ y &= \frac{1}{2}x - 2 \end{aligned}$$

Answer (b)  $x = 2, y = -1$  (both  $x$  and  $y$  must be correct for B1) [1]

- (c) Write down the equation of a line that passes through the origin and is parallel to the line  $2x + y = 3$ .

$$\begin{aligned} 2x + y &= 3 \\ y &= -2x + 3 \dots \dots [M1] \\ \therefore m &= -2, c = 0 \end{aligned}$$

Answer (c)  $y = -2x \dots [A1] [2]$

5 Solve the following equations

(a)  $2(x+3) - 5(1-x) = 7,$

$$2(x+3) - 5(1-x) = 7$$

$$2x + 6 - 5 + 5x = 7$$

$$7x + 1 = 7 \dots \dots \dots [M1]$$

$$7x = 6$$

$$x = \frac{6}{7}$$

Answer (a)  $x = \frac{6}{7} \dots [A1] [2]$

(b)  $\frac{x-2}{2x+1} = \frac{1}{4}$

$$\frac{x-2}{2x+1} = \frac{1}{4}$$

$$4(x-2) = 2x+1 \dots \dots \dots [M1]$$

$$4x - 8 = 2x + 1$$

$$4x - 2x = 8 + 1$$

$$2x = 9$$

$$x = \frac{9}{2} \text{ or } 4\frac{1}{2} \text{ or } 4.5$$

Answer (b)  $x = \frac{9}{2} \text{ or } 4\frac{1}{2} \text{ or } 4.5 \dots [A1] [2]$

6 (a) Factorise  $x^2 + 5x - 6$ .

Correct factorisation using cross method or multiplication frame [M1]

Answer (a)  $(x+6)(x-1) [A1 \text{ or } B2] [2]$

(b) Hence, using your result in (a), factorise  $(y-4)^2 + 5(y-4) - 6$ .

$$\begin{aligned} \text{Let } x &= y - 4 \\ (y-4)^2 + 5(y-4) - 6 &= (y-4+6)(y-4-1) \\ &= (y+2)(y-5) \end{aligned}$$

[B1 when both working shows result in (a) used and answer is correct]

Answer (b)  $(y+2)(y-5) [1]$

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For  
Examiner's  
Use

7 Solve the following simultaneous linear equation.

$$3x - 2y = 8$$

$$4x + 3y = 5$$

$$3x - 2y = 8 \dots\dots\dots (1)$$

$$4x + 3y = 5 \dots\dots\dots (2)$$

$$\text{From (1): } -2y = -3x + 8$$

$$2y = 3x - 8$$

$$y = \frac{3}{2}x - 4 \dots\dots\dots (3)$$

[M1 for showing the substitution method, or successfully eliminated  $x$  or  $y$ ]

Substitute (3) into (2):

$$4x + 3\left(\frac{3}{2}x - 4\right) = 5$$

$$4x + \frac{9}{2}x - 12 = 5$$

$$\frac{17}{2}x = 17$$

$$x = 2$$

Substitute  $x = 2$  into (1):

$$3(2) - 2y = 8$$

$$6 - 2y = 8$$

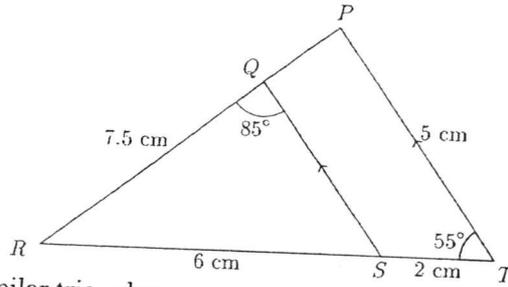
$$-2y = 2$$

$$y = -1$$

*Answer*  $x = 2$  [A1],  $y = -1$  [A1] [3]

For  
Examiner's  
Use

- 8 In the diagram below, line  $TP$  is parallel to line  $SQ$ ,  $QR$  is 7.5 cm,  $RS$  is 6 cm,  $ST$  is 2 cm and  $TP$  is 5 cm,  $\angle RQS = 85^\circ$  and  $\angle RTP = 55^\circ$ .



- (a) Name a pair of similar triangles.  
[B1 for a naming the correct pair, with vertices in the correct order]  
Other answers:  
RSQ & RTP, SQR & TPR, SRQ & TRP, QRS & PRT, QSR & PTR

Answer (a)  $\Delta RQS$  and  $\Delta RPT$  [1]

- (b) Find  $\angle PRT$ .

$$\begin{aligned} \angle TPR &= \angle SQR \\ &= 85^\circ \\ \angle PRT &= 180^\circ - \angle TPR - \angle PTR \\ &= 180^\circ - 85^\circ - 55^\circ \dots \dots \dots [M1] \\ &= 40^\circ \end{aligned}$$

Answer (b)  $\angle PRT = 40 \dots [M1]^\circ$  [2]

- (c) Find the length of  $SQ$ .

$$\begin{aligned} \text{Scale factor} &= \frac{RS}{RT} = \frac{6}{8} \dots \dots \dots [M1] \\ SQ &= \frac{6}{8} \times 5 \\ &= 3.75 \end{aligned}$$

Answer (c)  $SQ = 3.75 \dots [A1]$  cm [2]

- (d) Find  $\frac{\text{area of } \Delta PRT}{\text{area of } \Delta RQS}$

$$\begin{aligned} \text{Ratio of area} &= \text{square of length} \\ &= \frac{8^2}{6^2} \dots \dots \dots [M1] \\ &= \frac{64}{36} \\ &= \frac{16}{9} \end{aligned}$$

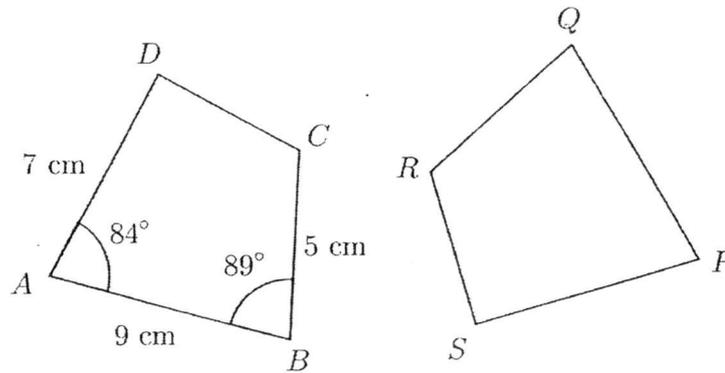
Alternative solution  $\Rightarrow$

$$\begin{aligned} \text{Let height of } \Delta PRT \text{ be } h_1. \\ \text{Let height of } \Delta RQS \text{ be } h_2. \\ \frac{h_1}{h_2} &= \frac{8}{6} \\ \frac{\text{area of } \Delta PRT}{\text{area of } \Delta RQS} &= \frac{0.5 \times h_1 \times 8}{0.5 \times h_2 \times 6} [M1] \\ &= \frac{0.5 \times 8}{0.5 \times 6} \times \frac{h_1}{h_2} \\ &= \frac{4}{3} \times \frac{8}{6} \\ &= \frac{16}{9} \end{aligned}$$

Answer (d)  $\frac{16}{9} \dots \dots [A1]$  [2]

For  
Examiner's  
Use

- 9 The quadrilaterals  $ABCD$  and  $PQRS$  are congruent (not drawn to scale).

For  
Examiner's  
Use

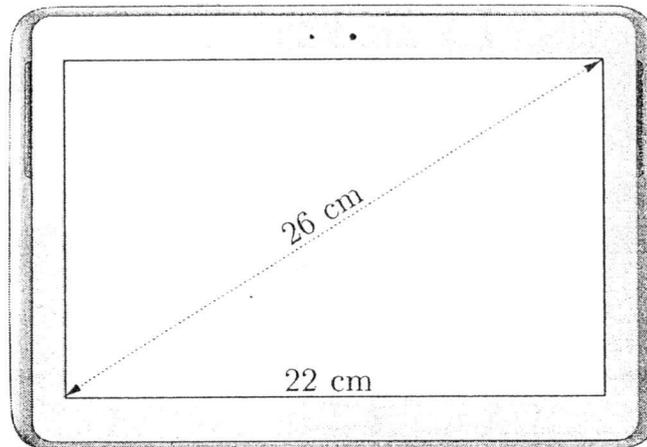
- (a) Write down the length of  $PQ$ .

Answer (a)  $PQ = 9$  [B1] cm [1]

- (b) Write down  $\angle PQR$ .

Answer (b)  $\angle PQR = 89$  [B1] $^\circ$  [1]

- 10 The figure below is an electronic tablet.  
Some of the dimensions for its rectangular screen are shown below.

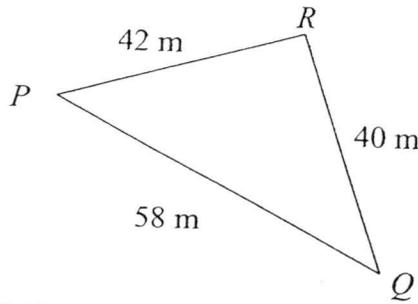


Find the height of the screen.

$$\begin{aligned}
 &\text{Let height be } h \text{ cm.} \\
 &\text{By Pythagoras' Theorem,} \\
 &22^2 + h^2 = 26^2 \\
 &h^2 = 26^2 - 22^2 \dots\dots [M1] \\
 &= 192 \\
 &h = \sqrt{192} \\
 &= 13.85640 \dots \\
 &= 13.8 \text{ (3sf)}
 \end{aligned}$$

Answer 13.8 [A1] cm [2]

- 11 The diagram shows a triangular piece of land  $PQR$  with the dimensions  $PQ = 58$  m,  $QR = 40$  m and  $RP = 42$  m.



- (a) Prove that triangle  $PQR$  is a right-angled triangle.

$$QR^2 + PR^2 = 40^2 + 42^2$$

$$= 3364$$

$$PQ^2 = 58^2$$

$$= 3364$$

$$\therefore PQ^2 = QR^2 + PR^2 \dots \dots \dots [M1]$$

$\therefore$  By converse of Pythagoras Theorem,  $\dots \dots \dots [A1]$

$\Delta PQR$  is a right - angled triangle.

[2]

- (b) Find the area of the piece of land.

$$Area = \frac{1}{2} \times 42 \times 40 \dots \dots \dots [M1]$$

$$= 840$$

Answer (b) 840 [A1] m<sup>2</sup> [2]

- (c) Find the shortest distance from  $R$  to  $PQ$ .

Let shortest distance be  $d$ .

$$\frac{1}{2} \times d \times 58 = 840 \dots \dots \dots [M1]$$

$$d = 840 \times 2 \div 58$$

$$= 28 \frac{28}{29}$$

$$= 28.9655 \dots$$

$$= 29.0 \text{ (3sf)}$$

Answer (c) 29.0 or  $28 \frac{28}{29}$  [A1] m [2]

**Section B (40 marks)**

12 Expand and simplify the following

(a)  $2(x^2 - 3x + 2) - 3(x^2 + x - 2)$ , [1]

$$2(x^2 - 3x + 2) - 3(x^2 + x - 2) = 2x^2 - 6x + 4 - 3x^2 - 3x + 6$$

$$= -x^2 - 9x + 10 \dots \dots \dots [B1]$$

(b)  $(2x - 3)(x^2 - 2x - 4)$  [2]

$$(2x - 3)(x^2 - 2x - 4) = 2x(x^2 - 2x - 4) - 3(x^2 - 2x - 4) \dots [M1]$$

$$= 2x^3 - 4x^2 - 8x - 3x^2 + 6x + 12$$

$$= 2x^3 - 7x^2 - 2x + 12 \dots \dots \dots [A1]$$

(c)  $3x^2 + 1 - 2(x + 1)^2$ . [3]

$$3x^2 + 1 - 2(x + 1)^2 = 3x^2 + 1 - 2(x^2 + 2x + 1) \dots [M1]$$

$$= 3x^2 + 1 - 2x^2 - 4x - 2 \dots [M1]$$

$$= x^2 - 4x - 1 \dots \dots \dots [A1]$$

13 (a) (i) Expand  $(a - b)^2$ . [1]

$$(a - b)^2 = a^2 - 2ab + b^2 \dots \dots [M1]$$

(ii) Hence, using your result in (a)(i), evaluate  $98^2$ . [2]Let  $a = 100$ ,  $b = 2$ .

$$98^2 = (100 - 2)^2$$

$$= 100^2 - 2(100)(2) + 2^2 \dots \dots [M1]$$

$$= 10000 - 400 + 4$$

$$= 9604 \dots \dots \dots [A1]$$

(b) If  $(x - y)^2 = 57$  and  $xy = 4$ , find the value of  $(x + y)^2$ . [2]

$$(x - y)^2 = x^2 - 2xy + y^2$$

$$x^2 - 2xy + y^2 = 57$$

$$x^2 - 2(4) + y^2 = 57$$

$$x^2 - 8 + y^2 = 57$$

$$x^2 + y^2 = 65 \dots \dots \dots [M1]$$

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$x^2 + 2xy + y^2 = 65 + 2(4)$$

$$= 73 \dots \dots \dots [A1]$$

14 Factorise the following completely

(a)  $2n^2 - 18$  [2]

$$2n^2 - 18 = 2(n^2 - 9) \dots \dots \dots [M1]$$

$$= 2(n + 3)(n - 3) \dots \dots \dots [A1]$$

(b)  $pq - 2q + 2 - p$ . [2]

$$pq - 2q + 2 - p = q(p - 2) - (p - 2) \dots \dots [M1]$$

$$= (q - 1)(p - 2) \dots \dots \dots [A1]$$

15 Express the following as a single fraction in its simplest form

(a)  $\frac{4}{3x} + \frac{1}{2+x}$  [2]

$$\begin{aligned} \frac{4}{3x} + \frac{1}{2+x} &= \frac{4(2+x)}{3x(2+x)} + \frac{3x}{3x(2+x)} \dots [M1] \\ &= \frac{8+4x+3x}{3x(2+x)} \\ &= \frac{8+7x}{3x(2+x)} \dots \dots \dots [A1] \end{aligned}$$

(b)  $\frac{3xy^3}{8z^2} \div \frac{9y^2}{10xz}$  [2]

$$\begin{aligned} \frac{3xy^3}{8z^2} \div \frac{9y^2}{10xz} &= \frac{3xy^3}{8z^2} \times \frac{10xz}{9y^2} \dots \dots [M1 \text{ for cancelling}] \\ &= \frac{5x^2y}{12z} \dots \dots \dots [A1] \end{aligned}$$

(c)  $\frac{3}{2x-1} - \frac{6x-1}{(2x-1)^2}$  [3]

$$\begin{aligned} \frac{3}{2x-1} - \frac{6x-1}{(2x-1)^2} &= \frac{3(2x-1)}{(2x-1)^2} - \frac{6x-1}{(2x-1)^2} \dots [M1] \\ &= \frac{3(2x-1) - (6x-1)}{(2x-1)^2} \dots \dots [M1] \\ &= \frac{6x-3-6x+1}{(2x-1)^2} \\ &= \frac{2}{(2x-1)^2} \dots \dots \dots [A1] \end{aligned}$$

16 (a) Express  $\frac{1}{x-2} \times \frac{6-x-x^2}{1-x}$  as a single fraction. [2]

$$\begin{aligned} \frac{1}{x-2} \times \frac{6-x-x^2}{1-x} &= \frac{1}{x-2} \times \frac{(3+x)(2-x)}{1-x} \dots \dots \dots [M1] \\ &= \frac{1}{x-2} \times \frac{(3+x)(x-2)}{1-x} \\ &= -\frac{3+x}{1-x} \text{ or } \frac{-3-x}{1-x} \text{ or } \frac{3+x}{x-1} \dots [A1] \end{aligned}$$

(b) Hence, or otherwise, solve the equation  $\frac{1}{x-2} \times \frac{6-x-x^2}{1-x} = 5$ . [2]

$$\begin{aligned} \frac{1}{x-2} \times \frac{6-x-x^2}{1-x} &= 5 \\ \frac{3+x}{x-1} &= 5 \dots \dots \dots [M1] \\ 3+x &= 5x-5 \\ 8 &= 4x \\ x &= 2 \dots \dots \dots [A1] \end{aligned}$$

NOTE: Strictly speaking,  $x = 2$  cannot be a solution, because  $\frac{1}{x-2}$ . Only found this out after banking in the paper.

17 It is given that  $Q = \sqrt{\frac{3P-1}{2P+1}}$ .

- (a) If  $P = 2$ , find the value of  $Q$ . [2]

$$\begin{aligned} Q &= \sqrt{\frac{3(2) - 1}{2(2) + 1}} \dots\dots [M1] \\ &= \sqrt{\frac{5}{5}} \\ &= \sqrt{1} \\ &= 1 \dots\dots\dots [A1] \end{aligned}$$

- (b) Make  $Q$  the subject of the formula. [3]

$$\begin{aligned} Q &= \sqrt{\frac{3P - 1}{2P + 1}} \\ Q^2 &= \frac{3P - 1}{2P + 1} \dots\dots [M1] \\ Q^2(2P + 1) &= 3P - 1 \\ 2PQ^2 + Q^2 &= 3P - 1 \\ 2PQ^2 - 3P &= -1 - Q^2 \dots\dots [M1] \\ P(2Q^2 - 3) &= -1 - Q^2 \\ P &= \frac{-1 - Q^2}{2Q^2 - 3} \text{ or } \frac{1 + Q^2}{3 - 2Q^2} \dots\dots [A1] \end{aligned}$$

- (c) Hence, or otherwise, find the value of  $P$  when  $Q = 2$ . [2]

"Hence" Solution:

$$\begin{aligned} P &= \frac{1 + (2)^2}{3 - 2(2)^2} \dots\dots [M1] \\ &= \frac{5}{-5} \\ &= -1 \dots\dots\dots [A1] \end{aligned}$$

"Otherwise" Solution:

$$\begin{aligned} 2 &= \sqrt{\frac{3P - 1}{2P + 1}} \\ 4 &= \frac{3P - 1}{2P + 1} \dots\dots [M1] \\ 8P + 4 &= 3P - 1 \\ 5P &= -5 \\ P &= -1 \dots\dots\dots [A1] \end{aligned}$$


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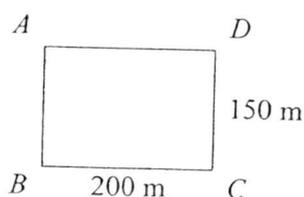
- 18 The time taken,  $t$  minutes, to pack all the Examination Care Packs is inversely proportional to the number of students,  $N$ , involved in the packing.

If a team of 3 students take 50 minutes to pack all the Examination Care Packs, how many **more** students are needed if the packing must be completed 20 minutes earlier?

[3]

$$\begin{aligned}
 t &\propto \frac{1}{N} \\
 t &= \frac{k}{N} \text{ or } tN = k \\
 k &= (50)(3) \\
 k &= 150 \\
 \therefore tN &= 150 \dots \dots [M1]
 \end{aligned}
 \qquad
 \begin{aligned}
 \text{Let } t &= 30 \\
 30N &= 150 \\
 N &= 5 \dots \dots [M1] \\
 5 - 3 &= 2 \\
 \therefore &2 \text{ more students.} \dots \dots [A1]
 \end{aligned}$$

- 19 The diagram below shows a rectangular field  $ABCD$  (not drawn to scale) with dimensions 200 m by 150 m.



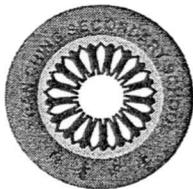
- (a) Find the distance from point  $A$  to point  $C$ . [2]

$$\begin{aligned}
 &\text{By Pythagoras Theorem,} \\
 AC^2 &= 200^2 + 150^2 \\
 AC &= \sqrt{200^2 + 150^2} \dots \dots [M1] \\
 &= 250 \dots \dots [A1] \\
 \therefore \text{distance from } A \text{ to } C &= 250 \text{ m}
 \end{aligned}$$

- (b) Mr. Cheow bought a new remote-controlled helicopter drone, and wants to fly it by standing at point  $A$ . The remote control has a maximum range of 225 m. Can the maximum range cover the whole field from where he stands? Explain why.

No. [B1] [2]

The helicopter cannot reach point  $C$  if Mr. Cheow stands at point  $A$ .  
(or any acceptable answer provided by student) [B1]



YUAN CHING SECONDARY SCHOOL  
2015 MID YEAR EXAMINATION  
SECONDARY TWO EXPRESS

MATHEMATICS  
4048 / 01

NAME: \_\_\_\_\_ ( )

TIME: 1 hour

CLASS: Sec \_\_\_\_\_

**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.

You may use a pencil for any diagrams or graphs.

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

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.

Omission of essential working will result in loss of marks.

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

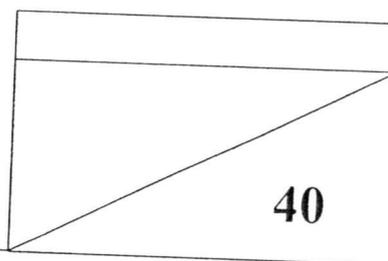
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

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

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 the marks for this paper is **40**.



This document consists of 7 printed pages.

[Turn Over

82

Answer **all** the questions.

- 1  $V$  is directly proportional to the square root of  $p$ . Given that  $V = 36$  when  $p = 16$ , find
- (a) an equation connecting  $V$  and  $p$ ,
  - (b) the value of  $V$  when  $p = 0.04$ ,
  - (c) the value of  $p$  when  $V = \frac{1}{3}$ .

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

(b)  $V =$  ..... [1]

(c)  $p =$  ..... [1]

- 2 Expand and simplify the following.

(a)  $(x + 2)(3x + 7)$ ,

(b)  $6x^2 - x(1 - 2x)$ .

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

(b) ..... [1]

3 Factorise each of the following completely.

(a)  $2x^2 + 9 + 9x$ ,

(b)  $25x^2 - 100$ ,

(c)  $x(y-1) + 1 - y$ ,

(d)  $6mx - 3kx - 4ky + 8my$ .

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

(b) ..... [2]

(c) ..... [2]

(d) ..... [2]

- 4 (a) Given that  $(x + y)^2 = 10$  and  $x^2 + y^2 = 6$ , find the value of  $xy$ .  
 (b) Evaluate the following using the special products of algebraic expressions.  
 (i)  $99^2$ ,  
 (ii)  $103 \times 97$ .

Answer (a)  $xy = \dots\dots\dots$  [1]

(bi)  $\dots\dots\dots$  [2]

(bii)  $\dots\dots\dots$  [2]

- 5 Express each of the following as a single fraction in its simplest form.

(a)  $\frac{x}{2} + \frac{x-5}{3}$ ,

(b)  $\frac{5}{x} - \frac{4}{x+2}$ .

Answer (a)  $\dots\dots\dots$  [1]

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

6 Simplify the following.

(a)  $\frac{5y}{10x} \times \frac{6x^2y}{3xy^3}$

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

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

(b) ..... [2]

7 Given that  $T = \sqrt{y - \frac{1}{2}x}$ ,

(a) express  $x$  in terms of  $y$  and  $T$ ,

(b) hence, find the value of  $x$  when  $y = 10.5$  and  $T = \frac{2}{3}$ .

Answer (a)  $x =$  ..... [2]

(b)  $w =$  ..... [1]

- 8 It is given that  $x = 4$  is a root of the equation  $2x^2 - (k + 1)x - 12 = 0$ , where  $k$  is a constant. Find
- (a) the value of  $k$ ,
  - (b) the other root of the equation.

*Answer (a)*  $k = \dots\dots\dots$  [2]

*(b)*  $x = \dots\dots\dots$  [2]

- 9 Using the elimination method, solve the pair of simultaneous equations

$$\begin{aligned} 7x - 3y &= 4, \\ 3y + 5x &= 2. \end{aligned}$$

*Answer*  $x = \dots\dots\dots$ ,  $y = \dots\dots\dots$  [3]

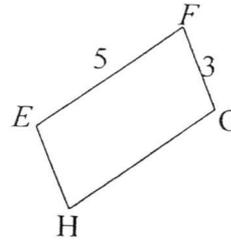
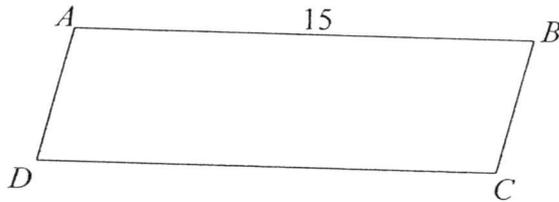
10 In the diagram, the parallelograms  $ABCD$  and  $EFGH$  are similar.

The dimensions given are in cm.

(a) Calculate the scale factor of enlargement/reduction,

(b) find the length of  $BC$ .

(The figures are not drawn to scale)



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

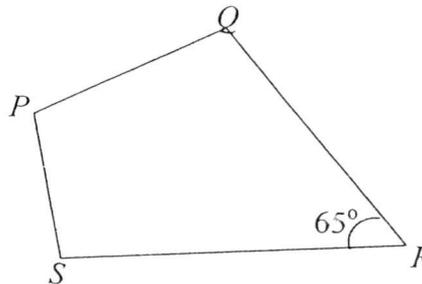
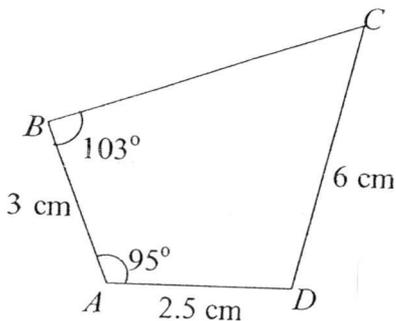
(b)  $BC =$  ..... cm [1]

11 Given that  $ABCD$  is congruent to  $PSRQ$ , find

(a) the length of  $PS$ ,

(b)  $\angle PQR$ .

(The figures are not drawn to scale.)



Answer (a)  $PS =$  ..... cm [1]

(b)  $\angle PQR =$  .....  $^\circ$  [2]

----- END OF PAPER -----  
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85

**Answer Key**

Qn	Answers
1a	$V = 9\sqrt{p}$
1b	$V = 45$
1c	$\frac{1}{729}$
2a	$3x^2 + 13x + 14$
2b	$8x^2 - x$
3a	$(2x + 3)(x + 3)$
3b	$25(x - 2)(x + 2)$
3c	$(x - 1)(y - 1)$ or $(1 - x)(1 - y)$ or $-(x - 1)(1 - y)$ or $-(1 - x)(y - 1)$
3d	$(3x + 4y)(2m - k)$
4a	$xy = 2$
4b	9801
4c	9991
5a	$\frac{5x - 10}{6}$
5b	$\frac{x + 10}{x^2 + 2x}$
6a	$\frac{1}{y}$
6b	$\frac{x}{2x - 3}$
7a	$x = 2(y - T^2)$
7b	$x = 20\frac{1}{9}$
8a	$k = 4$
8b	$x = -1\frac{1}{2}$
9a	$x = \frac{1}{2}$
9b	$x = -\frac{1}{6}$
10a	Enlargement = 3, reduction = $\frac{1}{3}$
10b	$BC = 9$ cm
11a	$PS = 3$ cm
11b	$\angle PQR = 97^\circ$



YUAN CHING SECONDARY SCHOOL  
2015 MID-YEAR EXAMINATION  
SECONDARY TWO EXPRESS

MATHEMATICS  
4048 / 02

NAME: \_\_\_\_\_ ( )

TIME: 1 hour 30 minutes

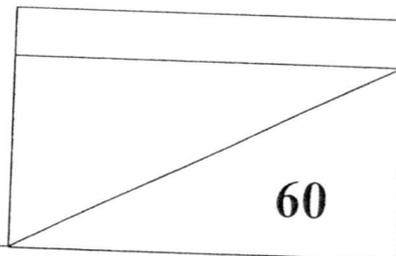
CLASS: Sec \_\_\_\_\_

**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.  
You may use a pencil for any diagrams or graphs.  
Do not use staple, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.  
If working is needed for any question it must be shown in the space below that 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  $\pi$ .

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 the marks for this paper is **60**.



This document consists of 4 printed pages.

[Turn Over

86

Answer **all** the questions.

- 1 (a) A map is drawn to a scale of 2 cm : 3 km.
- (i) Express the scale of the map in the form 1 :  $r$ . [1]
- (ii) Calculate the actual area, in  $\text{km}^2$ , of a region  $Y$ , which is represented by  $3 \text{ cm}^2$  on the map. [2]
- (b) An area of  $5 \text{ cm}^2$  on another map represents an actual area of  $20 \text{ km}^2$ . Calculate the actual distance, in km, represented by a length of 4 cm on the map. [2]
- 2 The rate,  $r$ , of a tap filling a tank is inversely proportional to the time,  $t$ , taken for the tank to be filled. When the rate is 6 l/min, the time taken is 12 minutes. If the rate is 16 l/min, find the time taken for the tank to be filled. [2]
- 3 Expand and simplify each of the following.
- (a)  $x(3x + 2y)(c + d)$ , [1]
- (b)  $2(4x - 3) - (3x - 1)^2$ , [2]
- (c)  $(5y - 3x + 2)(-x - y)$ . [2]
- 4 Using the special products of algebraic expressions of  $a^2 - b^2 = (a + b)(a - b)$ , factorise and simplify the expression  $(x + y)^2 - (x - y)^2$ . [2]
- 5 Express the following as a single fraction in its simplest form.
- (a)  $\frac{3x^2y^3}{11u^2v} \div \frac{9xy^2}{11u^3v^2xy}$ , [2]
- (b)  $\frac{8x - 4x^2}{3y + 5} \times \frac{5v + 3vy}{(2 - x)^2}$ , [2]
- (c)  $\frac{7}{y - 2} + \frac{y + 3}{y^2 + y - 6}$ , [2]
- (d)  $\frac{1}{(x + 1)^2} + \frac{3(x - 1)}{x + 1} - 2$ . [3]

- 6 The numerator of a fraction is 7 less than 3 times of its denominator. If 2 and 3 are added to the numerator and denominator respectively, the new fraction is equivalent to  $\frac{7}{3}$ . Find the original fraction. [4]

- 7 Solve the following equations.

(a)  $4x^2 - 24x + 36 = 0$ , [2]

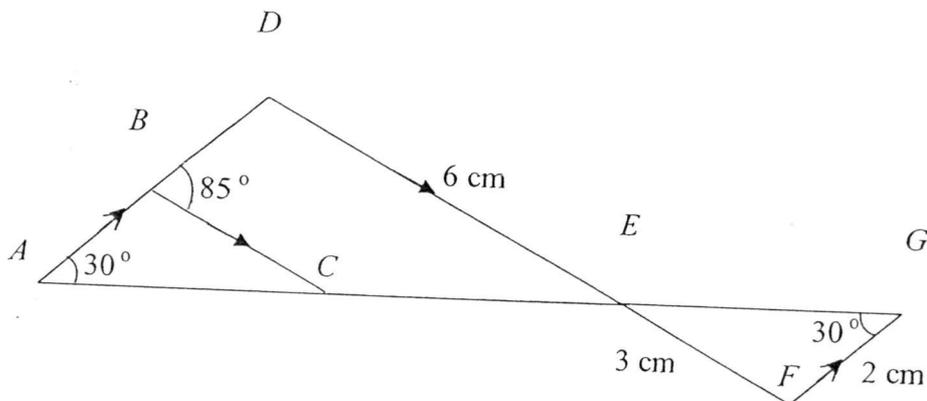
(b)  $(2x - 5)^2 = 49$ , [3]

(c)  $\frac{3}{x-2} = \frac{2x-1}{3}$ . [3]

- 8 Solve the pair of simultaneous equations [3]

$$\begin{aligned} x - 3y &= 4, \\ 2y + 5x &= 3. \end{aligned}$$

- 9 In the figure below,  $\triangle ABC$  and  $\triangle GFE$  are congruent.



- (a) Find  $\angle ABC$ , [1]
- (b) Find  $\angle GFE$ , [1]
- (c) Find the length of  $BC$ , [1]
- (d) State the triangle that is similar to  $\triangle ADE$ . [1]

- 10 Mr Eddie paid \$108 for some chairs. Each chair cost him \$ $x$ .
- (a) Find an expression, in terms of  $x$ , for the number of chairs he bought. [1]
- (b) He gave 2 of the chairs to a friend and sold all the remaining chairs each for \$2 more than its cost price.
- (i) Find an expression, in terms of  $x$ , for the sum of money that he collected from the sale of the chairs. [2]
- (ii) Mr Eddie made a profit of \$20 from the sale of the chairs. Form an equation, in terms of  $x$ , and show that it reduces to  $x^2 + 12x - 108 = 0$ . [3]
- (iii) Solve the equation in (b)(ii) to find the number of chairs that Mr Eddie bought. [3]

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

The following table shows some of the values for the equation  $y = x^2 - x + 1$ .

$x$	-2	-1	0	1	2
$y$	7	3	1	$k$	3

- (a) Find the value of  $k$ . [1]
- (b) Using a scale of 4 cm to represent 1 unit for  $x$ -axis and 2 cm to represent 1 unit for  $y$ -axis, draw the graph  $y = x^2 - x + 1$ . [3]
- (c) Using your graph, write down .
- (i) the value of  $y$  when  $x = 1.5$ , [1]
- (ii) the values of  $x$  when  $y = 2.5$ , [2]
- (iii) the coordinates of the minimum point, [1]
- (iv) the equation of the line of symmetry of the curve. [1]

----- END OF PAPER -----  
*Efforts Today, Rewards Tomorrow*

Answer Key

Qn	Answers
1(a)(i)	1 : 1 500
1(a)(ii)	$6\frac{3}{4}$
1(b)	8 km
2	$t = 4\frac{1}{2}$ min
3(a)	$3cx^2 + 3dx^2 + 2cxy + 2dxy$
3(b)	$-9x^2 + 14x - 5$
3(c)	$3x^2 - 5y^2 = 2xy - 2x - 2y$
4	$4xy$
5(a)	$\frac{x^2 y^2 uv}{3}$
5(b)	$\frac{4xv}{2-x}$
5(c)	$\frac{8}{y-2}$
5(d)	$\frac{x^2 - 4x - 6}{(x+1)^2}$
6	
7(a)	$x = 3$
7(b)	$x = 6$ or $x = -1$
7(c)	$x = 10$ or $x = -6$
8	$x = 1$ and $y = -1$
9(a)	$\angle ABC = 95^\circ$
9(b)	$\angle GFE = 95^\circ$
9(c)	$BC = 3$ cm
9(d)	$BD = 2$ cm
9(e)	$\triangle ADC$ or $\triangle GFE$
10(a)	$\frac{108}{x}$ chairs
10(b)(i)	$\left(\frac{108}{x} - 2\right)(x+2)$
10(b)(iii)	18 chairs



BEATTY SECONDARY SCHOOL  
END OF YEAR EXAMINATION 2015

SUBJECT : Mathematics

LEVEL : Sec 2 Express

PAPER : 1

DURATION : 1 hour 15 minutes

SETTER : Mr Lee Chau Loong

DATE : 5 Oct 2015

CLASS :	NAME :	REG NO :
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.....

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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
50

This paper consists of **11** printed pages (including this cover page)

90

[Turn over

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Examiner  
Use

- 1 Expand and simplify  $2(2 - m)^2 - m(5 - 4m)$ .

Answer : ..... [2]

- 2 The mean weight of 40 students in a class is 52.6 kilograms. After one student is removed from the class, the mean weight decreased to 52.2 kilograms. Find the weight of the student who was removed from the class.

Answer : .....kg [2]

- 3 Given that  $a - b = 3$  and  $ab = 5$ , find, without the use of a calculator, the value of  $a^2 + b^2$ .

Answer : ..... [2]

4  $y$  is inversely proportional to the square of  $x$ . When  $x = 4$ ,  $y = 0.25$ .

(a) Find the values of  $x$  when  $y = 25$ .

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

(b) Describe the change in  $y$  when  $x$  is halved.

Answer (b):  $\dots\dots\dots$   
 $\dots\dots\dots$   
 $\dots\dots\dots$  [1]

5 (a) Solve  $3x^2 + 7x - 6 = 0$ .

Answer (a):  $x = \dots\dots\dots$  [2]

(b) Hence state the positive value of  $y$  for which  $\frac{3}{y^2} + \frac{7}{y} - 6 = 0$ .

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

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6 Factorise completely

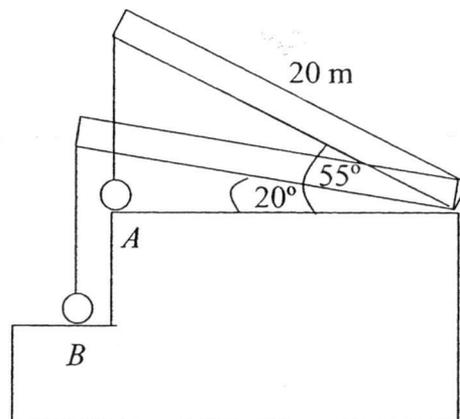
(a)  $28x^2 - 343$

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

(b)  $6a^2 - 3ay - 8y + 16a$

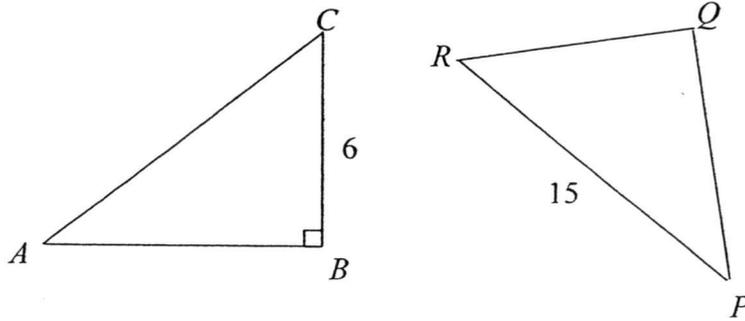
Answer (b): ..... [2]

- 7 A crane arm 20 meters long lowers a parcel from  $A$  to  $B$ . When the parcel is at  $A$ , the crane arm makes an angle of  $55^\circ$  with the horizontal. When the parcel is at  $B$ , the crane arm makes an angle of  $20^\circ$  with the horizontal. Find the vertical distance moved by the parcel.



Answer : ..... m [3]

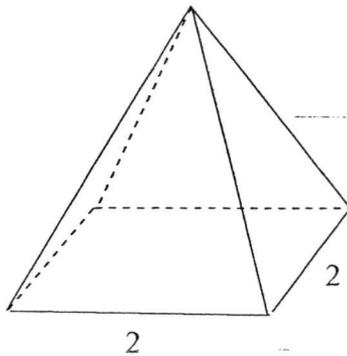
- 8 (a) Triangle  $ABC$  and triangle  $PQR$  are congruent.  
 $BC = 6$  cm,  $PR = 15$  cm and angle  $ABC = 90^\circ$ .



Find angle  $PRQ$ .

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

- (b) A right pyramid with square base of side 2 cm has a volume of  $20$  cm<sup>3</sup>.



Calculate the height of the pyramid.

Answer (b): ..... cm [2]

92

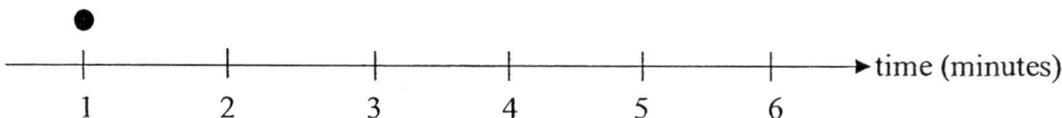
[Turn over

9 The waiting times, to the nearest minute, of twelve customers queuing at the cashier of a supermarket are recorded as a list:

4, 3, 4, 2, 5, 3, 4, 1, 2, 6, 3, 4

(a) Complete the dot diagram.

Answer (a): [1]



(b) Find the median.

Answer (b): ..... minutes [1]

(c) Find the mode.

Answer (c): ..... minutes [1]

(d) The supermarket manager claims that the distribution of waiting times is evenly distributed. Do you agree with his claim? Give a reason for your answer.

Answer (d): I agree/disagree because .....  
.....  
..... [1]

- 10** Each letter of the word "PIONEERS" is written on an identical card. The cards are then placed inside a box. Rainee picks a card at random from the box.

Find the probability that

(a) the letter P is chosen,

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

(b) the letter A is chosen,

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

(c) the letter E or S is chosen,

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

(d) a letter with a horizontal line of symmetry is chosen.

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

11 Solve the following equations.

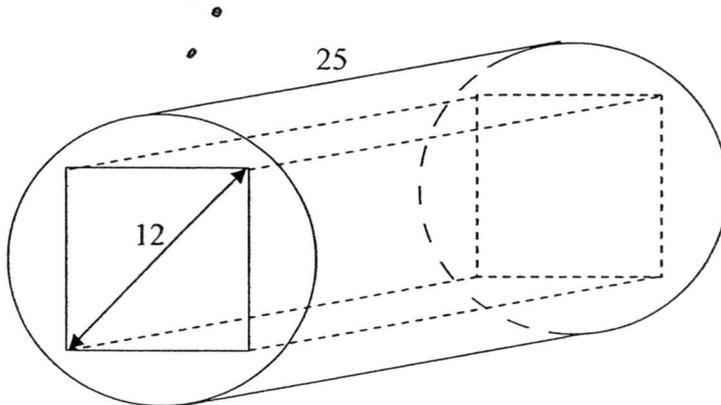
(a)  $\frac{x+3}{7} - \frac{4x-5}{6} = x$

Answer (a):  $x = \dots\dots\dots$  [2]

(b)  $\frac{y-1}{y+2} = \frac{y}{3y+2}$

Answer (b):  $y = \dots\dots\dots$  [3]

- 12 A solid cylinder of base radius 8 cm and length 25 cm has a square cross section of diagonal 12 cm removed from the cylinder, as shown in the diagram.



Find the total surface area of the remaining solid.

Answer : ..... cm<sup>2</sup> [5]

- 13 The Day Safari charges \$ $x$  for an adult ticket and \$ $y$  for a child ticket. The Lee family consists of 2 adults and 3 children. They paid a total of \$49. The Lim family consists of 3 adults and 1 child. They paid a total of \$56. Write down two equations in terms of  $x$  and  $y$ . Hence find the value of  $x$  and of  $y$ .

*Answer* :  $x = \dots\dots\dots$ ,  $y = \dots\dots\dots$  [4]

- 14 Thomas measured the heights of 30 students in his class. The table below shows the results.

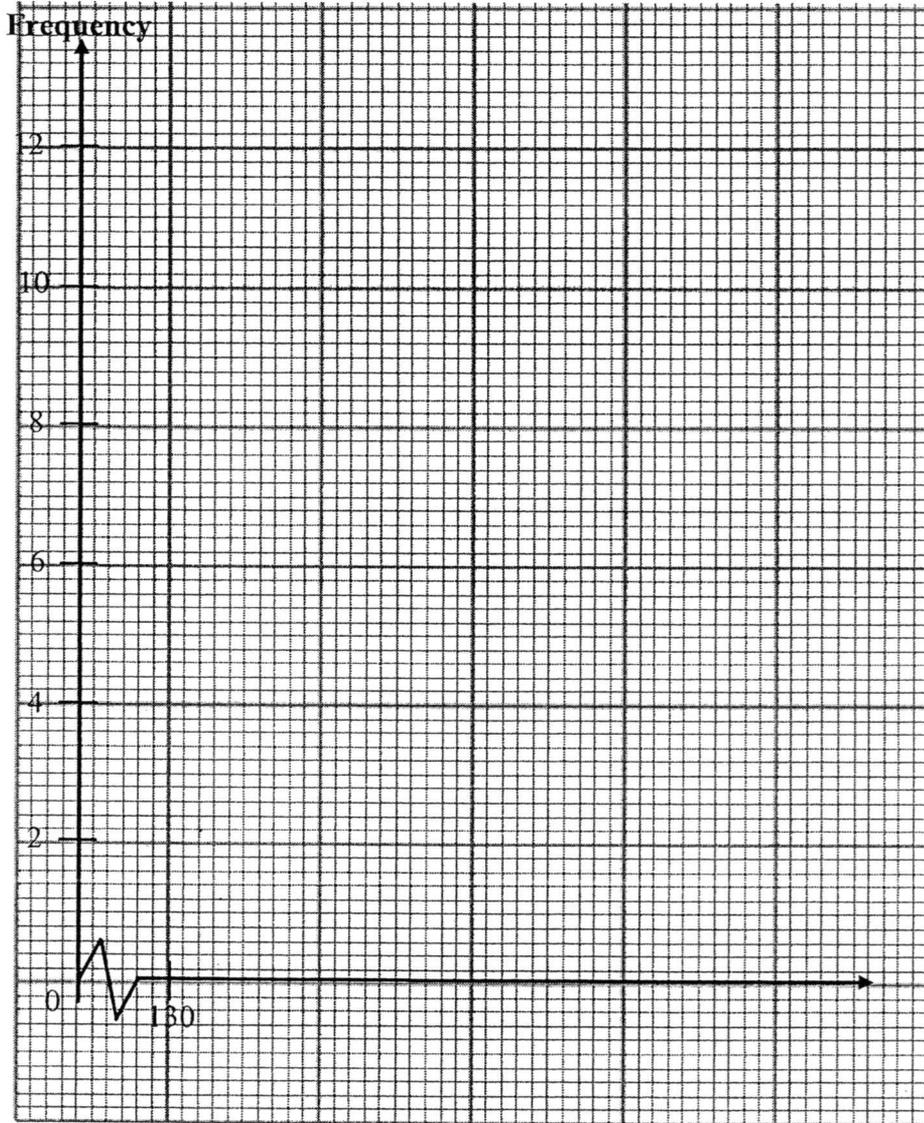
Heights (cm)	Frequency
$130 < h \leq 140$	6
$140 < h \leq 150$	$k$
$150 < h \leq 160$	8
$160 < h \leq 170$	5

14 (a) Find the value of  $k$ .

Answer (a):  $k = \dots\dots\dots$  [1]

(b) On the grid below, draw the histogram representing the data.  
Use a scale of 2 cm to 10 cm on the horizontal  $h$ -axis.

Answer (b): [2]



(c) Give one reason why a histogram is better than a pie chart.

Answer (c): .....

.....

..... [1]

**Answer Key**

1. 14.4 km/h

2(a)  $30^\circ$  (b)  $20^\circ$  (c)  $130^\circ$

3(a)  $120^\circ$  (b) 13 cm

4(a)  $x = \frac{y}{2}$  (b)  $m + n = 5q$

5(a)  $a = -1$  (b)  $c = -2$

6.  $x = 6\frac{2}{3}$  cm

7(a)  $70^\circ$  (b)  $70^\circ$  (c)  $110^\circ$

8(a)  $5x + 5$  (b)  $6x - 3$  (c)  $\frac{4x + 3}{6}$

9(a) 13.3 cm (b) 11.9 cm

10(a) 14.7 km (b) 6.75 kg

11(a)  $a = 20$  (b)  $b = 5.5$  (c)  $c = 1$

12(a)  $2x$  (b)  $x + 3$  (c)  $x = 7$

13(a) 4.47 m (b) 12 cm (c) 19.2 cm

Solution and Mark Scheme

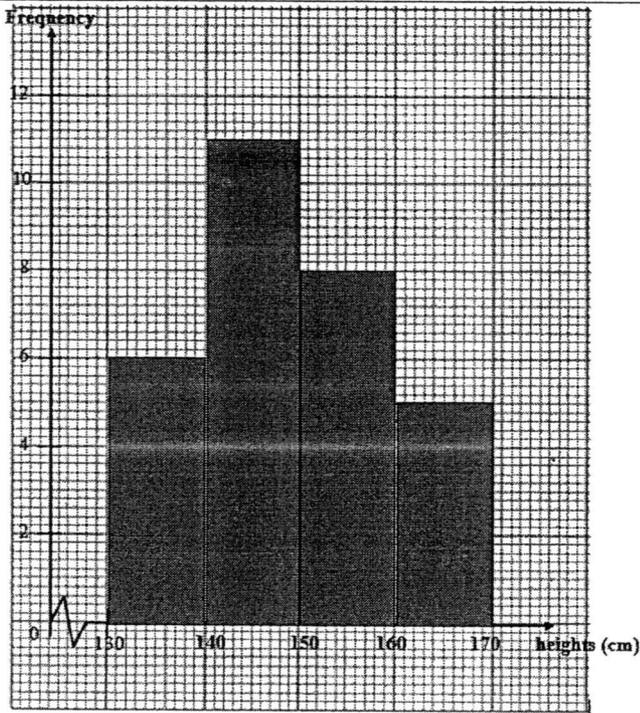
1.	$2(2-m)^2 - m(5-4m)$ $= 2(4-4m+m^2) - 5m + 4m^2$ $= 8-8m+2m^2 - 5m + 4m^2$ $= 6m^2 - 13m + 8$	M1 A1
2.	$40 \times 52.6 - 39 \times 52.2 = 2104 - 2035.8 = 68.2 \text{ kg}$	M1, A1
3.	$a^2 + b^2 = (a-b)^2 + 2ab$ $= 3^2 + 2(5)$ $= 19$	M1 A1
4(a)	$y = \frac{k}{x^2}$ <p>When <math>x = 4</math> and <math>y = 0.25</math>,</p> $0.25 = \frac{k}{4^2}$ $k = 4$ <p>Hence <math>y = \frac{4}{x^2}</math> or <math>yx^2 = 4</math></p> <p>When <math>y = 25</math>,</p> $25 = \frac{4}{x^2}$ $x^2 = \frac{4}{25}$ $x = -\frac{2}{5} \text{ or } \frac{2}{5}$	M1 A1 A1
4(b)	When $x$ is halved, the value of $y$ is increased 4 times. Also accept: the value of $y$ is multiplied by 4.	B1
5(a)	$3x^2 + 7x - 6 = 0$ $(3x-2)(x+3) = 0$ $x = \frac{2}{3} \text{ or } x = -3$	M1 A1
5(b)	$\frac{1}{y} = \frac{2}{3} \Rightarrow y = 1\frac{1}{2}$	B1

6(a)	$28x^2 - 343 = 7(4x^2 - 49)$ $= 7(2x - 7)(2x + 7)$	M1 A1
6(b)	$6a^2 - 3ay - 8y + 16a = 3a(2a - y) - 8(y - 2a)$ $= 3a(2a - y) + 8(2a - y)$ $= (3a + 8)(2a - y)$	M1 A1
7	$\sin 55^\circ = \frac{x}{20} \Rightarrow x = 20 \sin 55^\circ = 16.383$ $\sin 20^\circ = \frac{y}{20} \Rightarrow y = 20 \sin 20^\circ = 6.8404$ $16.383 - 6.8404 = 9.54 \text{ m (3 sf)}$	M1 M1 A1
8(a)	$\cos \angle PRQ = \frac{6}{15}$ $\angle PRQ = \cos^{-1}\left(\frac{6}{15}\right) = 66.4^\circ \text{ (1 dp)}$	M1 A1
8(b)	<p>Set <math>\frac{1}{3}(2^2)h = 20</math></p> $h = \frac{3 \times 20}{2^2} = 15 \text{ cm}$	M1 A1
9(a)		B1 – all correct
9(b)	$\frac{3 + 4}{2} = 3.5$	B1
9(c)	4	B1
9(d)	<p>Agree, because there are more dots from 1 to 3 minutes as compared to 5 to 6 minutes.</p> <p>Accept: The number of dots at 2 and 5 minutes are not equal. The number of dots at 3 and 4 minutes are not equal.</p>	B1

10(a)	$\frac{1}{8}$	B1
10(b)	0	B1
10(c)	$\frac{3}{8}$	B1
10(d)	The letters with horizontal line of symmetry are I, O, E $\frac{4}{8} = \frac{1}{2}$	B1
11(a)	$\frac{x+3}{7} - \frac{4x-5}{6} = x$ $\frac{6(x+3) - 7(4x-5)}{42} = x$ $6x+18 - 28x+35 = 42x$ $-22x+53 = 42x$ $64x = 53$ $x = \frac{53}{64}$	M1  A1
11(b)	$\frac{y-1}{y+2} = \frac{y}{3y+2}$ $(y-1)(3y+2) = y(y+2)$ $3y^2 - y - 2 = y^2 + 2y$ $2y^2 - 3y - 2 = 0$ $(2y+1)(y-2) = 0$ $y = -\frac{1}{2} \text{ or } y = 2$	M1  M1  A1

12	<p>Curved surface area = <math>2\pi(8)(25) = 400\pi</math> or 1256.6 (5 sf)</p> <p>Let side of square be <math>x</math> cm.  <math>x^2 + x^2 = 12^2</math>  <math>2x^2 = 144</math>  <math>x^2 = 72</math>  <math>x = \sqrt{72}</math> or 8.4853 (5 sf)</p> <p>Two ends = <math>2\left[\pi(8)^2 - (\sqrt{72})^2\right] = 2[64\pi - 72] = 128\pi - 144</math>  or 258.12 (5 sf)</p> <p>Four rectangles = <math>4\left[\sqrt{72} \times 25\right] = 100\sqrt{72}</math> or 848.53 (5 sf)</p> <p>Total = <math>400\pi + 128\pi - 144 + 100\sqrt{72}</math>  = 2363.29  = 2360 cm<sup>2</sup> (3 sf)</p>	<p>B1</p> <p>M1</p> <p>M1(✓)</p> <p>M1(✓)</p> <p>A1</p>
13	<p><math>2x + 3y = 49</math>  <math>3x + y = 56 \Rightarrow y = 56 - 3x</math></p> <p>Sub <math>y = 56 - 3x</math> into <math>2x + 3y = 49</math>  <math>2x + 3(56 - 3x) = 49</math>  <math>2x + 168 - 9x = 49</math>  <math>-7x = -119</math>  <math>x = 17</math></p> <p>Then, <math>y = 56 - 3(17) = 5</math></p>	<p>B1 – for both equations</p> <p>M1(✓)</p> <p>A1</p> <p>A1</p>
14(a)	$k = 30 - 6 - 8 - 5 = 11$	B1

14(b)



B1 – horizontal axis scale correct, and labelled

B1 – all bars correct height

14(c)

A histogram is better than a pie chart because the heights of the histogram represents the frequencies and hence the frequencies can be easily compared at a glance (while the sectors of a pie chart are less easy to compare.)

B1



**BEATTY SECONDARY SCHOOL  
END-OF-YEAR EXAMINATION 2015**

**SUBJECT : Mathematics**

**LEVEL : Sec 2 Express**

**PAPER : 2**

**DURATION : 1 hour 30 minutes**

**SETTER : Mr Ng Choon Cheng**

**DATE : 08 Oct 2015**

<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**.

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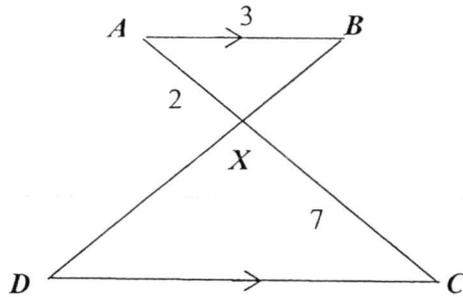
99

[Turn over

- 1 The masses, measured to the nearest kilogram, of 20 boys are given below.

57	45	42	48	58
51	45	50	52	57
57	45	46	57	53
44	48	46	43	41

- (a) Represent the above data in a split stem-and-leaf diagram. [3]
- (b) Find the mean mass. [2]
- 2 (a) An area of  $4 \text{ cm}^2$  on a map represents an actual area of  $0.36 \text{ km}^2$ . Calculate
- (i) the actual area in square kilometres represented by  $80 \text{ cm}^2$  on the map, [1]
- (ii) the scale of the map in the form  $1 : n$ , [2]
- (iii) the distance on the map in centimetres which represents an actual distance of 6 km. [1]
- (b) In the diagram below, triangle  $ABX$  is similar to triangle  $CDX$ .



Given that  $AB = 3 \text{ cm}$ ,  $AX = 2 \text{ cm}$  and  $CX = 7 \text{ cm}$ , find

- (i) the length of  $CD$ , [2]
- (ii) the ratio of  $DX : DB$ . [1]

3. (a) Simplify  $\frac{25xz^2}{3y} \div \frac{5yz^2}{6y^2}$ . [2]

(b) Express as a single fraction in its simplest form

$$\frac{6x}{4x^2 - 1} - \frac{3}{4x - 2} \quad [3]$$

(c) Given that  $\frac{p}{r} = \sqrt{\frac{q}{3} + p^2}$ , express  $p$  in terms of  $q$  and  $r$ . [3]

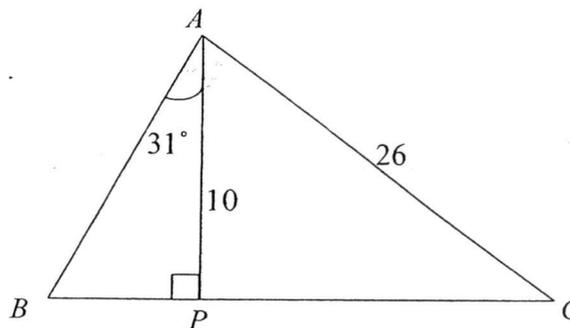
4. (a) Using the second Causeway at Tuas, Mr Ng travelled a distance of 600 km from Singapore to Penang in a time of  $t$  hours. Write down the average speed of the journey, in km/h, in terms of  $t$ . [1]

(b) If Mr Ng reduced his average speed by 5 km/h, he will take 30 minutes more to complete the same journey.  
Form an equation in  $t$  and show that it reduces to  $2t^2 + t - 120 = 0$ . [3]

(c) Solve the equation  $2t^2 + t - 120 = 0$ . [2]

(d) Find the original average speed. [1]

5 In the diagram,  $AP$  is perpendicular to  $BC$ .



Given that  $AP = 10$  cm,  $AC = 26$  cm and  $\angle BAP = 31^\circ$ , calculate

(a)  $\angle PAC$ , [2]

(b)  $PC$ , [2]

(c)  $PB$ , [2]

(d) the shortest distance from  $P$  to the line  $AC$ . [2]

100

[Turn over

- 6 Diagram I shows a hollow cone partially filled with water to a height of 24 cm. The cone has a height of 30 cm and a radius of 5 cm.

Formula: Curved surface area of a cone =  $\pi r l$

Surface area of a sphere =  $4\pi r^2$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

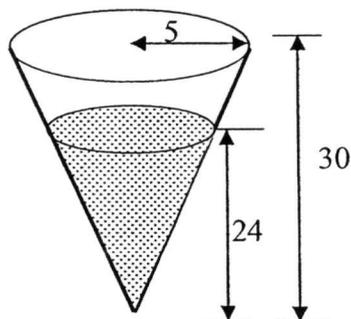


Diagram I

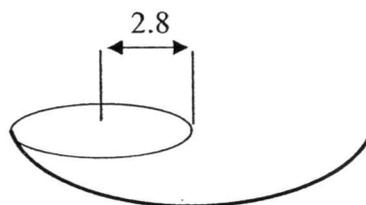


Diagram II

- (a) Show that the radius of the water surface is 4 cm. [1]
- (b) Find
- (i) the volume of the water in the cone, [1]
- (ii) the area of the inner surface of the cone in contact with the water. [2]

The water is poured into hemispherical bowls of radius 2.8 cm as shown in Diagram II.

- (c) Find the numbers of bowls that is completely filled with water. [3]

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

The variables  $x$  and  $y$  are connected by the equation  $y = 10 - x - x^2$ .

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

$x$	-4	-3	-2	-1	0	1	2	3
$y$	-2	4	8	10	10	8	4	$a$

- (a) Calculate the value of  $a$ . [1]
- (b) Taking 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  $y = 10 - x - x^2$  for  $-4 \leq x \leq 3$ . [3]
- (c) Use your graph to find
- (i) the values of  $x$  when  $y = 6.2$ , [2]
- (ii) the value of  $y$  when  $x = -1.2$ . [1]
- (d) Write down the equation of the line of symmetry. [1]

End of Paper

☺ One page answer ☺

Qn	Answer	Qn	Answer										
1a	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>stem</th> <th>leaf</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>1 2 3 4</td> </tr> <tr> <td>4</td> <td>5 5 5 6 6 8 8</td> </tr> <tr> <td>5</td> <td>0 1 2 3</td> </tr> <tr> <td>5</td> <td>7 7 7 7 8</td> </tr> </tbody> </table> <p>Key: 4 1 means 41 kg</p>	stem	leaf	4	1 2 3 4	4	5 5 5 6 6 8 8	5	0 1 2 3	5	7 7 7 7 8		
stem	leaf												
4	1 2 3 4												
4	5 5 5 6 6 8 8												
5	0 1 2 3												
5	7 7 7 7 8												
1b	Mean = 49.25 kg	5a	$\angle PAC = 67.4^\circ$ (1 d.p.)										
		5b	PC = 24 cm										
2ai	Actual area = 7.2 km <sup>2</sup>	5c	BP = 6.01 cm (3 s.f.)										
2aii	1 : 30000	5d	Shortest distance = $9\frac{3}{13}$ cm										
2aiii	Distance on map = 20 cm	6											
2bi	CD = 10.5 cm	6bi	volume of the water = 402 cm <sup>3</sup>										
2bii	7:9	6bii	inner surface in contact with the water = 306 cm <sup>2</sup> (3sf)										
		6c	Number of hemisphere filled = 8										
3a	10x	7a	a=-2										
3b	$\frac{3}{2(2x+1)}$	7ci	x = -2.51, x = 1.51 (+0.1)										
3c	$p = \pm \sqrt{\frac{qr^2}{(3)(1-r^2)}}$	7cii	y = 9.8 (+0.2)										
		7d	x = -0.5										
4a	$\frac{600}{t}$ km/h												
4b	$\frac{600}{t + \frac{1}{2}} = \frac{600}{t} - 5 \dots$												
4c	t = 7.5 or t = -8												
4d	80 km/h												



BEATTY SECONDARY SCHOOL  
END-OF-YEAR EXAMINATION 2015

SUBJECT : Mathematics

LEVEL : Sec 2 Express

PAPER : 2

DURATION : 1 hour 30 minutes

SETTER : Mr Ng Choon Cheng

DATE : 08 Oct 2015

CLASS :	NAME :	REG NO :
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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.

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**.

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

102

- 1 The masses, measured to the nearest kilogram, of 20 boys are given below.

57	45	42	48	58
51	45	50	52	57
57	45	46	57	53
44	48	46	43	41

- (a) Represent the above data in a split stem-and-leaf diagram. [3]

stem	leaf
4	1 2 3 4
4	5 5 5 6 6 8 8
5	0 1 2 3
5	7 7 7 7 8

Key: 4|1 means 41 kg

M1 Correct labelling and Stem and Leaf.

[2m] Stem and leaf for correct splitting

[1m] for Not splitting or split wrongly

[0 out of 2m] for back to back or non logical stem and leaf

- (b) Find the mean mass

$$\text{Mean} = 985 / 20$$

$$= 49.25 \text{ kg}$$

M1

A1

[2]

- 2 (a) An area of  $4 \text{ cm}^2$  on a map represents an actual area of  $0.36 \text{ km}^2$ . Calculate

- (i) the actual area in square kilometres represented by  $80 \text{ cm}^2$  on the map, [1]

$$\text{Actual area} = 0.36 \times 20 = 7.2 \text{ km}^2$$

B1

- (ii) the scale of the map in the form 1 : n, [2]

Map : actual

$$\text{area } 4 \text{ cm}^2 : 0.36 \text{ km}^2$$

$$\text{dist } 2 \text{ cm} : 0.6 \text{ km}$$

M1

$$1 \text{ cm} : 0.3 \text{ km}$$

$$1 : 30000$$

A1

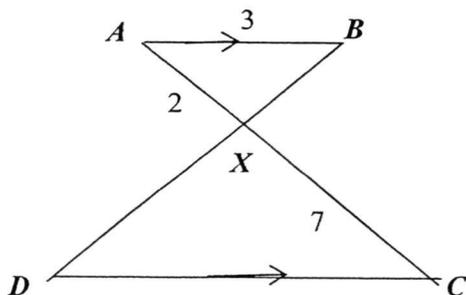
- (iii) the distance on the map in centimetres which represents an actual distance of 6 km. [1]

$$\text{Distance on map} = \frac{1}{0.3} \times 6$$

$$= 20 \text{ cm}$$

B1

- (b) In the diagram below, triangle  $ABX$  is similar to triangle  $CDX$ .



Given that  $AB = 3$  cm,  $AX = 2$  cm and  $CX = 7$  cm, find

- (i) the length of  $CD$ , [2]
- $$\frac{2}{7} = \frac{3}{CD}$$
- M1
- $$CD = \frac{21}{2}$$
- $CD = 10.5$  cm A1
- (ii) the ratio of  $DX : DB$ . [1]
- 7:9
- 3 (a) Simplify  $\frac{25xz^2}{3y} \div \frac{5yz^2}{6y^2}$ . [2]
- $$\frac{25xz^2}{3y} \div \frac{5yz^2}{6y^2} = \frac{25xz^2}{3y} \times \frac{6y^2}{5yz^2}$$
- M1
- $$= 10x$$
- A1
- (b) Express as a single fraction in its simplest form [3]
- $$\frac{6x}{4x^2 - 1} - \frac{3}{4x - 2}$$
- $$\frac{6x}{4x^2 - 1} - \frac{3}{4x - 2} = \frac{6x}{(2x-1)(2x+1)} - \frac{3}{2(2x-1)}$$
- M1 (factorise)
- $$= \frac{2(6x)}{(2x-1)(2x+1)} - \frac{3(2x+1)}{2(2x-1)(2x+1)}$$
- $$= \frac{12x - 6x - 3}{2(2x-1)(2x+1)}$$
- M1
- $$= \frac{6x - 3}{2(2x-1)(2x+1)}$$
- $$= \frac{3(2x-1)}{2(2x-1)(2x+1)}$$
- $$= \frac{3}{2(2x+1)}$$
- A1

- (c) Given that  $\frac{p}{r} = \sqrt{\frac{q}{3} + p^2}$ , express  $p$  in terms of  $q$  and  $r$ . [3]

$$\frac{p}{r} = \sqrt{\frac{q}{3} + p^2}$$

$$\left(\frac{p}{r}\right)^2 = \frac{q}{3} + p^2$$

M1 (square)

$$\frac{p^2}{r^2} - p^2 = \frac{q}{3}$$

$$\frac{p^2 - r^2 p^2}{r^2} = \frac{q}{3}$$

$$\frac{p^2(1 - r^2)}{r^2} = \frac{q}{3}$$

M1 (factorisation)

$$p^2(1 - r^2) = \frac{qr^2}{3}$$

$$p^2 = \frac{qr^2}{(3)(1 - r^2)}$$

$$p = \pm \sqrt{\frac{qr^2}{(3)(1 - r^2)}} \quad \text{or} \quad p = \pm \sqrt{\frac{qr^2}{(3)(1 - r^2)}} \quad \text{or} \quad p = \pm \sqrt{\frac{qr^2}{(3 - 3r^2)}} \quad \text{A1}$$

- 4 (a) Using the second Causeway at Tuas, Mr Ng travelled a distance of 600 km from Singapore to Penang in a time of  $t$  hours. Write down the average speed of the journey, in km/h in terms of  $t$ . [1]

(a)  $\frac{600}{t}$  km/h B1

- (b) If Mr Ng reduced his average speed by 5 km/h, he will take 30 minutes more to complete the same journey.

Form an equation in  $t$  and show that it reduces to  $2t^2 + t - 120 = 0$ . [3]

(b)  $\frac{600}{t + \frac{1}{2}} = \frac{600}{t} - 5$  M1

$$\frac{600}{\left(\frac{2t+1}{2}\right)} = \frac{600-5t}{t}$$

$$\frac{1200}{2t+1} = \frac{600-5t}{t}$$
 M1

$$1200t = (600 - 5t)(2t + 1)$$

$$1200t = 1200t + 600 - 10t^2 - 5t$$

$$10t^2 + 5t - 600 = 0$$

$$2t^2 + t - 120 = 0$$
 A1

- (c) Solve the equation  $2t^2 + t - 120 = 0$ . [2]

$$2t^2 + t - 120 = 0$$

$$(2t - 15)(t + 8) = 0$$

$$t = 7.5 \text{ or } t = -8$$

M1

A1

- (d) Find the original average speed. [1]

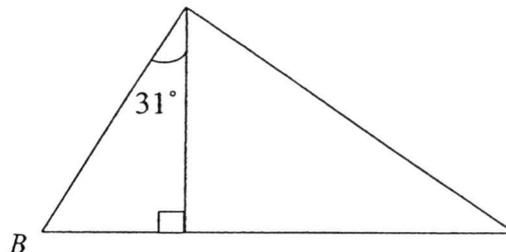
When  $t = 7.5 \text{ hrs}$

$$\text{Original Speed} = \frac{600}{7.5}$$

$$= 80 \text{ km/h (Only)}$$

B1

- 5 In the diagram,  $AP$  is perpendicular to  $BC$ . Given that  $AP = 10 \text{ cm}$ ,  $AC = 26 \text{ cm}$  and  $\angle BAP = 31^\circ$ , calculate



- (a)  $\angle PAC$ , [2]

$$\cos \angle PAC = \frac{10}{26}$$

M1

$$\angle PAC = 67.380^\circ$$

$$= 67.4^\circ \text{ (1 d.p.)}$$

A1

- (b)  $PC$ ,  $\tan 67.380 = \frac{PC}{10}$  [2]

$$PC^2 = 26^2 - 10^2 \quad \text{or} \quad \tan 67.380 = \frac{PC}{10} \quad \text{or} \quad \sin 67.380 = \frac{PC}{26} \quad \text{M1}$$

$$PC = 24 \text{ cm}$$

A1

- (c)  $PB$ , [2]

$$\tan 31^\circ = \frac{BP}{10}$$

M1

$$BP = 6.0086$$

$$= 6.01 \text{ cm (3 s.f.)}$$

A1

- (d) the shortest distance from  $P$  to the line  $AC$ . [2]

$$\text{Area of triangle} = \frac{1}{2} \times (24)(10)$$

$$= 120$$

$$\text{Shortest distance} = \frac{120 \times 2}{26}$$

M1

$$= 9\frac{3}{13} \text{ or } 9.230769$$

$$= 9\frac{3}{13} \text{ or } 9.23 \text{ cm}$$

A1

104

[Turn over

- 6 Diagram I shows a hollow cone partially filled with water to a height of 24 cm. The cone has a height of 30 cm and a radius of 5 cm.

Formula: Curved surface area of a cone =  $\pi r l$       Surface area of a sphere =  $4\pi r^2$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

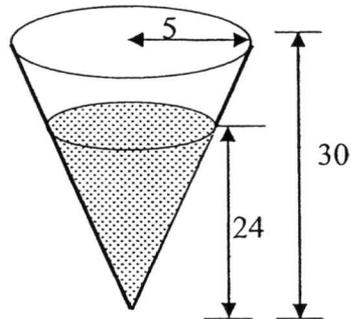


Diagram I

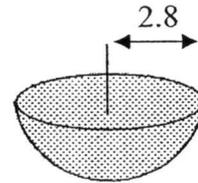


Diagram II

- (a) Show that the radius of the water surface is 4 cm. [1]

$$\frac{24}{30} = \frac{r}{5}$$

$$r = 4 \text{ cm}$$

B1

- (b) Find

- (i) the volume of the water in the container, [1]

$$\begin{aligned} \text{volume of the water} &= \frac{1}{3}(\pi)(4^2)(24) \\ &= 402.123 \\ &= 402 \text{ cm}^2 \end{aligned}$$

B1

- (ii) the area of the inner surface of the cone in contact with the water. [2]

$$\begin{aligned} \text{Slanted height} &= \sqrt{4^2 + 24^2} \\ &= \sqrt{592} \\ &= 24.331 \end{aligned}$$

M1

inner surface in contact with the water

$$= \pi \times 4 \times \sqrt{592}$$

$$= 305.75$$

$$= 306 \text{ cm}^2 \quad (3\text{sf})$$

A1

The water is poured into hemispherical bowls of radius 2.8 cm as shown in Diagram II.

- (c) Find the numbers of bowls that is completely filled with water. [3]

$$\begin{aligned} \text{Volume of hemisphere} &= \frac{2}{3} \times \pi \times 2.8^3 \\ &= 45.976 \end{aligned}$$

M1

$$\text{Number of hemisphere filled} = \frac{402.123}{45.976}$$

M1(Follow thro from B(i) and vol)

$$= 8.746$$

7

A1

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

The variables  $x$  and  $y$  are connected by the equation  $y = 10 - x - x^2$ .

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

- (a) Given that  $y = 10 - x - x^2$ , calculate the values of  $a$ . [1]

$x$	-4	-3	-2	-1	0	1	2	3
$y$	-2	4	8	10	10	8	4	$a$

$a = -2$  B1

- (b) Taking 2 cm to represent 1 unit on the  $x$ -axis and 1 cm to represent 1 units on the  $y$ -axis, draw the graph of  $y = 10 - x - x^2$  for  $-4 \leq x \leq 3$ . [3]

G1 Correct scale, G1 Correct plot, G1 Smooth graph

- (c) Using your graph, find

- (i) the value of  $x$  when  $y = 6.2$ . [2]

$$x = -2.51, x = 1.51 \quad (+-0.1)$$

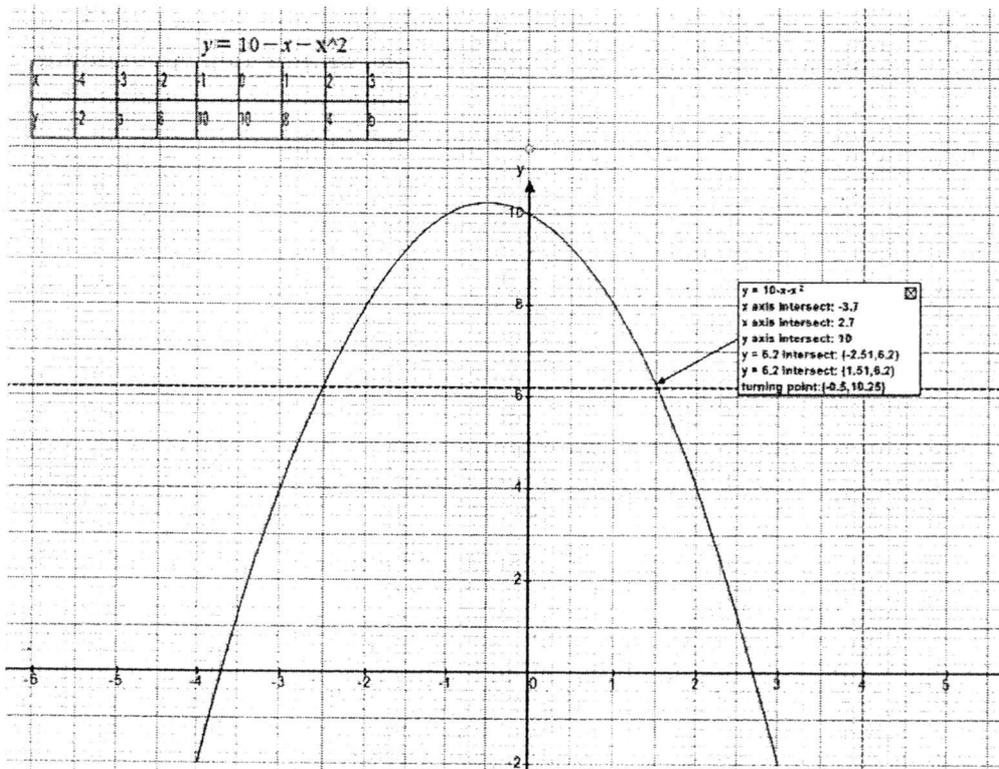
- (ii) The value of  $y$  when  $x = -1.2$ . [1]

$$y = 9.8 \quad (+-0.2)$$

- (d) Write down the equation of the line of symmetry of the graph. [1]

$$x = -0.5$$

A1



~ THE END ~

Class	Register No	Name
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**Bukit Merah Secondary School  
End-of-Year Examination 2015  
Secondary 2 Express**

<b>E</b>
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**MATHEMATICS**

**Paper 1**

Candidates answer on the Question Paper.

**1 Oct 2015**

**1 hour 15 minutes**

**READ THESE INSTRUCTIONS FIRST**

Write your class, register 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 when 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.

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**.

**Calculator Model:**

--

**For Examiner's Use**

--

This document consists of 13 printed pages.

106

**[TURN OVER**

Answer all the questions

For  
Examiner's  
use

- 1 Use a calculator to evaluate the following correct to the number of decimal places or significant figures required.

(a)  $\frac{\sqrt{778.2 + 568}}{\sqrt[3]{834.4}}$  [2 decimal places]

(b)  $(0.14)^3 + \frac{(0.65)^2}{\sqrt{7 - 1\frac{4}{9}}}$  [4 significant figures]

For  
Examiner  
use

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

(b) ..... [1]

[TURN OVER

For  
Examiner's  
use

For  
Examiner  
use

3

2 Given that  $2016 = 2^5 \times 3^2 \times 7$  and  $3240 = 2^3 \times 3^4 \times 5$ , find

- (a) the smallest integer that is a multiple of both 2016 and 3240,
- (b) the smallest possible integer  $k$  such that  $2016k$  is a perfect cube.

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

(b)  $k =$  ..... [1]

3 Joseph drives at  $(2x + 5)$  km/h for 3 hours. He then rested for 1 hour.

If his average speed for the whole journey is  $\frac{13}{8}x$  km/h, find the value of  $x$ .

Answer  $x =$  ..... [2]

107

[TURN OVER

For  
Examiner's  
use

For  
Examiner  
use

4 (a) Expand and simplify the following expression,  
 $50a^2 - (7a - 4b)^2$

(b) Factorise the following expressions completely.

(i)  $64c^2 - 25d^2$

(ii)  $32pr - 28qr + 21sq - 24sp$

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

(b) (i) ..... [1]

(ii) ..... [2]

[TURN OVER

For  
Examiner's  
use

5

Suppose that 6 cm on a map represents an actual distance of 15 km.

For  
Examiner  
use

- (a) Express the scale in the form  $1 : r$ .
- (b) The length of an underground tunnel measures 2.8 km.  
Calculate the length of the underground tunnel on the map in cm.
- (c) The area of a town measures  $13.4 \text{ cm}^2$  on the map.  
Find the actual area of the town in  $\text{km}^2$ .

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

(b) .....cm [1]

(c) ..... $\text{km}^2$  [2]

108

[TURN OVER

For  
Examiner's  
use

6

6  
Solve each of the following equations.

(a)  $6x^2 + 18x = 0$

(b)  $4x^2 - 24x + 35 = 0$

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

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

7

Solve the following simultaneous equations.

$$4x + 5y = -9$$

$$-3x + 7y = 39$$

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

$y = \dots\dots\dots$

For  
Examiner  
use

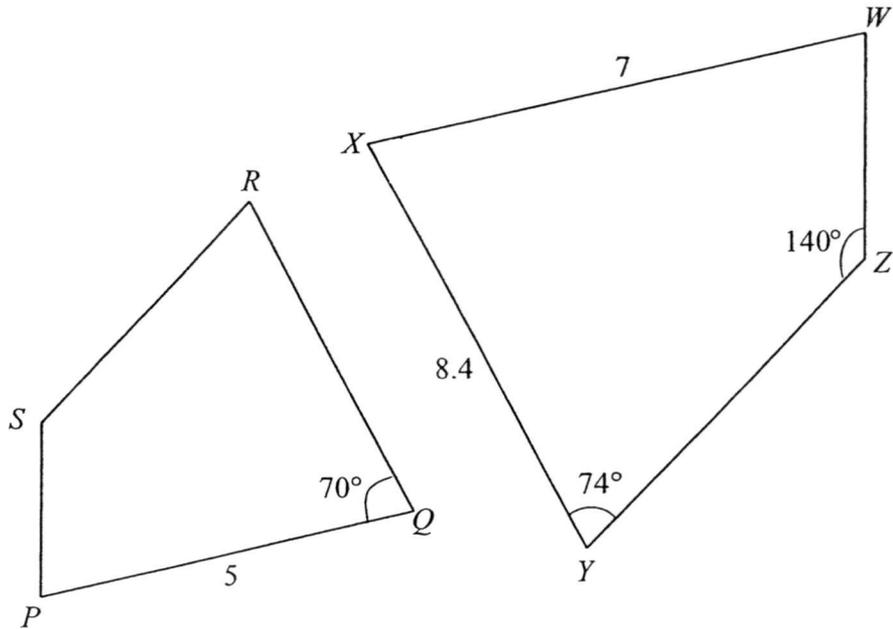
[TURN OVER

For  
Examiner's  
use

8

In the diagram,  $PQRS$  is similar to  $WXYZ$  with  $PQ = 5$  cm,  $WX = 7$  cm,  $XY = 8.4$  cm and  $\angle PQR = 70^\circ$ ,  $\angle XYZ = 74^\circ$  and  $\angle YZW = 140^\circ$ .

For  
Examiner  
use



Find

- (a)  $\angle ZWX$ ,
- (b)  $QR$ .

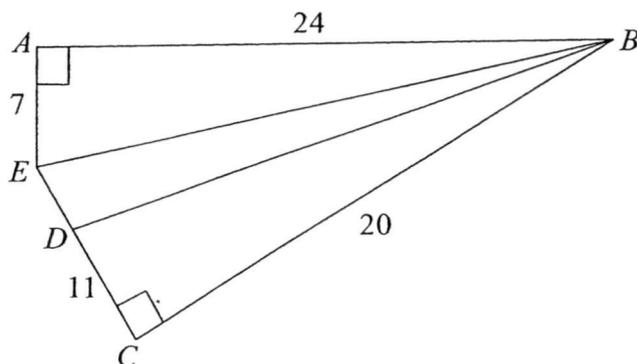
Answer (a) ..... [1]

(b) ..... [2]

109

[TURN OVER

- 9 In the diagram below,  $ABE$  is a right-angled triangle with  $AB = 24$  cm and  $AE = 7$  cm.  $CBE$  is a right-angled triangle with a point  $D$  on  $EC$  such that  $DC = 11$  cm and  $BC = 20$  cm.



- (a) By finding the length of  $BE$  first, show that the length of  $DE = 4$  cm [2]
- (b) Write down the value of
- (i)  $\cos \angle ABE$ ,                      (ii)  $\sin \angle BEC$ ,                      (iii)  $\tan \angle DBC$ .
- (c) Find the shortest distance of  $C$  to  $BE$ .

Answer (b) (i) ..... [1]

(ii) ..... [1]

(iii) ..... [1]

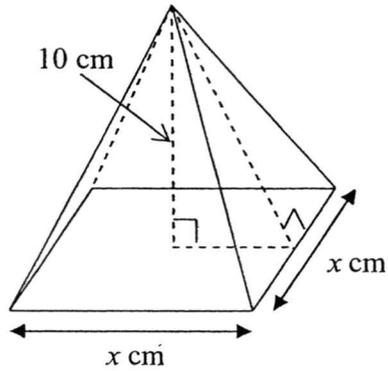
(c) .....cm [2]

[TURN OVER

For  
Examiner's  
use

10 The diagram below shows a right square pyramid with height 10 cm.

For  
Examiner  
s use



If it has a volume of  $480 \text{ cm}^3$ , find

- (a) the value of  $x$ ,
- (b) its total surface area.

Answer (a)  $x = \dots\dots\dots$  [2]

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

110

[TURN OVER

11

The table shows the record of scores by 19 students in a Mathematics test.

54	81	36	51	65	71	70	58	62	68
32	60	43	35	59	64	36	60	62	

The full score is 100 marks.

Mrs Lee tabulated the scores in the ordered stem-and-leaf diagram below.

Stem	Leaf
3	2 6 6 6
4	3
5	1 4 8 9
6	0 0 2 2 4 5 8
7	0 1
8	1

Key: 3 | 2 represents 32 marks

- (a) Write down the modal score of the 19 students.
- (b) Calculate the median score of the 19 students.
- (c) The top 6 students were selected to participate in a mathematics competition. What is the minimum mark a student needs to obtain to participate in the competition?
- (d) The passing mark for the test is 50. The scores of another 6 students were added to the record and the number of students who passed increase to 76%. How many new students passed the test?

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

(b) ..... [1]

(c) ..... [1]

(d) ..... [1]

[TURN OVER

For  
Examiner's  
use

12

The time taken by 70 Secondary Two Express students to complete their mathematics homework is given in the table below.

For  
Examiner  
s use

Time in minutes (min)	Number of Students ( $f$ )	Mid-value ( $x$ )	$fx$
$28 < x \leq 36$	17		
$36 < x \leq 44$	24	40	960
$44 < x \leq 52$	16		
$52 < x \leq 60$	13		
<b>Total</b>	70	<b>Total</b>	

- (a) Complete the table above and hence calculate an estimate of the mean time taken.
- (b) If a student is chosen from the group, what is the probability that he/she completes homework within 44 minutes?

Answer (a) ..... [3]

(b) ..... [1]

(11)

[TURN OVER

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Examiner's  
use

For  
Examiner  
use

13

The mean of 5 numbers is  $34\frac{3}{5}$ .

(a) Find the sum of the 5 numbers.

3 of the numbers are 36.75, 87 and 9.25.

The remaining 2 numbers are in the ratio of 3 : 5.

(b) Find the smaller of the remaining 2 numbers.

Answer (a) ..... [1]  
(b) ..... [2]

[TURN OVER

For  
Examiner's  
use

14

Consider the number pattern,

$$\text{Line 1: } 11 - 2 = 3^2$$

$$\text{Line 2: } 1111 - 22 = 33^2$$

$$\text{Line 3: } 111111 - 222 = 333^2$$

....

$$x - y = 333\ 333\ 333\ 333^2$$

- (a) Write down Line 4 for the pattern above.  
(b) Find the number of '1' in  $x$ .

For  
Examiner  
use

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

(b) ..... [1]

End-of-Paper 1

112

**Bukit Merah Secondary School**  
**End of Year Examination 2015**  
**Secondary 2 Express**  
**(Mathematics Paper 1) – Marking Scheme**

1	a	63.30	B1	
	b	0.1820	B1	
2	a	90720	B1	
	b	294	B1	
3		$\frac{3(2x+5)}{4} = \frac{13}{8}x$ $6(2x+5) = 13x$ $12x+30 = 13x$ $x = 30$	M1  A1	
4	a	$50a^2 - (49a^2 - 56ab + 16b^2)$ $= a^2 + 56ab - 16b^2$	M1 A1	
	b(i)	$(8c + 5d)(8c - 5d)$	B1	
	b(ii)	$32pr - 28qr + 21sq - 24sp$ $= 4r(8p - 7q) + 3s(7q - 8p)$ $= 4r(8p - 7q) - 3s(8p - 7q)$ $= (8p - 7q)(4r - 3s)$	M1  A1	
5	a	1 : 250000	B1	
	b	1.12 cm	B1	
	c	$1\text{cm}^2 : 6.25\text{km}^2$ $13.4\text{cm}^2 : 83.75\text{km}^2$	M1 A1	
6	a	$6x(x+3) = 0$ $x = 0 \text{ or } -3$	M1 A1 for both	
	b	$(2x-7)(2x-5) = 0$ $x = 3.5 \text{ or } 2.5$	M1 A1 for both	
7		$43y = 129$ $y = 3$ $x = -6$	M1 A1 A1	
8	a	76	B1	
	b	$\frac{QR}{8.4} = \frac{5}{7}$ $QR = 6$	M1 aef  A1	
9	a	$BE = 25$ $DE = 4$	M1 A1	
	b(i)	$\frac{24}{25}$	B1	
	(ii)	$\frac{4}{5}$	B1	

	(iii)	$\frac{11}{20}$	B1	
	c	$\frac{1}{2} \times 15 \times 20 = 150$ $h = 12$	M1 A1	
10	a	$\frac{1}{3}x^2(10) = 480$ $x^2 = 144$ $x = 12$	M1  A1	
	b	$12 \times 12 = 144$ $4\left(\frac{1}{2} \times 12 \times \sqrt{136}\right)$ 424	M1  M1 A1	
11	a	36	B1	
	b	60	B1	
	c	64	B1	
	d	5	B1	
12	a	32, 544 48, 768 56, 728	M1 ecf	
		Mean score = $\frac{544 + 960 + 768 + 728}{70}$ $= 42\frac{6}{7}$	M1 ecf  A1	
	b	$\frac{41}{70}$		
13	a	173		
	b	$40 \div 8 = 5$ $5 \times 3 = 15$	M1 A1	
14	a	$11111111-2222=3333^2$	B1	
	b	24	B1	

Class	Register No	Name
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**Bukit Merah Secondary School  
End-of-Year Examination 2015  
Secondary 2 Express**

<b>E</b>
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**MATHEMATICS**

**Paper 2**

**8 Oct 2015**

**1 hour 30 minutes**

Candidates answer on foolscap and graph papers

**READ THESE INSTRUCTIONS FIRST**

Write your class, register 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 when 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.

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**.

**Calculator Model:**

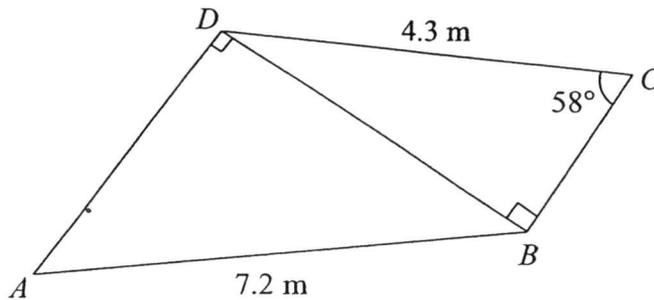
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**For Examiner's Use**

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Answer all the questions

- 1 In the figure below,  $CD = 4.3$  m,  $AB = 7.2$  m and  $\angle BCD = 58^\circ$ .



- Find
- (a)  $BD$ , [2]
- (b)  $\angle ABD$ . [2]

- 2 (a) Simplify each of the following algebraic fractions. [1]

(i)  $\frac{35b^2}{2y} \times \frac{y^2}{7ab^3}$

(ii)  $\frac{6}{8x^2 - 6xy} \div \frac{9}{3y - 4x}$  [2]

- (b) Express  $\frac{5}{x^2 + 3x - 4} - \frac{2}{x - 1}$  as a single fraction in its simplest form. [3]

- 3 (a) Given that  $y$  is inversely proportional to the cube root of  $x$ , and that  $x = 64$  when  $y = 12.75$ .

(i) Find the equation connecting  $x$  and  $y$ . [2]

(ii) Find the value of  $x$  when  $y = 3$ . [1]

(iii) Find the change in the value of  $y$  when the value of  $x$  is divided by 125. [2]

- (b) A formula is given as  $\sqrt{\frac{x - 2p}{9w + 5x}} = y$ . [3]  
 Make  $x$  the subject of the formula.

[TURN OVER

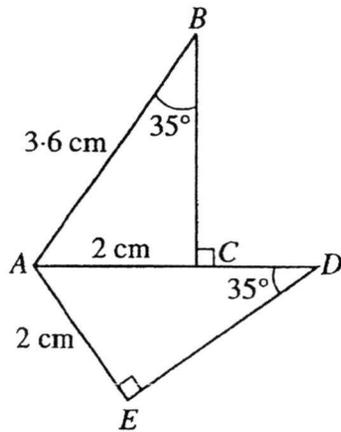
4

Mrs Lee bought some crabs and fish.

- (a) She bought  $x$  kg of crabs for \$140. [1]  
Write down an expression, in terms of  $x$  for the cost of 1 kg of crabs.
- (b) She bought some fish with \$140. She received 3 kg more fish than crabs. [1]  
Write down an expression, in terms of  $x$  for the cost of 1 kg of fish.
- (c) The cost of 1 kg of fish is \$15 less than the cost of 1 kg of crab. [3]  
Write down an equation in terms of  $x$  and show that it reduces to  $3x^2 + 9x - 84 = 0$ .
- (d) Solve the equation  $3x^2 + 9x - 84 = 0$ . [2]
- (e) How many kilograms of fish and crabs did she buy? [1]
- 

5

The two triangles shown below are congruent to each other.



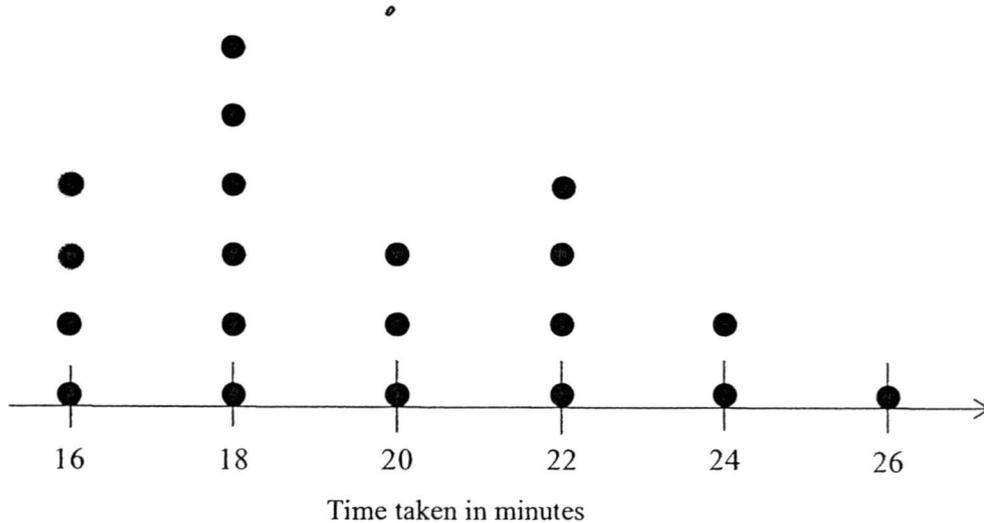
- (a) Name the triangle that is congruent to  $\triangle ABC$ . [1]
- (b) Find  $\angle BAC$ . [1]
- (c) Find the length of  $CD$ . [1]

- 6 (a) A card is drawn at random from a pack of 25 cards, numbered 1 to 25. Find the probability that the number on the card is,
- (i) a multiple of 6, [1]
  - (ii) not more than 13, [1]
  - (iii) a prime number. [1]
- (b) Jim is equally interested in buying rabbits named  $A$ ,  $B$ ,  $C$ ,  $D$  and  $E$ . He bought **two** of them at random because of the budget.
- (i) List down the sample space of his possible purchases. [2]
  - (ii) Find the probability that rabbit  $C$  is bought. [1]
  - (iii) Find the probability that rabbit  $B$  is bought but rabbit  $D$  is not bought. [1]

[TURN OVER

7

- (a) The time in minutes taken by 20 patrons at a food court *A* to finish their meal is represented by the dot diagram below.



- (i) Find the mean, median and mode of the data. [3]
- (ii) The management of the food court *A* says that the average time taken by a patron to finish a meal is 22 minutes. Does your data prove or disprove this statement? Explain briefly. [1]
- (b) The time in minutes taken by another 20 patrons at a food court *B* to finish their meal is represented by the frequency table below.

<b>Time (minutes)</b>	16	18	20	22	24	26	28
<b>Number of patrons</b>	1	3	4	2	7	2	1

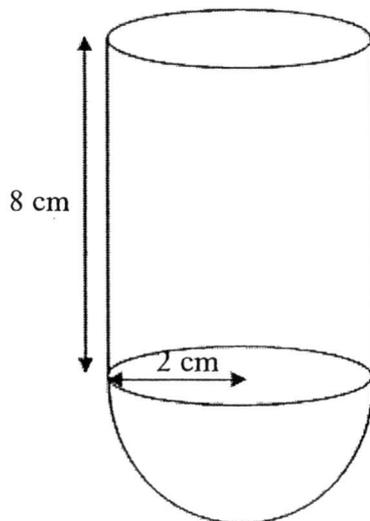
- This distribution is to be shown in a pie chart.
- (i) Calculate the angle representing the patrons who spent more than 24 minutes. [1]
- (ii) Calculate the median time taken by the patron in food court *B*. [1]
- (iii) State, with a reason, which food court has their patrons leaving earlier after their meal. [1]

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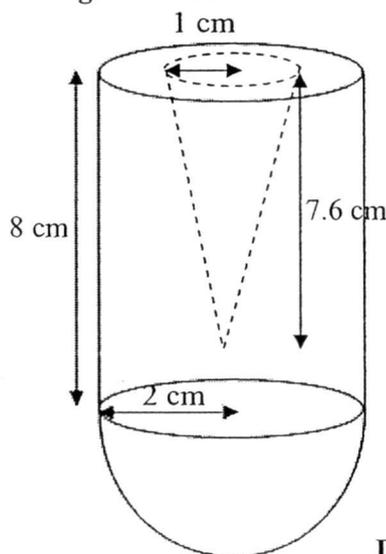
[TURN OVER

8

**Diagram I** below shows a solid balancing toy made up of a hemisphere attached to the bottom of the cylinder. The radius of the hemisphere is 2 cm and the height of the cylinder is 8 cm.

**Diagram I**

- (a) Find the volume of the toy. [3]
- (b) To lighten its weight, a cone with radius 1 cm and height 7.6 cm is sawed away from the toy as shown in **Diagram II** below.

**Diagram II**

- (i) Find the total surface area of the newly created toy in **Diagram II**. [4]
- (ii) Given that the newly created toy (in **Diagram II**) is melted to form a cube, what is the largest possible integer length of the cube? [3]

$$\left( \begin{array}{l} \text{Volume of Cone} = \frac{1}{3} \pi r^2 h ; \text{Volume of Sphere} = \frac{4}{3} \pi r^3, \\ \text{Curved Surface Area of Cone} = \pi r l ; \text{Surface Area of Sphere} = 4\pi r^2 \end{array} \right)$$

[TURN OVER

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

The variables  $x$  and  $y$  are connected by the equation  $y = 2x^2 - 6x + 11$ .  
The table of values is as shown below.

$x$	-2	-1	0	1	2	3
$y$	31	$p$	11	7	7	$q$

- (a) Find the values of  $p$  and  $q$ . [1]
- (b) Using 2 cm to represent 1 unit along the horizontal  $x$ -axis and 2 cm to represent 5 units along the vertical  $y$ -axis, draw the graph of  $y = 2x^2 - 6x + 11$  for  $-2 \leq x \leq 3$ . [3]
- (c) From your graph,
- (i) find the value of  $y$  when  $x = -0.5$  [1]
- (ii) write the coordinates of the minimum point. [1]
- (iii) write the equation of the line of symmetry. [1]

End-of-Paper 2

117

**Bukit Merah Secondary School**  
**End of Year Examination 2015**  
**Secondary 2 Express**  
**(Mathematics Paper 2) – Marking Scheme**

1	a	$\sin 58^\circ = \frac{BD}{4.3}$ $BD = 3.646606813$ $BD = 3.65$ $\cos \angle ABD = \frac{3.646606813}{7.2}$ $\angle ABD = 59.57080651^\circ$ $= 59.6^\circ$	M1  A1  M1 ECF  A1	
2	a(i)	$\frac{5y}{2ab}$	B1	
	(ii)	$\frac{6}{2x(4x-3y)} \div \frac{9}{3y-4x}$ $= \frac{6}{2x(4x-3y)} \times \frac{-(4x-3y)}{9}$ $= -\frac{1}{3x}$	M1  A1	
	b	$\frac{5}{x^2+3x-4} - \frac{2}{x-1}$ $= \frac{5}{(x+4)(x-1)} - \frac{2}{x-1}$ $= \frac{5-2(x+4)}{(x+4)(x-1)}$ $= \frac{-2x-3}{(x+4)(x-1)}$	M1  M1  A1	
3	a(i)	$y = \frac{k}{\sqrt[3]{x}}$ $12.75 = \frac{k}{\sqrt[3]{64}}$ $k = 51$ $y = \frac{51}{\sqrt[3]{x}}$	M1  A1	
	(ii)	$3\sqrt[3]{x} = 51$ $3\sqrt[3]{x} = 17$ $x = 4913$	B1 follow through	

	(iii)	$new\ y = \frac{51}{\sqrt[3]{\frac{x}{125}}}$ $= 5\left(\frac{51}{\sqrt[3]{x}}\right)$ <p>New <math>y</math> is 5 times of old <math>y</math>.</p>	M1 ECF  A1	
	b	$y^2 = \frac{x-2p}{9w+5x}$ $y^2(9w+5x) = x-2p$ $9y^2w+5xy^2 = x-2p$ $9y^2w+2p = x-5xy^2$ $x(1-5y^2) = 9y^2w+2p$ $x = \frac{9y^2w+2p}{1-5y^2}$	M1  M1 for take out factor  A1	
4	a	$\$ \frac{140}{x}$	B1	
	b	$\$ \frac{140}{x+3}$	B1	
	c	$\frac{140}{x+3} + 15 = \frac{140}{x}$ $140x + 15x^2 + 45x = 140x + 420$ $15x^2 + 45x - 420 = 0$ $3x^2 + 9x - 84 = 0$	M1  M1  A1	
	d	$(3x-12)(x+7) = 0$ $x = 4\text{ or } -7$	M1 A1 for both	
	e	4 kg of crabs and 7 kg of fish	B1	
5	a	$\triangle ADE$	B1	
	b	$55^\circ$ or $56.3$ (error)	B1	
	c	$1.6$ cm or $1.49$ (error)	B1	
6	a(i)	$\frac{4}{25}$	B1	
	(ii)	$\frac{13}{25}$	B1	
	(iii)	$\frac{9}{25}$	B1	
	b(i)	$\{AB, AC, AD, AE, BC, BD, BE, CD, CE, ED\}$	B1 for first 5 B1 for next 5	
	(ii)	$\frac{2}{5}$	B1	
	(iii)	$\frac{3}{10}$	B1	
7	a(i)	Mean is 19.7, median is 19, mode is 18	B1 B1 B1	

	(ii)	Disprove, all the averages are not 22.	B1 with reason	
	b(i)	54°	B1	
	(ii)	23 min	B1	
	(iii)	Food court A, because median time is lower	B1 with reason	
8	a	$volume = (\pi \times 2^2 \times 8) + \left(\frac{2}{3} \times \pi \times 2^3\right)$ $= 117.2861257$ $= 117cm^3$	M1 M1  A1	
	b(i)	$curvedSA = (2\pi \times 2^2) + (2\pi \times 2 \times 8)$ $= 125.6637061$ $topbasearea = \pi(2^2) - \pi(1)^2$ $= 9.424777961$ $slantedheight = \sqrt{1^2 + 7.6^2}$ $= \sqrt{58.76}$ $\pi \times 1 \times \sqrt{58.76}$ $= 24.08190098$ $totalSA = 125.6637061 + 9.424777961 + 24.08190098$ $= 159.170385$ $= 159$	M1  M1  M1 ECF  A1	
	(ii)	$117.2861257 - \left(\frac{1}{3} \times \pi \times 1^2 \times 7.6\right)$ $= 109.3274243$ $\sqrt[3]{109.3274243}$ $= 4.781634454$ $largestpossiblelength = 4cm$	M1 ECF  M1 ECF  B1 based on answer	
9	a	$p = 19, q = 11$	B1 for both	
	b	Plotting Scaling Curve (smooth)	P1 S1 C1	
	c(i)	14.5 (plus minus 0.5)	B1	
	(ii)	(1.5, 6.5) x coordinate plus minus 0.1 , y coordinate plus minus 0.5	B1	
	(iii)	x = 1.5 plus minus 0.1	B1	





# FAIRFIELD METHODIST SCHOOL (SECONDARY)

END-OF-YEAR EXAMINATION 2015  
SECONDARY 2 EXPRESS

## MATHEMATICS

### Paper 1

Date: 07 October 2015

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: Miss Germaine J Peter

120

This question paper consists of 15 printed pages including the cover page.

Answer all the questions.

- 1 Arrange the following numbers in ascending order.

$$\frac{1}{3}$$

40%

$$\sqrt[3]{-8}$$

$$\frac{2}{7}$$

0.3

Answer ....., ....., ....., ....., ..... [1]

---

- 2 Estimate the value of  $\frac{11.835 \times 6.051}{\sqrt{17}}$ , without the use of a calculator.

Answer ..... [2]

---

- 3 The length of each side of a square, of length  $x$  cm, is increased by 20%. Find the percentage increase in the area of the square.

Answer .....% [2]

- 4 (a) Express 1008 as a product of its prime factors, giving your answer in index notation.

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

- (b) Given that  $1350 = 2 \times 3^3 \times 5^2$ , find the lowest common multiple of 1008 and 1350, giving your answer in index notation.

Answer (b) ..... [1]

- (c) Given that  $\frac{1350}{k}$  is a square number, write down the smallest possible integer value of  $k$ .

Answer (c)  $k =$  ..... [1]

121

5 The force of attraction,  $F$  newtons, between two magnets is inversely proportional to the square of the distance,  $x$  centimetres, between them.

It is given that when the magnets are 4 centimetres apart, the force is 3 newtons.

(a) Find an equation connecting  $F$  and  $x$ .

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

(b) Find the force when the magnets are 2 centimetres apart.

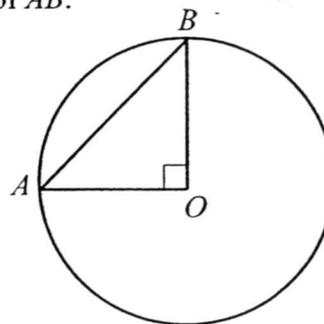
*Answer (b)* .....newtons [1]

(c) When the magnets are a certain distance apart, the force is 1.25 newtons. Write down the force when the distance is halved.

*Answer (c)* ..... newtons [2]

6 The diagram shows a right-angled triangle in a circle, with centre  $O$ .

Given that the diameter of the circle is 14 cm, find the length of  $AB$ .



Answer .....cm [2]

7 A closed cylindrical container has a radius of 6.8 cm and a volume of  $1500 \text{ cm}^3$ .  
[Take  $\pi$  to be 3.142]

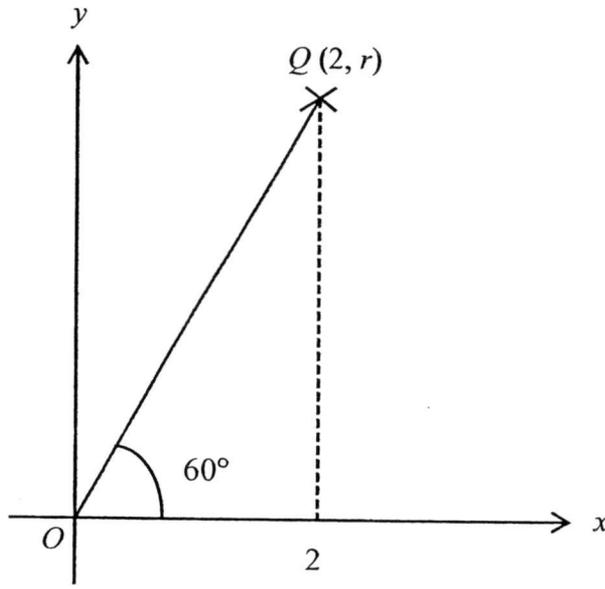
(a) Show that the height of the cylindrical container is 10.3 cm.

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

(b) Find the surface area of the cylindrical container.

Answer (b) ..... $\text{cm}^2$  [2]  
122

8 The diagram below shows a point  $Q$  with coordinates  $(2, r)$ .



(i) Find the length of  $OQ$ .

Answer (i)  $OQ = \dots\dots\dots$ cm [2]

(ii) Find the value of  $r$ .

Answer (ii)  $r = \dots\dots\dots$  [2]

9 Simplify the following expressions.

(a)  $\frac{3a^2}{7bc} \div \frac{9a}{14b}$

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

(b)  $\frac{2x}{x^2-25} - \frac{1}{x-5}$

Answer (b) ..... [3]

123

- 10 Petrol costs  $x$  cents per litre. John intends to take a road trip during the holidays.  
Find an expression for the number of litres of petrol that can be bought for  $y$  dollars.

*Answer* ..... [2]

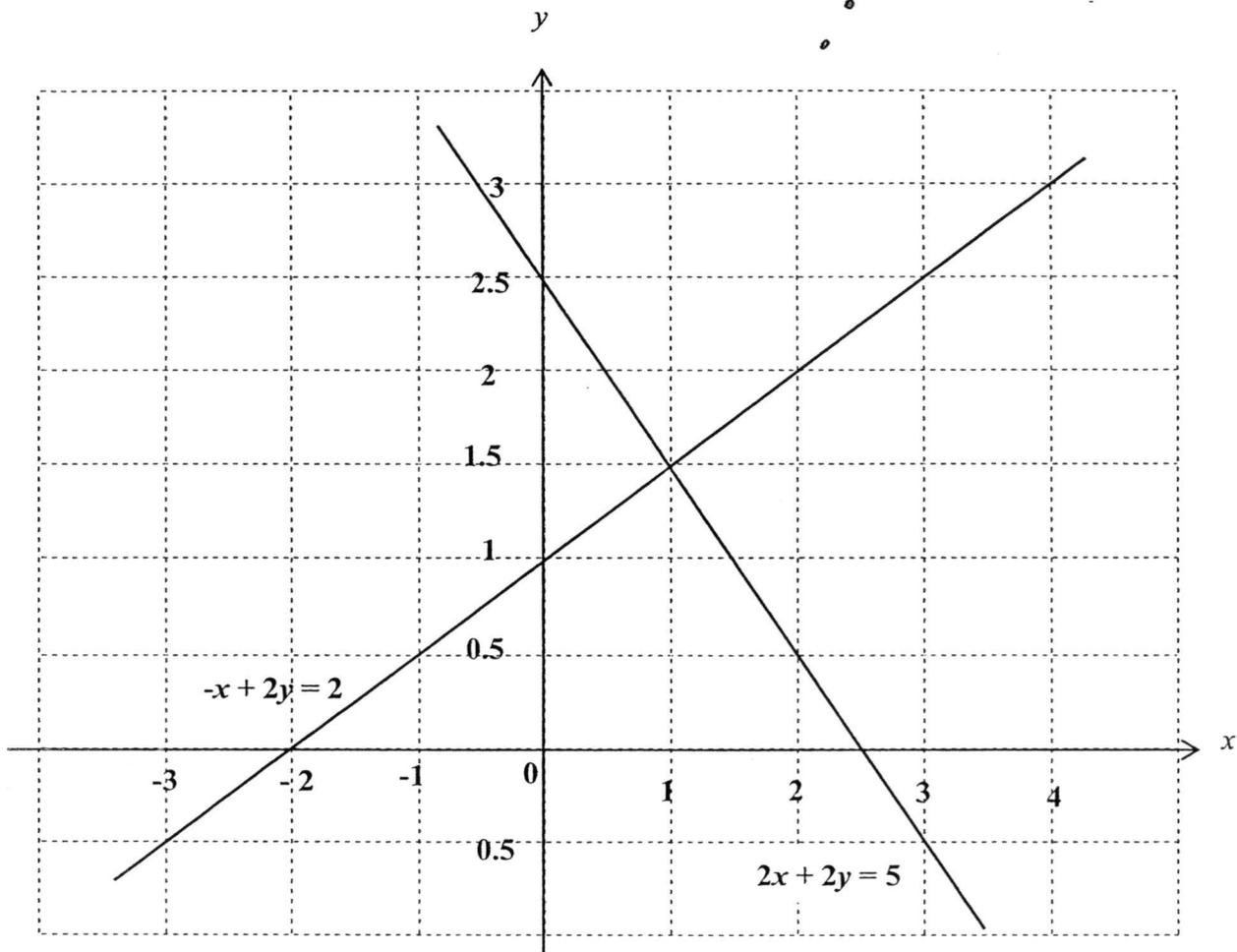
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- 11 A sum of money is divided between Alice, Betty and Charlie in the ratio 2 : 3 : 4 respectively. If, instead, this money had been divided equally between them, Alice would have received an extra \$20.

What was the total sum of money given to Alice, Betty and Charlie?

*Answer* \$..... [2]

- 12 The graph below shows the lines  $-x+2y=2$  and  $2x+2y=5$ .



- (a) State the solution of the simultaneous equations  $-x+2y=2$  and  $2x+2y=5$ .

Answer (a)  $x = \dots\dots\dots y = \dots\dots\dots$  [1]

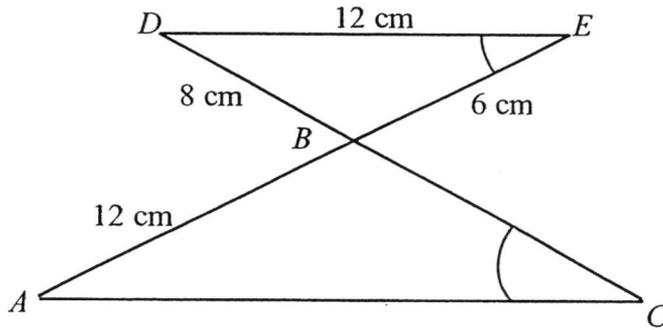
- (b) On the same grid above, draw and label clearly the line  $x=3$ . [1]

- (c) Find the area of the polygon enclosed by the 3 lines,  $-x+2y=2$ ,  $2x+2y=5$  and  $x=3$ . Leave your answer in square units.

Answer (c)  $\dots\dots\dots$  units<sup>2</sup> [1]

124

13 In the figure,  $ABC$  and  $DBE$  are similar triangles, where  $\angle ACB = \angle DEB$ .



Find

(a) the length of  $AC$ ,

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

(b) the length of  $CD$ .

Answer (b) .....cm [2]

14 Factorise fully each of the following expressions completely.

(a)  $3p^2 - 3pq - 5ap + 5aq$

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

(b)  $6x^2 + 14x - 12$

Answer (b) ..... [2]

15 A bag contains 10 red marbles, 5 blue marbles and 3 yellow marbles.

(a) Find the probability that the marble is red.

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

(b) How many more blue marbles must be placed in the bag so that the probability of choosing a blue marble would be  $\frac{1}{2}$ ?

Answer (b) .....blue marbles [1]

125

16 Solve the equation  $\frac{5}{y-3} + \frac{10}{3(3-y)} = 3$ .

*Answer*  $y = \dots\dots\dots$  [3]

17 Solve the following simultaneous equations.

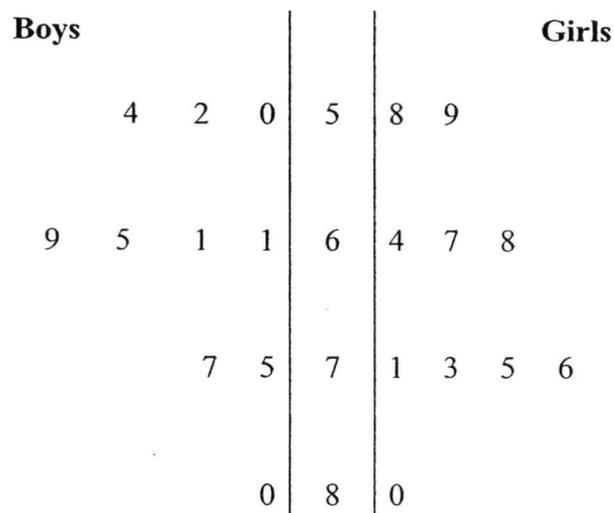
$$4a + 15b = 15$$

$$7a - 30b = 15$$

Answer  $a = \dots\dots\dots$ ,  $b = \dots\dots\dots$  [3]

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- 18 The following stem and leaf diagram represents the marks obtained by 10 boys and 10 girls in a Mathematics test.



Key (Boys): 2|5 means 52

Key (Girls): 5|8 means 58

From the data above, find

- (a) (i) the mode of the boys' marks,

*Answer (a)(i)*.....marks [1]

- (ii) the median of the girls' marks,

*Answer (a)(ii)*.....marks [1]

- (iii) the mean of the boys' marks.

*Answer (a)(iii)*.....marks [1]

- (b) Given that the mean of the girls' marks is 69.1, explain briefly whether the boys or girls performed better in the test.

*Answer (b)* [1]

.....

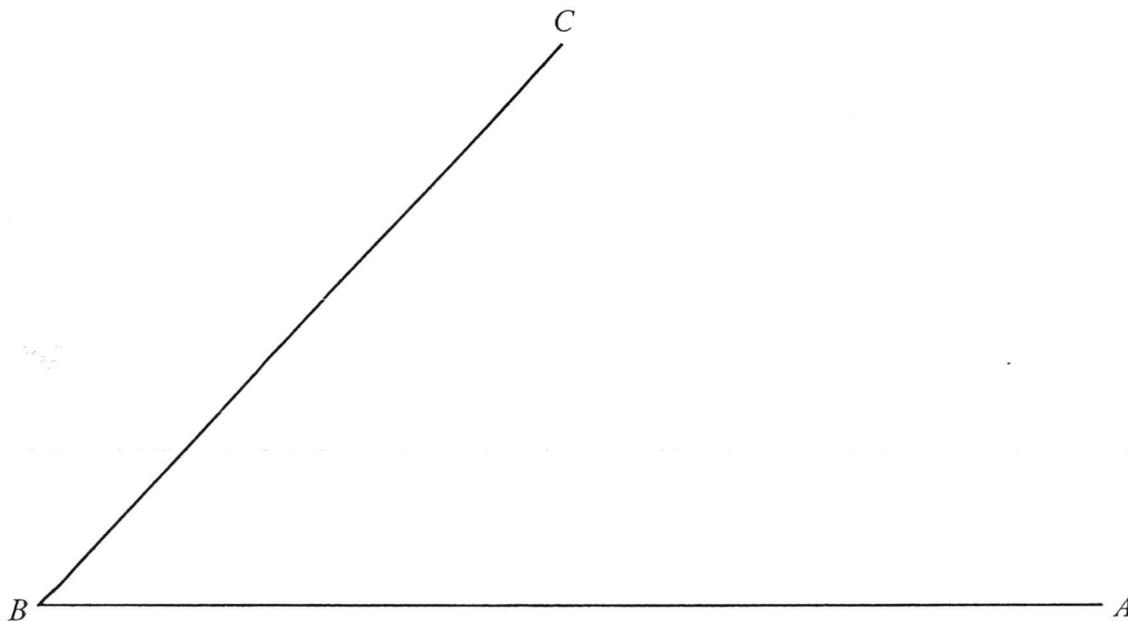
.....

- 19 (a) Construct the perpendicular bisector of  $BC$ . [1]  
(b) Construct the bisector of  $\angle ABC$ . [1]  
(c) The point  $D$  is such that  $\angle BCD = 130^\circ$  and  $AD = 7.5$  cm.  
Find the two possible positions of  $D$  and label them  $D_1$  and  $D_2$ . [2]  
(d) It is given that the two bisectors in (a) and (b) meet at  $P$ . [2]  
**Complete the statement below.**

The point  $P$  is equidistant from the lines ..... and .....

and equidistant from the points ..... and .....

Answer (a), (b), (c)



~ End of Paper ~

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**Fairfield Methodist School (Secondary)**  
**Sec 2 Express 2015 EOY Examination**  
**Mathematics Paper 1**  
**Answer Key**

No.	Answer	No.	Answer
1	$\sqrt[3]{-8}$ , $\frac{2}{7}$ , 0.3, $\frac{1}{3}$ , 40%	17	$a = 3$ $b = \frac{1}{5}$
2	18	18ai	61 marks
3	44%	18aii	69.5 marks
4a	$1008 = 2^4 \times 3^2 \times 7$	18aiii	64.4 marks
4b	$\text{LCM} = 2^4 \times 3^3 \times 5^2 \times 7$	19a	Refer to M.S
4c	$k = 6$	19b	Refer to M.S
5a	$F = \frac{48}{x^2}$	19c	Refer to M.S
5b	$F = 12$ newtons	19d	BA, BC ; B,C
5c	$F = 5$ newtons		
6	$AB = 9.90$		
7a	10.3		
7b	$732 \text{ cm}^2$ or $731 \text{ cm}^2$		
8i	$OQ = 4$		
8ii	$h = 3.46$		
9a	$\frac{2a}{3c}$		
9b	$\frac{1}{x+5}$		
10	$\frac{100y}{x}$		
11	\$180		
12a	$x = 1, y = 1.5$		
12c	3 units <sup>2</sup>		
13a	$AC = 18 \text{ cm}$		
13b	$CD = 17 \text{ cm}$		
14a	$(3p - 5a)(p - q)$		
14b	$2(3x - 2)(x + 3)$		
15a	$\frac{5}{9}$		
15b	8 more		
16	$3\frac{5}{9}$		

Sec 2 Express 2015  
EOY Examination  
Mathematics Paper 1 Marking Scheme

No.	Working	Allocation of marks
1	$\sqrt[3]{-8}, \frac{2}{7}, 0.3, \frac{1}{3}, 40\%$	[B1] no mark if answer is not according to question
2	$\frac{11.835 \times 6.051}{\sqrt{17}}$ $\approx \frac{12 \times 6}{\sqrt{16}}$ $= \frac{72}{4}$ $= 18$	[M1]  [A1]
3	Percentage increase = $\frac{(1.2x)^2 - x^2}{x^2} \times 100$ $= 44\%$	[M1]  [A1]
4a	$1008 = 2^4 \times 3^2 \times 7$	[B1]
4b	$\text{LCM} = 2^4 \times 3^3 \times 5^2 \times 7$	[B1]
4c	$k = 2 \times 3 = 6$	[B1]
5a	$F = \frac{k}{x^2}$ $3 = \frac{k}{4^2}$ $k = 3 \times 16$ $F = \frac{48}{x^2}$	[B1]
5b	$F = \frac{48}{2^2}$ $F = 12 \text{ newtons}$	No F.T. mark [B1]
5c	$1.25 = \frac{k}{x^2}$ $F = \frac{k}{\left(\frac{x}{2}\right)^2} = \frac{4k}{x^2}$ $\therefore F = 1.25 \times 4$ $= 5$	When $k = 48$ , $1.25 = \frac{48}{x^2}$ $F = \frac{48}{\left(\frac{x}{2}\right)^2}$ $F = 4 \left( \frac{48}{x^2} \right)$ $F = 1.25 \times 4$ $= 5$ [M1]  [A1]

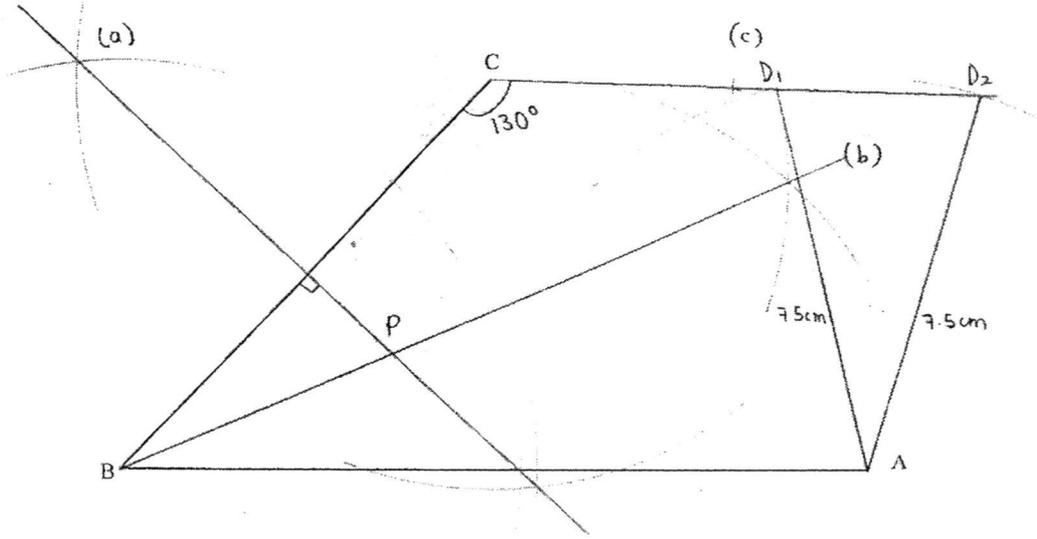
6	By Pythagoras' Theorem, $AB = \sqrt{\left(\frac{14}{2}\right)^2 + \left(\frac{14}{2}\right)^2}$ $AB = 7\sqrt{2} \text{ or } AB = 9.90 \text{ (to 3sf) (since length >0)}$		[M1] [A1]
7a	$\pi r^2 h = 1500$ $h = \frac{1500}{3.142 \times 6.8^2}$ $= 10.3244$ $= 10.3 \text{ (to 3sf)}$		[M1] [A1]
7b	$2\pi r^2 + 2\pi rh$ $= 2(3.142)(6.8^2)$ $+ 2(3.142)(6.8)(10.3244)$ $= 731.746$ $= 732 \text{ cm}^2 \text{ (to 3sf)}$	If h = 10.3 used, $2\pi r^2 + 2\pi rh$ $= 2(3.142)(6.8^2)$ $+ 2(3.142)(6.8)(10.3)$ $= 731.285$ $= 731 \text{ cm}^2 \text{ (to 3sf)}$	[M1] [A1]
8i	$\cos 60^\circ = \frac{2}{OQ}$ $\therefore OQ = 4$ $\text{or } OQ = 4.00(3sf)$	$\sin 30^\circ = \frac{2}{OQ}$ $\therefore OQ = 4$ $\text{or } OQ = 4.00(3sf)$	[M1] [A1]
8ii	$r = \sqrt{4^2 - 2^2}$ $r = 2\sqrt{3}$ $\text{Or } 3.464$ $= 3.46 \text{ (to 3 sf)}$	$\tan 60^\circ = \frac{r}{2}$ $\therefore r = 3.464$ $= 3.46 \text{ (to 3 sf)}$	[M1] [A1]
9a	$\frac{3a^2}{7bc} \div \frac{9a}{14b}$ $= \frac{3a^2}{7bc} \times \frac{14b}{9a}$ $= \frac{2a}{3c}$		[M1] for reciprocal of term after division sign [A1]
9b	$\frac{2x}{x^2 - 25} - \frac{1}{x - 5}$ $= \frac{2x - (x + 5)}{x^2 - 25}$ $= \frac{x - 5}{x^2 - 25}$ $a = 2$		[M1] for making 2 <sup>nd</sup> term have the same denominator [M1] for change of sign [A1]
10	$y \text{ dollars} = 100y \text{ cents}$		[M1]

	$\frac{100y}{x}$ Amount of petrol = $\frac{100y}{x}$	[A1]
<b>11°</b>	Total number of units = $2+3+4 = 9$ If equally divided among A, B and C, each will get 3 units  Therefore total sum of money = $(3-2) \times 9 \times \$20$ = \$180	[M1]  [A1]
<b>12a</b>	$x = 1, y = 1.5$	[B1]
<b>12b</b>	Line drawn at $x = 3$	[B1]
<b>12c</b>	Area = $\frac{1}{2} \times 6 \times 2$ = 6 units <sup>2</sup>	[B1]
<b>13a</b>	$\frac{12}{8} = \frac{AC}{12}$  $AC = \frac{144}{8} = 18cm$	[M1]  [A1]
<b>13b</b>	$\frac{CB}{6} = \frac{12}{8}$ $CB = 9$ $\therefore CD = 8 + 9 = 17cm$	[M1]  [A1]
<b>14a</b>	$3p^2 - 3pq - 5ap + 5aq$ = $3p(p-q) - 5a(p-q)$ = $(3p-5a)(p-q)$	[M1] [A1]
<b>14b</b>	$6x^2 + 14x - 12$ = $2(3x^2 + 7x - 6)$ = $2(3x-2)(x+3)$	[B1] for factor 2 [B1] for factors in brackets
<b>15a</b>	Total no. of balls = 18 Probability that ball is red = $\frac{10}{18} = \frac{5}{9}$	[B1]
<b>15b</b>	Let additional blue marbles be x. $\frac{5+x}{18+x} = \frac{1}{2}$ $18+x = 10+2x$ $x = 8$	[B1]

<b>16</b>	$\frac{5}{y-3} + \frac{10}{3(3-y)} = 3$ $\frac{5}{y-3} - \frac{10}{3(y-3)} = 3$ $\frac{5}{3(y-3)} = 3$ $5 = 9y - 27$ $y = \frac{32}{9}$ $= 3\frac{5}{9}$	<p>[M4] for change of sign</p> <p>[M1] for multiplying denominator to both sides and correct expansion</p> <p>[A1] marks awarded if improper fraction</p>
<b>17</b>	$4a + 15b = 15$ $7a - 30b = 15$ <p>(1) x 2: <math>8a + 30b = 30</math> ---(3)</p> <p>(2) + (3):  <math>15a = 45</math></p> $a = 3$ <p>Sub (<math>a = 3</math>) into (1):  <math>4(3) + 15b = 15</math>  <math>15b = 15 - 12</math></p> $b = \frac{1}{5}$	<p>[M1] for elimination or substitution method</p> <p>[A1]</p> <p>[A1]</p>
<b>18ai</b>	Modal marks = 61 marks	[B1]
<b>18aii</b>	$\text{Median current} = \frac{68+71}{2}$ $= 69.5 \text{marks}$	[B1]
<b>18aiii</b>	$\text{Mean of boys' marks} = \frac{50+52+54+2(61)+65+69+75+77+80}{10}$ $= 64.4 \text{marks}$	[B1]
<b>18b</b>	<p><u>Sample Answer:</u>          The girls preformed better.          Because they attained a higher mean score as compared to the boys</p>	<p>*definitely is girls</p> <p>[B1]</p>
<b>19d</b>	BA, BC ; B,C	[B1] [B1]

Qn 19a, b, c

Marking Scheme.  
Answer (a), (b), (c)



**FAIRFIELD METHODIST SCHOOL (SECONDARY)****END-OF-YEAR EXAMINATION 2015  
SECONDARY 2 EXPRESS****MATHEMATICS****Paper 2****Date: 08 October 2015****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 Michelle Tan

**This question paper consists of 16 printed pages including the cover page.**

Answer **all** the questions.

1. The ratio of the length and breadth of a rectangle is 5 : 3. Given that the perimeter of the rectangle is 32 cm, find the length of the rectangle.

*Answer* ..... cm [1]

---

2. Mdm Teo bought 48 apples, 72 oranges and 96 pears. If she wants each type of fruit to be distributed equally among a certain number of fruit baskets, what is the greatest number of fruit baskets that can be prepared?

*Answer* .....fruit baskets [2]

3. If  $y$  is directly proportional to  $x^3$  and the difference in the values of  $y$  when  $x = 1$  and  $x = 2$  is 35, find the value of  $y$  when  $x = -3$ .

Answer ..... [2]

---

4. (a) Calculate the sum of the interior angles of a decagon.

Answer (a) ..... ° [1]

- (b) Seven of the interior angles of a decagon are  $165^\circ$  each. The rest of the angles are  $2x^\circ$ ,  $(2x + 15)^\circ$  and  $(x - 30)^\circ$ . Find the value of the largest interior angle.

Answer (b) ..... ° [2]

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5. Jennifer sold  $x$  cupcakes at 60 cents each and 32 cookies at 20 cents each during a fund raising activity in school. At the end of the day, she received at least \$168.

(a) Write down an inequality in  $x$  to represent the information given above.

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

(b) Solve the inequality formed in (a).

*Answer (b)*..... [1]

(c) Hence, find the minimum number of cupcakes sold.

*Answer (c)*.....cupcakes [1]

6. Study the number pattern below.

	$C_1$	$C_2$	$C_3$	$C_4$
$R_1$	2	4	8	64
$R_2$	3	5	15	225
$R_3$	4	6	24	576
$R_4$	5	7	35	1225
$R_5$	6	8	48	2304
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
$R_n$	$n + 1$	$n + 3$	575	330625
$R_{n+1}$	$w$	$x$	$y$	$z$

(a) Write down an expression for  $w$ ,  $x$  and  $y$  in terms of  $n$ .

Answer (a)  $w = \dots\dots\dots$

$x = \dots\dots\dots$

$y = \dots\dots\dots$  [1]

(b) (i) Form an equation in terms of  $n$ .

Answer (b)..... [1]

(b) (ii) Show that your answer in (b)(i) can be simplified to  $n^2 + 4n - 572 = 0$ .

Answer (b)(ii)..... [1]

(c) Explain why the number 15000 would not appear in the column  $C_4$ .

Answer (c).....

..... [1]

(d) Write down an expression for  $z$  in terms of  $y$ .

Answer (d)  $z = \dots\dots\dots$  [1]

7. (a) Given that  $\sqrt[3]{\frac{1-x}{y}} = p$ , express  $x$  in terms of  $p$  and  $y$ .

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

- (b) Hence, find the value of  $x$  when  $p = -1$  and  $y = 6$ .

Answer (b)..... [1]

- 
8. It is given that  $a^2 + b^2 = 548$  and  $2ab = 352$  and  $a > b$ , find the value of  $a^2 - b^2$  where  $a$  and  $b$  are positive integers.

Answer ..... [3]

9. Expand and simplify the following expressions.

(a)  $-3x(2x - 5)$

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

(b)  $7(x - 4) - 3(2x + 4)$

Answer (b)..... [2]

---

10. (a) Factorise  $3k(4 - h) - (h - 4)$ .

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

(b) Hence, simplify  $\frac{3k(4 - h) - (h - 4)}{16 - h^2}$

Answer (b)..... [2]

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11. Solve the following equations.

(a)  $x - (2x - 8) = 28 + 4x$

*Answer (a)*  $x = \dots\dots\dots$  [2]

(b)  $(m - 20)^2 = 144$

*Answer (b)*  $m = \dots\dots\dots$  or  $\dots\dots\dots$  [2]

12. A map of Sentosa Island in Singapore is drawn to a scale of 1 : 50000.

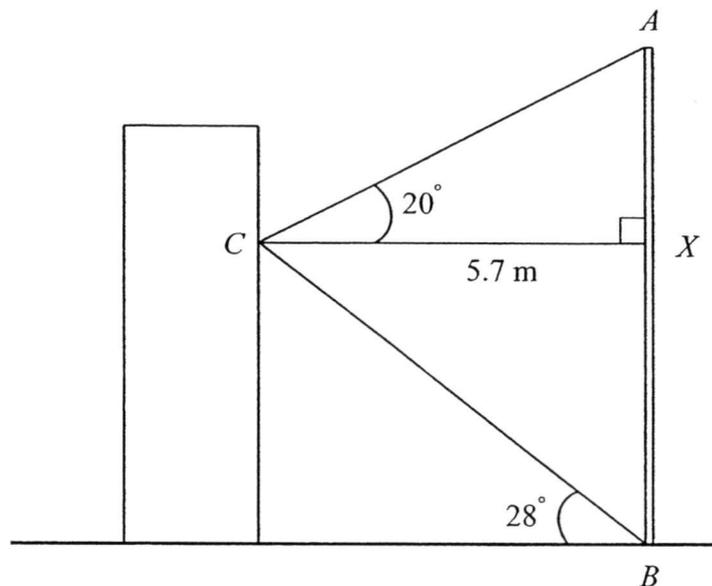
- (a) The distance on the map between the Merlion Park and Tanjong Beach is 3.6 cm. Calculate, in kilometers, the actual distance between these two places.

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

- (b) Sentosa Island has an actual area of 5 km<sup>2</sup>. Calculate in square centimeters, the area of Sentosa Island on the map.

*Answer (b)*.....cm<sup>2</sup> [2]

13. The figure shows a vertical monument  $AB$ . Caine is standing on a platform 5.7 m away, at point  $C$ .



It is given that the angle of elevation from  $C$  to the top of the monument is  $20^\circ$  and the angle of elevation from the foot of the monument to  $C$  is  $28^\circ$ . Find the height of the monument.

Answer..... m [3]

14. The table shows the number of hours,  $h$ , spent by a group of 20 students on the computer in a week.

5	2	14	8	17	0	11	3	9	20
3	10	12	22	14	20	18	20	12	24

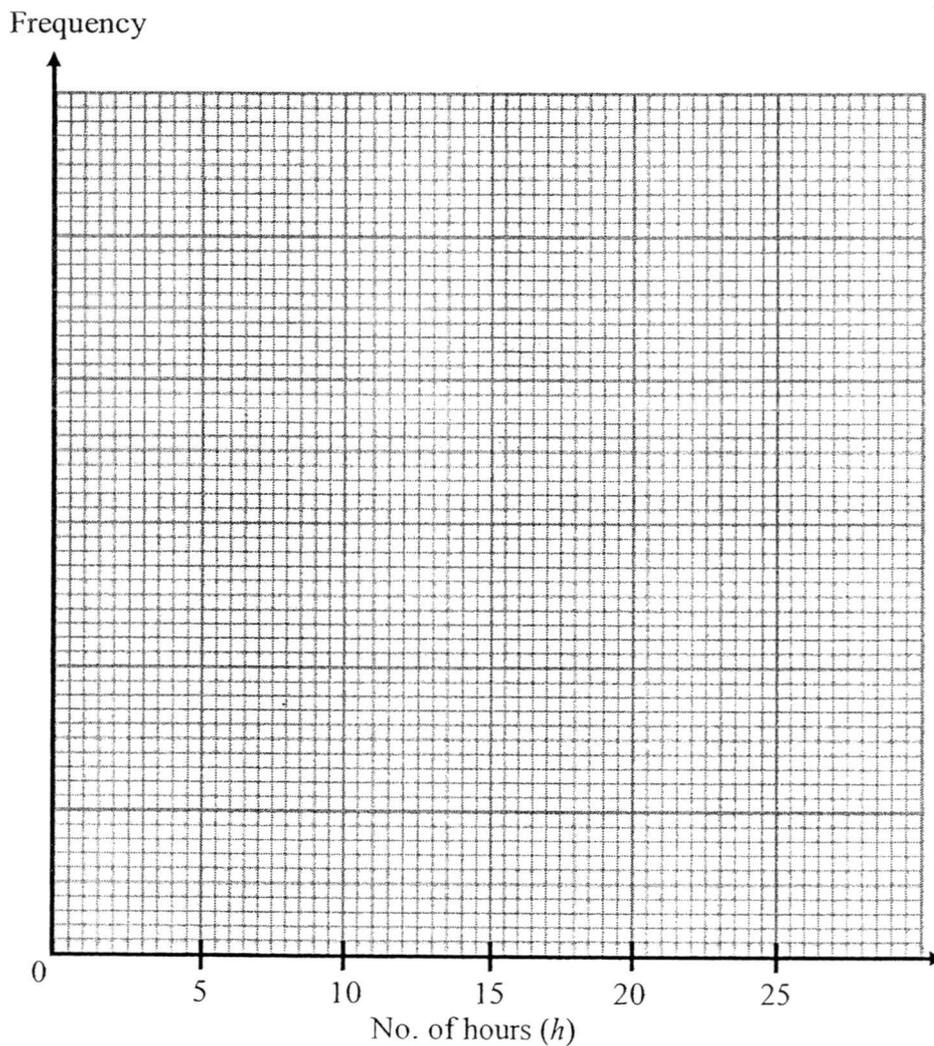
- (a) Complete the frequency table for the data.

[1]

No. of hours	Frequency
$0 \leq h < 5$	4
$5 \leq h < 10$	
$10 \leq h < 15$	
$15 \leq h < 20$	
$20 \leq h < 25$	

- (b) Draw a histogram to illustrate the data in (a).

[2]

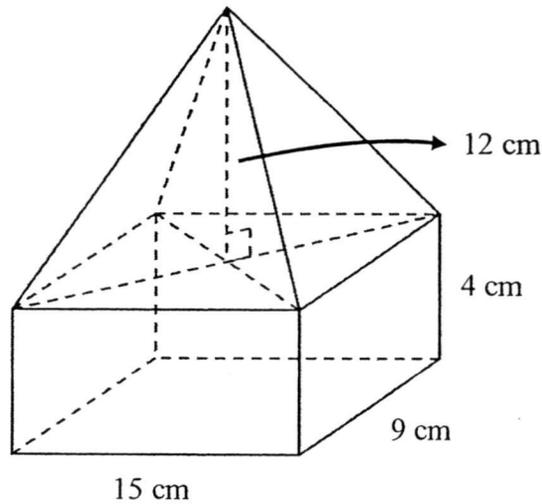


14. (c) Calculate an estimated mean for the number of hours the group of students spent on the computer in a week.

*Answer (c)..... [2]*

---

15. A metal ornament is made up of a pyramid with a rectangular cuboid as its base as shown in the diagram below.



- (a) It is given that the height of the pyramid is 12 cm and the dimensions of the cuboid is 15 cm by 9 cm by 4 cm.
- (i) Find the volume of the pyramid.

Answer (a)(i).....cm<sup>3</sup> [2]

- (ii) Show that the volume of the metal ornament is 1080 cm<sup>3</sup>.

Answer (a)(ii) [1]

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15. (b) The metal ornament was melted and recast into smaller solid cones with a base circumference of 12 cm and a slant height of 5 cm. Take  $\pi = 3.142$ .

(i) Find the volume of each cone.

Answer (b)(i).....cm<sup>3</sup> [3]

(ii) Hence, find the maximum number of cones that can be formed.

Answer (b)(ii).....cones [1]

15. (c) An engineer then cut off the top of the cone with a vertical height of 2 cm and a diameter of 1 cm. He intends to paint the remaining of the ornament after the removal of the top of the cone.
- (i) Find the curved surface area of the remaining ornament after the removal of the top of the cone.

*Answer (c)(i).....cm<sup>2</sup> [2]*

- (ii) Find the total surface area of the ornament to be painted.

*Answer (c)(ii).....cm<sup>2</sup> [2]*

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

The variables  $x$  and  $y$  are connected by the equation  $y = x^2 - 8x + 7$ . The table below shows the corresponding values of  $x$  and  $y$  for the equation.

$x$	0	2	3	4	5	6
$y$	7	-5	-8	$p$	-8	-5

- (a) Calculate the value of  $p$ . [1]
- (b) Taking 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  $y = x^2 - 8x + 7$  for  $0 \leq x \leq 6$ . [3]
- (c) Using your graph, solve  $x^2 - 8x + 7 = -4$ . [1]
- (d) State the equation of the line of symmetry of the graph. [1]

~ End of Paper ~

1	10 cm
2	24
3	-135
4a	1440°
4b	165°
5a	$60x + 32(20) \geq 16800$ or $0.6x + 32(0.2) \geq 168$
5b	$x \geq 269\frac{1}{3}$
5c	270
6a	$w = n + 2, x = n + 4, y = (n + 2)(n + 4)$
6bi	$(n + 1)(n + 3) = 575$
6bii	$(n + 1)(n + 3) = 575$ $n^2 + 4n + 3 = 575$ $n^2 + 4n - 572 = 0$ (shown)
6c	The numbers in $C_4$ are all perfect squares. Since 15000 is not a perfect square, it will not appear in $C_4$ .
6d	$z = y^2$
7a	$x = 1 - yp^3$
7b	$x = 1 - 6(-1)^3 = 7$
8	420
9a	$-6x^2 + 15x$
9b	$x - 40$
10a	$(4 - h)(3k + 1)$ or $(h - 4)(-3k - 1)$ or $-(-4 + h)(3k + 1)$
10b	$\frac{3k + 1}{4 + h}$
11a	$x = -4$
11b	$m = 32$ or $m = 8$
12a	1.8km
12b	20 cm <sup>2</sup>
13	5.11 m

14b

14c 12.75

15ai 540 cm<sup>3</sup>

15aii Volume of ornament =  $540 + (15 \times 9 \times 4) = 1080$  cm<sup>3</sup> (shown)

15bi 17.6 cm<sup>3</sup>

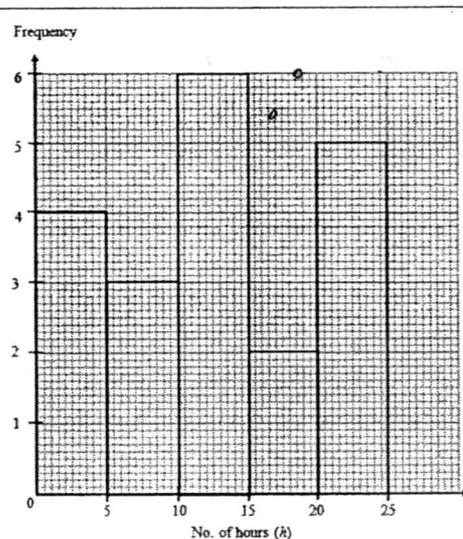
15bii 61

15ci 27.6 cm<sup>2</sup> (used int. values to 5sf) or 26.8 cm<sup>2</sup> (used exact int. values)

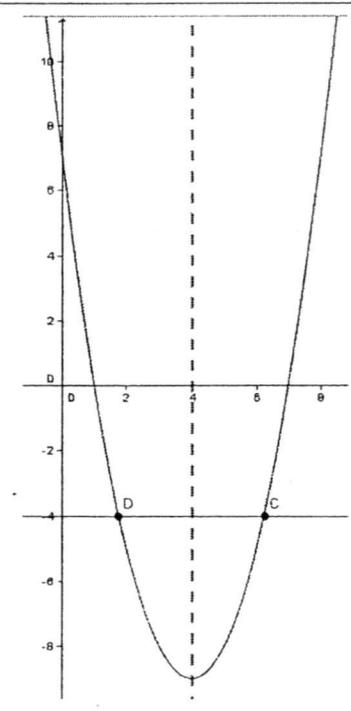
15cii 40.4 cm<sup>2</sup> (used int. values to 5sf) or 39.0 cm<sup>2</sup> (used exact int. values)

16a  $p = -9$

16b



No. of hours	Frequency
$0 \leq h < 5$	4
$5 \leq h < 10$	3
$10 \leq h < 15$	6
$15 \leq h < 20$	2
$20 \leq h < 25$	5



Name : \_\_\_\_\_ (       )

Sec 2\_\_

		16c	Accept $x= 1.7$ to $1.8$
		16d	$x= 4$

1.	Length of rectangle = $\frac{32}{16} \times 5 = 10 \text{ cm}$ [B1]
2.	$48 = 2^4 \times 3$ $72 = 2^3 \times 3^2$ $96 = 2^5 \times 3$  HCF = $2^3 \times 3$ [M1] = 24 [A1]
3.	$y = kx^3$  When $x = 1, y = k$ When $x = 2, y = 8k$  $8k - k = 35$ $7k = 35$ $k = 5$ [M1]  When $x = -3,$ $y = 5(-3)^3 = -135$ [A1]
4a.	$(10 - 2) \times 180^\circ = 1440^\circ$ [B1]
4b.	$7(165) + 2x + (2x + 15) + (x - 30) = 1440$ $5x = 300$ $x = 60$ [M1]  Largest interior angle = $165^\circ$ [A1]
5a.	$60x + 32(20) \geq 16800$ [B1]    or $0.6x + 32(0.2) \geq 168$ [B1]
5b.	$60x + 32(20) \geq 16800$ $60x \geq 16160$ $x \geq 269\frac{1}{3}$ (to 5sf) [B1]
5c.	270 [B1]
6a.	$w = n + 2, x = n + 4, y = (n + 2)(n + 4)$ [B1]
6bi.	$(n + 1)(n + 3) = 575$ [B1]
6bii.	$(n + 1)(n + 3) = 575$ $n^2 + 4n + 3 = 575$ $n^2 + 4n - 572 = 0$ (shown) [B1]
6c.	The numbers in $C_4$ are all perfect squares. Since 15000 is not a perfect square, it will not appear in $C_4$ . [B1]
6d.	$z = y^2$ [B1]

7a.	$\sqrt[3]{\frac{1-x}{y}} = p$ $\frac{1-x}{y} = p^3 \text{ [M1]}$ $1-x = yp^3$ $x = 1 - yp^3 \text{ [A1]}$
7b.	$x = 1 - 6(-1)^3 = 7 \text{ [B1]}$
8.	$a^2 + b^2 + 2ab = 548 + 352$ $(a + b)^2 = 900$ $a + b = 30 \text{ [M1]}$ $a^2 + b^2 - 2ab = 548 - 352$ $(a - b)^2 = 196$ $a - b = 14 \text{ [M1]}$ $a^2 - b^2 = (a + b)(a - b)$ $= 30(14)$ $= 420 \text{ [A1]}$
9a	$-6x^2 + 15x \text{ [B1]}$
9b	$7(x - 4) - 3(2x + 4)$ $= 7x - 28 - 6x - 12 \text{ [M1 for } -12]$ $= x - 40 \text{ [A1]}$
10a.	$3k(4 - h) - (h - 4)$ $= 3k(4 - h) + (4 - h)$ $= (4 - h)(3k + 1) \text{ [B1] accept } (h - 4)(-3k - 1) \text{ and } -(-4 + h)(3k + 1)$
10b.	$\frac{3k(4 - h) - (h - 4)}{16 - h^2}$ $= \frac{(4 - h)(3k + 1)}{(4 - h)(4 + h)} \text{ [M1 for factorising denominator]}$ $= \frac{3k + 1}{4 + h} \text{ [A1]}$
11a.	$x - (2x - 8) = 28 + 4x$ $x - 2x + 8 = 28 + 4x \text{ [M1 for } +8]$ $-5x = 20$ $x = -4 \text{ [A1]}$

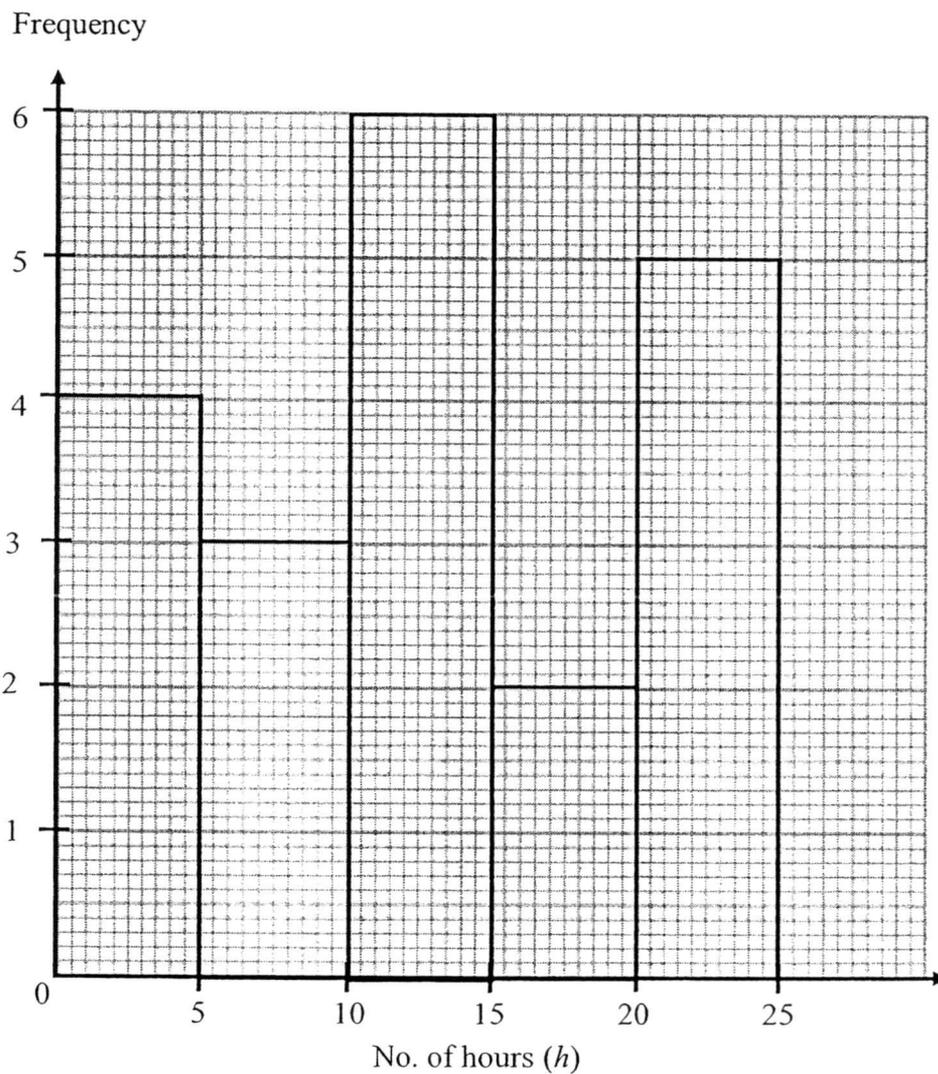
<p><b>11b.</b></p>	<p><math>(m - 20)^2 = 144</math>  <math>m - 20 = 12</math> or <math>m - 20 = -12</math> <b>[M1]</b>  <math>m = 32</math> or <math>m = 8</math> <b>[A1]</b></p> <p>Or</p> <p><math>(m - 20)^2 = 144</math>  <math>m^2 - 2(m)(20) + 20^2 = 144</math>  <math>m^2 - 40m + 256 = 0</math>  <math>(m - 8)(m - 32) = 0</math> <b>[M1 for factorisation]</b>  <math>m - 8 = 0</math> or <math>m - 32 = 0</math>  <math>m = 32</math> or <math>m = 8</math> <b>[A1]</b></p>
<p><b>12a.</b></p>	<p><u>Map</u>                  <u>Actual</u>          1 cm rep. 50000 cm          3.6 cm rep. 180000 cm = 1.8km <b>[B1]</b></p>
<p><b>12b.</b></p>	<p><u>Actual</u>                  <u>Map</u>          50000 cm rep. 1 cm          0.5km rep. 1 cm          0.25km<sup>2</sup> rep. 1 cm<sup>2</sup> <b>[M1]</b>          5km<sup>2</sup> rep. 20 cm<sup>2</sup> <b>[A1]</b></p>
<p><b>13.</b></p>	<p><math>\angle ACX = 28^\circ</math> (alt. angles)  <math>\tan 28^\circ = \frac{BX}{5.7}</math>  <math>BX = 3.0307</math> m (to 5 sf) <b>[M1]</b>  <math>\tan 20^\circ = \frac{AX}{5.7}</math>  <math>AX = 2.0746</math> m (to 5 sf) <b>[M1]</b>          Height of monument = <math>3.0307 + 2.0746 = 5.11</math> m (to 3sf) <b>[A1]</b></p> <p>Or</p> <p><math>\angle XBC = 62^\circ</math>  <math>\tan 62^\circ = \frac{5.7}{BX}</math>  <math>BX = 3.0307</math> m (to 5 sf) <b>[M1]</b>  <math>\tan 70^\circ = \frac{5.7}{AX}</math>  <math>AX = 2.0746</math> m (to 5 sf) <b>[M1]</b>          Height of monument = <math>3.0307 + 2.0746 = 5.11</math> m (to 3sf) <b>[A1]</b></p>

14a.

No. of hours	Frequency
$0 \leq h < 5$	4
$5 \leq h < 10$	3
$10 \leq h < 15$	6
$15 \leq h < 20$	2
$20 \leq h < 25$	5

**[B1 for all correct]**

14b.

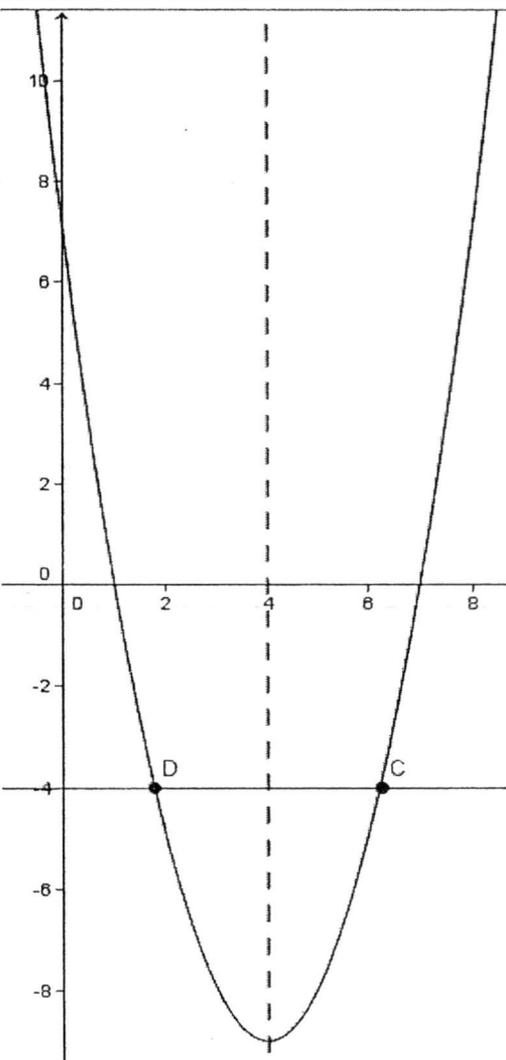


**[B2] for all heights of bars drawn correctly** [No FT mark]

**[B1] for 2 or less error in height of bars**

**[No marks if 3 or more errors]**

14c.	Estimated mean = $\frac{(2.5 \times 4) + (7.5 \times 3) + (12.5 \times 6) + (17.5 \times 2) + (22.5 \times 5)}{20}$ [M1] $= \frac{255}{20}$ $= 12.75$ [A1]
15ai.	Volume of pyramid = $\frac{1}{3} \times 15 \times 9 \times 12$ [M1] $= 540 \text{ cm}^3$ [A1]
15aii.	Volume of ornament = $540 + (15 \times 9 \times 4) = 1080 \text{ cm}^3$ (shown) [B1]
15bi.	Radius of base = $\frac{12}{3.142} \div 2 = 1.9096 \text{ cm}$ [M1 for radius or height] Height of cone = $\sqrt{5^2 - 1.9096^2} = 4.6210 \text{ cm}$ Volume of cone = $\frac{1}{3} \times 3.142 \times 1.9096^2 \times 4.6210$ [M1] $= 17.648 \text{ cm}^3$ (to 5 sf) $= 17.6 \text{ cm}^3$ (to 3 sf) [A1]
15bii.	Max. no. of cones = $1080 \div 17.648 = 61.196 = 61$ (nearest whole number) [B1]
15ci.	Slant height of removed part = $\sqrt{2^2 + 0.5^2}$ $= \sqrt{4.25}$ $= 2.0616$ (to 5sf) Remaining curved surface area $= (3.142 \times 1.9606 \times 5) - (3.142 \times 0.5 \times 2.0616)$ [M1] $= 27.562 \text{ cm}^2$ (to 5sf) $= 27.6 \text{ cm}^2$ (to 3sf) [A1]  Or  Remaining curved surface area $= (3.142 \times \left[ \frac{12}{3.142} \div 2 \right] \times 5) - (3.142 \times 0.5 \times \sqrt{4.25})$ [M1] $= 26.761 \text{ cm}^2$ (to 5sf) $= 26.8 \text{ cm}^2$ (to 3sf) [A1]

<p><b>15cii.</b></p>	<p>Total surface area to be painted  <math>= 27.562 + (3.142 \times 0.5^2) + (3.142 \times 1.9606^2)</math> [M1]  <math>= 40.425 \text{ cm}^2</math> (to 5sf)  <math>= 40.4 \text{ cm}^2</math> (to 3sf) [A1]</p> <p>Or</p> <p>Total surface area to be painted  <math>= 26.761 + (3.142 \times 0.5^2) + (3.142 \times \left[ \frac{12}{3.142} \div 2 \right]^2)</math> [M1 for addition of 3 parts]  <math>= 39.004 \text{ cm}^2</math> (to 5sf)  <math>= 39.0 \text{ cm}^2</math> (to 3sf) [A1]</p>
<p><b>16a.</b></p>	<p><math>p = -9</math> [B1]</p>
<p><b>16b.</b></p>	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p><b>P: 2</b>  <b>C: 1 (smooth curve)</b></p> <p>[Minus 1 mark for no label of axis or curve]</p> </div> </div>
<p><b>16c.</b></p>	<p><math>x = 0.4, 7.6</math> (+/- 0.1) [B1]</p>
<p><b>16d.</b></p>	<p><math>x = 4</math> [B1]</p>

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

End-of-Year Examination 2015  
Secondary Two

**INTEGRATED MATHEMATICS**

1 hour 30 minutes

**Paper 1**

**Thursday**

**8 October 2015**

**0800 - 0930**

**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 60.
3. You are reminded of the need for clear presentation in your answers.

Setter: E.Liow

This document consists of 11 printed pages.

NANYANG GIRLS' HIGH SCHOOL

[Turn over

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1. Arrange the following numbers in ascending order.

$$3.2 \times 10^{-16}, -32 \times 10^{-15}, 0.32 \times 10^{-17}, -3.2 \times 10^{-13}$$

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

---

2. Solve the following pair of simultaneous equations:

$$3x - y = 10$$

$$\frac{x}{2} + 2y = 6$$

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

3. One cubic box of length 40 cm contains 4000 SG50 commemorative coins. A truck container with dimensions 2.5 m by 6 m by 2.5 m is used to deliver the coins to the packing center. Find the maximum number of coins that can be delivered each time. Leave your answer in standard form.

Answer: \_\_\_\_\_ coins [2]

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4. Given that  $p = 2 \times 10^{10}$  and  $q = 1.62 \times 10^{12}$ , evaluate each of the following without the use of a calculator. Express your answers in standard form.

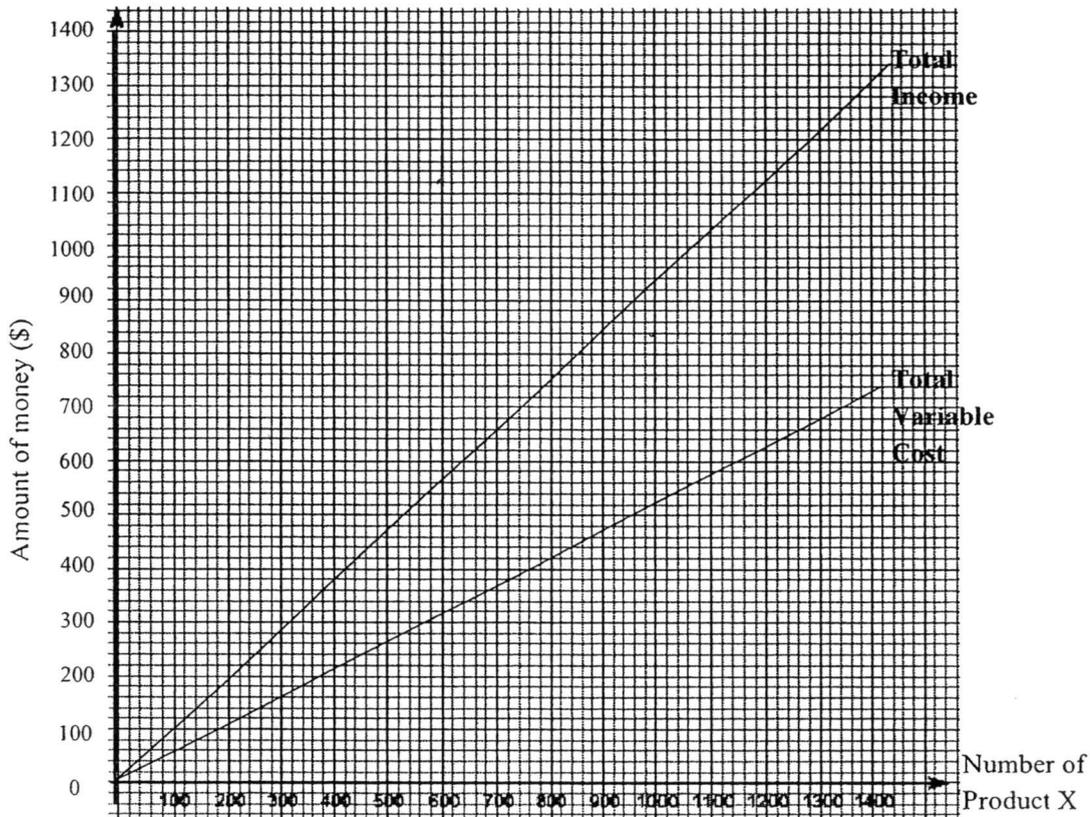
(a)  $8p$

(b)  $\frac{p^2}{q-p}$

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

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

5. The diagram below shows the Total Variable Cost and Total Income graphs of a company producing product X.



The Total Variable Cost includes expenses such as electricity bills, material costs, etc.

- (a) Find the gradient of the line representing the Total Variable Cost and explain its significance.

The Total Cost incurred by the company comprises of the Total Variable Cost and the Fixed Cost. The Fixed Cost is \$500 and includes expenses such as insurance fees, rental fees, etc.

- (b) (i) On the graph provided above, draw the line representing the Total Cost for  $0 \leq \text{number of Product X} \leq 1400$ . Label your graph "Total Cost". [1]
- (ii) State the Total Cost incurred by the company when 800 Product X are produced.
- (iii) Hence, conclude whether the company is making a profit or loss when 800 Product X are produced.

Answer : (a) Gradient = \_\_\_\_\_;

Significance : \_\_\_\_\_ [2]

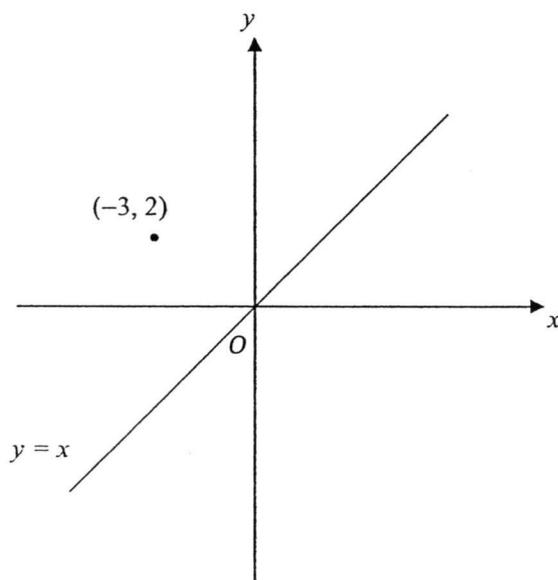
(b) (ii) \$ \_\_\_\_\_ [1] (iii) \_\_\_\_\_ [1]

6. The graph of  $y = x$  and the point  $(-3, 2)$  are plotted as shown below. On the axes below, sketch the graphs of the following given equations and, for each case, indicate the intercepts with the axes clearly. Label each graph clearly with its equation.

(a)  $x = -4$ , [1]

(b)  $y + x + 1 = 0$ , [2]

(c)  $y = k + kx$ , where  $k > 1$ . [2]



7. (a) Given that  $b(3a - b) = \frac{ac}{b}$ , express  $a$  in terms of  $b$  and  $c$ .

(b) State the range of values of  $x$  for the following equation to be defined.

$$\frac{1}{x\sqrt{x+1}} = \frac{1}{x+1}$$

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

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

[Turn Over

8. Simplify the following expressions leaving your answers in the simplest factorized form.

(a)  $\frac{1}{2x-1} - \frac{3}{4x-2} + \frac{2}{4x^2-4x+1}$

(b)  $\frac{3a^2-5ab-2b^2}{b^2-9a^2} \div \frac{ab-3a-2b^2+6b}{3}$

Answer : (a) \_\_\_\_\_ [4]

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

9. Simplify the following, giving your answers in positive indices only.

(a)  $\left(\frac{a^3}{27b}\right)^{\frac{2}{3}} \times \frac{b}{(-a)^2}$

(b)  $\frac{(a^{-2}b^3c^0)^2}{5a^3c^2} \times \sqrt{100b^{-8}}$

(c)  $\frac{3^{2x+1} - 2(9^x)}{3^x}$ , where  $x > 1$

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

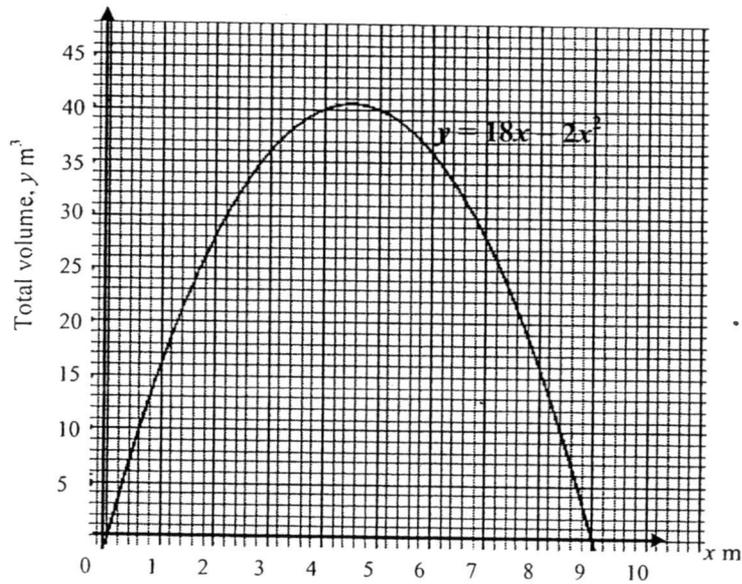
(b) \_\_\_\_\_ [3]

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

[Turn Over

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10. A solid cuboid has dimensions  $(9 - x)$  m by  $x$  m by 2 m. The graph representing its total volume,  $y = (18x - 2x^2) \text{ m}^3$ , against  $x$  m is shown below.



- (a) Find the value of  $m$  given that the points  $(2, n)$  and  $(m, n)$  lie on the curve.
- (b) State the significance of the point  $(4.5, 40.5)$  on the above graph.
- (c) Find the equation of the straight line that must be drawn on the above graph to solve  $x^2 - \frac{21}{2}x + 15 = 0$ .
- (d) Another cuboid with  $x$  m as one of its sides has a total volume of  $y = (30 - 3x) \text{ m}^3$ . By inserting the straight line  $y = 30 - 3x$  onto the graph above, find the value of  $x$ , where  $x < 5$ , when the two cuboids have the same volume.

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

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

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

(d) \_\_\_\_\_ [2]

11. The following is a pair of simultaneous equations:

$$x^2 - py^2 = 0,$$

$$x - 2y = 0.$$

(a) If  $x = p + 1$  and  $y = q$ , is the solution set of the above simultaneous equations, find the values of  $p$  and of  $q$ .

(b) Write down a linear equation such that it has

(i) an infinite number of solutions with  $x - 2y = 0$ ,

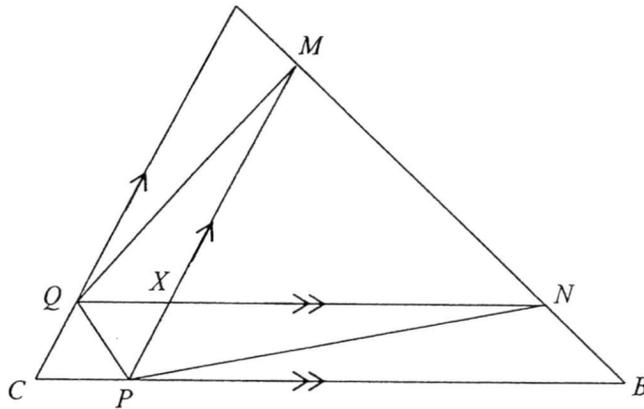
(ii) no solution with  $x - 2y = 0$ .

Answer : (a) \_\_\_\_\_ [5]

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

[Turn Over

12. In the diagram shown below,  $ABC$  is a triangle. The points  $M$  and  $P$  are on  $AB$  and  $BC$  respectively, such that  $PM$  is parallel to  $CA$ . The points  $N$  and  $Q$  are on  $AB$  and  $AC$  respectively, such that  $QN$  is parallel to  $CB$ .  $NQ$  and  $MP$  meet at the point  $X$ , such that  $QXPC$  is a rhombus.



- (a) Name a triangle which is similar to  $\triangle MNX$ .
- (b) What type of triangle should  $\triangle NXM$  be, for it to be similar to  $\triangle QXP$ ?
- (c) Given  $XN : QN : CB = 3 : 4 : 5$ .
- (i) Prove that  $\triangle ANQ$  and  $\triangle MBP$  are congruent. State the geometrical reasons and the case of congruence clearly. [2]
- (ii) If  $\triangle QXP$  and  $\triangle NXM$  are indeed similar, state the ratio  $QP : MN$ .

Answer:

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

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

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

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**END OF PAPER**

Set 2 EOY Paper 1 Solution

1	$-3.2 \times 10^{-13}, -32 \times 10^{-15}, 0.32 \times 10^{-17}, 3.2 \times 10^{-16}$
2	$3x - y = 10 \text{-----(1)}$ $\frac{x}{2} + 2y = 6 \text{-----(2)}$ <p>2(1) + (2) :</p> $2(3x) + \frac{x}{2} = 2(10) + 6$ $\frac{13x}{2} = 26$ $x = 4$ <p>Sub <math>x = 4</math> into (1), <math>3(4) - y = 10</math></p> $y = 2$ <p><u>Alternative method</u></p> $3x - y = 10 \text{-----(1)}$ $\frac{x}{2} + 2y = 6 \text{-----(2)}$ <p>From (1) : <math>y = 3x - 10 \text{-----(3)}</math></p> <p>Sub (3) into (2) :</p> $\frac{x}{2} + 2(3x - 10) = 6$ $\frac{13x}{2} = 26$ $x = 4$ <p>Sub <math>x = 4</math> into (3), <math>3(4) - y = 10</math></p> $y = 2$
3	<p>Maximum of boxes that can be packed into the truck container</p> $= \frac{2.5}{0.4} \times \frac{6}{0.4} \times \frac{2.5}{0.4}$ $\approx 6 \times 15 \times 6$ $= 540$ <p>Maximum number of coins that can be delivered each time</p>

	$= 540 \times 4000$ $= 2160000$ $= 2.16 \times 10^6$
4(a)	$8p$ $= 8(2 \times 10^{10})$ $= 16 \times 10^{10}$ $= 1.6 \times 10^{11}$
4(b)	$\frac{p^2}{q-p}$ $= \frac{(2 \times 10^{10})^2}{1.62 \times 10^{12} - 2 \times 10^{10}}$ $= \frac{4 \times 10^{20}}{1.62 \times 10^{12} - 0.02 \times 10^{12}}$ $= \frac{4 \times 10^{20}}{1.6 \times 10^{12}}$ or $\frac{4 \times 10^{20}}{160 \times 10^{10}}$ $= 2.5 \times 10^8$
5(a)	<p>Gradient = <math>\frac{420}{800} = 0.525</math></p> <p>Significance: For each product X being produced, \$0.53 (2d.p) of variable cost was made.</p>
5(bi)	Line drawn is <u>parallel</u> to Total Variable Cost line with <u>y-int=500</u>
5(bii)	$420+500=\$920$
5(biii)	loss
6	<p>(a) <math>x = -4</math></p> <p>(b) <math>y + x + 1 = 0</math></p> <p>(c) <math>y = k + kx, k &gt; 1</math></p> <p><math>y = x</math></p>

7(a)	$b(3a - b) = \frac{ac}{b}$ $3a - b = \frac{ac}{b^2}$ $3a - \frac{ac}{b^2} = b$ $a\left(\frac{3b^2 - c}{b^2}\right) = b$ $a = \frac{b^3}{3b^2 - c}$ <p><u>Alternative method:</u></p> $b(3a - b) = \frac{ac}{b}$ $3ab^2 - b^3 = ac$ $3ab^2 - ac = b^3$ $a(3b^2 - c) = b^3$ $a = \frac{b^3}{3b^2 - c}$
7(b)	$x \neq 0$ and $x > -1$ (Alt) $-1 < x < 0$ or $x > 0$
8(a)	$\frac{1}{2x-1} - \frac{3}{4x-2} + \frac{2}{4x^2-4x+1}$ $= \frac{1}{2x-1} - \frac{3}{2(2x-1)} + \frac{2}{(2x-1)^2}$ $= \frac{2(2x-1) - 3(2x-1) + 2(2)}{2(2x-1)^2}$ $= \frac{5-2x}{2(2x-1)^2}$
8(b)	$\frac{3a^2 - 5ab - 2b^2}{b^2 - 9a^2} \div \frac{ab - 3a - 2b^2 + 6b}{3}$ $= \frac{(a-2b)(3a+b)}{(b-3a)(b+3a)} \times \frac{3}{(a-2b)(b-3)}$ $= \frac{3}{(b-3a)(b-3)}$

9(a)	$\left(\frac{a^3}{27b}\right)^{\frac{2}{3}} \times \frac{b}{(-a)^2}$ $= \frac{a^2}{9b^{\frac{2}{3}}} \times \frac{b}{a^2}$ $= \frac{1}{9} b^{\frac{1}{3}}$
9(b)	$\frac{(a^{-2}b^3c^0)^2}{5a^3c^2} \times \sqrt{100b^{-8}}$ $= \frac{a^{-4}b^6}{5a^3c^2} \times 10b^{-4}$ $= \frac{2b^2}{a^7c^2}$
9(c)	$\frac{3^{2x+1} - 2(9^x)}{3^x}$ $= \frac{3(3^{2x}) - 2(3^{2x})}{3^x}$ $= \frac{3^{2x}}{3^x}$ $= 3^x$
10(a)	$m=7$
10(b)	The maximum total volume is $40.5 \text{ m}^3$ when $x=4.5$ .
10(c)	$x^2 - \frac{21}{2}x + 15 = 0$ $2x^2 - 21x + 30 = 0$ $30 - 3x = 18x - 2x^2$ $y = 30 - 3x$
10(d)	Line drawn passes through <u>(0,30) and (10, 0)</u> . Accept $x = 1.6$ to $1.8$

11(a)	$(p+1)^2 - pq^2 = 0 \text{-----(1)}$ $(p+1) - 2q = 0 \text{-----(2)}$ <p>From (2), <math>q = \frac{p+1}{2} \text{-----(3)}</math></p> <p>Sub (3) into (1), <math>(p+1)^2 - \frac{p(p+1)^2}{4} = 0</math></p> $(p+1)^2 \left[ 1 - \frac{p}{4} \right] = 0$ $p = -1 \text{ or } p = 4$ <p>From (3),  If <math>p = -1, q = 0</math>  If <math>p = 4, q = 2.5</math></p> <p><u>Alternative method:</u></p> $(p+1)^2 - pq^2 = 0 \text{-----(1)}$ $(p+1) - 2q = 0 \text{-----(2)}$ <p>From (2), <math>p = 2q - 1 \text{-----(3)}</math></p> <p>Sub (3) into (1), <math>(2q)^2 - (2q-1)q^2 = 0</math></p> $q^2(5-2q) = 0$ $q = 0 \text{ or } q = 2.5$ <p>From (3),  If <math>q = 0, p = -1</math>  If <math>q = 2.5, p = 4</math></p>
11(b)	(i) accept any $nx - 2ny = 0$ , where $n \neq 0$ (ii) accept any $x - 2y = n$ , where $n \neq 0$
12(a)	$\triangle ANQ$ or $\triangle MBP$ or $\triangle ABC$
12(b)	Isosceles / Equilateral triangle

12(ci)	$\angle QAN = \angle PMB$ (corr. $\angle$ s, $AC \parallel MP$ ) $\angle ANQ = \angle MBP$ (corr. $\angle$ s, $QN \parallel PB$ ) $\angle AQN = \angle MXN$ (corr. $\angle$ s, $AQ \parallel MP$ ) $= \angle MPB$ (corr. $\angle$ s, $AN \parallel PB$ ) (*any of the 2 pairs of angles)  $QX = CP$ $QN : PB = 4 : 5 - (4 - 3)$ $= 4 : 4$ $QN = PB$ $\triangle ANQ \cong \triangle MBP$ (AAS/ASA *depends)
12(cii)	$QP : MN = 1 : 3$

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

End-of-Year Examination 2015  
Secondary Two

**INTEGRATED MATHEMATICS**

1 hour 30 minutes

**Paper 2**

**1030 - 1200**

**08 October 2015**

**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 60.
3. You are reminded of the need for clear presentation in your answers.

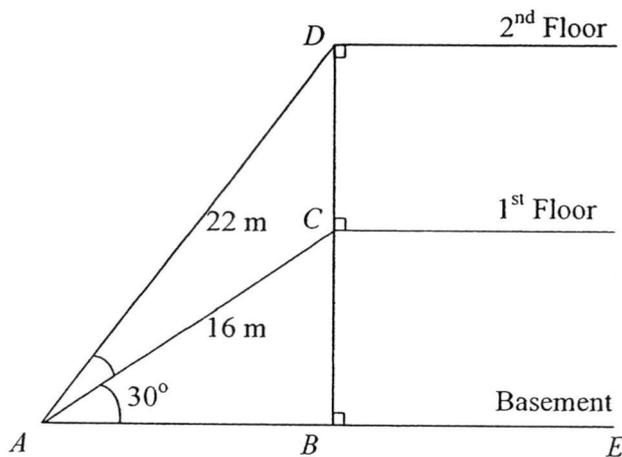
**Setter: S Lee**

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**NANYANG GIRLS' HIGH SCHOOL**

**[ Turn over**

- 1 (a) The point  $(3, k)$  lies on the line  $y = 3x + 1$ . Find the value of  $k$ . [1]
- (b) The line  $L_1$  passes through the point  $(4, 7)$  and is parallel to the line  $2y - x = 16$ . Find the equation of the line  $L_1$ . [3]
- (c) The line  $L_2$  passes through the points  $(2, -2)$  and  $(2, 7)$ . Write down the equation of the line  $L_2$ . [1]
- 2 (a) It is given that  $\frac{3x-1}{4} \leq \frac{7x+4}{3} < x + 2\frac{2}{3}$ .
- (i) Solve the inequality. [4]
- (ii) Hence, list the integer values of  $x$  that satisfy the inequality. [1]
- (b) Given that  $2 \leq p \leq 7$  and  $-1 \leq q \leq 5$ , find
- (i) the largest value of  $p - q$ , [1]
- (ii) the smallest value of  $p + q^2$ , [1]
- (iii) the smallest value of  $\frac{q^3}{p}$ . [1]
- 3 A delivery van runs  $x$  kilometres on each litre of petrol when it travels up a slope.
- (i) Write down, in terms of  $x$ , the number of litres of petrol used when the delivery van travels 70 km up the slope. [1]
- The delivery van runs  $(x + 2)$  kilometres on each litre of petrol when it travels down the slope.
- (ii) Write down, in terms of  $x$ , the number of litres of petrol used when the delivery van travels 70 km down the slope. [1]
- The delivery van uses 3 litres less petrol to travel down the slope than up the slope.
- (iii) Using this information, form an equation in  $x$  and show that it reduces to  $3x^2 + 6x - 140 = 0$ . [3]
- (iv) Solve the equation  $3x^2 + 6x - 140 = 0$ , giving both answers correct to two decimal places. [3]
- (v) Hence, calculate the total volume of petrol used when the van travels 70 km up the slope and 70 km down the slope. [2]

- 4 The quadratic curve  $y = ax^2 + bx + 23$  cuts the  $y$ -axis at point  $A$  and it passes through the points  $(1, 13)$  and  $(5, 13)$ .
- Write down the coordinates of point  $A$ . [1]
  - Find the equation of the line of symmetry of the curve. [2]
  - Find the value of  $a$  and of  $b$ . Hence, explain with a reason whether the curve has a maximum or minimum turning point. [5]
  - The line  $y = k$  meets the curve  $y = ax^2 + bx + 23$  at only one point. Find the value of  $k$ . [2]
- 5 The diagram shows two escalators,  $AC$  and  $AD$ , in a shopping centre.

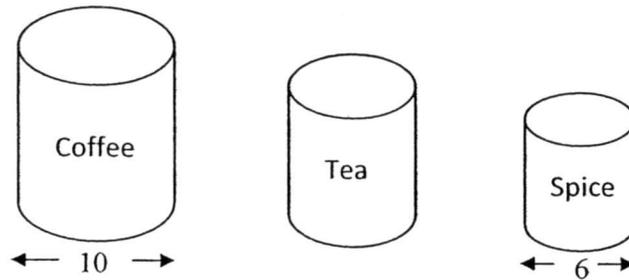


The escalator  $AC$  of length 16 m leads to the 1<sup>st</sup> Floor while the escalator  $AD$  of length 22 m leads to the 2<sup>nd</sup> Floor.

Given that the straight line  $BCD$  is perpendicular to the horizontal basement  $ABE$  and  $\angle BAC = 30^\circ$ , find

- the height between the basement and the 1<sup>st</sup> floor, [2]
- the height between the 1<sup>st</sup> floor and the 2<sup>nd</sup> floor, [4]
- $\angle DAC$ . [2]

- 6 The diagram shows three kitchen containers.



Each container is a cylinder and the containers are geometrically similar.

The bases of the Coffee and Spice containers have diameters of lengths 10 cm and 6 cm respectively.

- (a) Calculate the ratio

volume of the Spice container : volume of the Coffee container.

Hence, find the volume of the Spice container if the volume of the Coffee container is  $980 \text{ cm}^3$ .

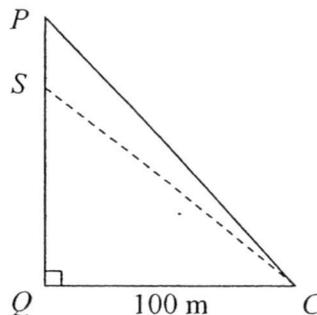
[3]

- (b) Given that the surface area of the Tea container is  $\frac{9}{16}$  of the surface area of the

Coffee container, evaluate  $\frac{\text{Surface area of the Spice container}}{\text{Surface area of the Tea container}}$ .

[3]

- 7 At the National Day Parade, a parachutist descended from a helicopter (not shown in the diagram). When he was at point  $P$ , he began to descend vertically at a constant speed of 7 m/s towards point  $Q$  on the parade ground. To record the descent, an automated motorized video camera was placed at point  $C$  on the parade ground, 100 m away from point  $Q$ . The angle of depression of  $C$  from  $P$  was  $60^\circ$ .



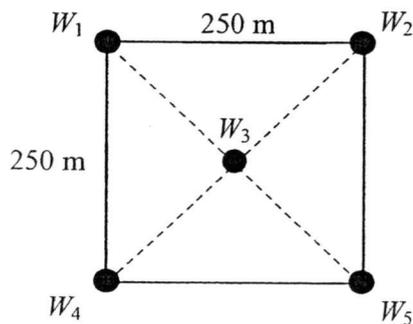
- (i) Calculate the time taken for the parachutist to reach the parade ground. [3]
- (ii) Given that in the descent, it took 10 s for the parachutist to reach point  $S$ , calculate the angle of elevation of  $S$  from  $C$ . [3]

- 8 Singapore aims to be a test-bed for micro-wind technology generating electricity with low wind speeds. A wind power station is proposed to be erected in a 250 m by 250 m horizontal field at Pulau Ubin and some wind towers will be built. Each wind tower has three rotor blades and the length of each blade is 40 m.



- (a) According to building regulations, the minimum distance between two wind towers, measured from the foot of one tower to another, has to be five times the length of a rotor blade.

An engineer made a suggestion on how to arrange five wind towers  $W_1$ ,  $W_2$ ,  $W_3$ ,  $W_4$  and  $W_5$ , in the square field. The arrangement is shown in the diagram below.



Explain why the engineer's suggestion does not meet the building regulations. Support your answer with working. [3]

- (b) Singapore wants to estimate the cost savings from generating electricity through this wind station. The formula  $C = -10y^2 + 90y - 130$  is used to estimate the cost savings in  $C$  million dollars during the first  $y$  years of operation.

This formula can be re-written as  $C = a(y - n)^2 + m$  where it will take  $n$  years to achieve the maximum cost savings of  $m$  million dollars. Find the maximum cost savings and the number of years it will take to achieve this. [4]

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[Please Turn Over

**Bonus Question**

- 9  $\alpha$  and  $\beta$  are the roots of the quadratic equation  $ax^2 + bx + c = 0$  where  $a$ ,  $b$  and  $c$  are constants and  $a \neq 0$ . Showing your working clearly, express the sum of the roots and the product of the roots in terms of  $a$ ,  $b$  and/or  $c$ . [3]

**End of Paper 2**

Sec 2 Math EOY 2015 Paper 2 Solution

1(a) [1 m]	$k = 10$
1(b) [3 m]	<p>Gradient of <math>L_1</math> is <math>\frac{1}{2}</math></p> <p>Let the equation of the line be <math>y = mx + c</math> and since the line passes through <math>(4, 7)</math></p> $7 = \frac{1}{2}(4) + c$ $\therefore c = 5$ <p>Equation of <math>L_1</math> is <math>y = \frac{1}{2}x + 5</math></p>
1(c) [1 m]	$x = 2$
2(a)(i) [4 m]	$\frac{3x-1}{4} \leq \frac{7x+4}{3} < x + 2\frac{2}{3}$ $\frac{3x-1}{4} \leq \frac{7x+4}{3}$ $9x-3 \leq 28x+16$ $-1 \leq x \text{ or } x \geq -1$ $\frac{7x+4}{3} < x + 2\frac{2}{3}$ $7x+4 < 3x+8$ $x < 1$ $\therefore -1 \leq x < 1$
2(a)(ii) [1 m]	$-1$ and $0$
2(b)(i) [1 m]	$8$
2(b)(ii) [1 m]	$2$
2(b)(iii) [1 m]	$-\frac{1}{2}$
3(i) [1 m]	$\frac{70}{x}$
3(ii) [1 m]	$\frac{70}{x+2}$

3(iii) [3 m]	$\frac{70}{x} - \frac{70}{x+2} = 3$ $70(x+2) - 70x = 3x(x+2)$ $70x + 140 - 70x = 3x^2 + 6x$ $3x^2 + 6x - 140 = 0 \text{ (shown)}$
3(iv) [3 m]	$x = \frac{-6 \pm \sqrt{6^2 - 4(3)(-140)}}{2(3)}$ $x \approx 5.90 \text{ or } -7.90$
3(v) [2 m]	$\frac{70}{5.904} + \frac{70}{5.904 + 2}$ $\approx 20.7 \text{ litres}$
4(i) [1 m]	(0, 23)
4(ii) [2 m]	$x = \frac{1+5}{2}$ <p>Line of symmetry is <math>x = 3</math></p>
4(iii) [5 m]	$a + b + 23 = 13$ $a + b = -10 \text{ .....(1)}$ $25a + 5b = -10 \text{ .....(2)}$ $25a + 5(-10 - a) = -10$ $\text{or } 25a + 5b - 5a - 5b = -10 - 5(-10)$ $20a = -10 + 50$ $a = 2$ $\text{From (1), } b = -10 - 2 = -12$ <p>Since <math>a</math>, the <i>coefficient of <math>x^2</math>, is positive</i>, the curve has a <u>minimum turning point</u>.</p>
4(iv) [2 m]	<p>When <math>x = 3</math></p> $k = 2(3)^2 - 12(3) + 23$ $\therefore k = 5$
5(i) [2 m]	$BC = 16 \sin 30^\circ$ $= 8 \text{ m}$
5(ii) [4 m]	$AB = 16 \cos 30^\circ$ $\approx 13.86 \text{ m}$ $BD = \sqrt{22^2 - 13.86^2}$ $\approx 17.09 \text{ m}$ $CD = 17.09 - 8$ $= 9.09 \text{ m}$

5(iii) [2 m]	$\angle BAD = \cos^{-1} \frac{13.86}{22}$ $\approx 50.95^\circ$ $\angle DAC = 50.95^\circ - 30^\circ \approx 21.0^\circ \text{ or } 20.9^\circ$
6(a) [3 m]	$6^3 : 10^3$ $= 27 : 125$ <p>Volume of Coffee container</p> $= \frac{27}{125} \times 980$ $= 211.68 \text{ cm}^3$
6(b) [4 m]	$\frac{\text{Surface area of Spice container}}{\text{Surface area of Coffee container}} = \left(\frac{3}{5}\right)^2$ $= \frac{9}{25}$ $\frac{\text{Surface area of Spice container}}{\text{Surface area of Tea container}} = \frac{9}{25} \div \frac{9}{16}$ $= \frac{16}{25}$
7(i) [3 m]	$\frac{QP}{100} = \tan 60^\circ$ $QP = 173.21$ <p>Time taken = <math>\frac{173.21}{7}</math></p> $\approx 24.7 \text{ s}$
7(ii) [3 m]	$QS = 173.21 - 10(7)$ $= 103.21$ <p>Angle of Elevation of S from C</p> $= \tan^{-1} \frac{103.21}{100}$ $\approx 45.9^\circ$
8(a) [3 m]	$\frac{\sqrt{250^2 + 250^2}}{2}$ $\approx 177$ <p>Since <math>177 &lt; 200</math>, the engineer's suggestion does not meet the building requirements.</p>
8(b) [4 m]	$-10(y^2 - 9y) - 130$ $= -10(y^2 - 9y + 4.5^2 - 4.5^2) - 130$ $= -10(y - 4.5)^2 + 72.5$ <p>It takes <u>4.5 years</u> to achieve a maximum cost</p>

	$\frac{v}{c} = g\alpha$	
	$\frac{v}{q} = g + \alpha$	
	$\frac{v}{c} + x \frac{v}{q} + x^2 \equiv g\alpha + x(g + \alpha) - x^2$	
	$g\alpha + x(g + \alpha) - x^2 = (g - x)(\alpha - x)$	6
savings of 725 million dollars		



**SWISS COTTAGE SECONDARY SCHOOL**  
**SECONDARY TWO EXPRESS**  
**SECOND SEMESTRAL EXAMINATIONS**

Name: \_\_\_\_\_ ( ) Class: Sec 2E\_\_\_\_\_

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**MATHEMATICS**

Paper 1

**4048/01**

**Friday 2 October 2015**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

---

**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.

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.

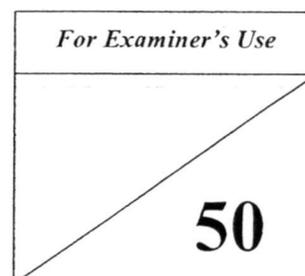
Calculators are **NOT ALLOWED** in this paper.

Give answers in degrees to one decimal place.

For  $\pi$ , use 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.



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This question paper consists of **10** printed pages.

**Setter:** Mr Wilson Wee

**Vetter:** Ms Zoe Pow

[Turn over

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*We Nurture Students to **Think, Care and Lead** with **P.R.I.D.E.***

Answer **all** the questions.

- 1 (a) Express 180 as a product of its prime factors.

Answer (a)  $180 = \dots\dots\dots$  [2]

- (b) Given that  $504 = 2^3 \times 3^2 \times 7$ , find the highest common factor of 504 and 180. Express your answer as a product of its prime factors.

Answer (b)  $\dots\dots\dots$  [1]

---

- 2 Given that  $a = 5, b = 2, c = -3$  and  $d = 8$ , evaluate  $\frac{3d}{b} - ac^2$ .

Answer  $\dots\dots\dots$  [2]

---

- 3 Make  $a$  the subject of the formula  $7a - 3b = 2ac + 8c$ .

Answer  $\dots\dots\dots$  [2]

---

- 4 (a) Solve the inequality  $16 - 4x < \frac{1}{2}x$ .

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

- (b) Hence, find the smallest possible value of  $x$  if

- (i)  $x$  is an integer,

Answer (b)(i) ..... [1]

- (ii)  $x$  is a prime number.

Answer (b)(ii) ..... [1]

- 5 Simplify the following.

(a)  $3 + \frac{5m - n}{3} - \frac{3m}{4}$

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

(b)  $\frac{x+3}{x-1} \div \frac{2x^2+7x+3}{2x-2}$

*Answer (b)* ..... [3]

---

6 Expand and simplify  $(x+3)^2 - (x^2 - 2x + 3)$ .

*Answer* ..... [2]

---

7 Factorise the following.

(a)  $2ab - 6b^2 - ac + 3bc$

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

(b)  $3x^2 - 75$

*Answer (b)* ..... [2]

---

8 Solve the simultaneous equations

$$2x - 3y = 14,$$

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

*Answer*

$x = \dots\dots\dots$

$y = \dots\dots\dots [3]$

9 8 workers can build a tower in 60 days.

- (a) How many days will it take to build the same tower if 3 workers were injured?

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

- (b) How many workers are required to build 5 towers in 30 days?

*Answer (b)* ..... workers [3]

10 A 3 km road is represented by 6 cm on a map.

(a) Find the scale of the map in the form 1 :  $n$ .

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

(b) A park has an area of  $27 \text{ km}^2$ .

Find the area of the park on the map in  $\text{cm}^2$ .

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

11 A laptop costs \$2500. Jonathan buys the laptop under hire purchase. According to the terms of the hire purchase, there is a down payment of 20%. The remaining amount is to be paid in monthly instalments over 4 years at a simple interest rate of 5% per annum. Calculate the monthly instalment that he has to pay.

Answer \$ ..... [3]

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12 A bag contains 5 red chips, 3 green chips and 6 yellow chips.

(a) Expressing your answer as a fraction in its lowest term, find the probability that

(i) the first chip taken is red.

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

(ii) the first chip taken is not yellow.

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

(iii) the first chip taken is either green or yellow.

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

(b) If the first chip taken is yellow and is **not replaced** in the bag, find the probability that the second chip taken is green.

*Answer (b)* ..... [2]

- 13 The table below shows the number of books that a group of people have read over 2 months.

Number of books	0	1	2	3	4
Frequency	1	3	4	$x$	2

- (a) If the mode is 2, write down the largest possible value of  $x$ .

*Answer (a)*  $x = \dots\dots\dots$  [1]

- (b) If the median is 2, write down the largest possible value of  $x$ .

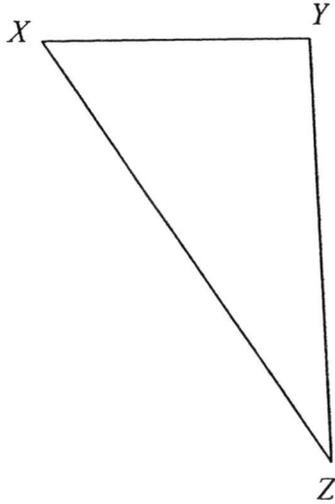
*Answer (b)*  $x = \dots\dots\dots$  [1]

- (c) If the mean is 2, calculate the value of  $x$ .

*Answer (c)*  $x = \dots\dots\dots$  [2]

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- 14 In the diagram below,  
Answer (a)



- (a) construct the
- (i) angle bisector of  $\angle YXZ$ , [1]
- (ii) perpendicular bisector of  $XZ$ . [1]
- (b) The angle bisector in (a)(i) meets the perpendicular bisector in (a)(ii) at point  $P$ . Measure the shortest distance of  $P$  from  $XZ$ .

Answer (b) ..... cm [1]

---

**End of Paper**

Answer Key for Math 2E SA2 P1 2015

Qn	Marking Point																		
1(a)	$2^2 \times 3^2 \times 5$																		
1(b)	$2^2 \times 3^2$																		
2	-33																		
3	$a = \frac{8c+3b}{7-2c}$																		
4(a)	$3\frac{5}{9} < x$																		
4(b)(i)	4																		
4(b)(ii)	5																		
5(a)	$\frac{36+11m-4n}{12}$																		
5(b)	$\frac{2}{(2x+1)}$																		
6	$8x+6$																		
7(a)	$(a-3b)(2b-c)$																		
7(b)	$3(x+5)(x-5)$																		
8	$y = -2$ $x = 4$																		
9(a)	96 days																		
9(b)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Workers</th> <th>Days</th> <th>Towers</th> </tr> </thead> <tbody> <tr> <td>8</td> <td>60</td> <td>1</td> </tr> <tr> <td><math>\times 5</math></td> <td></td> <td><math>\times 5</math></td> </tr> <tr> <td>= 40</td> <td>60</td> <td>= 5</td> </tr> <tr> <td><math>\times 2</math></td> <td><math>\div 2</math></td> <td></td> </tr> <tr> <td>= 80</td> <td>= 30</td> <td></td> </tr> </tbody> </table> <p><i>Answer</i> 80 workers</p>	Workers	Days	Towers	8	60	1	$\times 5$		$\times 5$	= 40	60	= 5	$\times 2$	$\div 2$		= 80	= 30	
Workers	Days	Towers																	
8	60	1																	
$\times 5$		$\times 5$																	
= 40	60	= 5																	
$\times 2$	$\div 2$																		
= 80	= 30																		
10(a)	Scale = 1 : 50000																		
10(b)	$108 \text{ cm}^2$																		

<b>11</b>	\$50
<b>12(a)(i)</b>	$\frac{5}{14}$
<b>12(a)(ii)</b>	$\frac{4}{7}$
<b>12(a)(iii)</b>	$\frac{9}{14}$
<b>12(b)</b>	$\frac{3}{13}$
<b>13(a)</b>	3
<b>13(b)</b>	5
<b>13(c)</b>	$x = 1$
<b>14(c)</b>	$1.7 \pm 0.1$ cm

Marking Scheme for Math 2E SA2 P1 2015

Qn	Marking Point	Marks Awarded	Remarks
1(a)	$\begin{array}{r} 2 \overline{)180} \\ 2 \overline{)90} \\ 3 \overline{)45} \\ 3 \overline{)15} \\ 5 \overline{)5} \\ 1 \end{array}$ $180 = 2^2 \times 3^2 \times 5$	M1  A1	
1(b)	$180 = 2^2 \times 3^2 \times 5$ $504 = 2^3 \times 3^2 \times 7$ $\text{HCF} = 2^2 \times 3^2$	B1	
2	$\frac{3d}{b} - ac^2$ $= \frac{3(8)}{2} - 5(-3)^2$ $= \frac{24}{2} - 5(9)$ $= 12 - 45$ $= -33$	M1  A1	Evaluation of $c^2$ as 9.
3	$7a - 3b = 2ac + 8c$ $7a - 2ac = 8c + 3b$ $a(7 - 2c) = 8c + 3b$ $a = \frac{8c + 3b}{7 - 2c}$	M1  A1	Factorising the terms containing $a$ .

<b>4(a)</b>	$16 - 4x < \frac{1}{2}x$ $16 < 4x + \frac{1}{2}x$ $16 < 4\frac{1}{2}x$ $16 < \frac{9}{2}x$ $32 < 9x$ $3\frac{5}{9} < x$	<b>M1</b>	Shifting the variables to one side.
		<b>A1</b>	
<b>4(b)(i)</b>	4	<b>B1</b>	
<b>4(b)(ii)</b>	5	<b>B1</b>	
<b>5(a)</b>	$3 + \frac{5m-n}{3} - \frac{3m}{4}$ $= \frac{36}{12} + \frac{4(5m-n)}{12} - \frac{9m}{12}$ $= \frac{36 + 4(5m-n) - 9m}{12}$ $= \frac{36 + 20m - 4n - 9m}{12}$ $= \frac{36 + 11m - 4n}{12}$	<b>M1</b>	Combining second and third term into one fraction with common denominator.
		<b>A1</b>	
<b>5(b)</b>	$\frac{x+3}{x-1} \div \frac{2x^2+7x+3}{2x-2}$ $= \frac{x+3}{x-1} \times \frac{2x-2}{2x^2+7x+3}$ $= \frac{x+3}{x-1} \times \frac{2(x-1)}{(x+3)(2x+1)}$ $= \frac{2}{(2x+1)}$	<b>M1</b>	Changing to multiply sign.  Factorising $2x^2 + 7x + 3$
		<b>M1</b>	
		<b>A1</b>	
<b>6</b>	$(x+3)^2 - (x^2 - 2x + 3)$ $= x^2 + 6x + 9 - x^2 + 2x - 3$ $= 8x + 6$	<b>M1</b>	Correct expansion and opening of bracket.
		<b>A1</b>	



<b>10(a)</b>	$\begin{aligned} 6 \text{ cm} & \text{-----} 300000 \text{ cm} \\ 1 \text{ cm} & \text{-----} \frac{300000}{6} \\ & = 50000 \text{ cm} \end{aligned}$ <p>Scale = 1 : 50000</p>	<b>B1</b>	
<b>10(b)</b>	$\begin{aligned} 3 \text{ km} & \text{-----} 6 \text{ cm} \\ (3\text{km})^2 & \text{-----} (6\text{cm})^2 \\ 9 \text{ km}^2 & \text{-----} 36 \text{ cm}^2 \\ 27 \text{ km}^2 & \text{-----} \frac{27}{9} \times 36 \\ & = 108 \text{ cm}^2 \end{aligned}$	<b>M1</b>  <b>A1</b>	Area scale
<b>11</b>	<p>Down payment = <math>\frac{20}{100} \times \\$2500</math> = \$500</p> <p>Remaining amt. = \$2500 - \$500 = \$2000</p> <p>Interest = <math>\frac{\\$2000 \times 5 \times 4}{100}</math> = \$400</p> <p>Total amt. to be paid for 4 years = \$2000 + \$400 = \$2400</p> <p>Monthly installment = <math>\frac{\\$2400}{12 \times 4}</math> = \$50</p>	<b>M1</b>        <b>M1</b>        <b>A1</b>	
<b>12(a)(i)</b>	$\begin{aligned} \text{Probability} & = \frac{5}{5+3+6} \\ & = \frac{5}{14} \end{aligned}$	<b>B1</b>	

<b>12(a)(ii)</b>	$\text{Probability} = 1 - \frac{6}{14}$ $= \frac{8}{14}$ $= \frac{4}{7}$	<b>M1</b>	
		<b>A1</b>	
<b>12(a)(iii)</b>	$\text{Probability} = \frac{3+6}{14}$ $= \frac{9}{14}$	<b>M1</b>	
		<b>A1</b>	
<b>12(b)</b>	$\text{Probability} = \frac{3}{14-1}$ $= \frac{3}{13}$	<b>M1</b>	
		<b>A1</b>	
<b>13(a)</b>	3	<b>B1</b>	
<b>13(b)</b>	0 1 1 1 2 2 2 2 3 ..... 3 4 4 <i>Answer 5</i>	<b>B1</b>	
<b>13(c)</b>	$\frac{0 \times 1 + 1 \times 3 + 2 \times 4 + 3 \times x + 4 \times 2}{1 + 3 + 4 + x + 2} = 2$ $3x + 19 = 2(x + 10)$ $3x + 19 = 2x + 20$ $x = 1$	<b>M1</b>	
		<b>A1</b>	
<b>14(c)</b>	$1.7 \pm 0.1 \text{ cm}$	<b>B1</b>	

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**SWISS COTTAGE SECONDARY SCHOOL**  
**SECONDARY TWO EXPRESS**  
**SECOND SEMESTRAL EXAMINATIONS**

Name: \_\_\_\_\_ (            )            Class: Sec 2E \_\_\_\_\_

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**MATHEMATICS**

Paper 2

**4048/02**

**Thursday 8 October 2015**

**1 hour 15 minutes**

Additional Materials: Graph Paper (1 sheet)

Additional Candidates answer on the Question Paper.

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**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.

You may use a pencil for any diagrams or graphs.

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

Answer **all** the 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.

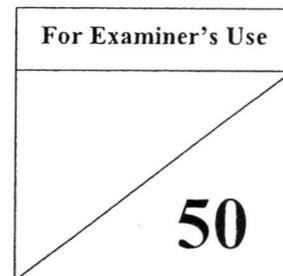
For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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

Attach the graph paper at the back of the question paper.

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.



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This question paper consists of 12 printed pages.

**Setter:** Mr Ngoh Kia Joon

**Vetter:** Ms Zoe Pow

[Turn over  
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*We Nurture Students to **Think, Care and Lead** with **P.R.I.D.E.***

***Mathematical Formulae***

Compound Interest

$$\text{Total amount} = P \left( 1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

Answer **all** questions.

- 1 (a) Evaluate  $\frac{17.69^2 - \sqrt{22.11}}{\frac{8}{3}\pi}$ , giving your answer correct to 1 decimal place.

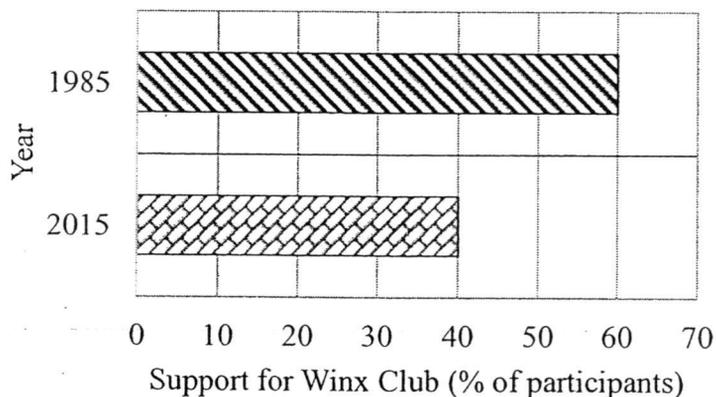
Answer (a) ..... [1]

- (b) A rectangular pond has a length of 31.356 m and breadth of 17.282 m.

Estimate the area of the pond by rounding off each given dimension to 1 significant number.

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

- 2 (a) Results of a recent poll on the support for Winx Football Club in the year 1985 and 2015 are shown below. Both polls were conducted on 100 participants.



Find the percentage decrease in the support for Winx Football Club in 2015 as compared to 1985.

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

16.7

- (b) John came across the following advertisement while he was shopping.

GAMING CONCEPT STORE

PS4 console



Usual Price: \$699  
Discounted Price: \$499

PS4 games bundle



Usual Price: \$125  
Discount: 15% off Usual Price

- (i) Calculate the percentage discount given for the PS4 console.

Answer (b)(i) .....% [2]

- (ii) Calculate the discounted price of the PS4 games bundle.

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

- 3 (a) David wishes to deposit \$2000 in a bank for 5 years. During his research, two brochures caught his interest.

## SBD BANK

## CBCO Bank

- 8% simple interest for 1<sup>st</sup> year
- 4% simple interest for subsequent years
- 4% compound interest per annum, compounded monthly

- (i) Calculate the interest David would earn from SBD Bank at the end of 5 years.

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

- (ii) Which bank should David deposit his money to earn the higher interest at the end of 5 years? Show all workings clearly.

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

- (b) During the December holidays, Kalif wishes to bring his family to Malaysia for a short getaway. On that particular day, the exchange rate between Singapore Dollar (S\$) and Malaysia Ringgit (RM) was S\$ 1 = RM 2.87.

- (i) Given that Kalif changed S\$950 in total, find the amount of Malaysia Ringgit he received.

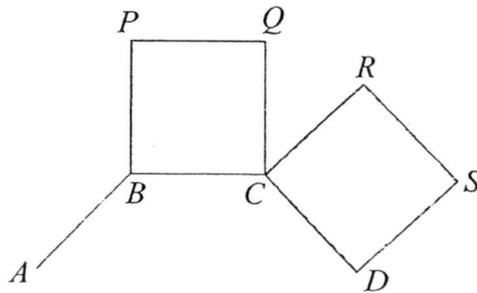
168

- Answer (b)(i)* RM..... [1]
- (ii) In Malaysia, Kalif and his family spent a total of RM 1220. Upon return, he decided to change his Malaysian Ringgit back to Singapore Dollar at the rate of S\$1 = RM 2.92.

Find the amount of Singapore Dollar he received from the exchange.

*Answer (b)(ii)* S\$..... [2]

- 4 The diagram below shows part of a **regular** polygon  $ABCD\dots$  and 2 squares  $PQCB$  and  $RSDC$ .



Given that polygon  $ABCD\dots$  has an exterior angle of  $45^\circ$ , find

- (a) the number of sides of polygon  $ABCD\dots$ ,

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

- (b)  $\angle QCR$ .

*Answer (b)* ..... $^\circ$  [2]

- 5 At 1000, Peter began cycling from Town  $A$  towards Town  $B$ , which is 85 km away. He cycled for 1 hour 40 minutes and covered a distance of 30 km before stopping to take a rest at a cafe. He spent  $x$  minutes in the cafe and before proceeding with his journey. For the rest of the journey, he cycled at an average speed 20 km/h and finally reached Town  $B$  at 1545.

Find

- (a) Peter's average speed while traveling from Town  $A$  to the cafe, giving your answer in km/h,

Answer (a) .....km/h [2]

- (b) the time Peter took to travel from the cafe to Town  $B$ , giving your answer in minutes,

Answer (b) .....min [2]

- (c) the value of  $x$ .

Answer (c)  $x =$ ..... [1]

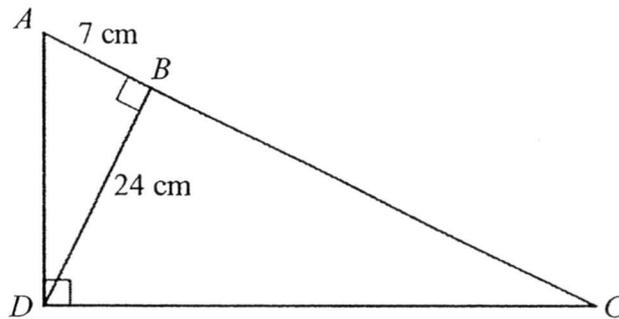
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On the return journey, Peter cycled at a uniform speed and took 5 hours to travel from Town  $B$  to Town  $A$ .

- (d) Calculate Peter's speed for the return journey.

Answer (d) .....km/h [1]

- 6 In the diagram below,  $\angle ABD = \angle ADC = 90^\circ$ ,  $AB = 7$  cm and  $BD = 24$  cm.



Find

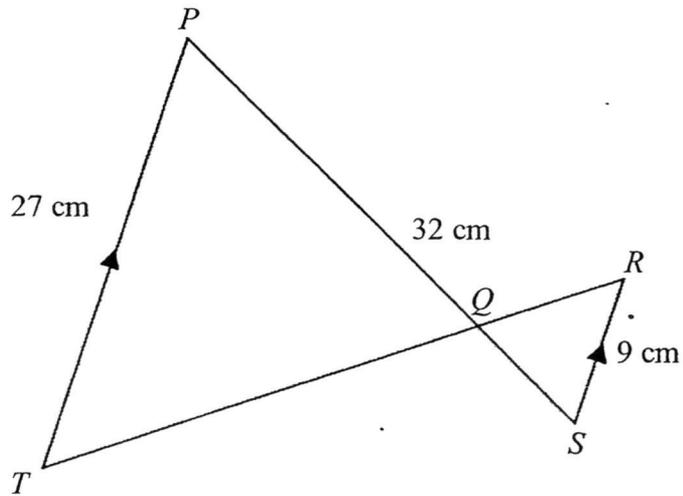
- (a) length  $AD$ ,

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

- (b)  $\angle BCD$ .

Answer (b) ..... $^\circ$  [2]

- 7 In the diagram below,  $TP \parallel SR$ ,  $PT = 27$  cm,  $RS = 9$  cm and  $PS = 32$  cm.  $PQS$  and  $TQR$  are straight lines.



- (a) Prove that  $\triangle PQT$  is similar to  $\triangle SQR$ .

*Answer*

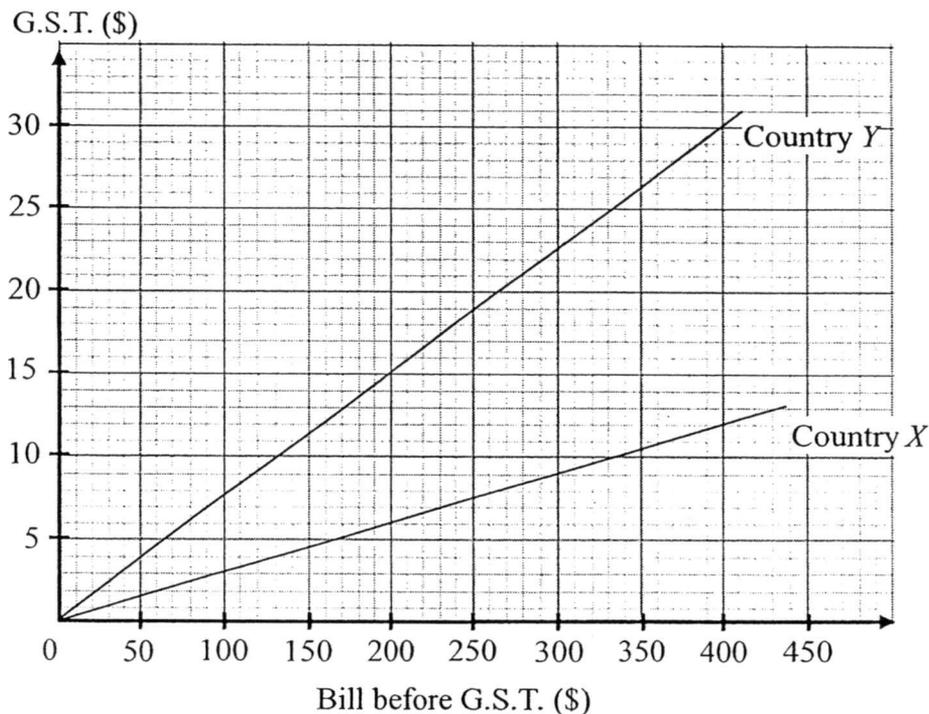
[2]

- (b) Find the length of  $QS$ .

*Answer (b)*  $QS = \dots\dots\dots$  cm [2]

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- 8 The Government Service Tax (G.S.T.) charged to a bill before G.S.T. in Country X and Country Y is shown in the graph below.



- (a) State the amount of G.S.T. when the bill before G.S.T. in Country X is \$200.

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

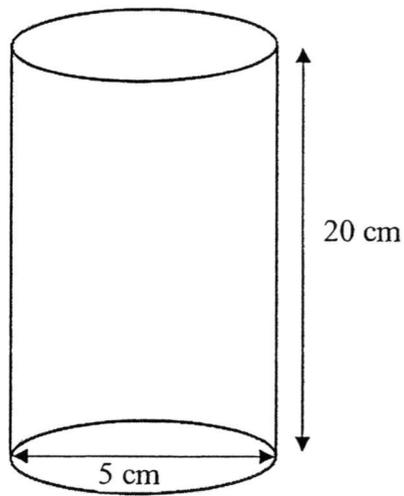
- (b) State the bill before G.S.T. when the G.S.T. charged in Country Y is \$19.

Answer (b) \$..... [1]

- (c) If Thomas spends \$170 before G.S.T., find the difference in the amount of G.S.T. charged between Country X and Country Y.

Answer (c) \$..... [1]

- 9 Gong Gong Teahouse sells milk tea with pearls in cups that take the shape of a closed cylinder with height 20 cm and base diameter 5 cm. Each cup of milk tea with pearls is filled to the brim with milk tea and 60 spherical pearls each of radius 0.5 cm.



- (a) Calculate the surface area of 1 spherical pearl.

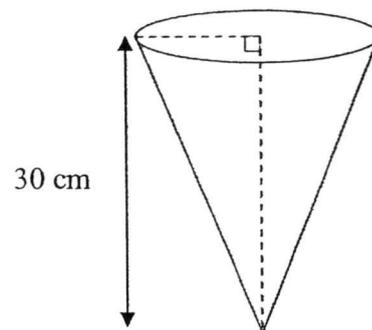
Answer (a) .....cm<sup>2</sup> [2]

- (b) Calculate the volume of the milk tea in the cup.

Answer (b) .....cm<sup>3</sup> [3]

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- (c) In a special edition, the same volume of milk tea from (b) is poured into an inverted cone of height 30 cm and filled it to the brim. Calculate the radius of the cone.



Answer (c) .....cm [2]

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

The table below shows the  $x$  and  $y$  values for the equation  $y = -x^2 - 5x + 4$ .

$x$	-7	-5	-3	-2	0	1
$y$	-10	$k$	10	10	4	-2

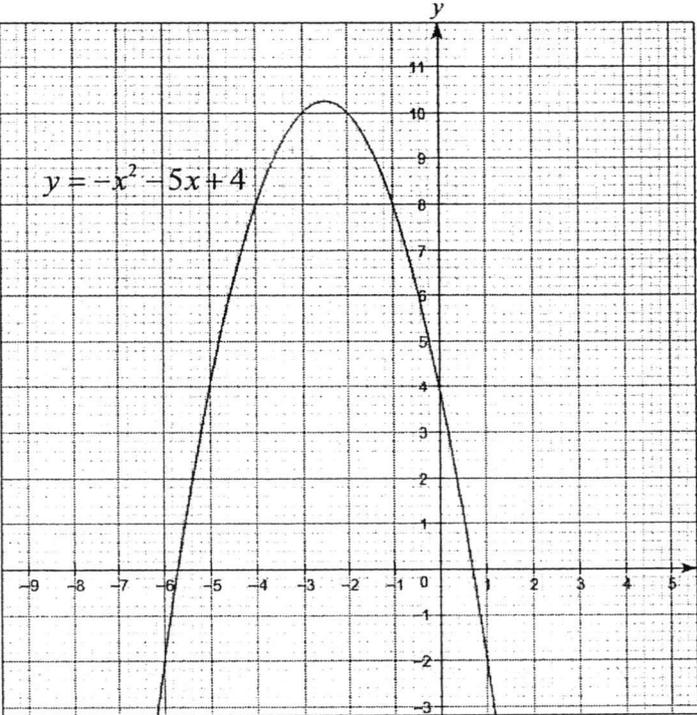
- (a) Calculate the value of  $k$ . [1]
- (b) Taking 2 cm to represent 1 unit on the  $x$ -axis and 1 cm to represent 1 unit on the  $y$ -axis, draw the graph of  $y = -x^2 - 5x + 4$  for  $-7 \leq x \leq 1$ . [3]
- (c) Using your graph, find
- (i) the coordinates of the maximum point of the graph, [1]
- (ii) the value of  $y$  when  $x = -1$ , [1]
- (iii) the solution(s) of  $-x^2 - 5x + 4 = 0$ . [1]

**End of Paper**

Answer Scheme for 2015 Sec 2 Express Maths SA2 P2

Q# No.	Solution
1	<p>(a) 36.8 (1 dp)</p> <p>(b) Area = <math>600 \text{ m}^2</math></p>
2	<p>(a) % decrease = <math>33\frac{1}{3}\%</math> or 33.3% (3sf)</p> <p>(b)(i) % discount = 28.6% (3sf)</p> <p>(b)(ii) Discounted price = \$106.25</p>
3	<p>(a)(i) Interest (SBD) = \$480</p> <p>(a)(ii) Interest (CBCO) = \$441.99 (nearest cents) Therefore David should deposit his money in <b>SBD Bank</b> to earn a higher interest.</p> <p>(b)(i) Amount received = RM 2726.50</p> <p>(b)(ii) Amount remaining (S\$) = SG\$515.92 (nearest cents)</p>
4	<p>(a) number of sides = 8</p> <p>(b) <math>\angle QCR = 45^\circ</math></p>
5	<p>(a) Averagespeed = 18 km/h</p> <p>(b) Time taken = 165 minutes</p> <p>(c) <math>x = 80</math></p> <p>(d) Uniform speed = 17 km/h</p>
6	<p>(a) <math>AD = 25 \text{ cm}</math></p> <p>(b) <math>\angle BCD = 16.3^\circ</math> (1 dp)</p>
7	<p>(a) <math>\angle TQP = \angle RQS</math> (vert. opp. <math>\angle</math>s) <math>\angle QPT = \angle QSR</math> (alt <math>\angle</math>s, <math>PT \parallel RS</math>) <math>\angle PTQ = \angle SRQ</math> (alt <math>\angle</math>s, <math>PT \parallel RS</math>) Since all corresponding angles are equal, therefore, <math>\triangle PQT</math> is similar to <math>\triangle SQR</math>.</p> <p>(b) <math>QS = 8 \text{ cm}</math></p>

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8	<p>(a) \$6  (b) \$250  (c) \$8</p>
9	<p>(a)  Surface area = <math>3.14 \text{ cm}^2</math> (3 sf)  (b)  Volume of milk tea = <math>361 \text{ cm}^3</math> (3sf)  (c)  radius = <math>3.39 \text{ cm}</math> (3sf)</p>
10	<p>(a) <math>k = 4</math>  (c)(i) <math>(-2.5, 10.3)</math>  (c)(ii) <math>y = 8</math>  (c)(iii) <math>-5.7</math> and <math>0.7</math>  (b) seen in graph below.</p> 

Qn No.	Solution	Marks
1	<p>(a) 36.8 (1 dp)</p> <p>(b) Area = <math>30 \times 20</math> = <math>600 \text{ m}^2</math></p>	<p>B1</p> <p>B1</p>
2	<p>(a) % decrease = <math>\frac{60 - 40}{60} \times 100\%</math> = <math>33\frac{1}{3}\%</math> or 33.3% (3sf)</p> <p>(b)(i) % discount = <math>\frac{699 - 499}{699} \times 100\%</math> = 28.6% (3sf)</p> <p>(b)(ii) Discounted price = <math>\frac{85}{100} \times 125</math> = \$106.25</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>
3	<p>(a)(i) Interest (SBD) = <math>\frac{8}{100} \times 2000 + \frac{4}{100} \times 2000 \times 4</math> = \$480</p> <p>(a)(ii) Final Amount (CBCO) = <math>2000(1 + \frac{12}{100})^6</math> = \$2441.993 Interest (CBCO) = <math>2441.993 - 2000</math> = \$441.99 (nearest cents)</p> <p>Therefore David should deposit his money in <b>SBD Bank</b> to earn a higher interest.</p> <p>(b)(i) Amount received = <math>950 \times 2.87</math> = RM 2726.50</p> <p>(b)(ii) Amount remaining (RM) = <math>2726.50 - 1220</math> = RM 1506.50 Amount remaining (S\$) = <math>\frac{1506.50}{2.92}</math> = SG\$515.92 (nearest cents)</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1 (Conclusion)</p> <p>B1</p> <p>M1</p> <p>A1</p>

4	<p><b>(a)</b>  number of sides = <math>\frac{360}{45}</math>  = 8</p> <p><b>(b)</b>  1 interior angle = <math>180 - 45</math>  = <math>135^\circ</math>  <math>\angle QCB = \angle RCD = 90^\circ</math> (Given)  <math>\angle QCR = 360 - 90 - 90 - 135</math> (Angles at a pt)  = <math>45^\circ</math></p>	M1 A1  M1  A1
5	<p><b>(a)</b>  Average speed = <math>\frac{30}{1\frac{2}{3}}</math>  = 18 km/h</p> <p><b>(b)</b>  <math>85 - 30 = 55</math> km  Time taken = <math>\frac{55}{20}</math>  = 2.75h  = 165 minutes</p> <p><b>(c)</b>  <math>1545 - 1000 = 5</math>h 45 mins = 345 mins  <math>x = 345 - 100 - 165</math>  = 80</p> <p><b>(d)</b>  Uniform speed = <math>\frac{85}{5}</math>  = 17 km/h</p>	M1 A1  M1  A1  B1  B1
6	<p><b>(a)</b>  By Pythagoras theorem,  <math>AD^2 = 7^2 + 24^2</math>  <math>AD^2 = 625</math>  <math>AD = 25</math> cm</p> <p><b>(b)</b>  <math>\tan \angle DAB = \frac{24}{7}</math>  <math>\angle DAB = \tan^{-1} \frac{24}{7} = 73.740</math>  <math>\angle BCD = 180 - 90 - \tan^{-1} \frac{24}{7}</math>  = <math>16.3^\circ</math> (1 dp)</p>	M1  A1  M1  A1

7	<p><b>(a)</b>  <math>\angle TQP = \angle RQS</math> (vert. opp. <math>\angle</math>s)  <math>\angle QPT = \angle QSR</math> (alt <math>\angle</math>s, <math>PT \parallel RS</math>)  <math>\angle PTQ = \angle SRQ</math> (alt <math>\angle</math>s, <math>PT \parallel RS</math>)</p> <p>Since all corresponding angles are equal, therefore, <math>\triangle PQT</math> is similar to <math>\triangle SQR</math>.</p> <p><b>(b)</b>  <math>\frac{QS}{QP} = \frac{RS}{TP} = \frac{1}{3}</math>  <math>PS = 4QS</math>  <math>QS = \frac{32}{4}</math>  <math>QS = 8 \text{ cm}</math></p>	<p>M1 A1 M1 A1</p>
8	<p><b>(a)</b> \$6  <b>(b)</b> \$250  <b>(c)</b> \$13 - \$5 = \$8</p>	<p>B1 B1 B1</p>
9	<p><b>(a)</b>  Surface area = <math>4 \times \pi \times 0.5^2</math>  <math>= 3.14 \text{ cm}^2</math> (3sf)</p> <p><b>(b)</b>  Volume of cylinder = <math>\pi \times 2.5^2 \times 20</math>  <math>= 125\pi \text{ cm}^3</math>  Volume of 60 pearls = <math>\frac{4}{3} \times \pi \times 0.5^3 \times 60</math>  <math>= 10\pi \text{ cm}^3</math>  Volume of milk tea = <math>125\pi - 10\pi</math>  <math>= 361 \text{ cm}^3</math> (3sf)</p> <p><b>(c)</b>  <math>115\pi = \frac{1}{3} \pi (r)^2 (30)</math>  radius = 3.39 cm (3sf)</p>	<p>M1 A1 M1 (For correct method) M1 (For correct method) A1 M1 A1</p>

10

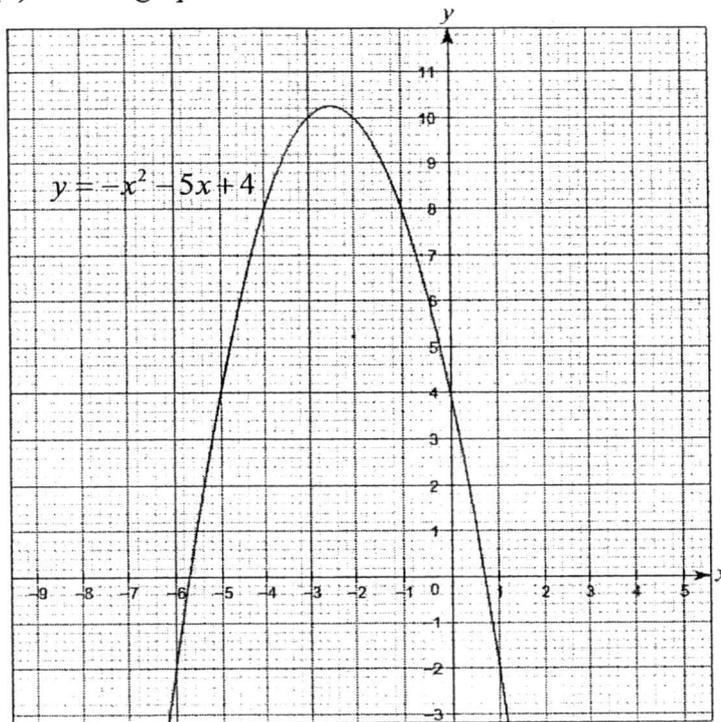
(a)  $k = 4$

(c)(i)  $(-2.5, 10.3)$

(c)(ii)  $y = 8$

(c)(iii)  $-5.7$  and  $0.7$

(b) seen in graph below.



B1  
B1  
B1  
B1

B1 for correct scale  
and label  
B1 for all points  
plotted  
B1 for smoothness  
of curve

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END