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 :

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on the top of this page.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

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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50

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

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2

Answer **all** the questions

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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]

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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): $x =$ ..... [3]

(b) Describe the change in y when x is halved.

Answer (b): .....

.....

..... [1]

5 **(a)** Solve $3x^2 + 7x - 6 = 0$.

Answer (a): $x =$ ..... [2]

(b) Hence state the positive value of y for which $\frac{3}{y^2} + \frac{7}{y} - 6 = 0$.

Answer (b): $y =$ ..... [1]

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6 Factorise completely

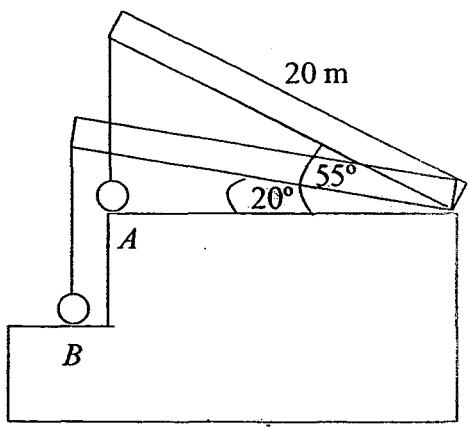
(a) $28x^2 - 343$

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° with the horizontal. When the parcel is at B, the crane arm makes an angle of 20° with the horizontal.
Find the vertical distance moved by the parcel.



Answer ..... m [3]

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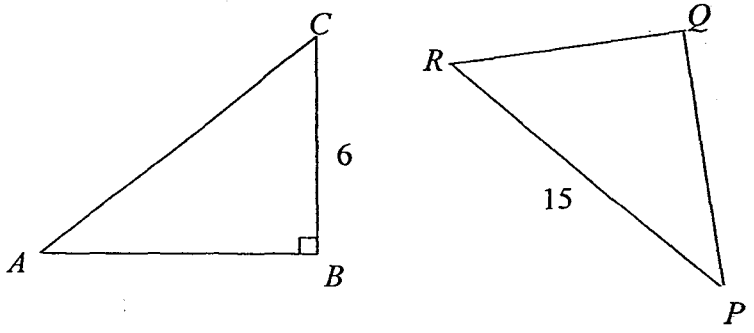
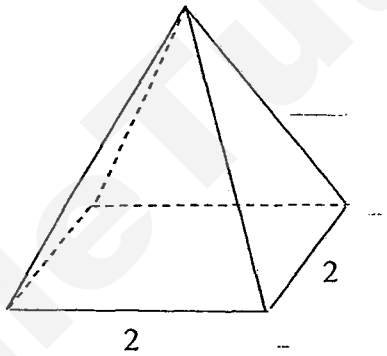
8 **(a)** Triangle ABC and triangle PQR are congruent.
$BC = 6$ cm, $PR = 15$ cm and angle $ABC = 90°$.



Find angle PRQ.

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

(b) A right pyramid with square base of side 2 cm has a volume of 20 cm^3.



Calculate the height of the pyramid.

Answer (b): ..... cm [2]

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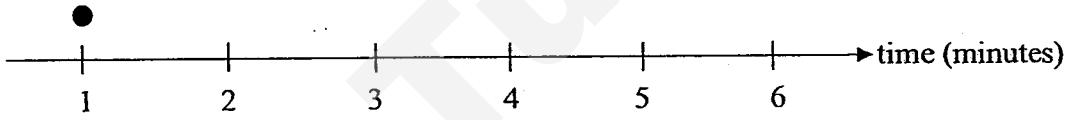
9 The waiting times, to the nearest minute, of twelve customers queuing at the cashier of a supermarket are recorded as a list:

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]

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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]

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11 Solve the following equations.

(a) $\frac{x+3}{7}-\frac{4x-5}{6}=x$

Answer (a): x = ... [2]

(b) $\frac{y-1}{y+2}=\frac{y}{3y+2}$

Answer (b): y = ... [3]

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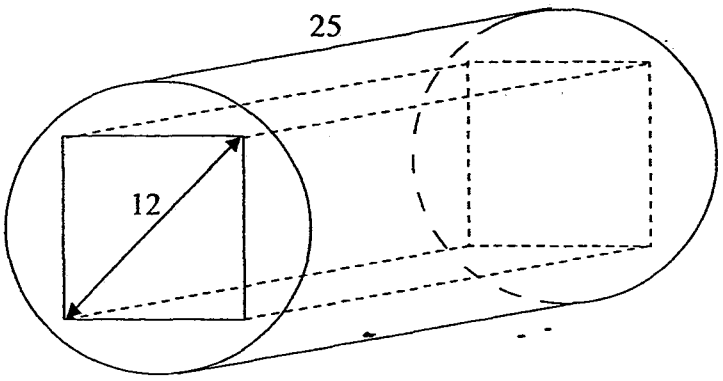
12 A solid cylinder of base radius 8 cm and length 25 cm has a square cross section of diagonal 12 cm removed from the cylinder, as shown in the diagram.



Find the total surface area of the remaining solid.

Answer : ..... cm^2 [5]

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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 : $x =$ ....., $y =$ ..... [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

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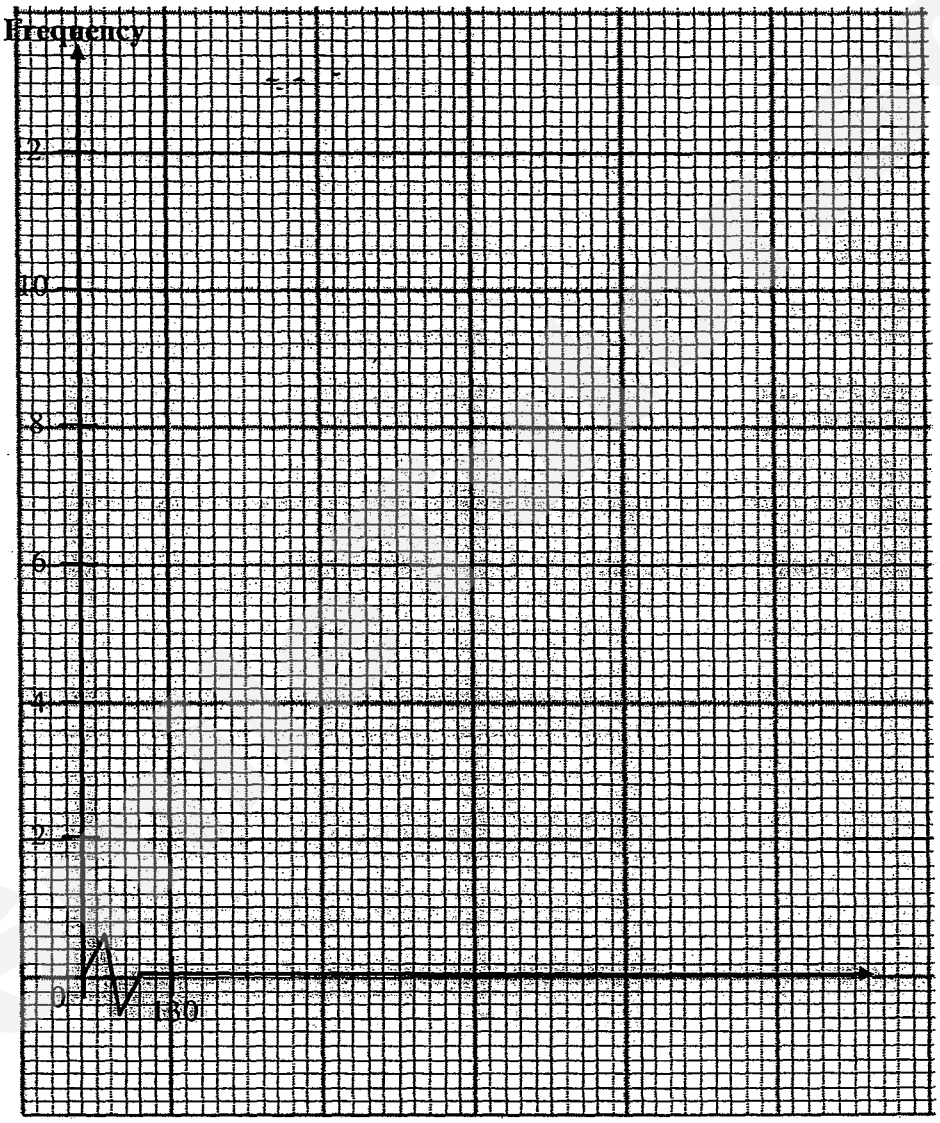
14 **(a)** Find the value of k.

Answer (b): k = ... [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]

End of Paper

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Answer Key

1. 14.4 km/h

2(a) 30° (b) 20° (c) 130°

3(a) 120° (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° (b) 70° (c) 110°

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

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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)	$y = \frac{k}{x^2}$ When $x = 4$ and $y = 0.25$, $0.25 = \frac{k}{4^2}$ $k = 4$ Hence $y = \frac{4}{x^2}$ or $yx^2 = 4$ When $y = 25$, $25 = \frac{4}{x^2}$ $x^2 = \frac{4}{25}$ $x = -\frac{2}{5}$ 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)	$3x^2 + 7x - 6 = 0$ $(3x-2)(x+3) = 0$ $x = \frac{2}{3}$ or $x = -3$	M1 A1
5(b)	$\frac{1}{y} = \frac{2}{3} \Rightarrow y = 1\frac{1}{2}$	B1

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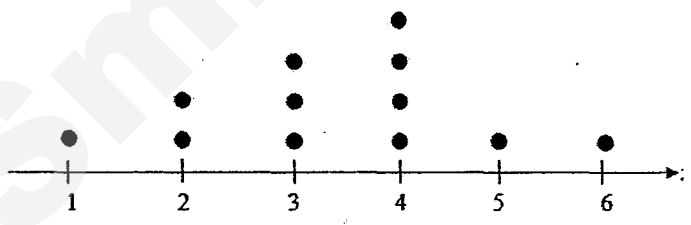
6(a)	$28x^2-343=7\left(4x^2-49\right)$ $=7(2x-7)(2x+7)$	M1 A1
6(b)	$6a^2-3ay-8y+16a=3a(2a-y)-8(y-2a)$ $=3a(2a-y)+8(2a-y)$ $=(3a+8)(2a-y)$	M1 A1
7	$\sin 55°=\frac{x}{20} \Rightarrow x=20\sin 55°=16.383$ $\sin 20°=\frac{y}{20} \Rightarrow y=20\sin 20°=6.8404$ $16.383-6.8404=9.54$ m (3 sf)	M1 M1 A1
8(a)	$\cos\angle PRQ=\frac{6}{15}$ $\angle PRQ=\cos^{-1}\left(\frac{6}{15}\right)=66.4°$ (1 dp)	M1 A1
8(b)	Set $\frac{1}{3}\left(2^2\right)h=20$ $h=\frac{3\times 20}{2^2}=15$ cm	M1 A1
9(a)		B1 – all correct
9(b)	$\frac{3+4}{2}=3.5$	B1
9(c)	4	B1
9(d)	Agree, because there are more dots from 1 to 3 minutes as compared to 5 to 6 minutes. 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.	B1

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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)	$\frac{y-1}{y+2}=\frac{y}{3y+2}$ $(y-1)(3y+2)=y(y+2)$ $3y^2-y-2=y^2+2y$ $2y^2-3y-2=0$ $(2y+1)(y-2)=0$ $y=-\frac{1}{2}$ or $y=2$	M1 M1 A1

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12	Curved surface area $= 2\pi(8)(25) = 400\pi$ or 1256.6 (5 sf)	B1
	Let side of square be x cm. $x^2 + x^2 = 12^2$ $2x^2 = 144$ $x^2 = 72$ $x = \sqrt{72}$ or 8.4853 (5 sf)	M1
	Two ends $= 2\left[\pi(8)^2 - \left(\sqrt{72}\right)^2\right] = 2[64\pi - 72] = 128\pi - 144$ or 258.12 (5 sf)	M1(√)
	Four rectangles $= 4\left[\sqrt{72} \times 25\right] = 100\sqrt{72}$ or 848.53 (5 sf)	M1(√)
	Total $= 400\pi + 128\pi - 144 + 100\sqrt{72}$ $= 2363.29$ $= 2360$ cm^2 (3 sf)	A1
13	$2x + 3y = 49$ $3x + y = 56 \Rightarrow y = 56 - 3x$	B1 – for both equations
	Sub $y = 56 - 3x$ into $2x + 3y = 49$ $2x + 3(56 - 3x) = 49$ $2x + 168 - 9x = 49$ $-7x = -119$ $x = 17$	M1(√) A1
	Then, $y = 56 - 3(17) = 5$	A1
14(a)	$k = 30 - 6 - 8 - 5 = 11$	B1

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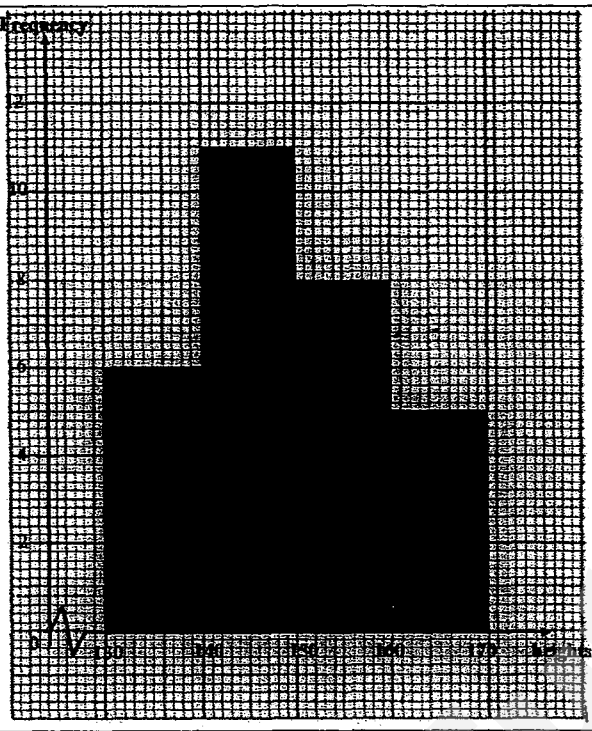
14(b)		B1 – horizontal axis scale correct, and labelled B1 – all bars correct height
14(c)	A histogram is better than a pie chart because the heights of the histogram represents the frequencies and hence the frequencies can be easily compared at a glance (while the sectors of a pie chart are less easy to compare.)	B1

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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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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]

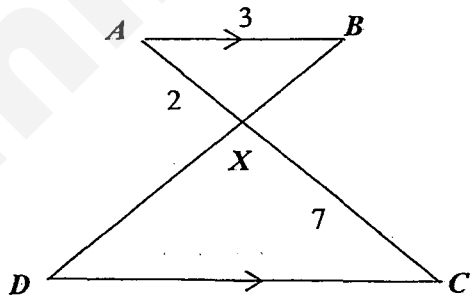
2 **(a)** An area of 4 cm^2 on a map represents an actual area of 0.36 km^2.
Calculate

(i) the actual area in square kilometres represented by 80 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 $AB = 3$ cm, $AX = 2$ cm and $CX = 7$ cm, find

(i) the length of CD, [2]

(ii) the ratio of $DX : DB$. [1]

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3 **(a)** Simplify $\frac{25xz^2}{3y} \div \frac{5yz^2}{6y^2}$. [2]

(b) Express as a single fraction in its simplest form

$$\frac{6x}{4x^2-1} - \frac{3}{4x-2}$$ [3]

(c) Given that $\frac{p}{r} = \sqrt{\frac{q}{3} + p^2}$, express p in terms of q and r. [3]

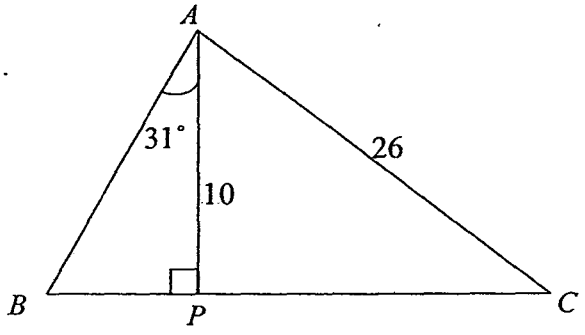
4 **(a)** Using the second Causeway at Tuas, Mr Ng travelled a distance of 600 km from Singapore to Penang in a time of t hours. Write down the average speed of the journey, in km/h, in terms of t. [1]

(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 $\angle BAP = 31°$, calculate

(a) $\angle PAC$, [2]

(b) PC, [2]

(c) PB, [2]

(d) the shortest distance from P to the line AC. [2]

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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 = πrl Surface area of a sphere = $4\pi r^2$

Volume of a cone = $\frac{1}{3}\pi r^2 h$ Volume of a sphere = $\frac{4}{3}\pi r^3$

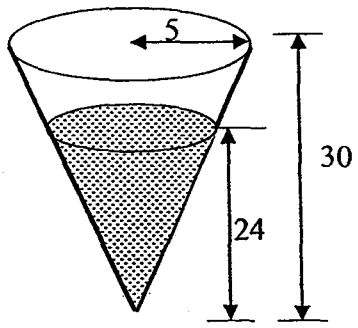

Diagram I

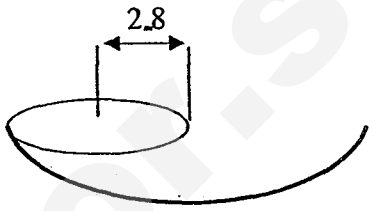

Diagram II

(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 $-4 \le x \le 3$. [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]

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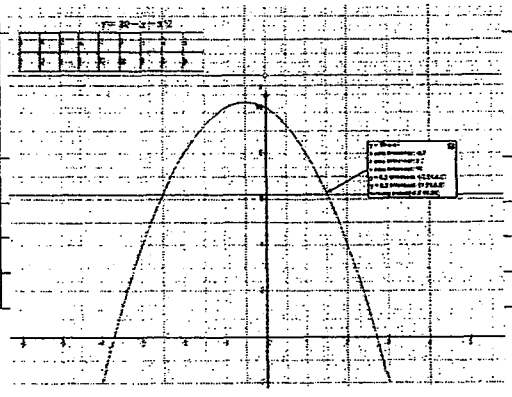
☺ One page answer ☺

Qn	Answer	Qn	Answer
1a	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		
1b	Mean = 49.25 kg	5a	$\angle PAC = 67.4°$ (1 d.p.)
		5b	PC = 24 cm
2ai	Actual area = 7.2 km^2	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^2
2bii	7:9	6bii	inner surface in contact with the water = 306 cm^2 (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	$\frac{600}{t+\frac{1}{2}} = \frac{600}{t} - 5$		
4c	$t = 7.5$ or $t = -8$		
4d	80 km/h		



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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 [2]

Mean = 985 / 20 M1

= 49.25 kg A1

2 **(a)** An area of 4 cm^2 on a map represents an actual area of 0.36 km^2. Calculate

(i) the actual area in square kilometres represented by 80 cm^2 on the map, [1]

Actual area = 0.36 x 20 = 7.2 km^2 B1

(ii) the scale of the map in the form 1 : n, [2]

Map : actual

area 4 cm^2 : 0.36 km^2

dist 2 cm : 0.6 km M1

1 cm: 0.3 km

1 : 30000 A1

(iii) the distance on the map in centimetres which represents an actual distance of 6 km. [1]

Distance on map = $\frac{1}{0.3} \times 6$

= 20 cm B1

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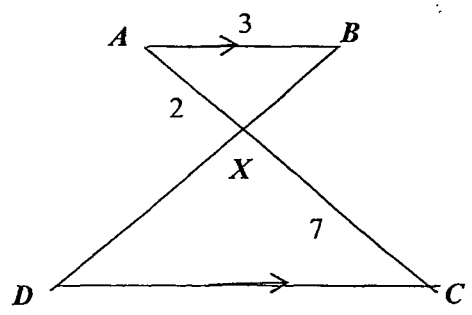
(b) In the diagram below, triangle ABX is similar to triangle CDX.



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

$\frac{6x}{4x^2-1} - \frac{3}{4x-2}$ [3]

$\frac{6x}{4x^2-1} - \frac{3}{4x-2} = \frac{6x}{(2x-1)(2x+1)} - \frac{3}{2(2x-1)}$ 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

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(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)

$\frac{p^2}{r^2}-p^2=\frac{q}{3}$

$\frac{p^2-r^2p^2}{r^2}=\frac{q}{3}$

$\frac{p^2(1-r^2)}{r^2}=\frac{q}{3}$ M1 (factorisation)

$p^2(1-r^2)=\frac{qr^2}{3}$

$p^2=\frac{qr^2}{(3)(1-r^2)}$

$p=\pm\sqrt{\frac{qr^2}{(3)(1-r^2)}}$ or $p=\pm\sqrt{\frac{qr^2}{(3)(1-r^2)}}$ or $p=\pm\sqrt{\frac{qr^2}{(3-3r^2)}}$ 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

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(c) Solve the equation $2t^2 + t - 120 = 0$. [2]

$2t^2 + t - 120 = 0$

$(2t - 15)(t + 8) = 0$ M1

$t = 7.5 \quad or \quad t = -8$ A1

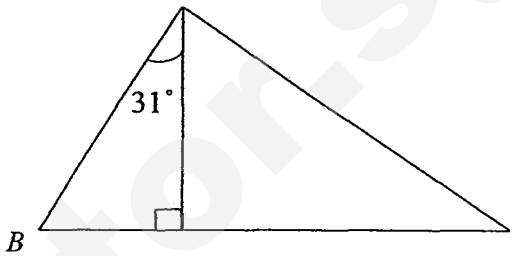
(d) Find the original average speed. [1]

When $t = 7.5$ *hrs*

$$\text{Origianl Speed} = \frac{600}{7.5}$$

$= 80$ km/h (Only) B1

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]

$\cos \angle PAC = \frac{10}{26}$ M1

$\angle PAC = 67.380°$

$= 67.4°$ (1 d.p.) A1

(b) PC, $\tan 67.380 = \frac{PC}{10}$ [2]

$PC^2 = 26^2 - 10^2$ or $\tan 67.380 = \frac{PC}{10}$ or $\sin 67.380 = \frac{PC}{26}$ M1

PC = 24 cm A1

(c) PB, [2]

$\tan 31° = \frac{BP}{10}$ M1

BP = 6.0086

= 6.01 cm (3 s.f.) A1

(d) the shortest distance from P to the line AC. [2]

$Area\ of\ triangle = \frac{1}{2} \times (24)(10)$

$= 120$

$\text{Shortest distance} = \frac{120 \times 2}{26}$ M1

$= 9\frac{3}{13}$ or 9.230769

$= 9\frac{3}{13}$ or 9.23 cm A1

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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 = πrl Surface area of a sphere = $4\pi r^2$

Volume of a cone = $\frac{1}{3}\pi r^2 h$ Volume of a sphere = $\frac{4}{3}\pi r^3$

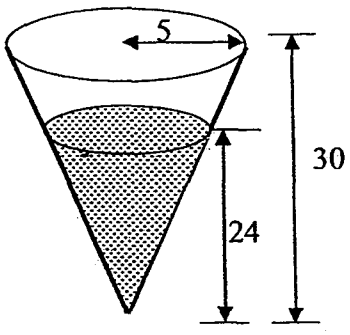

Diagram I

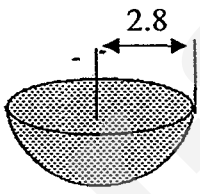

Diagram II

(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]

volume of the water = $\frac{1}{3}(\pi)(4^2)(24)$

$= 402.123$

$= 402\ \text{cm}^2$ B1

(ii) the area of the inner surface of the cone in contact with the water. [2]

Slanted height = $\sqrt{4^2 + 24^2}$

$= \sqrt{592}$ M1

$= 24.331$

inner surface in contact with the water

$= \pi \times 4 \times \sqrt{592}$

$= 305.75$

$= 306\ \text{cm}^2$ (3sf) 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]

Volume of hemisphere = $\frac{2}{3} \times \pi \times 2.8^3$ M1

$= 45.976$

Number of hemisphere filled = $\frac{402.123}{45.976}$ M1(Follow thro from B(i) and vol)

$= 8.746$

7 A1

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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 $-4 \le x \le 3$. [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]

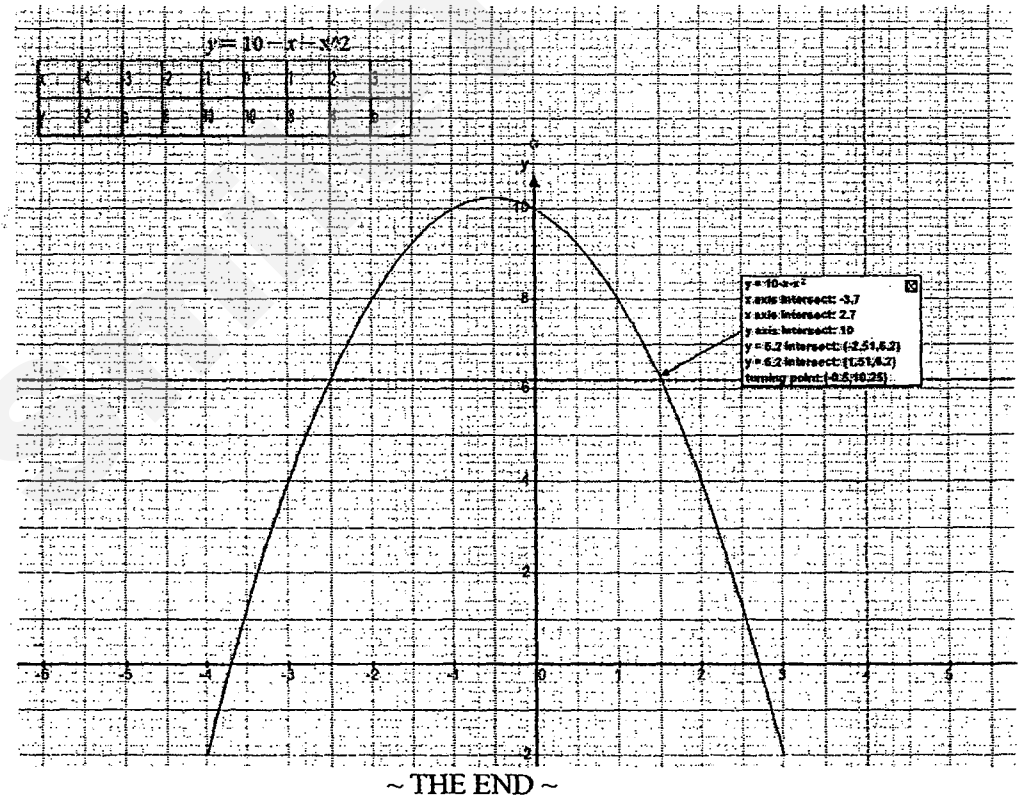
$x = -2.51, x = 1.51$ (+-0.1)

(ii) The value of y when x = −1.2. [1]

y = 9.8 **(+-0.2)**

(d) Write down the equation of the line of symmetry of the graph. [1]

$x = -0.5$ A1



~ THE END ~

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Class	Register No	Name

Bukit Merah Secondary School
End-of-Year Examination 2015
Secondary 2 Express

E

MATHEMATICS

1 Oct 2015

Paper 1

1 hour 15 minutes

Candidates answer on the Question Paper.

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 π, 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

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Answer **all** the questions

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

(a) $\dfrac{\sqrt{778.2}+568}{\sqrt[3]{834.4}}$ [2 decimal places]

(b) $(0.14)^3+\dfrac{(0.65)^2}{\sqrt{7-1\frac{4}{9}}}$ [4 significant figures]

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

(b) ..... **[1]**

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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]**

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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) $32pr - 28qr + 21sq - 24sp$

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

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

(ii) ..... **[2]**

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5 Suppose that 6 cm on a map represents an actual distance of 15 km.

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(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 cm^2 on the map.
Find the actual area of the town in km^2.

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

(b) .....cm **[1]**

(c) .....km^2 **[2]**

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6 Solve each of the following equations.

(a) $6x^2 + 18x = 0$

(b) $4x^2 - 24x + 35 = 0$

Answer *(a)* $x =$ ..... *or* ..... **[2]**

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

7 Solve the following simultaneous equations.

$4x + 5y = -9$

$-3x + 7y = 39$

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

$y =$ .....

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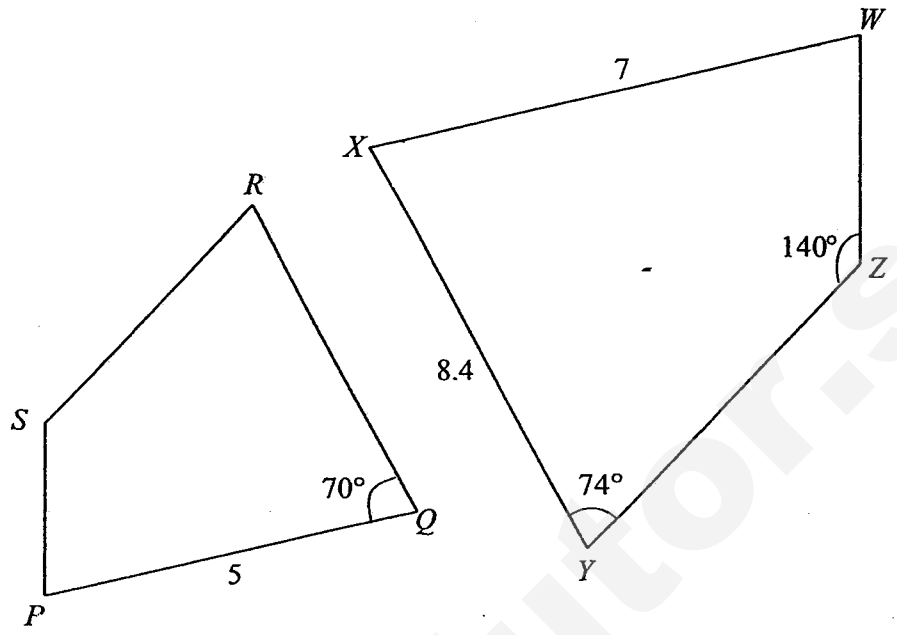
8 In the diagram, $PQRS$ is similar to $WXYZ$ with $PQ = 5$ cm, $WX = 7$ cm, $XY = 8.4$ cm and $\angle PQR = 70°$, $\angle XYZ = 74°$ and $\angle YZW = 140°$.



Find

(a) $\angle ZWX$,

(b) QR.

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

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

[TURN OVER

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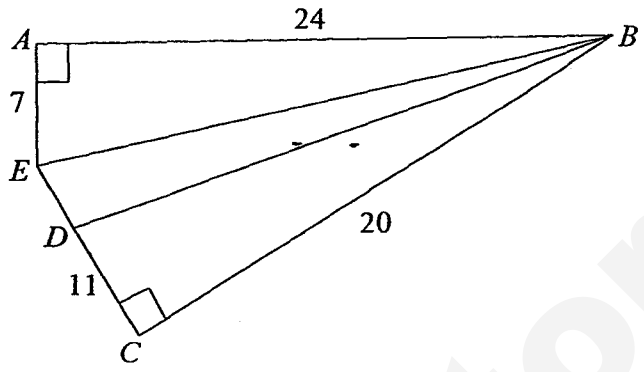
9 In the diagram below, ABE is a right-angled triangle with $AB = 24$ cm and $AE = 7$ cm. CBE is a right-angled triangle with a point D on EC such that $DC = 11$ cm and $BC = 20$ cm.



(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]

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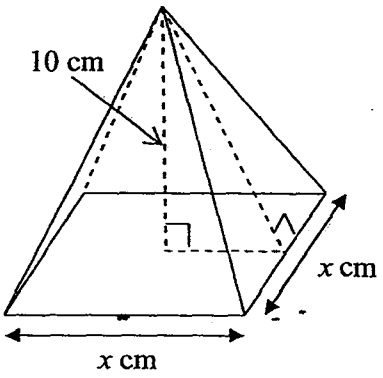
10 The diagram below shows a right square pyramid with height 10 cm.



If it has a volume of 480 cm^3, find

(a) the value of x,

(b) its total surface area.

Answer *(a)* $x =$ ..... [2]

(b) .....cm^2 [3]

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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]**

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12 The time taken by 70 Secondary Two Express students to complete their mathematics homework is given in the table below.

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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		
Total	70	**Total**	

(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]**

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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]**

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14 Consider the number pattern,

Line 1: $11 - 2 = 3^2$

Line 2: $1111 - 22 = 33^2$

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.

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

(b) ..... **[1]**

End-of-Paper 1

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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	$1cm^2 : 6.25km^2$ $13.4cm^2 : 83.75km^2$	M1 A1	
6	a	$6x(x+3)=0$ $x=0 or -3$	M1 A1 for both	
	b	$(2x-7)(2x-5)=0$ $x=3.5 or 2.5$	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	

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	(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	$12\times 12=144$ $4(\frac{1}{2}\times 12\times\sqrt{136})$ 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	

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Class	Register No	Name

Bukit Merah Secondary School
End-of-Year Examination 2015
Secondary 2 Express

E

MATHEMATICS

8 Oct 2015

Paper 2

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 π, 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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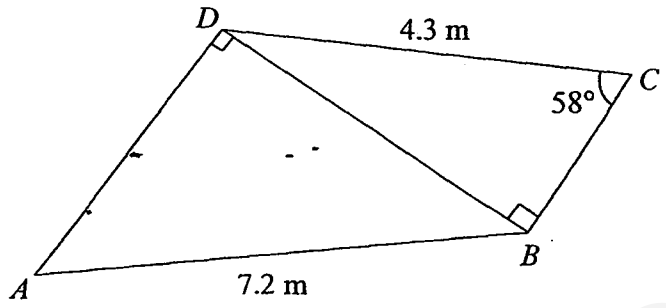
Answer **all** the questions

1 In the figure below, $CD = 4.3$ m, $AB = 7.2$ m and $\angle BCD = 58°$.



Find

(a) BD, [2]

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

---

2 **(a)** Simplify each of the following algebraic fractions.

(i) $\dfrac{35b^2}{2y} \times \dfrac{y^2}{7ab^3}$ [1]

(ii) $\dfrac{6}{8x^2 - 6xy} \div \dfrac{9}{3y - 4x}$ [2]

(b) Express $\dfrac{5}{x^2 + 3x - 4} - \dfrac{2}{x - 1}$ 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 $\sqrt{\dfrac{x - 2p}{9w + 5x}} = y$. [3]

Make x the subject of the formula.

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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.

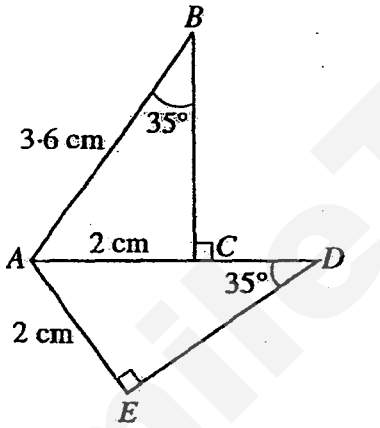
(c) The cost of 1 kg of fish is \$15 less than the cost of 1 kg of crab. **[3]**
Write down an equation in terms of x and show that it reduces to $3x^2 + 9x - 84 = 0$.

(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 ΔABC. **[1]**

(b) Find $\angle BAC$. **[1]**

(c) Find the length of CD. **[1]**

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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]**

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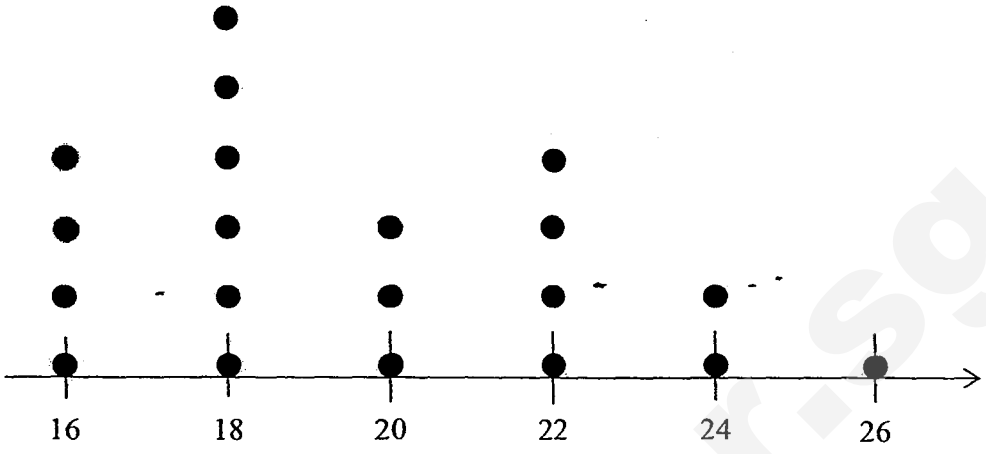
7 **(a)** The time in minutes taken by 20 patrons at a food court *A* to finish their meal is represented by the dot diagram below.



(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.

Time (minutes)	16	18	20	22	24	26	28
Number of patrons	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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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.

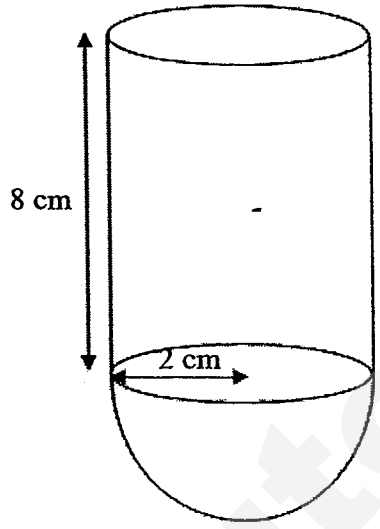

Diagram I

(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.

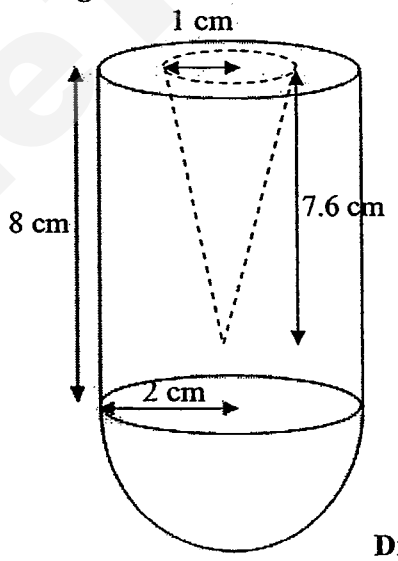

Diagram II

(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]

$$\left(\begin{array}{l}\text{Volume of Cone} = \frac{1}{3}\pi r^2 h \text{ ; Volume of Sphere} = \frac{4}{3}\pi r^3, \\ \text{Curved Surface Area of Cone} = \pi r l \text{ ; Surface Area of Sphere} = 4\pi r^2\end{array}\right)$$

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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

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Bukit Merah Secondary School
End of Year Examination 2015
Secondary 2 Express
(Mathematics Paper 2) – Marking Scheme

1	a	$\sin 58° = \frac{BD}{4.3}$ $BD = 3.646606813$ $BD = 3.65$ $\cos \angle ABD = \frac{3.646606813}{7.2}$ $\angle ABD = 59.57080651°$ $= 59.6°$	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	

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	(iii)	$newy = \frac{51}{\sqrt[3]{\frac{x}{125}}}$ $= 5(\frac{51}{\sqrt[3]{x}})$ New y is 5 times of old y.	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	$(3x-12)(x+7) = 0$ $x = 4 or -7$	M1 A1 for both	
	e	4 kg of crabs and 7 kg of fish	B1	
5	a	ΔADE	B1	
	b	55° 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	

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	(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	$volume = (\pi \times 2^2 \times 8) + (\frac{2}{3} \times \pi \times 2^3)$ $= 117.2861257$ $= 117 cm^3$	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)	$117.2861257 - (\frac{1}{3} \times \pi \times 1^2 \times 7.6)$ $= 109.3274243$ $\sqrt[3]{109.3274243}$ $= 4.781634454$ $l \arg estpossiblelength = 4cm$	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	

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NAME: _____ ( ) CLASS: _____

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 π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

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

This question paper consists of 15 printed pages including the cover page.

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 Name: _____ ( ) Class: _____

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]

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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]

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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]

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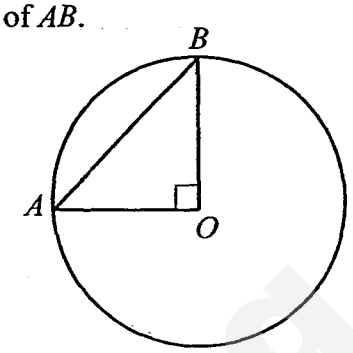
6 The diagram shows a right-angled triangle in a circle, with centre O.

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 cm^3.
[Take π 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) .....cm^3 [2]

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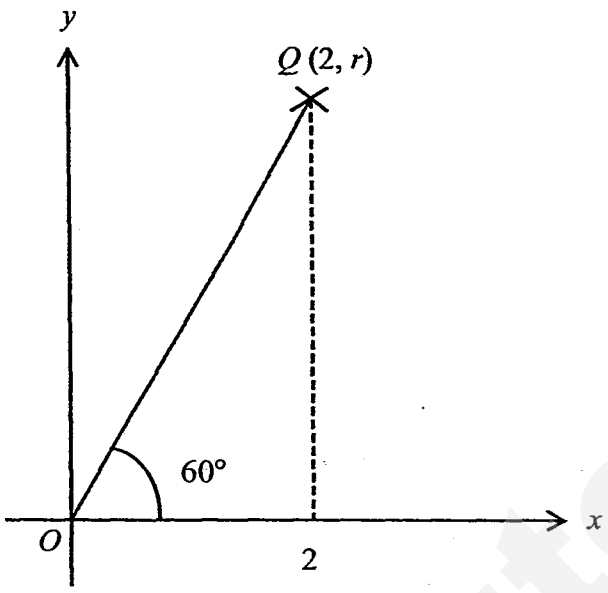
 Name: _____ ( ) Class: _____

8 The diagram below shows a point Q with coordinates $(2, r)$.



(i) Find the length of OQ.

Answer (i) OQ = ...cm [2]

(ii) Find the value of r.

Answer (ii) r = ... [2]

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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]

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 Name: _____ ( ) Class: _____

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 .....*l* [2]

---

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]

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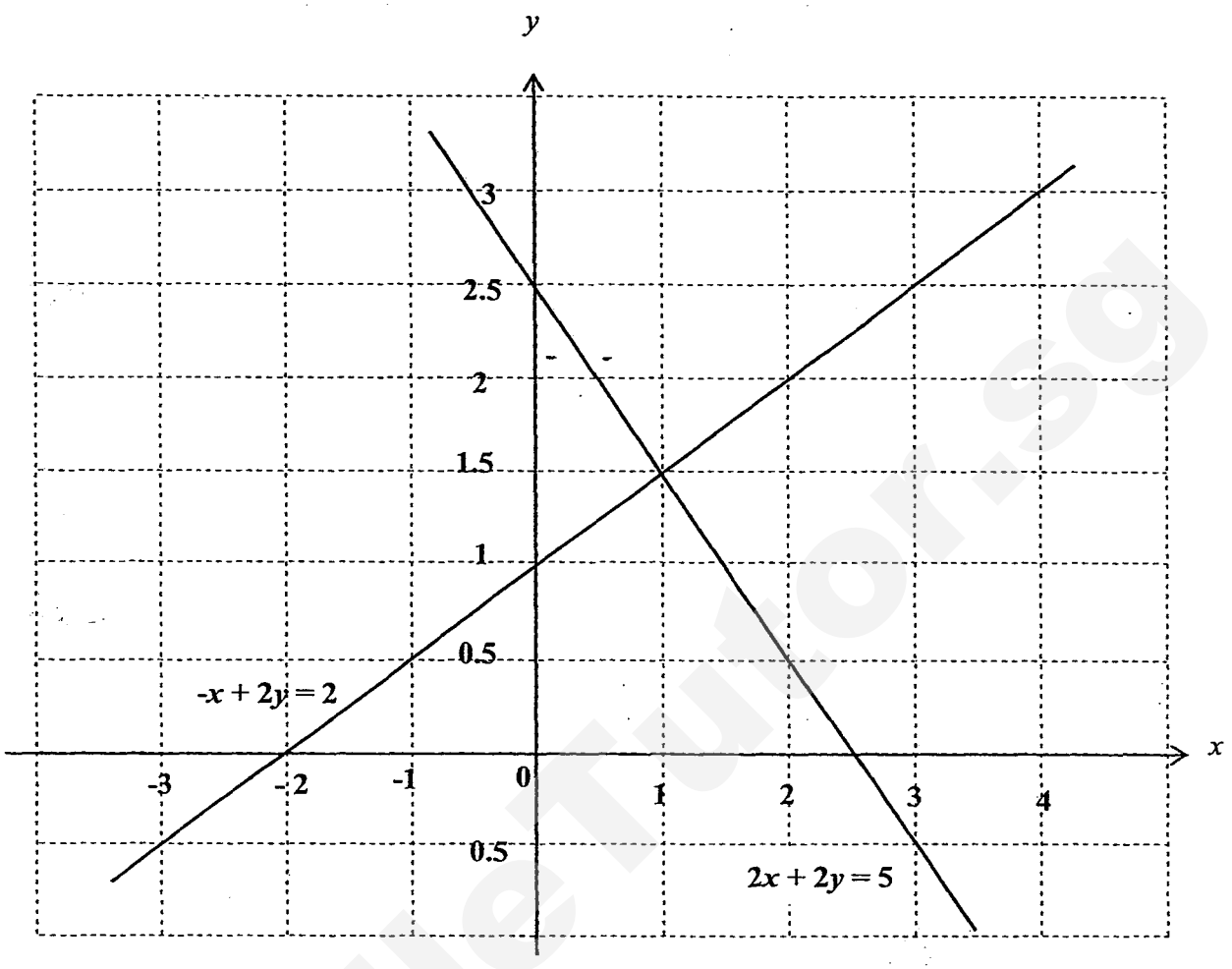
12 The graph below shows the lines $-x+2y=2$ and $2x+2y=5$.



(a) State the solution of the simultaneous equations $-x+2y=2$ and $2x+2y=5$.

Answer (a) $x =$ ..... $y =$ ..... [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) ..... units^2 [1]

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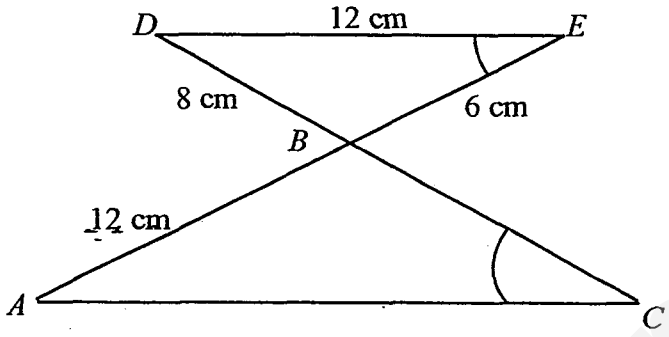
 Name: _____ ( ) Class: _____

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]

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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]

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 Name: _____ ( ) Class: _____

16 Solve the equation $\frac{5}{y-3}+\frac{10}{3(3-y)}=3$.

Answer y =..... [3]

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17 Solve the following simultaneous equations.

$$4a+15b=15$$
$$7a-30b=15$$

Answer a = ..., b = ... [3]

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 Name: _____ ( ) Class: _____

18 The following stem and leaf diagram represents the marks obtained by 10 boys and 10 girls in a Mathematics test.

Boys					Girls			
	4	2	0	5	8	9		
9	5	1	1	6	4	7	8	
		7	5	7	1	3	5	6
			0	8	0			

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]

.....

.....

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19 **(a)** Construct the perpendicular bisector of BC. [1]

(b) Construct the bisector of $\angle ABC$. [1]

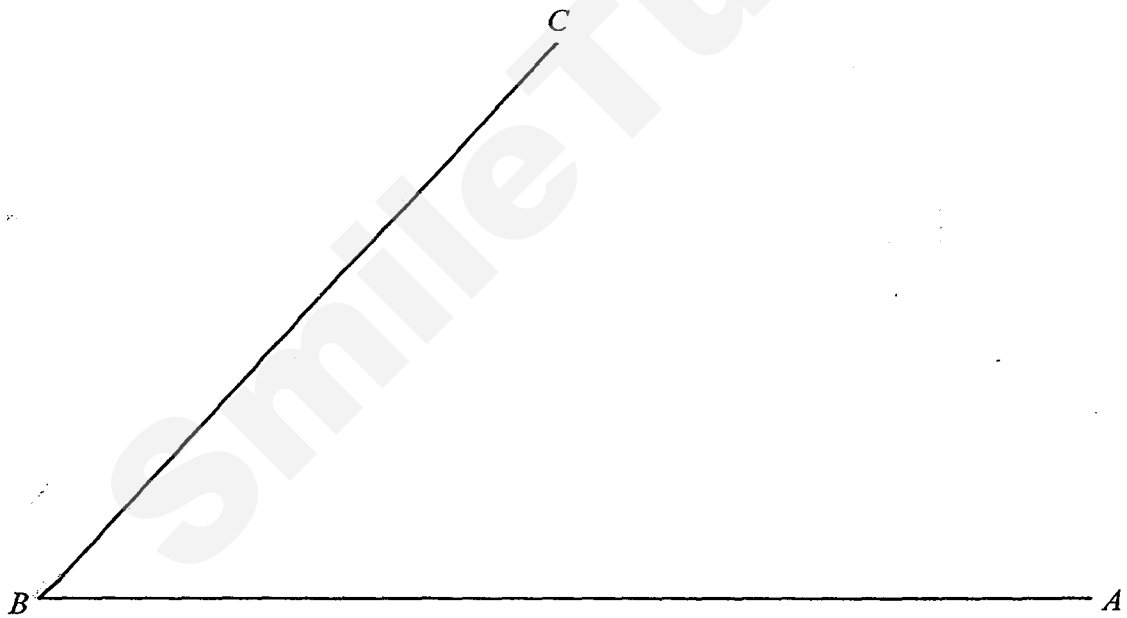
(c) The point D is such that $\angle BCD = 130°$ and $AD = 7.5$ cm.
Find the two possible positions of D and label them D_1 and D_2. [2]

(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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Name: _____ ( ) Class: _____

Fairfield Methodist School (Secondary)
Sec 2 Express 2015 EOY Examination
Mathematics Paper 1
Answer Key

No.	Answer
1	$\sqrt[3]{-8}$, $\frac{2}{7}$, 0.3, $\frac{1}{3}$, 40%
2	18
3	44%
4a	$1008 = 2^4 \times 3^2 \times 7$
4b	LCM $= 2^4 \times 3^3 \times 5^2 \times 7$
4c	$k = 6$
5a	$F = \frac{48}{x^2}$
5b	$F = 12$ newtons
5c	F = 5 newtons
6	$AB = 9.90$
7a	10.3
7b	732 cm^2 or 731 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 $units^2$
13a	AC = 18 cm
13b	CD = 17 cm
14a	$(3p-5a)(p-q)$
14b	$2(3x-2)(x+3)$
15a	$\frac{5}{9}$
15b	8 more
16	$3\frac{5}{9}$
17	$a = 3$ $b = \frac{1}{5}$
18ai	61 marks
18aii	69.5 marks
18aiii	64.4 marks
19a	Refer to M.S
19b	Refer to M.S
19c	Refer to M.S
19d	BA, BC ; B,C

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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	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	$F=\frac{48}{2^2}$ $F=12$ newtons	No F.T. mark [B1]
5c	$1.25=\frac{k}{x^2}$ $F=\frac{k}{(\frac{x}{2})^2}=\frac{4k}{x^2}$ $\therefore F=1.25\times 4$ $=5$	When k = 48, $1.25=\frac{48}{x^2}$ $F=\frac{48}{(\frac{x}{2})^2}$ $F=4\left(\frac{48}{x^2}\right)$ $F=1.25\times 4$ $=5$

[M1]

[A1]

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6	By Pythagoras' Theorem, $AB=\sqrt{(\frac{14}{2})^2+(\frac{14}{2})^2}$ $AB=7\sqrt{2}$ or $AB=9.90$ (to 3sf) (since length >0)		[M1] [A1]
7a	$\pi r^2 h=1500$ $h=\frac{1500}{3.142\times 6.8^2}$ $=10.3244$ $=10.3$ (to 3sf)		[M1] [A1]
7b	$2\pi r^2+2\pi rh$ $=2(3.142)(6.8^2)$ $+2(3.142)(6.8)(10.3244)$ $=731.746$ $=732$ cm² (to 3sf)	If h = 10.3 used, $2\pi r^2+2\pi rh$ $=2(3.142)(6.8^2)$ $+2(3.142)(6.8)(10.3)$ $=731.285$ $=731$ cm² (to 3sf)	[M1] [A1]
8i	$\cos 60^\circ=\frac{2}{OQ}$ $\therefore OQ=4$ or $OQ=4.00(3sf)$	$\sin 30^\circ=\frac{2}{OQ}$ $\therefore OQ=4$ or $OQ=4.00(3sf)$	[M1] [A1]
8ii	$r=\sqrt{4^2-2^2}$ $r=2\sqrt{3}$ Or 3.464 = 3.46 (to 3 sf)	$\tan 60^\circ=\frac{r}{2}$ $\therefore r=3.464$ = 3.46 (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 2nd term have the same denominator [M1] for change of sign [A1]
10	y dollars = $100y$ cents		[M1]

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	Amount of petrol = $\frac{100y}{x}$	[A1]
11	Total number of units = 2+3+4 = 9 If equally didved among A, B and C, each will get 3 units Therefore total sum of money $= (3-2)\times 9\times \$20$ $= \$180$	[M1] [A1]
12a	$x=1, y=1.5$	[B1]
12 b	Line drawn at $x=3$	[B1]
12c	Area = $\frac{1}{2}\times 6\times 2$ = 6 units^2	[B1]
13a	$\frac{12}{8}=\frac{AC}{12}$ $AC=\frac{144}{8}=18cm$	[M1] [A1]
13b	$\frac{CB}{6}=\frac{12}{8}$ $CB=9$ $\therefore CD=8+9=17cm$	[M1] [A1]
14a	$3p^2-3pq-5ap+5aq$ $=3p(p-q)-5a(p-q)$ $=(3p-5a)(p-q)$	[M1] [A1]
14b	$6x^2+14x-12$ $=2(3x^2+7x-6)$ $=2(3x-2)(x+3)$	[B1] for factor 2 [B1] for factors in brackets
15a	Total no. of balls = 18 Probability that ball is red $=\frac{10}{18}=\frac{5}{9}$	[B1]
15b	Let additional blue marbles be x. $\frac{5+x}{18+x}=\frac{1}{2}$ $18+x=10+2x$ $x=8$	[B1]

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16	$\frac{5}{y-3}+\frac{10}{3(3-y)}=3$ $\frac{5}{y-3}-\frac{10}{3(y-3)}=3$ $\frac{5}{3(y-3)}=3$ $5=9y-27$ $y=\frac{32}{9}$ $=3\frac{5}{9}$	[M1] for change of sign [M1] for multiplying denominator to both sides and correct expansion [A1] marks awarded if improper fraction
17	$4a+15b=15$ $7a-30b=15$ (1) x 2: 8a + 30b = 30 ---(3) (2) + (3): 15a = 45 $a=3$ Sub ($a=3$) into (1): $4(3)+15b=15$ $15b=15-12$ $b=\frac{1}{5}$	[M1] for elimination or substitution method [A1] [A1]
18ai	Modal marks = 61 marks	[B1]
18aii	Median current = $\frac{68+71}{2}$ $=69.5 marks$	[B1]
18aiii	Mean of boys' marks $=\frac{50+52+54+2(61)+65+69+75+77+80}{10}$ $=64.4 marks$	[B1]
18b	Sample Answer: The girls preformed better. Because they attained a higher mean score as compared to the boys	*definitely is girls [B1]
19d	BA, BC ; B,C	[B1] [B1]

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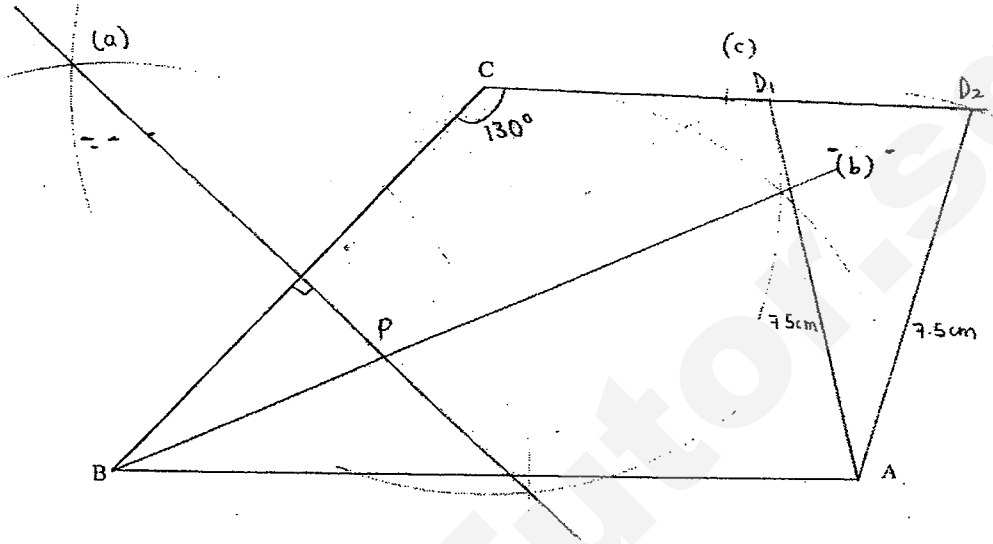
Qn 19a , b , c

Marking Scheme.
Answer (a), (b), (c)



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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 π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

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.

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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 ..... [2]

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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° 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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Name : _____( ) Sec 2__

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]

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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
⋮	⋮	⋮	⋮	⋮
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) $w =$ .....

$x =$ .....

$y =$ ..... [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) $z =$ ..... [1]

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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]

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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 $\dfrac{3k(4-h)-(h-4)}{16-h^2}$

Answer (b)..... [2]

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11. Solve the following equations.

(a) $x-(2x-8)=28+4x$

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

(b) $(m-20)^2=144$

Answer (b) $m=$ ..... or ..... [2]

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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^2. Calculate in square centimeters, the area of Sentosa Island on the map.

Answer (b).....cm^2 [2]

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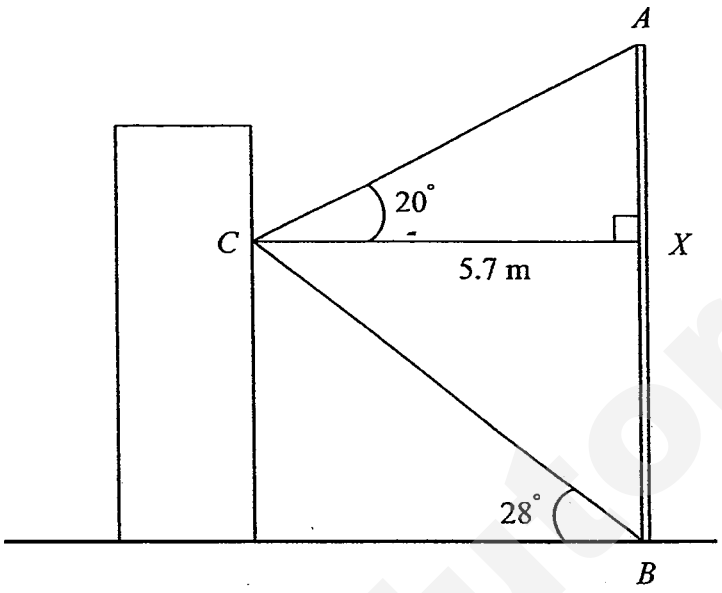
 Name : _____( ) Sec 2__

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° and the angle of elevation from the foot of the monument to C is 28°. Find the height of the monument.

Answer m [3]

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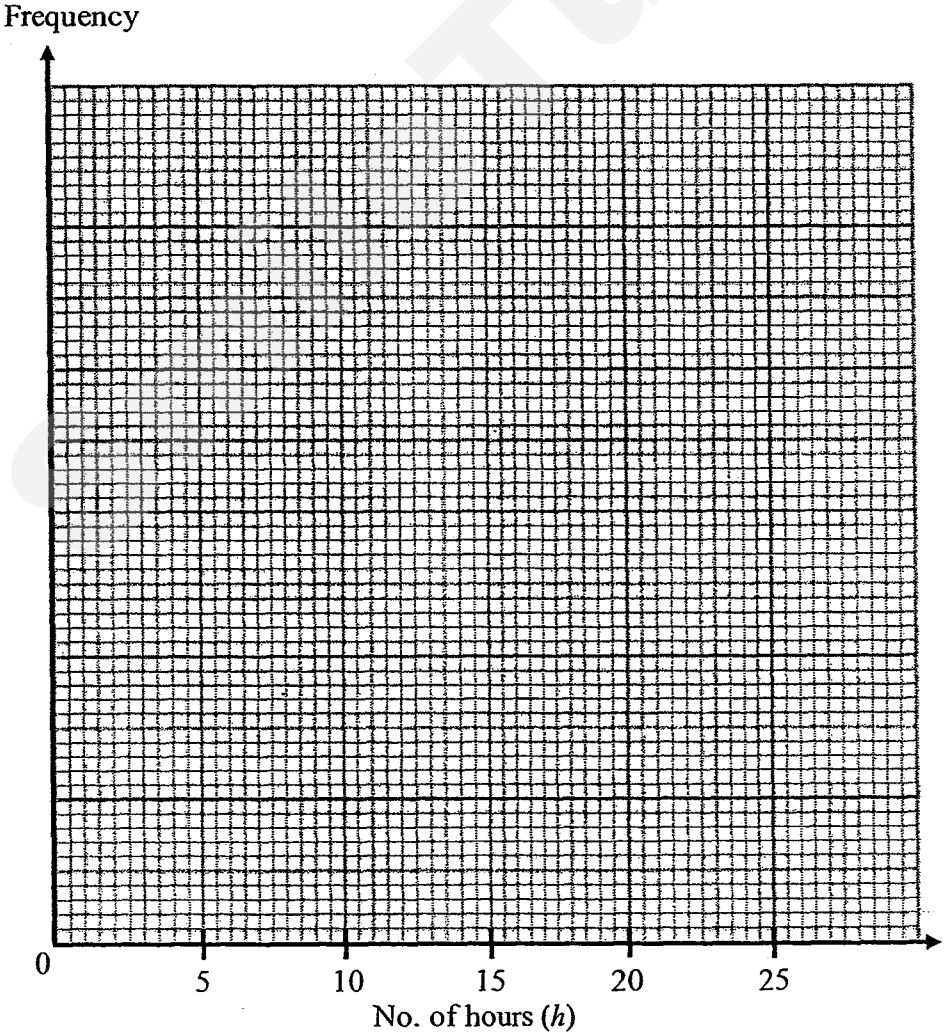
14. The table shows the number of hours, h, spent by a group of 20 students on the computer in a week.

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
$0 \le h < 5$	4
$5 \le h < 10$	
$10 \le h < 15$	
$15 \le h < 20$	
$20 \le h < 25$	

(b) Draw a histogram to illustrate the data in **(a)**. [2]



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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]

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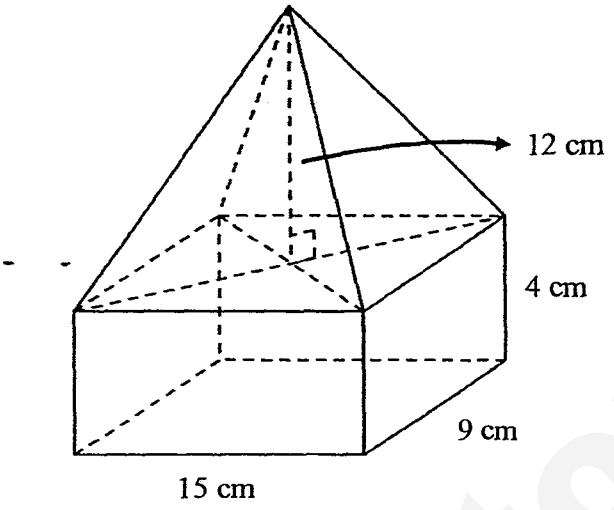
15. A metal ornament is made up of a pyramid with a rectangular cuboid as its base as shown in the diagram below.



(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^3 [2]

(ii) Show that the volume of the metal ornament is 1080 cm^3.

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^3 [3]

(ii) Hence, find the maximum number of cones that can be formed.

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

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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^2 [2]

(ii) Find the total surface area of the ornament to be painted.

Answer (c)(ii).....cm^2 [2]

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 Name : _____( ) Sec 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 $0 \le x \le 6$. [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 ~

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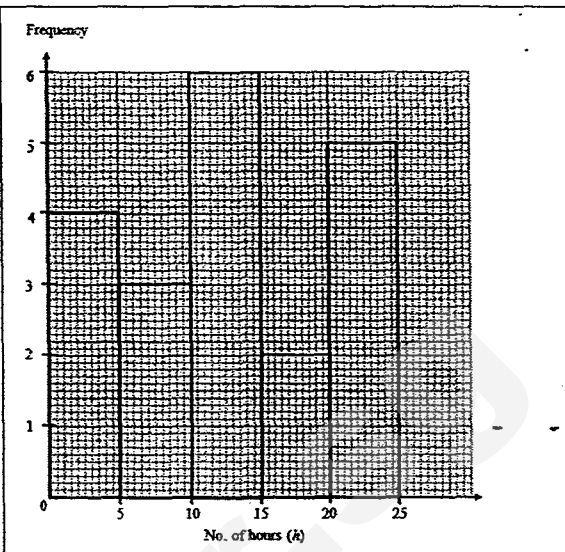
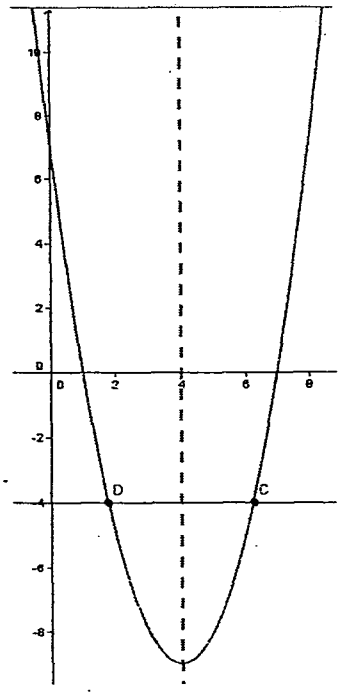
	10 cm
	24
	-135
ı	1440°
)	165°
ı	$60x + 32(20) \geq 16800$ or $0.6x + 32(0.2) \geq 168$
)	$x \geq 269\frac{1}{3}$
:	270
ı	$w = n + 2$, $x = n + 4$, $y = (n+2)(n+4)$
)i	$(n+1)(n+3) = 575$
)ii	$(n+1)(n+3) = 575$ $n^2 + 4n + 3 = 575$ $n^2 + 4n - 572 = 0$ (shown)
:	The numbers in C_4 are all perfect squares. Since 15000 is not a perfect square, it will not appear in C_4.
l	$z = y^2$
ı	$x = 1 - yp^3$
)	$x = 1 - 6(-1)^3 = 7$
	420
ı	$-6x^2 + 15x$
)	$x - 40$
)a	$(4-h)(3k+1)$ or $(h-4)(-3k-1)$ or $-(-4+h)(3k+1)$
)b	$\frac{3k+1}{4+h}$
.a	$x = -4$
b	$m = 32$ or $m = 8$
!a	1.8km
!b	20 cm^2
;	5.11 m
la	

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

14b	
14c	12.75
15ai	540 cm^3
15aii	Volume of ornament = $540 + (15 \times 9 \times 4) =$ 1080 cm^3 (shown)
15bi	17.6 cm^3
15bii	61
15ci	27.6 cm^2 (used int. values to 5sf) or 26.8 cm^2 (used exact int. values)
15cii	40.4 cm^2 (used int. values to 5sf) or 39.0 cm^2 (used exact int. values)
16a	$p = -9$
16b	

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 Name : _____( ) Sec 2__

		16c	Accept $x = 1.7$ to 1.8
		16d	$x = 4$

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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.	$(10-2) \times 180° = 1440°$ **[B1]**
4b.	$7(165) + 2x + (2x+15) + (x-30) = 1440$ $5x = 300$ $x = 60$ **[M1]** Larges interior angle $= 165°$ **[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]**

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7a.	$\sqrt[3]{\frac{1-x}{y}} = p$ $\frac{1-x}{y} = p^3$ **[M1]** $1-x = yp^3$ $x = 1-yp^3$ **[A1]**
7b.	$x = 1-6(-1)^3 = 7$ **[B1]**
8.	$a^2 + b^2 + 2ab = 548 + 352$ $(a+b)^2 = 900$ $a+b = 30$ **[M1]** $a^2 + b^2 - 2ab = 548 - 352$ $(a-b)^2 = 196$ $a-b = 14$ **[M1]** $a^2 - b^2 = (a+b)(a-b)$ $= 30(14)$ $= 420$ **[A1]**
9a	$-6x^2 + 15x$ **[B1]**
9b	$7(x-4) - 3(2x+4)$ $= 7x - 28 - 6x - 12$ [M1 for -12] $= x - 40$ **[A1]**
10a.	$3k(4-h) - (h-4)$ $= 3k(4-h) + (4-h)$ $= (4-h)(3k+1)$ **[B1]** accept $(h-4)(-3k-1)$ and $-(-4+h)(3k+1)$
10b.	$\frac{3k(4-h) - (h-4)}{16-h^2}$ $= \frac{(4-h)(3k+1)}{(4-h)(4+h)}$ **[M1 for factorising denominator]** $= \frac{3k+1}{4+h}$ **[A1]**
11a.	$x - (2x-8) = 28 + 4x$ $x - 2x + 8 = 28 + 4x$ **[M1 for +8]** $-5x = 20$ $x = -4$ **[A1]**

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11b.

$(m-20)^2 = 144$

$m-20 = 12$ or $m-20 = -12$ **[M1]**

$m = 32$ or $m = 8$ **[A1]**

Or

$(m-20)^2 = 144$

$m^2 - 2(m)(20) + 20^2 = 144$

$m^2 - 40m + 256 = 0$

$(m-8)(m-32) = 0$ **[M1 for factorisation]**

$m-8 = 0$ or $m-32 = 0$

$m = 32$ or $m = 8$ **[A1]**

12a.

Map Actual

1 cm rep. 50000 cm

3.6 cm rep. 180000 cm = 1.8km **[B1]**

12b.

Actual Map

50000 cm rep. 1 cm

0.5km rep. 1 cm

0.25km^2 rep. 1 cm^2 **[M1]**

5km^2 rep. 20 cm^2 **[A1]**

13.

$\angle ACX = 28^\circ$ (alt. angles)

$\tan 28^\circ = \dfrac{BX}{5.7}$

$BX = 3.0307$ m (to 5 sf) **[M1]**

$\tan 20^\circ = \dfrac{AX}{5.7}$

$AX = 2.0746$ m (to 5 sf) **[M1]**

Height of monument = 3.0307 + 2.0746 = 5.11 m (to 3sf) **[A1]**

Or

$\angle XBC = 62^\circ$

$\tan 62^\circ = \dfrac{5.7}{BX}$

$BX = 3.0307$ m (to 5 sf) **[M1]**

$\tan 70^\circ = \dfrac{5.7}{AX}$

$AX = 2.0746$ m (to 5 sf) **[M1]**

Height of monument = 3.0307 + 2.0746 = 5.11 m (to 3sf) **[A1]**

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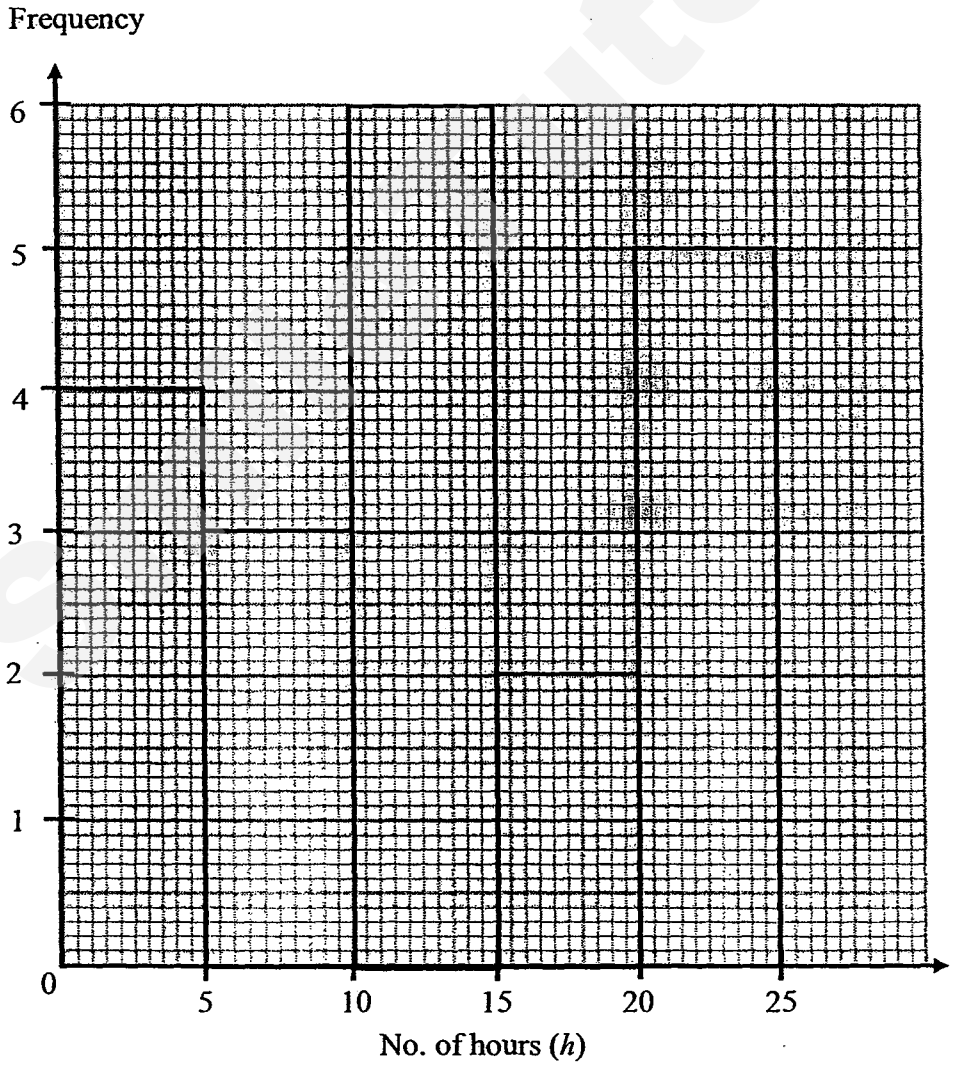
14a.

No. of hours	Frequency
$0 \le h < 5$	4
$5 \le h < 10$	**3**
$10 \le h < 15$	**6**
$15 \le h < 20$	**2**
$20 \le h < 25$	**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]

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14c.

Estimated mean $= \dfrac{(2.5\times 4)+(7.5\times 3)+(12.5\times 6)+(17.5\times 2)+(22.5\times 5)}{20}$ **[M1]**

$= \dfrac{255}{20}$

$=12.75$ **[A1]**

15ai.

Volume of pyramid $= \dfrac{1}{3}\times 15\times 9\times 12$ **[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 $= \dfrac{12}{3.142}\div 2 = 1.9096$ cm **[M1 for radius or height]**

Height of cone $= \sqrt{5^2 - 1.9096^2} = 4.6210$ cm

Volume of cone $= \dfrac{1}{3}\times 3.142\times 1.9096^2\times 4.6210$ **[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

$= (3.142\times\left[\dfrac{12}{3.142}\div 2\right]\times 5) - (3.142\times 0.5\times\sqrt{4.25})$ **[M1]**

$= 26.761\ \text{cm}^2$ (to 5sf)

$= 26.8\ \text{cm}^2$ (to 3sf) **[A1]**

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15cii.

Total surface area to be painted

$= 27.562 + (3.142 \times 0.5^2) + (3.142 \times 1.9606^2)$ **[M1]**

$= 40.425 \text{ cm}^2$ (to 5sf)

$= 40.4 \text{ cm}^2$ (to 3sf) **[A1]**

Or

Total surface area to be painted

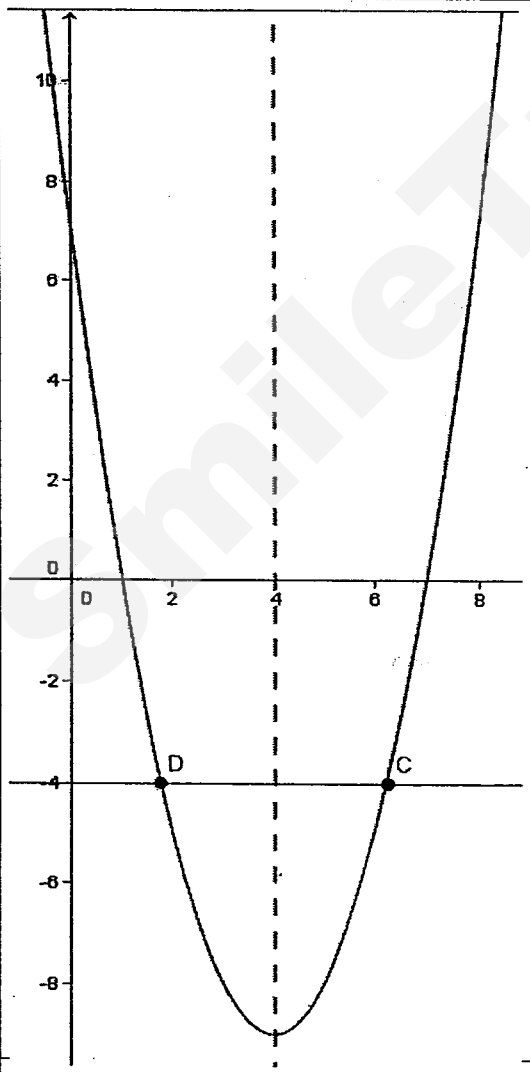
$= 26.761 + (3.142 \times 0.5^2) + (3.142 \times \left[\frac{12}{3.142} \div 2\right]^2)$ **[M1 for addition of 3 parts]**

$= 39.004 \text{ cm}^2$ (to 5sf)

$= 39.0 \text{ cm}^2$ (to 3sf) **[A1]**

16a. $p = -9$ **[B1]**

16b.



P: 2
C: 1 (smooth curve)

[Minus 1 mark for no label of axis or curve]

16c. $x = 0.4, 7.6$ (+/- 0.1) **[B1]**

16d. $x = 4$ **[B1]**

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Class	Register Number	Name

南洋女子中学校

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.

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1. Arrange the following numbers in ascending order.

$$3.2\times10^{-16}, -32\times10^{-15}, 0.32\times10^{-17}, -3.2\times10^{-13}.$$

Answer: _____ [2]

2. Solve the following pair of simultaneous equations:

$$3x - y = 10$$

$$\frac{x}{2} + 2y = 6$$

Answer: $x =$ _____ ; $y =$ _____ [3]

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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]

---

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) $\dfrac{p^2}{q-p}$

Answer : (a)_____ [1]

(b)_____ [3]

[Turn Over

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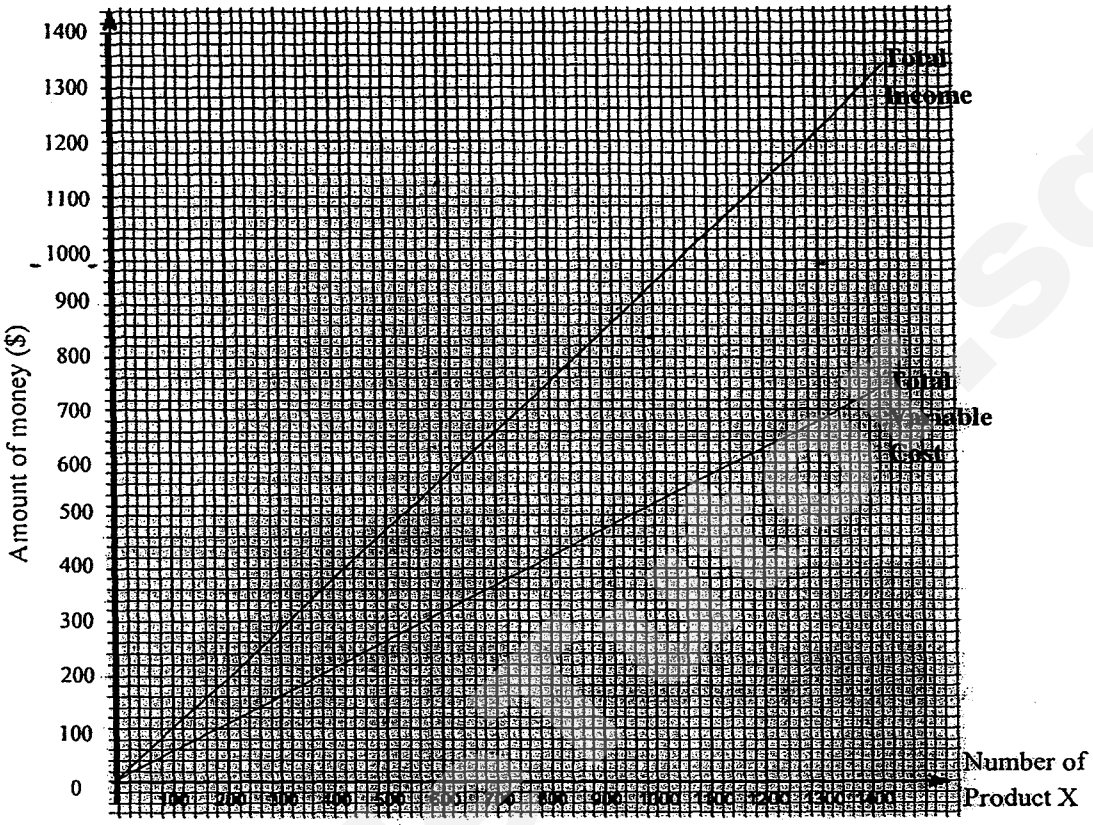
5. The diagram below shows the Total Variable Cost and Total Income graphs of a company producing product X.



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 $0 \leq$ number of Product X ≤ 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]

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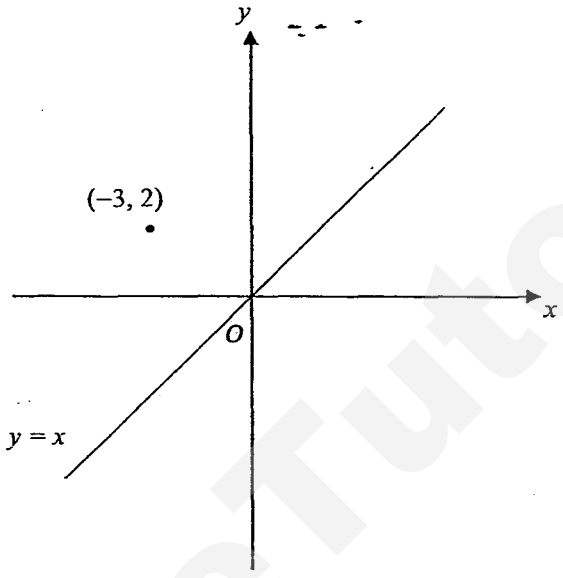
6. The graph of $y = x$ and the point $(-3, 2)$ are plotted as shown below. On the axes below, sketch the graphs of the following given equations and, for each case, indicate the intercepts with the axes clearly. Label each graph clearly with its equation.

(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

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8. Simplify the following expressions leaving your answers in the simplest factorized form.

(a) $\dfrac{1}{2x-1}-\dfrac{3}{4x-2}+\dfrac{2}{4x^2-4x+1}$

(b) $\dfrac{3a^2-5ab-2b^2}{b^2-9a^2}\div\dfrac{ab-3a-2b^2+6b}{3}$

Answer : (a)_____[4]

(b)_____ [4]

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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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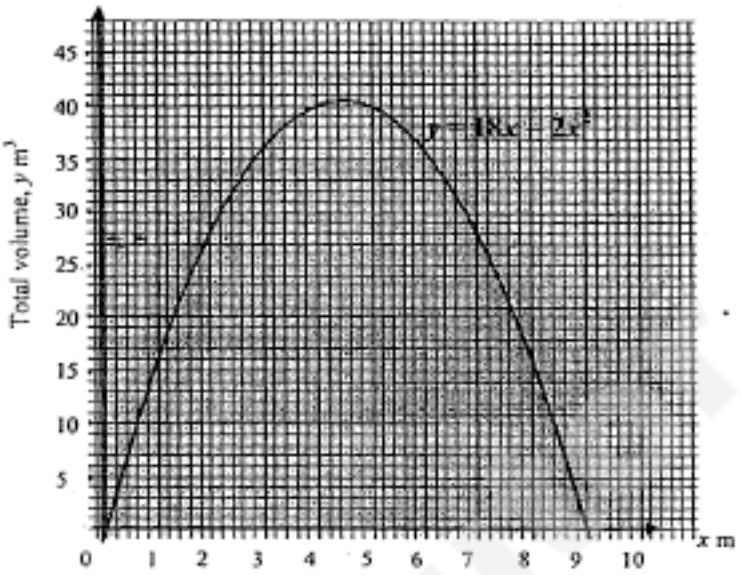
10. A solid cuboid has dimensions $(9-x)$ m by x m by 2 m. The graph representing its total volume, $y=(18x-2x^2)$ m^3, against x m is shown below.



(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 $y=(30-3x)$ 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]

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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

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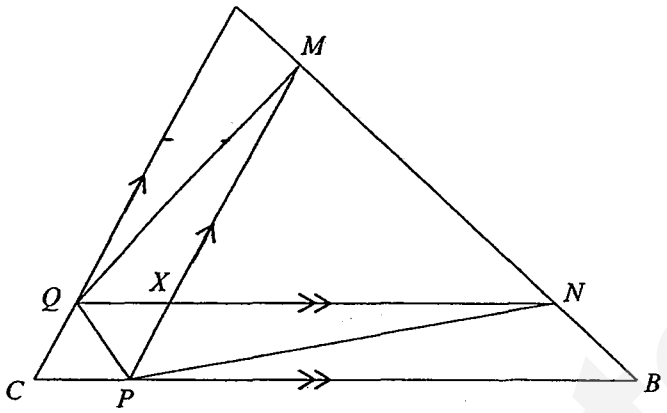
12. In the diagram shown below, ABC is a triangle. The points M and P are on AB and BC respectively, such that PM is parallel to CA. The points N and Q are on AB and AC respectively, such that QN is parallel to CB. NQ and MP meet at the point X, such that $QXPC$ is a rhombus.



(a) Name a triangle which is similar to ΔMNX .

(b) What type of triangle should ΔNXM be, for it to be similar to ΔQXP ?

(c) Given $XN : QN : CB = 3 : 4 : 5$.

(i) Prove that ΔANQ and ΔMBP are congruent. State the geometrical reasons and the case of congruence clearly. [2]

(ii) If ΔQXP and ΔNXM are indeed similar, state the ratio $QP : MN$.

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Answer:

(a)_____ [1]

(b)_____ [1]

(c)(ii)_____ [1]

END OF PAPER

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Sec 2 EOY Paper 1 Solution

1	$-3.2\times10^{-13}, -32\times10^{-15}, 0.32\times10^{-17}, 3.2\times10^{-16}$
2	$3x-y=10$ ---------(1) $\frac{x}{2}+2y=6$ ---------(2) $2(1)+(2)$: $2(3x)+\frac{x}{2}=2(10)+6$ $\frac{13x}{2}=26$ $x=4$ Sub $x=4$ into (1), $3(4)-y=10$ $y=2$ <u>Alternative method</u> $3x-y=10$ ---------(1) $\frac{x}{2}+2y=6$ ---------(2) From (1) : $y=3x-10$ --------(3) Sub (3) into (2) : $\frac{x}{2}+2(3x-10)=6$ $\frac{13x}{2}=26$ $x=4$ Sub $x=4$ into (3), $3(4)-y=10$ $y=2$
3	Maximum of boxes that can be packed into the truck container $=\frac{2.5}{0.4}\times\frac{6}{0.4}\times\frac{2.5}{0.4}$ $\approx 6\times15\times6$ $=540$ Maximum number of coins that can be delivered each time

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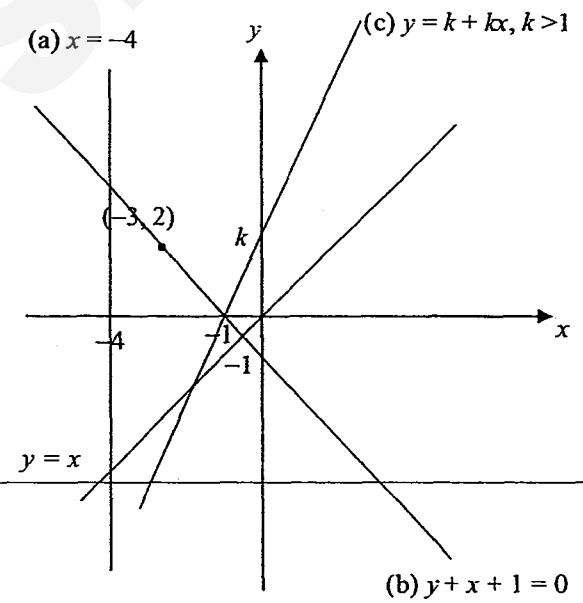
	$= 540 \times 4000$ $= 2160000$ $= 2.16 \times 10^6$
4(a)	$8p$ $= 8(2 \times 10^{10})$ $= 16 \times 10^{10}$ $= 1.6 \times 10^{11}$
4(b)	$\frac{p^2}{q-p}$ $= \frac{(2 \times 10^{10})^2}{1.62 \times 10^{12} - 2 \times 10^{10}}$ $= \frac{4 \times 10^{20}}{1.62 \times 10^{12} - 0.02 \times 10^{12}}$ $= \frac{4 \times 10^{20}}{1.6 \times 10^{12}}$ or $\frac{4 \times 10^{20}}{160 \times 10^{10}}$ $= 2.5 \times 10^8$
5(a)	Gradient $= \frac{420}{800} = 0.525$ Significance: For each product X being produced, \$0.53 (2d.p) of variable cost was made.
5(bi)	Line drawn is parallel to Total Variable Cost line with y-int=500
5(bii)	420+500=\$920
5(biii)	loss
6	

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7(a)	$b(3a-b)=\frac{ac}{b}$ $3a-b=\frac{ac}{b^2}$ $3a-\frac{ac}{b^2}=b$ $a\left(\frac{3b^2-c}{b^2}\right)=b$ $a=\frac{b^3}{3b^2-c}$ Alternative method: $b(3a-b)=\frac{ac}{b}$ $3ab^2-b^3=ac$ $3ab^2-ac=b^3$ $a(3b^2-c)=b^3$ $a=\frac{b^3}{3b^2-c}$
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)	$\frac{3a^2-5ab-2b^2}{b^2-9a^2}\div\frac{ab-3a-2b^2+6b}{3}$ $=\frac{(a-2b)(3a+b)}{(b-3a)(b+3a)}\times\frac{3}{(a-2b)(b-3)}$ $=\frac{3}{(b-3a)(b-3)}$

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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 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 (0,30) and (10, 0). Accept $x = 1.6$ to 1.8

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11(a)	$(p+1)^2 - pq^2 = 0$ ----------(1) $(p+1) - 2q = 0$ ----------(2) From (2), $q = \frac{p+1}{2}$ ----------(3) Sub (3) into (1), $(p+1)^2 - \frac{p(p+1)^2}{4} = 0$ $(p+1)^2\left[1 - \frac{p}{4}\right] = 0$ $p = -1$ or $p = 4$ From (3), If $p = -1, q = 0$ If $p = 4, q = 2.5$ <u>Alternative method:</u> $(p+1)^2 - pq^2 = 0$ ----------(1) $(p+1) - 2q = 0$ ----------(2) From (2), $p = 2q - 1$ ----------(3) Sub (3) into (1), $(2q)^2 - (2q-1)q^2 = 0$ $q^2(5-2q) = 0$ $q = 0$ *or* $q = 2.5$ From (3), If $q = 0, p = -1$ If $q = 2.5, p = 4$
11(b)	(i) accept any $nx - 2ny = 0$, where $n \neq 0$ (ii) accept any $x - 2y = n$, where $n \neq 0$
12(a)	ΔANQ or ΔMBP or ΔABC
12(b)	Isosceles / Equilateral triangle

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12(ci)	$\angle QAN = \angle PMB$ (corr. $\angle$s, $AC \parallel MP$) $\angle ANQ = \angle MBP$ (corr. $\angle$s, $QN//PB$) $\angle AQN = \angle MXN$ (corr. $\angle$s, $AQ//MP$) $= \angle MPB$ (corr. $\angle$s, $AN//PB$) (*any of the 2 pairs of angles) $QX = CP$ $QN : PB = 4 : 5 - (4 - 3)$ $= 4 : 4$ $QN = PB$ $\Delta ANQ \equiv \Delta MBP$ (AAS/ASA * depends)
12(cii)	$QP : MN = 1 : 3$

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Class	Register Number	Name

南洋女子中学校
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.

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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]

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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).

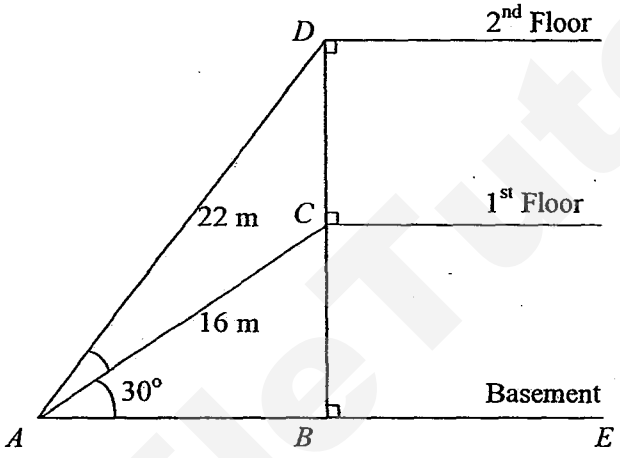
(i) Write down the coordinates of point A. [1]

(ii) Find the equation of the line of symmetry of the curve. [2]

(iii) Find the value of a and of b. Hence, explain with a reason whether the curve has a maximum or minimum turning point. [5]

(iv) 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 1st Floor while the escalator AD of length 22 m leads to the 2nd Floor.

Given that the straight line BCD is perpendicular to the horizontal basement ABE and $\angle BAC = 30°$, find

(i) the height between the basement and the 1st floor, [2]

(ii) the height between the 1st floor and the 2nd floor, [4]

(iii) $\angle DAC$. [2]

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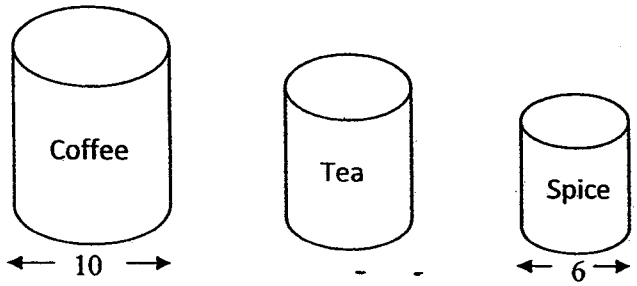
6 The diagram shows three kitchen containers.



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.

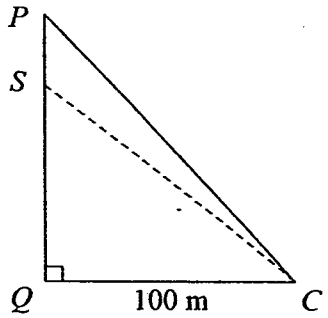
(a) Calculate the ratio

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 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°.



(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]

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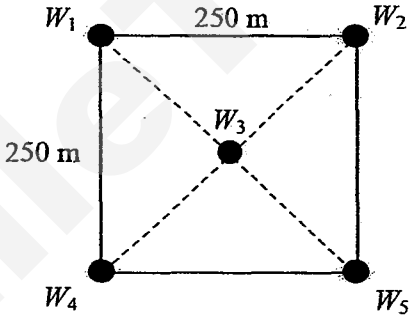
8 Singapore aims to be a test-bed for micro-wind technology generating electricity with low wind speeds. A wind power station is proposed to be erected in a 250 m by 250 m horizontal field at Pulau Ubin and some wind towers will be built. Each wind tower has three rotor blades and the length of each 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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Bonus Question

9 α and β 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

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Sec 2 Math EOY 2015 Paper 2 Solution

1(a) [1 m]	$k = 10$
1(b) [3 m]	Gradient of L_1 is $\frac{1}{2}$ Let the equation of the line be $y = mx + c$ and since the line passes through (4, 7) $7 = \frac{1}{2}(4) + c$ $\therefore c = 5$ Equation of L_1 is $y = \frac{1}{2}x + 5$
1(c) [1 m]	$x = 2$
2(a)(i) [4 m]	$\frac{3x-1}{4} \le \frac{7x+4}{3} < x + 2\frac{2}{3}$ $\frac{3x-1}{4} \le \frac{7x+4}{3}$ $9x - 3 \le 28x + 16$ $-1 \le x$ or $x \ge -1$ $\frac{7x+4}{3} < x + 2\frac{2}{3}$ $7x + 4 < 3x + 8$ $x < 1$ $\therefore -1 \le x < 1$
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]	$\frac{70}{x+2}$

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3(iii) [3 m]	$\frac{70}{x}-\frac{70}{x+2}=3$ $70(x+2)-70x=3x(x+2)$ $70x+140-70x=3x^2+6x$ $3x^2+6x-140=0$ (shown)
3(iv) [3 m]	$x=\frac{-6\pm\sqrt{6^2-4(3)(-140)}}{2(3)}$ $x\approx 5.90$ or -7.90
3(v) [2 m]	$\frac{70}{5.904}+\frac{70}{5.904+2}$ ≈ 20.7 litres
4(i) [1 m]	(0, 23)
4(ii) [2 m]	$x=\frac{1+5}{2}$ Line of symmetry is $x=3$
4(iii) [5 m]	$a+b+23=13$ $a+b=-10$ .....(1) $25a+5b=-10$ .....(2) $25a+5(-10-a)=-10$ or $25a+5b-5a-5b=-10-5(-10)$ $20a=-10+50$ $a=2$ From (1), b = $-10-2=-12$ Since a, the *coefficient of x^2, is positive*, the curve has a minimum turning point.
4(iv) [2 m]	When $x=3$ $k=2(3)^2-12(3)+23$ $\therefore k=5$
5(i) [2 m]	$BC=16\sin 30°$ $=8$ m
5(ii) [4 m]	$AB=16\cos 30°$ ≈ 13.86 m $BD=\sqrt{22^2-13.86^2}$ ≈ 17.09 m $CD=17.09-8$ $=9.09$ m

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5(iii) [2 m]	$\angle BAD = \cos^{-1}\frac{13.86}{22}$ $\approx 50.95°$ $\angle DAC = 50.95° - 30° \approx 21.0°$ or $20.9°$
6(a) [3 m]	$6^3 : 10^3$ $= 27 : 125$ Volume of Coffee container $= \frac{27}{125} \times 980$ $= 211.68\,\text{cm}^3$
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]	$\frac{QP}{100} = \tan 60°$ $QP = 173.21$ Time taken $= \frac{173.21}{7}$ $\approx 24.7\,\text{s}$
7(ii) [3 m]	$QS = 173.21 - 10(7)$ $= 103.21$ Angle of Elevation of S from C $= \tan^{-1}\frac{103.21}{100}$ $\approx 45.9°$
8(a) [3 m]	$\frac{\sqrt{250^2 + 250^2}}{2}$ ≈ 177 Since 177 < 200, the engineer's suggestion does not meet the building requirements.
8(b) [4 m]	$-10(y^2 - 9y) - 130$ $= -10(y^2 - 9y + 4.5^2 - 4.5^2) - 130$ $= -10(y - 4.5)^2 + 72.5$ It takes 4.5 years to achieve a maximum cost

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	savings of 72.5 million dollars
9	$(x-\alpha)(x-\beta) = x^2 - (\alpha+\beta)x + \alpha\beta$ $x^2 - (\alpha+\beta)x + \alpha\beta \equiv x^2 + \frac{b}{a}x + \frac{c}{a}$ $\therefore \alpha+\beta = -\frac{b}{a}$ $\alpha\beta = \frac{c}{a}$

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SWISS COTTAGE SECONDARY SCHOOL
SECONDARY TWO EXPRESS
SECOND SEMESTRAL EXAMINATIONS

Name: _____( ) Class: Sec 2E____

MATHEMATICS **4048/01**
Paper 1 **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 π, use 3.142 unless the question requires the answer in terms of π.

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 question paper consists of **10** printed pages.

Setter: Mr Wilson Wee
Vetter: Ms Zoe Pow

[Turn over

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Answer **all** the questions.

1 **(a)** Express 180 as a product of its prime factors.

Answer (a) 180 = ... [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) ..... [1]

---

2 Given that $a = 5, b = 2, c = -3$ and $d = 8$, evaluate $\frac{3d}{b} - ac^2$.

Answer ..... [2]

---

3 Make a the subject of the formula $7a - 3b = 2ac + 8c$.

Answer ..... [2]

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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]

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(b) $\dfrac{x+3}{x-1} \div \dfrac{2x^2+7x+3}{2x-2}$

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]

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8 Solve the simultaneous equations

$$2x - 3y = 14,$$

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

Answer $x =$ .....

$y =$ ..... [3]

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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]

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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 km^2.

Find the area of the park on the map in cm^2.

Answer (b) ..... 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]

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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) $x =$ ..... [1]

(b) If the median is 2, write down the largest possible value of x.

Answer (b) $x =$ ..... [1]

(c) If the mean is 2, calculate the value of x.

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

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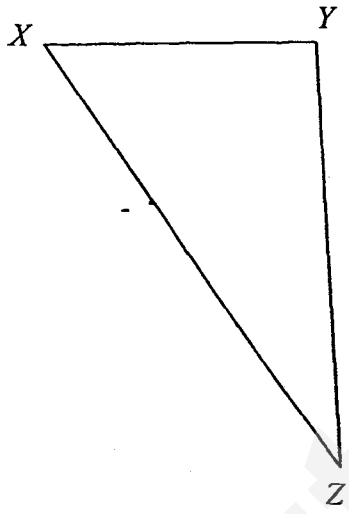
14 In the diagram below,

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

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Answer Key for Math 2E SA2 P1 2015

<table>
<tr><th>Qn</th><th>Marking Point</th></tr>
<tr><td>1(a)</td><td>$2^2 \times 3^2 \times 5$</td></tr>
<tr><td>1(b)</td><td>$2^2 \times 3^2$</td></tr>
<tr><td></td><td></td></tr>
<tr><td>2</td><td>-33</td></tr>
<tr><td></td><td></td></tr>
<tr><td>3</td><td>$a = \dfrac{8c+3b}{7-2c}$</td></tr>
<tr><td></td><td></td></tr>
<tr><td>4(a)</td><td>$3\dfrac{5}{9} < x$</td></tr>
<tr><td>4(b)(i)</td><td>4</td></tr>
<tr><td>4(b)(ii)</td><td>5</td></tr>
<tr><td></td><td></td></tr>
<tr><td>5(a)</td><td>$\dfrac{36+11m-4n}{12}$</td></tr>
<tr><td>5(b)</td><td>$\dfrac{2}{(2x+1)}$</td></tr>
<tr><td></td><td></td></tr>
<tr><td>6</td><td>$8x+6$</td></tr>
<tr><td></td><td></td></tr>
<tr><td>7(a)</td><td>$(a-3b)(2b-c)$</td></tr>
<tr><td>7(b)</td><td>$3(x+5)(x-5)$</td></tr>
<tr><td></td><td></td></tr>
<tr><td>8</td><td>$y=-2$
$x=4$</td></tr>
<tr><td></td><td></td></tr>
<tr><td>9(a)</td><td>96 days</td></tr>
<tr><td>9(b)</td><td>
<table>
<tr><th>Workers</th><th>Days</th><th>Towers</th></tr>
<tr><td>8</td><td>60</td><td>1</td></tr>
<tr><td>×5</td><td></td><td>×5</td></tr>
<tr><td>= 40</td><td>60</td><td>= 5</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>×2</td><td>÷2</td><td></td></tr>
<tr><td>= 80</td><td>= 30</td><td></td></tr>
</table>
Answer 80 workers</td></tr>
<tr><td></td><td></td></tr>
<tr><td>10(a)</td><td>Scale = 1 : 50000</td></tr>
<tr><td>10(b)</td><td>108 cm^2</td></tr>
</table>

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11	\$50
12(a)(i)	$\frac{5}{14}$
12(a)(ii)	$\frac{4}{7}$
12(a)(iii)	$\frac{9}{14}$
12(b)	$\frac{3}{13}$
13(a)	3
13(b)	5
13(c)	$x = 1$
14(c)	1.7 ± 0.1 cm

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Marking Scheme for Math 2E SA2 P1 2015

Qn	Marking Point	Marks Awarded	Remarks
1(a)	$2 \mid 180$ $2 \mid 90$ $3 \mid 45$ $3 \mid 15$ $5 \mid 5$ 1 $180 = 2^2 \times 3^2 \times 5$	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.

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4(a)	$16-4x<\frac{1}{2}x$ $16<4x+\frac{1}{2}x$ $16<4\frac{1}{2}x$ $16<\frac{9}{2}x$ $32<9x$ $3\frac{5}{9}<x$	**M1** **A1**	Shifting the variables to one side.
4(b)(i)	4	**B1**	
4(b)(ii)	5	**B1**	
5(a)	$3+\frac{5m-n}{3}-\frac{3m}{4}$ $=\frac{36}{12}+\frac{4(5m-n)}{12}-\frac{9m}{12}$ $=\frac{36+4(5m-n)-9m}{12}$ $=\frac{36+20m-4n-9m}{12}$ $=\frac{36+11m-4n}{12}$	 **M1** **A1**	Combining second and third term into one fraction with common denominator.
5(b)	$\frac{x+3}{x-1}\div\frac{2x^2+7x+3}{2x-2}$ $=\frac{x+3}{x-1}\times\frac{2x-2}{2x^2+7x+3}$ $=\frac{x+3}{x-1}\times\frac{2(x-1)}{(x+3)(2x+1)}$ $=\frac{2}{(2x+1)}$	 **M1** **M1** **A1**	Changing to multiply sign. Factorising $2x^2+7x+3$
6	$(x+3)^2-(x^2-2x+3)$ $=x^2+6x+9-x^2+2x-3$ $=8x+6$	 **M1** **A1**	Correct expansion and opening of bracket.

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7(a)	$2ab-6b^2-ac+3bc$ $=2b(a-3b)-c(a-3b)$ $=(a-3b)(2b-c)$	 **M1** **A1**	
7(b)	$3x^2-75$ $=3(x^2-25)$ $=3(x+5)(x-5)$	 **M1** **A1**	
8	$2x-3y=14$ --------(1) $3x+4y=4$ --------(2) $(1)\times 3$, $6x-9y=42$ ------(3) $(2)\times 2$, $6x+8y=8$ ------(4) $(3)-(4)$, $-17y=34$ $y=-2$ Subst. $y=-2$ into (1), $2x-3(-2)=14$ $2x+6=14$ $2x=8$ $x=4$	 **M1** **A1** **A1**	Subtracting eq. (4) from (3).
9(a)	8 workers ----- 60 days 5 workers ----- $\frac{8}{5}\times 60$ $=96$ days	 **M1** **A1**	
9(b)	<table><tr><th>Workers</th><th>Days</th><th>Towers</th></tr><tr><td>8</td><td>60</td><td>1</td></tr><tr><td>$\times 5$</td><td></td><td>$\times 5$</td></tr><tr><td>$=40$</td><td>60</td><td>$=5$</td></tr><tr><td></td><td></td><td></td></tr><tr><td>$\times 2$</td><td>$\div 2$</td><td></td></tr><tr><td>$=80$</td><td>$=30$</td><td></td></tr></table> *Answer* 80 workers	 **M1** **M1** **A1**	

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10(a)	6 cm ----- 300000 cm 1 cm ----- $\frac{300000}{6}$ $= 50000$ cm Scale = 1 : 50000	 **B1**	
10(b)	3 km ----- 6 cm $(3\text{km})^2$ ----- $(6\text{cm})^2$ 9 km^2 ----- 36 cm^2 27 km^2 ----- $\frac{27}{9} \times 36$ $= 108\ cm^2$	 **M1** **A1**	Area scale
11	Down payment $= \frac{20}{100} \times \$2500$ $= \$500$ Remaining amt. $= \$2500 - \$500$ $= \$2000$ Interest $= \frac{\$2000 \times 5 \times 4}{100}$ $= \$400$ Total amt. to be paid for 4 years $= \$2000 + \$400$ $= \$2400$ Monthly installment $= \frac{\$2400}{12 \times 4}$ $= \$50$	**M1** **M1** **A1**	
12(a)(i)	Probability $= \frac{5}{5+3+6}$ $= \frac{5}{14}$	 **B1**	

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12(a)(ii)	Probability $= 1-\frac{6}{14}$ $=\frac{8}{14}$ $=\frac{4}{7}$	**M1** **A1**	
12(a)(iii)	Probability $=\frac{3+6}{14}$ $=\frac{9}{14}$	**M1** **A1**	
12(b)	Probability $=\frac{3}{14-1}$ $=\frac{3}{13}$	**M1** **A1**	
13(a)	3	**B1**	
13(b)	0 1 1 1 2 2 2 2 3 ..... 3 4 4 *Answer* 5	 **B1**	
13(c)	$\frac{0\times1+1\times3+2\times4+3\times x+4\times2}{1+3+4+x+2}=2$ $3x+19=2(x+10)$ $3x+19=2x+20$ $x=1$	**M1** **A1**	
14(c)	1.7 ± 0.1 cm	**B1**	

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SWISS COTTAGE SECONDARY SCHOOL
SECONDARY TWO EXPRESS
SECOND SEMESTRAL EXAMINATIONS

Name: _____( ) Class: Sec 2E____

MATHEMATICS

4048/02

Paper 2

Thursday 8 October 2015
1 hour 15 minutes

Additional Materials: Graph Paper (1 sheet)

Additional 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** 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 π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

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.

For Examiner's Use
50

This question paper consists of **12** printed pages.

Setter: Mr Ngoh Kia Joon
Vetter: Ms Zoe Pow

[Turn over

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Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

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Answer **all** questions.

1 **(a)** Evaluate $\dfrac{17.69^2 - \sqrt{22.11}}{\frac{8}{3}\pi}$, giving your answer correct to 1 decimal place.

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

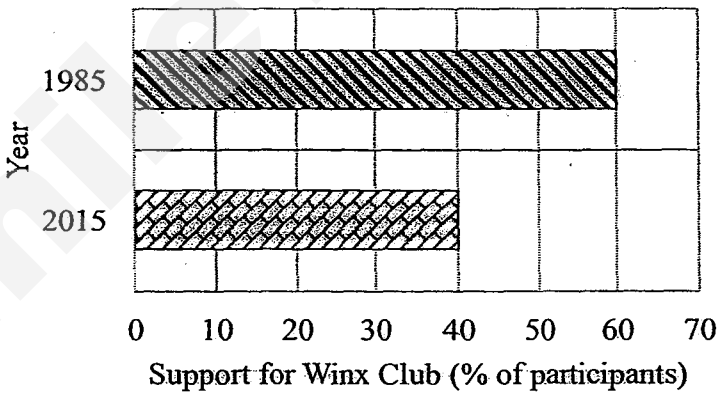
(b) A rectangular pond has a length of 31.356 m and breadth of 17.282 m.

Estimate the area of the pond by rounding off each given dimension to 1 significant number.

Answer (b) .....m^2 [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]

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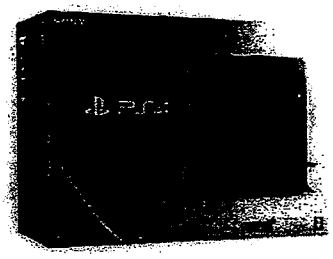
(b) John came across the following advertisement while he was shopping.

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]

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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 1st 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.

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

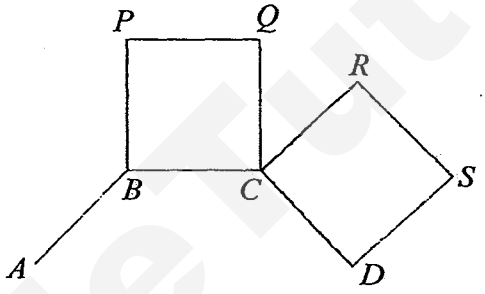
(ii) In Malaysia, Kalif and his family spent a total of RM 1220. Upon return, he decided to change his Malaysian Ringgit back to Singapore Dollar at the rate of S$1 = RM 2.92.

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*... and 2 squares *PQCB* and *RSDC*.



Given that polygon *ABCD*... has an exterior angle of 45°, find

(a) the number of sides of polygon *ABCD*...,

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

(b) ∠QCR.

Answer (b) .....° [2]

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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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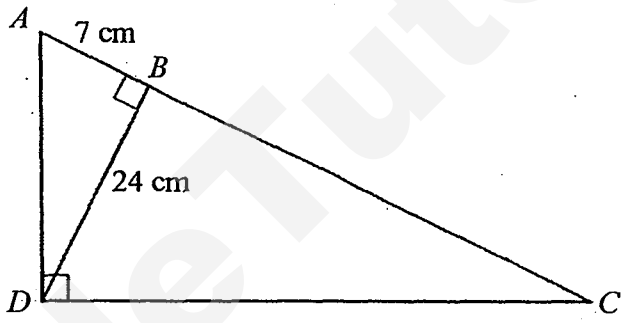
On the return journey, Peter cycled at a uniform speed and took 5 hours to travel from Town B to Town A.

(d) Calculate Peter's speed for the return journey.

Answer (d) .....km/h [1]

---

6 In the diagram below, $\angle ABD = \angle ADC = 90°$, $AB = 7$ cm and $BD = 24$ cm.



Find

(a) length AD,

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

(b) $\angle BCD$.

Answer (b) .....° [2]

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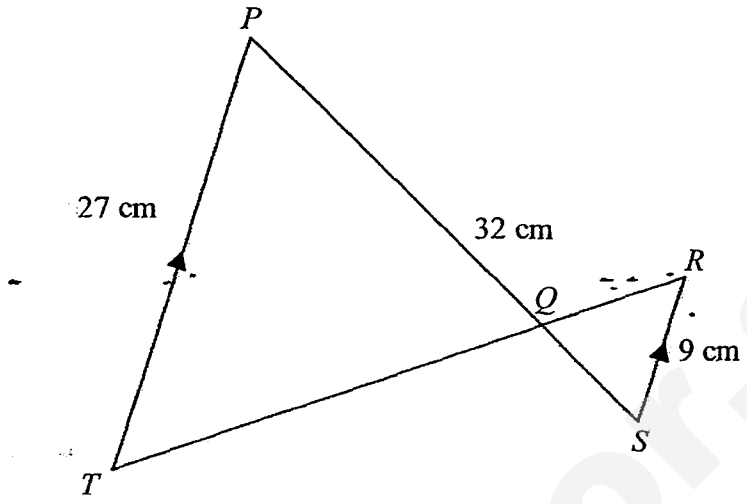
7 In the diagram below, TP // SR, $PT = 27$ cm, $RS = 9$ cm and $PS = 32$ cm. PQS and TQR are straight lines.



(a) Prove that ΔPQT is similar to ΔSQR.

Answer

[2]

(b) Find the length of QS.

Answer (b) QS =.....cm [2]

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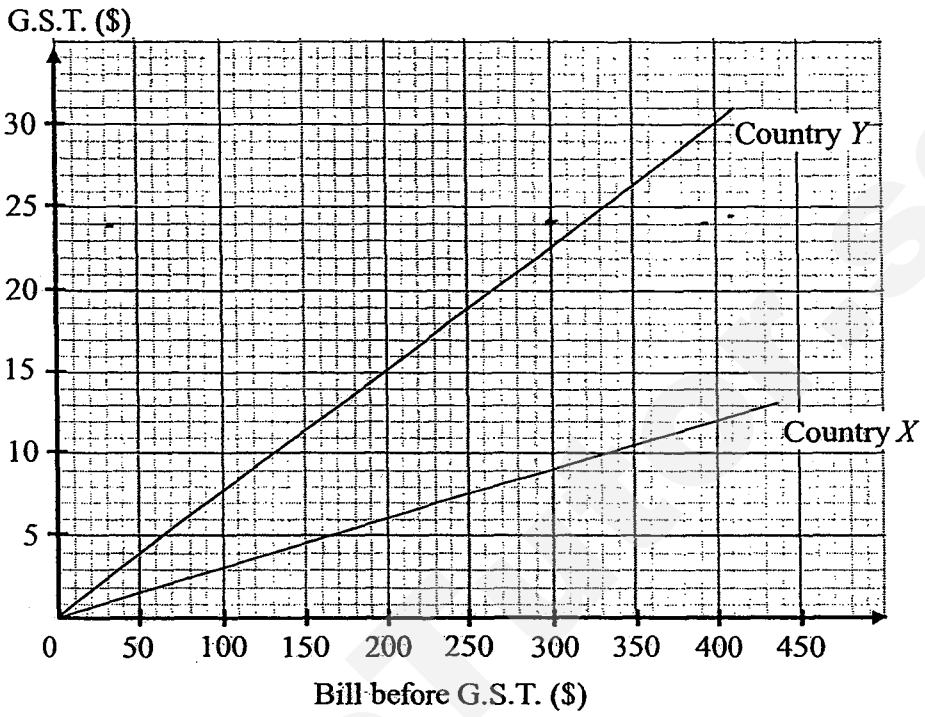
8 The Government Service Tax (G.S.T.) charged to a bill before G.S.T. in Country *X* and Country *Y* is shown in the graph below.



(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]

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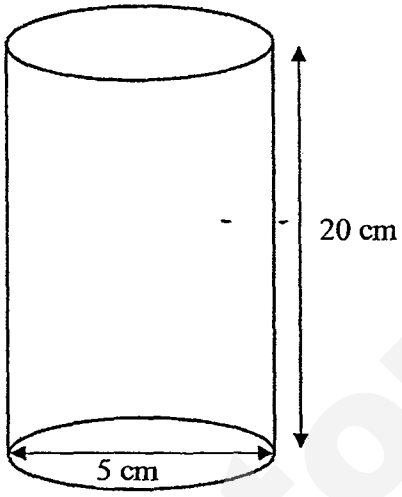
9 Gong Gong Teahouse sells milk tea with pearls in cups that take the shape of a closed cylinder with height 20 cm and base diameter 5 cm. Each cup of milk tea with pearls is filled to the brim with milk tea and 60 spherical pearls each of radius 0.5 cm.



(a) Calculate the surface area of 1 spherical pearl.

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

(b) Calculate the volume of the milk tea in the cup.

Answer (b) .....cm^3 [3]

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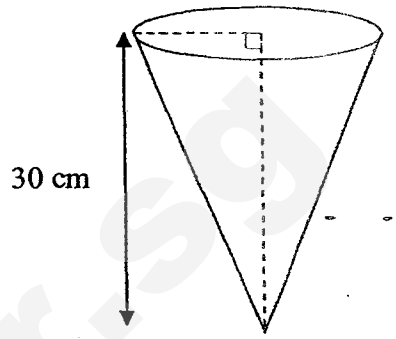
(c) In a special edition, the same volume of milk tea from **(b)** is poured into an inverted cone of height 30 cm and filled it to the brim. Calculate the radius of the cone.



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

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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

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Answer Scheme for 2015 Sec 2 Express Maths SA2 P2

Qn No.	Solution
1	**(a)** 36.8 (1 dp) **(b)** Area = $600\ m^2$
2	**(a)** % decrease = $33\frac{1}{3}$% or 33.3% (3sf) **(b)(i)** % discount = 28.6% (3sf) **(b)(ii)** Discounted price = \$106.25
3	**(a)(i)** Interest (SBD) = \$480 **(a)(ii)** Interest (CBCO) = \$441.99 (nearest cents) Therefore David should deposit his money in **SBD Bank** to earn a higher interest. **(b)(i)** Amount received = RM 2726.50 **(b)(ii)** Amount remaining (S\$) = SG\$515.92 (nearest cents)
4	**(a)** number of sides = 8 **(b)** $\angle QCR = 45°$
5	**(a)** Average speed = 18 km/h **(b)** Time taken = 165 minutes **(c)** $x = 80$ **(d)** Uniform speed = 17 km/h
6	**(a)** $AD = 25$ cm **(b)** $\angle BCD = 16.3°$ (1 dp)
7	**(a)** $\angle TQP = \angle RQS$ (vert. opp. $\angle$s) $\angle QPT = \angle QSR$ (alt $\angle$s, $PT // RS$) $\angle PTQ = \angle SRQ$ (alt $\angle$s, $PT // RS$) Since all corresponding angles are equal, therefore, ΔPQT is similar to ΔSQR. **(b)** $QS = 8$ cm

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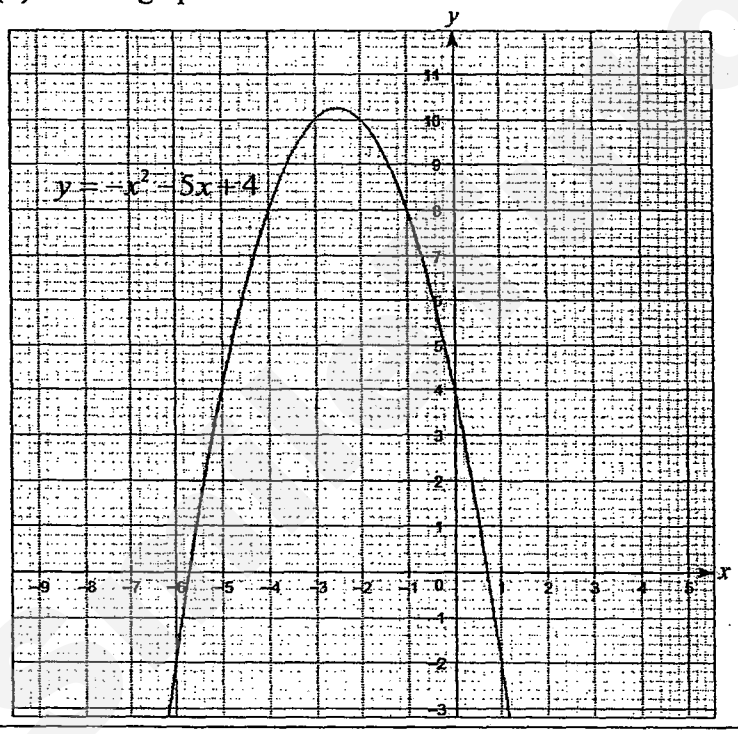
8	**(a)** \$6 **(b)** \$250 **(c)** \$8
9	**(a)** Surface area $= 3.14\ \text{cm}^2$ (3 sf) **(b)** Volume of milk tea $= 361\ \text{cm}^3$ (3sf) **(c)** radius $= 3.39$ cm (3sf)
10	**(a)** $k = 4$ **(c)(i)** (−2.5, 10.3) **(c)(ii)** $y = 8$ **(c)(iii)** −5.7 and 0.7 **(b)** seen in graph below. 

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Qn	Solution	Marks
1	**(a)** 36.8 (1 dp) **(b)** $\text{Area} = 30 \times 20$ $= 600\,\text{m}^2$	B1 B1
2	**(a)** $\%\text{ decrease} = \frac{60-40}{60} \times 100\%$ $= 33\frac{1}{3}\%$ or 33.3% (3sf) **(b)(i)** $\%\text{ discount} = \frac{699-499}{699} \times 100\%$ $= 28.6\%$ (3sf) **(b)(ii)** $\text{Discounted price} = \frac{85}{100} \times 125$ $= \$106.25$	 M1 A1 M1 A1 M1 A1
3	**(a)(i)** $\text{Interest (SBD)} = \frac{8}{100} \times 2000 + \frac{4}{100} \times 2000 \times 4$ $= \$480$ **(a)(ii)** $\text{Final Amount (CBCO)} = 2000(1+\frac{\frac{4}{12}}{100})^{60}$ $= \$2441.993$ $\text{Interest (CBCO)} = 2441.993 - 2000$ $= \$441.99$ (nearest cents) Therefore David should deposit his money in **SBD Bank** to earn a higher interest. **(b)(i)** $\text{Amount received} = 950 \times 2.87$ $= \text{RM } 2726.50$ **(b)(ii)** $\text{Amount remaining (RM)} = 2726.50 - 1220$ $= \text{RM } 1506.50$ $\text{Amount remaining (S\$)} = \frac{1506.50}{2.92}$ $= \text{SG\$}515.92$ (nearest cents)	 M1 A1 M1 A1 (Conclusion) B1 M1 A1

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4	**(a)** $\text{number of sides} = \frac{360}{45}$ $= 8$ **(b)** 1 interior angle $= 180 - 45$ $= 135°$ $\angle QCB = \angle RCD = 90°$ (Given) $\angle QCR = 360 - 90 - 90 - 135$ (Angles at a pt) $= 45°$	M1 A1 M1 A1
5	**(a)** $\text{Average speed} = \frac{30}{1\frac{2}{3}}$ $= 18 \text{ km/h}$ **(b)** $85 - 30 = 55 \text{ km}$ $\text{Time taken} = \frac{55}{20}$ $= 2.75\text{h}$ $= 165 \text{ minutes}$ **(c)** $1545 - 1000 = 5\text{h } 45 \text{ mins} = 345 \text{ mins}$ $x = 345 - 100 - 165$ $= 80$ **(d)** $\text{Uniform speed} = \frac{85}{5}$ $= 17 \text{ km/h}$	M1 A1 M1 A1 B1 B1
6	**(a)** **By Pythagoras theorem,** $AD^2 = 7^2 + 24^2$ $AD^2 = 625$ $AD = 25 \text{ cm}$ **(b)** $\tan \angle DAB = \frac{24}{7}$ $\angle DAB = \tan^{-1} \frac{24}{7} = 73.740$ $\angle BCD = 180 - 90 - \tan^{-1} \frac{24}{7}$ $= 16.3° \text{ (1 dp)}$	M1 A1 M1 A1

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7	**(a)** $\angle TQP = \angle RQS$ (vert.opp. $\angle$s) $\angle QPT = \angle QSR$ (alt $\angle$s, $PT // RS$) $\angle PTQ = \angle SRQ$ (alt $\angle$s, $PT // RS$) Since all corresponding angles are equal, therefore, ΔPQT is similar to ΔSQR. **(b)** $\frac{QS}{QP} = \frac{RS}{TP} = \frac{1}{3}$ $PS = 4QS$ $QS = \frac{32}{4}$ $QS = 8$ cm	M1 A1 M1 A1
8	**(a)** \$6 **(b)** \$250 **(c)** \$13 − \$5 = \$8	B1 B1 B1
9	**(a)** Surface area $= 4 \times \pi \times 0.5^2$ $= 3.14\text{ cm}^2$ (3 sf) **(b)** Volume of cylinder $= \pi \times 2.5^2 \times 20$ $= 125\pi\text{ cm}^3$ Volume of 60 pearls $= \frac{4}{3} \times \pi \times 0.5^3 \times 60$ $= 10\pi\text{ cm}^3$ Volume of milk tea $= 125\pi - 10\pi$ $= 361\text{ cm}^3$ (3sf) **(c)** $115\pi = \frac{1}{3}\pi(r)^2(30)$ radius $= 3.39$ cm (3sf)	M1 A1 M1 (For correct method) M1 (For correct method) A1 M1 A1

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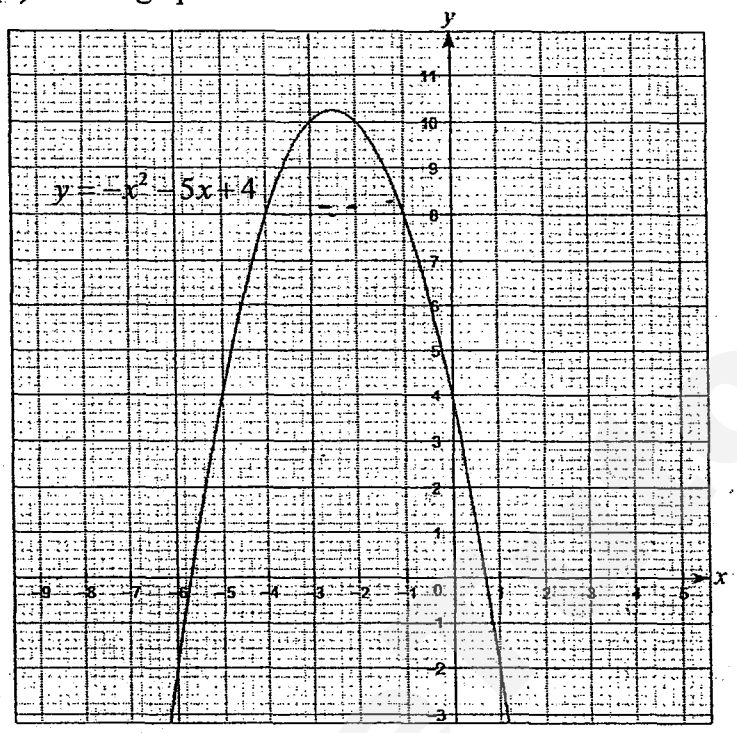
10	**(a)** $k = 4$ **(c)(i)** (–2.5, 10.3) **(c)(ii)** $y = 8$ **(c)(iii)** –5.7 and 0.7 **(b)** seen in graph below.  	B1 B1 B1 B1 B1 for correct scale and label B1 for all points plotted B1 for smoothness of curve

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