

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)



[Twitter.com/freetestpaper](https://twitter.com/freetestpaper)



**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 :
----------------	---------------	-----------------

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

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

Answer **all** questions.

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

Omission of essential working will result in loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to

three significant figures. Give answers in degrees to one decimal place.

For 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.

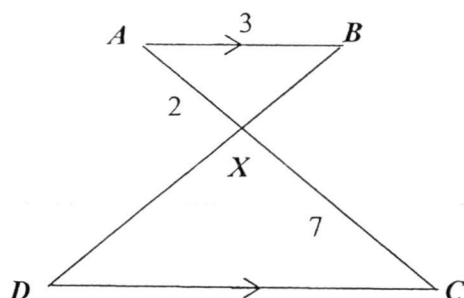
The number of marks is given in brackets [] at the end of each question or part question.

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

- 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 $AB = 3 \text{ cm}$, $AX = 2 \text{ cm}$ and $CX = 7 \text{ cm}$, find

- (i) the length of CD , [2]
- (ii) the ratio of $DX : DB$. [1]

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

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

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

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

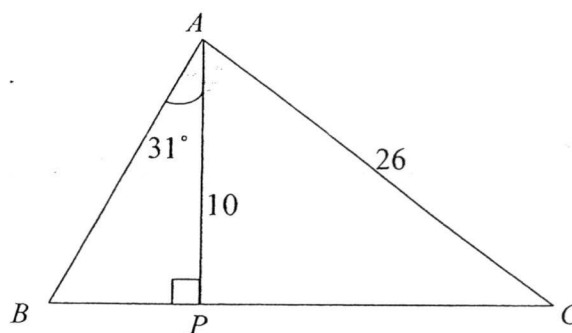
4 (a) Using the second Causeway at Tuas, Mr Ng travelled a distance of 600 km from Singapore to Penang in a time of t hours. Write down the average speed of the journey, in km/h, in terms of t . [1]

(b) If Mr Ng reduced his average speed by 5 km/h, he will take 30 minutes more to complete the same journey.
Form an equation in t and show that it reduces to $2t^2 + t - 120 = 0$. [3]

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

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

5 In the diagram, AP is perpendicular to BC .



Given that $AP = 10$ cm, $AC = 26$ cm and $\angle BAP = 31^\circ$, calculate

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

(b) PC , [2]

(c) PB , [2]

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

- 6 Diagram I shows a hollow cone partially filled with water to a height of 24 cm. The cone has a height of 30 cm and a radius of 5 cm.

Formula: Curved surface area of a cone = $\pi r l$

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

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

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

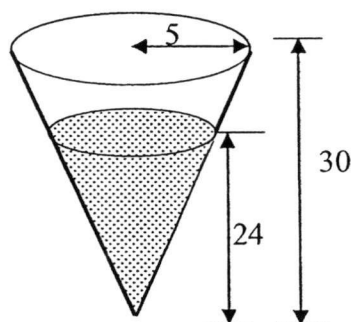


Diagram I

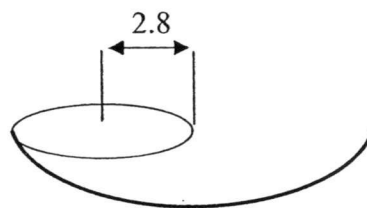


Diagram II

- (a) Show that the radius of the water surface is 4 cm. [1]

- (b) Find

- (i) the volume of the water in the cone, [1]
 (ii) the area of the inner surface of the cone in contact with the water. [2]

The water is poured into hemispherical bowls of radius 2.8 cm as shown in Diagram II.

- (c) Find the numbers of bowls that is completely filled with water. [3]

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

The variables x and y are connected by the equation $y = 10 - x - x^2$.

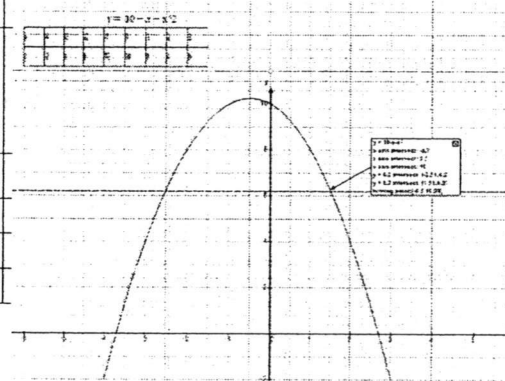
Some corresponding values of x and y are given in the table below.

x	-4	-3	-2	-1	0	1	2	3
y	-2	4	8	10	10	8	4	a

- (a) Calculate the value of a . [1]
- (b) Taking 2 cm to represent 1 unit on the x -axis and 1 cm to represent 1 unit on the y -axis, draw the graph of $y = 10 - x - x^2$ for $-4 \leq x \leq 3$. [3]
- (c) Use your graph to find
- (i) the values of x when $y = 6.2$, [2]
 (ii) the value of y when $x = -1.2$. [1]
- (d) Write down the equation of the line of symmetry. [1]

☺ One page answer ☺

Qn	Answer	Qn	Answer										
1a	<table><thead><tr><th>stem</th><th>leaf</th></tr></thead><tbody><tr><td>4</td><td>1 2 3 4</td></tr><tr><td>4</td><td>5 5 5 6 6 8 8</td></tr><tr><td>5</td><td>0 1 2 3</td></tr><tr><td>5</td><td>7 7 7 7 8</td></tr></tbody></table> Key: 4 1 means 41 kg	stem	leaf	4	1 2 3 4	4	5 5 5 6 6 8 8	5	0 1 2 3	5	7 7 7 7 8		
stem	leaf												
4	1 2 3 4												
4	5 5 5 6 6 8 8												
5	0 1 2 3												
5	7 7 7 7 8												
1b	Mean = 49.25 kg	5a	$\angle PAC = 67.4^\circ$ (1 d.p.)										
		5b	PC = 24 cm										
2ai	Actual area = 7.2 km 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	$\frac{600}{t + \frac{1}{2}} = \frac{600}{t} - 5 \dots\dots$												
4c	t = 7.5 or t = -8												
4d	80 km/h												





**BEATTY SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2015**

SUBJECT : Mathematics

LEVEL : Sec 2 Express

PAPER : 2

DURATION : 1 hour 30 minutes

SETTER : Mr Ng Choon Cheng

DATE : 08 Oct 2015

CLASS :	NAME :	REG NO :
----------------	---------------	-----------------

.....

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

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

Answer **all** questions.

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

Omission of essential working will result in loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to

three significant figures. Give answers in degrees to one decimal place.

For 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 **50**.

- 1 The masses, measured to the nearest kilogram, of 20 boys are given below.

57	45	42	48	58
51	45	50	52	57
57	45	46	57	53
44	48	46	43	41

- (a) Represent the above data in a split stem-and-leaf diagram.

[3]

stem	leaf
4	1 2 3 4
4	5 5 5 6 6 8 8
5	0 1 2 3
5	7 7 7 7 8

Key: 4|1 means 41 kg

M1 Correct labelling and Stem and Leaf.

[2m] Stem and leaf for correct splitting

[1m] for Not splitting or split wrongly

[0 out of 2m] for back to back or non logical stem and leaf

- (b) Find the mean mass

[2]

$$\text{Mean} = 985 / 20$$

M1

$$= 49.25 \text{ kg}$$

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]

$$\text{Actual area} = 0.36 \times 20 = 7.2 \text{ km}^2$$

B1

- (ii) the scale of the map in the form 1 : n,

[2]

Map : actual

$$\text{area} \quad 4 \text{ cm}^2 : 0.36 \text{ km}^2$$

$$\text{dist} \quad 2 \text{ cm} : 0.6 \text{ km}$$

M1

$$1 \text{ cm} : 0.3 \text{ km}$$

$$1 : 30000$$

A1

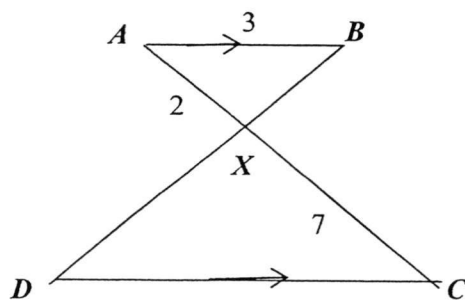
- (iii) the distance on the map in centimetres which represents an actual distance of 6 km.

[1]

$$\begin{aligned} \text{Distance on map} &= \frac{1}{0.3} \times 6 \\ &= 20 \text{ cm} \end{aligned}$$

B1

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



Given that $AB = 3$ cm, $AX = 2$ cm and $CX = 7$ cm, find

- (i) the length of CD ,

[2]

$$\frac{2}{7} = \frac{3}{CD}$$

M1

$$CD = \frac{21}{2}$$

$$CD = 10.5 \text{ cm}$$

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

103

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

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

$$\left(\frac{p}{r}\right)^2 = \frac{q}{3} + p^2$$

M1 (square)

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

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

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

M1 (factorisation)

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

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

$$p = \pm \sqrt{\frac{qr^2}{(3)(1 - r^2)}} \quad \text{or} \quad p = \pm \sqrt{\frac{qr^2}{(3)(1 - r^2)}} \quad \text{or} \quad p = \pm \sqrt{\frac{qr^2}{(3 - 3r^2)}} \quad \text{A1}$$

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

(a) $\frac{600}{t}$ km/h

B1

- (b) If Mr Ng reduced his average speed by 5 km/h, he will take 30 minutes more to complete the same journey.

Form an equation in t and show that it reduces to $2t^2 + t - 120 = 0$. [3]

(b) $\frac{600}{t + \frac{1}{2}} = \frac{600}{t} - 5$

M1

$$\frac{600}{\left(\frac{2t+1}{2}\right)} = \frac{600-5t}{t}$$

$$\frac{1200}{2t+1} = \frac{600-5t}{t}$$

M1

$$1200t = (600 - 5t)(2t + 1)$$

$$1200t = 1200t + 600 - 10t^2 - 5t$$

$$10t^2 + 5t - 600 = 0$$

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

A1

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

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

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

$$t = 7.5 \quad \text{or} \quad t = -8$$

M1

A1

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

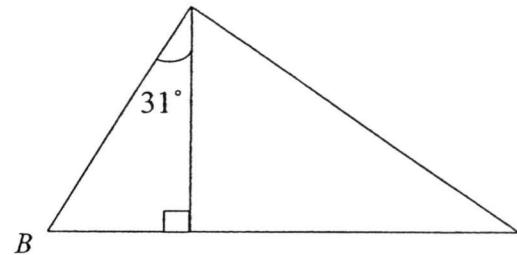
When $t = 7.5$ hrs

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

$$= 80 \text{ km/h (Only)}$$

B1

- 5 In the diagram, AP is perpendicular to BC . Given that $AP = 10$ cm, $AC = 26$ cm and $\angle BAP = 31^\circ$, calculate



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

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

M1

$$\angle PAC = 67.380^\circ$$

$$= 67.4^\circ \text{ (1 d.p.)}$$

A1

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

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

$$PC = 24 \text{ cm}$$

A1

- (c) PB , [2]

$$\tan 31^\circ = \frac{BP}{10}$$

M1

$$BP = 6.0086$$

$$= 6.01 \text{ cm (3 s.f.)}$$

A1

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

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

$$= 120$$

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

M1

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

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

A1

104

- 6 Diagram I shows a hollow cone partially filled with water to a height of 24 cm. The cone has a height of 30 cm and a radius of 5 cm.

Formula: Curved surface area of a cone = $\pi r l$ Surface area of a sphere = $4\pi r^2$

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

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

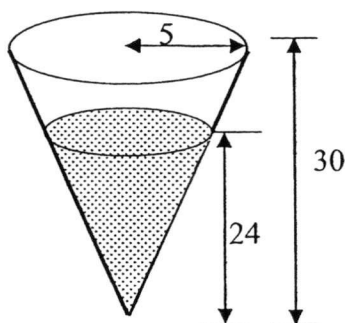


Diagram I

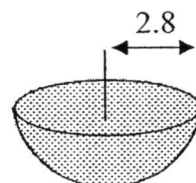


Diagram II

- (a) Show that the radius of the water surface is 4 cm. [1]

$$\frac{24}{30} = \frac{r}{5}$$

$$r = 4 \text{ cm}$$

B1

- (b) Find

- (i) the volume of the water in the container, [1]

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

$$= 402.123$$

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

B1

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

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

$$= \sqrt{592}$$

$$= 24.331$$

M1

inner surface in contact with the water

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

$$= 305.75$$

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

A1

The water is poured into hemispherical bowls of radius 2.8 cm as shown in Diagram II.

- (c) Find the numbers of bowls that is completely filled with water. [3]

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

M1

$$= 45.976$$

$$\text{Number of hemisphere filled} = \frac{402.123}{45.976}$$

M1(Follow thro from B(i) and vol)

$$= 8.746$$

7

A1

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

The variables x and y are connected by the equation $y = 10 - x - x^2$.

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

- (a) Given that $y = 10 - x - x^2$, calculate the values of a . [1]

x	-4	-3	-2	-1	0	1	2	3
y	-2	4	8	10	10	8	4	a

$a = -2$

B1

- (b) Taking 2 cm to represent 1 unit on the x -axis and 1 cm to represent 1 units on the y -axis, draw the graph of $y = 10 - x - x^2$ for $-4 \leq x \leq 3$. [3]

G1 Correct scale, G1 Correct plot, G1 Smooth graph

- (c) Using your graph, find

- (i) the value of x when $y = 6.2$. [2]

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

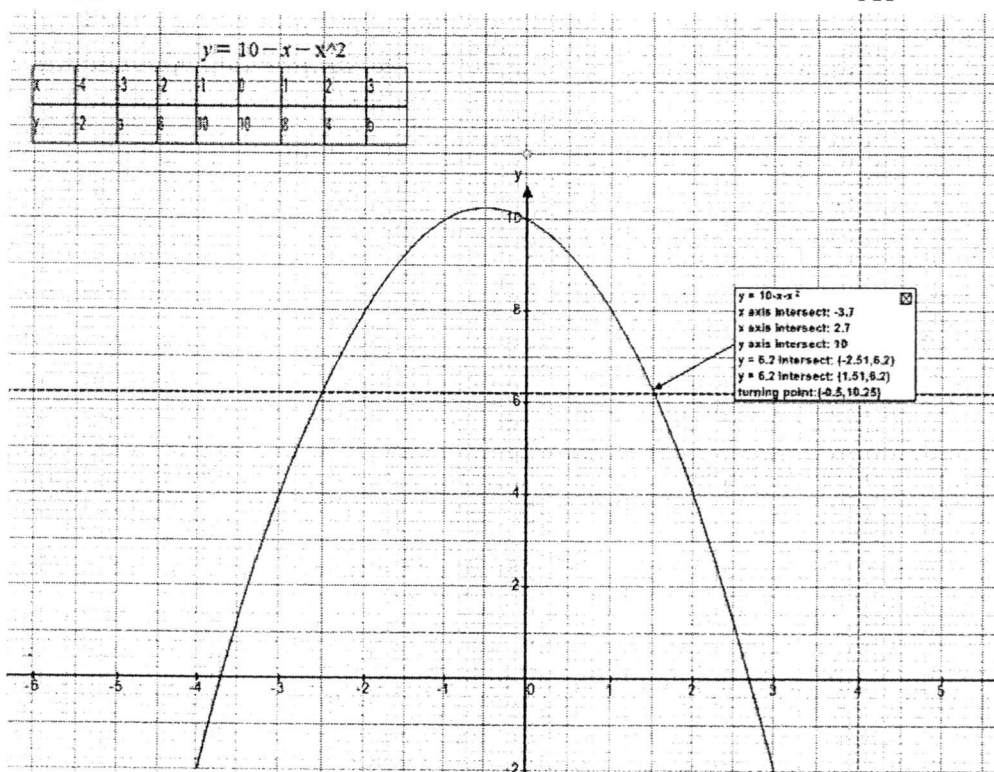
- (ii) The value of y when $x = -1.2$. [1]

$y = 9.8$ (+0.2)

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

$x = -0.5$

A1



~ THE END ~