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**PRELIMINARY EXAMINATION 2  
2015**



4016/01

**MATHEMATICS**

**Paper 1**

**Secondary 4 Express/ 5 Normal Academic  
25th August 2015**

**2 hours**

**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 on both sides of the paper.  
You may use a pencil for any diagrams or graphs.  
Do not use staples, highlighters, glue or correction fluid.

Answer **all** questions.

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

Omission of essential working will result in loss of marks.

Calculators should be used where appropriate.

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

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

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

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

The total marks for this paper is 80.

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

For Examiner's use

80

This document consists of **18** printed pages, including this cover page.

Setter: Ms Melissa Chong

63

**Mathematical Formulae***Compound interest*

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

*Mensuration*

$$\text{Curve surface area of a cone} = \pi r l$$

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

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

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

$$\text{Area of triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector Area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

*Trigonometry*

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

*Statistics*

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left( \frac{\sum fx}{\sum f} \right)^2}$$

For  
Examiner's  
Use

1

Answer **all** the questions.For  
Examiner's  
Use

Write the following in order of size, smallest first.

$$0.55^{\frac{2}{3}} \quad \sqrt{0.21} \quad \frac{23}{41} \quad 0.671$$

f

Answer ....., ....., ....., ..... [1]

2

The diameter of a spherical atom is 125 picometres.

- (a) Express the diameter in metres, giving your answer in standard form.
- (b) Find the volume in  $\text{cm}^3$  of one billion such atoms. Give your answer in standard form correct to 1 significant figure.

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

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

3

The sine of an angle is 0.821.  
Give two possible values for the angle.

Answer ..... or ..... [2]

[Turn over

64

For  
Examiner's  
Use

4

Simplify the following, leaving your answer in positive index.

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

(b)  $\frac{\sqrt{a}}{(-2a)^3 \times 3a^0}$

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

(b) ..... [1]

5

Express  $\frac{2}{2-t} + \frac{3t-5}{t^2-7t+10}$  as a single fraction in its simplest form.

Answer ..... [3]

[Turn over

For  
Examiner's  
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For  
Examiner's  
Use  
6

Solve the inequality  $\frac{x-12}{3} \leq \frac{x-15}{6}$ .

For  
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Answer ..... [2]

7

A man wants to invest \$100 000 in an investment scheme for a period of 2 years.  
Bank A offers a compound interest of 5% per annum, compounded yearly.  
Bank B offers a compound interest of 4.9% per annum, compounded monthly.  
Showing your working clearly, indicate the bank that he should invest his money  
in.

Answer ..... [3]

For  
Examiner's  
Use

8

Two bottles are geometrically similar. The smaller bottle has a capacity of 1 litre and the larger bottle has a capacity of 9 litres. Calculate the height of the smaller bottle as a percentage of the height of the larger bottle.

Answer .....% [2]

For  
Examiner's  
Use

9

Three interior angles of an  $n$ -sided polygon are  $160^\circ$ ,  $164^\circ$  and  $168^\circ$ . The size of each of the remaining exterior angles is  $13^\circ$ . Find the value of  $n$ .

Answer  $n =$  ..... [2]

10

The intensity  $I$ , of a given light source is inversely proportional to the square of distance,  $d$ . For a given distance of  $d$  cm, the intensity is 120 units. Find the new value of  $I$  when  $d$  is halved.

Answer ..... [2]

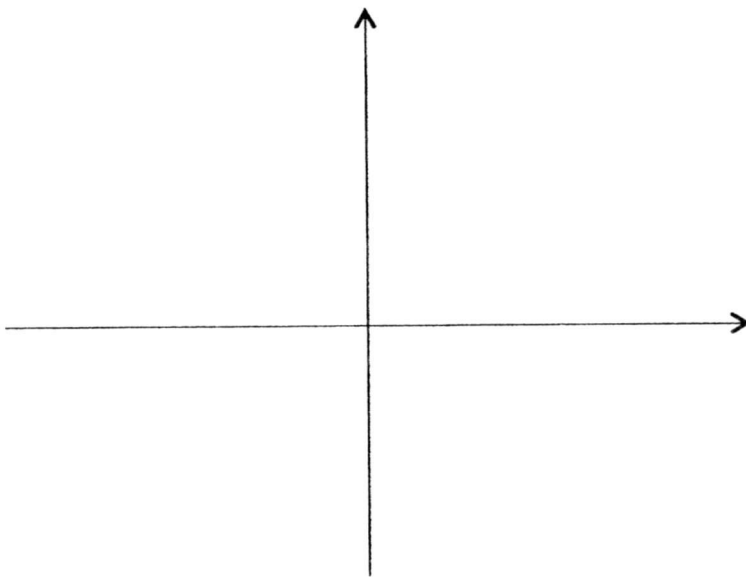
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Examiner's  
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For  
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**11** (a) Express  $x^2 - 6x - 10$  in the form of  $(x - a)^2 + b$ .

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

(b) Sketch the graph of  $y = x^2 - 6x - 10$ . [2]



For  
Examiner's  
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12

Written as the product of prime factors,  $3500 = 2^2 \times 5^3 \times 7$ .

- (a) Express 720 as a product of its prime factors.  
 (b) Hence, write down  
 (i) the largest integer which is a factor of both 3500 and 720,  
 (ii) the smallest positive integer  $k$  for which  $720k$  is a multiple of 3500.

For  
Examiner's  
Use

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

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

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

13

Factorise completely

(a)  $\frac{9}{16}x^2 - 1$ ,

(b)  $ab - a - b + 1$ .

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

(b) ..... [1]

[Turn over

For  
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Use  
14

For  
Examiner's  
Use

$$\mathcal{E} = \{\text{integers } x : 1 \leq x \leq 12\}$$

$$A = \{\text{even numbers}\}$$

$$B = \{\text{multiples of } 4\}$$

- (a) Draw a Venn Diagram to illustrate this information.
- (b) List the elements contained in the set  $(A \cap B)$ .

Answer (a)

[2]

(b) ..... [1]

15

- (a) (i) The  $n$ th term of a sequence is given by  $(2n - 1)^2$ . Write down the first 4 terms.
- (ii) Explain clearly why all the terms in the sequence can never be even.
- (b) The first four terms of another sequence are 25, 49, 81, 121.....  
By comparing this sequence with your answer in (ai), write down the  $n$ th term.

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

(ii) .....

.....

.....

..... [1]

(b) ..... [1]

[Turn over

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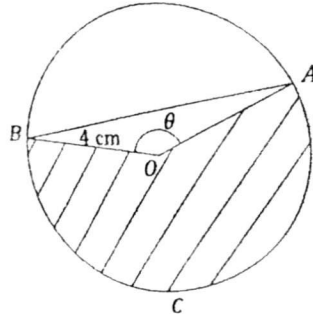
**16** The gradient of the line joining  $A(8, p)$  and  $B(-2, 7)$  is 4. Find

- (a) the equation of the line  $AB$ ,
- (b) the length of  $AB$ .

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

(b) ..... [1]

**17** The figure shows a circle, centre  $O$  of radius 4 cm.



Given that the area of triangle  $OAB$  is  $6 \text{ cm}^2$ , find

- (a)  $\theta$  in radians,
- (b) the area of the shaded region,
- (c) the perimeter of the major sector  $ABC$ .

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

(b) .....  $\text{cm}^2$  [1]

(c) ..... cm [1]

For  
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Use

For  
Examiner's  
Use

18

$$\overline{AB} = \begin{pmatrix} -2 \\ 6 \end{pmatrix} \text{ and } \overline{DC} = \frac{2}{3} \overline{AB}.$$

- (a) Express  $\overline{CD}$  as a column vector.
- (b) Given that  $A$  is the point  $(1, -3)$ , find the coordinates of  $B$ .
- (c) What is the special name given to the quadrilateral  $ABCD$ ?

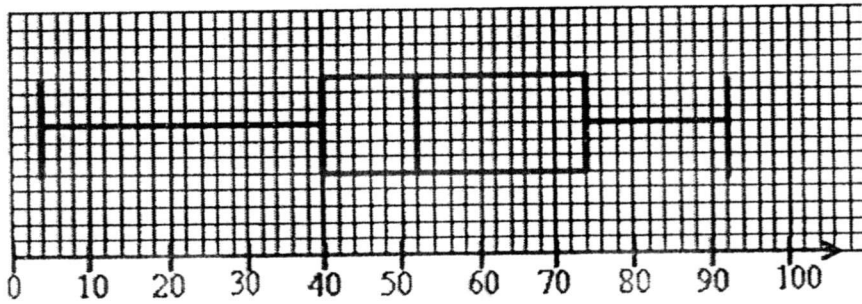
Answer (a) ..... [1]

(b) ..... [1]

(c) ..... [1]

19

A group of students sat for their Preliminary Examination Maths paper and their results are represented in the box-and-whisker plot.



- (a) Find the median of the results.
- (b) Find the interquartile range of the results.

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

(b) ..... [1]

For  
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Use  
20

For  
Examiner's  
Use

The matrices below shows the number of tour packages to Hong Kong, Korea and Taiwan sold in May and June.

	May	June
Hongkong	17	15
Korea	32	36
Taiwan	11	13

The price of the Hong Kong, Korea and Taiwan package is \$690, \$1500 and \$1200 respectively.

(a) If  $M = \begin{pmatrix} 690 & 1500 & 1200 \\ 17 & 15 \\ 32 & 36 \\ 11 & 13 \end{pmatrix}$ , evaluate  $M$ .

(b) Explain what the elements of  $M$  represent.

(c) Evaluate  $\frac{1}{2}M \begin{pmatrix} 1 \\ 1 \end{pmatrix}$  and explain what the answer represents.

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

(b) .....

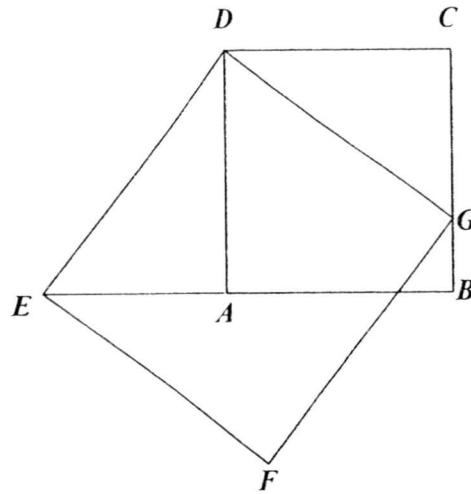
..... [1]

(c) .....

..... [2]

[Turn over

In the diagram,  $ABCD$  is a square and  $DEFG$  is a rectangle.  $EAB$  is a straight line.



- (a) Show that angle  $ADE = \text{angle } CDG$   
 (b) Prove that triangle  $ADE$  is congruent to triangle  $CDG$ .

*Answer*

(a)

[2]

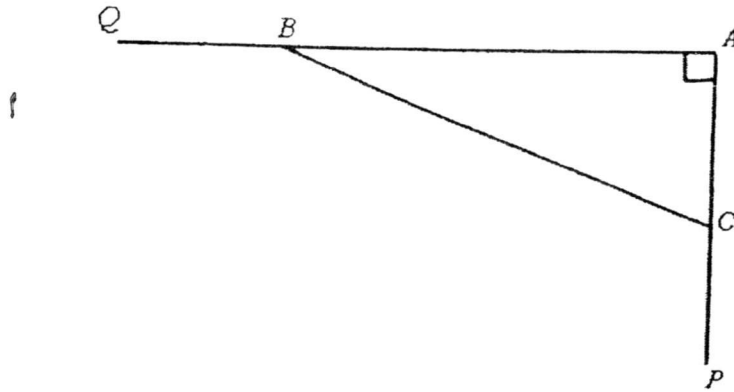
(b)

[2]

For  
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22

For  
Examiner's  
Use

$ABC$  is a right-angled triangle in which  $AB = 24$  cm and  $BC = 25$  cm.  $AC$  is produced to  $P$  and  $AB$  is produced to  $Q$ .



- (a) Given that  $C$  is the midpoint of  $AP$  and the area of  $\Delta APQ$  is 3 times the area of  $\Delta ACB$ , find the length of  $AQ$ .
- (b) Express, as a fraction, the value of
- (i)  $\tan \angle APQ$ ,
  - (ii)  $\cos \angle BCP$ .

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

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

(ii)..... [1]

[Turn Over

For  
Examiner's  
Use

For  
Examiner's  
Use

23

Jenny is playing with 715 one-centimetre cubes.

- (a) She uses all 715 cubes to make a cuboid. All of the sides of the cuboid are longer than 1 cm. Find the dimensions of the cuboid.
- (b) Jenny makes the largest cube possible using some of the 715 cubes. How many cubes does she have left over?

†

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

(b) ..... [2]

24

A bag initially contains 6 blue balls,  $x$  green balls and  $y$  red balls. The probability of drawing a blue ball is  $\frac{1}{3}$ . If 3 more green balls are added into the bag and 1 red ball is removed from the bag, the possibility of drawing a red ball from the bag is  $\frac{1}{4}$ . Find the value of  $y$ .

Answer ..... [3]

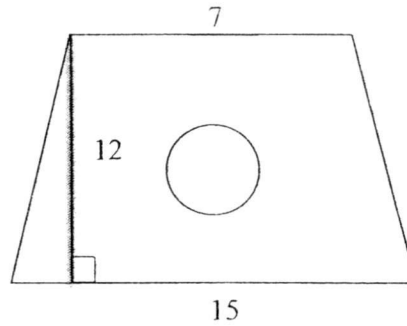
70

[Turn over

For  
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25

For  
Examiner's  
Use

The cross section of a bronze medal is a trapezium with a circular hole, as shown. All measurements are in centimetres.



The diameter of the circular hole is 1 cm and the uniform thickness of the medal is 0.5 cm.

The mass of 1 cubic centimetre of bronze is 8.4 g.

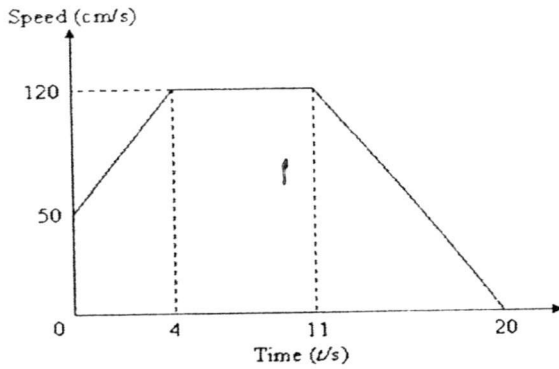
The price of 1 gram of the bronze is \$2.45.

Calculate the value of the bronze in the medal, giving your answer to the nearest cent.

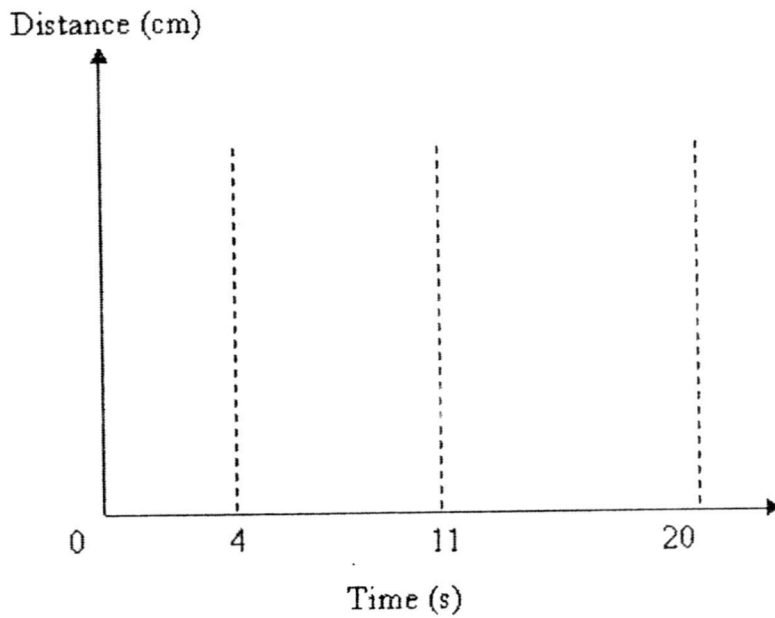
Answer ..... [4]

[Turn Over

The diagram below shows the speed-time graph of a particle over a period of 20 seconds.



- (a) Find,  
 (i) the acceleration of the particle at time  $t = 3$ ,  
 (ii) the speed when time  $t = 17$ .
- (b) Sketch the distance-time graph for the same journey. [2]



Answer (a)(i) .....  $\text{cm/s}^2$  [1]

(ii).....  $\text{cm/s}$  [2]

[Turn Over

For  
Examiner's  
Use  
27

For  
Examiner's  
Use

- (a) Construct triangle  $XYZ$  where  $XZ = 8.5$  cm,  $\angle ZYX = 52^\circ$  and  $Z$  is above the line  $XY$ .  
 $XY$  has already been drawn. [1]

*Answer for (a), (b) and (c).*



- (b) Construct
- (i) the perpendicular bisector of the line  $XY$ . [1]
  - (ii) the bisector of angle  $ZXY$  [1]
- (c) Mark clearly a possible point which is inside the triangle, equidistant from  $XZ$  and  $XY$  and nearer to  $Y$  than to  $X$ .  
Label this point  $P$ . [1]

**END OF PAPER**

## Answers

1	$\sqrt{0.21} \quad \frac{23}{41} \quad 0.671 \quad 0.55^{\frac{2}{3}}$
2(a)	$1.25 \times 10^{-10}$
(b)	$1 \times 10^{-15}$
3	$55.2^\circ$ or $124.8^\circ$ or $0.963$ rad or $2.18$ rad
4(a)	$4/a^3$
(b)	$-\frac{1}{24a^{\frac{5}{2}}}$
5	$\frac{t+5}{(t-5)(t-2)}$
6	$x \leq 9$
7	Bank A - \$110 250; Bank B - \$110 274.27; Bank B
8	48.1
9	27
10	480
11(a)	$(x-3)^2 - 19$
12(a)	$2^4 \times 3^2 \times 5$
(b)(i)	20
(b)(ii)	175
13(a)	$(\frac{3}{4}x+1)(\frac{3}{4}x-1)$
(b)	$(a-1)(b-1)$
14(b)	{1, 2, 3, 5, 6, 7, 9, 10, 11}
15(a)(i)	1, 9, 25, 49
(ii)	$(2n-1)$ is always an odd number. When squared, it will always still remain as an odd number.
(b)	$(2n+3)^2$
16(a)	$y = 4x + 15$
(b)	41.2 units

17(a)	2.29 rad
(b)	31.9 cm <sup>2</sup>
(c)	24.0 cm
18(a)	$\frac{4}{3}$ -4
(b)	(-1, 3)
(c)	trapezium
19(a)	52
(b)	34
20(a)	(72 930 79950)
(b)	The total amount earned from all the tour packages to Hong Kong, Korea and Taiwan in May and June respectively
(c)	(76 440); The average amount of money earned from all the tour packages to Hong Kong, Korean and Taiwan in May and June;
22(a)	36 cm
(b)(i)	18/7
(ii)	- 7/25
23(a)	5 by 11 by 13
(b)	203
24	6
25	\$1350.20
26(a)(i)	17.5 cm/s <sup>2</sup>
(ii)	40 cm/s

Calculator Model :

Class

Full Name

Index Number



**PRELIMINARY EXAMINATION II  
2015**



4016/02

**MATHEMATICS**

**Paper 2**

**Secondary 4 Express / 5 Normal Academic**  
27<sup>th</sup> Aug 2015

**2 hours 30 minutes**

Additional Materials: Graph Paper (1 sheet)  
Answer Paper (6 sheets)

**READ THESE INSTRUCTIONS FIRST**

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

Answer **all** questions.

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

Omission of essential working will result in loss of marks.

The use of a scientific calculator is expected, where appropriate,

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

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

At the end of the test, 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 100.

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

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100

This document consists of **11** printed pages, including this cover page.

## *Mathematical Formulae*

### *Compound Interest*

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

### *Mensuration*

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

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

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

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

$$\text{Area of a triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

### *Trigonometry*

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

### *Statistics*

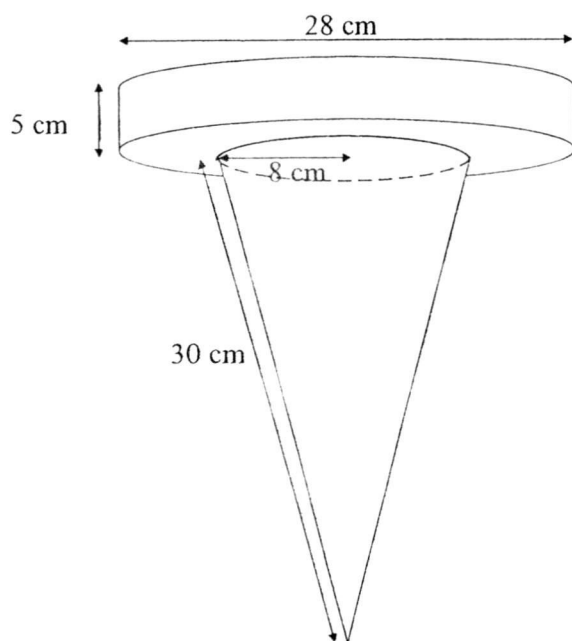
$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left( \frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** the questions.

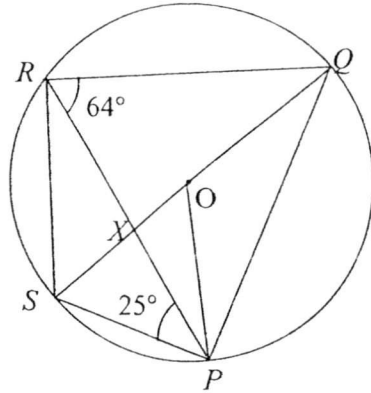
- 1 (a) Simplify  $\sqrt[3]{27m^6n^9}$ . [1]
- (b) Factorise  $9q^3 + 9pq^2 - q - p$  completely. [2]
- (c) Simplify  $\frac{(a+b)^2}{2a^2 + 2b^2 + 4ab}$ . [2]
- (d) (i) Express  $\frac{5}{x-1} + \frac{3}{1-x^2}$  as a single fraction [2]
- (ii) Hence, solve  $2\left(\frac{5}{x-1} + \frac{3}{1-x^2}\right) = \frac{1}{3}$ . [3]

- 2 The figure shows an Olympic Torch comprising a cylinder attached to the base of a cone.



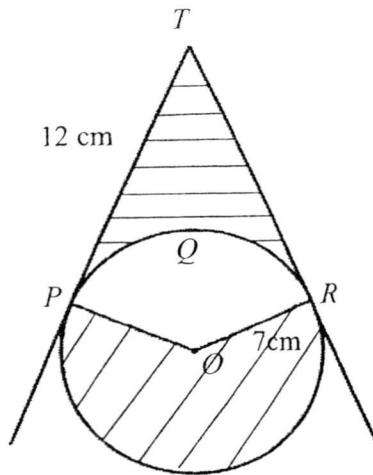
- (a) Show that the height of the cone is  $\sqrt{836}$  cm. [1]
- (b) Calculate
- (i) the volume of the figure, [2]
- (ii) the surface area of the figure. [3]

- 3 In the diagram,  $P$ ,  $Q$ ,  $R$  and  $S$  are points on the circle with centre  $O$ .  $PR$  intersect  $QS$  at  $X$ .  $\angle QRP = 64^\circ$  and  $\angle SPR = 25^\circ$ .

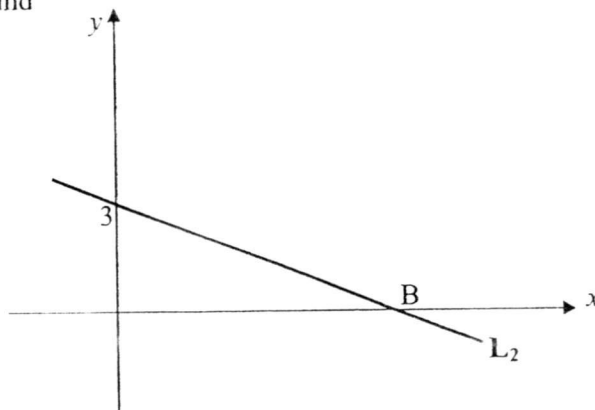


- (a) Show that  $\triangle RXQ$  is similar to  $\triangle SXP$ . [2]
- (b) Calculate, stating your reasons clearly,
- $\angle SXP$ , [1]
  - $\angle RPQ$ , [1]
  - $\angle SRP$ , [1]
  - $\angle RPO$ . [2]
- (c) If  $SX : XQ = 1 : 3$ , calculate the area of  $\triangle RXS$  if the area of  $\triangle PXQ$  is  $72 \text{ cm}^2$ . [2]
- 4 (a) Given  $\varepsilon = \{\text{integers } x: 2 < x < 23\}$ ,
- $A = \{\text{even numbers}\}$ ,
- $B = \{\text{prime numbers}\}$ ,
- $C = \{\text{multiples of } 4\}$ .
- Draw a Venn diagram to illustrate this information. [2]
  - List the elements contained in the set  $(A \cap C)$ . [1]
  - Write down  $n(A \cup B \cup C)$ . [1]

- 4 (b) Given that the radius of the circle is 7 cm and  $TP = TR = 12$  cm, calculate

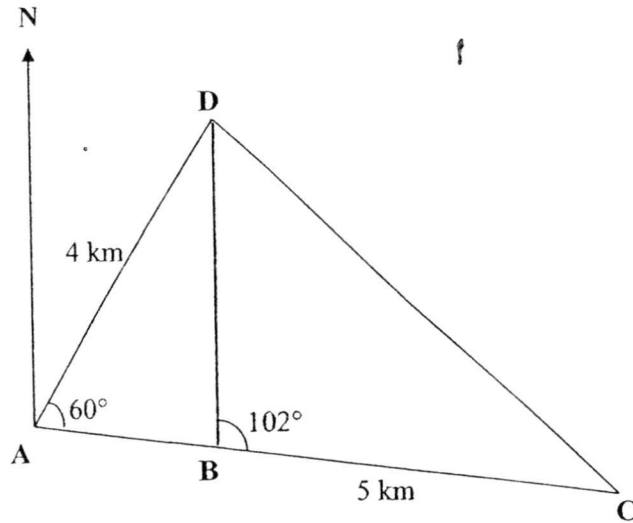


- (i) reflex  $\angle POR$  in radians, [2]  
(ii) arc length PQR, [1]  
(iii) area of the shaded region. [3]
- 5 A line  $L_1$  is parallel to the line  $L_2: 2y + x - 6 = 0$  and passes through the point A (-2, 5). Find



- (a) the equation of  $L_1$ , [2]  
(b) the coordinates of B where the line  $L_2$  cuts the  $x$ -axis, [1]  
(c) the value of  $k$  if the coordinates C ( $k$ , 1) lies on the line  $L_1$ , [1]  
(d) the length of DE where the coordinates D and E are the points where  $L_1$  cuts the  $x$  and  $y$ -axis respectively, [2]  
(e) the area the trapezium bounded by the lines  $L_1$ ,  $L_2$  and the  $x$  and  $y$ -axis. [2]

- 6 The diagram shows a school labeled as A and three other landmarks B, C and D. Given that D is due north of B,  $AD = 4$  km,  $BC = 5$  km,  $\angle BAD = 60^\circ$  and  $\angle CBD = 102^\circ$ , calculate



- (a) the bearing of A from D, [1]
- (b) distance between B and D, [2]
- (c) distance between C and D, [2]
- (d) the bearing of D from C, [3]
- (e) the shortest distance from B to CD, [1]
- (f) A 9-storey HDB flat of height 950 m is located at B and X is the highest point on the flat. Calculate the greatest angle of elevation of X when viewed from a point on CD. [1]

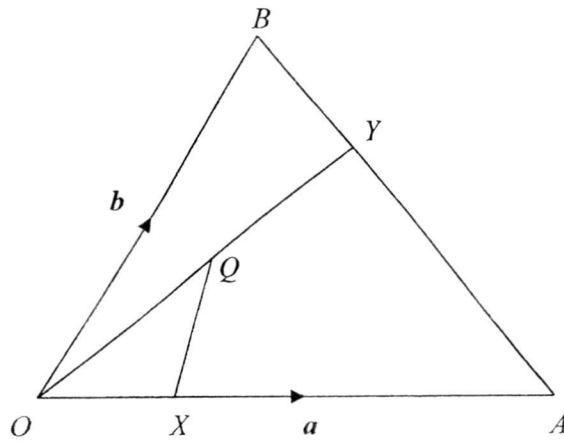
7 (a) The position vectors of  $A, B, C$  and  $D$  are  $\mathbf{a} = \begin{pmatrix} -1 \\ 6 \end{pmatrix}$ ,  $\mathbf{b} = \begin{pmatrix} 3 \\ -6 \end{pmatrix}$ ,  $\mathbf{c} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$  and

$\mathbf{d} = \begin{pmatrix} p \\ 1 \end{pmatrix}$  respectively whereby  $AB \parallel CD$ .

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

(ii) Hence, find the value of  $|\overline{AD}|$ . [2]

(b) In the diagram,  $X$  and  $Y$  are points on  $OA$  and  $AB$  respectively such that  $XA = 3OX$  and  $AY = 2YB$ .  $Q$  is the midpoint of  $OY$ .



It is given that  $\overline{OA} = \mathbf{a}$  and  $\overline{OB} = \mathbf{b}$ .

Express, as simply as possible, in terms of  $\mathbf{a}$  and/ or  $\mathbf{b}$ ,

(i)  $\overline{YO}$ , [2]

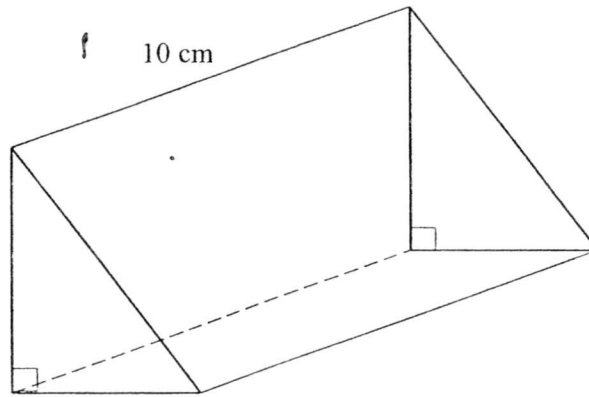
(ii)  $\overline{XQ}$ , [2]

(iii)  $\overline{XB}$ , [1]

(iv) Write down 2 facts about vectors  $\overline{XQ}$  and  $\overline{XB}$ . [2]

(v) Find the ratio of  $\frac{\Delta OXQ}{\Delta OQB}$ . [1]

- 8 The diagram shows a right-angled triangular prism. The perpendicular height of the right-angled triangle is 7 cm more than the base and is 1 cm less than the hypotenuse.



- (a) Given that the base of the triangle is  $x$  cm, write down an expression, in terms of  $x$ , for
- the perpendicular height, [1]
  - the hypotenuse. [1]
- (b) Write down an expression for the total surface area of the prism. [2]
- (c) Given that the total surface area is  $360 \text{ cm}^2$ , show that it simplifies to
- $$x^2 + 37x - 210 = 0. \quad [1]$$
- (d) Solve the equation  $x^2 + 37x - 210 = 0$ . [2]
- (e) Calculate the volume of the prism. [2]

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

The variables  $x$  and  $y$  are connected by the equation  $y = x + \frac{10}{x} - 4$ .

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

$x$	1	1.5	2	3	4	5	6	7	8
$y$	7	$a$	3	2.3	2.5	3	3.6	4.4	5.25

(a) Calculate the value of  $a$  correct to 2 decimal places. [1]

(b) Using a scale of 2 cm to represent 1 unit on both axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find the value of  $x$  when the gradient of the curve

$y = x + \frac{10}{x} - 4$  is equal to zero. [1]

(d) (i) On the same axes, draw the graph of the straight line  $y = 1 - x$ . [1]

(ii) Hence, use your graph to estimate the coordinates of the point Q on the curve where the gradient of the curve is  $-1$ . [1]

(e) By drawing a suitable straight line on the same axes, use your graph to find the

solutions of the equation  $\frac{1}{2}x + \frac{10}{x} - 7 = 0$ . [3]

10 A container contains 3 red marbles and equal number of blue and green marbles.

(a) Two marbles are drawn without replacement. If the probability of drawing both red marbles is  $\frac{1}{7}$ , calculate

(i) the total number of blue and green marbles in the container. [2]

(ii) the probability of getting different coloured marbles. [1]

(b) The following stem and leaf diagram shows the weight (kg) distribution of 16 Bowenians.

STEM	LEAF
4	5 7 9
5	1 5 5 7
6	0 1 6 7 8 9
7	1 1 6

Key : 4 | 5 means 45 kg

(i) Find the median and the interquartile range of the distribution. [3]

(ii) Find the mean and standard deviation of the weights. [3]

- 11 Three brands of rice are sold at Sheng Yong Supermarket in two locations, Bedok and Buangkok

The following tables show the price of each brand at each location.

The prices are given in dollars per carton of 5 kg.

Data is given for the months June and July of 2015.

Brand Location	June		July		
	Bedok	Buangkok	Bedok	Buangkok	
Golden Cockroach	12.30	12.35	Golden Cockroach	12.60	12.75
Loyal Umbrella	13.55	13.50	Loyal Umbrella	13.95	13.80
Crazy Family	14.20	14.55	Crazy Family	14.65	14.95

The information for June can be represented by the matrix  $M = \begin{pmatrix} 12.30 & 12.35 \\ 13.55 & 13.50 \\ 14.20 & 14.55 \end{pmatrix}$

The information for July is represented by a matrix N.

- (a) Write down the matrix N. [1]
- (b) Calculate  $N - M$ . [1]
- (c) Describe what is represented by the elements of  $(N - M)$ . [1]
- (d) Given that  $S = \begin{pmatrix} 1 & 1 & 1 \end{pmatrix}$ , calculate  $R = SM$ . [1]
- (e) Describe what is represented by the elements of R. [1]
- (f) Write down the matrix T such that the product NT will show the total cost, in dollars, of buying 10 kg of each brand at two locations in July. [1]
- (g) Calculate NT. [1]

End of Paper

**Answer Key**

1a	$3m^2n^3$	7ai	$p = 7$
b	$(3q + 1)(3q - 1)(q + p)$	ii	9.43
c	1/2	bi	$-\frac{1}{3}(a - 2b)$
di	$\frac{5x + 2}{x^2 - 1}$	ii	$\frac{1}{3}(-\frac{1}{4}a + b)$
ii	$x = 30.4 \text{ or } -0.292$	iii	$-\frac{1}{4}a + b$
		iv	1/3 1) $XB = 3XQ$ 2) X, Q, B lies on a straight line
2a	$h^2 + 8^2 = 30^2$ Thus $h = \sqrt{836}$ (Shown)	v	1: 2
b	$5014 \text{ cm}^3$	8a	$(x + 7) \text{ cm}$
c	$2223 \text{ cm}^2$	b	$(x + 8) \text{ cm}$
3a	$\angle PRQ = \angle QSP$ (Angle sin samesegment) $\angle RQS = \angle RPS$ (Angle sin samesegment) & $\angle RXQ = \angle PXS$ (vertoppangles) $\therefore \Delta RXQ$ is similar to $\Delta PXS$ (AAA)	c	$(x^2 + 37x + 150) \text{ am}^2$
bi	$91^\circ$	e	$300 \text{ cm}^2$
ii	$65^\circ$	9a	$a = 4.17$
iii	$26^\circ$	b	See Graph
iv	$39^\circ$	c	3.16
c	$8 \text{ cm}^2$	di	See Graph
4a		e	$y = \frac{1}{2}x + 3, x = 1.6$
aii	{6,10,14,18,22}	10ai	4
iii	3	ii	16/21
4bi	4.20 rad	bi	Median = 60.5, IQ = 15.5
ii	14.6 cm	ii	Mean = 60.5, SD = 9.29
iii	$143 \text{ cm}^2$		
5a	$y = -\frac{1}{2}x + 4$	11a	$\begin{pmatrix} 12.60 & 12.75 \\ 13.95 & 13.20 \\ 14.65 & 14.95 \end{pmatrix}$
b	(6, 0)	b	$\begin{pmatrix} 0.30 & 0.40 \\ 0.40 & 0.30 \\ 0.45 & 0.04 \end{pmatrix}$
c	$k = 6$	c	The increase in the price of different brand of rice over at the 2 locations in the 2 months
d	(0, 4)	d	(40.05 40.40)
e	$7 \text{ cm}^2$	e	Total price of one carton of 3 rice at each location in the month of June

6a	222°	g	( 50.70 ) ( 55.50 ) ( 59.20 )
b	3.54 km		
c	6.70 km		
d	313°		
e	2.58 km		
g	20.2°		

