

Name : _____

Class	Index Number

METHODIST GIRLS' SCHOOL

Founded in 1887



PRELIMINARY EXAMINATION Secondary 4

Wednesday

MATHEMATICS

4048/01

14 August 2019

Paper 1

2 hours

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

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

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

Answer **all** questions.

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

Omission of essential working will result in loss of marks.

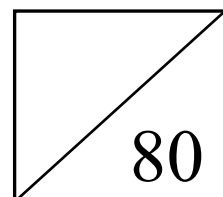
The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give your answer 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 80.



Mathematical Formulae*Compound Interest*

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

Mensuration

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

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

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

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

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

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

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

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 questionsFor
Examiner's
Use**1**

(a) Calculate $\frac{3.618^3}{\sqrt{24.75 - 1.593^2}}$.

Write down the first five digits on your calculator display.

Answer (a) [1]**(b)** Write down your answer to part **(a)** correct to 4 significant figures.*Answer (b)*[1]**2**

Solve the equation $\frac{3x-5}{4} - \frac{x}{6} = 3$.

Answer[2]**3**

\$50000 is invested in an account which pays 1.5% per annum compounded half-yearly. Find the compound interest earned at the end of one-and a half year, giving your answer to the nearest cent.

Answer \$ [2]

4 Jane is travelling from Singapore to Malaysia.
In Singapore, the exchange rate is 1 Singapore dollar (S\$) = 3.027 Malaysian Ringgit (RM).
In Malaysia, the exchange rate is 1 Malaysian Ringgit (RM) = 0.3295 Singapore dollar (S\$).

Jane wants to change S\$1000 into Malaysia Ringgit.

Should she change in Singapore or Malaysia? Justify your answer.

Answer
..... [2]

5 (a) Express 3969 as a product of prime factors.

Answer (a) [1]

(b) p and q are **prime** numbers.

Find the values of p and q so that $3969 \times \frac{p}{q}$ is a perfect cube.

Answer(c) $p =$
 $q =$ [1]

(c) Written as a product of its prime factors, $3150 = 2 \times 3^2 \times 5^2 \times 7$.

Find the greatest integer that will divide both 3150 and 3969 exactly.

Answer (c) [1]

- 6 (a) Express $x^2 - 8x + 13$ in the form of $(x - a)^2 + b$.

Answer (a) [1]

- (b) Hence solve the equation $x^2 - 8x + 13 = 0$, giving your answers in two decimal places.

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

- 7 (a) Solve the equation $32^{2x-3} = \frac{1}{8}$.

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

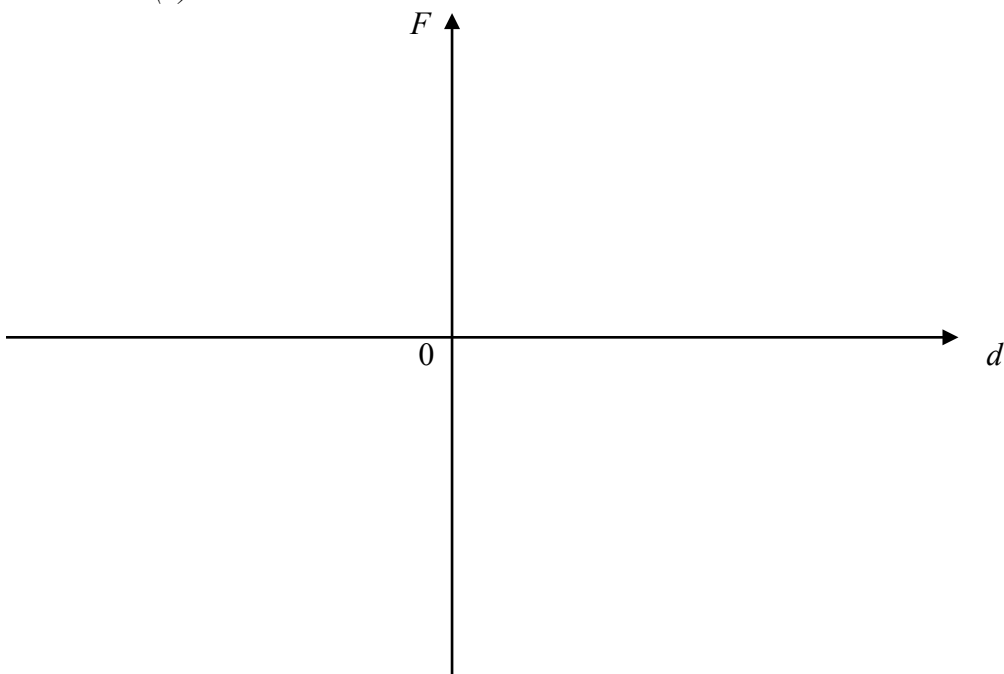
- (b) Simplify $\left(\frac{216x^3}{y^{12}}\right)^{\frac{1}{3}} \div \frac{(2xy)^2}{5y}$.

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

8 The force, F , between two object is inversely proportional to the square of distance, d , between them.

(a) Sketch the graph of F against d in the space below.

Answer (a)



[1]

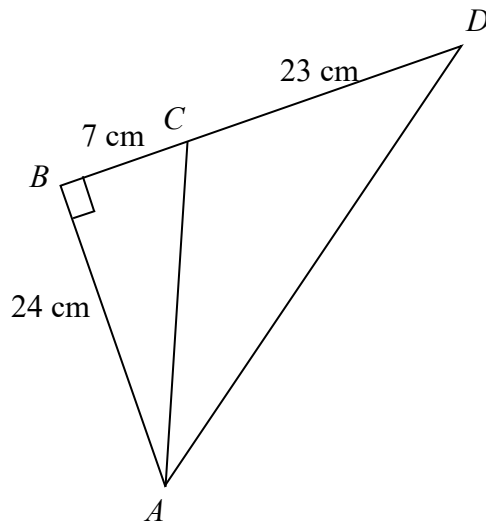
(b) It is given that $F = y$ for a particular value d . Express the value of F in terms of y when this value of d is halved.

Answer [2]

9

In the diagram, $AB = 24$ cm, $BC = 7$ cm, $CD = 23$ cm, angle $ABC = 90^\circ$ and BCD is a straight line.

For
Examiner's
Use



(a) Find AC .

Answer (a) cm [1]

(b) Giving each answer as a fraction in its simplest form, find

(i) $\tan \angle BDA$,

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

(ii) $\cos \angle ACD$

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

10 A café sells tea and coffee, each in small, regular or large cups.

The cost of a small cup of either drink is \$1.80, the cost of a regular cup is \$2.50 and the cost of a large cup is \$3.

The following table shows the numbers of cups of drinks sold during a period of five minutes.

	Small	Regular	Large
Tea	3	5	2
Coffee	4	6	2

Given that $\mathbf{P} = \begin{pmatrix} 3 & 5 & 2 \\ 4 & 6 & 2 \end{pmatrix}$ and $\mathbf{Q} = \begin{pmatrix} 1.80 \\ 2.50 \\ 3 \end{pmatrix}$,

(a) evaluate \mathbf{PQ} .

Answer (a) [1]

(b) Explain what the numbers in your answer to part **(a)** represent.

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

(c) Using the matrix product \mathbf{PQ} found in part **(a)** and another matrix, find the total amount of money which would be obtained from the sale of all drinks during the five-minute period.

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

11 A bag contains 5 identical balls numbered 1, 2, 3, 4 and 5.
Two balls are drawn at random, one after another, from the bag without replacement.

(a) Draw a possibility diagram to show the outcomes of the draw.

Answer (a) [1]

(b) Find, as a fraction in its simplest form, the probability that

(i) both balls have an odd number.

Answer (b)(i) [1]

(ii) the product of the numbers drawn is greater than 10.

Answer (b)(ii) [1]

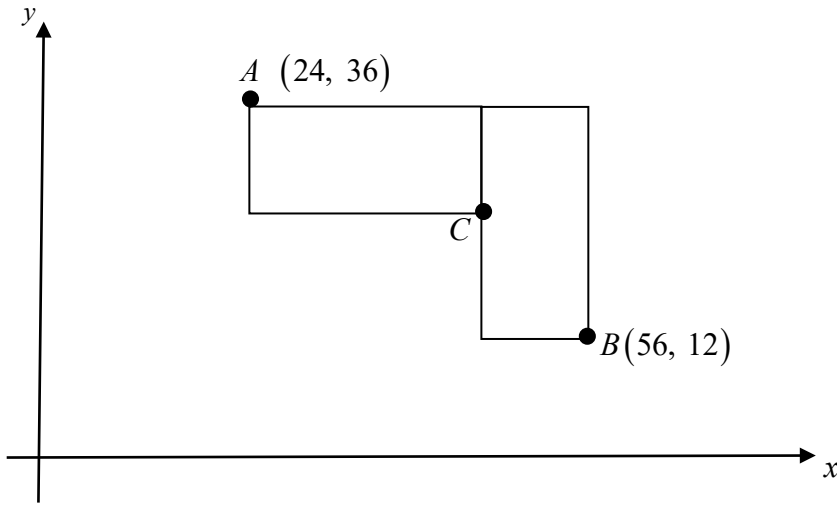
(iii) the sum of both numbers drawn is 10.

Answer (b)(iii) [1]

(c) Explain what the answer in (b) (iii) represents.

Answer (c) [1]

- 12** The diagram shows two congruent rectangles.
The sides are horizontal and vertical.
 A is the point $(24, 36)$ and B is the point $(56, 12)$.



Find,

- (a)** the length of AB .

Answer (a) units [1]

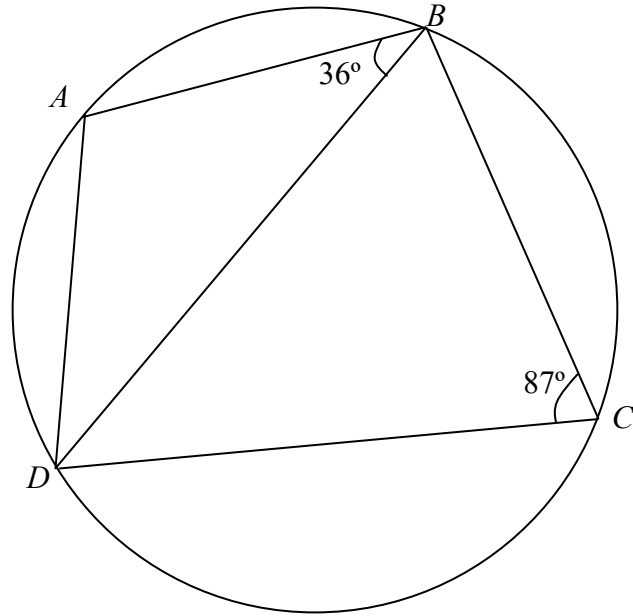
- (b)** the equation of line AB .

Answer (b) [1]

- (c)** the coordinates of C .

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

13 A, B, C and D are four points on a circle.



(a) Calculate, with reasons clearly stated,

(i) $\angle DAB$,

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

(ii) $\angle ACB$,

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

(b) Given also that $\angle DBC = 2 \angle BDC$ find $\angle BDC$.

Answer (b) $\angle BDC = \dots\dots\dots^\circ$ [2]

(c) Determine, with a reason, whether or not AC is a diameter of the circle.

Answer (c)

.....
.....[1]

14 $\vec{AB} = \begin{pmatrix} 7 \\ -3 \end{pmatrix}$ and $\vec{BC} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$.

(a) Calculate $|\vec{AB}|$.

Answer (a)units [1]

(b) Find \vec{AC} .

Answer (b) $\vec{AC} =$ [1]

(c) Given that the coordinates of C is $(10, 9)$, find the position vector of point A .

Answer (c) [2]

- 15** The table below shows the number of tourists visiting Singapore annually from 2014 to 2016.

Year	2014	2015	2016
Number of tourists (in millions)	15.10	15.23	16.40

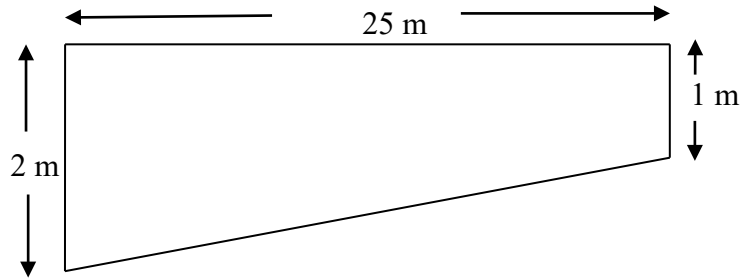
- (a)** Calculate the average number of tourists visiting Singapore daily in 2014. Express your answer in standard form and to a sensible degree of accuracy. You may assume that there are 365 days in a year.

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

- (b)** Calculate the percentage increase in the number of tourists visiting Singapore from 2015 to 2016.

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

- 16** The diagram shows the cross-section of a swimming pool. The pool is 25 metres long, 1 metre at the shallow end and 2 metres deep at the other end. The bottom slopes uniformly from one end to the other.
- Water is pumped into the pool, which is initially empty, at a constant rate.
- The time taken to fill the pool completely is 3 hours.



- (a)** Find the area of the cross-section of the pool.

Answer (a)m² [1]

- (b)** Find the time taken to fill the pool to a depth of 1 m at the deep end.

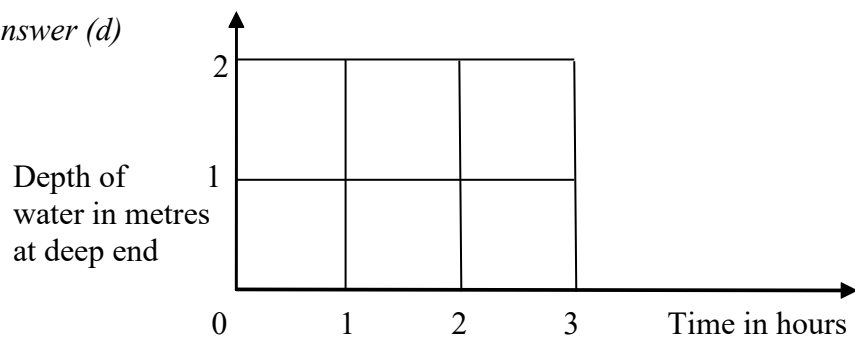
Answer (b) h [1]

- (c)** Find the depth of the water at the deep end after 2 hours.

Answer (c) m [1]

- (d)** On the axes in the answer space, draw a sketch graph to represent how the depth of water at the deep end of the pool changes with time.

Answer (d)

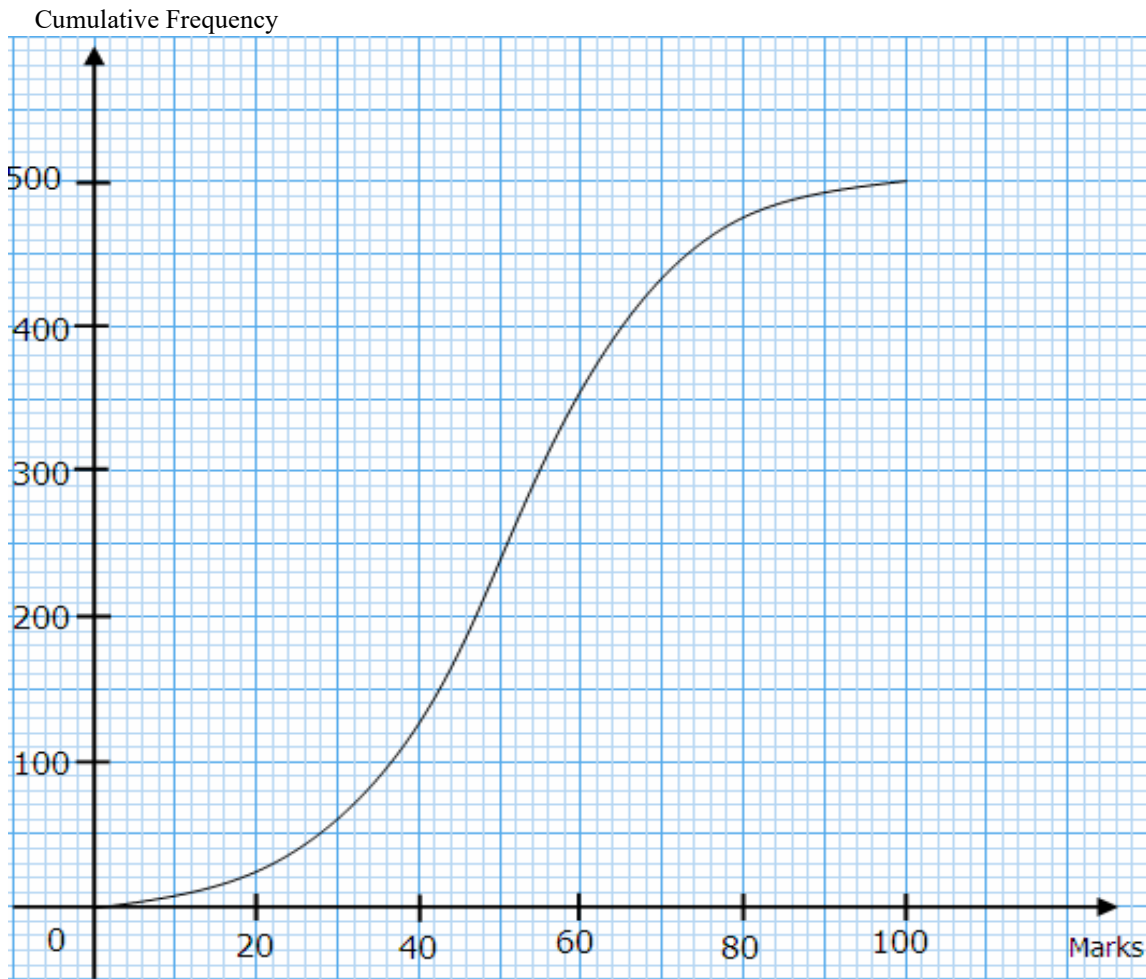


[1]

17

The marks scored by a group of 500 students in a Mathematics test are shown in the cumulative frequency curve below.

*For
Examiner's
Use*

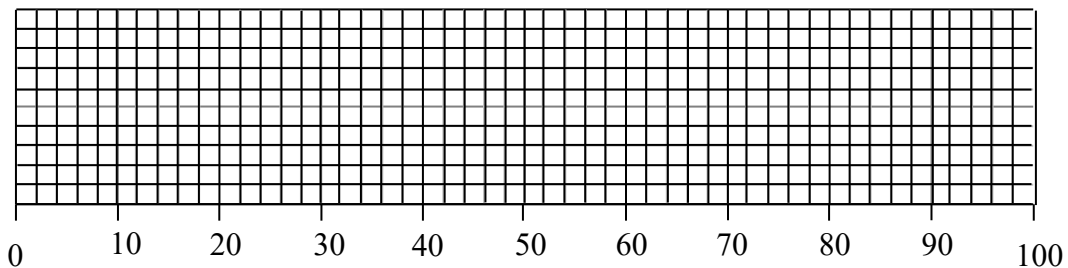


Showing your method clearly, use the graph to estimate the

(a) (i) lower quartile mark, *Answer (i)*..... [1]

(ii) 86th percentile. *Answer (ii)*..... [1]

(b) The same set of marks of the 500 students is to be presented in a box and whiskers. Draw the box and whiskers below to illustrate the data.



[2]

18

The diagram shows two geometrically similar jugs A and B .
Given that the base area of jug A and jug B is 16 cm^2 and 36 cm^2 respectively.



Jug A



Jug B

- (a) Find, in its simplest integer form, the ratio of the heights of jug A to jug B .

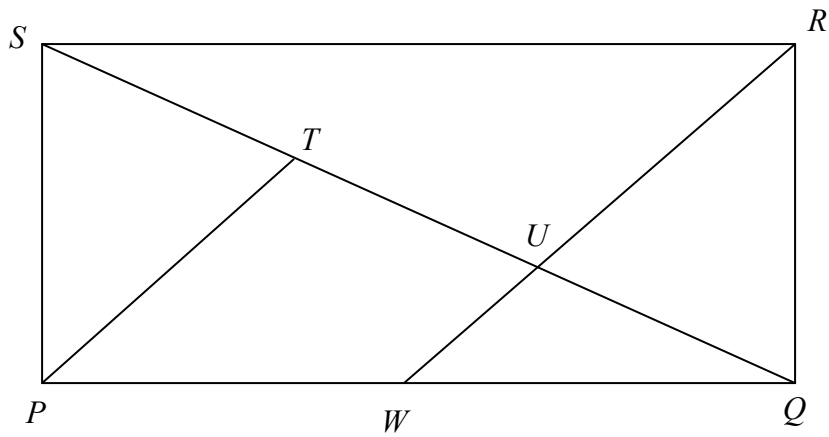
Answer (a) : [1]

- (b) The capacity of the larger jug is 5.4 litres.
Find the capacity of the smaller jug.
Give your answer in cubic centimetres.

Answer (b) cm^3 [1]

19 In the diagram, $PQRS$ is a rectangle and $ST = TU = QU$.

For
Examiner's
Use



(a) Prove that the triangles PST and RQU are congruent.

Answer (a) In ΔPST and ΔRQU ,.....

[2]

(b) Prove that the triangles of PTQ and WUQ are similar.

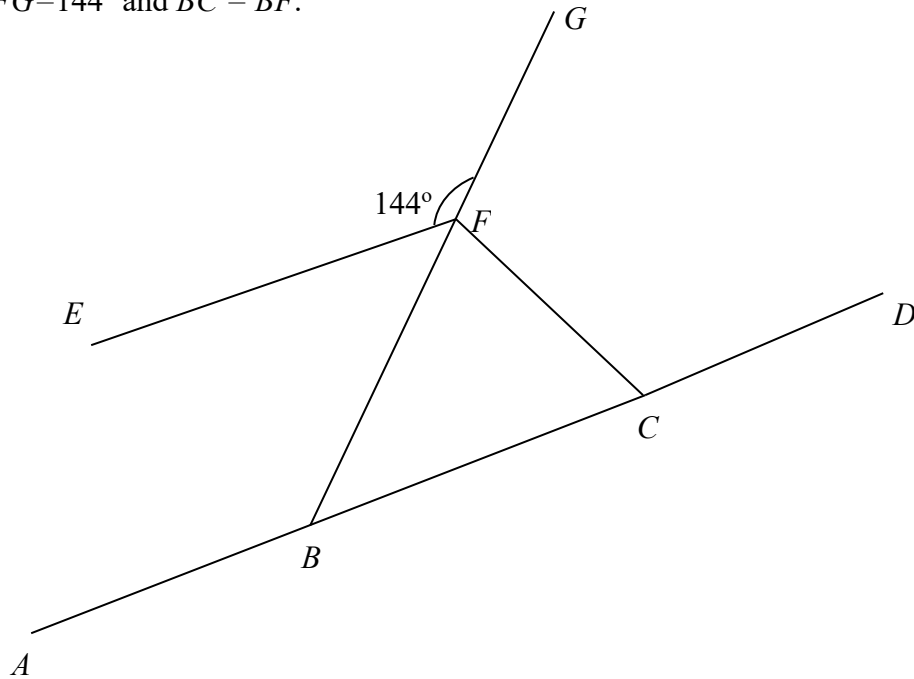
Answer (a) In ΔPTQ and ΔWUQ ,.....

[2]

(c) Find the ratio of area of ΔPTQ : area of ΔWUQ .

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

- 20** In the diagram, $ABCD$ and BFG are straight lines.
 CD , CF and FG are the sides of a regular pentagon.
 Angle $EFG=144^\circ$ and $BC = BF$.



- (a)** Calculate
(i) Angle FCD ,

Answer (a) (i) [1]

- (ii)** Angle FBC

Answer (a)(ii) [1]

- (iii)** Angle EFB

Answer(a)(iii) [1]

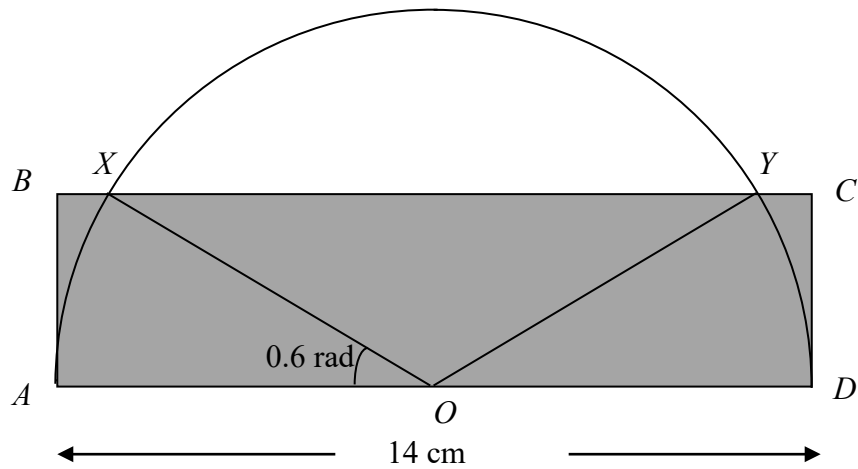
- (b)** State, showing your reason, whether AD is or is not parallel to EF .

Answer(b) AD parallel to EF because

.....

..... [1]

- 21 $ABCD$ is a rectangle and O is the midpoint of AD . A semicircle with diameter $AD = 14$ cm is drawn. The semicircle cuts the side BC at X and Y and $\angle AOX = 0.6$ radians.



Calculate

- (a) the length of the arc XY ,

Answer (a) cm [1]

- (b) the length of CD ,

Answer (b) cm [1]

- (c) the **unshaded** area of the diagram,

Answer (c) cm^2 [2]

- (d) angle XOA in degrees .

Answer (d) $^\circ$ [1]

22 The diagram below is a scale drawing representing the positions of three points A, B, C of a playground in the shape of a quadrilateral $ABCD$.
In the drawing, 1 cm represents 2 km.

(a) Express the scale in the form 1 : n .

Answer (a) 1 : [1]

(b) Find the bearing of B from C .

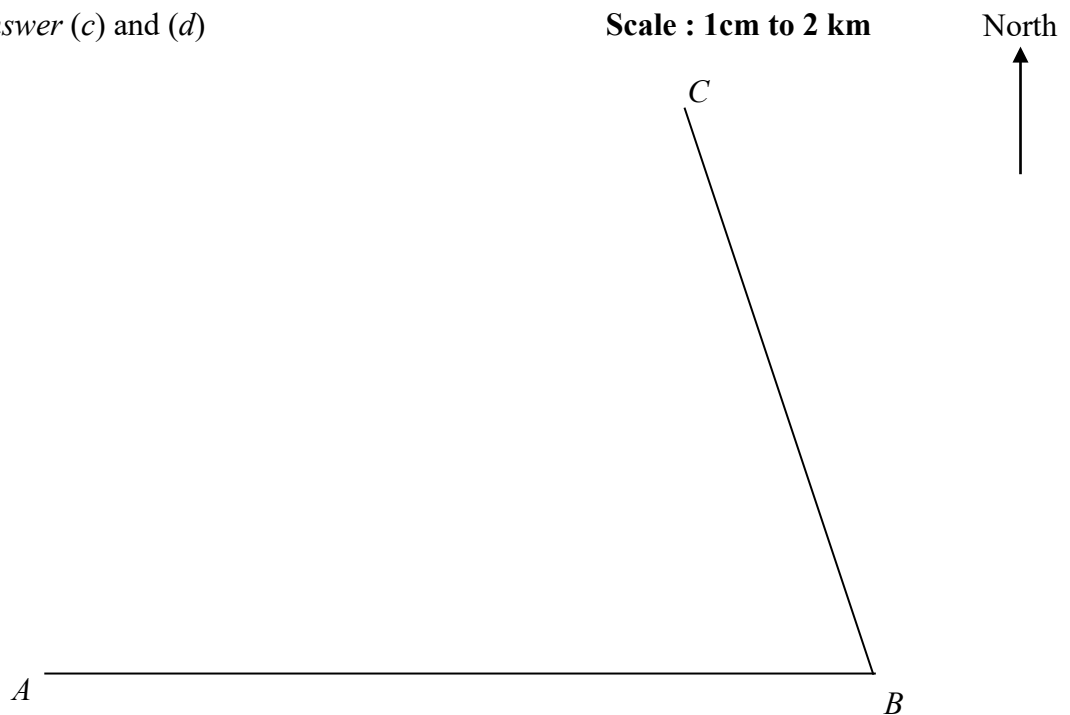
Answer (b)^o [1]

(c) A fourth point, D is on the same side of AB as C . It is 12 km from A and 18 km from B .
Using ruler and compasses only, construct the quadrilateral $ABCD$.

(d) A swing, S , is to be situated, inside the quadrilateral $ABCD$, such that it is
I equidistant from A and B ,
II equidistant from BA and BC .

By constructing a perpendicular bisector and an angle bisector, find and label the position of S .

Answer (c) and (d)



[4]

----- THE END -----

METHODIST GIRLS' SCHOOL

Founded in 1887



PRELIMINARY EXAMINATION Secondary 4

Wednesday

MATHEMATICS

4048/01

14 August 2019

Paper 1

2 hours

Write your Centre number, index number and name at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

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

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

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

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

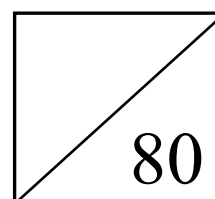
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give your answer in degrees to one decimal place.

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 80.



Compound Interest

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

Mensuration

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

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

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

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

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

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

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

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 questionsFor
Examiner's
Use

1 (a) Calculate $\frac{3.618^3}{\sqrt{24.75-1.593^2}}$.

Write down the first five digits on your calculator display.

10.048

Answer (a) [1]

(b) Write down your answer to part (a) correct to 4 significant figures.

10.05

Answer (b) [1]

2 Solve the equation $\frac{3x-5}{4} - \frac{x}{6} = 3$.

$$\frac{3x-5}{4} - \frac{x}{6} = 3$$

$$3(3x-5) - 2x = 36$$

$$9x - 15 - 2x = 36$$

$$7x = 51$$

$$x = 7\frac{2}{7}$$

Answer $x = \dots 7\frac{2}{7} \dots [2]$

3 \$50000 is invested in an account which pays 1.5% per annum compound interest. Find the compound interest earned at the end of one and a half year, giving your answer to the nearest cent

$$\begin{aligned} \text{Compound Interest} &= \$ \left[50000 \left(1 + \frac{1.5\%}{2} \right)^3 - 50000 \right] \\ &= \$ 1133.46 \end{aligned}$$

Answer \$ 1133.46 [2]

4 Jane is travelling from Singapore to Malaysia.

In Singapore, the exchange rate is 1 Singapore dollar = 3.027 Malaysian Ringgit.
In Malaysia, the exchange rate is 1 Malaysian Ringgit = 0.3295 Singapore dollar.

Jane wants to change S\$1000 into Malaysia Ringgit.

Should she change in Singapore or Malaysia? Justify your answer.

In Singapore, Jane will get RM 3027

In Malaysia, Jane will get $RM \frac{1000}{0.3295} = RM 3034.90$

Difference = $RM(3034.90 - 3027) = RM 7.90$

Answer ..

Jane should change in Malaysia as she will get RM 7.90 more.

[2]

5 (a) Express 3969 as a product of prime factors.

$$\begin{array}{r}
 3 \overline{) 3969} \\
 \underline{3 1323} \\
 3 441 \\
 \underline{3 147} \\
 7 49 \\
 \underline{7 49} \\
 7
 \end{array}$$

Answer (a) $3^4 \times 7^2$ [1]

(b) p and q are **prime** numbers.

Find the values of p and q so that $3969 \times \frac{p}{q}$ is a perfect cube.

Answer(c) $p = \dots\dots\dots 7 \dots\dots\dots$

$q = \dots\dots 3 \dots\dots [1]$

(c) Written as a product of its prime factors, $3150 = 2 \times 3^2 \times 5^2 \times 7$.

Find the greatest integer that will divide both 3150 and 3969 exactly.

$$3^2 \times 7$$

Answer (c)63..... [1]

- 6 (a) Express $x^2 - 8x + 13$ in the form of $(x - a)^2 + b$.

$$\begin{aligned}x^2 - 8x + 13 &= x^2 - 8x + 4^2 - 4^2 + 13 \\ &= (x - 4)^2 - 3\end{aligned}$$

Answer (a) ... $(x - 4)^2 - 3$ [1]

- (b) Hence solve the equation $x^2 - 8x + 13 = 0$, giving your answers in two decimal places.

$$\begin{aligned}(x - 4)^2 - 3 &= 0 \\ x - 4 &= \pm\sqrt{3} = 0 \\ x &= 4 \pm \sqrt{3}\end{aligned}$$

Answer (b) $x =$ 5.73..... or2.27..... [2]

- 7 (a) Solve the equation $32^{2x-3} = \frac{1}{8}$.

$$\begin{aligned}32^{2x-3} &= \frac{1}{8} \\ 2^{5(2x-3)} &= 2^{-3} \\ 10x - 15 &= -3 \\ 10x &= 12 \\ x &= 1.2\end{aligned}$$

Answer (a)..... $x = 1.2$ [2]

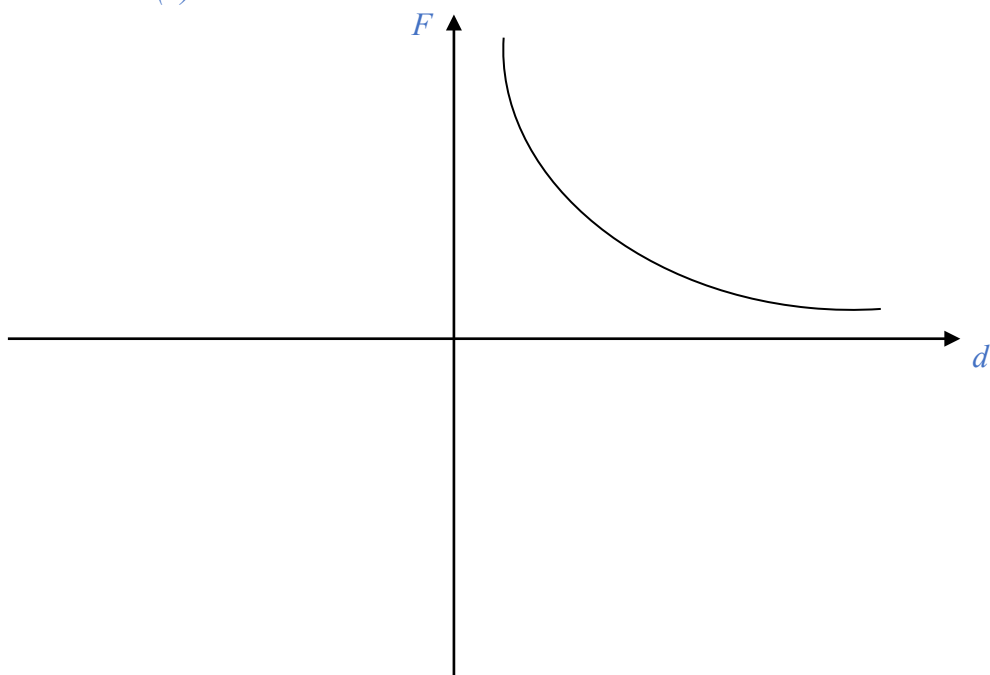
- (b) Simplify $\left(\frac{216x^3}{y^{12}}\right)^{\frac{1}{3}} \div \frac{(2xy)^2}{5y}$.

$$\begin{aligned}\left(\frac{216x^3}{y^{12}}\right)^{\frac{1}{3}} \div \frac{(2xy)^2}{5y} &= \left(\frac{6^3 x^3}{y^{12}}\right)^{\frac{1}{3}} \times \frac{5y}{4x^2 y^2} \\ &= \frac{y^4}{6x} \times \frac{5y}{4x^2 y^2} \\ &= \frac{5y^3}{24x^3}\end{aligned}$$

Answer (b)..... $\frac{5y^3}{24x^3}$ [2]

- 8 (a) The force, F , between two object is inversely proportional to then square of distance, d , between them
Sketch the graph of F against d in the space below.

Answer (a)



[1]

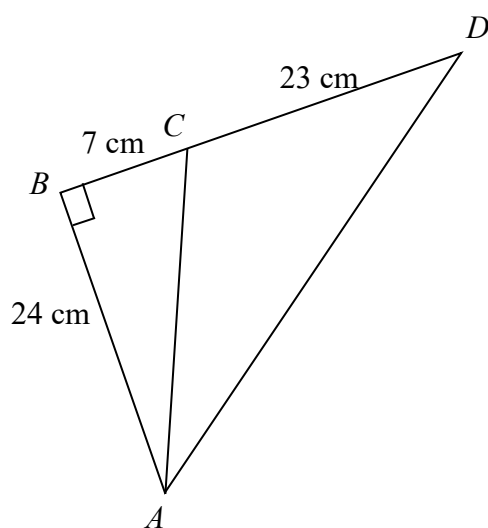
- (b) It is given that $F = y$ for a particular value d . Express the value of F in terms of y when this value of q is halved.

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

$$\begin{aligned} \text{New Force} &= \frac{k}{\left(\frac{1}{2}d\right)^2} \\ &= \frac{4k}{d^2} \\ &= 4y \end{aligned}$$

Answer ... 4y..... [2]

- 9 In the diagram, $AB = 24$ cm, $BC = 7$ cm, $CD = 23$ cm, angle $ABC = 90^\circ$ and BCD is a straight line.



- (a) Find AC .

$$\begin{aligned} AC &= \sqrt{24^2 + 7^2} \\ &= 25 \end{aligned}$$

Answer (a) $AD = \dots 25 \dots \dots \dots$ [1]

- (b) Giving each answer as a fraction in its simplest form, find

- (i) $\tan \angle BDA$,

$$\tan \angle BDA = \frac{24}{30}$$

Answer (b) (i) $\dots \frac{4}{5} \dots \dots \dots$ [1]

- (ii) $\cos \angle ACD$

$$\begin{aligned} \cos \angle ACD &= -\cos \angle ACB \\ &= -\frac{7}{25} \end{aligned}$$

$$-\frac{7}{25}$$

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

- 10 A café sells tea and coffee, each in small, regular or large cups.

The cost of a small cup of either drink is \$1.80, the cost of a regular cup is \$2.50 and the cost of a large cup is \$3.

The following table shows the numbers of cups of drinks sold during a period of five minutes.

	Small	Regular	Large
Tea	3	5	2
Coffee	4	6	2

Given that $\mathbf{P} = \begin{pmatrix} 3 & 5 & 2 \\ 4 & 6 & 2 \end{pmatrix}$ and $\mathbf{Q} = \begin{pmatrix} 1.80 \\ 2.50 \\ 3 \end{pmatrix}$,

- (a) evaluate \mathbf{PQ} .

$$\begin{pmatrix} 3 & 5 & 2 \\ 4 & 6 & 2 \end{pmatrix} \begin{pmatrix} 1.80 \\ 2.50 \\ 3 \end{pmatrix} = \begin{pmatrix} 23.9 \\ 28.2 \end{pmatrix}$$

$$\begin{pmatrix} 23.9 \\ 28.2 \end{pmatrix}$$

Answer (a) [1]

- (b) Explain what the numbers in your answer to part (a) represent.

Answer(b) The total amount collected from the sale of cups of tea and coffee during a period of 5 minutes respectively. [1]

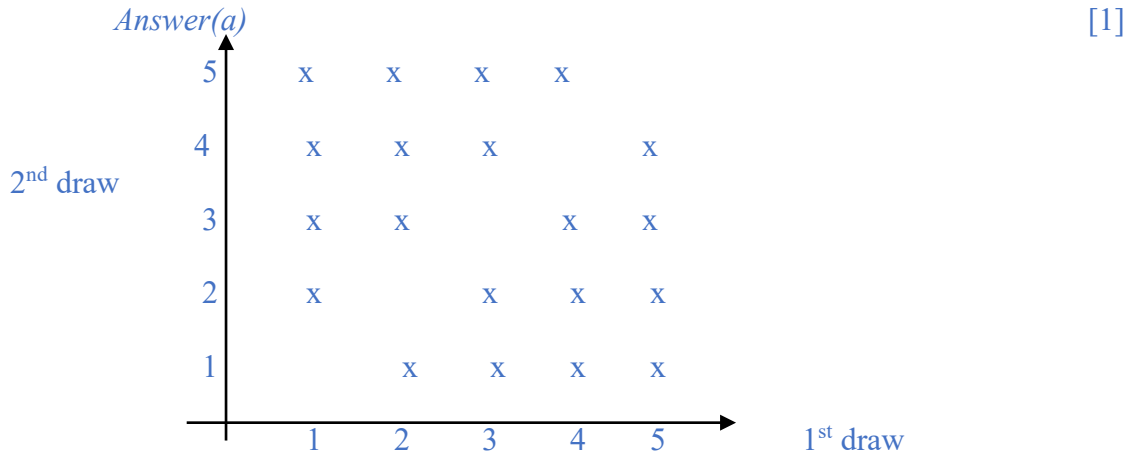
- (c) Using the matrix product \mathbf{PQ} found in part (a) and another matrix, find the total amount of money which would be obtained from the sale of all drinks during the five-minute period.

$$\begin{aligned} (1 \quad 1) \begin{pmatrix} 23.9 \\ 28.2 \end{pmatrix} &= (23.9 + 28.2) \\ &= (52.1) \end{aligned}$$

Answer (c) \$.....52.10..... [2]

11 A bag contains 5 identical balls numbered 1, 2, 3, 4 and 5.
Two balls are drawn at random, one after the other, from the bag without replacement.

(a) Draw a possibility diagram to show the outcomes of the draw.



(b) Find, as a fraction in its simplest form, the probability that

(i) both balls have an odd number.

$$\frac{6}{20}$$

$$\frac{3}{10}$$

Answer (b)(i) [1]

(ii) the product of the numbers drawn is greater than 10.

$$\frac{6}{20}$$

$$\frac{3}{10}$$

Answer(b) (ii) [1]

(iii) the sum of both numbers drawn is 10.

$$0$$

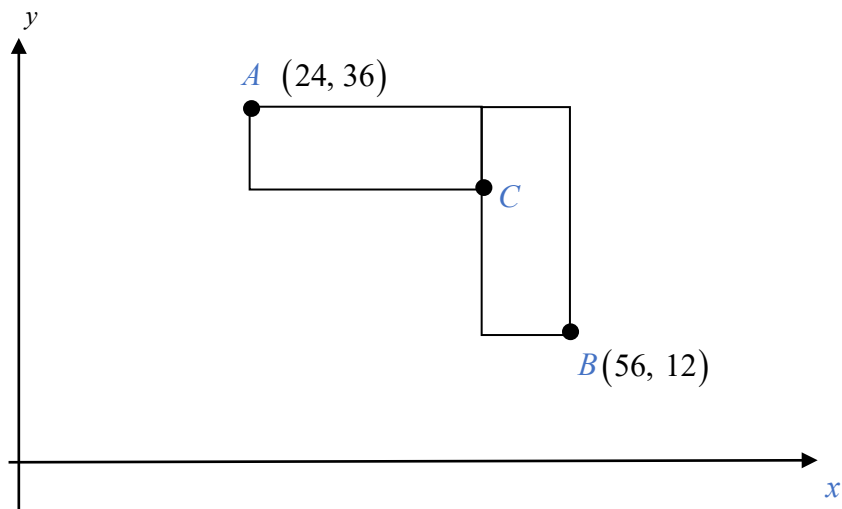
Answer (b)(iii) [1]

(c) Explain what the answer in (b) (iii) represents.

Answer (c) It is an impossible event.

..... [1]

- 12** The diagram shows two congruent rectangles.
The sides are horizontal and vertical.
 A is the point $(24, 36)$ and B is the point $(56, 12)$.



Find,

- (a) the length of AB .

$$AB = \sqrt{(56-24)^2 + (12-36)^2}$$

$$= 40$$

Answer (a)40..... [1]

- (b) the equation of line AB .

$$\text{Gradient of } AB = \frac{36-12}{24-56}$$

$$= -\frac{24}{32}$$

$$= -\frac{3}{4}$$

$$y-36 = -\frac{3}{4}(x-24)$$

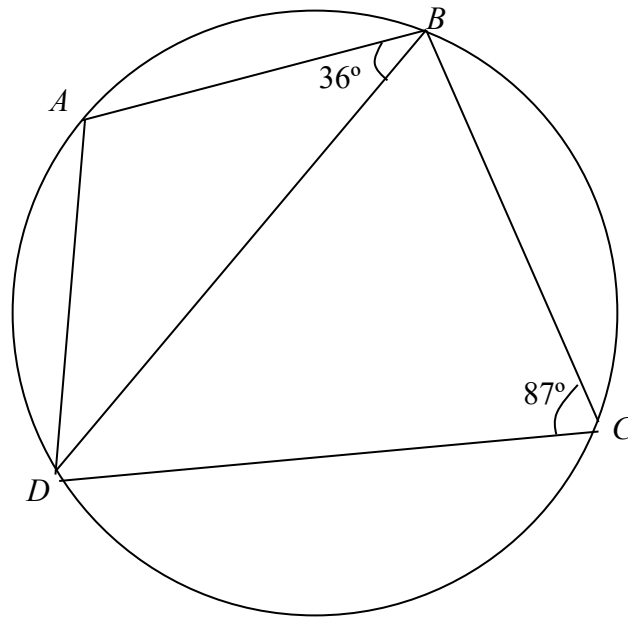
$$y = -\frac{3}{4}x + 54$$

Answer (b) $y = -\frac{3}{4}x + 54$ [1]

- (c) the coordinates of C .

Answer (c) (.....48.....,28.....) [2]

- 13 A, B, C and D are four points on a circle.



- (a) Calculate, with reasons clearly stated,

(i) $\angle DAB$,
 $\angle DAB = 180^\circ - 87^\circ$ (Angles in opposite segments)
 $= 93^\circ$

Answer (i) $\angle DAB = \dots 93^\circ \dots [1]$

- (ii) $\angle ACB$,

$\angle ACD = 36^\circ$ (Angles in the same segment)
 $\angle ACB = 87^\circ - 36^\circ$
 $= 51^\circ$

Answer (ii) $\angle ACB = \dots 51^\circ \dots [1]$

- (b) Given also that $\angle DBC = 2\angle BDC$ find $\angle BDC$.

Let $\angle BDC = x$

$x + 2x + 87^\circ = 180^\circ$ (Angle sum of triangle)

$3x = 93^\circ$

$x = 31^\circ$

Answer (b) $\angle BDC = \dots 31^\circ \dots [2]$

- (c) Determine, with a reason, whether or not AC is a diameter of the circle.

Answer (c) No as $\angle ABC = 36^\circ + 62^\circ = 98^\circ$ which is more than 90° . [1]

$$14 \quad \overline{AB} = \begin{pmatrix} 7 \\ -3 \end{pmatrix} \quad \text{and} \quad \overline{BC} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}.$$

(a) Calculate $|\overline{AB}|$.

$$\begin{aligned} |\overline{AB}| &= \sqrt{7^2 + (-3)^2} \\ &= \sqrt{49 + 9} \\ &= \sqrt{58} \end{aligned}$$

Answer (a)7.62.....units [1]

(b) Find \overline{AC} .

$$\overline{AC} = \overline{AB} + \overline{BC}$$

Answer (b) $\overline{AC} = \begin{pmatrix} 12 \\ 5 \end{pmatrix}$ [2]

(c) Given that the coordinates of C is (10, 9), find the position vector of point A.

$$\begin{aligned} \overline{OA} + \overline{AC} &= \overline{OC} \\ \overline{OA} &= \overline{OC} - \overline{AC} \\ &= \begin{pmatrix} 10 \\ 9 \end{pmatrix} - \begin{pmatrix} 12 \\ 5 \end{pmatrix} \\ &= \begin{pmatrix} -2 \\ 4 \end{pmatrix} \end{aligned}$$

Answer (c) ... $\begin{pmatrix} -2 \\ 4 \end{pmatrix}$ [1]

- 15** The table below shows the number of tourists visiting Singapore annually from 2014 to 2016.

Year	2014	2015	2016
Number of tourists (in millions)	15.10	15.23	16.40

- (a) Calculate the average number of tourists visiting Singapore daily in 2014.
Express your answer in standard form and to a sensible degree of accuracy.
You may assume that there are 365 days in a year.

- (a) Average daily number in 2014

$$\begin{aligned}
 &= \frac{15.10 \times 10^6}{365} && \text{M1} \\
 &= 4.14 \times 10^4 && \text{A 1 3 s.f. or 2 d.p.} \\
 \text{or } &= 4.1 \times 10^4 && \text{A 1 2 s.f. or 1 d.p.} \\
 &= 4 \times 10^4 && \text{A 1 1 s.f.}
 \end{aligned}$$

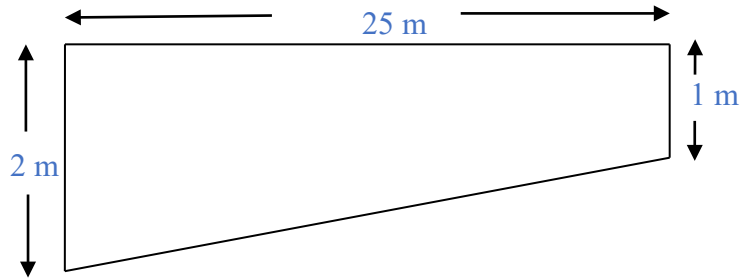
Answer (a) 4.1 × 10⁴ [2]

- (b) Calculate the percentage increase in the number of tourists visiting Singapore from 2015 to 2016.

$$\begin{aligned}
 \text{(b)} \quad \text{Percentage increase} &= \frac{16.4 - 15.23}{15.23} \times 100\% && \text{M1} \\
 &= 7.68\% \text{ (3 s.f.)} && \text{A1}
 \end{aligned}$$

Answer (b) 7.68% [2]

- 16** The diagram shows the cross-section of a swimming pool. The pool is 25 metres long, 1 metre at the shallow end and 2 metres deep at the other end. The bottom slopes uniformly from one end to the other.
- Water is pumped into the pool, which is initially empty, at a constant rate.
- The time taken to fill the pool completely is 3 hours.



- (a) Find the area of the cross-section of the pool.

Area of cross-section of pool = $\frac{1}{2}(1+2) \times 25 = 37.5 \text{ m}^2$

Answer (a) (ii)..... 37.5 m² [1]

- (b) Find the time taken to fill the pool to a depth of 1 m at the deep end.

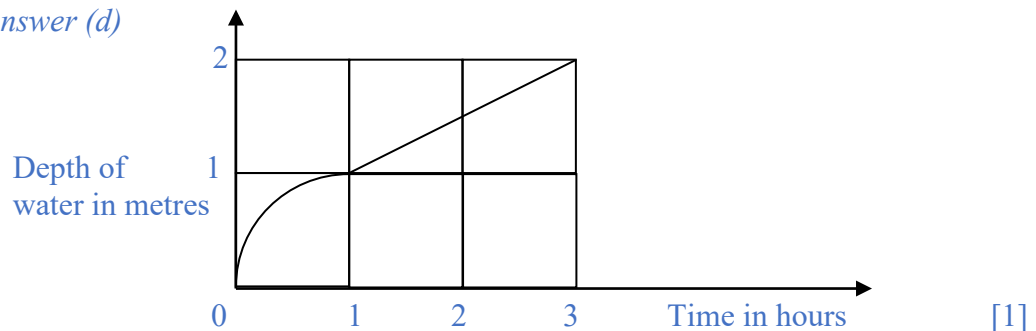
Answer (b) ...1..... h [1]

- (c) Find the depth of the water at the deep end after 2 hours.

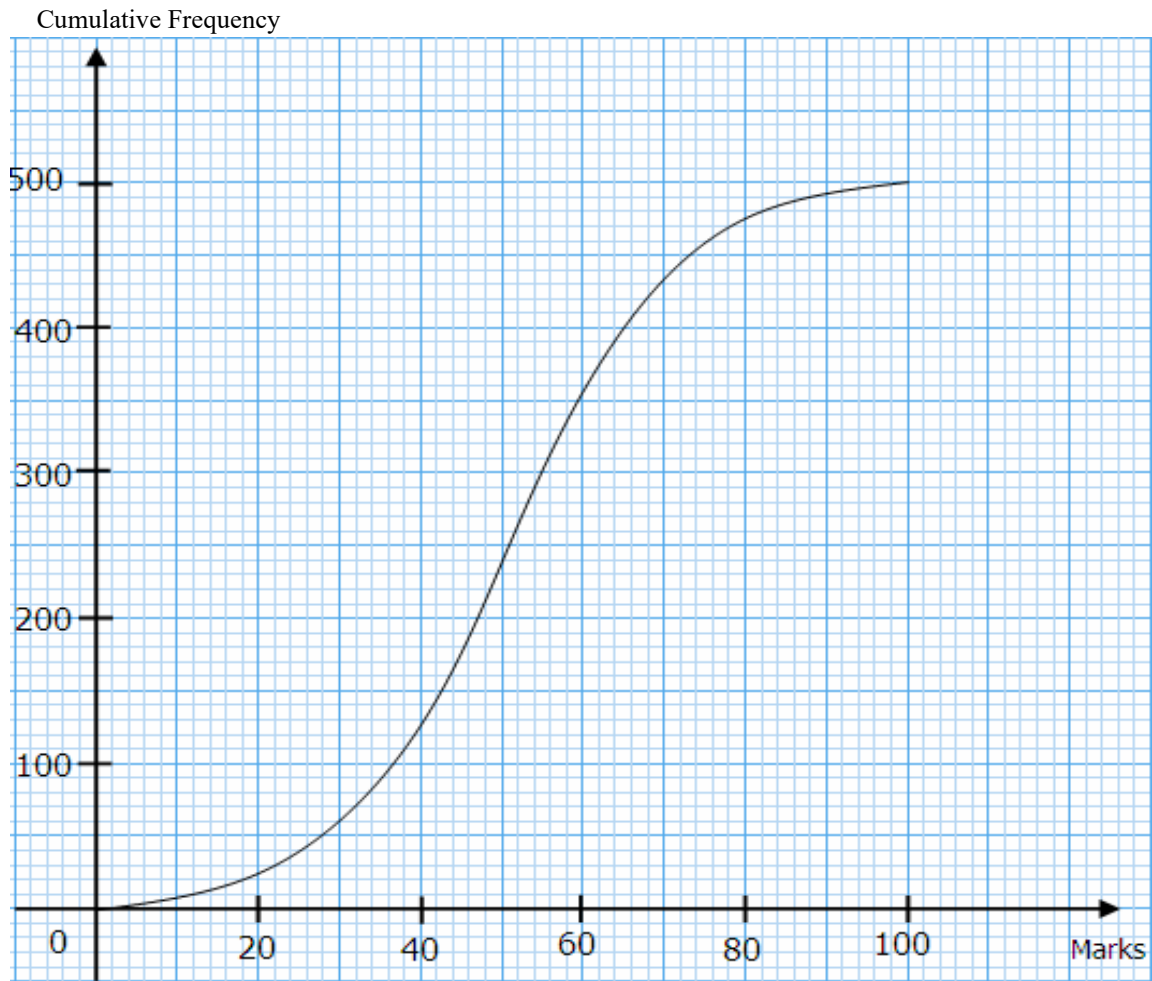
Answer (c) 1.5 m [1]

- (d) On the axes in the answer space, draw a sketch graph to represent how the depth of water at the deep end of the pool changes with time.

Answer (d)



- 17 The marks scored by a group of 500 students in a Mathematics test are shown in the cumulative frequency curve below.

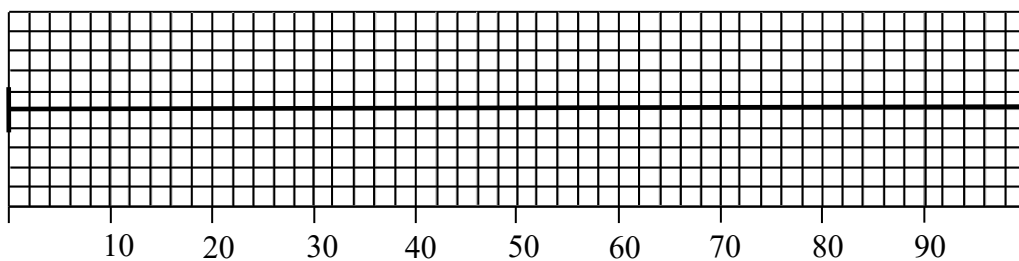


Showing your method clearly, use the graph to estimate the

(a) lower quartile mark, *Answer (a)*.....40..... [1]

(b) 86th percentile. *Answer (b)*.....70..... [1]

- (b) The same set of marks of the 500 students is to be presented in a box and whiskers. Draw the box and whiskers below to illustrate the data.



[2]

18

The diagram shows two geometrically similar jugs A and B .
Given that the base area of jug A and jug B is 16 cm^2 and 36 cm^2 respectively.



Jug A



Jug B

(a) Find, in its simplest integer form, the ratio of the heights of jug A to jug B .

$$\begin{aligned} \sqrt{16} &: \sqrt{36} \\ \text{Ratio of the heights of jug } A \text{ to jug } B &= 4:6 \\ &= 2:3 \end{aligned}$$

Answer (a)2..... : ...3..... [1]

(b) The capacity of the larger jug is 5.4 litres.

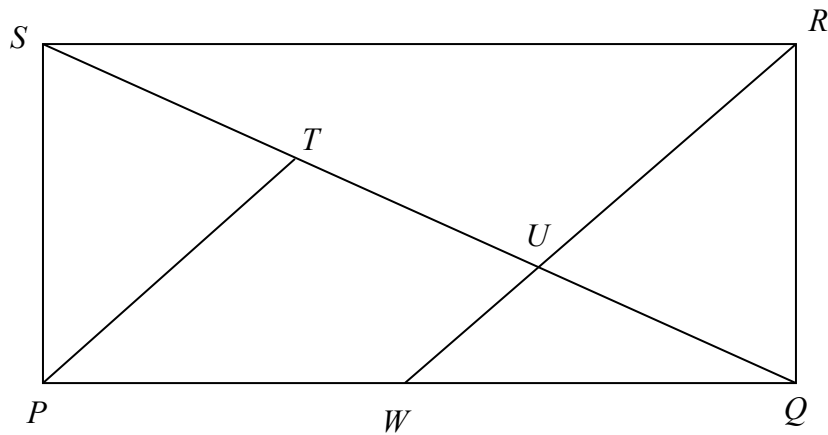
Find the capacity of the smaller jug.

Give your answer in cubic centimetres.

$$\begin{aligned} \text{Capacity of the smaller jug} &= \left(\frac{2}{3}\right)^3 \times 5.4l \\ &= 1.6l \\ &= 1600 \text{ cm}^3 \end{aligned}$$

Answer (b)1600..... cm³ [1]

- 19 In the diagram, $PQRS$ is a rectangle and $ST = TU = QU$.



- (a) Prove that the triangles PST and RQU are congruent.

Answer (a) In ΔPST and ΔRQU ,

$$PS = RQ \quad (\text{opposite sides of a rectangle})$$

$$\angle PST = \angle RUQ \quad (\text{alternate angles, } PS \text{ parallel to } QR)$$

$$ST = QU \quad (\text{given}) \quad [2]$$

$$\therefore \Delta PST \equiv \Delta RQU \quad (\text{SAS})$$

- (b) Prove that the triangles of PTQ and WUQ are similar.

Answer (a) In ΔPTQ and ΔWUQ ,

$$\angle PQT = \angle WQU \quad (\text{common angle})$$

$$\angle PTQ = 180^\circ - \angle PTS \quad (\text{adjacent angles on straight lines})$$

$$\angle WUQ = 180^\circ - \angle RUQ \quad (\text{adjacent angles on straight lines})$$

$$\therefore \angle PTQ = \angle WUQ \quad (\angle PTS = \angle RUQ \quad \text{from (a)})$$

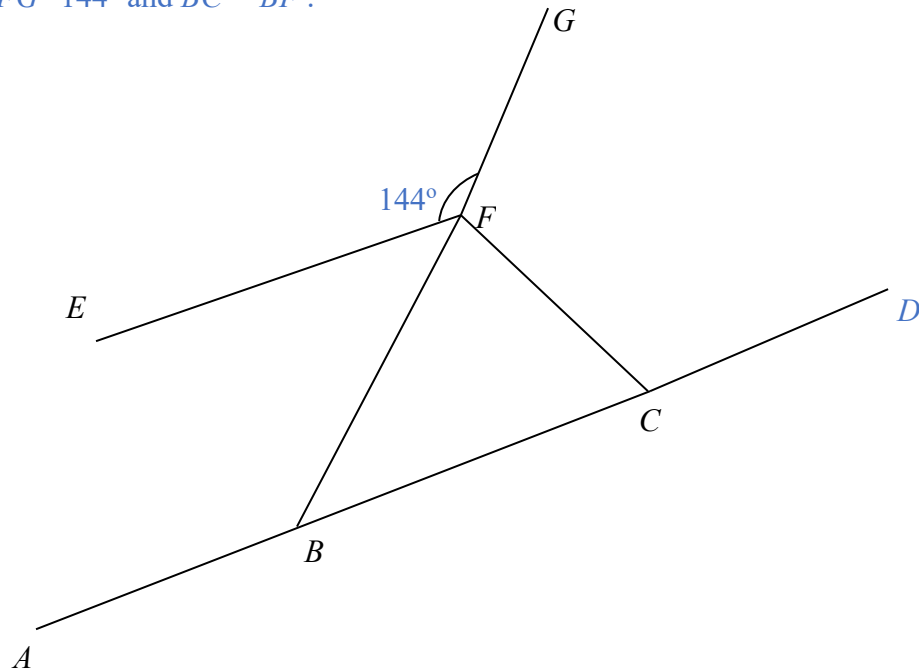
$$\therefore \Delta PTQ \text{ is similar to } \Delta WUQ$$

[2]

- (c) Find the ratio of area of ΔPTQ : area of ΔWUQ .

Answer (c).....4 : 1.....[1]

- 20 In the diagram, $ABCD$ and EF are straight lines.
 CD , CF and FG are the sides of a regular pentagon.
 Angle $EFG=144^\circ$ and $BC = BF$.



(a) Calculate

(i) Angle FCD ,

$$\angle FCD = \frac{(5-2)}{5} \times 180^\circ = 108^\circ$$

Answer (a) (i)108..... [1]

(ii) Angle FBC

$$\angle FBC = 180^\circ - 72^\circ - 72^\circ = 36^\circ$$

Answer (a)(ii)36..... [1]

(iii) Angle EFB

$$\angle EFB = 180^\circ - 144^\circ = 36^\circ$$

Answer(a)(iii)36..... [1]

(b) State, showing your reason, whether AD is or is not parallel to EF .

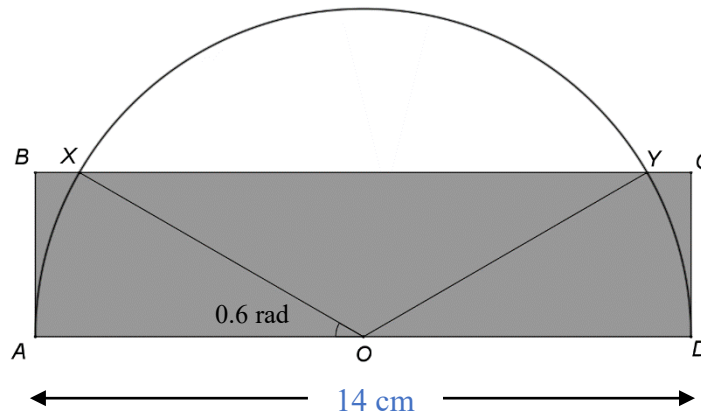
Answer(b) AD is..... parallel to EF because ... $\angle FBC = \angle EFB$
 Forming a pair of alternate angles.

..... [1]

21

$ABCD$ is a rectangle and O is the midpoint of AD . A semicircle with diameter $AD = 14$ cm is drawn. The semicircle cuts the side BC at X and Y and $\angle AOX = 0.6$ radians.

For
Examiner's
Use



Calculate

(a) the length of the arc XY ,

$$\angle XOY = \pi - 0.6 - 0.6 = 1.9416$$

$$\text{arc } XY = 7 \times 1.9416$$

Answer (a)13.6.....cm..... [1]

(b) the length of CD ,

$$\frac{CD}{7} = \sin 0.6$$

$$CD = 7 \times \sin 0.6$$

Answer (b)3.95 cm..... [1]

(c) the unshaded area of the diagram,

$$\text{Unshaded area} = \frac{1}{2}(7)^2 [(1.9416) - \sin(1.9416)]$$

Answer (c) ...24.7 cm²..... [2]

(d) angle XOA in degrees .

$$0.6 \times \frac{180^\circ}{\pi}$$

Answer (d)34.4°..... [1]

22 The diagram below is a scale drawing representing the positions of three points A, B, C of a playground in the shape of a quadrilateral $ABCD$.
In the drawing, 1 cm represents 2 km.

(a) Express the scale in the form 1 : n .

1 cm : 2 km

1 cm : $2 \times 1000 \times 100$ cm

1 : 200000

Answer (a) 1 :20000..... [1]

(b) Find the bearing of B from C .

Answer (b) $161^\circ \pm 1^\circ$ [1]

(c) A fourth point, D is on the same side of AB as C . It is 12 km from A and 18 km from B .
Using ruler and compasses only, construct the quadrilateral $ABCD$.

(d) A swing, S , is to be situated, inside the quadrilateral $ABCD$, such that it is

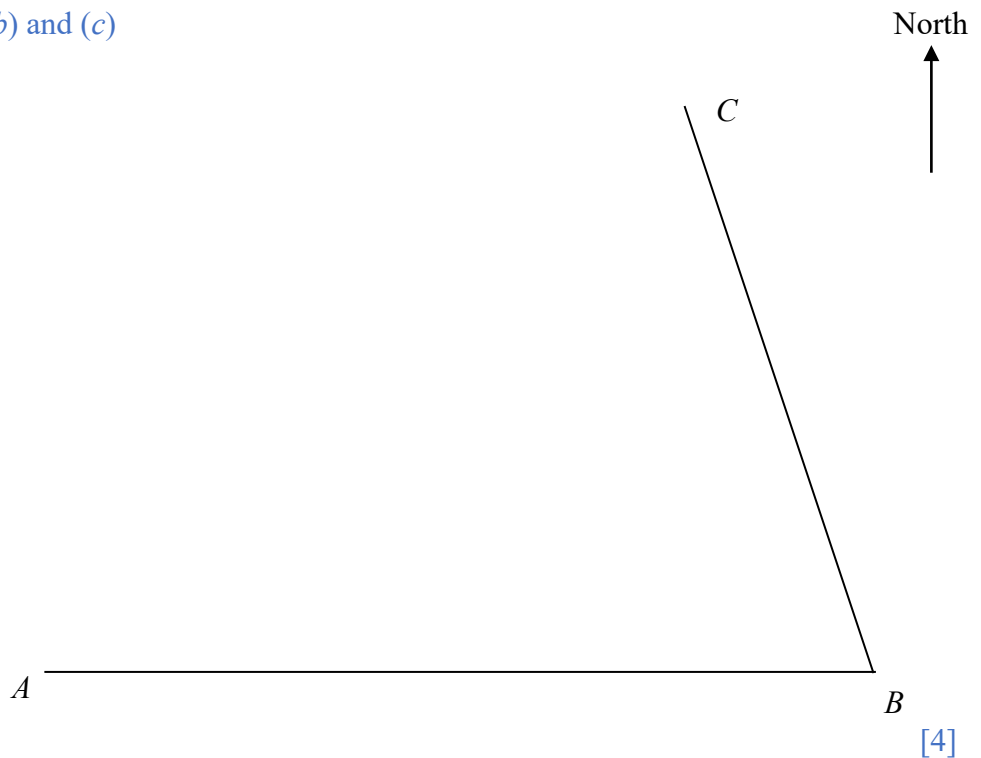
I equidistant from A and B ,

II equidistant from BA and BC .

By constructing a perpendicular bisector and an angle bisector, find and label the position of S .

Scale : 1 cm to 2 km

Answer (b) and (c)



BLANK PAPER