

Write your name here

Surname

Other names

**Edexcel**

**International GCSE**

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

# Mathematics A

**Paper 3H**



**Higher Tier**

Wednesday 11 January 2012 – Morning

**Time: 2 hours**

Paper Reference

**4MA0/3H**

**You must have:**

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.  
Anything you write on the formulae page will gain **NO** credit.

## Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ►

P40612A

©2012 Pearson Education Ltd.

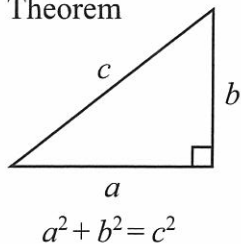
6/6/6/4/4



**PEARSON**

**International GCSE MATHEMATICS  
FORMULAE SHEET – HIGHER TIER**

Pythagoras' Theorem

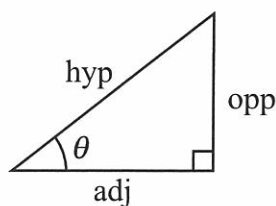
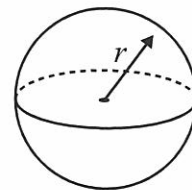
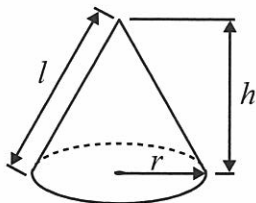


Volume of cone =  $\frac{1}{3} \pi r^2 h$

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

Curved surface area of cone =  $\pi r l$

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



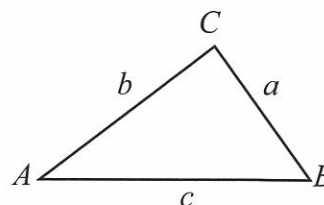
adj = hyp  $\times$  cos  $\theta$   
opp = hyp  $\times$  sin  $\theta$   
opp = adj  $\times$  tan  $\theta$

or  $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

$\cos \theta = \frac{\text{adj}}{\text{hyp}}$

$\tan \theta = \frac{\text{opp}}{\text{adj}}$

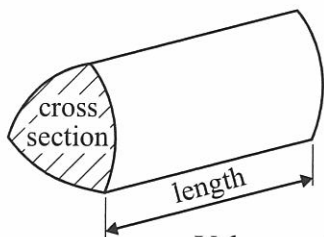
In any triangle ABC



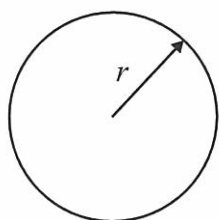
Sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



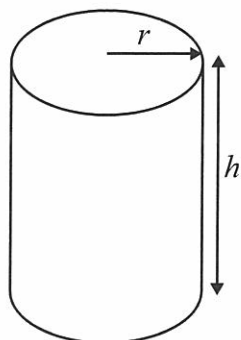
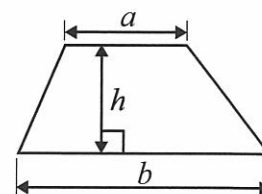
Volume of prism = area of cross section  $\times$  length



Circumference of circle =  $2 \pi r$

Area of circle =  $\pi r^2$

Area of a trapezium =  $\frac{1}{2} (a + b) h$



Volume of cylinder =  $\pi r^2 h$

Curved surface area of cylinder =  $2 \pi r h$

The Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



Answer ALL TWENTY ONE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 In January 2007 the population of Canada was 32 million.  
7 million of these Canadian people spoke French as their first language.

- (a) Express 7 million as a percentage of 32 million.  
Give your answer correct to 1 decimal place.

$$\frac{7 \times 10^6}{32 \times 10^6} \times 100 = \frac{7}{32} \times 100 = 21.9\% \text{ (1 d.p.)}$$

21.9  
..... %  
(2)

Between January 2007 and January 2009 the population of Canada increased by 4%.

- (b) Increase 32 million by 4%.  
Give your answer correct to the nearest million.

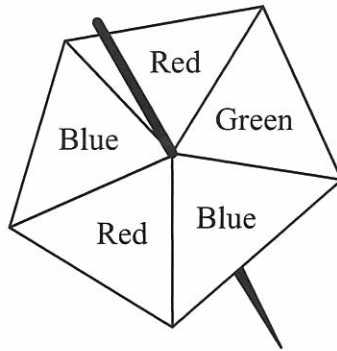
$$32,000,000 \times 1.04 = 33,280,000$$
$$= 33 \text{ million (to nearest million)}$$

33  
..... million  
(3)

(Total for Question 1 is 5 marks)



2 Here is a fair 5-sided spinner.



Hans spins the spinner 30 times.

Work out an estimate for the number of times the spinner lands on Red.

$$P(R) \times 30 = \frac{1}{5} \times 30 = \frac{30}{5} = 6$$

6

(Total for Question 2 is 2 marks)

3

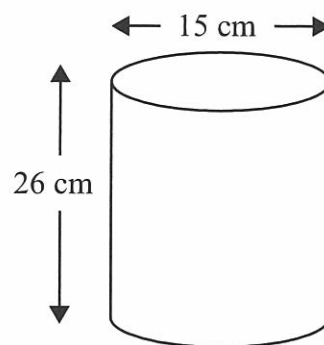


Diagram NOT accurately drawn

A cylinder has a diameter of 15 cm and a height of 26 cm.

Work out the volume of the cylinder.

Give your answer correct to 3 significant figures.

$$\begin{aligned} \text{Volume of cylinder} &= \pi r^2 h \\ &= \pi (7.5^2)(26) \\ &= 4,590 \text{ cm}^3 \text{ (3 s.f.)} \end{aligned}$$

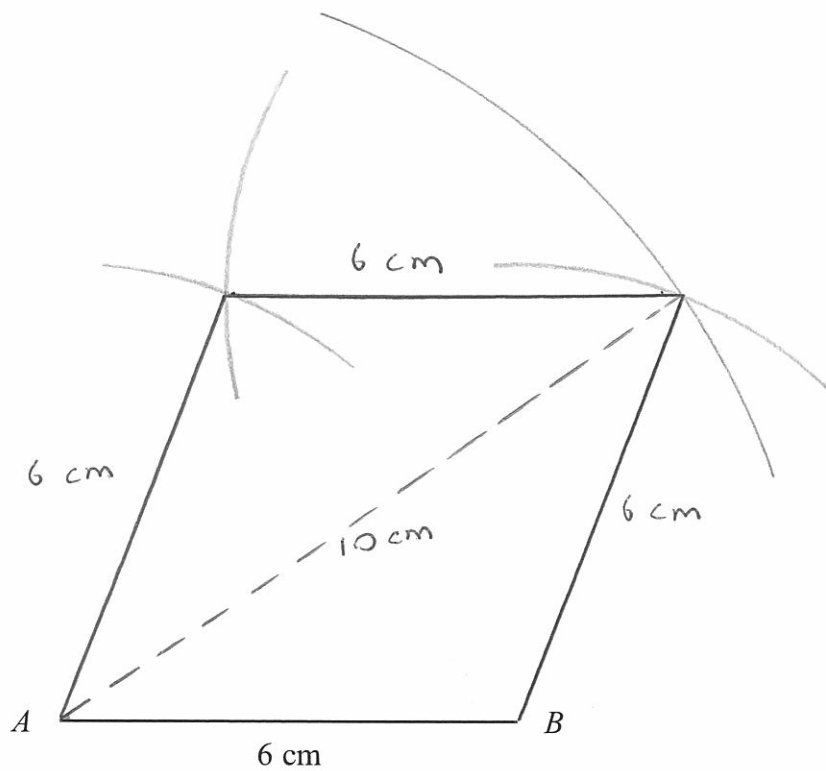
4,590 cm<sup>3</sup>

(Total for Question 3 is 3 marks)



- 4 The lengths of the sides of a rhombus are 6 cm.  
The length of the longer diagonal of the rhombus is 10 cm.  
 $AB$  is a side of the rhombus.

**Construct** an accurate, full-size drawing of the rhombus.  
You must show all construction lines.



(Total for Question 4 is 4 marks)



5 (a) Factorise  $5a - 3a^2$

$$\frac{a(5 - 3a)}{(2)}$$

(b) Expand

(i)  $2(4 - 3w)$

$$\frac{8 - 6w}{(2)}$$

(ii)  $y^2(y + 10)$

$$\frac{y^3 + 10y^2}{(3)}$$

(c)  $W = \frac{5.6a}{b^2}$

$a = 1.28$     $b = 0.8$

Work out the value of  $W$ .

$$W = \frac{5.6(1.28)}{0.8^2} = 11.2$$

$$W = \frac{11.2}{(2)}$$

(Total for Question 5 is 7 marks)



- 6 (a)  $\mathcal{E} = \{\text{Students in Year 12}\}$   
 $G = \{\text{Students who study German}\}$   
 $F = \{\text{Students who study French}\}$   
 $M = \{\text{Students who study Maths}\}$

(i)  $G \cap M = \emptyset$

Use this information to write a statement about the students who study German in Year 12

There are no students of German in Yr 12 who are also studying Maths.

- (ii) Preety is a student in Year 12  
 $\text{Preety} \notin F$ .

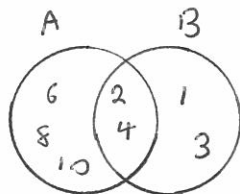
Use this information to write a statement about Preety.

Preety is not studying French.

(2)

- (b)  $A = \{2, 4, 6, 8, 10\}$   
 $A \cap B = \{2, 4\}$   
 $A \cup B = \{1, 2, 3, 4, 6, 8, 10\}$

List all the members of set  $B$ .



$$B = \{1, 2, 3, 4\}$$

(2)

(Total for Question 6 is 4 marks)

Do NOT write in this space.



- 7 The table shows information about the numbers of text messages sent by 40 teenagers in one day.

	$f$	$m$	$m \times f$
Number of text messages	Number of teenagers	Mid-interval value	Mid-interval value $\times$ No. of teenagers
0 to 2	3	1	3
3 to 5	6	4	24
6 to 8	10	7	70
9 to 11	15	10	150
12 to 14	5	13	65
15 to 17	1	16	16

- (a) Write down the modal class.

9 to 11

(1)

- (b) (i) Work out an estimate for the mean number of texts sent by the 40 teenagers in one day.

$$\frac{\sum m f}{\sum f} = \frac{328}{40} = 8.2$$

8.2

- (ii) Explain why your answer to part (b)(i) is an estimate.

The representation of this data in class intervals prevents us knowing the specific and exact no. of messages sent by each teenager.

(5)

(Total for Question 7 is 6 marks)





- 8 A bag contains 60 beads.  
 $x$  of the beads are red and the rest are green.  
 Altaaf takes at random a bead from the bag.

(a) State, in terms of  $x$ , the probability that Altaaf takes a red bead.

$$P(\text{Red}) = \frac{x}{60}$$

$$\frac{x}{60}$$

(1)

Altaaf puts his bead back in the bag.  
 Another 20 red beads are added to those in the bag.  
 The probability that Altaaf takes a red bead is now doubled.

- (b) (i) Use this information to write down an equation in  $x$   
 and show that your equation can be expressed as  $8x = 3(x + 20)$

$$2\left(\frac{x}{60}\right) = \frac{x + 20}{60 + 20}$$

$$\Rightarrow \frac{2x}{60} = \frac{x + 20}{80}$$

$$\Rightarrow 160x = 60(x + 20)$$

$$\Rightarrow 8x = 3(x + 20)$$

- (ii) Solve  $8x = 3(x + 20)$   
 Show your working clearly.

$$8x = 3x + 60$$

$$\Rightarrow 5x = 60$$

$$\Rightarrow x = \frac{60}{5} = 12$$

$$x = \frac{12}{\dots\dots\dots}$$

(5)

(Total for Question 8 is 6 marks)



9

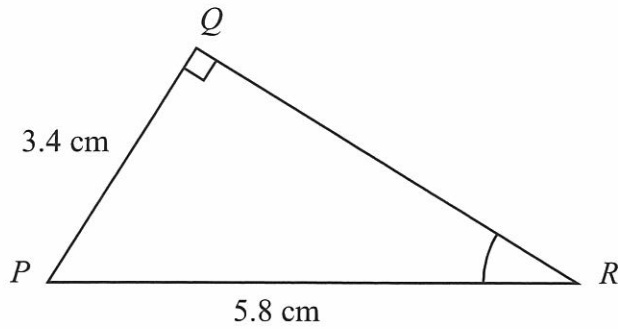


Diagram NOT  
accurately drawn

Triangle  $PQR$  has a right angle at  $Q$ .

$PQ = 3.4$  cm and  $PR = 5.8$  cm.

- (a) Work out the size of angle  $QRP$ .  
Give your answer correct to 1 decimal place.

$$\sin \theta = \frac{3.4}{5.8}$$

$$\Rightarrow \theta = \sin^{-1} \frac{3.4}{5.8} = 35.9^\circ \text{ (1 d.p.)}$$

.....  
35.9 °  
.....  
(3)

The length 5.8 cm, of  $PR$ , is correct to 2 significant figures.

- (b) (i) Write down the upper bound of the length of  $PR$ .

.....  
5.85 ..... cm

- (ii) Write down the lower bound of the length of  $PR$ .

.....  
5.75 ..... cm  
(2)

(Total for Question 9 is 5 marks)



- 10 A bank pays compound interest of 6% per annum on its savings accounts.  
Julia invests \$7500 for 3 years.

Calculate the total interest gained after 3 years.

$$7500 \times 1.06^3 = \$8,932.62$$

$$8932.62 - 7500 = \$1,432.62$$

ALTERNATIVELY,  $(1.06^3 - 1) \times 7500 = \$1,432.62$

$$\$ 1,432.62$$

(Total for Question 10 is 3 marks)

- 11 Make  $y$  the subject of  $3(y + 2x - 1) = x + 5y$

$$3y + 6x - 3 = x + 5y$$

$$\Rightarrow 5x - 3 = 2y$$

$$\Rightarrow y = \frac{5x - 3}{2}$$

$$y = \frac{5x - 3}{2}$$

(Total for Question 11 is 3 marks)



12  $ABCD$  and  $APQR$  are two similar quadrilaterals.

- $PQ = 9$  cm.  
 $BC = 6$  cm.  
 $AD = 5$  cm.  
 $QR = 12$  cm.

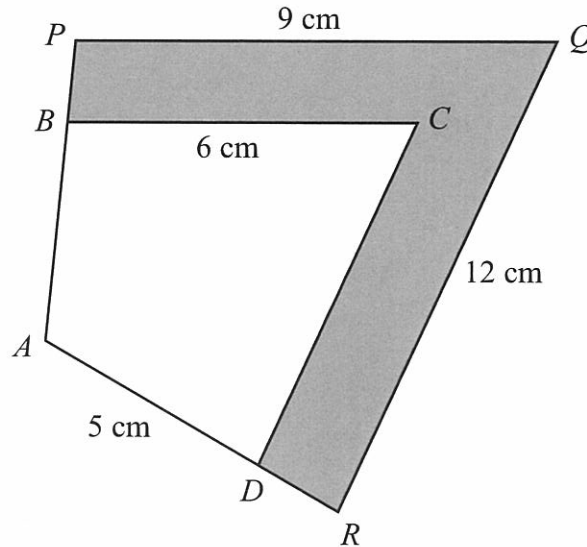


Diagram NOT accurately drawn

(a) Find the length of  $DC$ .

$$\frac{9}{6} = \frac{12}{DC}$$

$$\Rightarrow DC = \frac{12}{3/2} = 8 \text{ cm}$$

..... 8 ..... cm  
(2)

(b) Find the length of  $AR$ .

$$\frac{AR}{5} = \frac{3}{2}$$

$$\Rightarrow AR = \frac{3}{2} \times 5 = 7.5 \text{ cm}$$

..... 7.5 ..... cm  
(2)

The area of the quadrilateral  $ABCD$  is  $32 \text{ cm}^2$ .

(c) Calculate the area of the shaded region.

$$\text{Area of shaded region} = \text{Area of } APQR - \text{Area of } ABCD$$

$$= 32 \times \left(\frac{3}{2}\right)^2 - 32$$

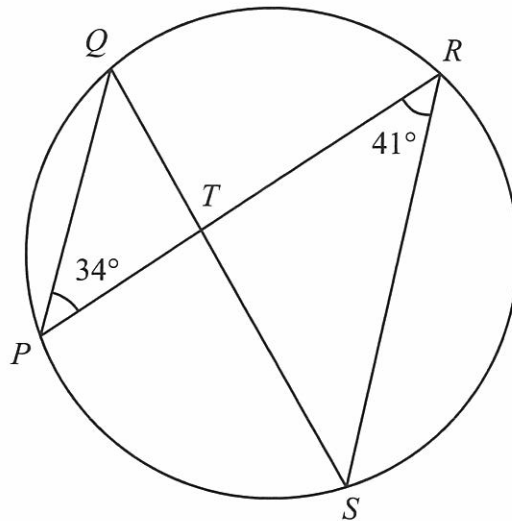
$$= 72 - 32 = 40 \text{ cm}^2$$

..... 40 .....  $\text{cm}^2$   
(3)

(Total for Question 12 is 7 marks)



13

Diagram NOT  
accurately drawn

$P, Q, R$  and  $S$  are points on the circumference of a circle.

$PR$  and  $QS$  intersect at  $T$ .

Angle  $QPR = 34^\circ$  and angle  $PRS = 41^\circ$

(a) (i) Find the size of angle  $PQS$ .

41 °

(ii) Give a reason for your answer.

Angles within the same segment subtended by the same arc are equal.

(2)

(b) (i) Find the size of angle  $PTS$ .

$$\begin{aligned} \hat{PTS} &= 180 - (180 - 34 - 41) \\ &= 34 + 41 \\ &= 75^\circ \end{aligned}$$

75 °

(ii) Explain why  $T$  cannot be the centre of the circle.

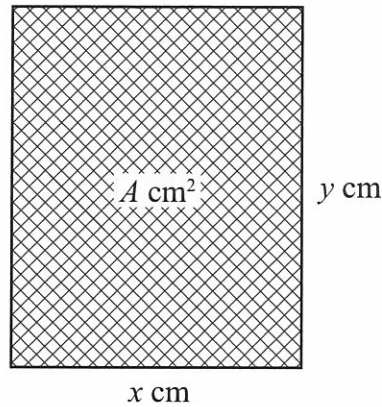
The angle subtended by an arc at the centre is always double the angle subtended at the circumference. Since angle  $\hat{PTS}$  is not  $82^\circ$ ,  $T$  cannot be the centre of the circle.

(2)

(Total for Question 13 is 4 marks)



14



The diagram shows a rectangular photo frame of area  $A \text{ cm}^2$ .  
 The width of the photo frame is  $x \text{ cm}$ .  
 The height of the photo frame is  $y \text{ cm}$ .  
 The perimeter of the photo frame is  $72 \text{ cm}$ .

(a) Show that  $A = 36x - x^2$

$$\text{Perimeter} = 72$$

$$\Rightarrow 2x + 2y = 72$$

$$\Rightarrow y = \frac{72 - 2x}{2} = 36 - x$$

$$\therefore \text{Area} = x(36 - x) = 36x - x^2$$

(3)

(b) Find  $\frac{dA}{dx}$

$$\frac{dA}{dx} = 36 - 2x$$

$$\frac{36 - 2x}{\dots}$$

(2)

(c) Find the maximum value of  $A$ .

$$\frac{dA}{dx} = 0$$

$$\Rightarrow 36 - 2x = 0$$

$$\Rightarrow x = \frac{36}{2} = 18 \text{ cm}$$

So maximum area occurs when  $x = 18 \text{ cm}$   
 & is given by  $A = 36(18) - 18^2 = 324 \text{ cm}^2$

$$A = \frac{324 \text{ cm}^2}{\dots}$$

(3)

(Total for Question 14 is 8 marks)



- 15 Two small magnets attract each other with a force,  $F$  newtons.  
 $F$  is inversely proportional to the square of the distance,  $d$  cm, between them.

When  $d = 2$ ,  $F = 12$

- (a) Express  $F$  in terms of  $d$ .

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

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

$$\Rightarrow 12 = \frac{k}{2^2}$$

$$k = 12 \times 4 = 48$$

$$\therefore F = \frac{48}{d^2}$$

$$F = \frac{48}{d^2}$$

---

(3)

- (b) Calculate the value of  $F$  when  $d = 5$

$$F = \frac{48}{5^2} = \frac{48}{25} = 1.92 \text{ N}$$

$$F = 1.92 \text{ newtons}$$

---

(1)

- (c) Calculate the value of  $d$  when  $F = 3$

$$3 = \frac{48}{d^2}$$

$$\Rightarrow d^2 = \frac{48}{3} = 16$$

$$\therefore d = \sqrt{16} = 4 \text{ cm}$$

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

---

(2)

(Total for Question 15 is 6 marks)



16 The incomplete table shows information about the times, in minutes, that runners took to complete a race.

Time ( $t$ minutes)	$30 \leq t < 35$	$35 \leq t < 40$	$40 \leq t < 50$	$50 \leq t < 60$	$60 \leq t < 80$
Number of runners	12	20	30	12	16

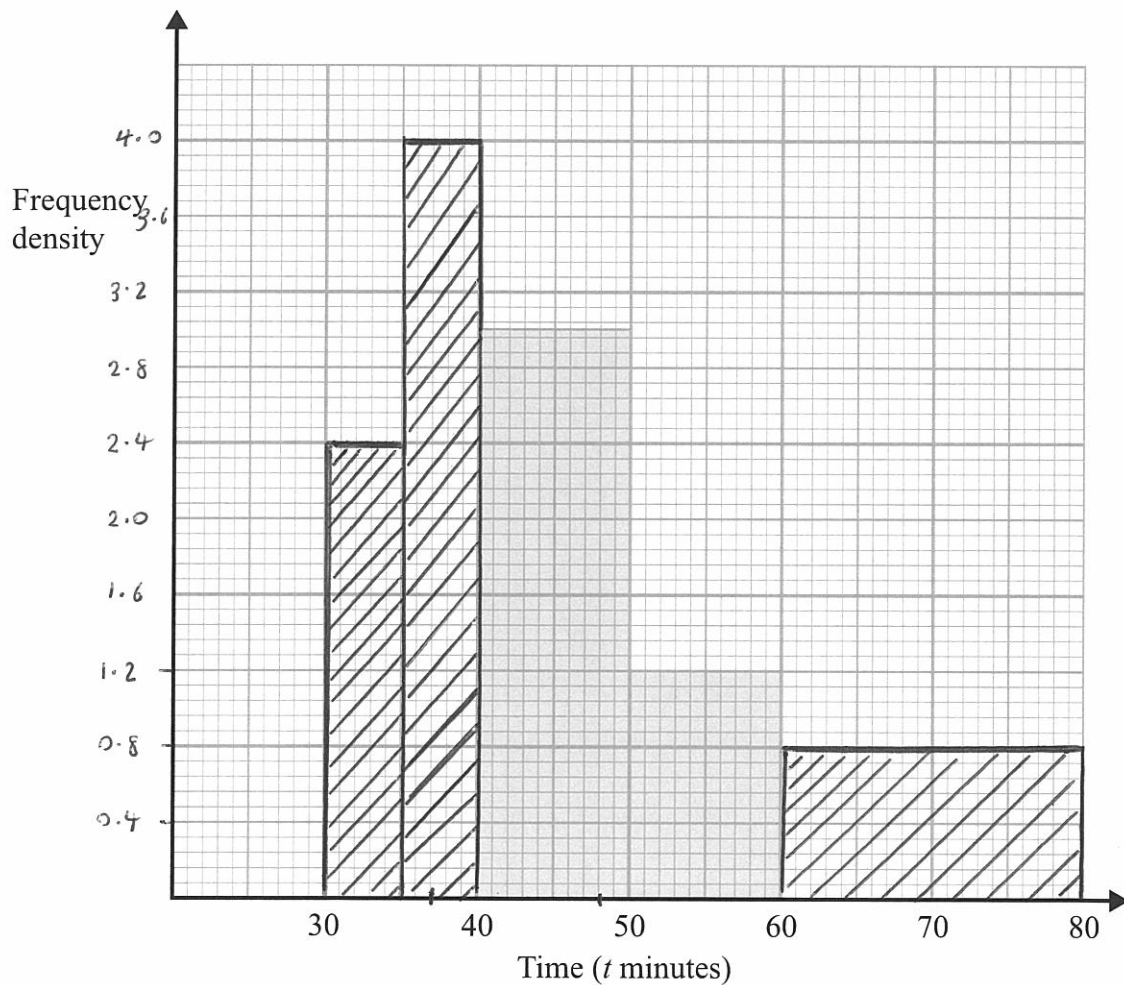
(a) Use the histogram to calculate the number of runners who took between 40 and 50 minutes to complete the race.

$$\text{Freq. Density} = \frac{\text{Freq.}}{\text{class width}}$$

30

(2)

(b) Complete the histogram for the remaining results.



(2)





Runners who achieved a time between 37 and 48 minutes to complete the race were each awarded a silver medal.

(c) Calculate an estimate of the number of runners awarded silver medals.

$$\begin{aligned} & (3 \times 4) + (8 \times 3) \\ &= 12 + 24 \\ &= 36 \end{aligned}$$

36

(2)

(Total for Question 16 is 6 marks)

17 Show that the recurring decimal  $0.1\dot{7} = \frac{8}{45}$

$$\text{Let } x = 0.1\dot{7}$$

$$\text{Then } 10x = 1.\dot{7} \text{ and } 100x = 17.\dot{7}$$

$$\Rightarrow 100x - 10x = 17.\dot{7} - 1.\dot{7} = 16$$

$$\Rightarrow 90x = 16$$

$$\therefore x = \frac{16}{90} = \frac{8}{45}$$

(Total for Question 17 is 2 marks)



18

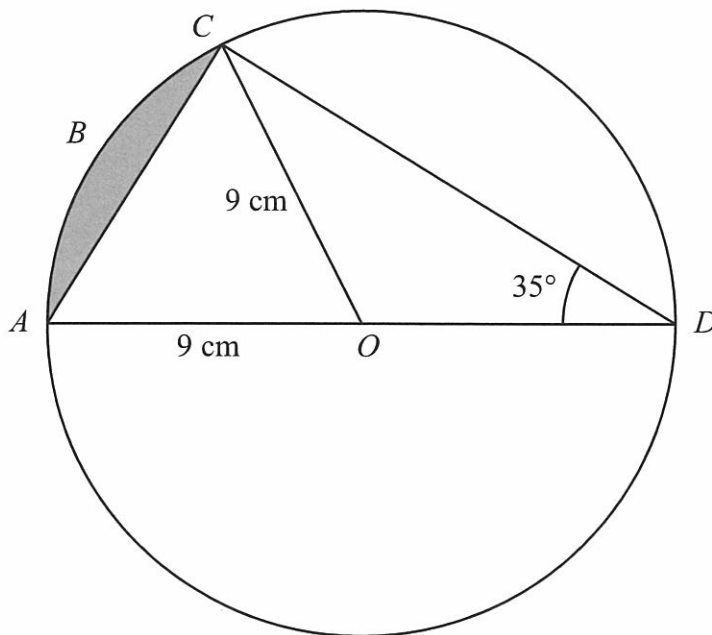


Diagram **NOT**  
accurately drawn

$AOD$  is a diameter of a circle, with centre  $O$  and radius  $9\text{ cm}$ .

$ABC$  is an arc of the circle.

$AC$  is a chord.

Angle  $ADC = 35^\circ$

Calculate the area of the shaded segment.

Give your answer correct to 3 significant figures.

$$\text{Angle } \hat{AOC} = 70^\circ \quad (\text{Double angle theorem in circle geometry})$$

$$\text{Area of shaded segment} = \text{Area of sector } AOC - \text{Area of triangle } AOC$$

$$= \frac{70}{360} \pi (9^2) - \frac{1}{2} (9)(9) \sin 70^\circ$$

$$= 11.4 \text{ cm}^2 \text{ (3 s.f.)}$$

..... 11.4 .....  $\text{cm}^2$

(Total for Question 18 is 6 marks)



19 Show that  $\frac{\sqrt{3} + \sqrt{27}}{\sqrt{2}}$  can be expressed in the form  $\sqrt{k}$  where  $k$  is an integer.

State the value of  $k$ .

$$\begin{aligned} \frac{\sqrt{3} + \sqrt{27}}{\sqrt{2}} &= \frac{\sqrt{3} + \sqrt{3 \cdot 9}}{\sqrt{2}} = \frac{\sqrt{3} + 3\sqrt{3}}{\sqrt{2}} = \frac{4\sqrt{3}}{\sqrt{2}} \\ &= \frac{4\sqrt{3} \cdot \sqrt{2}}{2} = 2\sqrt{3} \cdot \sqrt{2} = \sqrt{4 \cdot 3 \cdot 2} = \sqrt{24} \end{aligned}$$

$$\therefore k = 24$$

$$k = 24$$

(Total for Question 19 is 3 marks)

20 Simplify fully  $\frac{4}{x} + \frac{3}{2-x}$

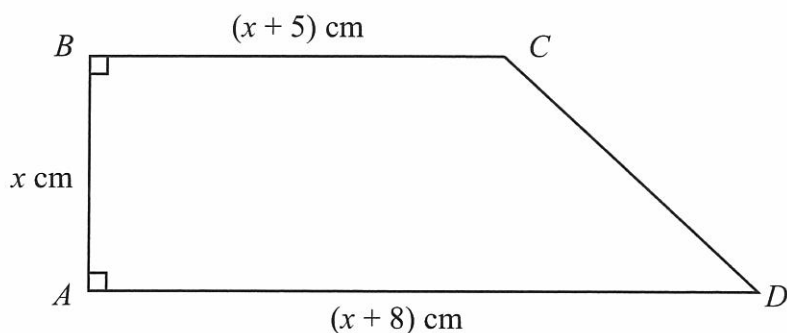
$$\frac{4(2-x) + 3x}{x(2-x)} = \frac{8-x}{2x-x^2}$$

$$\frac{8-x}{2x-x^2}$$

(Total for Question 20 is 3 marks)



21

Diagram NOT  
accurately drawn

The diagram shows a trapezium  $ABCD$  with  $AD$  parallel to  $BC$ .

$AB = x$  cm,  $BC = (x + 5)$  cm and  $AD = (x + 8)$  cm.

The area of the trapezium is  $42$  cm<sup>2</sup>.

(a) Show that  $2x^2 + 13x - 84 = 0$

$$\frac{1}{2} (x + 5 + x + 8) x = 42$$

$$\Rightarrow (2x + 13)x = 84$$

$$\Rightarrow 2x^2 + 13x - 84 = 0$$

(2)

(b) Calculate the perimeter of the trapezium.

Factorising  $2x^2 + 13x - 84 = 0$  gives

$$(2x + 21)(x - 4) = 0$$

$\Rightarrow x = 4$  since  $x$  must be positive.

When  $x = 4$ , perimeter,  $P$ , is given by:

$$P = 4 + 12 + 9 + \sqrt{3^2 + 4^2}$$

$$= 25 + 5 = 30 \text{ cm}$$

..... 30 ..... cm

(5)

(Total for Question 21 is 7 marks)

TOTAL FOR PAPER IS 100 MARKS

