Write your name here

Surname	Other names

Edexcel Certificate
Edexcel International GCSE

Centre Number

Candidate Number

Mathematics A

Paper 3H

Higher Tier

Friday 11 May 2012 – Afternoon **Time: 2 hours**	Paper Reference **4MA0/3H** **KMA0/3H**

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 ▶

P40660A

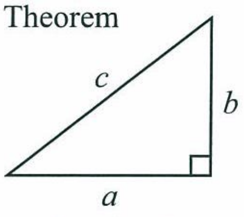
6/6/6/4/4/3

P 4 0 6 6 0 A 0 1 2 4

PEARSON

FORMULAE SHEET – HIGHER TIER

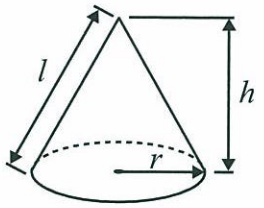
Pythagoras' Theorem



$a^2 + b^2 = c^2$

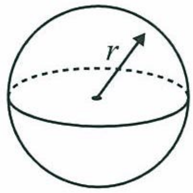
Volume of cone $= \frac{1}{3}\pi r^2 h$

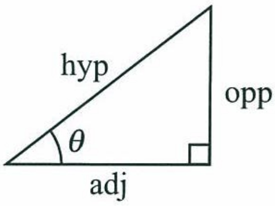
Curved surface area of cone $= \pi r l$



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

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





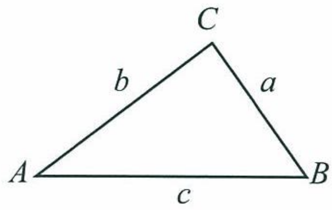
adj = hyp × cos θ
opp = hyp × sin θ
opp = adj × tan θ

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

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

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

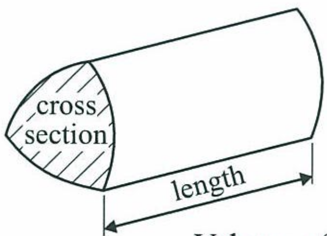
In any triangle ABC



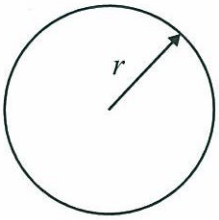
Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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



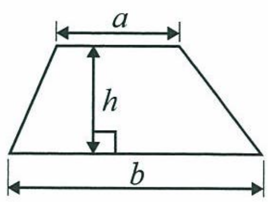
Volume of prism = area of cross section × length

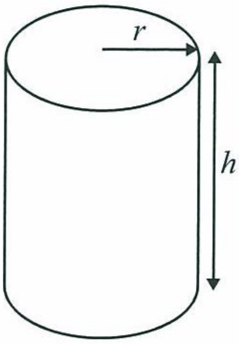


Circumference of circle $= 2\pi r$

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 (a) The length of an Airbus A300 aeroplane is 54 m.
The ratio of the length of this aeroplane to its wingspan is 6 : 5

Work out the wingspan of the aeroplane.

$54 : x = 6 : 5$

$\Rightarrow \frac{x}{54} = \frac{5}{6}$

$\Rightarrow x = \frac{5}{6} \times 54 = 45\text{m}$

45 m

(2)

(b) A model is made of the Airbus A300 aeroplane.
The length of the model is 36 cm.
The length of the real aeroplane is 54 m.

Find the ratio of the length of the model to the length of the real aeroplane.
Give your ratio in the form 1 : *n*

$54\text{m} = 5400\text{ cm}$

$\frac{5400}{36} = 150$

$\therefore\ 36 : 5400 = 1 : 150$

1 : 150

(3)

(Total for Question 1 is 5 marks)

Do NOT write in this space.

2 $A = 2x^2 + kx$

(a) $x = -3$
$k = 4$

Work out the value of A.

$A = 2(-3)^2 + 4(-3)$

$= 2(9) - 12 = 6$

$A =$ 6

(2)

(b) $A = 38$
$x = 4$

Work out the value of k.

$k = \dfrac{A - 2x^2}{x} = \dfrac{38 - 2(4^2)}{4} = \dfrac{38 - 32}{4} = \dfrac{6}{4} = \dfrac{3}{2}$

$= 1.5$

$k =$ 1.5

(3)

(Total for Question 2 is 5 marks)

Do NOT write in this space.

3 (a) Write $2^3 \times 2^6$ as a single power of 2

$2^{(3+6)} = 2^9$

2^9

(1)

(b) Write $\frac{3^9}{3^4}$ as a single power of 3

$3^{(9-4)} = 3^5$

3^5

(1)

(c) $\frac{5^n}{5^4 \times 5^6} = 5^3$

Find the value of n.

$\frac{5^n}{5^{10}} = 5^3$

$\Rightarrow 5^n = 5^3 \times 5^{10} = 5^{13}$

$\Rightarrow n = 13$

$n =$ 13

(2)

(Total for Question 3 is 4 marks)

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4

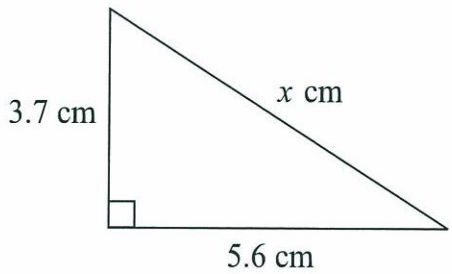


Diagram **NOT** accurately drawn

Work out the value of x.
Give your answer correct to 3 significant figures.

$x = \sqrt{3.7^2 + 5.6^2}$

$= 6.71$ (3 s.f.).

$x =$ 6.71

(Total for Question 4 is 3 marks)

---

5 Three positive whole numbers have a mean of 4 and a range of 7

Find the three positive whole numbers.

$\frac{x+y+z}{3} = 4$

where $x \leq y \leq z$ and $z = x + 7$

$\Rightarrow x + y + x + 7 = 12$

$\Rightarrow 2x + y = 5$

$\Rightarrow x = 1$ and $y = 3$

and $z = 1 + 7 = 8$

1 .... 3 .... 8 ....

(Total for Question 5 is 2 marks)

P 4 0 6 6 0 A 0 6 2 4

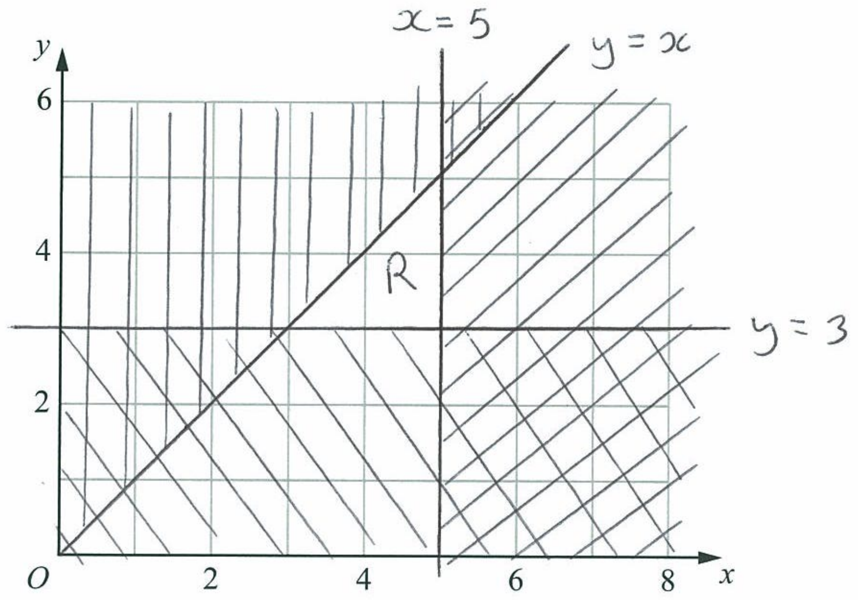
6 Show, by shading on the grid, the region defined by all three of the inequalities

$x \leqslant 5$

$y \geqslant 3$

$y \leqslant x$

Label your region **R**.



(Total for Question 6 is 3 marks)

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7

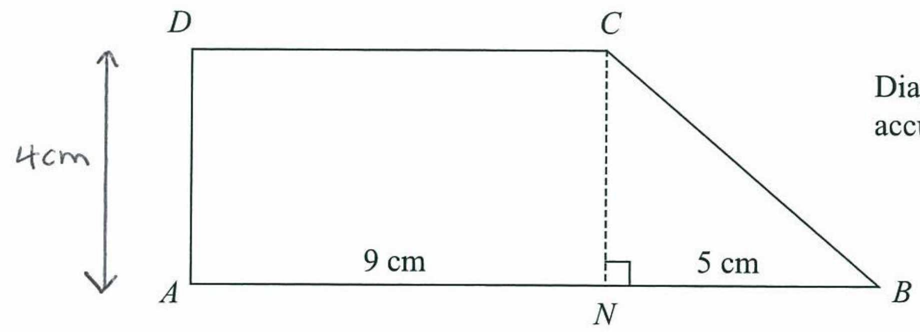

Diagram **NOT** accurately drawn

The shape *ABCD* is made from a rectangle *ANCD* and the right-angled triangle *NBC*.
ANB is a straight line.
$AN = 9$ cm.
$NB = 5$ cm.
The area of rectangle *ANCD* is 36 cm^2

Work out the area of shape *ABCD*.

Height of trapezium ABCD is given by $\frac{36}{9} = 4\text{cm}$

Area of trapezium $= 36 + \frac{5(4)}{2} = 46\text{ cm}^2$

Alternatively Area of $= \frac{1}{2}(a+b)h = \frac{1}{2}(14+9)(4)$
$= 2(23) = 46\text{cm}^2$

46 cm^2

(Total for Question 7 is 4 marks)

Do NOT write in this space.

P 4 0 6 6 0 A 0 8 2 4

8 On 9th May, 2009, there were 3440 people in the world with swine flu.
Of these people, 1639 were in the USA.

(a) Express 1639 as a percentage of 3440
Give your answer correct to 1 decimal place.

$\frac{1639}{3440} \times 100 = 47.6\%$ (1d.p.).

47.6 %
(2)

The 3440 people who had swine flu on 9th May was an increase of 37.6% on the number of people who had swine flu on 8th May.

(b) Calculate the number of people who had swine flu on 8th May.

$\frac{3440}{1.376} = 2500$

2,500
(3)

(Total for Question 8 is 5 marks)

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(b) Tariq puts the 25 pods in a bag.
He takes at random one of the pods.

Find the probability that he takes a pod with 3 peas or a pod with 4 peas.

P(3 peas or 4 peas) $= \frac{13}{25}$

$\frac{13}{25}$

(2)

(c) Laila puts the 25 pods in a bag.
She takes at random two pods without replacement.

Calculate the probability that

(i) there are 3 peas in each of the two pods she takes,

P(3 peas AND 3 peas)

$= \frac{5}{25} \times \frac{4}{24} = \frac{20}{600} = \frac{1}{30}$

$\frac{1}{30}$

(ii) there is a total of 4 peas in the two pods she takes.

P(1 and 3 OR 3 and 1 OR 2 and 2)

$= \frac{3}{25}\left(\frac{5}{24}\right) + \frac{5}{25}\left(\frac{3}{24}\right) + \frac{6}{25}\left(\frac{5}{24}\right)$

$= \frac{15 + 15 + 30}{600} = \frac{60}{600} = \frac{1}{10}$

$\frac{1}{10}$

(5)

(Total for Question 10 is 10 marks)

9 (a) Solve $3(2x - 1) = 6$
Show clear algebraic working.

$6x - 3 = 6$

$\Rightarrow x = \frac{6+3}{6} = \frac{9}{6} = \frac{3}{2} = 1.5$

$x =$ 1.5

(3)

(b) Solve $\frac{2y+1}{3} = \frac{y-2}{4}$

Show clear algebraic working.

$4(2y+1) = 3(y-2)$

$\Rightarrow 8y + 4 = 3y - 6$

$\Rightarrow 5y + 4 = -6$

$\Rightarrow y = \frac{-6-4}{5} = \frac{-10}{5} = -2$

$y =$ -2

(4)

(Total for Question 9 is 7 marks)

10 The table shows information about the number of peas in each of 25 pods.

Number of peas	1	2	3	4	5	6
Number of pods	3	6	5	8	2	1

(a) Work out the mean number of peas in the 25 pods.

$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{3(1) + 6(2) + 5(3) + 8(4) + 2(5) + 1(6)}{25}$

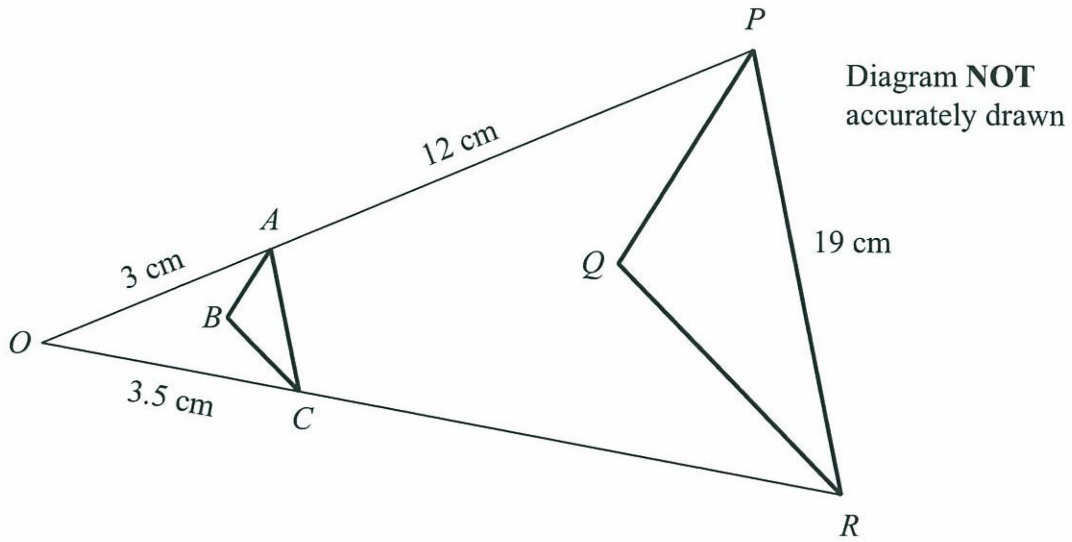
$= \frac{78}{25} = 3.12$

3.12

(3)

P 4 0 6 6 0 A 0 1 0 2 4

11



Triangle PQR is an enlargement, centre O, of triangle ABC.
OAP and OCR are straight lines.
$OA = 3$ cm.
$AP = 12$ cm.
$OC = 3.5$ cm.
$PR = 19$ cm.

(a) Work out the length of CR.

$$\frac{CR + 3.5}{3.5} = \frac{15}{3} = 5$$

$$\Rightarrow CR = 5(3.5) - 3.5 = 14 \text{ cm}$$

14 cm
(2)

(b) Work out the length of AC.

$$AC = \frac{19}{5} = 3.8 \text{ cm}$$

3.8 cm
(3)

The area of triangle ABC is 2 cm^2

(c) Work out the area of triangle PQR.

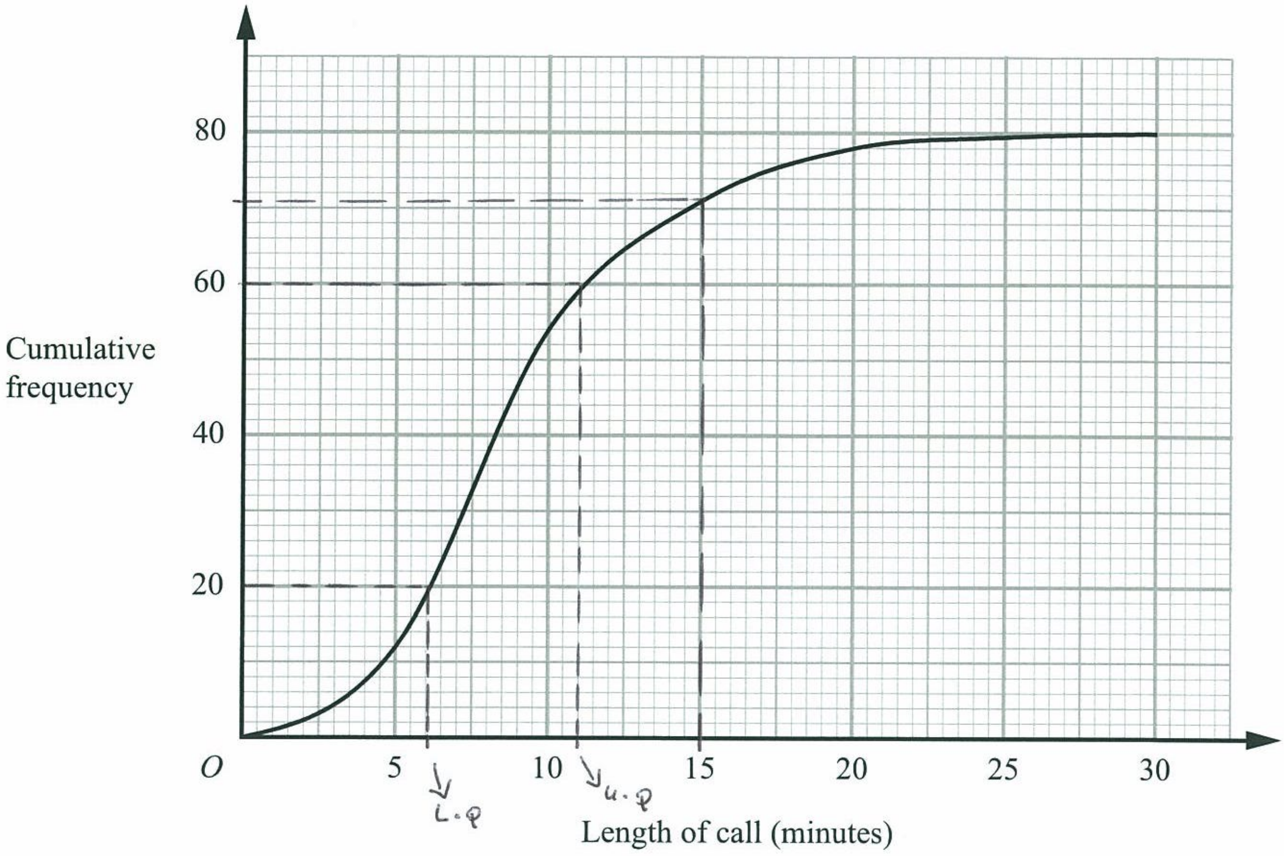
$$2 \times 5^2 = 2 \times 25 = 50 \text{ cm}^2$$

50 cm^2
(2)

(Total for Question 11 is 7 marks)

P 4 0 6 6 0 A 0 1 2 2 4

12 The cumulative frequency graph gives information about the lengths, in minutes, of 80 telephone calls.



(a) Find an estimate for the number of calls which were longer than 15 minutes.

$80 - 71 = 9$

.......9.......

(2)

(b) Find an estimate for the interquartile range of the lengths of the 80 calls.

I.Q. Range = U.Q − L.Q = 11 − 6 = 5 minutes

.......5....... minutes

(2)

(Total for Question 12 is 4 marks)

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13

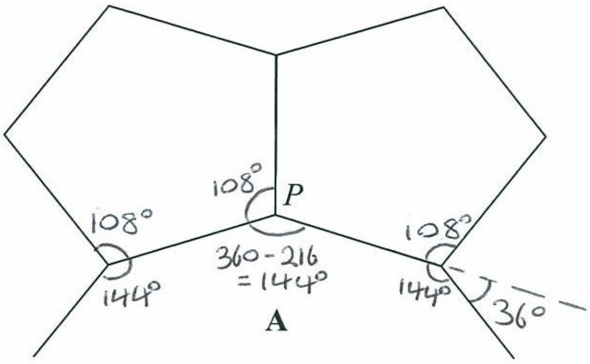

Diagram **NOT** accurately drawn

The diagram shows two congruent regular pentagons and part of a regular n-sided polygon **A**.
Two sides of each of the regular pentagons and two sides of **A** meet at the point P.

Calculate the value of n.
Show your working clearly.

Interior angles of pentagons are all equal and given by $180 - \frac{360}{5} = 180 - 72 = 108°$

Interior angles of polygon A are all equal and are given by $360 - 2(108) = 360 - 216 = 144°$

Exterior angles of regular n-sided polygon A are given by $\frac{360}{n} = 180 - 144 = 36°$

$\Rightarrow \frac{360}{n} = 36$

$\Rightarrow n = \frac{360}{36} = 10$

$n =$ 10

(Total for Question 13 is 5 marks)

14 (a) The equation of a line **L** is $2x - 3y = 6$
Find the gradient of **L**.

$3y = 2x - 6$

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

Gradient $= \frac{2}{3}$

(3)

(b) Find the equation of the line which is parallel to **L** and passes through the point (6, 9).

$y = \frac{2}{3}x + c$

$\Rightarrow 9 = \frac{2}{3}(6) + c$

$\Rightarrow c = 9 - 4 = 5.$

$\therefore y = \frac{2}{3}x + 5$

OR $3y = 2x + 15$

OR $2x - 3y = -15$

$3y - 2x = 15$

(2)

(Total for Question 14 is 5 marks)

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15

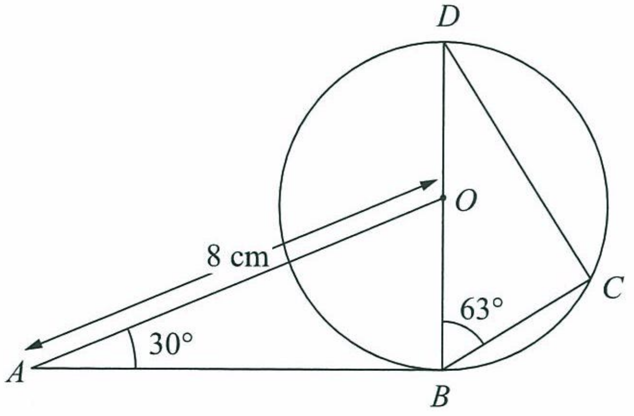

Diagram **NOT** accurately drawn

B, C and D are points on a circle, centre O.
BOD is a diameter of the circle.
AB is the tangent to the circle at B.
$AO = 8$ cm. Angle $BAO = 30°$ Angle $CBD = 63°$

Calculate the length of BC.
Give your answer correct to 3 significant figures.

$BC = BD \times \cos 63°$
$= 2(OB) \cos 63°$
$= 2(8 \sin 30°) \cos 63°$
$= 2(4) \cos 63°$
$= 8 \cos 63°$
$= 3.63$ cm (3 s.f.).

N.B: $B\hat{C}D = 90°$ since lines drawn from either end of a diameter to a point on the circumference form a right-angle where they meet.

$A\hat{B}D = 90°$ since a tangent and radius form a right-angle where they meet.

3.63 cm

(Total for Question 15 is 4 marks)

P 4 0 6 6 0 A 0 1 6 2 4

16 The population of India increased by 20% between 1989 and 1999.
The population of India increased by a further 17% between 1999 and 2009.

Calculate the percentage by which the population of India increased between 1989 and 2009.

$$((1.2 \times 1.17) - 1) \times 100 = 40.4\%$$

Using algebra to show this mathematical reasoning from first principles, let x = population of India in 1989. Then $\frac{(x \times 1.2 \times 1.17) - x}{x} \times 100$

$$= \frac{1.2(1.17)\cancel{x} - \cancel{x}}{\cancel{x}} \times 100$$

which simplifies to the shorthand calculation I started with, namely $100(1.2(1.17) - 1)$

40.4 %

(Total for Question 16 is 3 marks)

---

17 (a) Simplify $(3a^2b)^4$

N.B: $(ax)^n = a^n x^n$

$3^4(a^2)^4 b^4$

$= 81 a^{(2\times4)} b^4$

$= 81 a^8 b^4$

$81a^8b^4$

(2)

(b) Simplify $(9c^8)^{\frac{1}{2}}$

$9^{\frac{1}{2}}(c^8)^{\frac{1}{2}}$

$= 3c^{(8\times\frac{1}{2})}$

$= 3c^4$

$3c^4$

(2)

(Total for Question 17 is 4 marks)

18

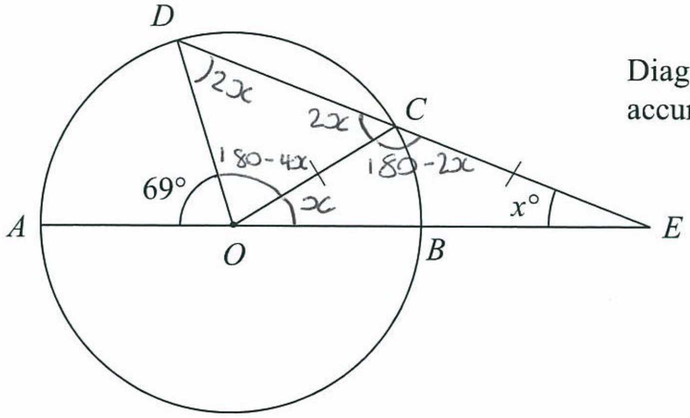

Diagram **NOT** accurately drawn

A, B, C and D are points on a circle, centre O.
$AOBE$ and DCE are straight lines.
$CO = CE$.
Angle $AOD = 69°$
Angle $CEO = x°$

Calculate the value of x.
Show your working clearly.

COB = $x°$ since CEO is an isosceles triangle.

OCE = $180 - 2x$ since angles of a triangle add to 180°

DCO = $180 - (180 - 2x) = 2x$ since angles across a straight line are supplementary.

ODC = $2x$ since ΔODC is an isosceles triangle.

DOC = $180 - 4x$ since angles of a triangle add to 180°

$69 + 180 - 4x + x = 180$ since angles across a straight line add to 180°

$\Rightarrow 3x = 69$

$\Rightarrow x = \frac{69}{3} = 23°$

$x =$ ....

(Total for Question 18 is 6 marks)

19

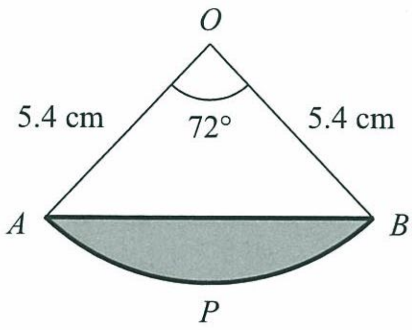

Diagram **NOT** accurately drawn

The diagram shows a sector *OAPB* of a circle, centre *O*.
AB is a chord of the circle.
OA = *OB* = 5.4 cm.
Angle *AOB* = 72°

Calculate the area of the shaded segment *APB*.
Give your answer correct to 3 significant figures.

Area of shaded segment = Area of sector OAPB − Area of triangle OAB

$$= \frac{72}{360}\pi(5.4^2) - \frac{1}{2}(5.4^2)\sin 72^\circ$$

$$= 4.46 \text{ cm}^2 \text{ (3 s.f.)}$$

4.46 cm^2

(Total for Question 19 is 5 marks)

20 Correct to 2 decimal places, the volume of a solid cube is 42.88 cm^3

Calculate the lower bound for the surface area of the cube.

Volume of cuboid $= l \times w \times d$

For a cube, $l = w = d$

$\Rightarrow$ Volume of cube $= l^3$

If $V = 42.88 \text{ cm}^3$ (to 2 d.p.).

then $V_{LOWER} = 42.875 \text{ cm}^3$

$\Rightarrow l_{LOWER} = \sqrt[3]{42.875}$

$\Rightarrow$ Surface Area$_{LOWER} = 6 \times (l_{LOWER})^2$

$= 6 \times 3.5^2 = 73.5 \text{ cm}^2$

73.5 cm^2

(Total for Question 20 is 4 marks)

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21 Solve the simultaneous equations

$$y = 2x^2$$

$$y = 20 - 3x$$

Show clear algebraic working.

$2x^2 = 20 - 3x$

$\Rightarrow 2x^2 + 3x - 20 = 0$

$\Rightarrow (2x - 5)(x + 4) = 0$

$\Rightarrow x = \frac{0+5}{2} = 2.5$ or $x = -4$

When $x = 2.5$, $y = 2(2.5)^2 = 2(6.25) = 12.5$

When $x = -4$, $y = 2(-4)^2 = 2(16) = 32$

$\therefore (x, y) = (2.5, 12.5)$ or $(-4, 32)$

$(x, y) = (2.5, 12.5)$ or $(-4, 32)$

(Total for Question 21 is 5 marks)

(TOTAL FOR PAPER IS 100 MARKS)

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