ANSWERS

GCSE Mathematics Practice Tests: Set 2

Paper 3H (Calculator)

Time: 1 hour 30 minutes

You should have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be be used.**
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- The total mark for this paper is 80
- 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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. Each year Wenford Hospital records how long patients wait to be treated in the Accident and Emergency department.

In 2015 patients waited 11% less time than in 2014. ∴ 89% OF 2014 TIME
In 2015 the average time patients waited was 68 minutes.

(a) Work out the average time patients waited in 2014.
Give your answer to the nearest minute.

$0.89 \times \text{TIME IN 2014} = 68$

$\therefore \text{TIME IN 2014} = \frac{68}{0.89} = 76.4$

76 minutes

(3)

The hospital has a target to reduce the average time patients wait to be treated in the Accident and Emergency department to 60 minutes in 2016.

(b) Work out the percentage decrease from 68 minutes to 60 minutes.

$68 - 60 = 8$

$\frac{8}{68} \times 100 = 11.765$

11.8 %

(2)

(Total 5 marks)

2. There are only red pens and blue pens in a box.
There are 12 red pens in the box.

The probability of taking at random a blue pen from the box is $\frac{2}{3}$

Work out the total number of pens in the box.

PROBABILITY OF RED = $1 - \frac{2}{3} = \frac{1}{3}$

∴ TOTAL NUMBER = $3 \times 12 = 36$

36

(Total 3 marks)

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3. Each length of the side of square B is twice the length of the side of square A.

John says that this means the area of square B is twice the area of square A.

Is John right?
Justify your answer.

JOHN IS WRONG. AREA OF B = 4 × AREA OF A

(Total 1 mark)

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4. Show that $7\frac{1}{2} - 4\frac{2}{3} = 2\frac{5}{6}$

$\frac{15}{2} - \frac{14}{3}$

$= \frac{45 - 28}{6}$

$= \frac{17}{6}$

$= 2\frac{5}{6}$

(Total 3 marks)

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5. Make t the subject of $5(t - g) = 2t + 7$

$5t - 5g = 2t + 7$

$5t - 2t = 5g + 7$

$3t = 5g + 7$

$t = \frac{5g + 7}{3}$

$t = \frac{5g+7}{3}$

(Total 3 marks)

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6. Henry is thinking about having a water meter.

These are the two ways he can pay for the water he uses.

Water Meter	**No Water Meter**
A charge of £28.20 per year **plus** 91.22p for every cubic metre of water used **1 cubic metre = 1000 litres**	A charge of £107 per year

Henry uses an average of 180 litres of water each day.

Henry wants to pay as little as possible for the water he uses.
Should Henry have a water meter?

METER: 91.22p PER m^3

$\therefore \frac{91.22}{1000}$ PER ℓ

$\therefore \frac{91.22}{1000} \times 180$ FOR EACH DAY

$\therefore \frac{91.22}{1000} \times 180 \times 365$ PER YEAR (IN PENCE)

$= £59.93$

PLUS FIXED CHARGE OF £28.20

$\therefore$ TOTAL CHARGE $= £88.13$

HENRY SHOULD HAVE A METER SINCE IT COSTS £88.13 AS OPPOSED TO £107 WITHOUT A METER.

(Total 5 marks)

7. Cameron invests £1200 for 3 years in a savings account.
He gets 4.1% per annum **simple** interest.

Mitchell invests £1200 for 3 years in a savings account.
He gets 4% per annum **compound** interest.

Who will have the most money in his savings account at the end of the 3 years?
You must show all your working.

C : $1200 \times 0.041 \times 3 = 147.60$

$1200 + 147.60 = £1347.60$

M : $1200 \times 1.04^3 = £1349.84$

MITCHELL WILL HAVE MORE

(Total 5 marks)

8. Here are the first four terms of an arithmetic sequence.

3 (+7) 10 (+7) 17 (+7) 24

(a) Find, in terms of n, an expression for the nth term of this arithmetic sequence.

$7n - 4$

(2)

(b) Is 150 a term of this sequence?

You must explain how you get your answer.

FOR 150 TO BE A TERM $7n - 4 = 150$ FOR n AN INTEGER $\therefore 7n = 154 \therefore n = 22$

$\therefore$ 150 IS A TERM IN THE SEQUENCE

(2)

(Total 4 marks)

9. Here are the marks that James scored in eleven maths tests.

16 12 19 18 17 13 13 20 11 19 17

(*a*) Find the interquartile range of these marks.

PUT IN ORDER

11 12 13 13 16 17 17 18 19 19 20

19 − 13 = 6

6

(3)

Sunil did the same eleven maths tests.
The median mark Sunil scored in his tests is 17.
The interquartile range is 8.

(*b*) Which one of Sunil or James has the more consistent marks?
Give a reason for your answer.

JAMES IS MORE CONSISTENT BECAUSE THE SPREAD OF HIS SCORES (ie HIS IQR) IS LESS

(1)

Sunil did four more maths tests.
His scores in these four tests were 16, 20, 18 and 10.

(*c*) How does his new median mark for the fifteen tests compare with his median mark of 17 for the eleven tests?

Tick (✓) one box.

☐ new median is lower ☑ new median is 17 ☐ new median is higher

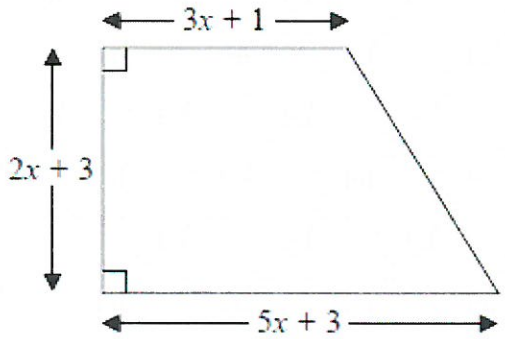
Explain your answer.

TWO SCORES < 17 AND TWO SCORES > 17 ∴ MIDDLE VALUE IS STILL 17

(1)

(Total 5 marks)

10. The diagram shows a trapezium.



All the measurements are in centimetres.
The area of the trapezium is 46 cm^2.

(a) Show that $x^2 + 2x - 5 = 0$

$$\text{AREA} = \frac{2x+3}{2}(3x+1+5x+3)$$

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

$$= (2x+3)(4x+2)$$

$$= 8x^2 + 16x + 6 = 46$$

$$\therefore 8x^2 + 16x - 40 = 0$$

$$\therefore x^2 + 2x - 5 = 0$$

(3)

(b) Solve the equation $x^2 + 2x - 5 = 0$
Give your solutions correct to 2 decimal places.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad a = 1 \quad b = 2 \quad c = -5$$

$$= \frac{-2 \pm \sqrt{2^2 + 4 \times 1 \times 5}}{2}$$

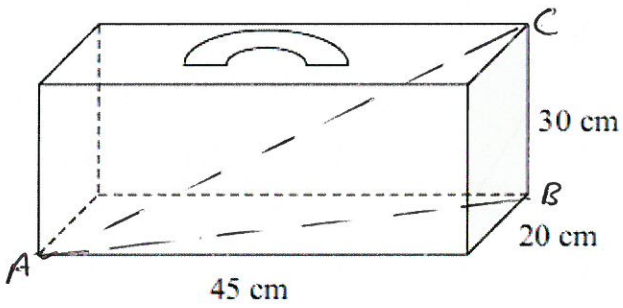
$$= \frac{-2 \pm \sqrt{24}}{2}$$

1.45 , −3.45

(3)

(Total 6 marks)

11. The diagram shows Diana's suitcase.
The suitcase is in the shape of a cuboid.



AC IS MAX LENGTH IN SUITCASE

Diana has a walking stick that folds.
The folded walking stick has a length of 60 cm.

Diana wants to put the folded walking stick in the suitcase.

Will the folded walking stick fit in the suitcase?

$AB^2 = 45^2 + 20^2 = 2425$

$AC^2 = AB^2 + 30^2 = 2425 + 900 = 3325$

$\therefore AC = \sqrt{3325} = 57.7\text{ cm}$

SINCE THE FOLDED WALKING STICK HAS LENGTH = 60cm
IT WILL NOT FIT IN THE SUITCASE

(Total 4 marks)

12. The surface area of Earth is 510 072 000 km^2.
The surface area of Jupiter is 6.21795 × 1010 km^2. 10^{10}

The surface area of Jupiter is greater than the surface area of Earth.
How many times greater?
Give your answer in standard form.

$$\frac{6.21795 \times 10^{10}}{5.10072 \times 10^{8}}$$

$$\simeq 1.219 \times 10^{2}$$

1.219×10^2

$(1.21 \times 10^2$
$-1.22 \times 10^2)$

(Total 3 marks)

13. Brian's band is playing at a concert in a hall.

The loudness of a band varies inversely as the square of the distance from the band.
Brian measures the normal loudness of his band as 100 decibels at a distance of 5 metres.

The band has to stop playing if the loudness is 85 decibels or more at a distance of 5.4 metres.

Does the band have to stop playing?

$L \propto \frac{1}{D^2}$

$\therefore L = \frac{k}{D^2}$

$100 = \frac{k}{5^2}$

$\therefore k = 2500$

$\therefore L = \frac{2500}{D^2}$

$D = 5.4 \quad L = \frac{2500}{5.4^2} = \frac{2500}{29.16} = 85.73$

SINCE LOUDNESS IS 85.73 DECIBELS AND ∴ EXCEEDS 85 DECIBELS THE BAND HAS TO STOP PLAYING

(Total 4 marks)

14.

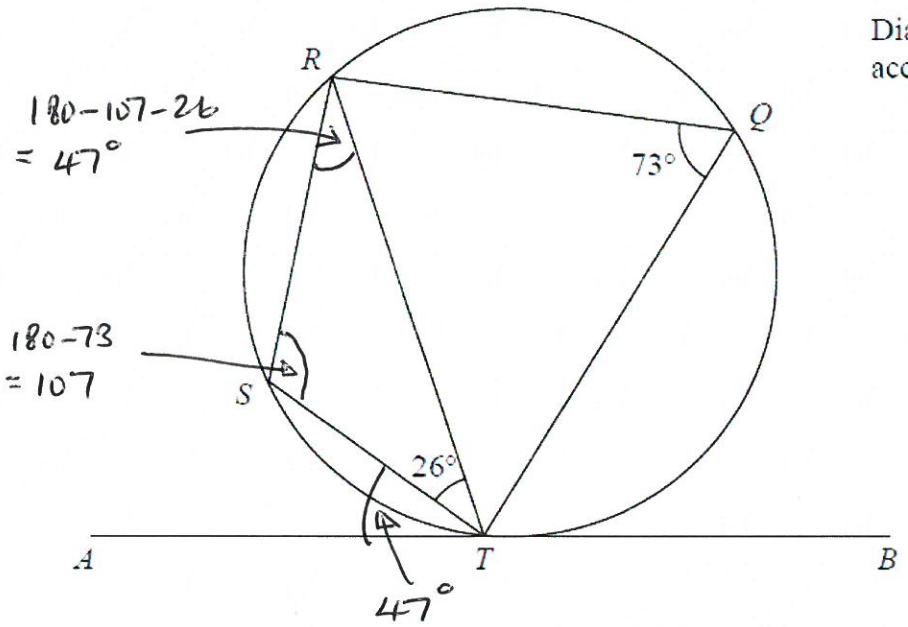


Diagram **NOT** accurately drawn

Q, R, S and T are points on a circle.
ATB is the tangent to the circle at T

Angle $STR = 26°$
Angle $RQT = 73°$

Work out the size of angle STA
Give a reason for each stage in your working.

$R\hat{S}T = 107°$ ANGLES OPPOSITE EACH OTHER IN A CYCLIC QUADRILATERAL ADD UP TO 180°

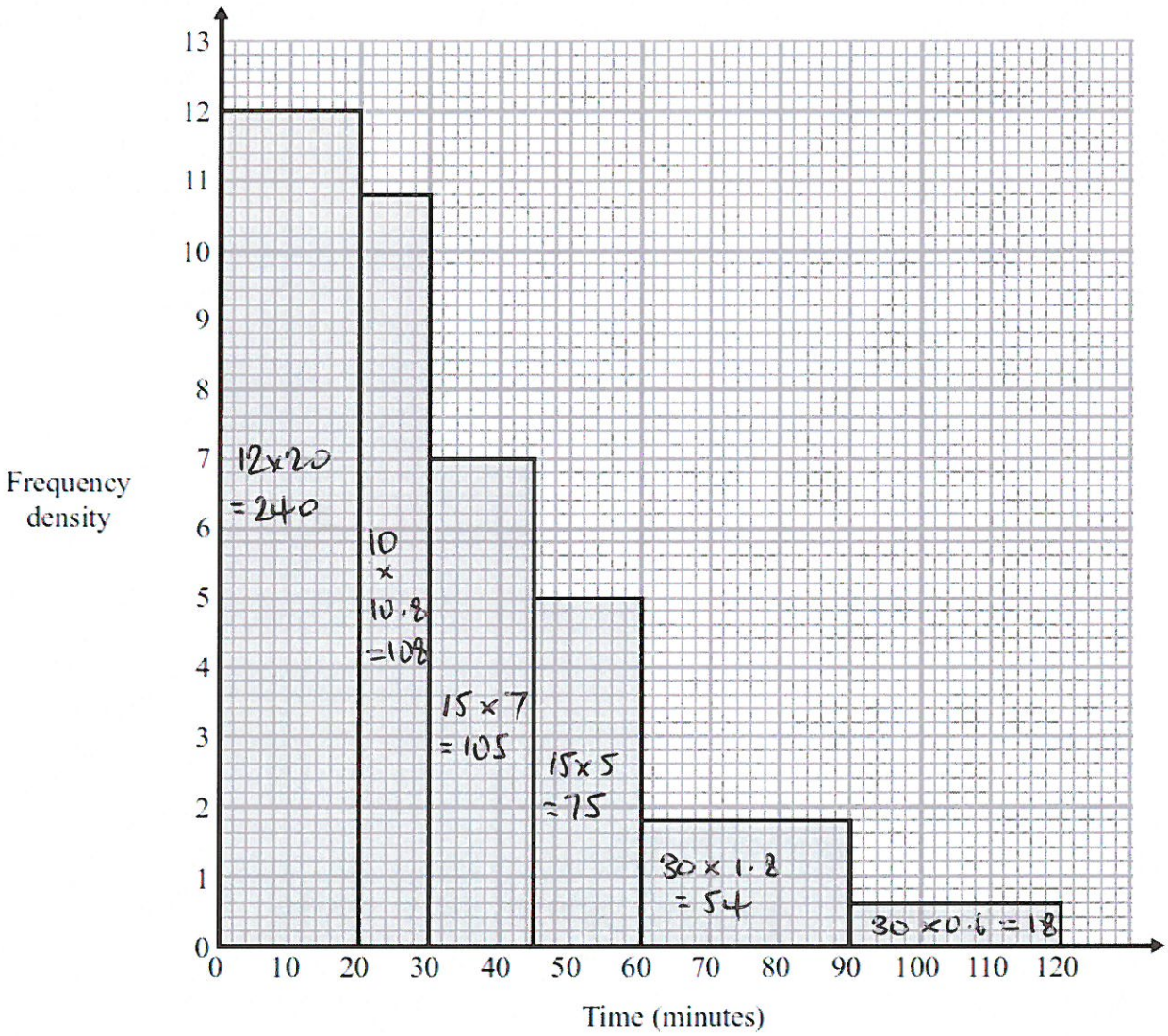
$S\hat{R}T = 47°$ ANGLES IN A TRIANGLE ADD UP TO 180°

$S\hat{T}A = 47°$ BY ALTERNATE SEGMENT THEOREM

47 .....°

(Total 3 marks)

15. The histogram shows information about the times, in minutes, that some passengers had to wait at an airport.



Work out the percentage of the passengers who had to wait for more than one hour.

TOTAL AREA = 240 + 108 + 105 + 75 + 54 + 18 = 600

AREA TO RIGHT OF 60 MINUTES = 54 + 18 = 72

$\frac{72}{600} \times 100 = 12\%$

12%

(Total 3 marks)

16. Given that $\left(2^{\frac{1}{2}}\right)^n = \frac{2^x}{8^y}$

express n in terms of x and y.

$8 = 2^3 \quad \therefore 8^y = 2^{3y} \quad \therefore \frac{2^x}{8^y} = 2^{x-3y}$

$(2^{1/2})^n = 2^{n/2} \quad \therefore \frac{n}{2} = x - 3y \quad \therefore n = 2(x-3y)$ or $2x - 6y$

$n = 2(x - 3y)$

(Total 3 marks)

17.

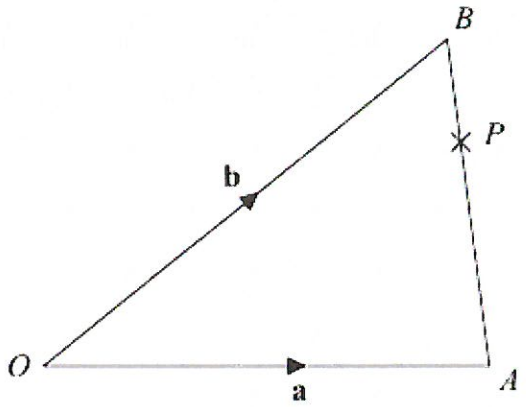


Diagram **NOT** accurately drawn

OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$
$\overrightarrow{OB} = \mathbf{b}$

(a) Find $\overrightarrow{AB}$ in terms of **a** and **b**.

$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$-\underline{a} + \underline{b}$

(1)

P is the point on AB such that $AP : PB = 3 : 1$

$\therefore AP = \frac{3}{4} AB$

$\therefore \overrightarrow{AP} = \frac{3}{4} \overrightarrow{AB} = \frac{3}{4}(-\underline{a} + \underline{b})$

(b) Find $\overrightarrow{OP}$ in terms of **a** and **b**.
Give your answer in its simplest form.

$\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$

$= \underline{a} + \frac{3}{4}(-\underline{a} + \underline{b})$

$= \underline{a} - \frac{3}{4}\underline{a} + \frac{3}{4}\underline{b}$

$= \frac{1}{4}\underline{a} + \frac{3}{4}\underline{b}$

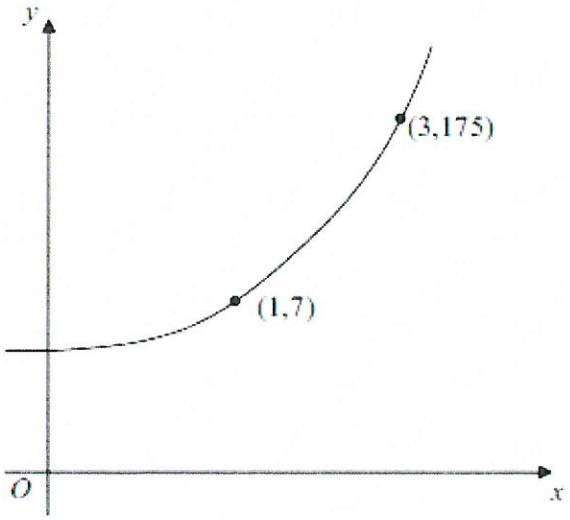
$= \frac{1}{4}(\underline{a} + 3\underline{b})$

$\overrightarrow{OP} = \frac{1}{4}(\underline{a} + 3\underline{b})$

(3)

(Total 4 marks)

18.



The sketch shows a curve with equation

$y = ka^x$

where k and a are constants, and $a > 0$

The curve passes through the points (1, 7) and (3, 175).

Calculate the value of k and the value of a.

$x = 1$ WHEN $y = 7$

$\therefore 7 = ka$

$\therefore k = \frac{7}{a}$

$\therefore y = 7a^{x-1}$

$x = 3$ WHEN $y = 175$

$\therefore 175 = 7a^2$

$\therefore a^2 = \frac{175}{7} = 25$

$\therefore a = 5$

$\therefore k = \frac{7}{5}$

$k =$ $\frac{7}{5}$ or 1.4

$a =$ 5

(Total 3 marks)

19. **A** and **B** are straight lines.
Line **A** has equation $2y = 3x + 8$.
Line **B** goes through the points $(-1, 2)$ and $(2, 8)$.

Do lines **A** and **B** intersect?
You must show all your working.

GRADIENT OF B = $\frac{8-2}{2--1} = \frac{6}{3} = 2$

∴ EQUATION OF B IS $y = 2x + c$

AT $(2, 8)$ $8 = 2\times2 + c = 4 + c$ ∴ $c = 4$

∴ EQUATION OF B IS $y = 2x + 4$

EQUATION OF A IS $y = \frac{3x}{2} + 4$

A & B INTERSECT IF $2x + 4 = \frac{3x}{2} + 4$

∴ $x = 0$

AT $x = 0$, $y = 4$

∴ INTERSECT AT $(0, 4)$

(OR GRADIENT OF A = $3/2$ AND GRADIENT OF B = 2
∴ GRADIENTS ARE DIFFERENT ∴ LINES WILL INTERSECT)

(Total 3 marks)

20.

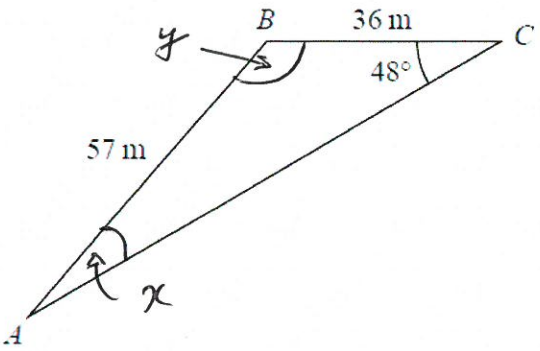


Diagram **NOT** accurately drawn

Work out the area of triangle ABC.
Give your answer correct to 3 significant figures.

SINE RULE $\quad \frac{\sin x}{36} = \frac{\sin 48}{57}$

$\therefore \quad \sin x = \frac{36 \sin 48}{57}$

$\therefore \quad x = \sin^{-1}\left(\frac{36 \sin 48}{57}\right) = 27.992°$

$\therefore \quad y = 180 - 48 - 27.992 = 104.008°$

$\text{AREA} = \frac{1}{2} \times 57 \times 36 \times \sin 104.008°$

$= 995 \text{ m}^2$

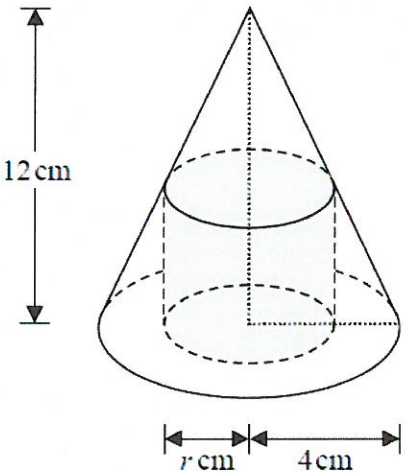
995 ..... m^2

(Total 4 marks)

21. The diagram shows a cylinder inside a cone on a horizontal base.

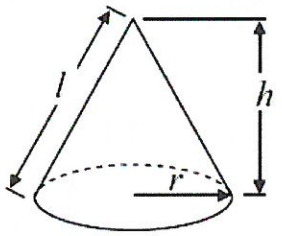
The cone and the cylinder have the same vertical axis.
The base of the cylinder lies on the base of the cone.

The circumference of the top face of the cylinder touches the curved surface of the cone.



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

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



The height of the cone is 12 cm and the radius of the base of the cone is 4 cm.

(*a*) Work out the curved surface area of the cone.
Give your answer correct to 3 significant figures.

$l^2 = 12^2 + 4^2 = 160$

$\therefore l = \sqrt{160}$

$\therefore$ S.A. $= \pi \times 4 \times \sqrt{160}$

$= 159$

159 ..... cm^2

(3)

The cylinder has radius r cm and volume V cm^3

(*b*) Show that $V = 12\pi r^2 - 3\pi r^3$

SMALL CONE ABOVE CYLINDER IS SIMILAR TO LARGE CONE
LARGE CONE HAS HEIGHT = 3 × RADIUS ∴ SO DOES SMALL CONE ∴ HEIGHT = $3r$
∴ HEIGHT OF CYLINDER = $12 - 3r$

∴ VOLUME OF CYLINDER $V = \pi r^2(12 - 3r)$

$\therefore V = 12\pi r^2 - 3\pi r^3$

(3)

(Total 6 marks)

TOTAL FOR PAPER IS 80 MARKS

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