



Please write clearly in block capitals.

Centre number

Candidate number

Surname _____

Forename(s) _____

Candidate signature _____

GCSE MATHEMATICS

H

Higher Tier

Paper 2 Calculator

Thursday 7 June 2018

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
2-3	
4-5	
6-7	
8-9	
10-11	
12-13	
14-15	
16-17	
18-19	
20-21	
22-23	
24-25	
26-27	
28-29	
TOTAL	



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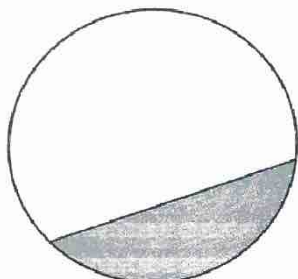
IB/M/Jun18/E7

8300/2H

Answer all questions in the spaces provided

Do not write
outside the
box

- 1 Here is a circle.



Circle the word that describes the shaded part.

[1 mark]

segment

chord

sector

arc

- 2 Circle the number that is in standard form.

[1 mark]

0.25×10^4

6×10^7

38×10^{-3}

$4 \times 10^{\frac{1}{2}}$



3

y is $1\frac{1}{2}$ times x .

~~100~~

$$\begin{array}{l} 1\frac{1}{2} : 1 \\ 3 : 2 \end{array}$$

Circle the ratio that is equivalent to

$$\begin{array}{l} y : x \\ \times 2 \left(\begin{array}{l} 1\frac{1}{2} : 1 \\ 3 : 2 \end{array} \right) \times 2 \end{array}$$

[1 mark]

2 : 5

5 : 2

3 : 2

2 : 3

4

Work out 40 as a percentage of 10

Circle your answer.

[1 mark]

$$\frac{40}{10} = 4$$

4%

25%

300%

400%

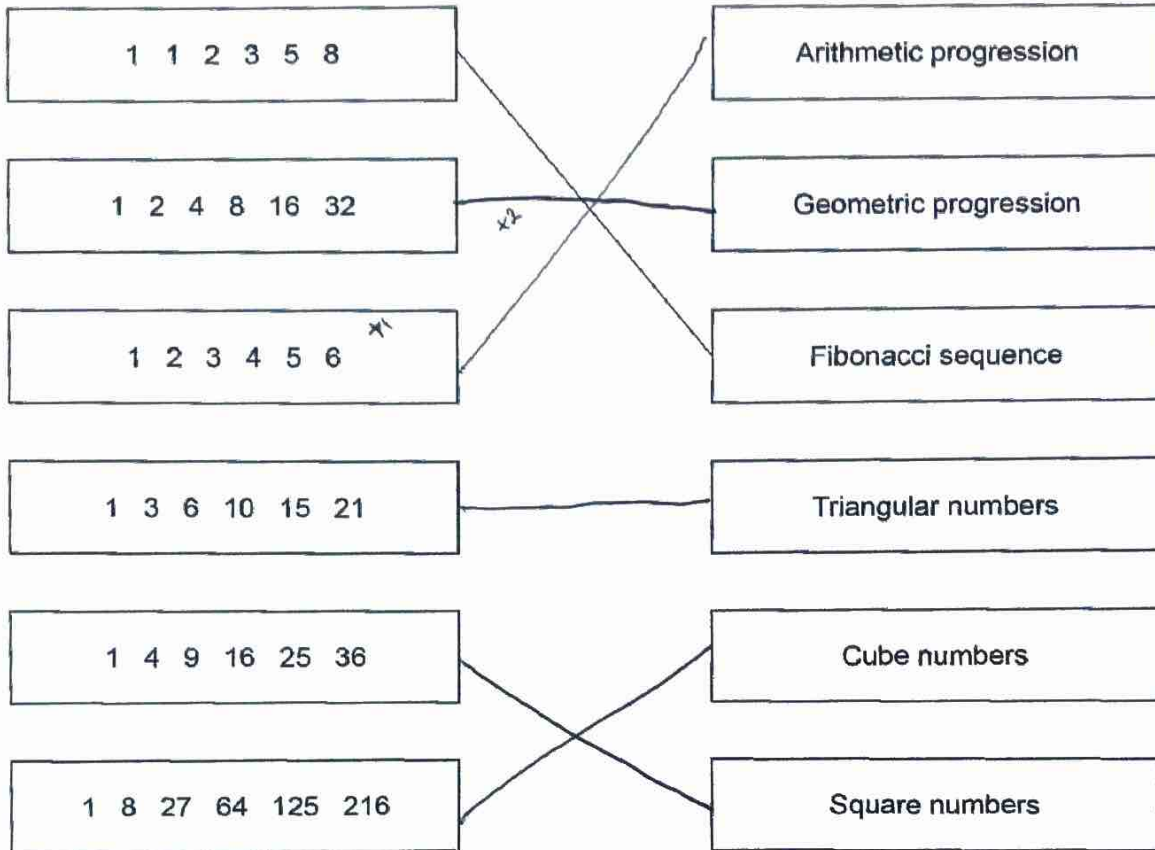
Turn over for the next question

Turn over ►



- 5 Match each sequence to its description.
One has been done for you.

[4 marks]



6

The table shows information about the population of a city.

Population in 2001	Population in 2011
420 000	480 000

Liam claims,

"From 2011 to 2021 the population of the city will increase by the same percentage as from 2001 to 2011"

He works out,

$$\begin{aligned} \text{population increase from 2001 to 2011} &= 480\,000 - 420\,000 \\ &= 60\,000 \end{aligned}$$

$$\begin{aligned} \text{population in 2021} &= 480\,000 + 60\,000 \\ &= 540\,000 \end{aligned}$$

Does the population of 540 000 match his claim?

You **must** show your working.

[3 marks]

NO $\frac{60,000}{420,000} = \frac{1}{7} = 14.3\%$

$$\frac{60,000}{480,000} = \frac{1}{8} = 12.5\%$$

∴ the percentage increase is not the same

Answer

NO

Turn over for the next question

Turn over ►



- 7 On three days, Ali throws darts at a target.
Here are his results.

	Number of throws	Number of hits	Number of misses
Monday	20	15	5
Tuesday	30	22	8
Wednesday	40	17	23
Total	90	54	36

- 7 (a) Work out two different estimates for the probability of Ali hitting the target.

[2 marks]

$$\frac{15}{20} = 75\% \qquad \frac{22}{30} = 0.73\%$$

Answer 75% and ~~75%~~ 73%

- 7 (b) Which of your two answers is the better estimate for the probability of Ali hitting the target?

Give a reason for your answer.

[1 mark]

Answer 73%

Reason It has the largest sample size
30 > 20



8

Theo starts with savings of £18
James starts with no savings.

Each week from now,

Theo will save £4.50 and James will save £4

In how many weeks will Theo and James have savings in the ratio 15 : 8 ?

[3 marks]

	Theo	James	
1	18.00	0	
2	22.50	4	
3	27.00	8	
4	31.50	12	
5	36.00	16	
6	40.50	20	
	45.00	24	45 : 24
			15 : 8

Answer 6 weeks



9 The length of each side of a regular pentagon is 8.4 cm to 1 decimal place.

± 0.05

9 (a) Complete the error interval for the length of one side.

[2 marks]

$$8.35 \leq 8.4 < 8.45$$

$$\underline{8.35} \text{ cm} \leq \text{length} < \underline{8.45} \text{ cm}$$

9 (b) Complete the error interval for the perimeter.

[1 mark]

$$5 \times 8.35 = 41.75$$

$$5 \times 8.45 = 42.25$$

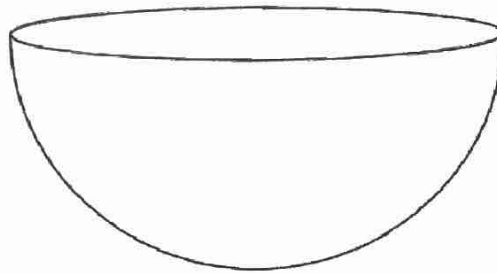
$$\underline{41.75} \text{ cm} \leq \text{perimeter} < \underline{42.25} \text{ cm}$$



10

Volume of a sphere = $\frac{4}{3}\pi r^3$ where r is the radius

A container is a hemisphere of radius 30 cm



Sand fills the container at a rate of 4000 cm^3 per minute.

Does it take **less than** a quarter of an hour to fill the container?

You must show your working.

[3 marks]

$$\begin{aligned} \text{Volume of hemisphere} &= \frac{1}{2} \times \frac{4}{3} \pi 30^3 \\ &= \frac{4}{6} \pi 30^3 \\ &= \frac{2}{3} \pi 30^3 \\ &= 18000 \pi \text{ cm}^3 \end{aligned}$$

$$\frac{18000}{4000} = 14.14 \text{ minutes}$$

$$14.14 < 15 \text{ mins}$$

Answer yes

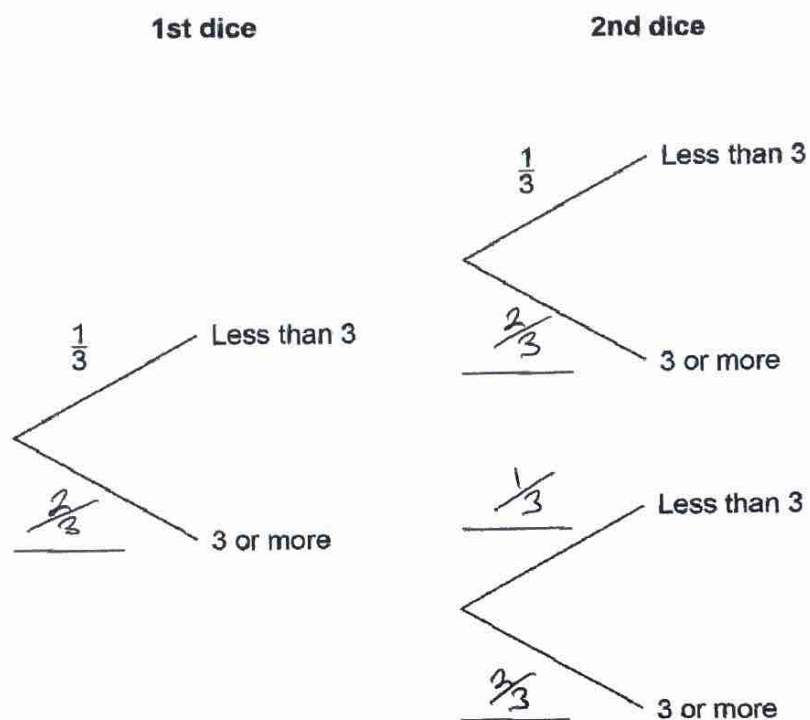
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11 Two ordinary fair dice are rolled.

11 (a) Complete the tree diagram.

[1 mark]



11 (b) Work out the probability that **both** dice land on a number less than 3

[1 mark]

$$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$$

Answer $\frac{1}{9}$



- 11 (c) Work out the probability that exactly one of the dice lands on a number less than 3

[2 marks]

$$L3 \text{ M3} \quad \frac{1}{3} \times \frac{2}{3} = \frac{2}{9}$$

$$M3 \text{ L3} \quad \frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$$

$$\frac{2}{9} + \frac{2}{9} = \frac{4}{9}$$

Answer

$$\frac{4}{9}$$

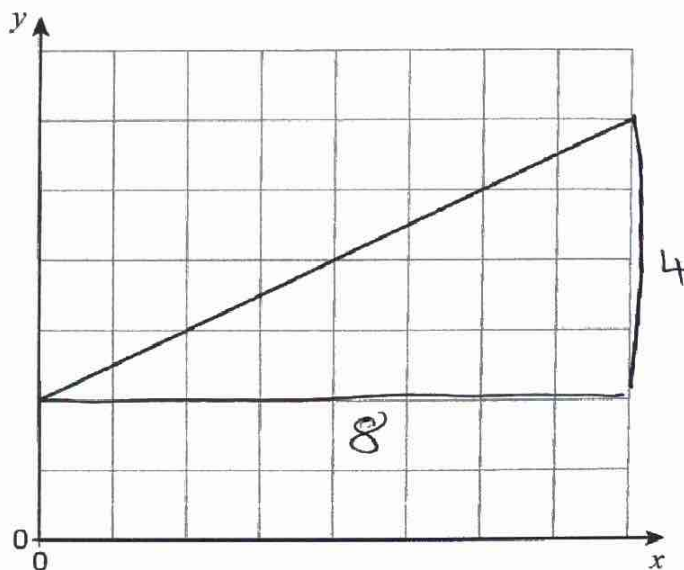
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12

A straight line is drawn on the centimetre grid.



Fay assumes that the scale is 1 cm represents 1 unit.

12 (a) Use her assumption to work out the gradient of the line.

[1 mark]

$$\text{Gradient} = \frac{\Delta y}{\Delta x} = \frac{4}{8} = \frac{1}{2}$$

Answer _____

 $\frac{1}{2}$ 

12 (b) In fact, the scale is 1 cm represents 2 units.

Which statement is correct?

Tick one box.

[1 mark]

The answer to part (a) is too big

The answer to part (a) stays the same

The answer to part (a) is too small

$$\frac{8}{16} = \frac{4}{8}$$

Turn over for the next question

Turn over ►



13

Show that, for $x \neq -1$

$$\frac{8x^2 - 8}{4x + 4}$$

simplifies to the form $ax + b$ where a and b are integers.

[3 marks]

$$\frac{8x^2 - 8}{4x + 4} = \frac{8(x^2 - 1)}{4(x + 1)} = \frac{2(x^2 - 1)}{x + 1}$$

← Difference between 2 Squares

$$\frac{2(\cancel{x+1})(x-1)}{\cancel{(x+1)}} \rightarrow \frac{2(x-1)}{2x-2}$$

$$a = 2 \quad b = -2$$



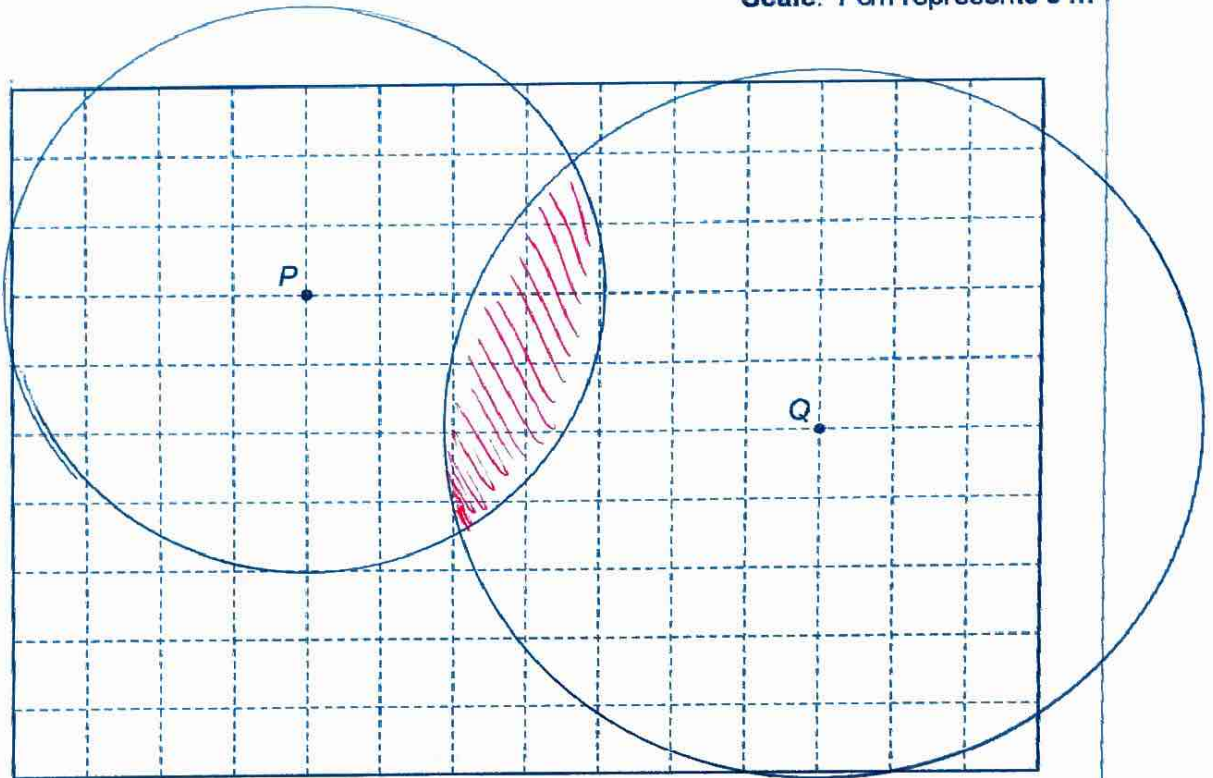
14

The scale drawing represents a garden.

Water from a sprinkler at P reaches up to 20 metres from P .

Water from a sprinkler at Q reaches up to 25 metres from Q .

Scale: 1 cm represents 5 m



Using a pair of compasses,

show the region that water from both sprinklers reaches.

[2 marks]

Turn over for the next question

Turn over ►



15 100 men and 100 women took a test.

Scores

	Median	Interquartile range	Range
Men	28	7.5	31
Women	30	9	37

Using this data, which statement must be true?

Tick **one** box.

[1 mark]

Men had a higher average score than women

Men had more consistent scores than women

A woman had the highest score

A man had the lowest score



16 Some concrete has volume 3.8 m^3

16 (a) The density of the concrete is 2400 kg/m^3

$$\frac{M}{D \times V}$$

Work out the mass of the concrete.

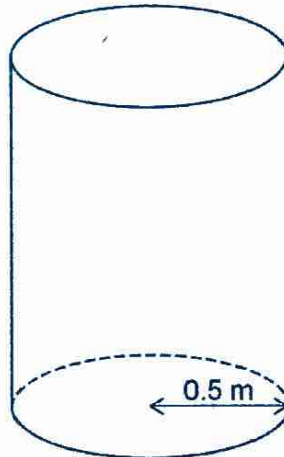
[2 marks]

$$M = D \times V \quad 2400 \times 3.8 = 9120$$

Answer 9120 kg

16 (b) The 3.8 m^3 of concrete is made into the shape of a cylinder.
The base has radius 0.5 metres.

$$\pi r^2 \times h$$



Work out the height of the cylinder.

[2 marks]

$$\pi \times 0.5^2 \times h = 3.8$$

$$\frac{3.8}{\pi \times 0.5^2} = h =$$

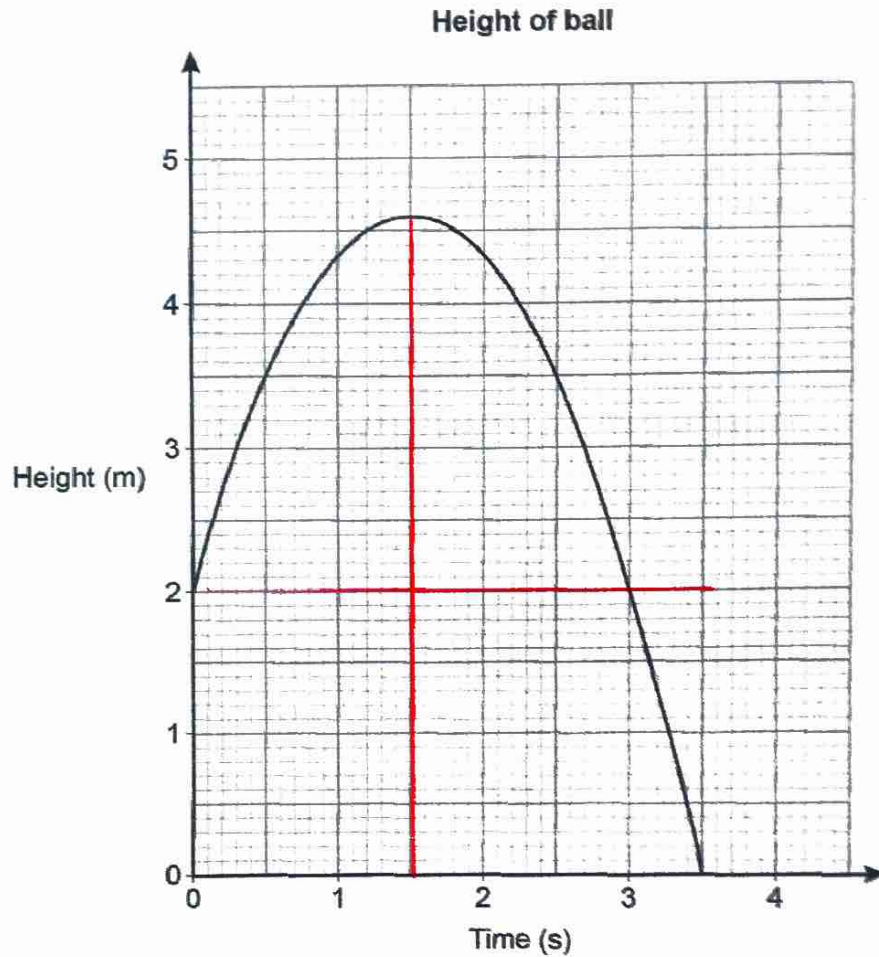
Answer 4.8 m



17

A ball is thrown vertically upwards.

The graph shows the height of the ball above the ground after it is thrown.



- 17 (a) For how many seconds is the ball at a height of more than 2 metres?

[1 mark]

Answer 3 s

- 17 (b) After how many seconds is the ball at instantaneous rest when it is in the air?

[1 mark]

Answer 1.5 s



- 17 (c) Work out the average speed of the ball when it is moving downwards.

[2 marks]

$$s = \frac{d}{t} \quad d = 4.6 \text{ m} \quad \frac{4.6}{2} = 2.3$$

$$t = 2 \text{ s}$$

Answer 2.3 m/s

- 18 The solution of $3^x = 300$ lies between two consecutive integers.
Work out the two integers.

[1 mark]

$$3^5 = 243$$

$$3^6 = 729$$

Answer 5 and 6

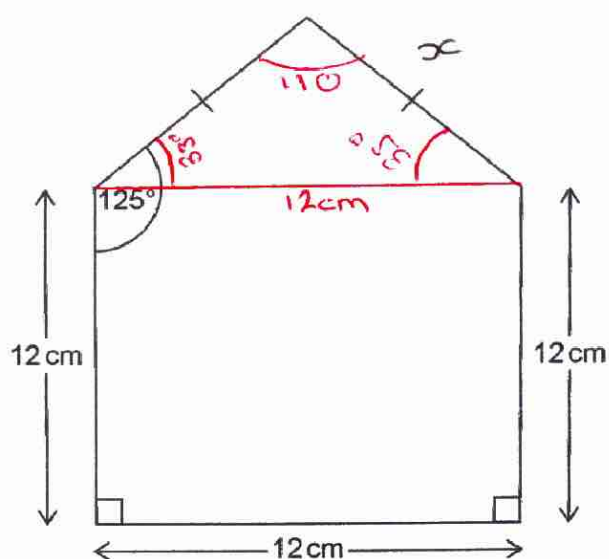
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19

A pentagon is made from a square and an isosceles triangle.

Not drawn
accurately

Work out the perimeter of the pentagon.

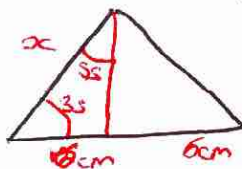
[4 marks]

$$\frac{x}{\sin(35)} = \frac{12}{\sin(110)} \quad x = \frac{12}{\sin(110) + \sin(35)} = 7.3246\dots$$

$$(12 \times 3) + (7.3246 + 2) = 50.65$$

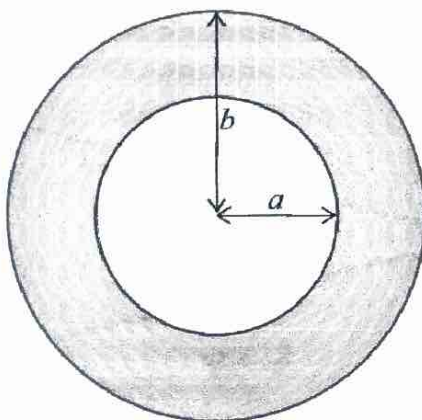
Answer 50.65 cm

you can also split the triangle and use
SINCAH TOA



20

Here is an inflated swimming ring with dimensions in centimetres.

The volume of the ring, $V \text{ cm}^3$, is given by

$$V = 0.25\pi^2(b - a)^2(b + a)$$

Work out the volume when $a = 20$ and $b = 30$

Give your answer to 3 significant figures.

[3 marks]

$$\begin{aligned} V &= 0.25 \times \pi^2 \times (30 - 20)^2 \times (30 + 20) \\ &= 12337.005 \\ &= 12300 \quad 3 \text{ sig fig} \end{aligned}$$

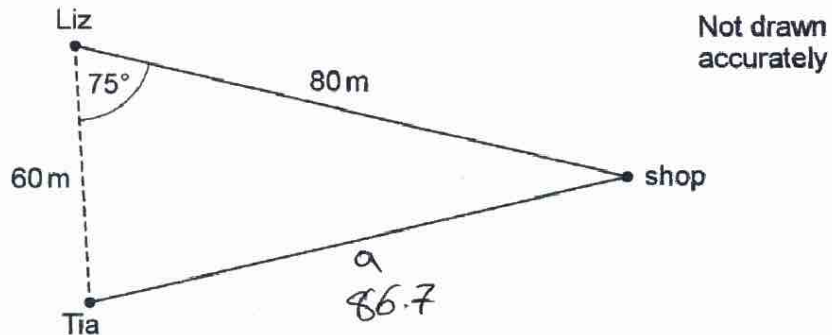
Answer 12300 cm^3

Turn over for the next question

Turn over ►



- 21 Liz and Tia are walking towards a shop along different straight paths.
The diagram shows their positions at 2 pm



- 21 (a) Assume they walk at the same speed.

Who will arrive at the shop first?

You must show your working.

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

[3 marks]

$$a^2 = 60^2 + 80^2 - 2 \times 60 \times 80 \times \cos(75)$$

$$a^2 = 7515.337...$$

$$a = 86.69104 = 86.7$$

~~err~~ Liz is closer \therefore Liz will arrive first.

Answer ~~86.7~~

- 21 (b) In fact, Liz walks at a faster speed than Tia.

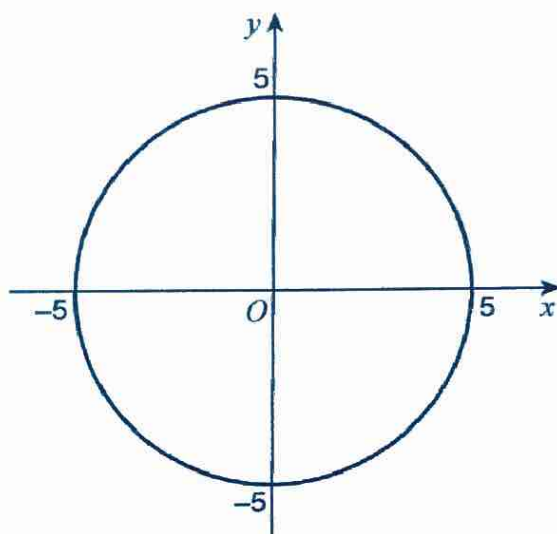
How does this affect the answer to part (a)?

[1 mark]

No change, Liz will still arrive first.



- 22 A circle, centre O , passes through $(5, 0)$.



What is the equation of the circle?

Circle your answer.

[1 mark]

$x^2 + y^2 = 25$
 $x^2 + y^2 = 5$
 $x^2 + y^2 = 10$
 $x^2 + y^2 = 100$

$$x^2 + y^2 = r^2$$

$$r = 5$$

Turn over for the next question

Turn over ►



23

Solids X and Y are similar.

X has volume 64 cm^3 Y has volume 343 cm^3 The surface area of X is 176 cm^2

Work out the surface area of Y.

[3 marks]

1D		1.75	
2D	176	1.75^2	
3D	64	5.35...	343

$$\frac{343}{64} = 176 + 1.75^2 = 539$$

Answer 539 cm^2

- 1) Find scale factor in 3D
- 2) cube root Sj
- 3) Square Sj to get to area.



24

A tank is a cuboid measuring 50 cm by 35 cm by 20 cm
All lengths are to the nearest centimetre.

A container has a capacity of **exactly** 34 litres.

$$1 \text{ litre} = 1000 \text{ cm}^3$$

Which has the greater capacity?

Tick **one** box.

Tank

Container

Cannot tell

Show working to support your answer.

[4 marks]

$$\begin{array}{l} 49.5 \leq 50 \leq 50.5 \quad \text{largest Tank} \quad 36751.375 \\ 34.5 \leq 35 \leq 35.5 \quad 50.5 + 35.5 + 20.5 = 106.5 \\ 19.5 \leq 20 \leq 20.5 \quad \text{Smallest Tank} \\ 49.5 + 34.5 + 19.5 = 103.5 \\ \text{Container} \quad 33301.125 \end{array}$$

$$34 \times 1000 = 34000 \text{ cm}^3$$

$$\begin{array}{l} \text{Upper bound} > 34000 \\ \text{Lower bound} < 34000 \end{array}$$

Turn over for the next question

Turn over ►



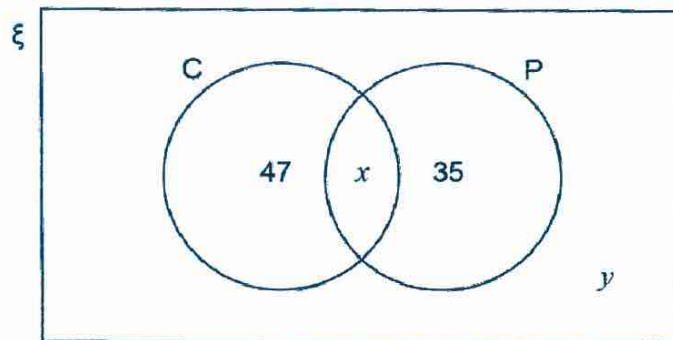
25

The Venn diagram shows some information about 150 students.

$\xi = 150$ students

C = students who study Chemistry

P = students who study Physics



The probability that a Physics student, chosen at random, also studies Chemistry is $\frac{5}{12}$
One of the 150 students is chosen at random.

Work out the probability that the student does **not** study either Chemistry or Physics.

[4 marks]

$$\frac{x}{35+x} = \frac{5}{12} \qquad 150 - 47 - 25 - 35 = 43$$

$$y = 43$$

$$12x = 5(35+x)$$

$$12x = 175 + 5x$$

$$\text{probability} = \frac{43}{150}$$

$$7x = 175$$

$$x = 25$$

Answer

$$\frac{43}{150}$$



26

A curve has equation $y = 4x^2 + 5x + 3$ A line has equation $y = x + 2$

Show that the curve and the line have exactly one point of intersection.

Do not use a graphical method.

[4 marks]

$$x + 2 = 4x^2 + 5x + 3$$

$$-x + 2 \qquad -x + 2$$

$$0 = 4x^2 + 4x + 1$$

$$0 = (2x + 1)(2x + 1)$$

$$2x + 1 = 0 \quad \text{or} \quad x = -0.5$$

$$2x + 1 = 0 \qquad x = -0.5$$

$$0 = (2x + 1)^2 \quad x = -0.5 \text{ only}$$

Turn over for the next question

Turn over ►



27

Prove algebraically that $2.7\dot{5}$ converts to the fraction $\frac{124}{45}$

Do not write
outside the
box

[3 marks]

$$x = 2.7\dot{5}$$

$$10x = 27.\dot{5}$$

$$100x = 275.\dot{5}$$

$$100x = 275.\dot{5}$$

$$- 10x = 27.5$$

$$90x = 248$$

$$x = \frac{248}{90} = \frac{124}{45}$$



28 $f(x) = 5 - x$ and $g(x) = 3x + 7$

28 (a) Simplify $f(2x) + g(x - 1)$

[3 marks]

$$5 - 2x + 3(x - 1) + 7$$

$$5 - 2x + 3x - 3 + 7$$

$$x + 9$$

Answer $x + 9$

28 (b) Solve $g^{-1}(x) = 2x$

[3 marks]

$$x = 3y + 7$$

$$g^{-1}(x) = \frac{x - 7}{3}$$

$$x - 7 = 3y$$

$$\frac{x - 7}{3} = 2x$$

$$\frac{x - 7}{3} = y$$

$$x - 7 = 6x$$

$$-7 = 5x$$

$$x = -\frac{7}{5}$$

$x = -\frac{7}{5}$

END OF QUESTIONS

