Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
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	

AQA

General Certificate of Secondary Education
Higher Tier
June 2015

Applications of Mathematics (Linked Pair) 93702H

Unit 2 Geometry and Measures

H

Thursday 11 June 2015 1.30 pm to 3.00 pm

For this paper you must have:
- a calculator
- mathematical instruments.

Time allowed
- 1 hour 30 minutes

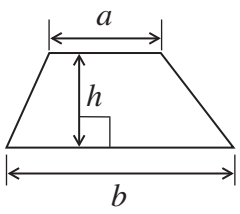
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80
- The quality of your written communication is specifically assessed in Questions 2 and 19
  These questions are indicated with an asterisk (*).
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.
- You are expected to use a calculator where appropriate.

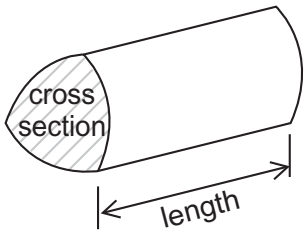
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

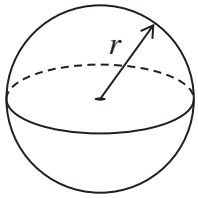


Volume of prism = area of cross section × length



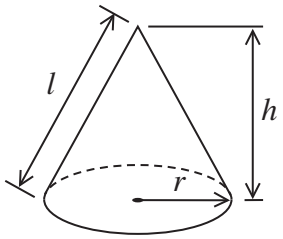
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

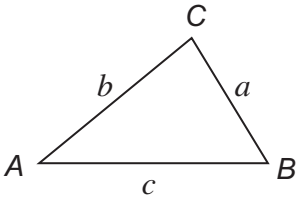
Curved surface area of cone = $\pi r l$



In any triangle *ABC*

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

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



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

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** questions in the spaces provided.

1 To make pancakes for 6 people you need 210 millilitres of milk.

How much milk do you need to make pancakes for 4 people?

[2 marks]

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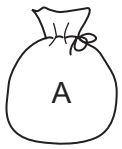
Answer ..... ml

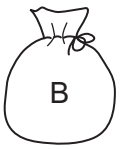
Turn over for the next question

2

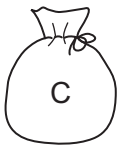
2 Saj has four bags of apples.



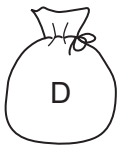
x apples



(x + 6) apples



5x apples



2(x + 6) apples

Bag C and Bag D have the same number of apples.

2 (a) Circle the correct equation.

[1 mark]

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$5x = 2x + 6$ $5x = 2x + 12$ $2x = 5x - 6$ $5x = x + 12$

2 (b) Work out the number of apples in bag A.

[2 marks]

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Answer .....

***2 (c)** Saj needs 5 apples to make an apple pie.

Are there enough apples in all four bags to make 10 apple pies?
You **must** show your working.

[2 marks]

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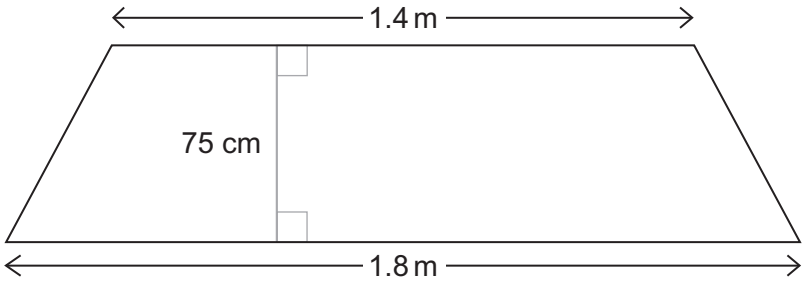
Turn over for the next question

5

3 A rug is in the shape of a trapezium.



Not drawn accurately

Work out the area of the rug.
State the units of your answer.

[3 marks]

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Answer .....

4 Numbers that are the product of two different prime numbers are used in internet security.

6497 is the product of two prime numbers.

4 (a) Explain why

one of the prime numbers could have **unit** digit 3

and

the other prime number could have **unit** digit 9

[1 mark]

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4 (b) Work out the two prime numbers which have a product of 6497

[2 marks]

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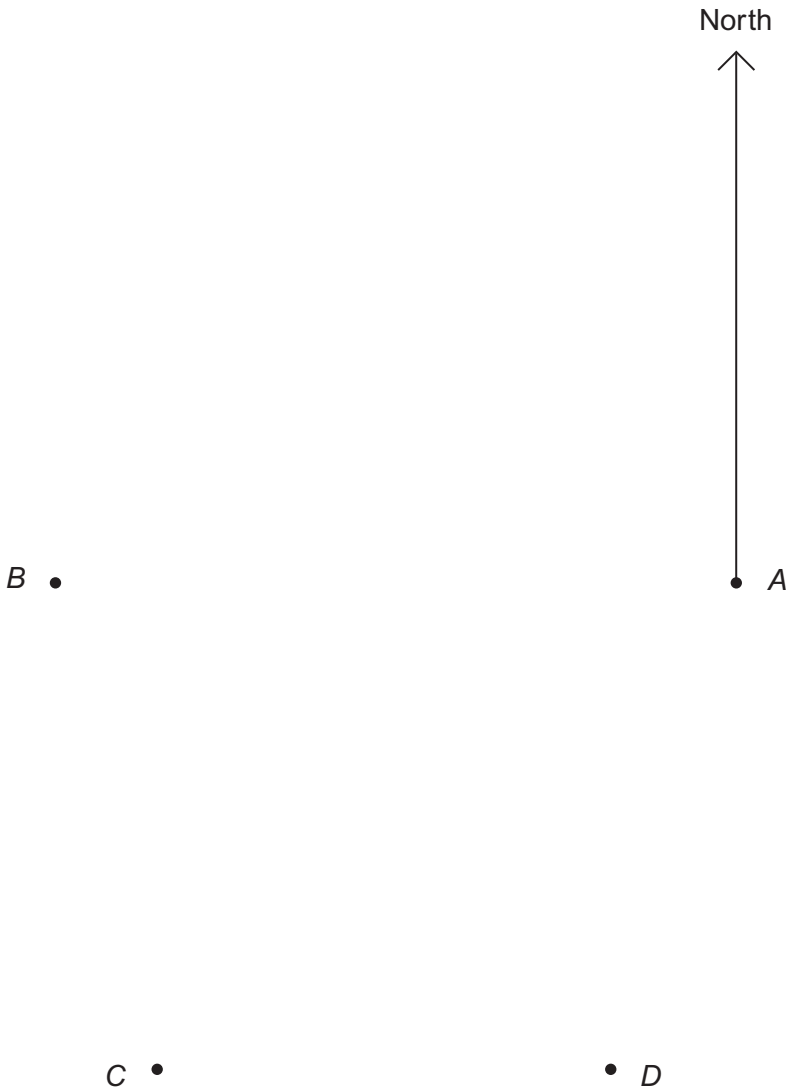
Answer ..... and .....

6

5 The scale drawing shows the positions of towns *A*, *B*, *C* and *D*.

Scale 1 cm represents 5 km



5 (a) A helicopter flies directly from *A* to *C*.

On what bearing does the helicopter fly?

[1 mark]

Answer ..... °

5 (b) The distances along roads between the towns are shown in this table, in kilometres.

	A	***B***	***C***	***D***
A		52	59	36
B	52		38	54
C	59	38		39
D	36	54	39	

A car travels by road

from *A* to *D*

and then from *D* to *C*.

How many **more** kilometres does the car travel than the helicopter?

[3 marks]

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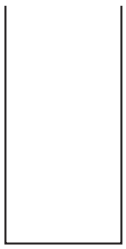
Answer ..... km

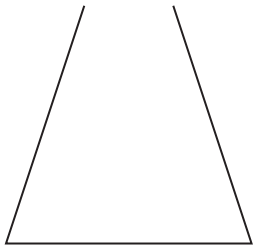
4

6 Four containers are of equal height.
These diagrams show the cross section of each container.

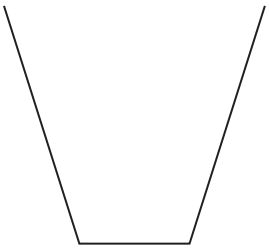
A



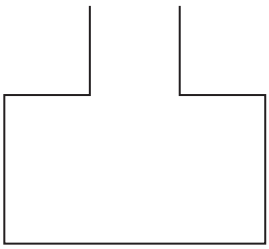
B



C

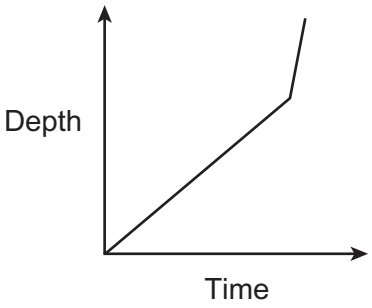


D

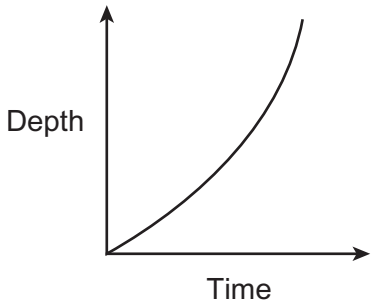


Water flows into each container at a constant rate until the container is full.
These sketch graphs show how the depth of the water changes with time, for each container.

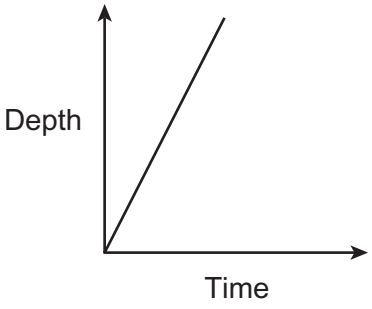
Graph 1



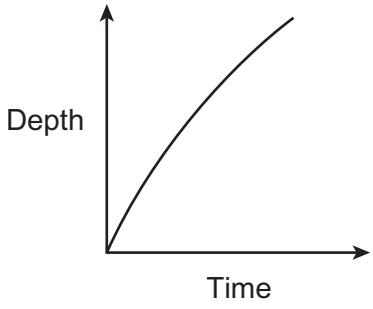
Graph 2



Graph 3



Graph 4



6 (a) Complete this table to match each container to a graph.

[2 marks]

Container A	Graph .....
Container B	Graph .....
Container C	Graph .....
Container D	Graph .....

6 (b) Which graph shows that the depth of water increases at a constant rate until the container is full?

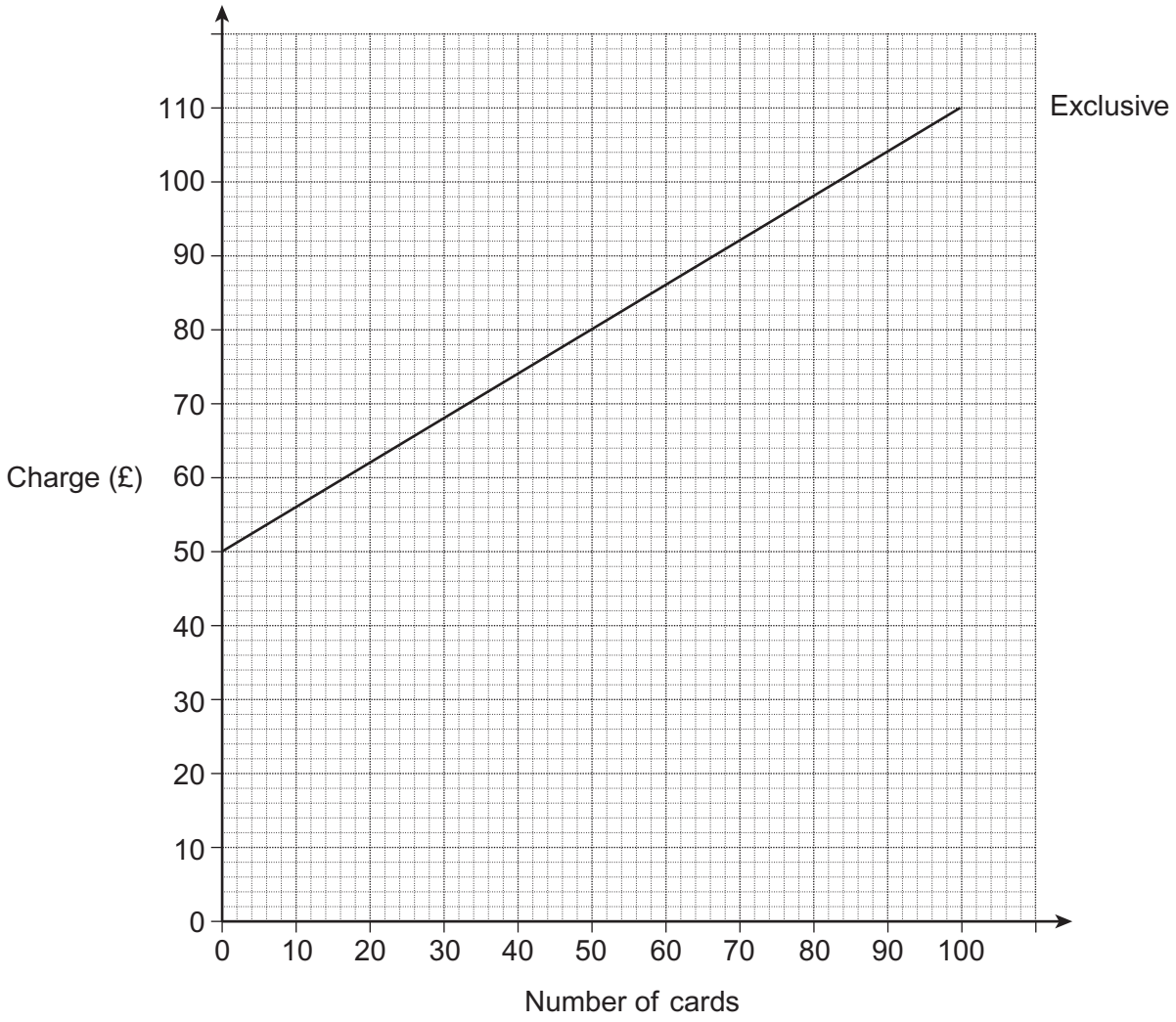
[1 mark]

Answer .....

Turn over for the next question

3

7 A company designs and prints **standard** and **exclusive** wedding invitation cards.
This graph shows how much the company charges for up to 100 **exclusive** cards.



This table shows the design and printing charges for the **standard** card.

Design charge	Printing charge
£40	30p per card

7 (a) On the grid above, draw a graph to show how much the company charges for up to 100 **standard** cards.

[2 marks]

7 (b) Work out the **total** charge for 10 exclusive cards and 50 standard cards.

[2 marks]

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Answer £ .....

7 (c) Ann and Mike want to spend £130 on wedding invitation cards.
They would like 150 **exclusive** cards.

Is £130 enough?
You **must** show your working.

[2 marks]

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Turn over for the next question

6

8 A ship travels a distance of 30 km at a speed of 24 km/h

Work out the time taken.
Give your answer in hours and minutes.

[3 marks]

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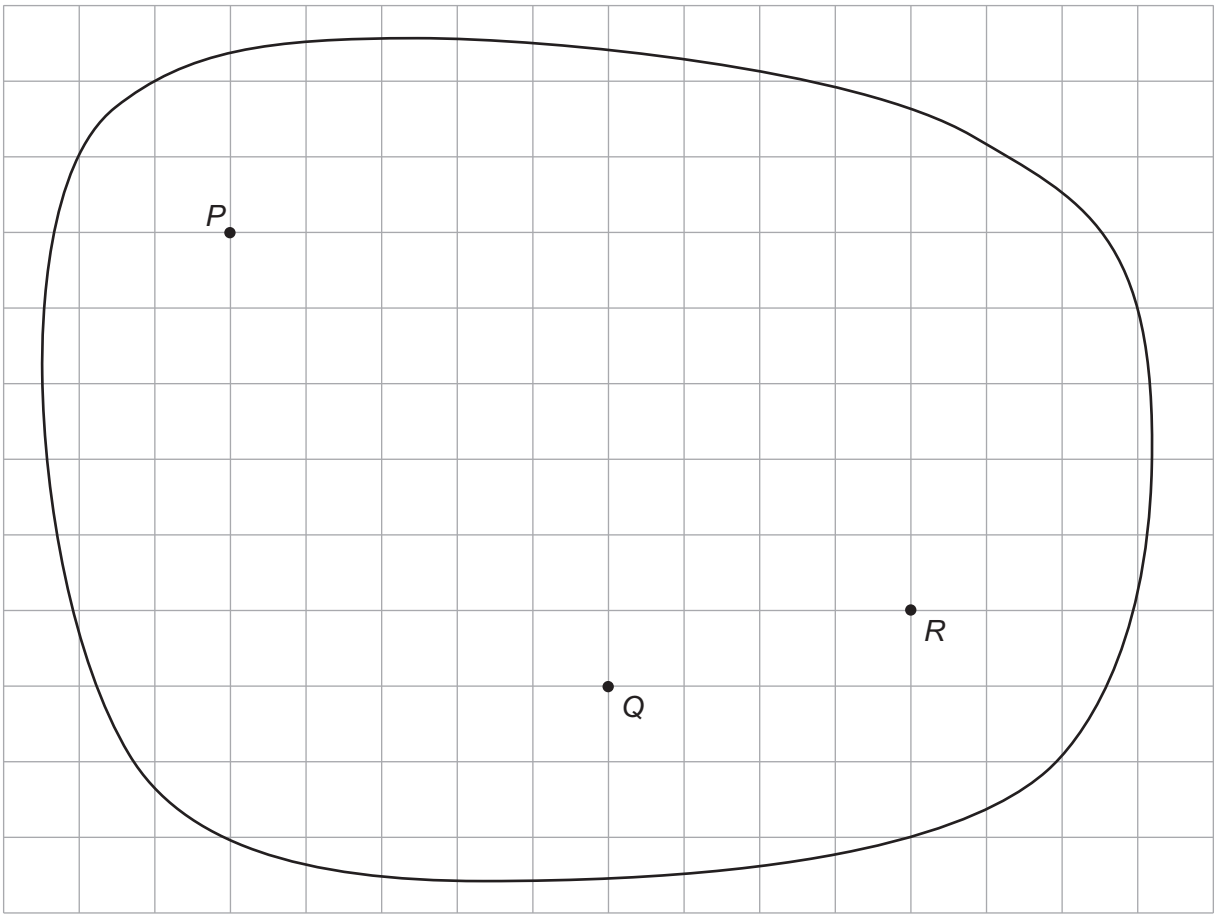
Answer ..... hours ..... minutes

9 You will need a ruler and compasses to answer this question.

The scale drawing shows the positions of three trees, *P*, *Q* and *R* on an island.

Scale 1 cm represents 100 metres



Some treasure is buried

less than 500 metres from *P*
less than 750 metres from *R*
nearer to *P* than to *Q*.

Shade the region where the treasure could be.

[3 marks]

6

10 Jack sells packs of envelopes.
There are three types of pack, Economy (E), Standard (S) and Luxury (L).

One week he sells 270 packs in the ratio

E : S : L = 5 : 3 : 2

He makes a profit of

12p a pack on Economy packs

15p a pack on Standard packs

20p a pack on Luxury packs.

Work out the **total** profit he makes selling envelopes.

[3 marks]

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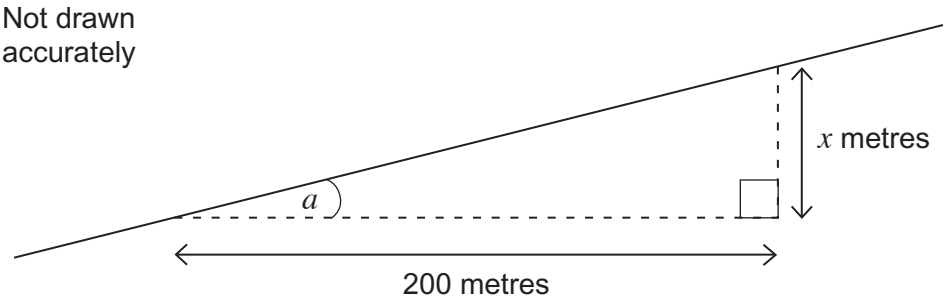
Answer £ .....

11 The diagram shows a section of a railway line with gradient $\frac{1}{37}$



11 (a) Work out the value of x.
Give your answer to 3 significant figures.

[3 marks]

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Answer .....

11 (b) Work out the size of angle a.

[3 marks]

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Answer ..... degrees

9

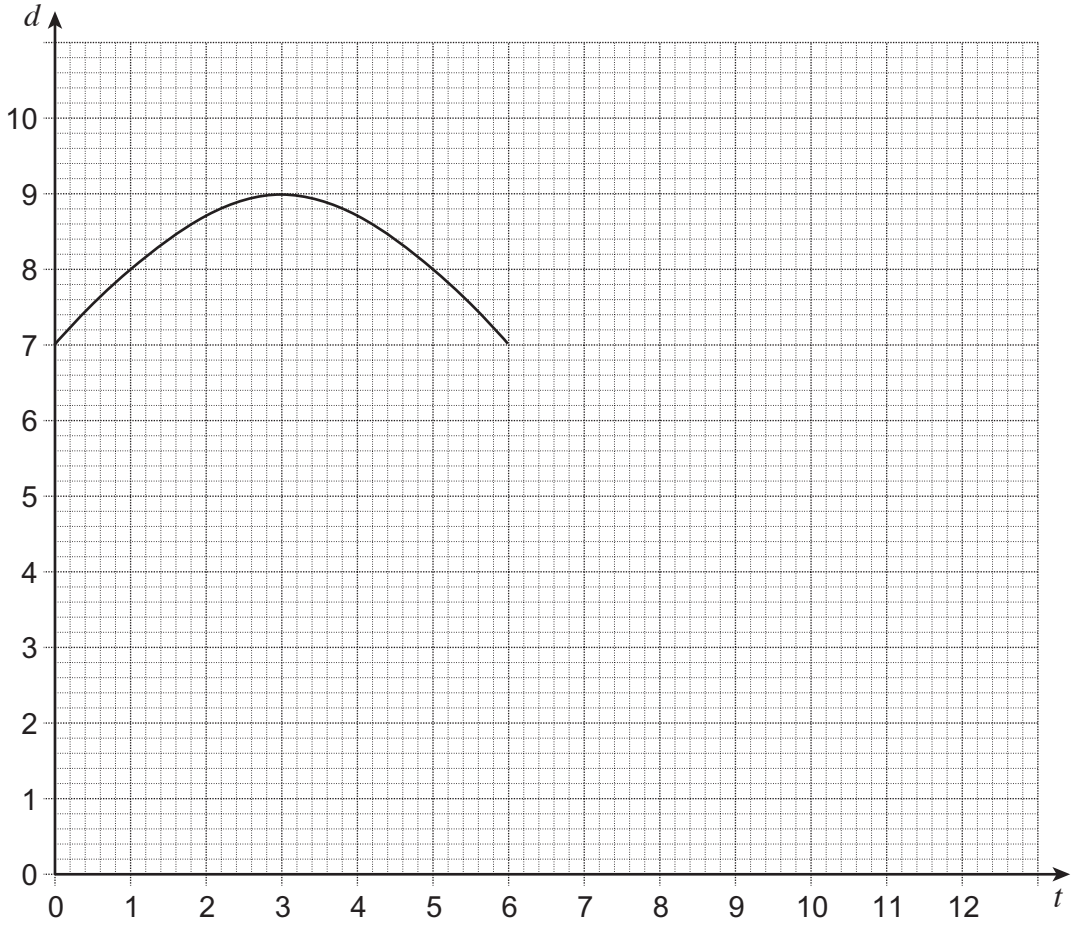
Turn over ▶

12 The depth of water in a harbour is modelled by the equation

$$d = 7 + 2 \sin (30t)^\circ$$

d is the depth of water in metres.
t is the number of hours after 4.00 am

The graph shows the depth of water for values of t from 0 to 6



12 (a) Complete the table.

[2 marks]

t	7	8	9	10	11	12
d						

12 (b) On the grid opposite, draw the graph for values of t from 6 to 12

[1 mark]

12 (c) Between what times of day is the depth at least 8 metres?

[2 marks]

Between ..... and .....

Turn over for the next question

5

13 John makes a **square** tile *ABCD*.
He joins together

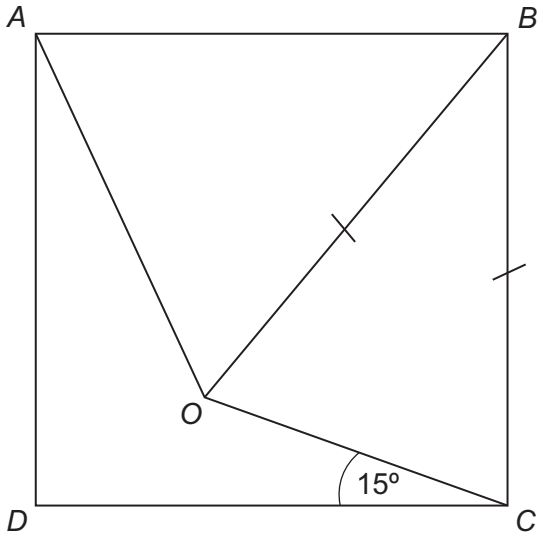
quadrilateral *AOCD*

isosceles triangle *BOC*

triangle AOB.

OB = *CB*

Not drawn accurately



Show that triangle *AOB* is equilateral.
You **must** show your working, some of which may be on the diagram.

[5 marks]

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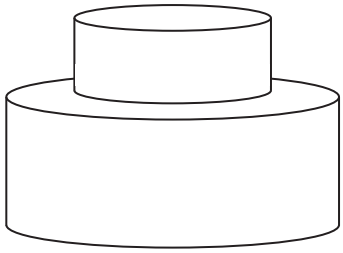
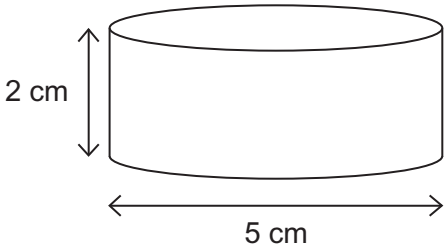
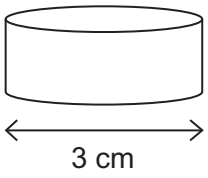
14 The diagram shows a paperweight.



The paperweight is made from these two **similar** glass cylinders.





The density of the glass is 2.6 g per cm^3

Work out the mass of the paperweight in grams.

[5 marks]

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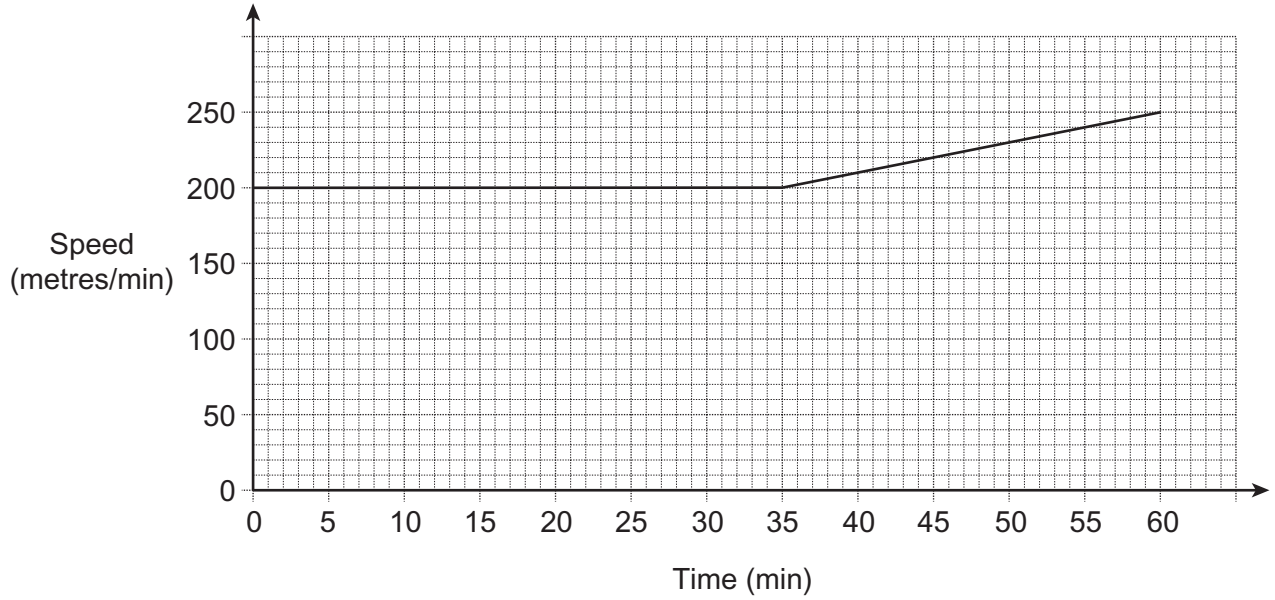
Answer ..... g

10

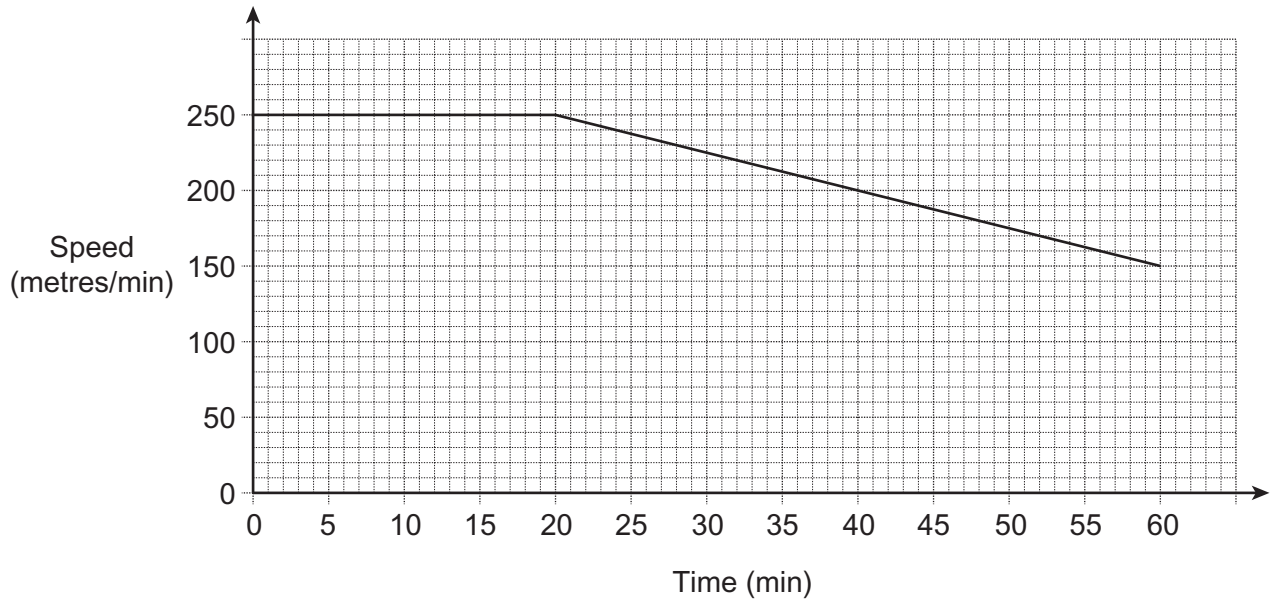
Turn over ▶

15 Chloe is training for a marathon.
These speed-time graphs model her training runs on Monday and Wednesday.

Monday



Wednesday



On which day did Chloe run further?
You **must** show your working.

[4 marks]

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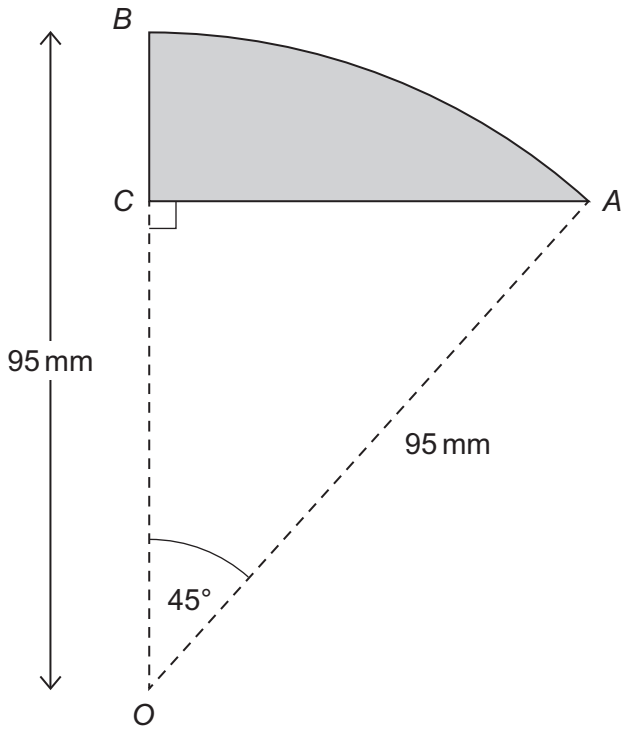
Answer .....

4

16 The **shaded** section *ABC* shows the plan view of a silver pendant.

OAB is a sector of a circle, centre *O*, radius 95 mm



Not drawn accurately

16 (a) Work out the area of the **sector** *OAB*.

[3 marks]

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Answer ..... mm^2

16 (b) Show that OC = 67.2 mm to 3 significant figures.

[2 marks]

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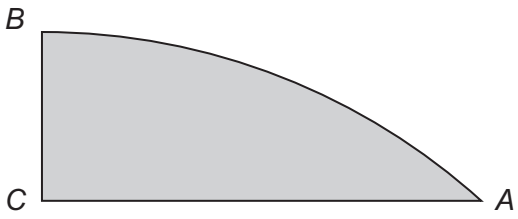
16 (c) The silver pendant is a prism with thickness 2.5 mm
The cross section is shown.



Not drawn accurately

Work out the volume of silver in the pendant.

[3 marks]

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Answer ..... mm^3

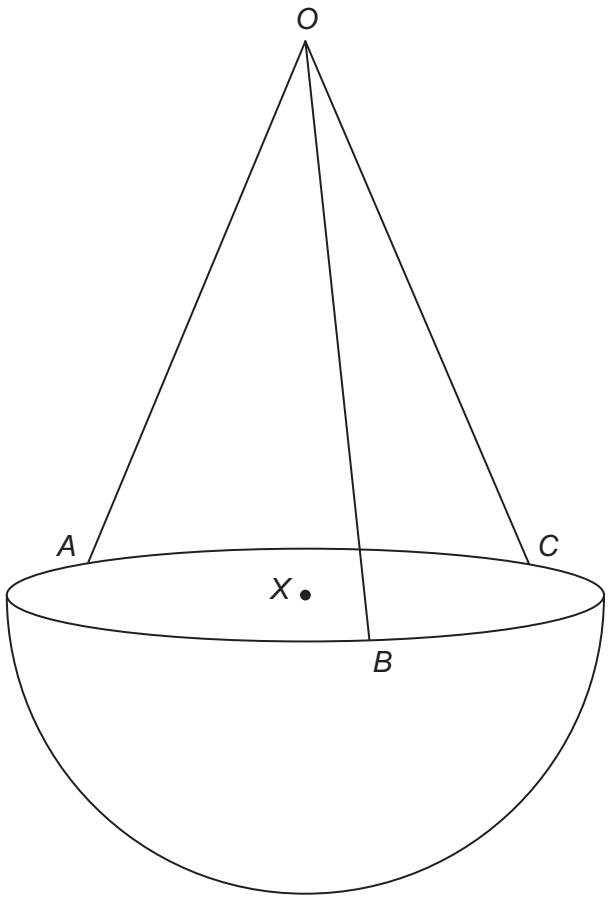
8

17 A hanging basket consists of

a hemisphere of diameter 24 cm

3 chains, *OA*, *OB* and *OC*, each of length 28 cm

A, *B* and *C* are 3 points on the circular rim of the hemisphere.
O is directly above *X*, the centre of circle *ABC*.



Work out the length *OX*.

[3 marks]

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Answer ..... cm

18

For a model aeroplane

L = length in centimetres

A = surface area of the wings in square centimetres

M = mass in grams

A model aeroplane has

$L = 24$ $A = 120$ $M = 40$

A larger, similar model aeroplane is made by increasing the **length** by scale factor x.

18 (a) Circle the expression for the surface area of the wings of the larger model.

[1 mark]

$24x$ $24x^2$ $120x$ $120x^2$ $30x^2$

18 (b) Circle the expression for the mass of the larger model.

[1 mark]

$40x$ $40x^2$ $40x^3$ $24x^3$ $120x$

18 (c) For a model aeroplane to fly $M \div A$ must be 0.5 or less.

Work out the **biggest** value that x can be for the larger model to fly.

[2 marks]

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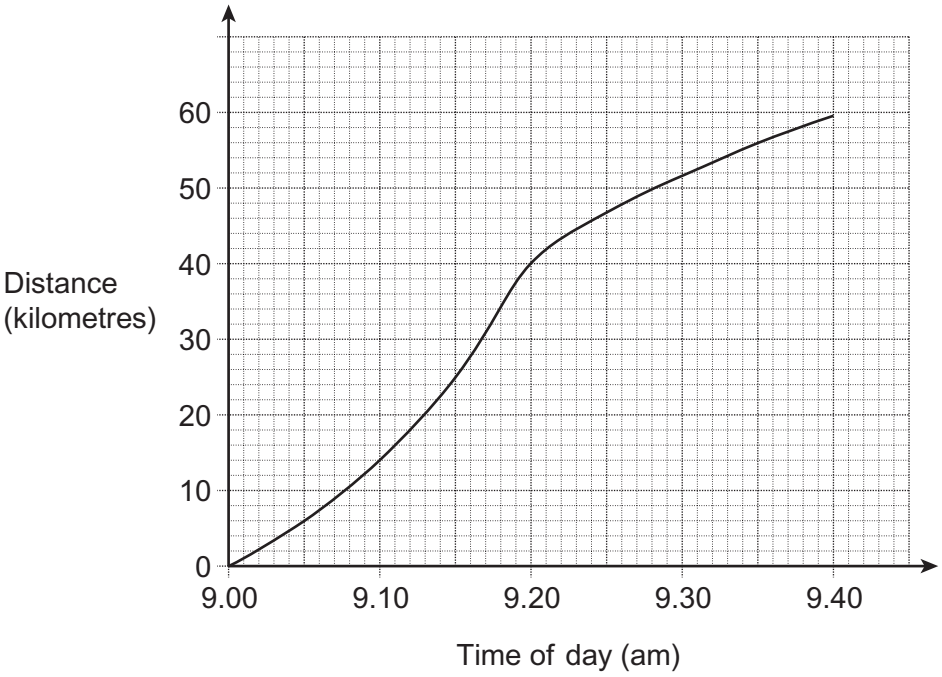
Answer .....

7

***19** The distance-time graph shows a car journey on a motorway.
Distances are measured in kilometres.



The speed limit for the motorway is 70 miles per hour.

At 9.20 am, was the car travelling at more than 70 miles per hour?
You **must** show your working.

[5 marks]

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END OF QUESTIONS

5

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