

Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
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TOTAL	



General Certificate of Secondary Education  
Higher Tier  
January 2012

# Applications of Mathematics 93702H (Linked Pair Pilot)

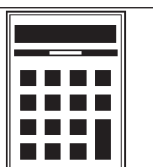
Unit 2 Geometry and Measures

# H

Thursday 26 January 2012 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  $\pi$  button, take the value of  $\pi$  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 1, 5 and 8.  
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 booklet.
- You are expected to use a calculator where appropriate.

### Advice

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



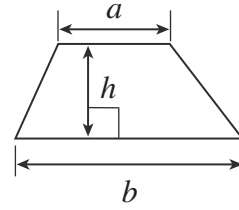
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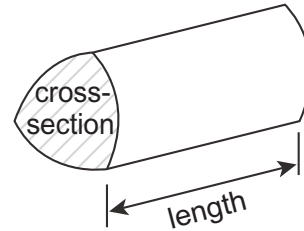
# 93702H

### Formulae Sheet: Higher Tier

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

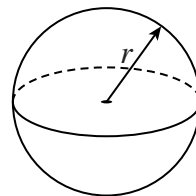


**Volume of prism** = area of cross-section  $\times$  length



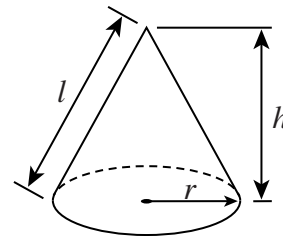
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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

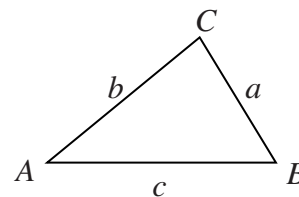


**In any triangle ABC**

**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

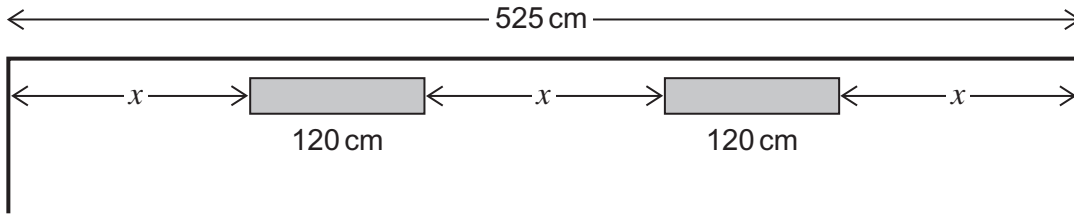
The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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



Answer **all** questions in the spaces provided.

- \*1 A wall is 525 centimetres long.  
Two radiators, each 120 centimetres long, are fitted to the wall as shown.



Not drawn accurately

Set up and solve an equation to find the value of  $x$ .

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Answer  $x =$  ..... cm (4 marks)

- 2 Delia makes a fruit salad from apples, oranges and pears.  
For every 4 apples, she uses 3 oranges and 1 pear.  
Delia uses 24 pieces of fruit altogether.

Work out the number of apples she uses.

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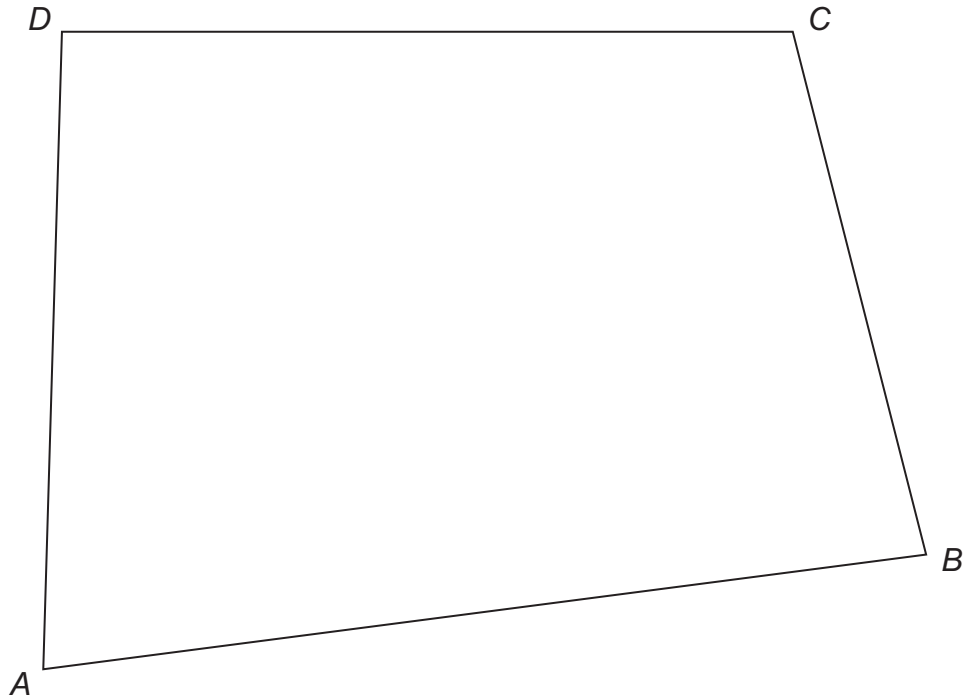
Answer ..... (3 marks)



3

$ABCD$  is a scale drawing of a playground.

Scale: 1 centimetre represents 20 metres



A swing is placed 180 metres from A and 120 metres from B.

Use ruler and compasses only to show the position of the swing.  
Mark the position X.

(3 marks)



4 Crude oil is sold in barrels.

1 barrel = 35 gallons  
Cost of 1 barrel = £52

Crude oil is used to make petrol.  
One litre of petrol costs £1.20

Jasmine says



One gallon of petrol costs  
about twice as much as  
one gallon of crude oil.

Jasmine

Is Jasmine correct?  
You **must** show your working.

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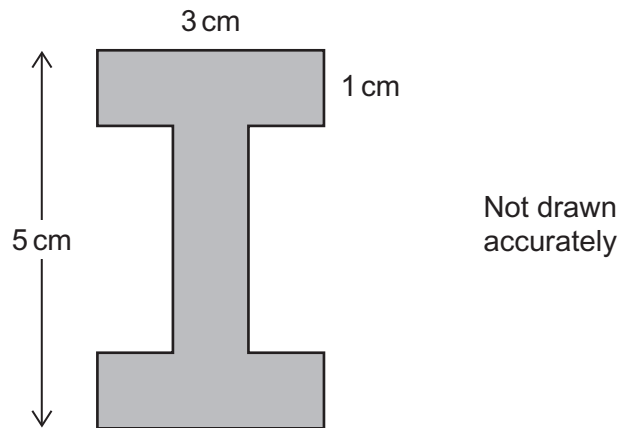
(4 marks)

Turn over for the next question

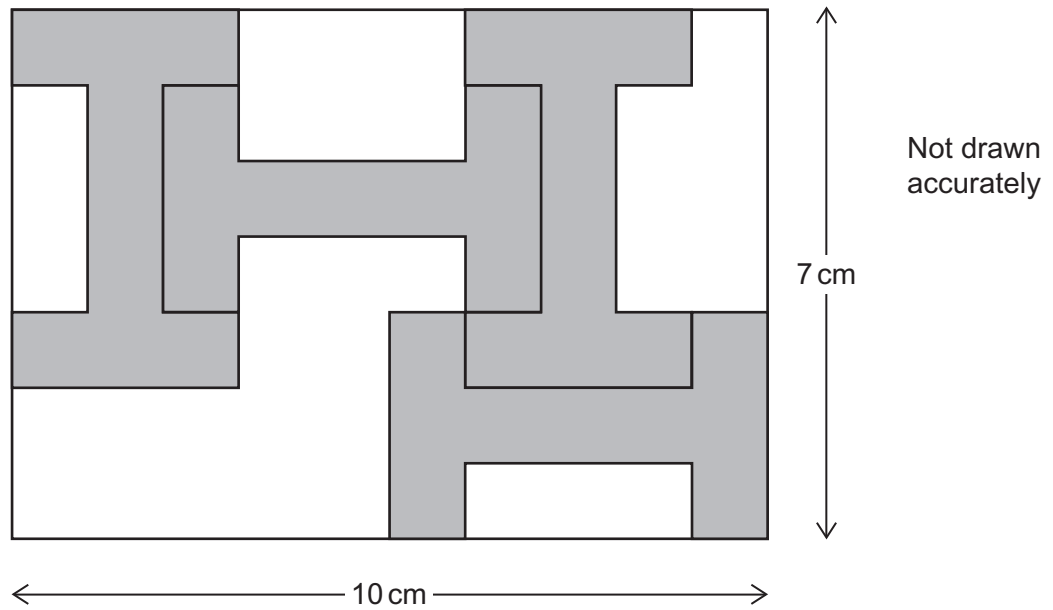


\*5

David cuts out this symmetrical letter I from sheets of wood.



The diagram shows how he cuts four of these letters from a 10 cm by 7 cm rectangular sheet.



The sheet of wood is 1.2 cm thick.  
The wood that is **not** used is waste.



Work out the volume of wood that is waste.

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Answer ..... cm<sup>3</sup> (5 marks)

**Turn over for the next question**

5

**Turn over ►**



6 Drinks are sold in packs of 12.  
Chocolate bars are sold in packs of 15.  
Chris buys the same number of drinks as chocolate bars.

What is the smallest possible number of each pack that he buys?

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Answer ..... packs of drinks  
..... packs of chocolate bars (2 marks)

7 A solid statue has volume  $720 \text{ cm}^3$  and mass 2.5 kilograms.  
The density of bronze is 8 grams per  $\text{cm}^3$ .

Is the statue made of bronze?  
Show how you decide.

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(3 marks)







**9** Julia buys a new scooter for £882.  
 The value of the scooter reduces by  $\frac{1}{3}$  each year.

**9 (a)** Work out the value of the scooter in two years time.

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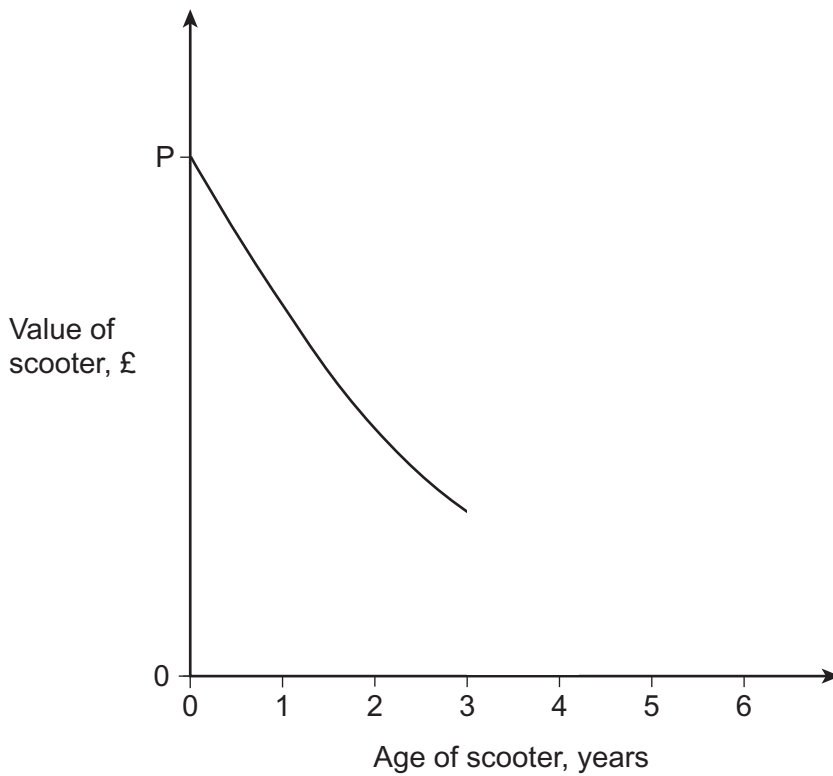
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Answer £ ..... (3 marks)

**9 (b)** This sketch graph shows how the value of the scooter changes during the first three years.



**9 (b) (i)** Write down the value of  $P$ .

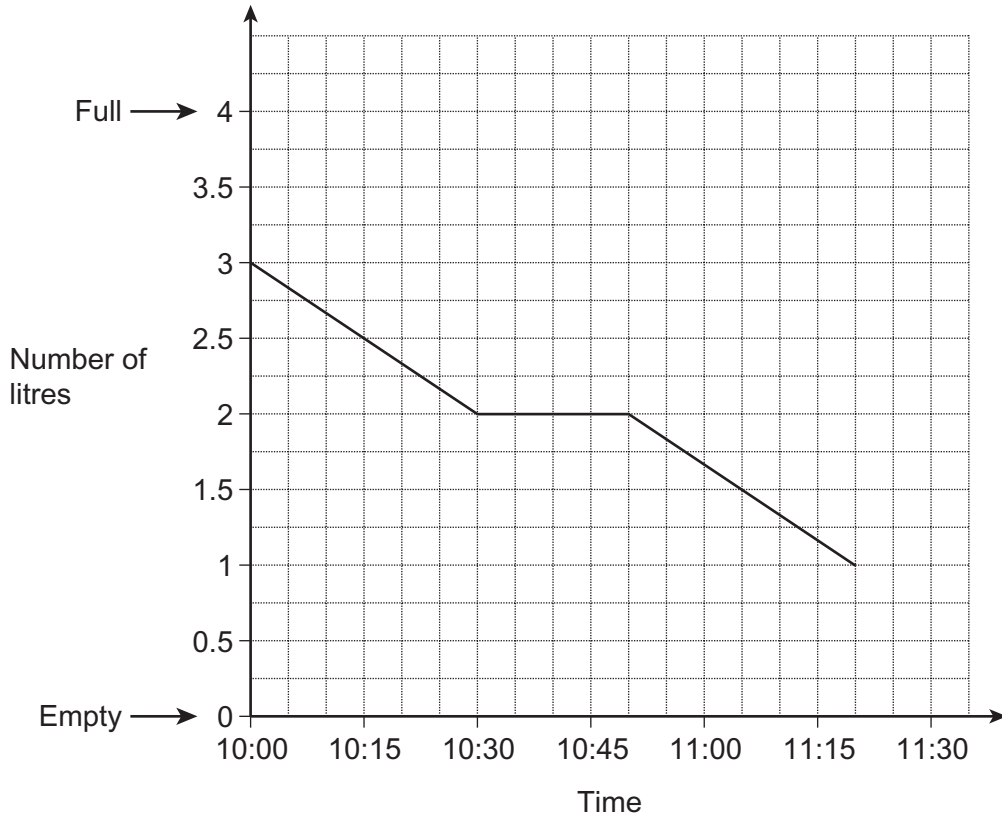
Answer ..... (1 mark)

**9 (b) (ii)** Complete the sketch graph to show how the value of the scooter changes during the next three years.

(1 mark)



9 (c) Julia leaves home on her scooter at 10:00  
This graph shows the number of litres of petrol in her scooter.



9 (c) (i) Her scooter travels 15 miles on one litre of petrol.

What speed is the scooter travelling at between 10:00 and 10:30?  
Give your answer in miles per hour.

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Answer ..... mph (2 marks)

9 (c) (ii) For how long is the scooter **not** moving?

Answer ..... minutes (1 mark)

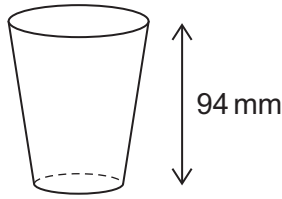
9 (c) (iii) The scooter holds a maximum of 4 litres of petrol.  
At 11:20, Julia fills the scooter with petrol.

Show this information on the graph above.

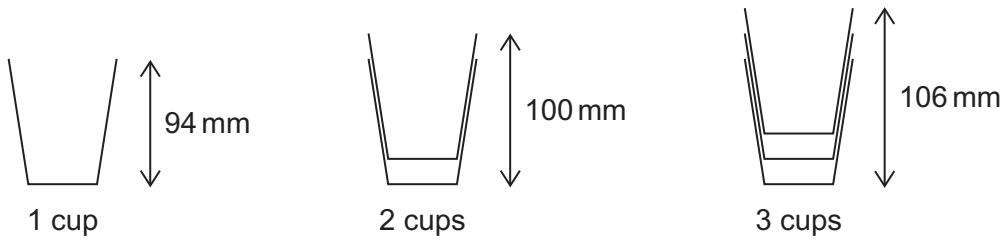
(1 mark)



10 The diagram shows a plastic cup of height 94 millimetres.



The cups can be stacked.  
The heights of some stacks are shown.



Not drawn accurately

10 (a) Complete the table.

<b>Number of cups, <math>n</math></b>	1	2	3	4	5
<b>Height of stack, <math>h</math> (mm)</b>	94	100	106		

..... (1 mark)

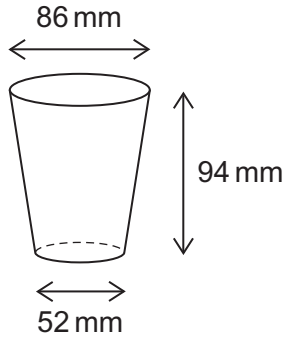
10 (b) Work out a formula for  $h$  in terms of  $n$ .

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Answer ..... (2 marks)

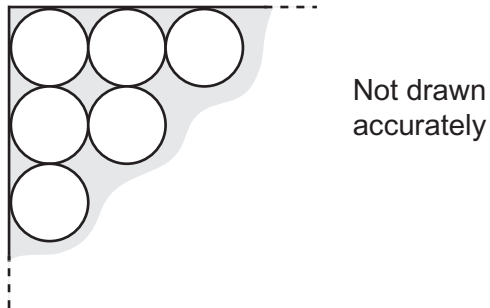


10 (c) 120 of these cups are to be packed in a box.



The cups will be packed in stacks of equal height.

A plan view of how the stacks are arranged in the box is shown.



Work out suitable dimensions for the box.  
You **must** show your working.

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Answer Length ..... mm

Width ..... mm

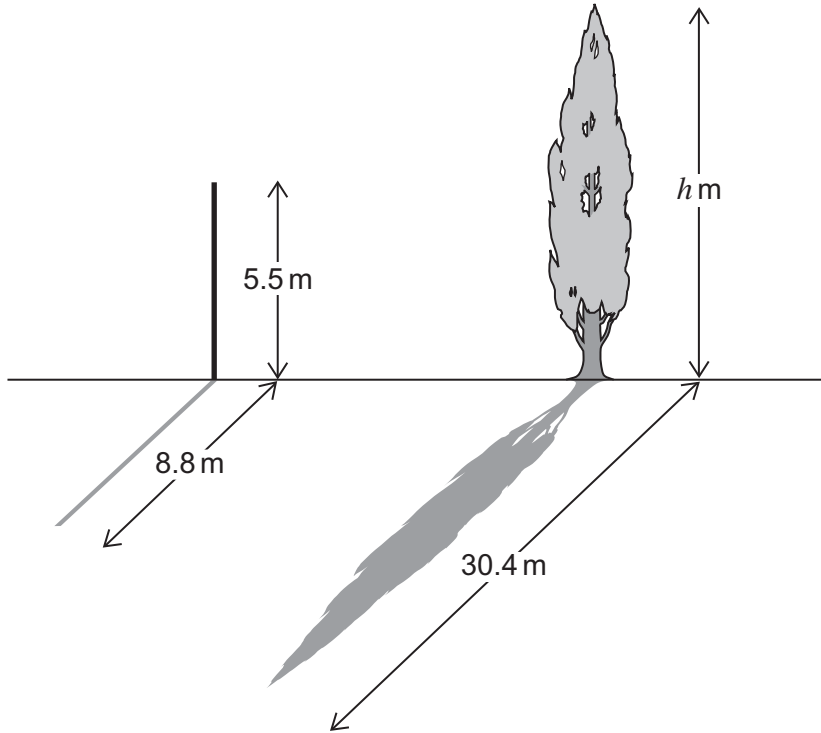
Height ..... mm

(5 marks)



11

A telegraph pole is 5.5 metres high.  
A tree is  $h$  metres high.  
At 3 pm, the shadow of the telegraph pole is 8.8 metres long and the shadow of the tree is 30.4 metres long.



Work out  $h$ .

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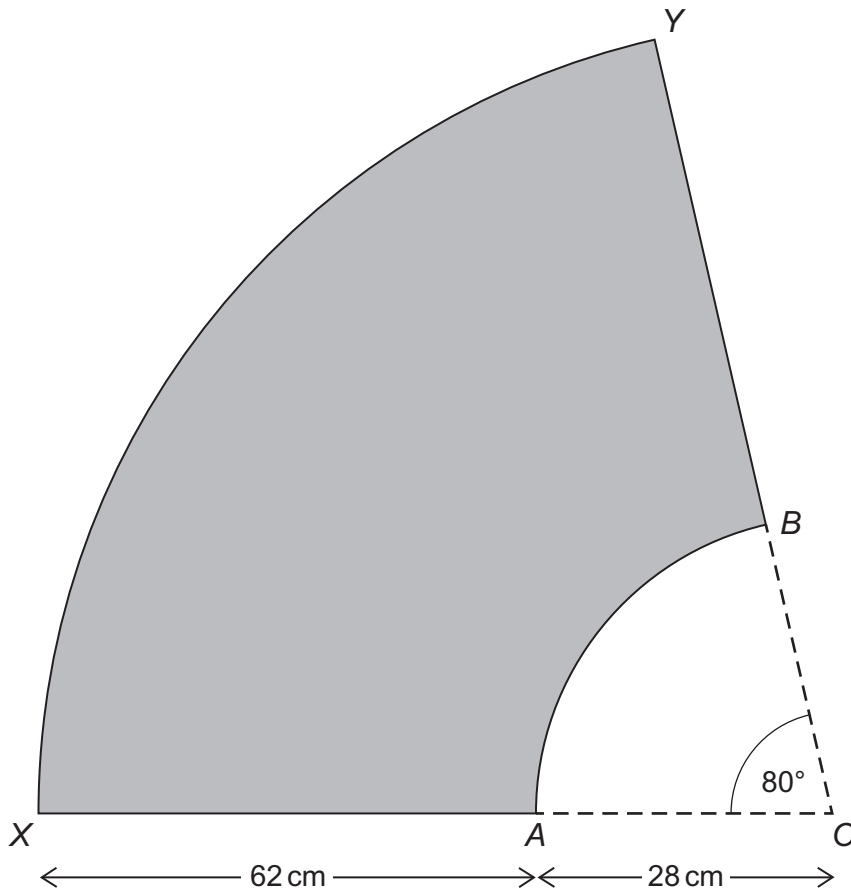
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Answer ..... m (3 marks)



12

A wiper blade on a windscreen cleans the shaded area shown.  $OAB$  and  $OXY$  are sectors of a circle, centre  $O$ .



Not drawn accurately

Calculate the area of the windscreen which the wiper cleans.

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Answer ..... cm<sup>2</sup> (5 marks)

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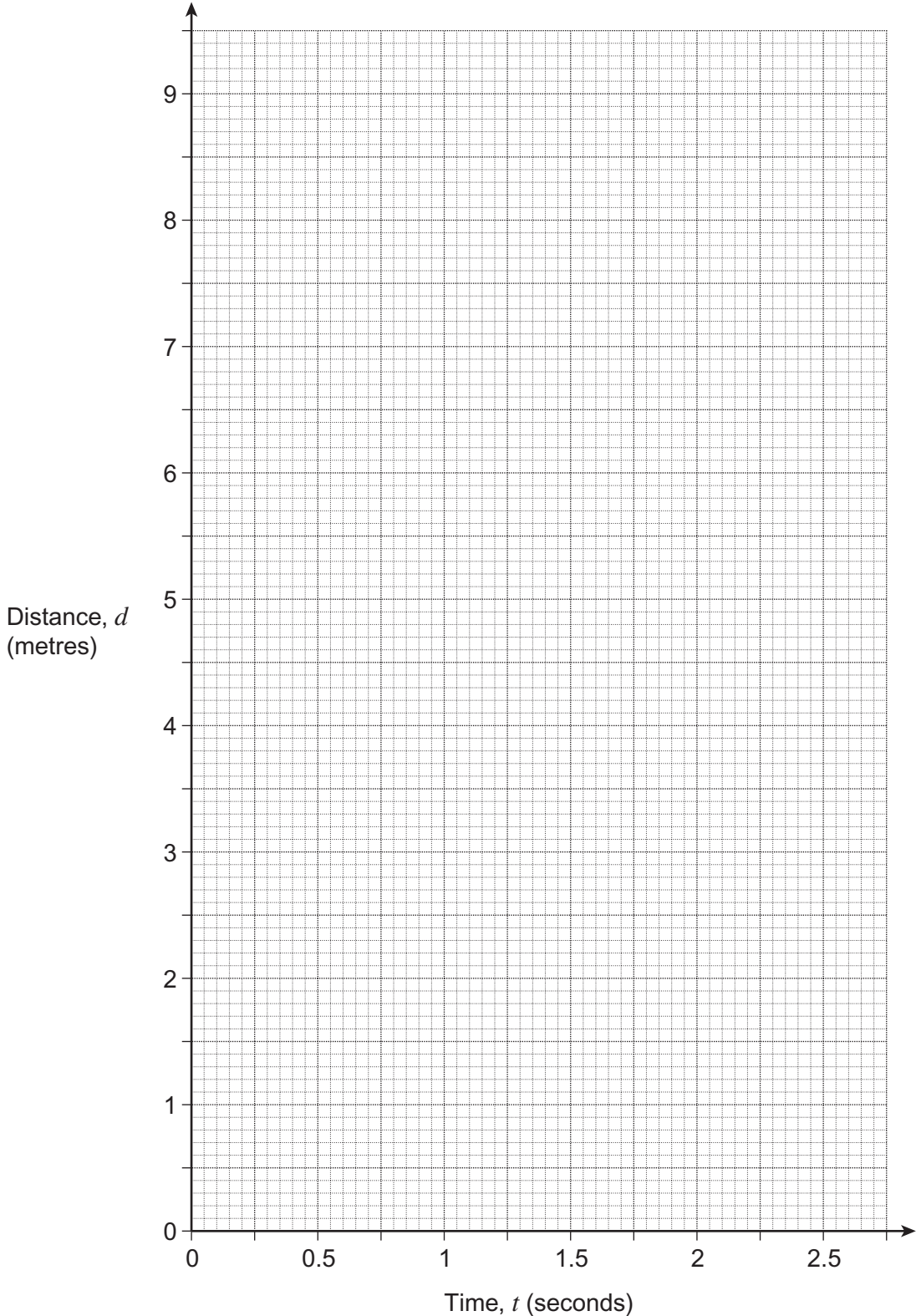
Turn over ►



**13** A ball rolls down a slope for 10 seconds.  
In  $t$  seconds it travels  $d$  metres.  
The table shows the data for the first 2.5 seconds.

<b>Time, <math>t</math> (seconds)</b>	0	0.5	1	1.5	2	2.5
<b>Distance, <math>d</math> (metres)</b>	0	0.35	1.4	3.15	5.6	8.75

**13(a) (i)** On this grid, draw a graph of  $d$  against  $t$ .



(2 marks)





13 (a) (ii) How long does it take for the ball to roll 7 metres down the slope?

Answer ..... s (1 mark)

13 (b) The equation connecting  $d$  and  $t$  is  $d = kt^2$

Work out the distance the ball will roll during the first 5 seconds.

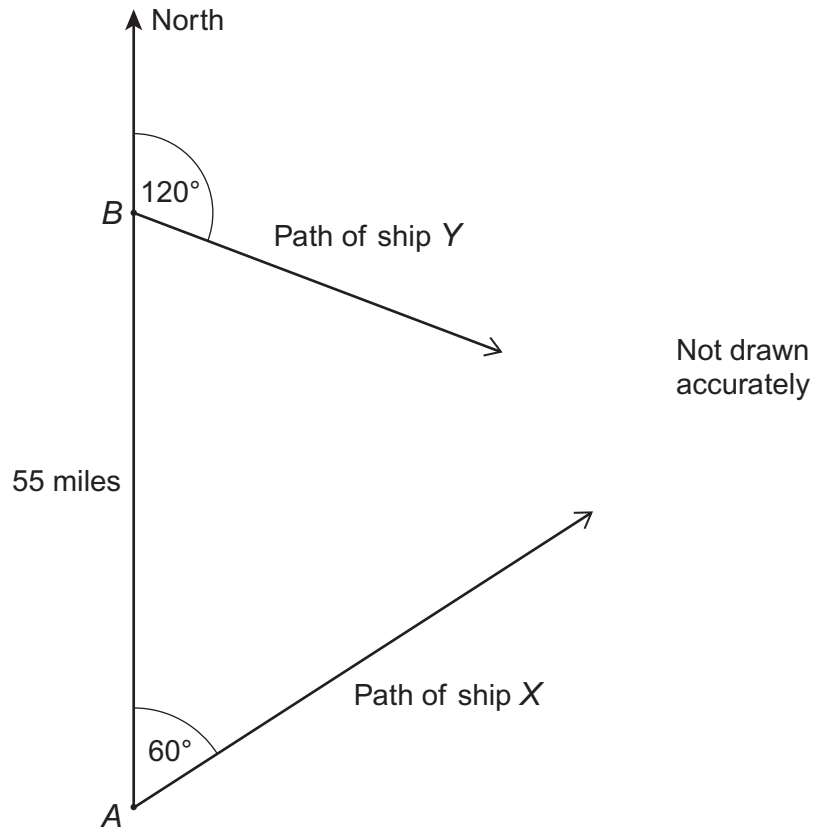
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Answer ..... m (4 marks)

Turn over for the next question

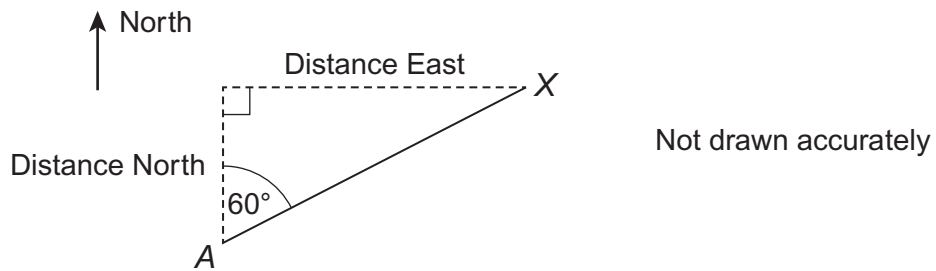


14 The diagram shows ports A and B and the paths of two ships, X and Y.



Port A is South of port B.  
The distance from A to B is 55 miles.

14 (a) Ship X leaves port A at 3.00 pm.  
It sails on a bearing of  $060^\circ$  at a speed of 25 miles per hour.  
This sketch shows where ship X is at 5.00 pm.



14 (a) (i) How far is ship X from port A at 5.00 pm?

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Answer ..... miles (2 marks)



14 (a) (ii) How far East and how far North is ship X from port A at 5.00 pm?

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Answer Distance East = ..... miles

Answer Distance North = ..... miles (4 marks)

14 (b) Ship Y leaves port B at 3.30 pm.  
It sails on a bearing of 120° at a speed of 28 miles per hour.

How far apart are the two ships at 5.00 pm?

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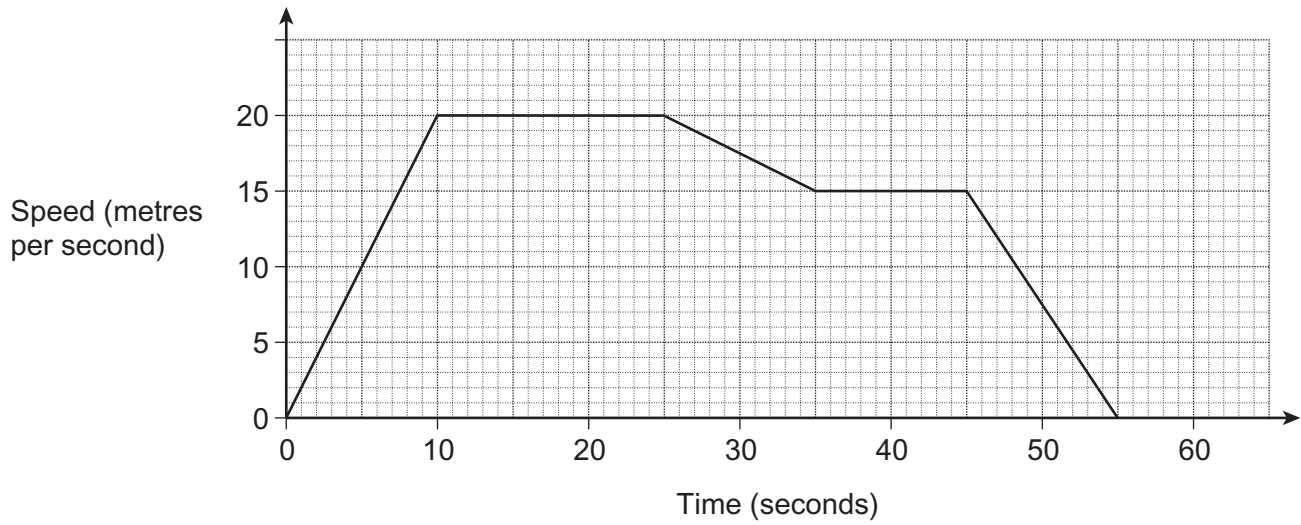
Answer ..... miles (7 marks)

Turn over for the next question

Turn over ►



15 This speed-time graph shows the journey of a bus as it travels between two bus stops.



After how many seconds does the bus pass the halfway point between the bus stops?

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Answer ..... seconds (5 marks)

**END OF QUESTIONS**

