

**MATHEMATICS B**

**J567/04**

Paper 4 (Higher Tier)

Candidates answer on the question paper.

**ADDITIONAL SPECIMEN**

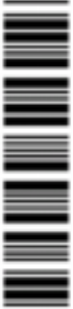
**OCR Supplied Materials:**

None

**Duration:** 1 hour 45 minutes

**Other Materials Required:**

- Geometrical instruments
- Tracing paper (optional)
- Scientific or graphical calculator



Candidate Forename		Candidate Surname	
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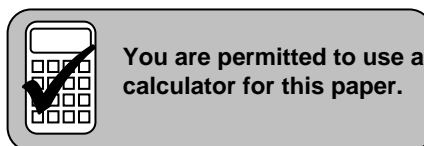
Centre Number						Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

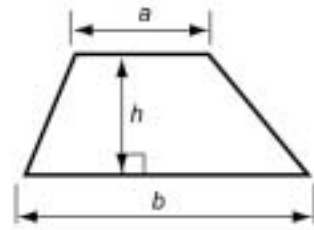
**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You are permitted to use a calculator for this paper.
- Use the  $\pi$  button on your calculator or take  $\pi$  to be 3.142 unless the question says otherwise.
- Your Quality of Written Communication is assessed in questions marked with an asterisk (\*).
- The total number of marks for this paper is **100**.
- This document consists of **24** pages. Any blank pages are indicated.

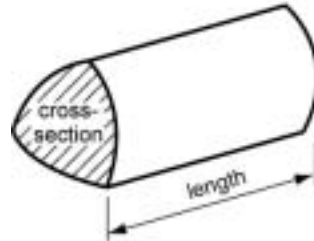


## Formulae Sheet: Higher Tier

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



$$\text{Volume of prism} = (\text{area of cross-section}) \times \text{length}$$

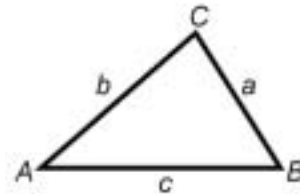


In any triangle *ABC*:

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

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$

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



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

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



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

$$\text{Curved surface area of cone} = \pi r l$$

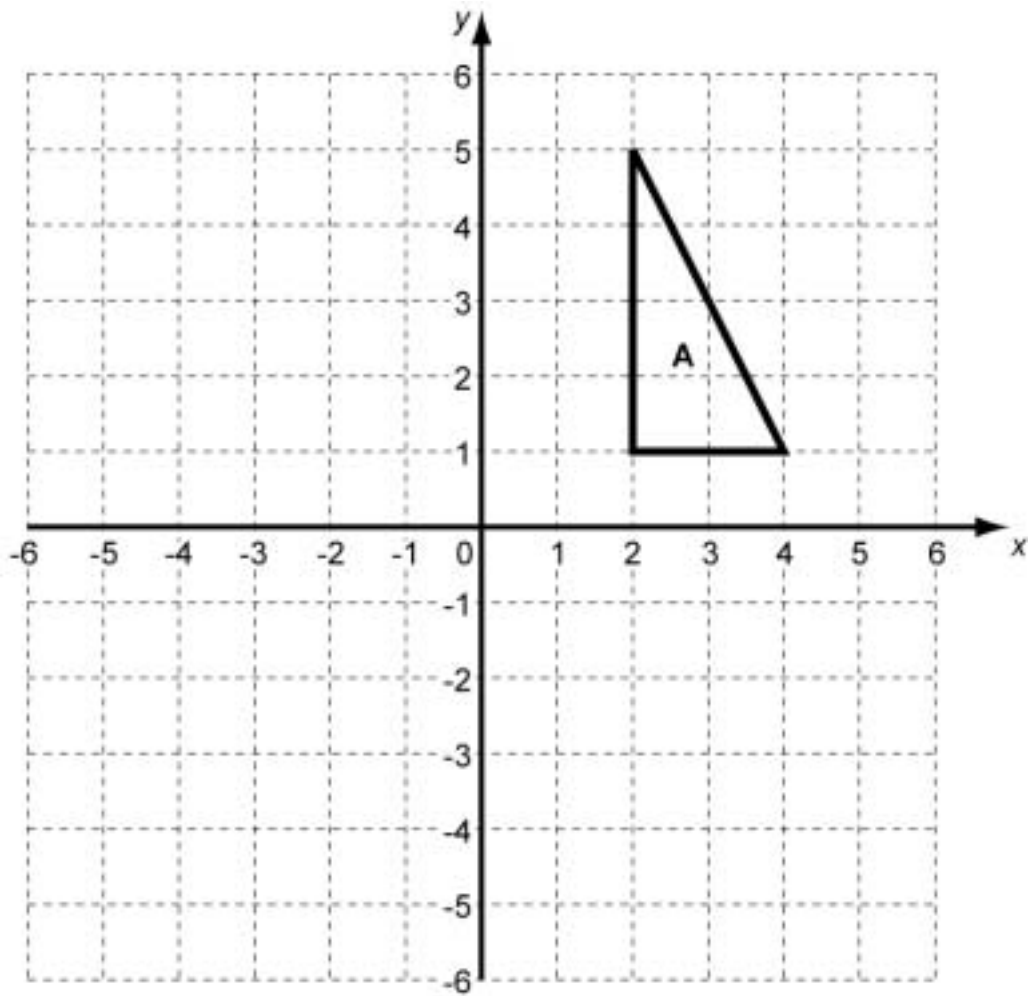


### The Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

**PLEASE DO NOT WRITE ON THIS PAGE**

1



- (a) Rotate triangle **A** through  $90^\circ$  anticlockwise about the point  $(2, 0)$ .  
Label the image **B**.

[3]

- (b) Is **B** congruent to **A**? Explain your answer.

Write Yes  
or No.

\_\_\_\_\_ because \_\_\_\_\_

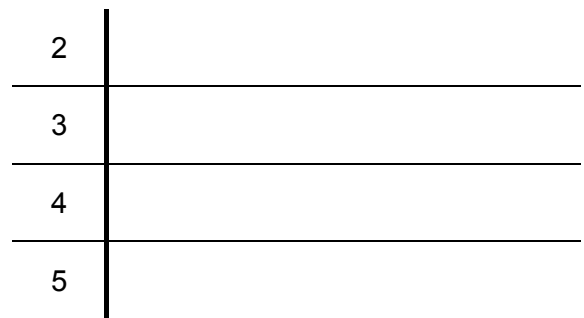
\_\_\_\_\_ [1]

- 2 (a) Kie measured the speeds of 20 cars that went along a country lane during one hour. Here are his results, in miles per hour.

23    27    41    44    56    48    25    30    36    52  
 28    31    40    42    35    51    52    32    53    37

- (i) Complete this stem and leaf diagram to represent the data.

**Key:** 2 | 9 represents 29 miles per hour



[3]

- (ii) Find the range of these speeds.

(a)(ii) \_\_\_\_\_ miles per hour [1]

- (iii) Find the median of these speeds.

(iii) \_\_\_\_\_ miles per hour [2]

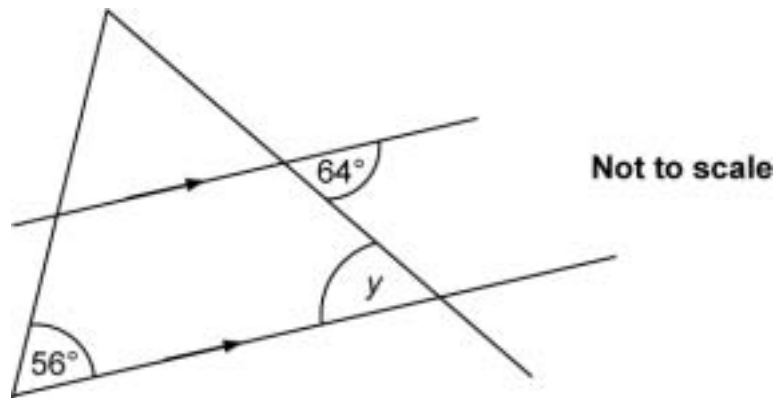
(b) This table summarises the lengths of 20 cars.

Length ( $c$ metres)	Frequency
$2.5 \leq c < 3.0$	2
$3.0 \leq c < 3.5$	5
$3.5 \leq c < 4.0$	3
$4.0 \leq c < 4.5$	7
$4.5 \leq c < 5.0$	3

Calculate an estimate of the mean length of these cars.

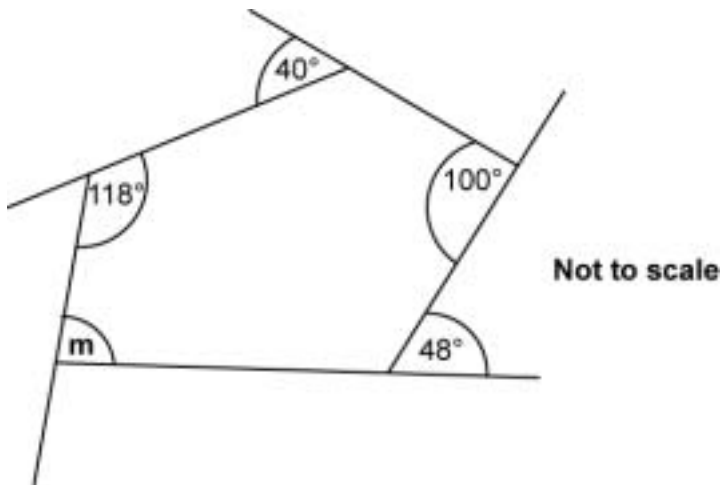
(b) \_\_\_\_\_ m [4]

- 3 (a) Find the size of angle  $y$ .



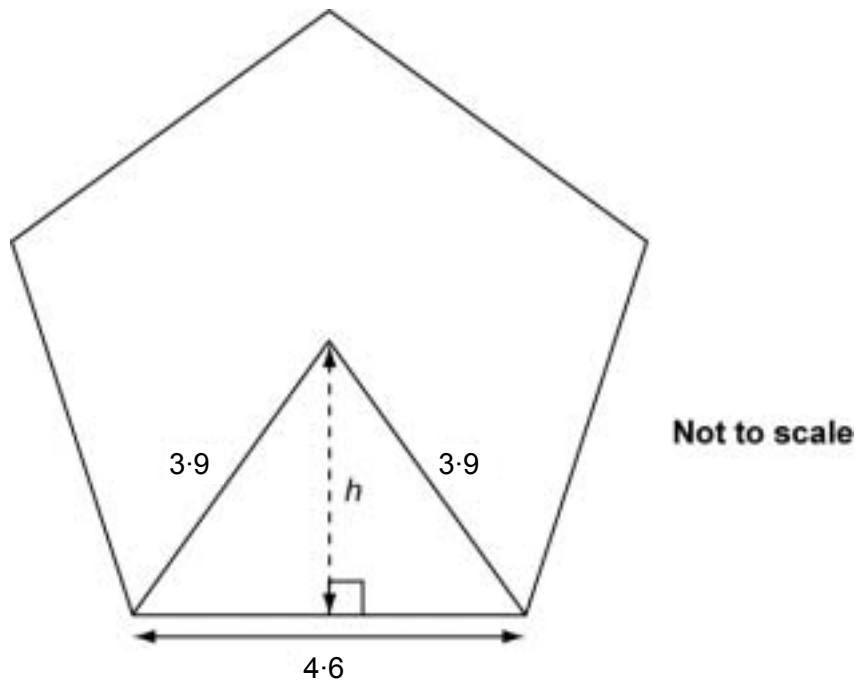
(a) \_\_\_\_\_° [1]

- (b) The diagram shows a pentagon, with the sizes of some of its interior and exterior angles. Find the size of angle  $m$ .



(b) \_\_\_\_\_° [3]

- (c) The sides of a regular pentagon have length 4.6 cm and the distances of the centre from the vertices are 3.9 cm.



Use Pythagoras' theorem to calculate the distance,  $h$  cm, of the centre of the pentagon from the sides.

(c) \_\_\_\_\_ cm [3]

- 4 (a) At birth, a young whale has a length of 6.1 m.  
The young whale grows 3 cm in length per day.

At this rate, what will be the length of this young whale after 6 months?

(a) \_\_\_\_\_ m [3]

- (b) An adult whale is 14 m long, correct to the nearest metre.

What is the least the length of this whale can be?

(b) \_\_\_\_\_ m [1]

- (c) There is a population of Southern Right Whales off the coast of South Africa.  
The size of this population was about 5100 in the year 2009.  
The number of these whales is increasing at about 7% every year.

Calculate the size of this population of whales in 2010.

(c)(i) \_\_\_\_\_ [3]



**(ii)** The Tourist Board says:

Their number grows by about 7% every year, which means that their population doubles every 10 years.

Assuming this growth rate continues, show whether the statement is correct.

**(ii)** The Tourist Board's statement is \_\_\_\_\_ **[3]**

5 Solve.

(a)  $3x - 8 = x + 5$

(a) \_\_\_\_\_ [3]

(b)  $5x + 17 < 2$

(b) \_\_\_\_\_ [2]

- 6 (a) Haroon's cup contains 30 ml of milk and 225 ml of tea.

Write the ratio of milk to tea in its lowest terms.

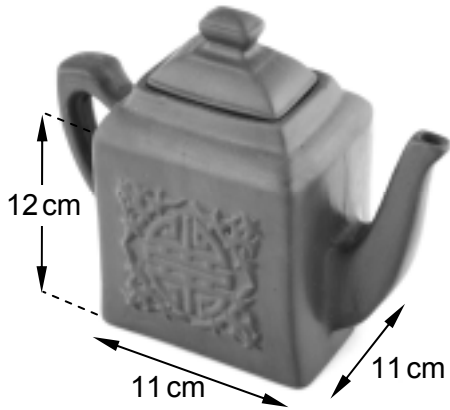
(a) \_\_\_\_\_ [2]

- (b) A café serves drinks in two sizes of cup.  
The ratio of the amounts of drink in a large cup to a regular cup is 3 : 2.  
The regular cup contains 240 ml.

How much does the large cup contain?

(b) \_\_\_\_\_ m [2]

- (c)\* Jean's teapot is in the shape of a cuboid (ignoring the spout, the handle and the lid). Its internal measurements are 11 cm by 11 cm by 12 cm. It is full of tea. The mugs she has are cylinders, of internal radius 3.5 cm and height 8.4 cm.



Is there enough tea in the pot to fill 4 of these mugs to just 1 cm away from the top?

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[5]

(d) In 2008, China produced  $1.26 \times 10^6$  tonnes of tea and India produced  $8.05 \times 10^5$  tonnes.

(i) How much **more** tea did China produce than India?

(d) (i) \_\_\_\_\_ tonnes [2]

(ii) The total world production of tea in 2008 was  $4.36 \times 10^6$  tonnes.

What percentage of this tea was produced by China?

(ii) \_\_\_\_\_ % [2]

(e) These two milk jugs are mathematically similar.

The capacity of the smaller jug is 250 ml.

The height of the smaller jug is 8.4 cm and the height of the larger jug is 12.6 cm.



Calculate the capacity of the larger jug.

(e) \_\_\_\_\_ ml [3]

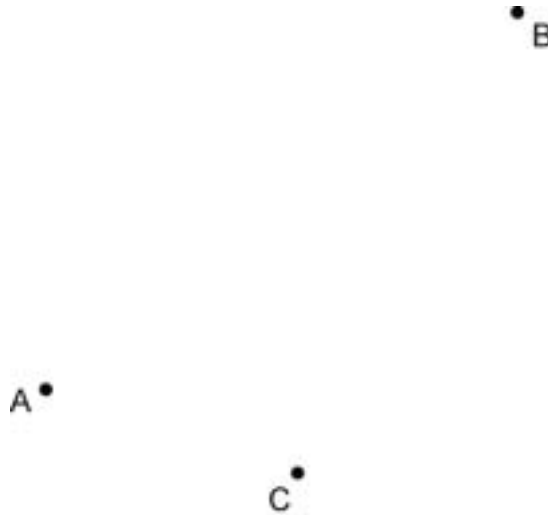
7 The scale drawing shows the position of three buoys at A, B and C.

A boat moves so that it is

- nearer to A than B,
- less than 500 m from C.

Using a ruler and a pair of compasses, construct and shade the region where the boat can be.

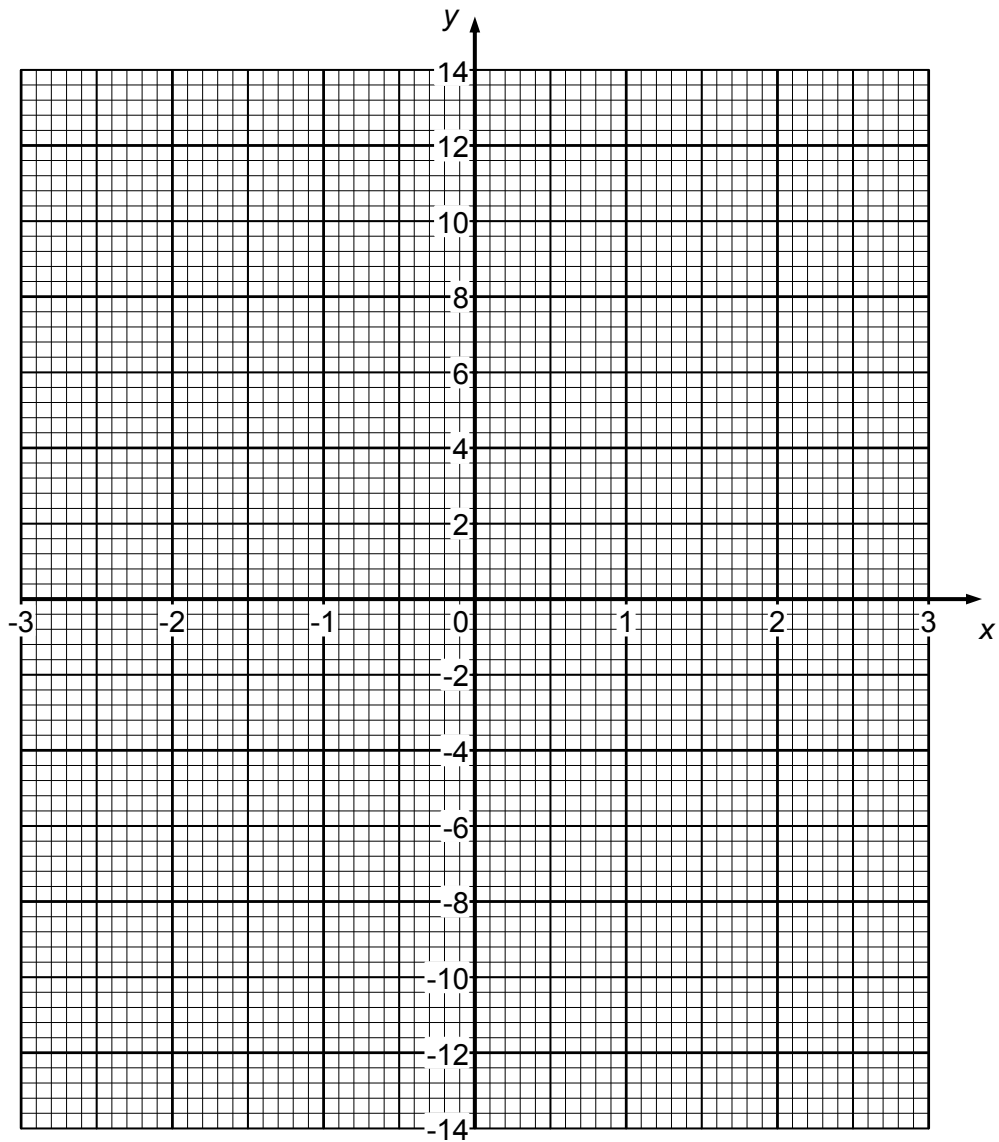
**Scale: 1 cm to 100 m**



[4]

- 8 (a) Complete the table and draw the graph of  $y = x^3 - 5x$  for values of  $x$  from  $-3$  to  $3$ .

$x$	$-3$	$-2$	$-1$	$0$	$1$	$2$	$3$
$y$	$-12$	$2$		$0$		$-2$	$12$



[4]

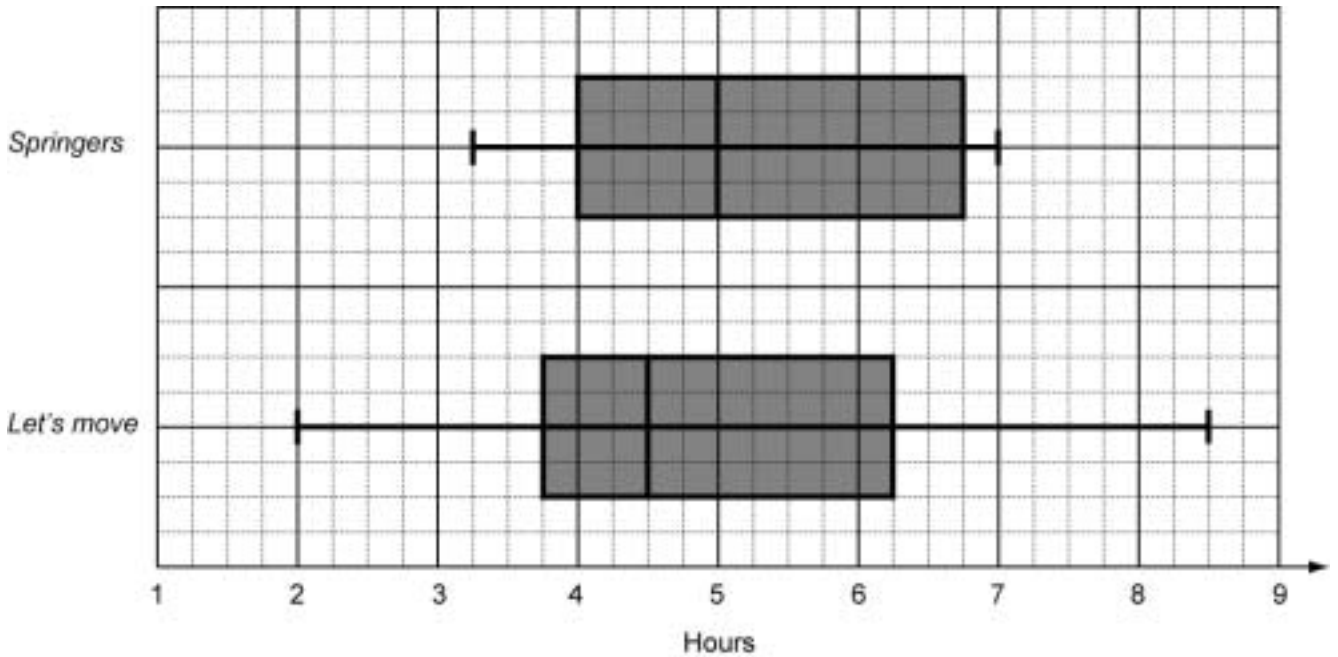
- (b) Use trial and improvement to find, correct to 2 decimal places, the solution of the equation  $x^3 - 5x = 6$ . Show clearly your trials and the values of their outcomes.

(b) \_\_\_\_\_ [4]



- 9 The members of two dance clubs, *Letsmove* and *Springers* were each asked how many hours they had spent dancing one week.

These box plots represent the distributions of the results for each group.



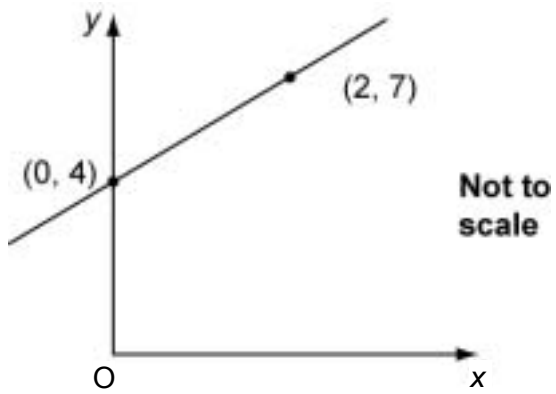
For each of the following statements

- tick (✓) to show whether you agree or disagree,
- state the evidence you used to reach your decision, giving numerical values where necessary.

Statement	Agree	Disagree	Reason
<i>Letsmove</i> dancers spent longer dancing than <i>Springers</i> on average			
More than a quarter of the <i>Letsmove</i> dancers spent at least 6 hours dancing			
The time spent by the <i>Springers</i> dancers was more consistent than by the <i>Letsmove</i> dancers			

[3]

10 A straight line passes through the points  $(0, 4)$  and  $(2, 7)$ .



(a) Find the gradient of the line.

(a) \_\_\_\_\_ [2]

(b) Find the equation of the line.

(b) \_\_\_\_\_ [2]

11 (a) Factorise.

$$x^2 - x - 20$$

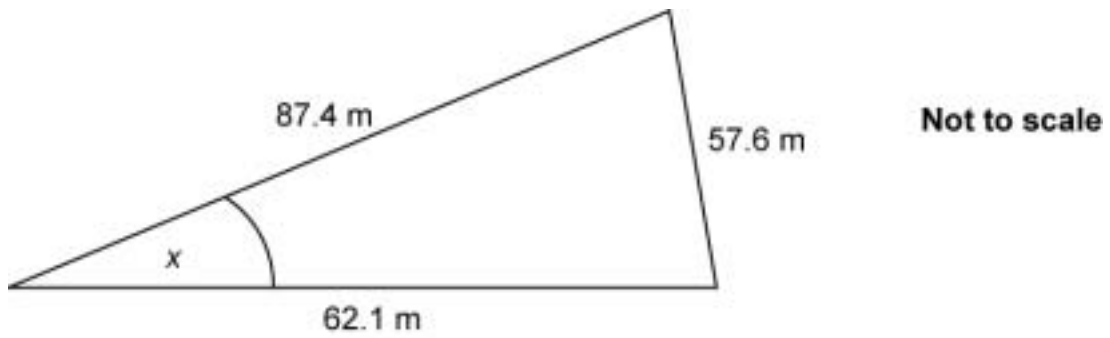
(a) \_\_\_\_\_ [2]

(b) Rearrange this formula to make  $r$  the subject.

$$V = \frac{2\pi r^3}{3}$$

(b) \_\_\_\_\_ [3]

12 Mike saw this field advertised for sale as farmland.



(a) Show that  $x = 41.1^\circ$ , correct to 1 decimal place.

[2]

(b) In January 2010, the average price of farmland in the UK was £1.23 per square metre.  
On that basis, calculate the sale price of this field.

(b) £ \_\_\_\_\_ [3]

13 (a) Show that the equation

$$\frac{1}{x+2} + \frac{7}{x-3} = 4$$

can be written as  $4x^2 - 12x - 35 = 0$ .

[3]

(b) Solve the equation  $4x^2 - 12x - 35 = 0$ .

Give your answers correct to 2 decimal places.

(b) \_\_\_\_\_ [3]

14 (a) You are given that  $y$  is directly proportional to  $x^2$  and  $y = 100$  when  $x = 2$ .

Find an equation connecting  $x$  and  $y$ .

(a) \_\_\_\_\_ [3]

(b) Calculate the value of  $y$  when  $x = 6$ .

(b) \_\_\_\_\_ [1]

- 15 A metal cuboid measures 3.2 cm by 2.6 cm by 1.8 cm, correct to the nearest millimetre. The density of the metal is  $16 \text{ g/cm}^3$ , correct to the nearest integer.

Calculate the upper bound of the mass of the cuboid, giving your answer in grams, correct to 3 decimal places.

\_\_\_\_\_ g [4]

**TURN OVER FOR QUESTION 16**

16 Three ordinary dice are thrown.

Show that there is a greater chance of obtaining a total of 10 than there is of obtaining a total of 9, and calculate the difference between the probabilities of these two events.

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[5]

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Q 6 (c) Images of mugs © [www.iStockphoto.com](http://www.iStockphoto.com)

Q 6 (e) Image of milk jugs © [www.iStockphoto.com](http://www.iStockphoto.com)

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