

Tuesday 6 November 2012 – Morning

**GCSE MATHEMATICS B**

**J567/03** Paper 3 (Higher Tier)

Candidates answer on the Question Paper.

**OCR supplied materials:**

None

**Other materials required:**

- Geometrical instruments
- Tracing paper (optional)

**Duration:** 1 hour 45 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure 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.
- 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).
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- 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 **20** pages. Any blank pages are indicated.

**WARNING**

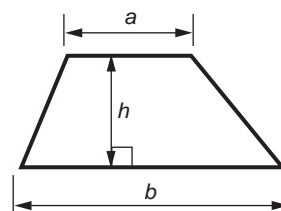


**No calculator can be used for this paper**

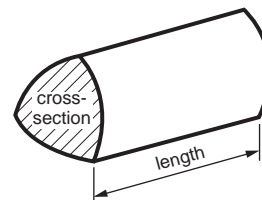
This paper has been pre modified for carrier language

## Formulae Sheet: Higher Tier

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



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

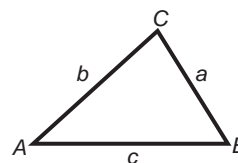


In any triangle *ABC*

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

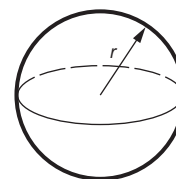
Cosine rule  $a^2 = b^2 + c^2 - 2bc \cos A$

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



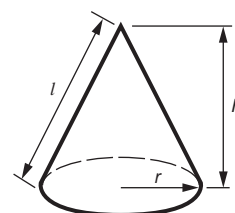
Volume of sphere =  $\frac{4}{3}\pi r^3$

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



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

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



**The Quadratic Equation**

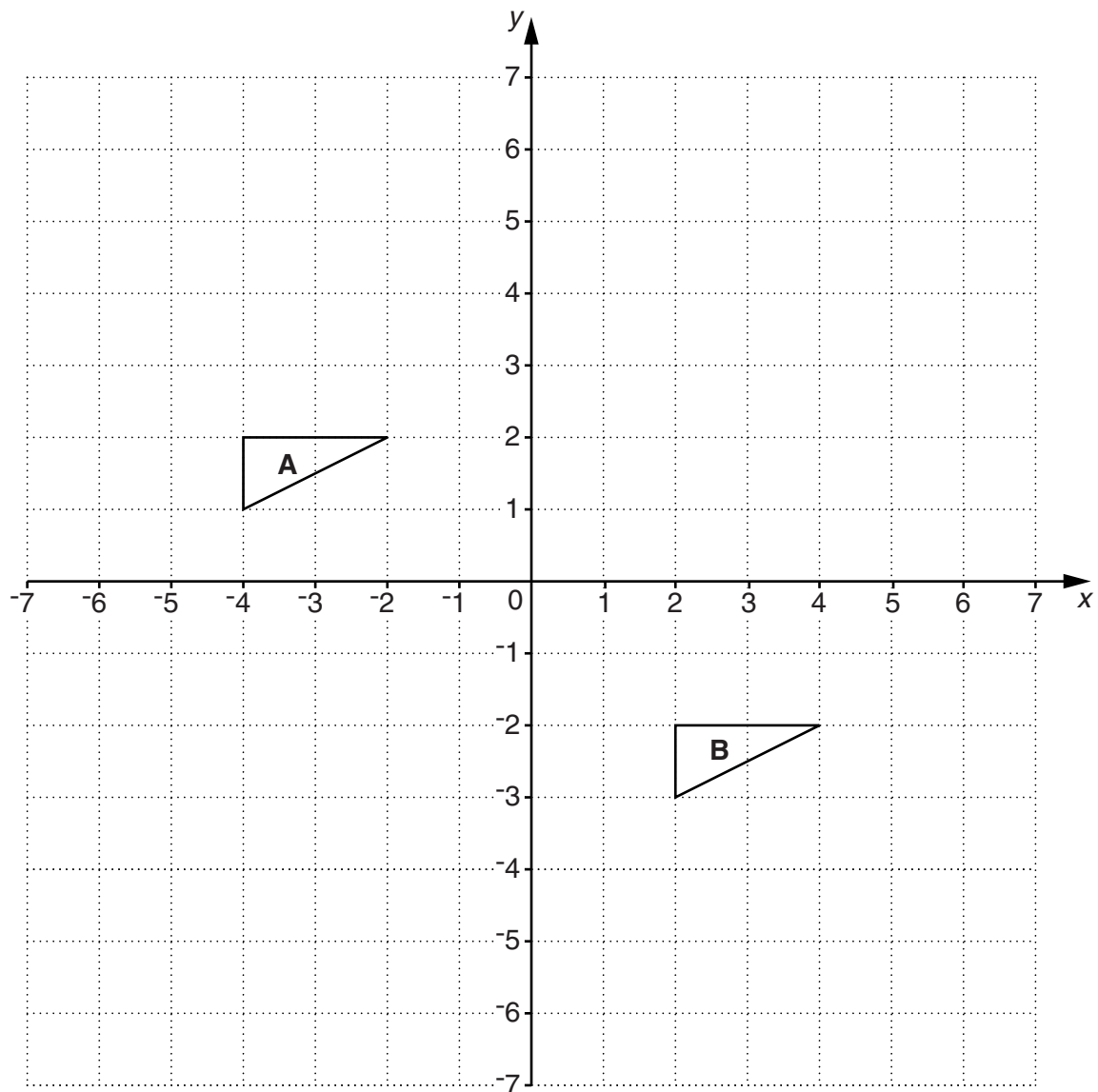
The solutions of  $ax^2 + bx + c = 0$ ,  
where  $a \neq 0$ , are given by

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

**PLEASE DO NOT WRITE ON THIS PAGE**

3

1 Here is a coordinate grid.



- (a) Reflect triangle **A** in the line  $x = 1$ .  
Label the image **C**.

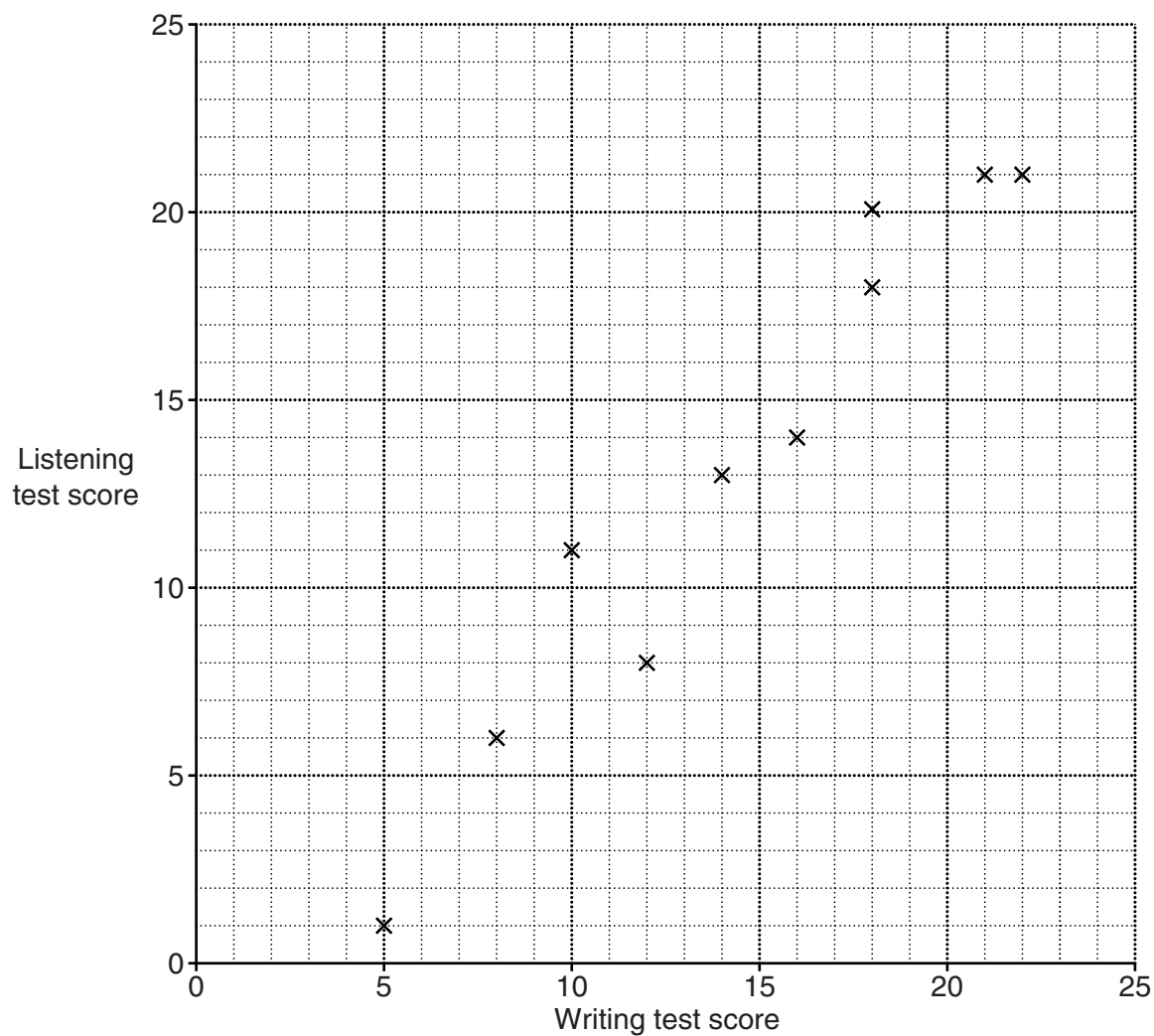
[2]

- (b) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

[2]

4

- 2 This scatter diagram shows the scores for a group of students in a French writing test and a French listening test.



- (a) Describe the correlation.

(a) \_\_\_\_\_ [1]

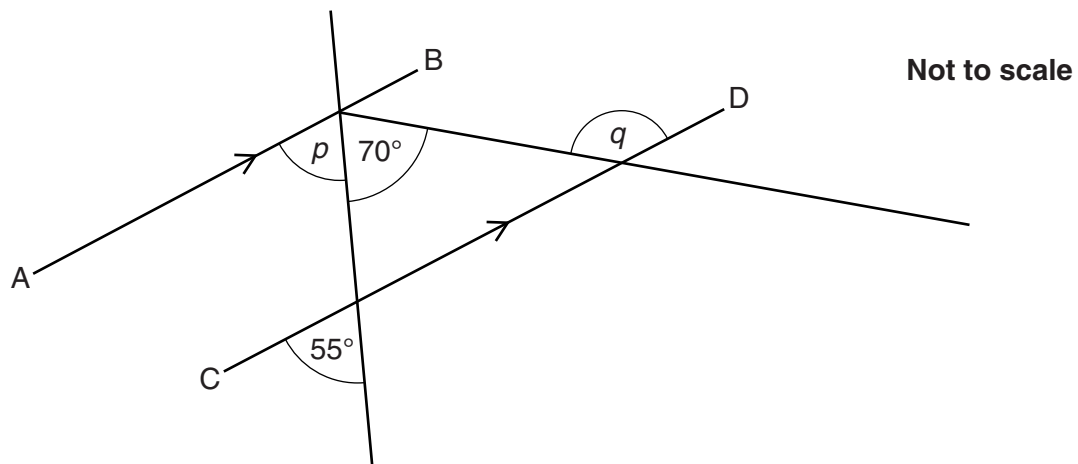
- (b) Lola scored 11 in the writing test but was absent for the listening test.

Draw a line of best fit and use it to estimate Lola's score in the listening test.

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

5

- 3 (a) In the diagram below, AB is parallel to CD.



Work out angle  $p$  and angle  $q$ .  
Give a reason for each answer.

(i)  $p =$  \_\_\_\_\_  $^{\circ}$  because \_\_\_\_\_  
\_\_\_\_\_ [2]

(ii)  $q =$  \_\_\_\_\_  $^{\circ}$  because \_\_\_\_\_  
\_\_\_\_\_ [2]

- (b) The exterior angle of a regular polygon is  $40^{\circ}$ .

How many sides does the polygon have?

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

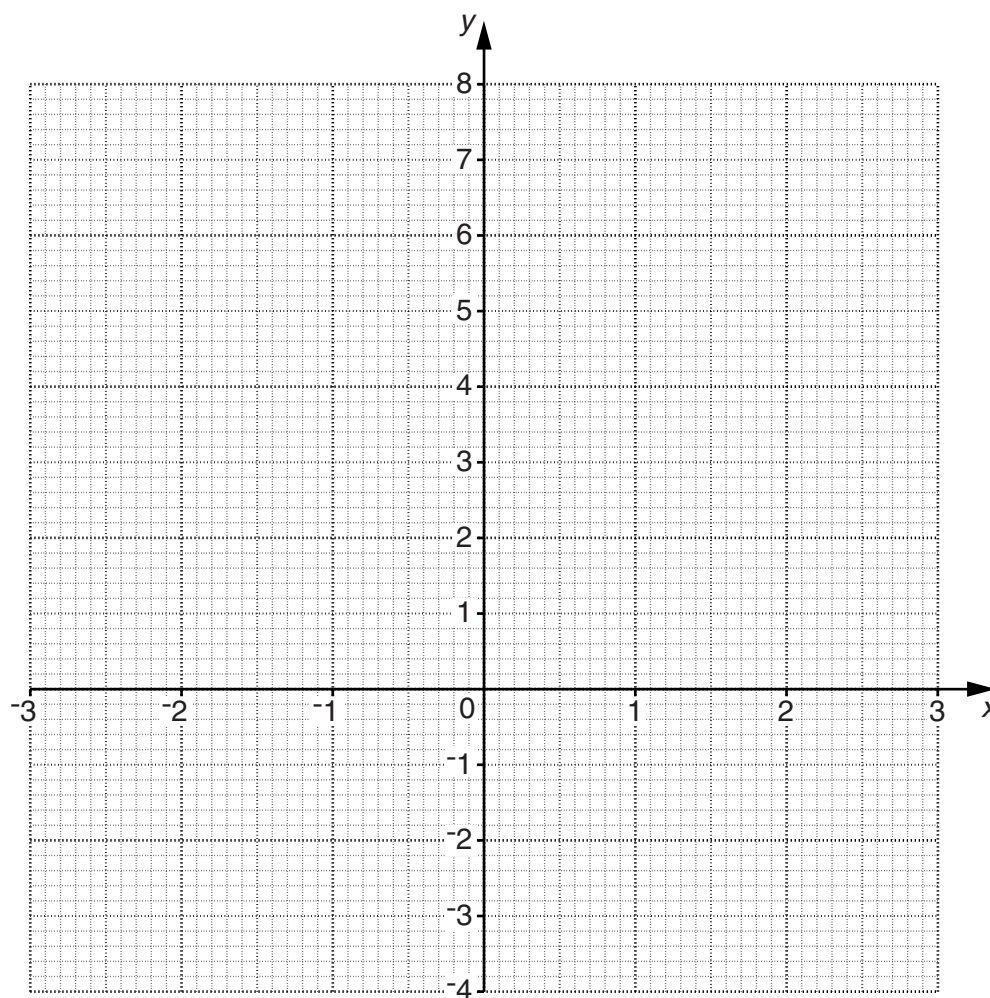
6

- 4 (a) Complete the table for  $y = x^2 - 2$ .

x	-3	-2	-1	0	1	2	3
y	7			-2			7

[2]

- (b) Draw the graph of  $y = x^2 - 2$ .



[2]

- (c) Use your graph to solve the equation  $x^2 - 2 = 0$ .

(c)  $x =$  \_\_\_\_\_ and  $x =$  \_\_\_\_\_ [2]

7

- 5 (a) Ivan pays £120 rent each week.  
He earns £300 each week.

Work out his rent as a percentage of his earnings.

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

- (b) Ivan joins a gym.  
Membership usually costs £34.50 per month.  
He gets a discount of 20% for the first six months.

Work out how much he pays altogether for his first **six months**' membership.

(b) £ \_\_\_\_\_ [4]

- (c) Ivan has a monthly bus pass.  
The price of the bus pass is increased by 20%.  
After the price increase, the bus pass costs £48.

Work out the cost of the bus pass **before** the increase.

(c) £ \_\_\_\_\_ [3]

## 8

6\* Each week Mike drives 195 miles travelling to and from work.

Average fuel consumption for Mike's car: 51.4 miles per gallon

Cost of 1 litre of fuel: 138.9p

1 gallon = 4.55 litres

A weekly train pass for Mike's journey costs £31.50.

Mike says:

I will save money if I travel to and from work by train.

Is Mike correct?

Use estimation to justify your answer.

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[5]



## 9

- 7 A bag contains red, green, yellow and blue counters only.  
There are 24 counters altogether in the bag.

Alisha takes a counter at random from the bag, records the colour and replaces it.  
She does this 200 times.  
Her results are shown in the table.

Colour	Red	Green	Yellow	Blue
Frequency	72	30	48	50

- (a) Explain why it is reasonable for Alisha to use her results to estimate the number of counters of each colour in the bag.

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[1]

- (b) **Estimate** the number of counters of each colour.

(b) \_\_\_\_\_ red  
 \_\_\_\_\_ green  
 \_\_\_\_\_ yellow  
 \_\_\_\_\_ blue [3]

10

8 Lewis is doing a survey about sport in his school.

(a) Here is one of his questions.

Do you agree that we shouldn't have to do PE?	
Yes <input style="width: 40px; height: 20px;" type="checkbox"/>	No <input style="width: 40px; height: 20px;" type="checkbox"/>

Do you think this is a good question?  
Explain your answer.

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

(b) In the survey, Lewis wants to find out what sport people would like to do in their PE lessons.

Write a suitable question he could ask, with response boxes for people to tick. [2]

(c) There are 900 students in the school.

This table shows the number of students in each year group.

Year	7	8	9	10	11
Number of students	210	190	175	175	150

Lewis decides to interview a representative stratified sample of 120 students.

How many students should he interview from year 11?

(c) \_\_\_\_\_ [2]

9 (a) Solve.

$$6x + 5 = 2x - 1$$

(a)  $x =$  \_\_\_\_\_ [3]

(b) Factorise fully.

$$6x - 4x^2$$

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

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

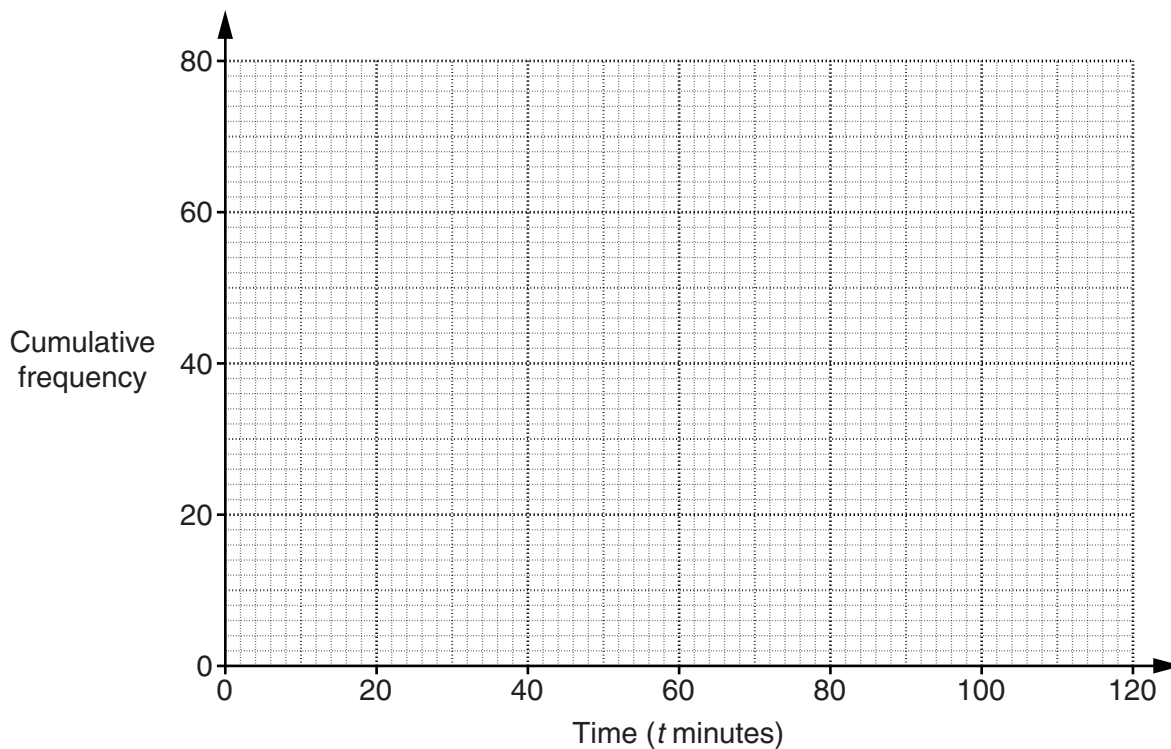
$$S = 4\pi r^2$$

(c)  $r =$  \_\_\_\_\_ [2]

12

- 10 (a) This cumulative frequency table summarises the times taken by the staff of Spring Hill School to travel to school.

Time ( $t$ minutes)	$t \leq 20$	$t \leq 40$	$t \leq 60$	$t \leq 80$	$t \leq 100$	$t \leq 120$
Cumulative frequency	12	45	62	72	78	80



- (i) Draw the cumulative frequency graph for this distribution. [2]

- (ii) Use your graph to estimate the median time.

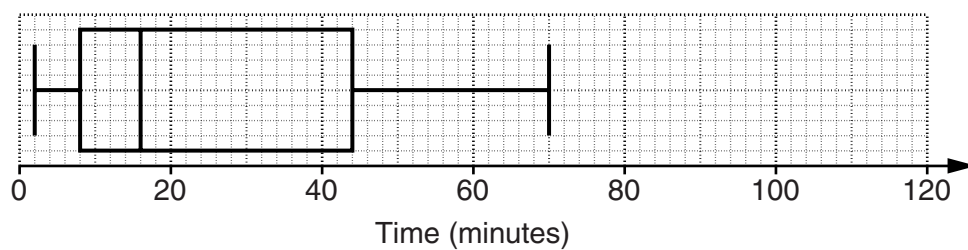
(a)(ii) \_\_\_\_\_ minutes [1]

- (iii) Use your graph to estimate the interquartile range of the times.

(iii) \_\_\_\_\_ minutes [2]

13

- (b) The box plot below shows the distribution of the times taken by the students of Spring Hill School to travel to school.



Make two comparisons between the times taken by the staff and by the students.

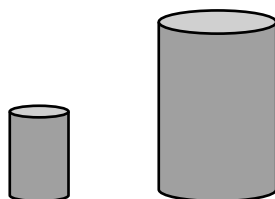
1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_ [2]

- 11 These two glasses are similar.  
The height of the smaller glass is 7 cm and the height of the larger glass is 14 cm.



- (a) Ruby says:

The base area of the smaller glass is half the base area of the larger glass.

Explain why she is wrong.

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

- (b) The volume of the larger glass is  $480 \text{ cm}^3$ .

Calculate the volume of the smaller glass.

(b) \_\_\_\_\_  $\text{cm}^3$  [2]

14

- 12 (a) The number 1200 can be written as a product of prime factors in the form

$$1200 = 2^p \times 3^q \times 5^r.$$

Find the values of  $p$ ,  $q$  and  $r$ .

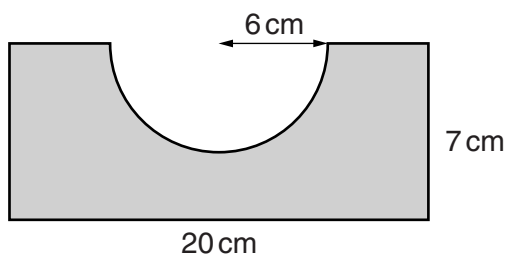
(a)  $p =$  \_\_\_\_\_  $q =$  \_\_\_\_\_  $r =$  \_\_\_\_\_ [2]

- (b) The highest common factor of two numbers is 12.  
The lowest common multiple of these numbers is 72.  
Both numbers are greater than 12.

What are the two numbers?

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

- 13 A rectangle has a semicircle of radius 6 cm removed.



Not to scale

Find an expression, in terms of  $\pi$ , for the shaded area.  
Give your answer in the form  $a - b\pi$ .

\_\_\_\_\_  $\text{cm}^2$  [3]

15

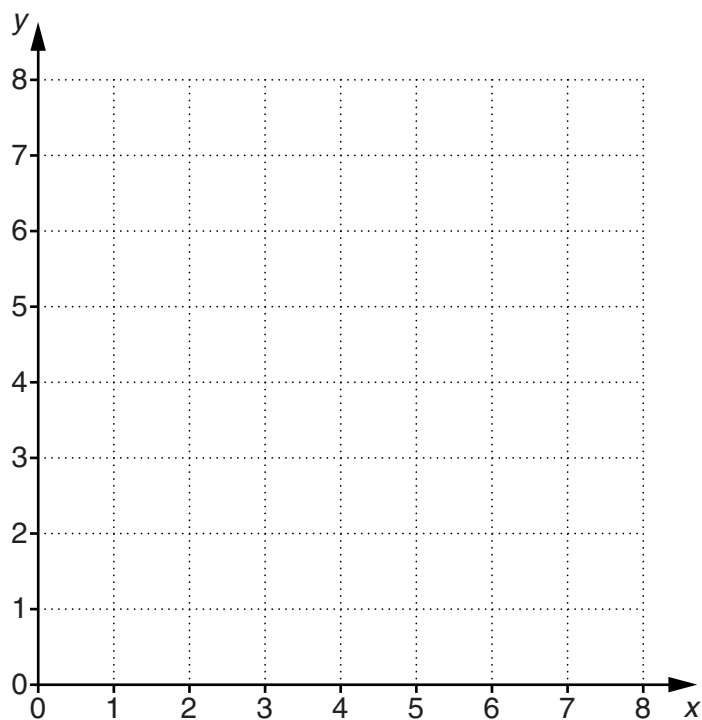
- 14 The point  $P$  has coordinates  $(x, y)$  where  $x$  and  $y$  are both integers. The values of  $x$  and  $y$  satisfy these three inequalities.

$$x \geq 2$$

$$y > 1$$

$$x + y < 7$$

Find all the possible coordinates of  $P$ .  
You may use the grid below.



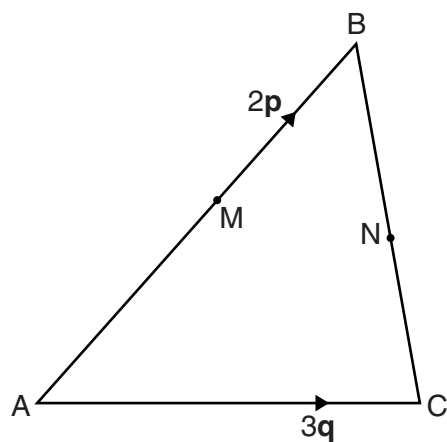
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[4]

16

- 15 ABC is a triangle.  
 M is the midpoint of AB and N is the midpoint of BC.  
 $\vec{AB} = 2\mathbf{p}$  and  $\vec{AC} = 3\mathbf{q}$ .



Not to scale

- (a) Find, in terms of  $\mathbf{p}$  and  $\mathbf{q}$ ,

(i)  $\vec{BC}$ ,

(a)(i) \_\_\_\_\_ [1]

(ii)  $\vec{AN}$ .

(ii) \_\_\_\_\_ [1]

- (b) What type of quadrilateral is AMNC?  
 You must use vectors to justify your answer.

(b) AMNC is a \_\_\_\_\_ [3]



16 (a) Evaluate.

$$\left(\frac{9^{10}}{9^4}\right)^{\frac{1}{3}}$$

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

(b) Write 0.34 as a fraction.

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

17 (a) Solve.

$$\frac{4x+3}{3} - \frac{3x-2}{4} = 5$$

(a) \_\_\_\_\_ [4]

(b) Express as a single fraction in its simplest form.

$$\frac{3}{2a} + \frac{5}{6a}$$

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

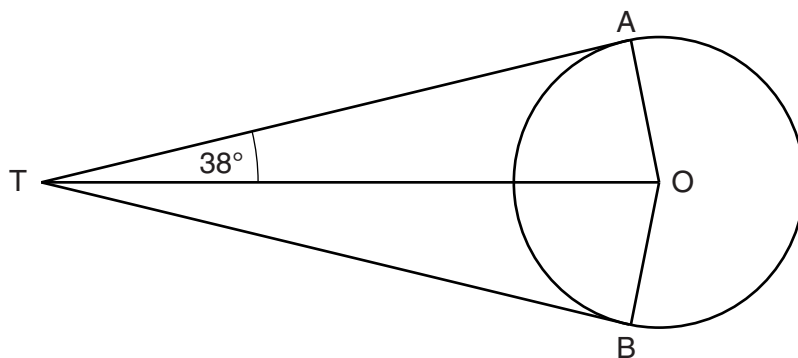
(c) Simplify fully.

$$\frac{x^2 - 16}{x^2 + x - 20}$$

(c) \_\_\_\_\_ [4]

19

- 18 In the diagram, AT and BT are tangents to the circle, centre O.  
Angle ATO =  $38^\circ$ .



Not to scale

- (a) Calculate angle AOT.

(a) \_\_\_\_\_<sup>°</sup> [1]

- (b) Use congruent triangles to prove that tangents AT and BT are of equal length.

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[4]

**TURN OVER FOR QUESTION 19**

20

19 Solve algebraically these simultaneous equations.

$$y = x^2 - 4x - 11$$

$$y = 2x + 5$$

$$x = \underline{\hspace{2cm}} \quad y = \underline{\hspace{2cm}}$$

$$x = \underline{\hspace{2cm}} \quad y = \underline{\hspace{2cm}} \quad [5]$$

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