

Thursday 21 May 2015 – 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 | |
|-----------------------|--|----------------------|--|

| | | | | | | | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre number | | | | | | Candidate number | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|

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.
- 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.

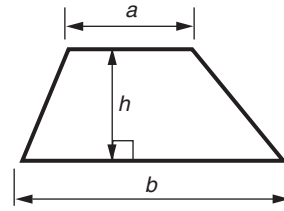
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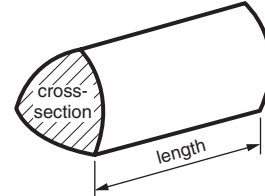
No calculator can be used for this paper

Formulae Sheet: Higher Tier

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



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

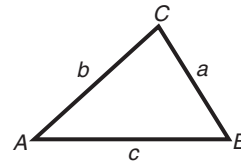


In any triangle ABC

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

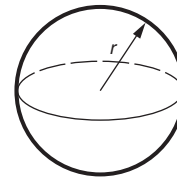
Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

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



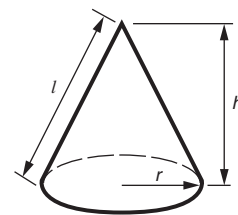
Volume of sphere = $\frac{4}{3}\pi r^3$

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

Answer **all** the questions.

- 1 (a) Highstone Builders mix cement and sand in the ratio 1 : 5.
They need to make 240m^3 of the mixture.

Work out how much sand they need.

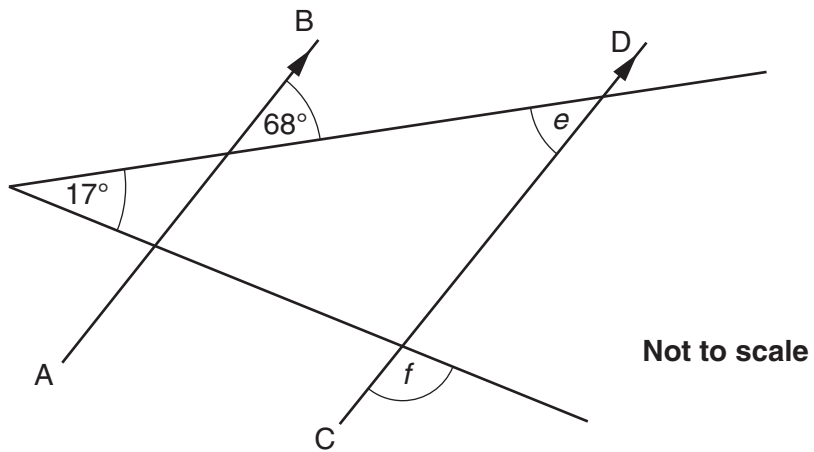
(a) _____ m^3 [2]

- (b) Sturdy Construction mix cement and sand in the ratio 2 : 7.

Work out how much sand they need to mix with 22m^3 of cement.

(b) _____ m^3 [2]

2 In the diagram AB is parallel to CD.



Work out the following angles, giving reasons for your answers.

(a) Angle $e =$ _____ $^{\circ}$ because _____
 _____ [1]

(b) Angle $f =$ _____ $^{\circ}$ because _____

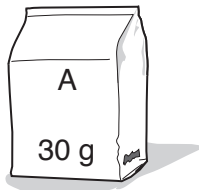
 _____ [3]

- 3 (a) The cost of a packet of spice is 80p.
The cost is increased by 15%.

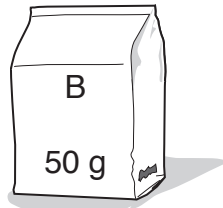
Work out the new cost of the packet.

(a) _____ p [3]

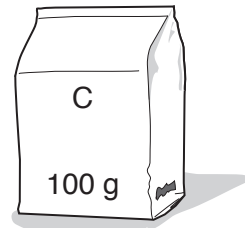
- (b) Here are three packets of a different spice.



23p



39p



80p

Which packet offers the best value for money?
Show clearly how you decide.

(b) _____ [3]

4 (a) Multiply out.

$$5(2x + 3)$$

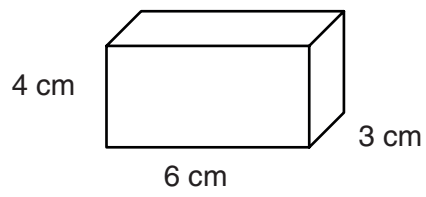
(a) _____ [1]

(b) Factorise completely.

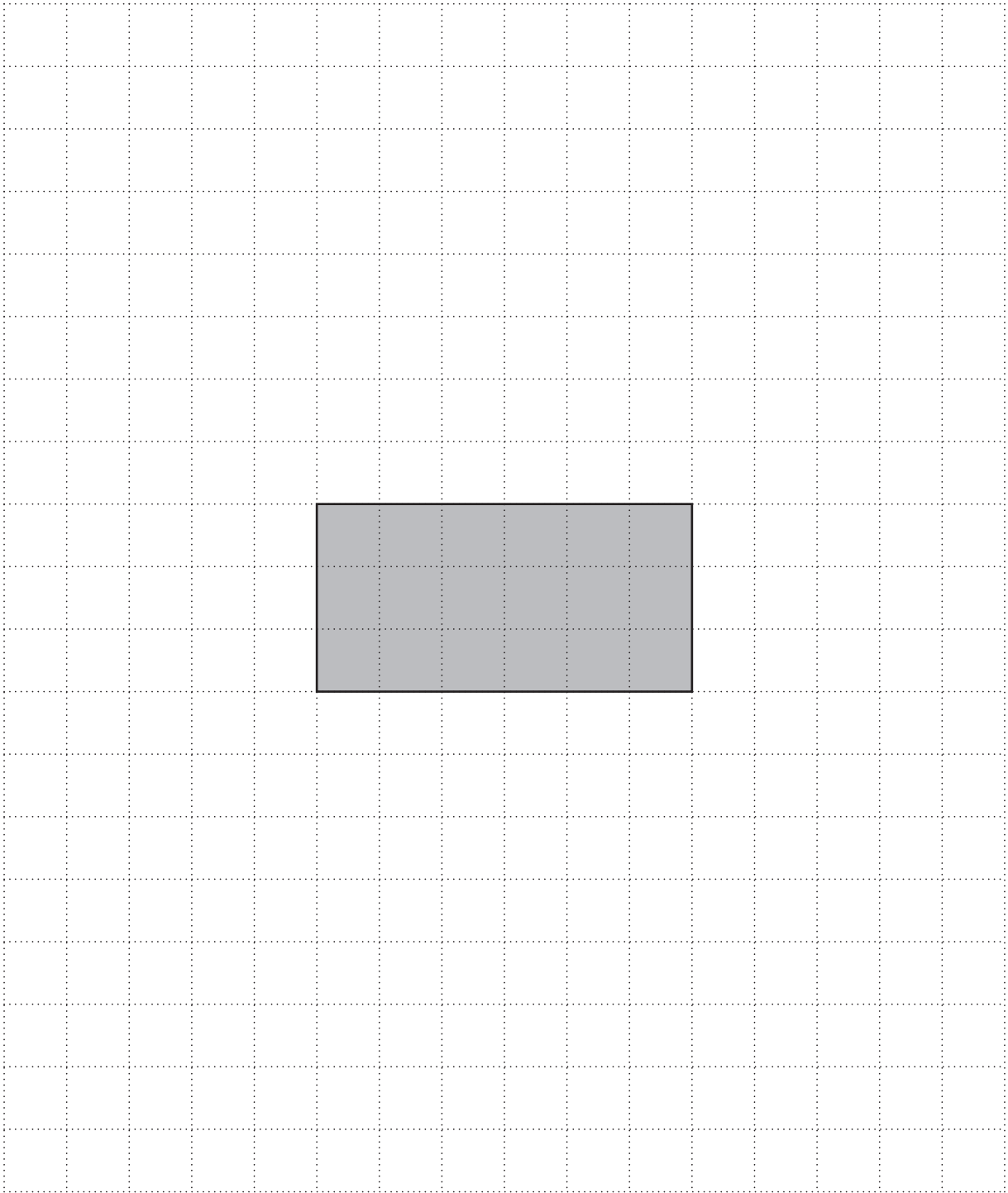
$$3x^2 - 12x$$

(b) _____ [2]

5 The diagram shows a cuboid.

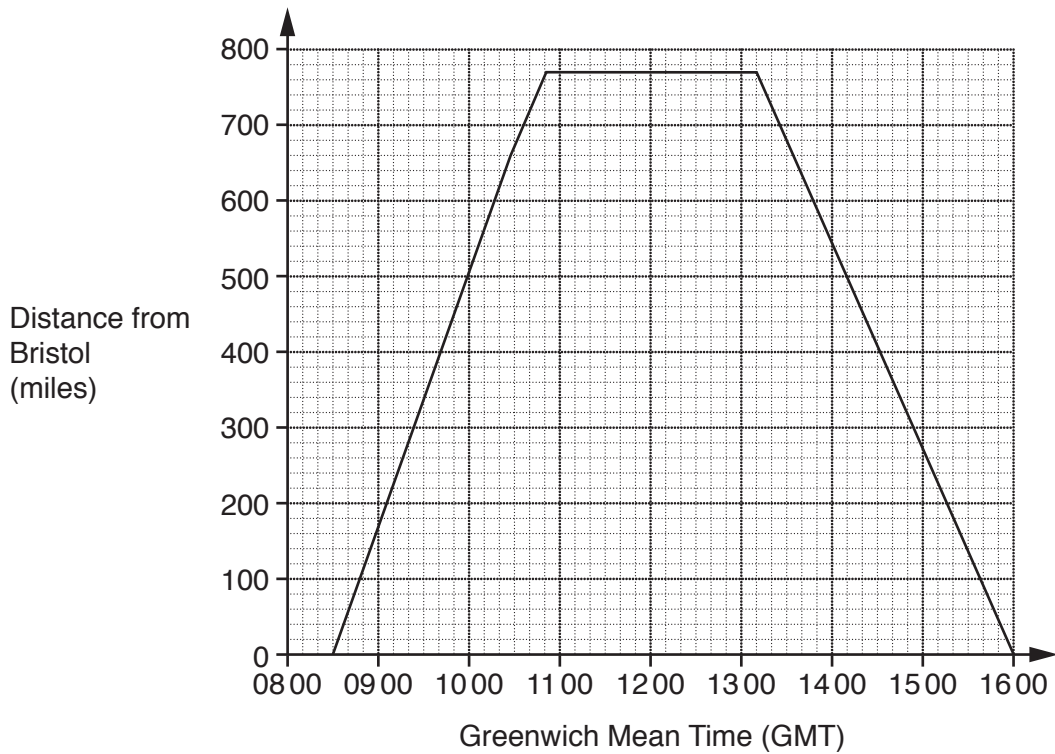


Complete the net of this cuboid on the one-centimetre square grid below.



[3]

- 6 The graph shows the journey of a plane from Bristol to Barcelona and back.



- (a) (i) Use the graph to complete this table.

| | | |
|-------------------------------|-------|-------|
| Time (GMT) | 08 30 | 10 30 |
| Distance from Bristol (miles) | 0 | |

[1]

- (ii) Use the table to work out the average speed of the plane on the outward journey from Bristol to Barcelona.
Give the units of your answer.

(a)(ii) _____ [3]

- (b) The local time in Barcelona is one hour **ahead** of GMT.

What was the **local time** when the plane landed at Barcelona?

(b) _____ [1]

- (c) The plane flew over a beacon which is 280 miles from Bristol.

Write down the GMT times when the plane flew over the beacon.

(c) _____ and _____ [2]

7* A family has four daughters, Molly, Daisy, Rosie and Tilly.

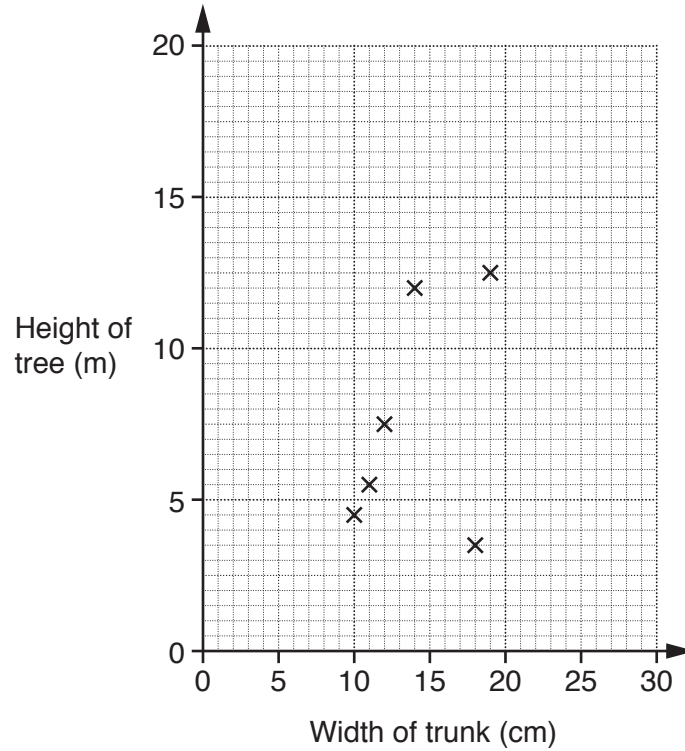
- Daisy is six years older than Molly.
- Molly is four years younger than Tilly.
- Rosie is one year older than double Molly's age.
- The total of their ages is 51.

Find the age of each of the four girls.

[5]

- 8 Amber measures the heights of some young trees and the widths of their trunks. The results are shown in the table below.

| | | | | | | | | | | |
|---------------------|-----|-----|-----|----|-----|------|------|----|----|----|
| Width of trunk (cm) | 10 | 11 | 12 | 14 | 18 | 19 | 22 | 23 | 28 | 29 |
| Height of tree (m) | 4.5 | 5.5 | 7.5 | 12 | 3.5 | 12.5 | 11.5 | 16 | 15 | 18 |



- (a) The first six points have been plotted on the scatter diagram.

Complete the diagram by plotting the last four points.

[2]

- (b) State the correlation shown by the scatter diagram.

(b) _____ [1]

- (c) Use your diagram to describe the relationship between the width of a tree trunk and the height of the tree.

_____ [1]

(d) (i) Draw a line of best fit on the diagram. [1]

(ii) Amber has a tree with a trunk width of 25 cm.

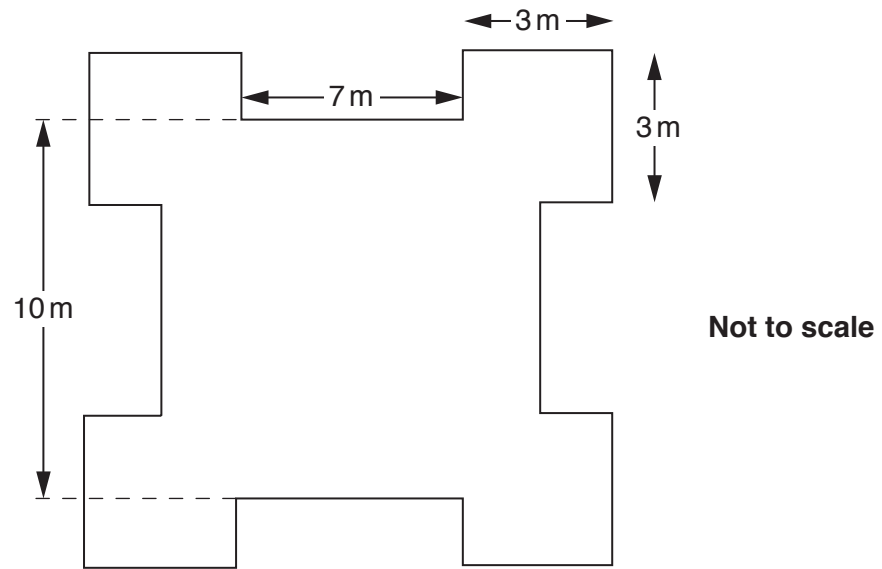
Use your diagram to estimate the height of this tree.

(d)(ii) _____ m [1]

(e) One of these trees is from a different species.

On the diagram put a circle around the point for that tree. [1]

- 9 The diagram shows the plan of a castle.
The plan has four lines of symmetry.



Work out the area of the plan.

_____ m² [4]

10 (a) Solve.

$$7x - 2 = 3x + 20$$

(a) $x =$ _____ [3]

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

$$A = 4 + r^2$$

(b) _____ [2]

11 Magda is conducting a survey on travel.

(a) Here is one of her questions.

| | | |
|--|-----|---|
| Do you agree that public transport is better now than it was five years ago? | | |
| <input type="checkbox"/> | Yes | <input type="checkbox"/> No <input type="checkbox"/> Don't know |

Explain what is wrong with her question.

[1]

(b) Write a suitable question, with response boxes, to find out how many train journeys a person takes in a month.

Use 20 journeys as a maximum number. [2]

(c) Magda wants to take a stratified random sample from a group of people.

Which of these statements best describes a stratified random sample?

Statement A: You go through the population and pick every tenth person.

Statement B: You select a month at random and pick people who were born in that month.

Statement C: The population is divided into groups, each group having something in common, and the same proportion is randomly selected from each group to form the sample.

Statement D: You put all the names of the members of the population into a hat and take out some names at random.

(c) Statement _____ [1]

(d) Magda decides to ask a sample of people her questions.

Criticise each of these methods for collecting the information.

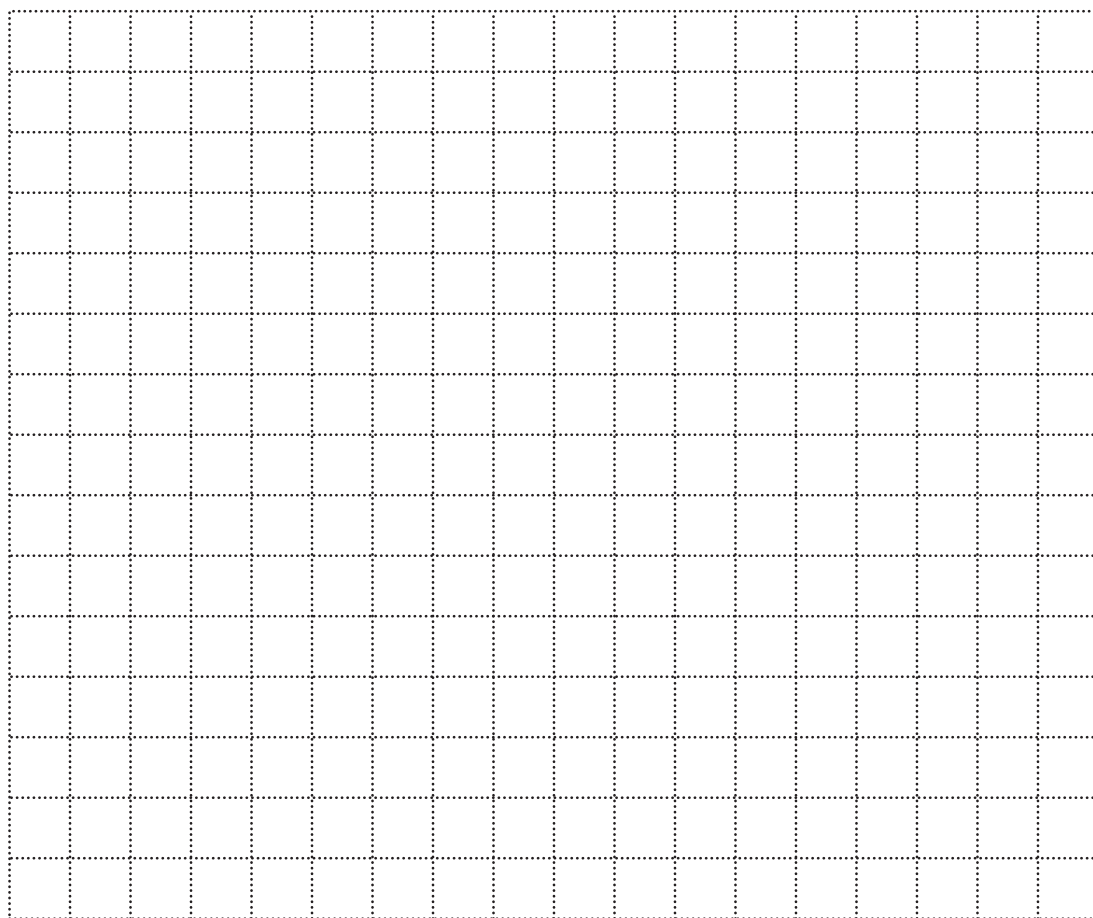
(i) Stand outside the railway station and select people randomly.

[1]

(ii) Select telephone numbers at random from a directory and telephone them.

[1]

12 Here is a grid.



Find the **single** transformation that is equivalent to

- reflection in $x = -1$

followed by

- reflection in $x = 2$.

You may use the grid to help you.

13 (a) Solve these simultaneous equations algebraically.

$$\begin{aligned}4x - 2y &= 2 \\ 3x + y &= 14\end{aligned}$$

(a) $x =$ _____
 $y =$ _____ [3]

(b) Write the expression $x^2 - 10x + 10$ in the form $(x - a)^2 - b$.

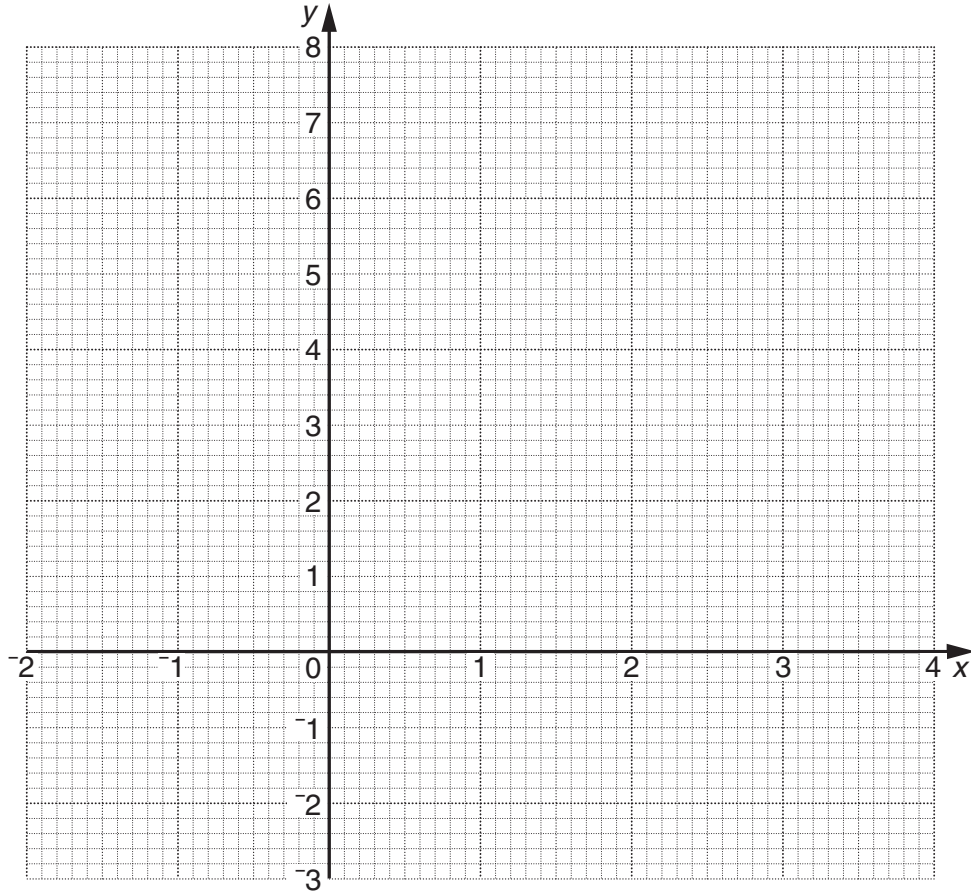
(b) _____ [3]

14 (a) Complete this table for $y = x^2 - 2x - 1$.

| | | | | | | | |
|-----|----|----|----|---|----|---|---|
| x | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| y | 7 | 2 | -1 | | -1 | 2 | 7 |

[1]

(b) Draw the graph of $y = x^2 - 2x - 1$ for values of x from -2 to 4.



[3]

(c) Use the graph to solve the equation $x^2 - 2x - 1 = 0$.

(c) $x =$ _____ or $x =$ _____ [2]

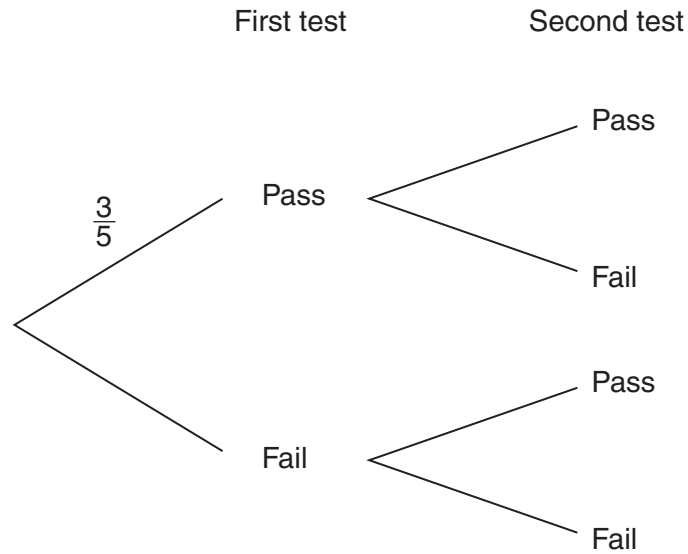
- 15 A pottery factory makes teapots.
 Each teapot has to go through two stages of quality testing.
 If it passes **both tests** it is called 'perfect' otherwise it is called 'faulty'.

The probability that any teapot will pass the first test is $\frac{3}{5}$.

If it passes the first test the probability that it passes the second test is $\frac{3}{4}$.

If it fails the first test the probability that it passes the second test is $\frac{1}{3}$.

- (a) Complete the tree diagram below.

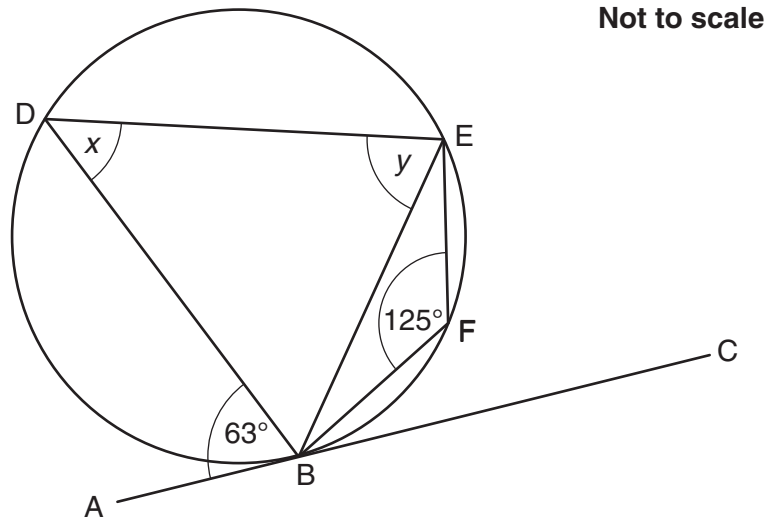


[2]

- (b) Work out the probability that a teapot will be called 'faulty'.

(b) _____ [3]

- 16 In the diagram, BDEF are points on the circumference of a circle.
AC is the tangent to the circle at B.
Angle ABD = 63° and angle EFB = 125° .



Find each of these angles, giving a reason for your answers.

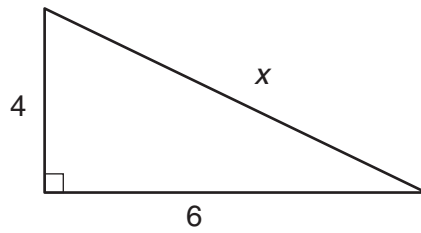
(a) $x =$ _____ $^\circ$ because _____

_____ [2]

(b) $y =$ _____ $^\circ$ because _____

_____ [2]

- 17 (a) The diagram shows a right-angled triangle.

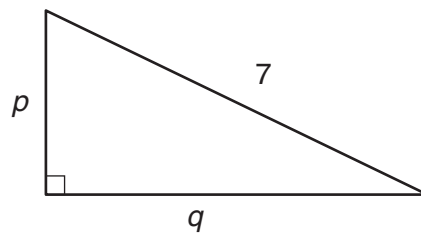


Not to scale

Show that x can be written as $2\sqrt{13}$.

[3]

- (b) The diagram shows another right-angled triangle.



Not to scale

Find **two** different pairs of values for p and q where p is an integer. Write any surd in its simplest form.

(b) $p =$ _____ and $q =$ _____

$p =$ _____ and $q =$ _____ [3]

18 (a) Write these numbers in standard form.

(i) 670 000

(a)(i) _____ [1]

(ii) 0.0092

(ii) _____ [1]

(b) Here is Joel's answer to one question in his homework.

$$(6.8 \times 10^5) \div (2 \times 10^{-3}) = 3.4 \times 10^2$$

Explain how you can tell his answer is wrong.

_____ [1]

19 Write $0.\dot{3}2\dot{4}$ as a fraction in its simplest form.

_____ [3]

20 (a) Write this expression as a single power of x .

$$\left(\frac{x^9}{x^{-3}}\right)^{\frac{1}{2}}$$

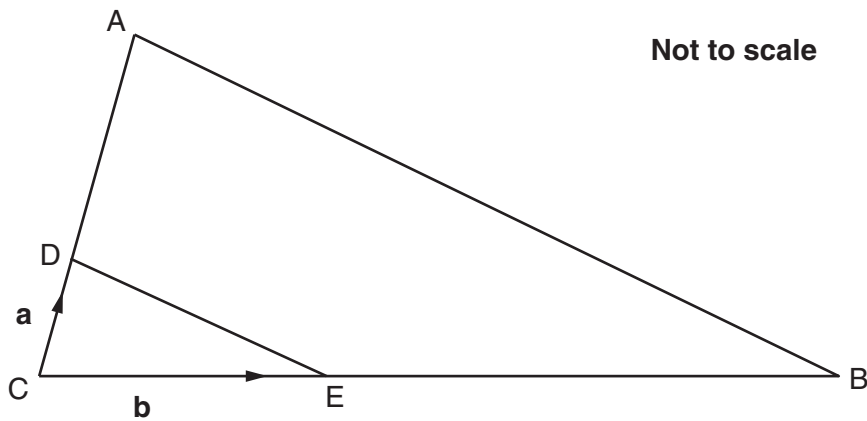
(a) _____ [2]

(b) Simplify.

$$\frac{x^2 + 2x - 15}{x^2 - 9}$$

(b) _____ [4]

21 In the diagram ABC is a triangle.



D is a point on CA such that $CA = 4CD$.

E is a point on CB such that $CB = 4CE$.

$\vec{CD} = \mathbf{a}$ and $\vec{CE} = \mathbf{b}$.

Show that lines DE and AB are parallel.

[4]

END OF QUESTION PAPER

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