



H

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
MATHEMATICS SYLLABUS A**

J512/03

Paper 3 (Higher Tier)

**Monday 6 June 2011
Afternoon**

Duration: 2 hours

Candidates answer on the question paper.

OCR supplied materials:
None

- Other materials required:**
- Geometrical instruments
 - Tracing paper (optional)



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. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Show your 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).
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

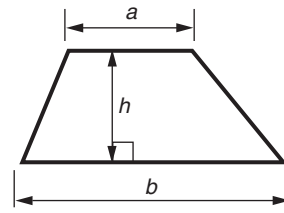
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **100**.
- This document consists of **24** pages. Any blank pages are indicated.

WARNING

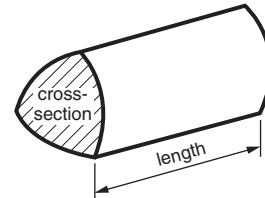
No calculator can be used for this paper

Formulae Sheet: Higher Tier

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



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

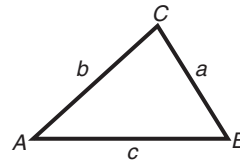


In any triangle ABC

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

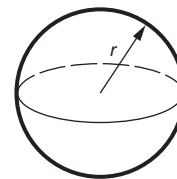
Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

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 = $\pi r l$



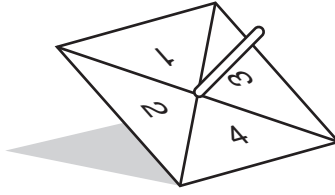
The Quadratic Equation

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

- 1 A biased spinner is numbered 1 to 4.



- (a) Complete the table to show the probability of getting 4.

.....

Score	1	2	3	4
Probability	0.3	0.25	0.1	

[2]

- (b) Connor spins the spinner 200 times.

How many times might he expect to get 1?

.....

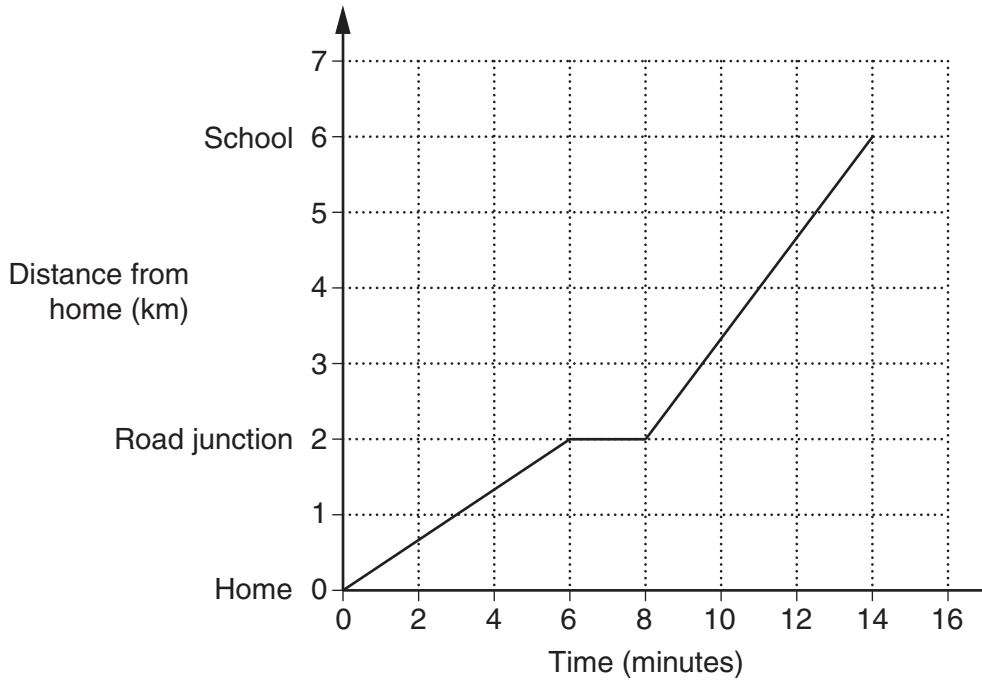
(b) _____ [2]

- (c) Work out the probability that the spinner lands on either 2 or 3.

.....

(c) _____ [2]

- 2 Laura's mum drove her to school one morning. The graph represents their journey.



Complete this description of their journey from home to school.

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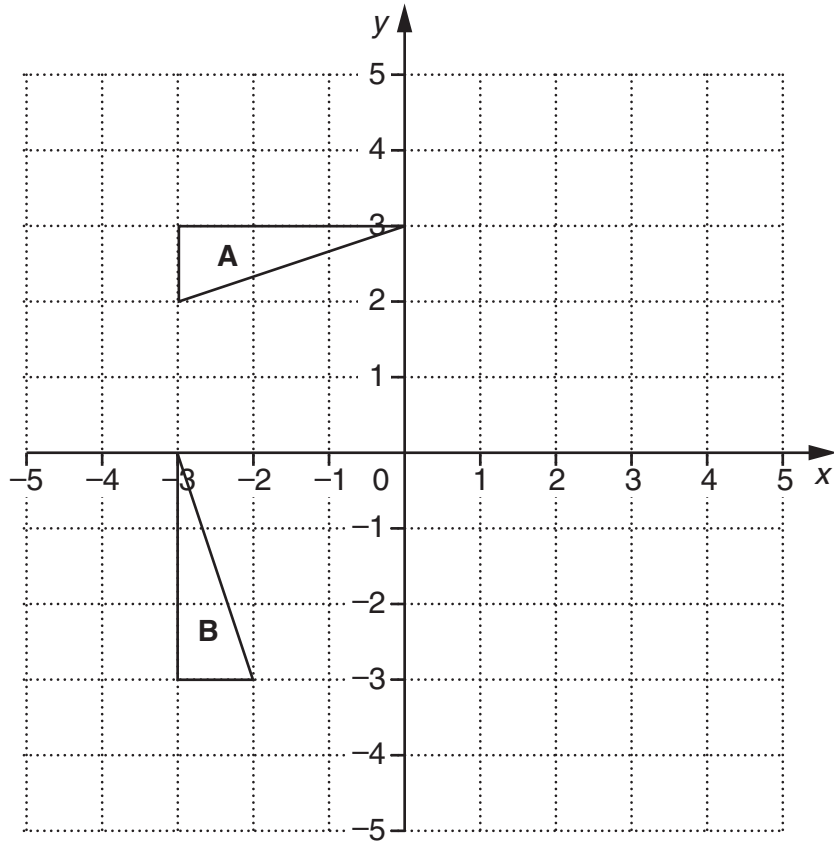
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From home to the road junction they travelled at a constant speed of _____ km/h.

When they reached the road junction they _____ for _____ minutes.

After the road junction they travelled at a _____ speed of _____ km/h until they reached school.

[6]



- (a) Describe fully the **single** transformation which maps triangle **A** onto triangle **B**.

[3]

- (b) Translate triangle **A** by 4 units to the right and 1 unit up.
Label the image **P**.

[2]

- (c) Reflect triangle **B** in the line $x = 1$.
Label the image **Q**.

[2]

4 Solve.

(a) $\frac{x}{2} = 8$

.....
.....

(a) _____ [1]

(b) $3(2x - 5) = 30$

.....
.....
.....
.....

(b) _____ [3]

- 5 (a) Tom had £50.
He bought a bike for £46.

What percentage of the £50 did Tom spend on the bike?

.....
.....
.....

(a) _____ % [2]

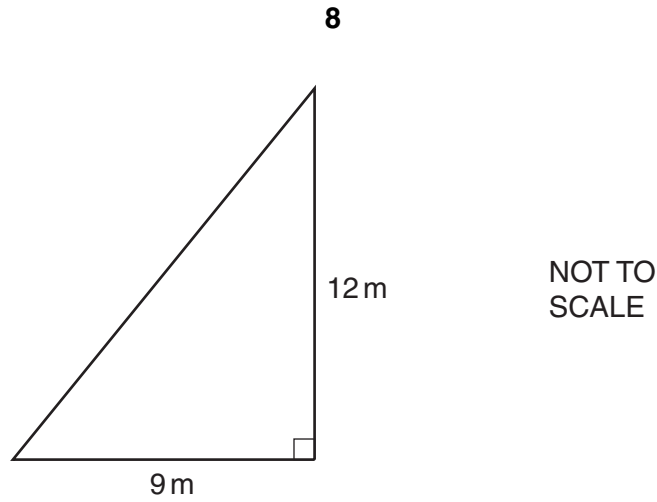
- (b) A company makes pork pies in two sizes.
The smaller pork pies each weigh 820 g.
The larger pork pies weigh $17\frac{1}{2}\%$ more than the smaller ones.

Work out the weight of one of the larger pork pies.

.....
.....
.....
.....
.....

(b) _____ g [3]

6



(a) (i) Work out the area of this triangle.

.....

.....

.....

(a)(i) _____ m² [2]

(ii) Change your answer to part (a)(i) to an area in cm².

.....

.....

.....

(ii) _____ cm² [1]

(b) Work out the length of the hypotenuse of the triangle.

.....

.....

.....

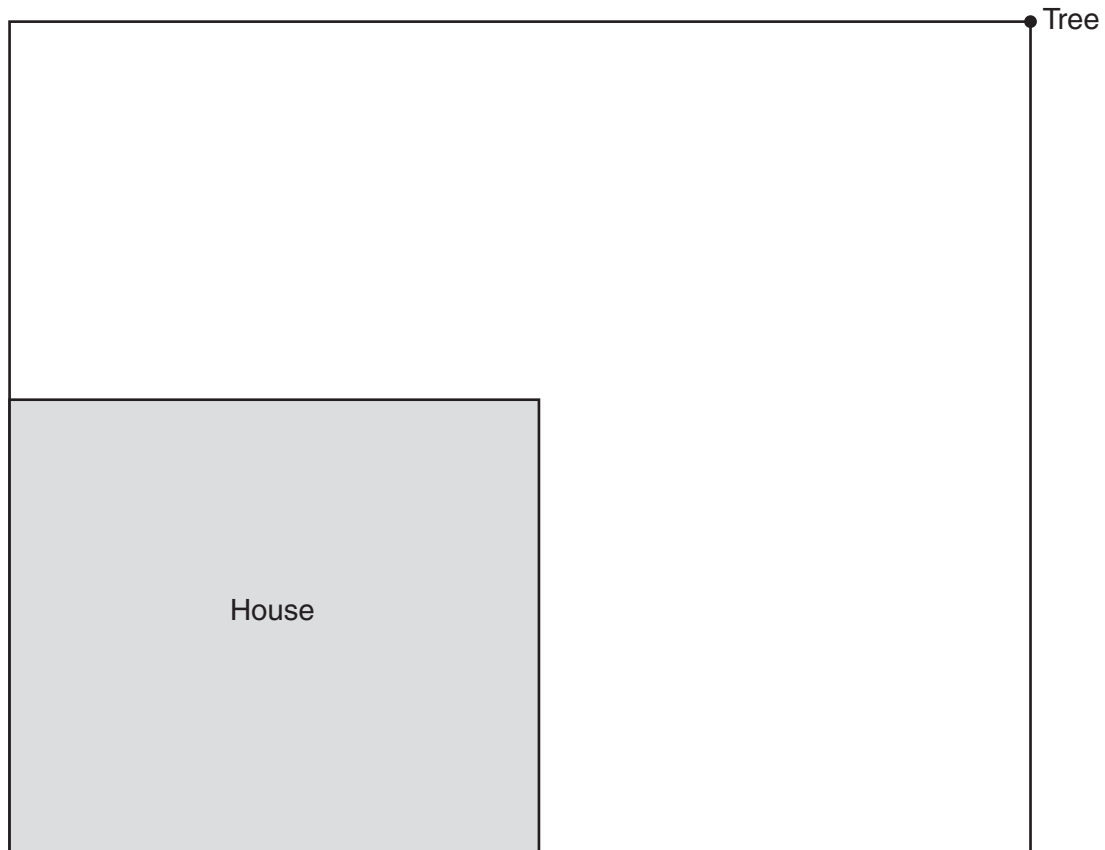
.....

(b) _____ m [3]

7 Use ruler and compasses in this question.

The diagram is a scale drawing of a house and its garden.
There is a tree in one corner of the garden.

The scale is 1 cm represents 2 m.



A second tree is to be planted in the garden.
It must be

- more than 8 m from the house,
- more than 12 m from the first tree.

On the diagram construct accurately and shade the regions where the second tree can be planted.

[6]

- 8 (a) 8, 9 and 10 are consecutive whole numbers.

Show that their sum is a multiple of 3.

[1]

- (b) $n, n + 1, n + 2$ represent three consecutive whole numbers.

(i) Write down their sum, giving your answer in its simplest form.

.....
.....

(b)(i) _____ [1]

(ii) Explain why this sum is a multiple of 3.

[1]

- (c) The sum of three consecutive whole numbers is 78.

Using $n, n + 1, n + 2$ to represent the three whole numbers, write down an equation in n and solve it to find the three whole numbers.

.....
.....
.....
.....

(c) _____ [3]

- (d) (i) Give an example showing that the **product** of three consecutive whole numbers is a multiple of 6.

[1]

- (ii) Explain why the **product** of three consecutive whole numbers is **always** a multiple of 6. You do not need to use any algebra in this part of the question.

[1]

- 9 (a) Calculate an **estimate** of the following.
Show clearly the values that you use.

$$\sqrt{\frac{40\,095}{(9.87)^2}}$$

.....
.....
.....
.....

(a) _____ [2]

- (b) Work out the following.
Give your answer as a mixed number in its simplest form.

$$3\frac{1}{3} \times 1\frac{3}{4}$$

.....
.....
.....
.....
.....

(b) _____ [3]

10 Write each of the following as a single power of p .

(a) $p^2 \times p^6$

.....
.....

(a) _____ [1]

(b) $\frac{p^2}{p^6}$

.....
.....

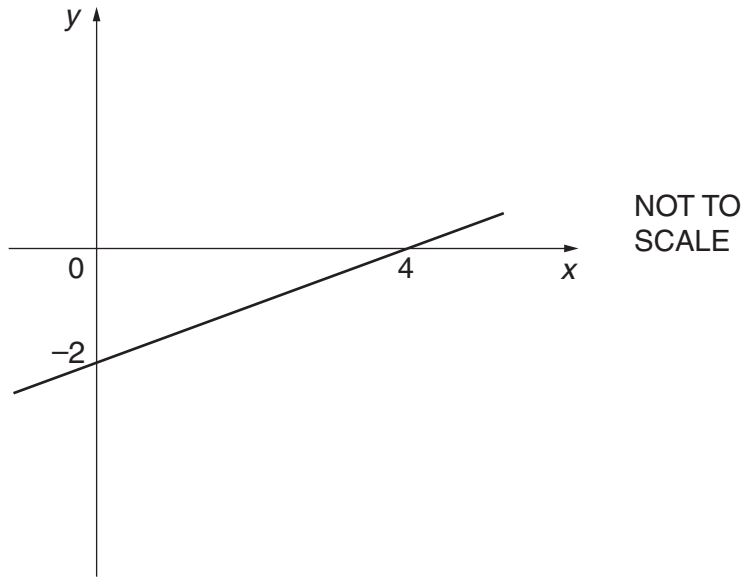
(b) _____ [1]

(c) $(p^2)^6$

.....
.....

(c) _____ [1]

11



Find the equation of this straight line.

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.....

.....

.....

.....

.....

.....

_____ [3]

12 Solve algebraically these simultaneous equations.

$$3x - y = 1$$

$$5x + 3y = 4$$

.....

.....

.....

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.....

$$x = \underline{\hspace{2cm}} \quad y = \underline{\hspace{2cm}} \quad [3]$$

13 Simplify.

(a) $(\sqrt{3})^2$

.....
.....

(a) _____ [1]

(b) $\sqrt{6} \times \sqrt{3}$

.....
.....

(b) _____ [2]

(c) $\frac{6}{\sqrt{3}}$

.....
.....

(c) _____ [2]

14 (a) Multiply out and simplify.

$$(x + 4)(x - 2)$$

.....
.....
.....

(a) _____ [2]

(b) Factorise.

$$10x^2 + 5xy$$

.....
.....
.....

(b) _____ [2]

(c) Factorise and solve.

$$2x^2 + 7x - 15 = 0$$

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(c) _____ [3]

- 15 (a) This table shows the distribution of the times, in hours and minutes, taken by 100 runners to complete a half marathon.

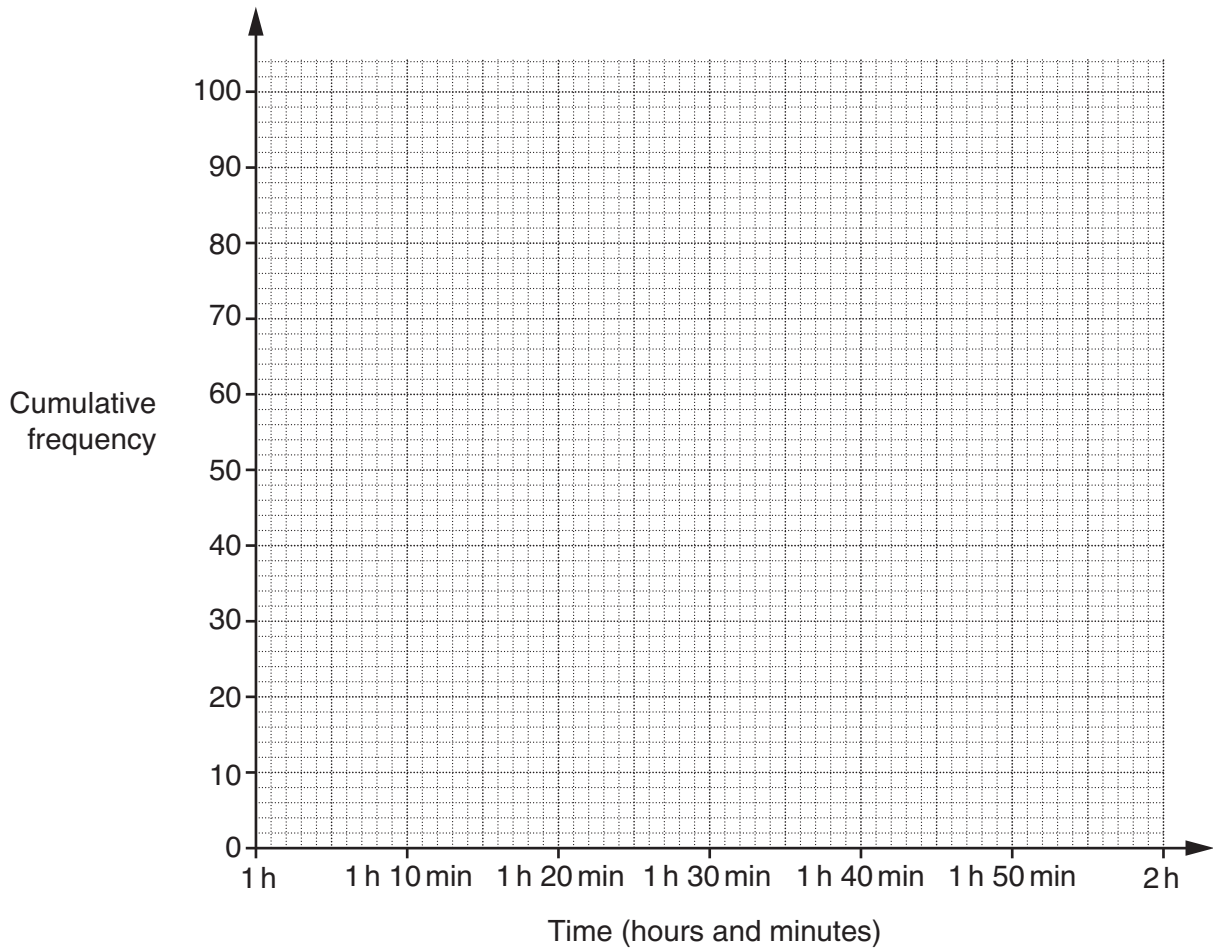
Time (t hours and minutes)	Number of runners (frequency)
$1 \text{ h} < t \leq 1 \text{ h } 10 \text{ min}$	6
$1 \text{ h } 10 \text{ min} < t \leq 1 \text{ h } 20 \text{ min}$	24
$1 \text{ h } 20 \text{ min} < t \leq 1 \text{ h } 30 \text{ min}$	44
$1 \text{ h } 30 \text{ min} < t \leq 1 \text{ h } 40 \text{ min}$	20
$1 \text{ h } 40 \text{ min} < t \leq 1 \text{ h } 50 \text{ min}$	5
$1 \text{ h } 50 \text{ min} < t \leq 2 \text{ h}$	1

- (i) Complete the cumulative frequency table below.

Time (t hours and minutes)	Cumulative frequency
$t \leq 1 \text{ h}$	0
$t \leq 1 \text{ h } 10 \text{ min}$	6
$t \leq 1 \text{ h } 20 \text{ min}$	
$t \leq 1 \text{ h } 30 \text{ min}$	
$t \leq 1 \text{ h } 40 \text{ min}$	
$t \leq 1 \text{ h } 50 \text{ min}$	
$t \leq 2 \text{ h}$	100

[1]

(ii) On the grid, draw a cumulative frequency diagram for the times.



[3]

(iii) Use the cumulative frequency diagram to find an estimate of the number of runners who took longer than 1 hour 35 minutes.

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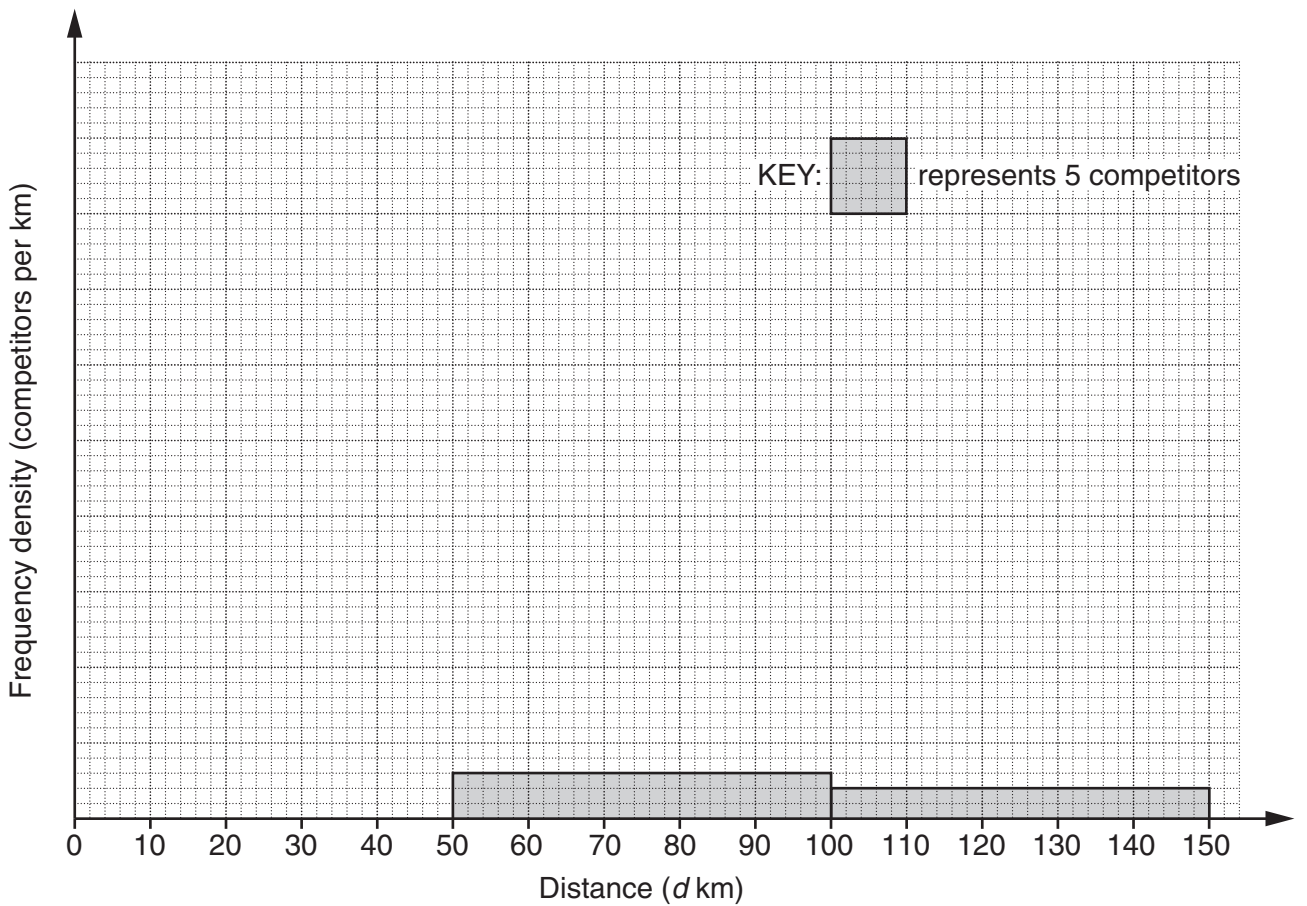
(a)(iii) _____ [2]

(b) Each of the 100 competitors was asked how far, in km, they travelled from their home to the half marathon venue.

The distribution of these distances is shown in the table.

Distance (d km)	Frequency
$0 < d \leq 10$	12
$10 < d \leq 20$	45
$20 < d \leq 50$	18
$50 < d \leq 100$	X
$100 < d \leq 150$	Y

(i) Complete the histogram to represent this information.



[4]

(ii) Use the histogram to work out the values of X and Y.

.....

.....

.....

.....

(b)(ii) X = _____ Y = _____ [2]

16 (a) A Christmas card weighs 25g, correct to the nearest gram.

Work out the smallest possible total weight of 10 of these cards.

.....
.....

(a) _____ g [1]

(b) The Christmas cards are square.
Each side is 10.5 cm, correct to the nearest 0.1 cm.
Their envelopes are square and of side 11 cm, correct to the nearest centimetre.

Is it certain that a card will fit inside its envelope?
Show how you decide.

_____ [3]

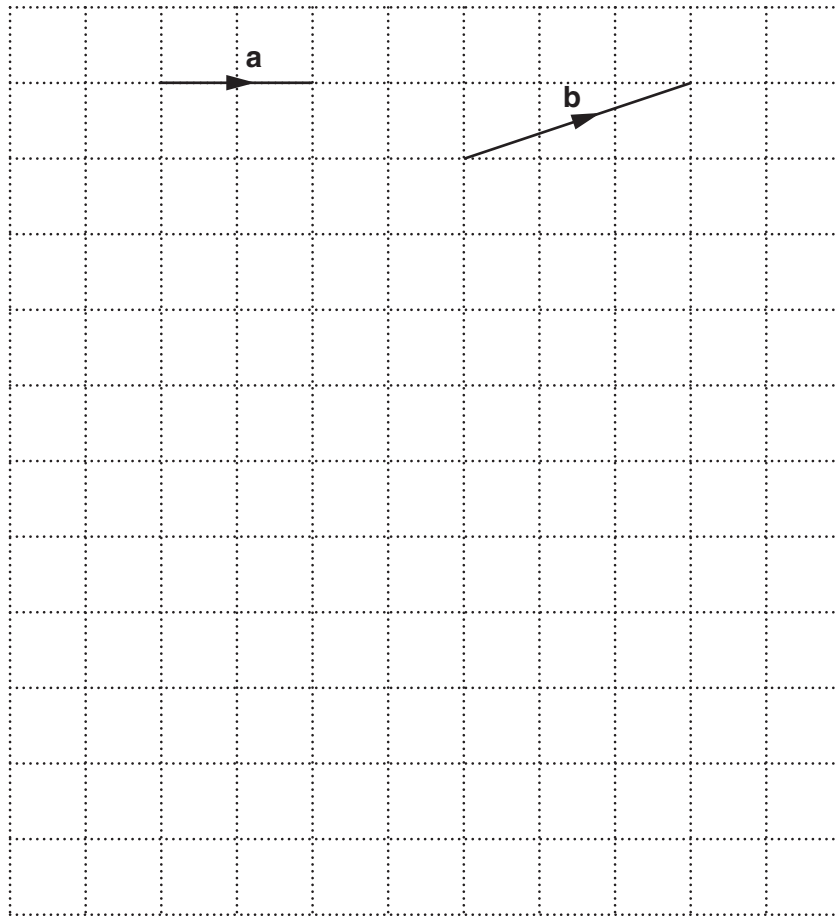
17 There are 5 lemon sweets and 4 orange sweets in a bag.
Kiran takes one of the sweets at random and eats it.
Claire then takes a sweet at random.

Calculate the probability that they both take a sweet of the same flavour.

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_____ [4]

18 (a) The diagram shows the vectors **a** and **b**.

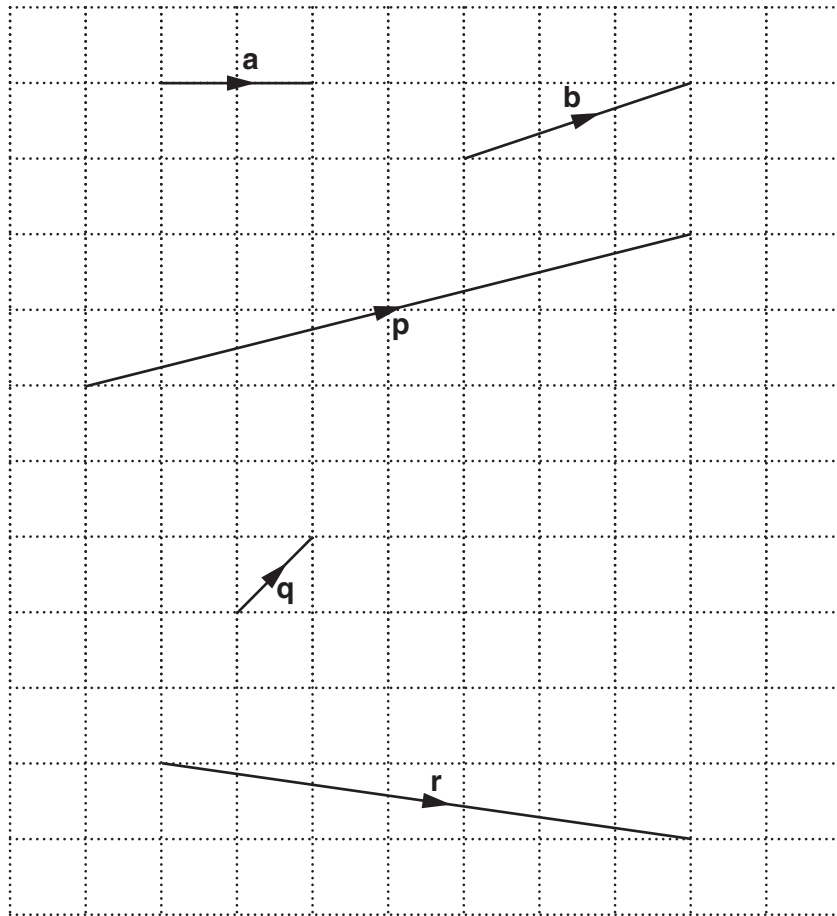


On the grid above, draw and label the vectors

- (i) $2\mathbf{b}$,
- (ii) $-3\mathbf{a}$,
- (iii) $\mathbf{a} + \mathbf{b}$.

[3]

(b) This diagram shows the vectors **a** and **b** and vectors **p**, **q** and **r**.



Write, in terms of **a** and **b**, an expression for each of the vectors **p**, **q** and **r**.
Give each answer in its simplest form.

(b) **p** = _____

q = _____

r = _____ [3]

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