Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

J512/03

MATHEMATICS SYLLABUS A

Paper 3 (Higher Tier)

MONDAY 6 JUNE 2011: Afternoon
DURATION: 2 hours

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Geometrical instruments
Tracing paper (optional)

WARNING
No calculator can be used for this paper.

READ INSTRUCTIONS OVERLEAF

DC (NH/SW) 11MEP06312 47981/1

INSTRUCTIONS TO CANDIDATES

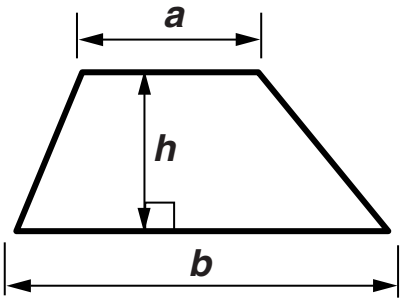
- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **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.**

INFORMATION FOR CANDIDATES

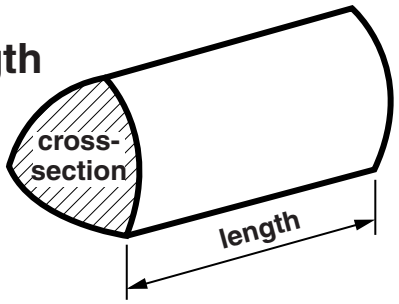
- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The total number of marks for this paper is 100.**

FORMULAE SHEET: HIGHER TIER

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

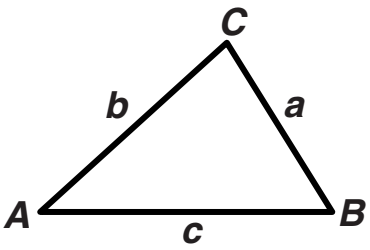


Volume of prism = (area of cross-section) × length



In any triangle ABC

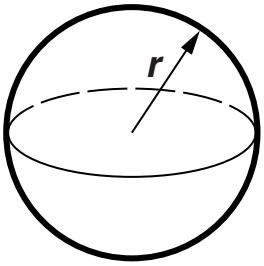
Sine rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$



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

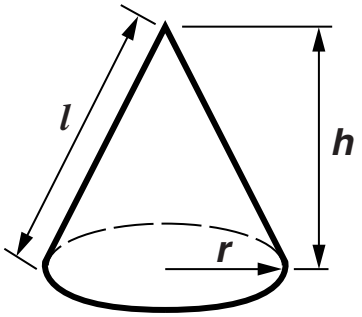
Area of triangle $= \frac{1}{2}ab\sin C$

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 $= \pi rl$

The Quadratic Equation

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

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

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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.

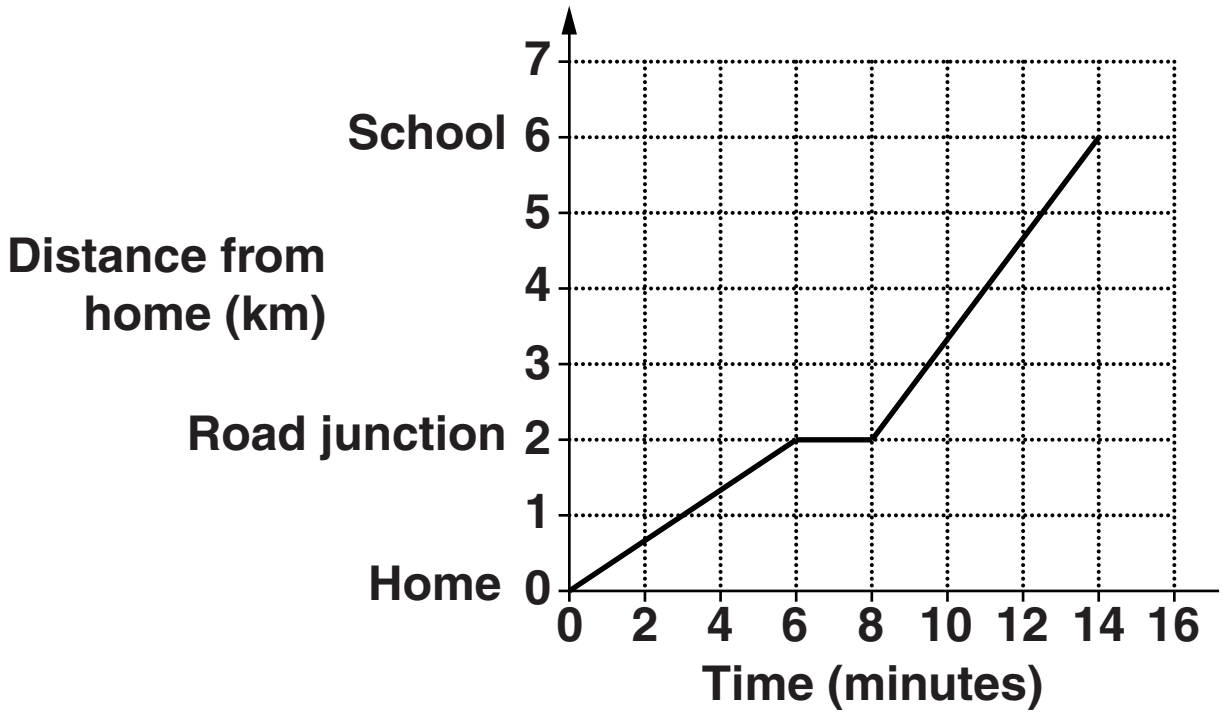
How many times might he expect to get 1?

(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.

From home to the road junction they travelled at

a constant speed of _____ km/h.

When they reached the road junction they

_____ for _____ minutes.

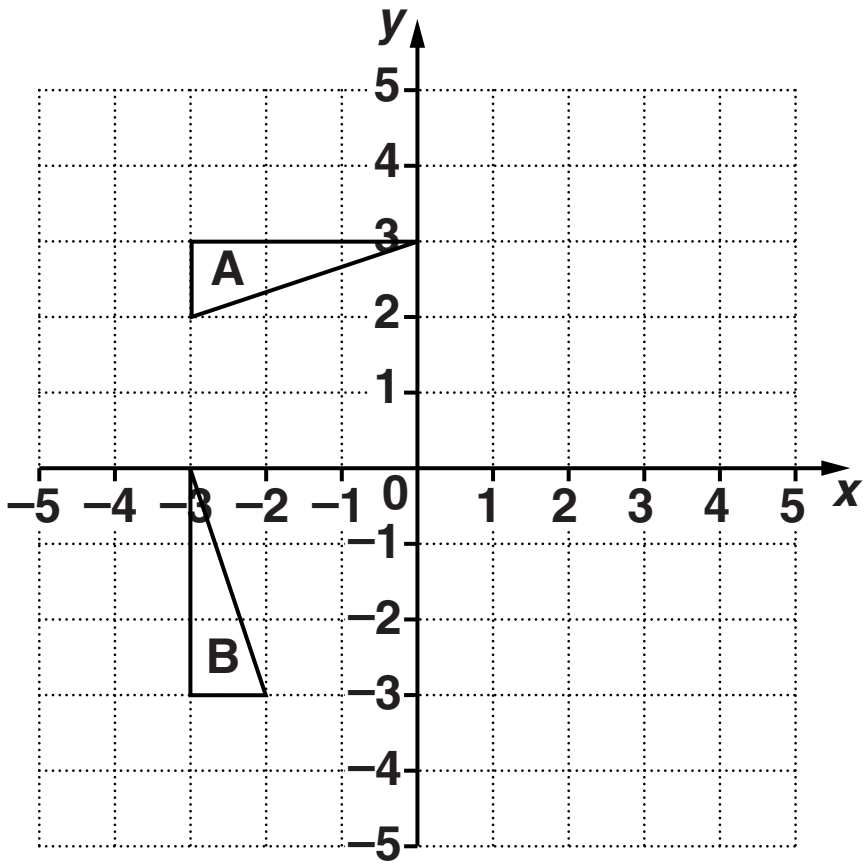
After the road junction they travelled at a

_____ speed of _____ km/h

until they reached school.

[6]

3 Use the grid below to answer the questions which follow.



(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.

_____

_____

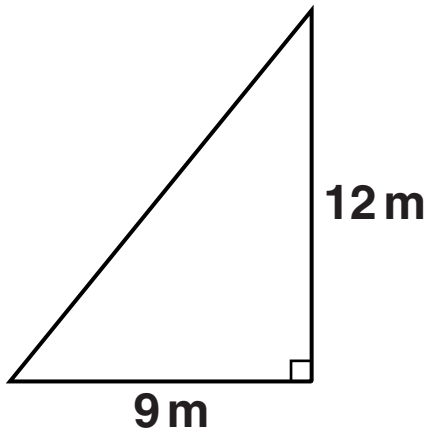
_____

_____

_____

(b) _____ g [3]

6 Use the triangle below to answer the questions that follow.



NOT TO SCALE

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

_____

_____

_____

(a)(i) _____ m^2 [2]

(ii) Change your answer to part (a)(i) to an area in cm^2.

_____

_____

_____

(ii) _____ cm^2 [1]

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

_____

_____

_____

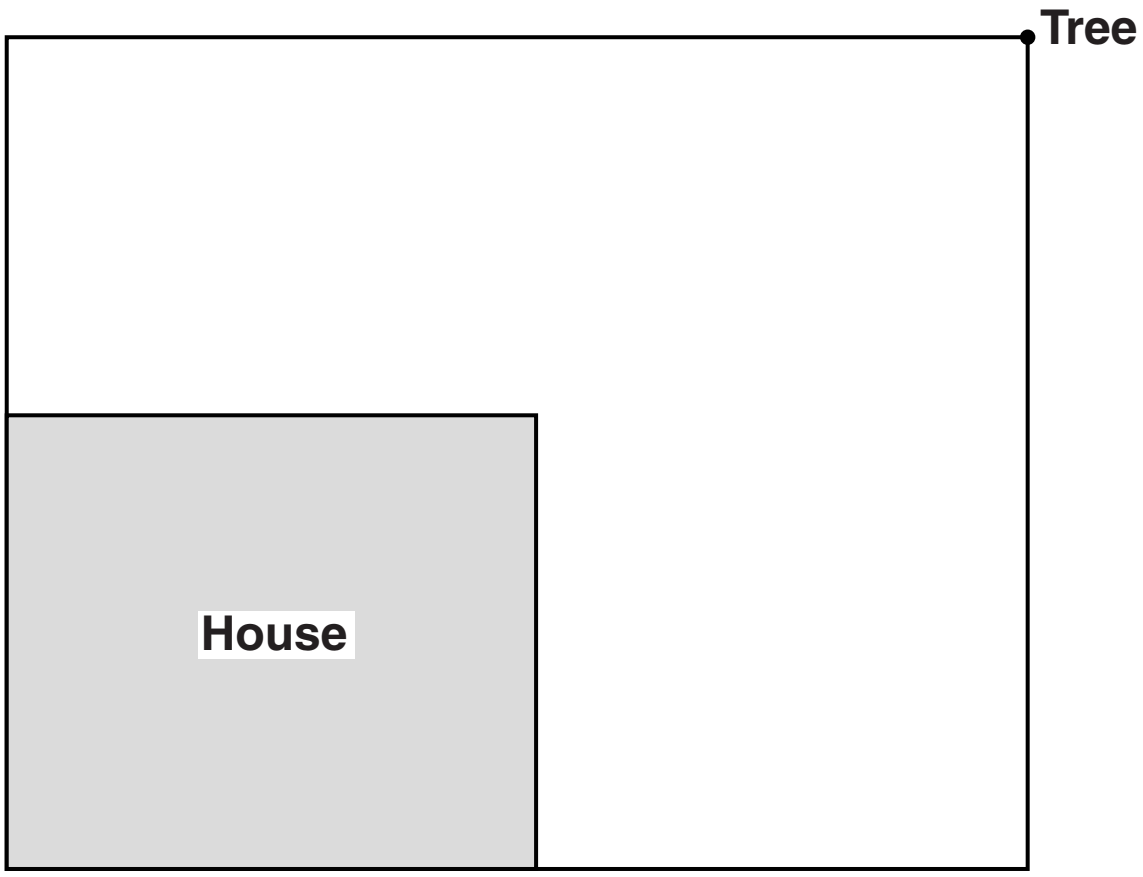
_____

(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) $\dfrac{p^2}{p^6}$

_____

_____

(b) _____ **[1]**

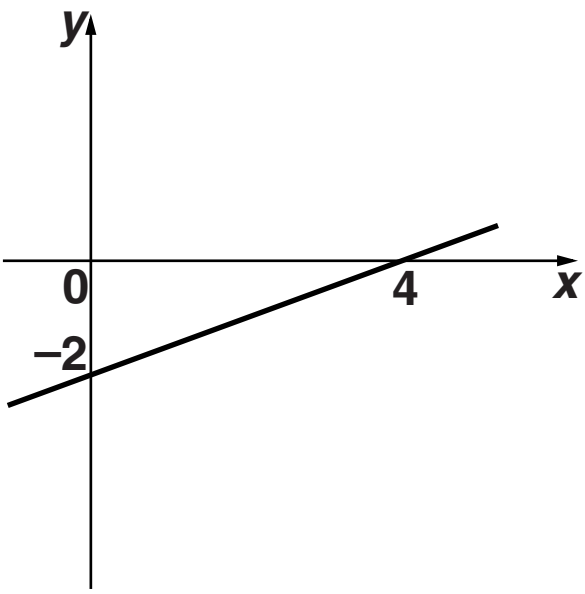
(c) $(p^2)^6$

_____

_____

(c) _____ **[1]**

11 Find the equation of this straight line below.



NOT TO SCALE

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_____ **[3]**

12 Solve algebraically these simultaneous equations.

$3x - y = 1$
$5x + 3y = 4$

$x =$ _____ $y =$ _____ **[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.

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

_____

_____

_____

_____

_____

_____

(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.

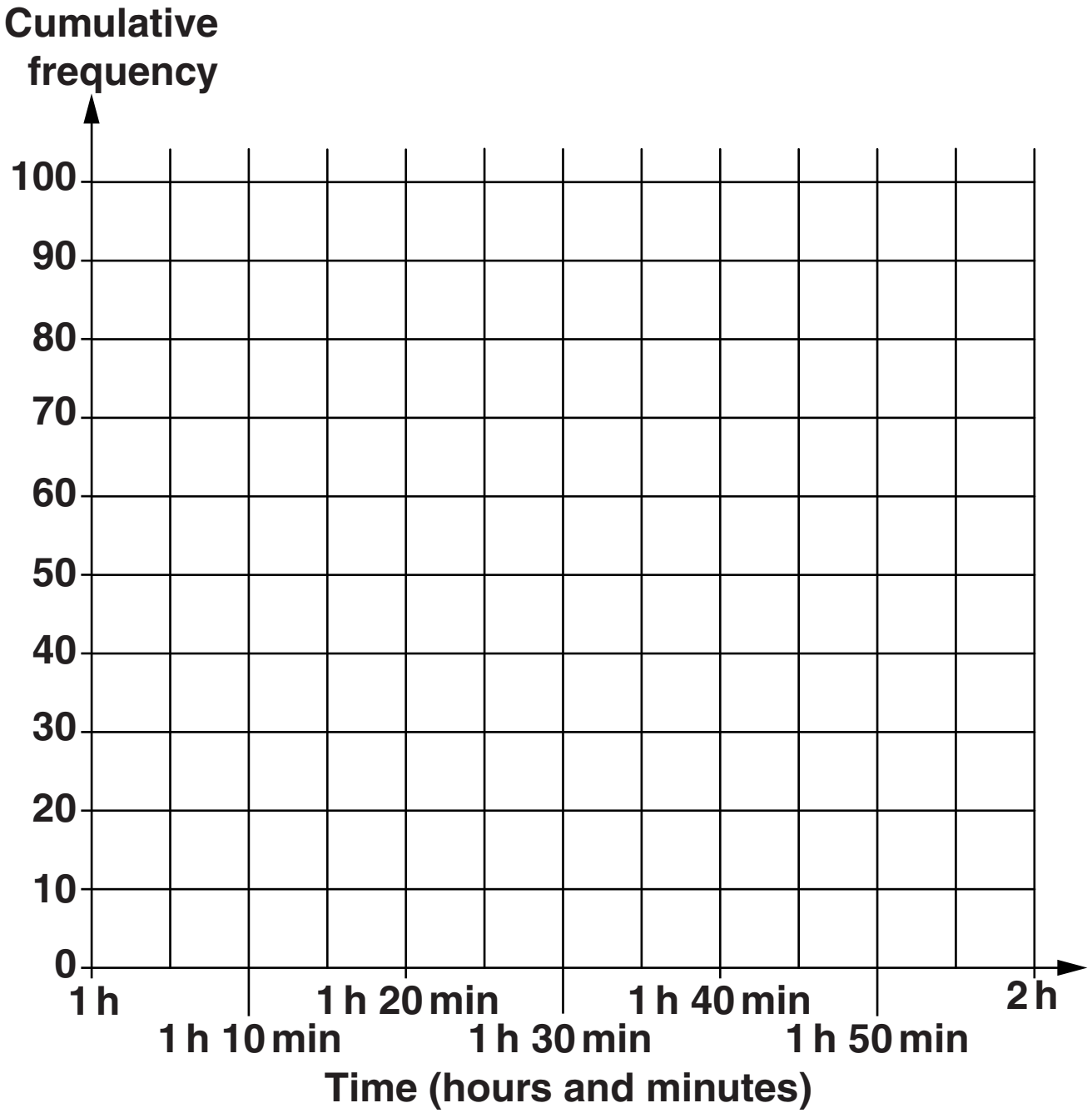
Time (t hours and minutes)	Number of runners (frequency)
$1\,\text{h} < t \leqslant 1\,\text{h}\ 10\,\text{min}$	6
$1\,\text{h}\ 10\,\text{min} < t \leqslant 1\,\text{h}\ 20\,\text{min}$	24
$1\,\text{h}\ 20\,\text{min} < t \leqslant 1\,\text{h}\ 30\,\text{min}$	44
$1\,\text{h}\ 30\,\text{min} < t \leqslant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

(i) Complete the cumulative frequency table below.

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

_____

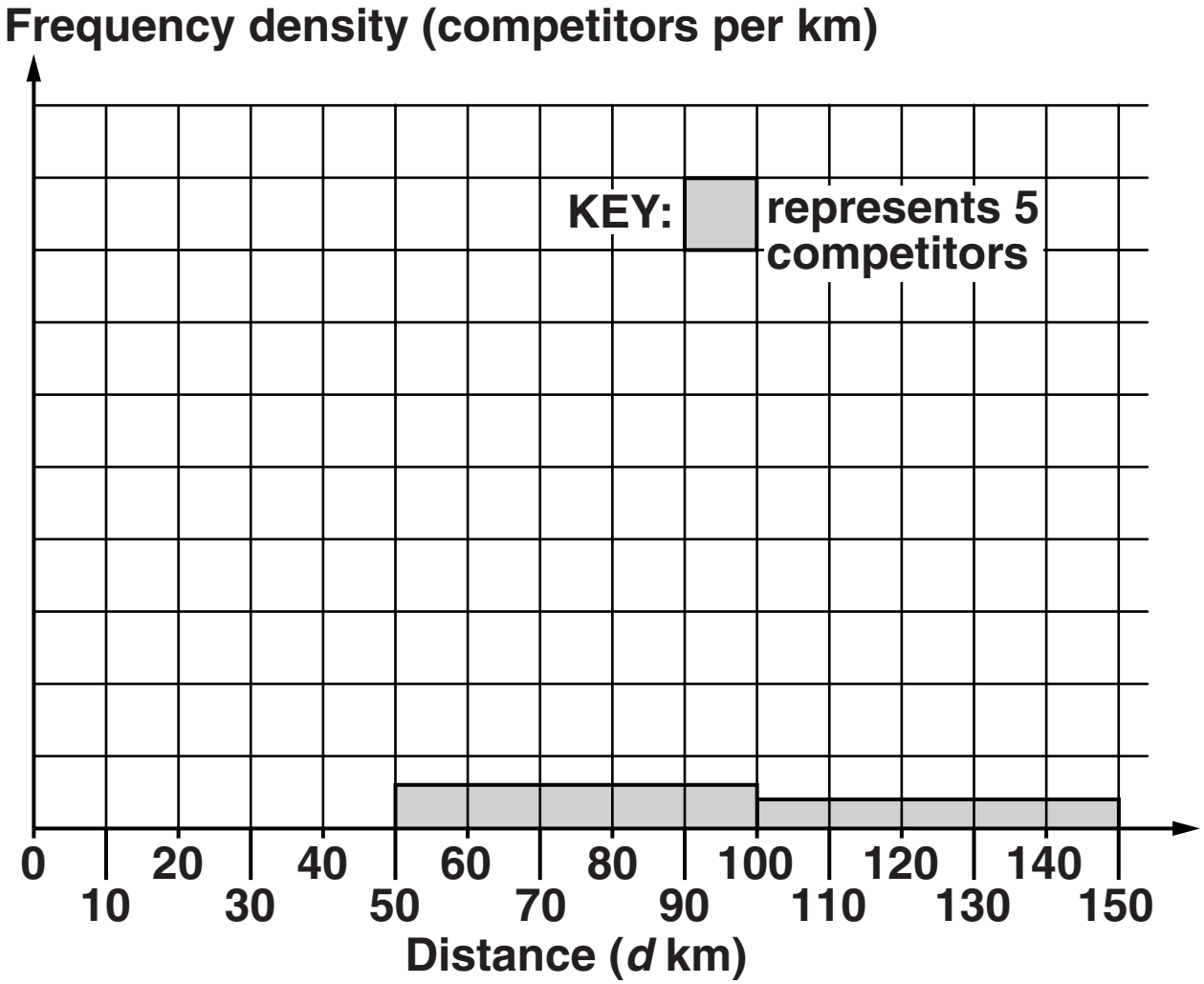
_____

(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
$0 < d \leqslant 10$	12
$10 < d \leqslant 20$	45
$20 < d \leqslant 50$	18
$50 < d \leqslant 100$	X
$100 < d \leqslant 150$	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 25 g, 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.

_____

_____

_____

_____

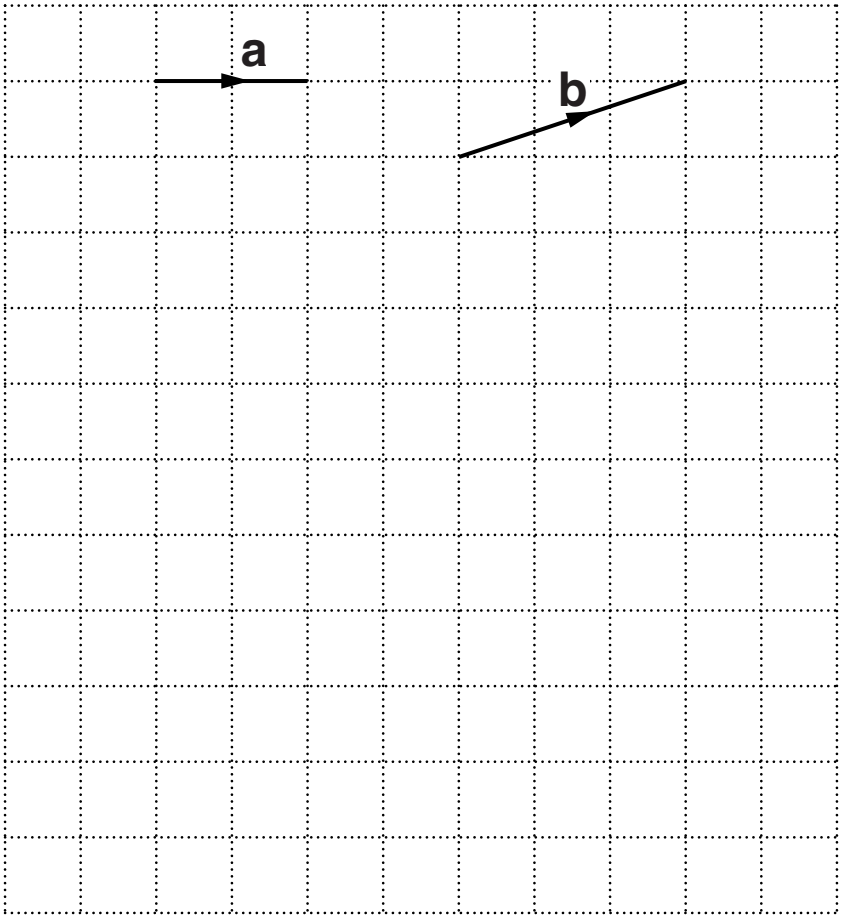
_____

_____

_____

_____ **[4]**

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



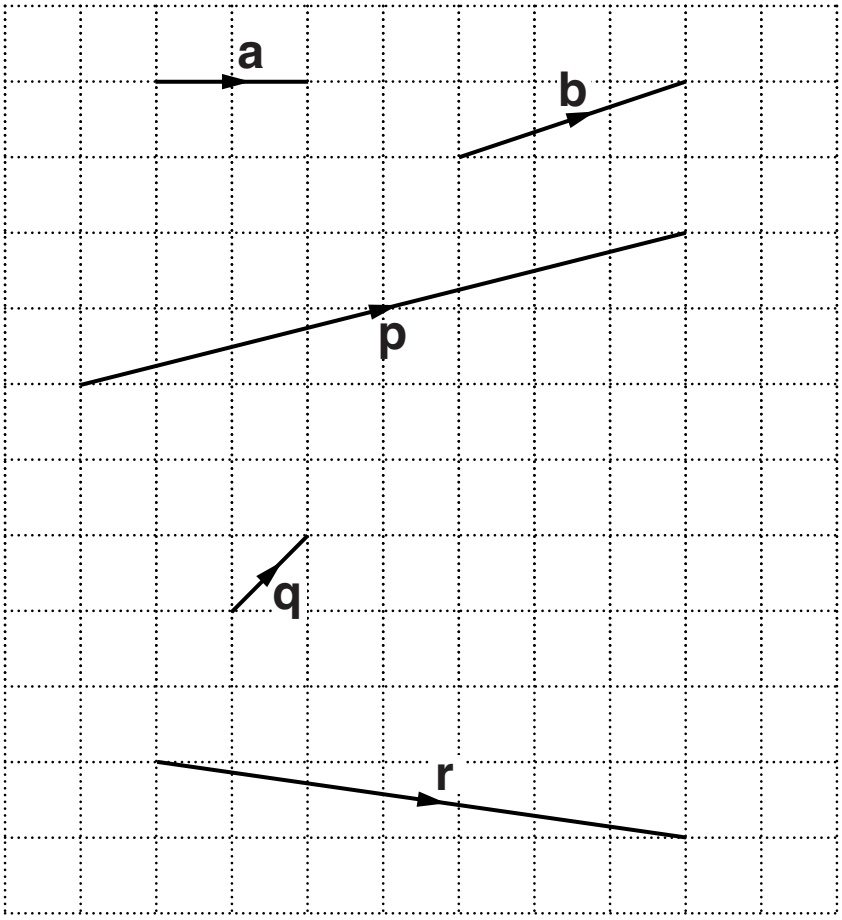
On the grid above, draw and label the vectors

(i) 2b,

(ii) –3a,

(iii) a + 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]**