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

J512/03

Paper 3 (Higher Tier)

Candidates answer on the question paper.

OCR supplied materials:
None

Other materials required:

- Geometrical instruments
- Tracing paper (optional)

**Tuesday 11 January 2011
Morning**

Duration: 2 hours



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

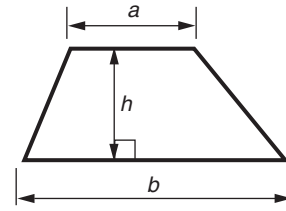
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **100**.
- This document consists of **24** pages. Any blank pages are indicated.

WARNING

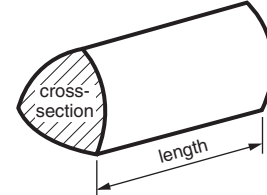
No calculator can be used for this paper

Formulae Sheet: Higher Tier

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



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

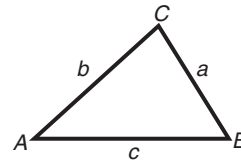


In any triangle ABC

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

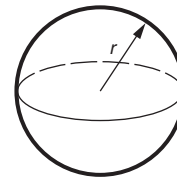
Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

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



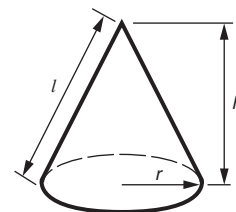
Volume of sphere = $\frac{4}{3}\pi r^3$

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) Write each of these ratios in its simplest form.

(i) 30 : 12

.....
.....

(a)(i) _____ : _____ [1]

(ii) 75p : £2

.....
.....

(ii) _____ : _____ [1]

(iii) $3\frac{1}{2}$: 5

.....
.....

(iii) _____ : _____ [1]

(b) Andy, Karen and Phil share £1600 in the ratio 2 : 5 : 3.

Work out how much money each of them gets.

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(b) Andy £ _____ Karen £ _____ Phil £ _____ [3]

- 2 Elaine sets off on a journey at 2:15 pm.
She travels 150 miles at an average speed of 60 mph.

At what time does she complete the journey?

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_____ pm [3]

- 3 Faisal carries out a survey of 100 students in Year 11. He asks each student how many cars there are at their household. The results are shown in the table.

Number of cars	Frequency
0	8
1	17
2	52
3	20
4	3
Total	100

Work out the mean number of cars at each household.

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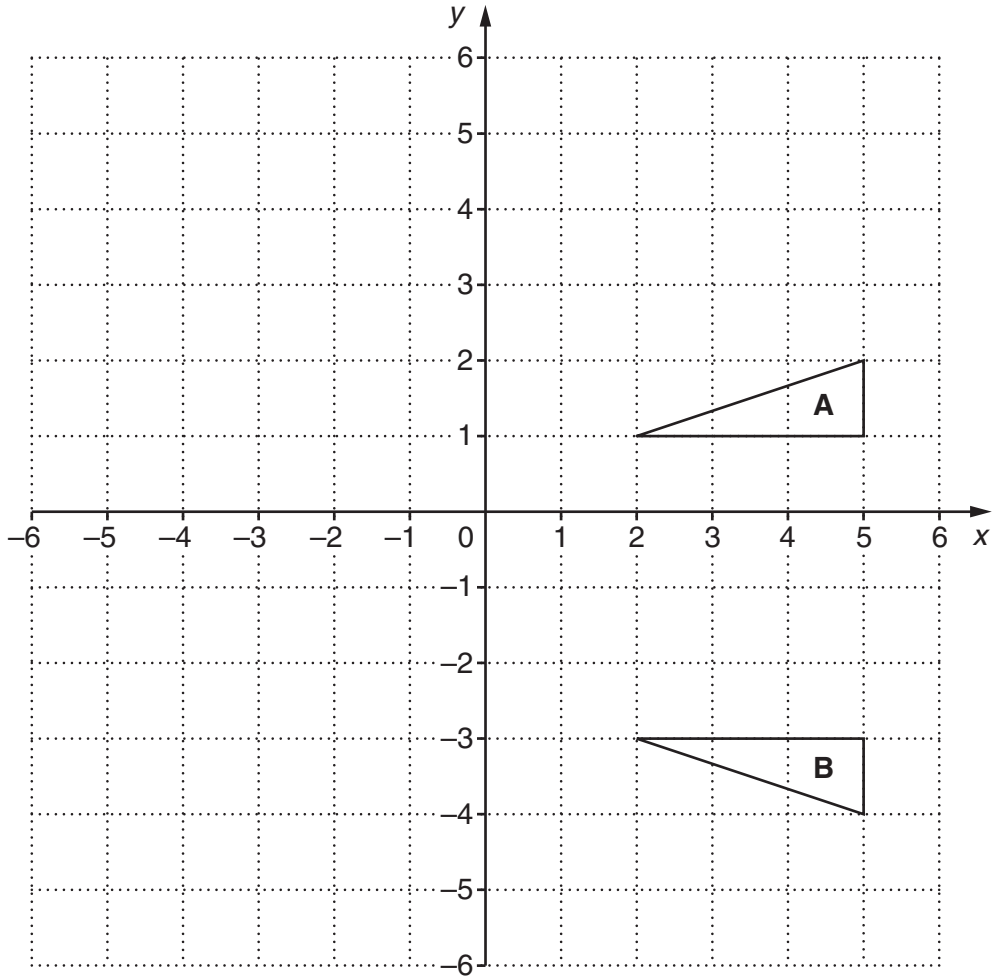
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_____ [3]

4



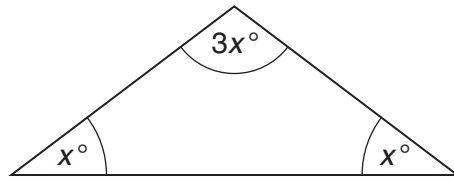
- (a) Describe the **single** transformation which maps triangle **A** onto triangle **B**.

[2]

- (b) Rotate triangle **A** 90° anticlockwise about (0,0).
Label the image **P**.

[3]

5 Here is an isosceles triangle.



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Use this information to write down an equation in x .

Solve your equation and work out the size of each angle in the triangle.

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_____° _____° _____° [3]

- 6 (a) Factorise this expression.

$$3x - 9$$

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.....

(a) _____ [1]

- (b) Multiply out the brackets and simplify your answer.

$$2(3x + 1) + 5(2x - 3)$$

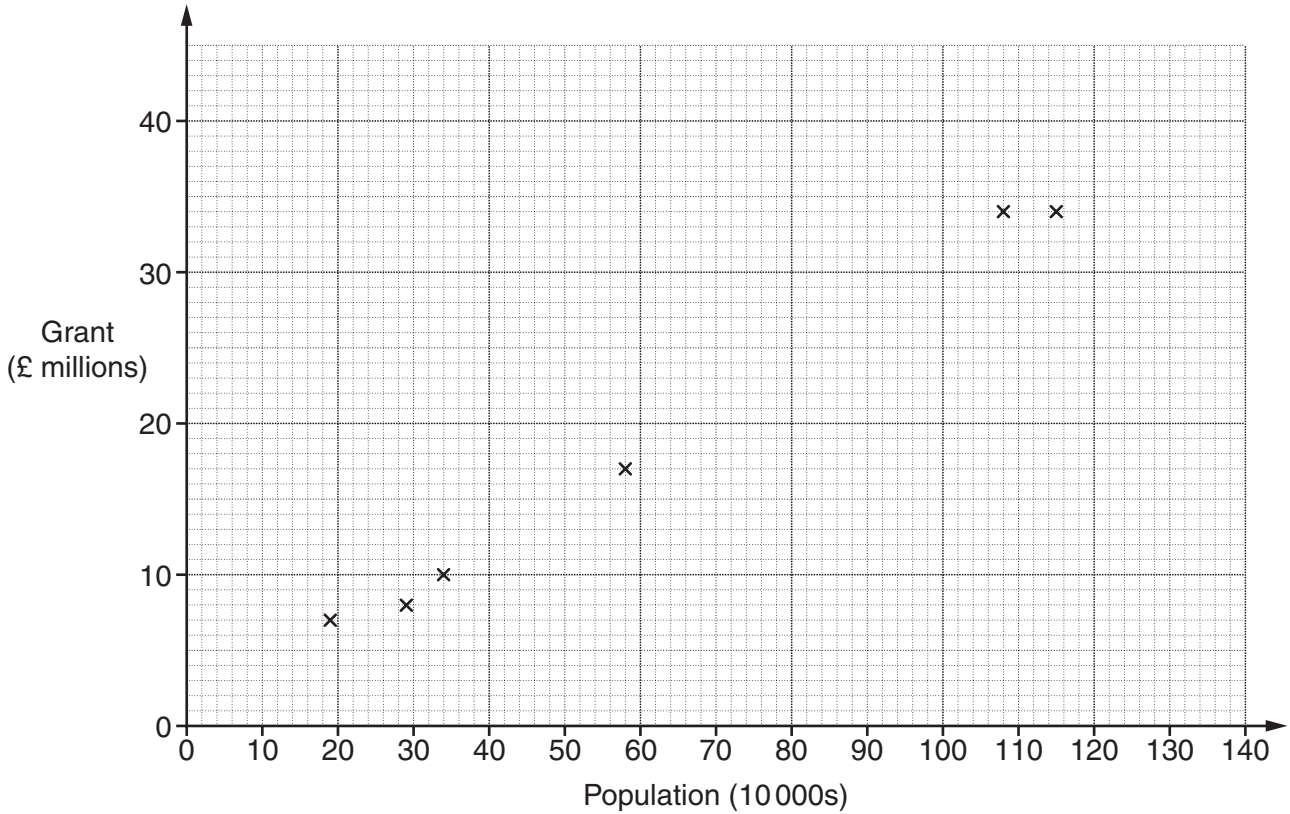
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(b) _____ [2]

- 7 The table shows the population (in tens of thousands) of 10 English counties and the grant (in millions of pounds) they each received to prevent flooding.

Population (10 000s)	29	58	108	34	115	19	136	25	47	49
Grant (£ millions)	8	17	34	10	34	7	41	9	12	17

The first six points have been plotted on this scatter diagram.



- (a) Complete the scatter diagram. [2]

- (b) Describe the relationship shown in the scatter diagram.

_____ [1]

- (c) Draw a line of best fit on your scatter diagram. [1]

- (d) Another county has a population of 800 000.

Use your line of best fit to estimate the grant for this county.

(d) £ _____ million [1]

- 8 (a) The n th term of a sequence of numbers is given by $n^2 + 3$.

Work out the first two terms of this sequence.

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(a) _____ [2]

- (b) Here are the first four terms of another sequence.

2 6 10 14

Work out the formula for the n th term of this sequence.

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(b) _____ [2]

- (c) Here is the formula for the n th term, T , of a different sequence.

$$T = 2n + 5$$

Rearrange this formula to make n the subject.

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(c) $n =$ _____ [2]

9 Give a reason why each of these questions would be unsuitable for use in a survey.

(a) 'What is your favourite drink: tea, coffee or water?'

_____ [1]

(b) 'Don't you think that the government should reduce taxes?'

_____ [1]

10 Solve each of these equations algebraically.

(a) $3x + 7 = 2x + 4$

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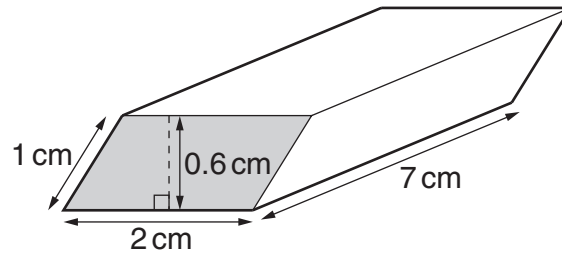
(a) _____ [2]

(b) $\frac{3x - 1}{4} = 5$

.....

(b) _____ [3]

- 11 An eraser is a prism with a parallelogram as its cross-section.



Work out the volume of the eraser.
Give the units of your answer.

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_____ [3]

- 12 Each year, a car loses 20% of its value at the start of that year.
The car is bought for £10 000.

Work out the value of the car after 3 years.

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£ _____ [4]

13 (a) Write 360 as a product of its prime factors.

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.....

(a) _____ [2]

(b) On a Year 11 school trip the students are split into groups.
A teacher works out that they could be split exactly into groups of 15 or into groups of 21.

What is the smallest number of students there could be in Year 11?

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(b) _____ [3]

14 Solve these simultaneous equations algebraically.

$$\begin{aligned}3x + y &= 13 \\2x - y &= 12\end{aligned}$$

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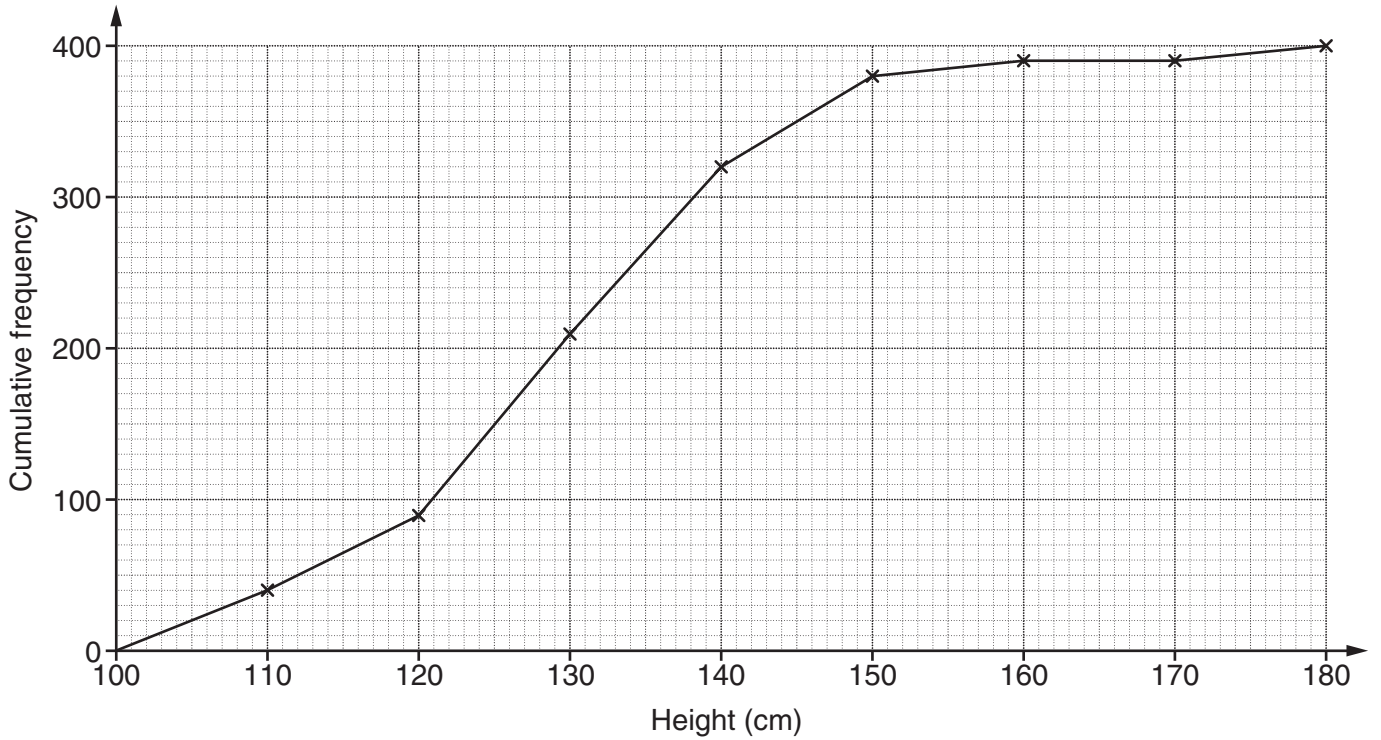
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$$x = \underline{\hspace{2cm}} \quad y = \underline{\hspace{2cm}} \quad [2]$$

15 The cumulative frequency diagram shows the distribution of heights, in cm, of 400 students in a school.



Use the diagram to find an estimate of

(a) the median height,

(a) _____ cm [1]

(b) the number of students with height less than 124 cm,

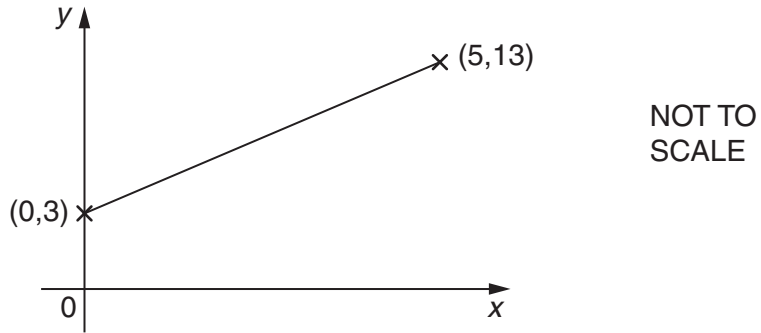
(b) _____ [1]

(c) the number of students with height more than 147 cm.

.....

(c) _____ [2]

16 The sketch shows a straight line joining the points (0,3) and (5,13).



(a) Work out the gradient of the line.

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(a) _____ [2]

(b) Find the equation of the line.

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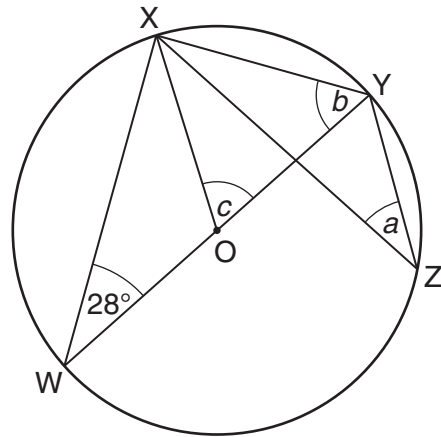
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(b) _____ [2]

- 17 W, X, Y and Z are points on the circumference of a circle, centre O. WOY is a diameter and angle XWY = 28°.



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- (a) What is the size of angle a ? Give a reason for your answer.

$a =$ _____ $^{\circ}$ because _____
 _____ [2]

- (b) Work out the size of angle b . Give reasons for your answer.

.....

 $b =$ _____ $^{\circ}$ because _____

 _____ [3]

- (c) What is the size of angle c ?

.....

 (c) _____ $^{\circ}$ [1]

18 (a) Evaluate.

(i) 5^0

(a)(i) _____ [1]

(ii) 3^{-4}

.....
.....

(ii) _____ [1]

(iii) $(2^3)^2$

.....
.....

(iii) _____ [1]

(b) Simplify these as far as possible.

(i) $(\sqrt{7})^2$

.....

(b)(i) _____ [1]

(ii) $\frac{28}{\sqrt{7}}$

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(ii) _____ [2]

19 Multiply out and simplify.

$$(2x + 1)(3x - 4)$$

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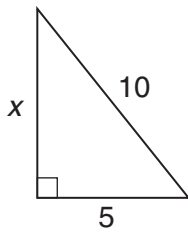
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_____ [2]

- 20 (a) The diagram shows a right-angled triangle. All lengths are in cm.

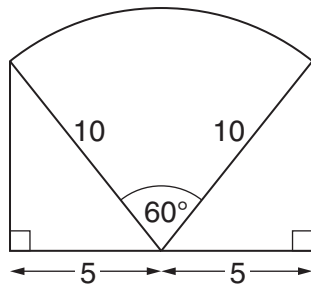


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Show that $x = 5\sqrt{3}$.

[3]

- (b) The diagram shows a company logo made using two right-angled triangles and a sector of a circle. All lengths are in cm.



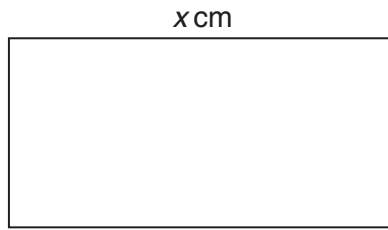
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Find the total area of the logo.
Give your answer in terms of π and $\sqrt{3}$.

(b) _____ cm² [5]

Turn over

21 The diagram shows a rectangle of length x cm.



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(a) The perimeter of the rectangle is 25 cm.

Find an expression for the width of the rectangle.

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.....

(a) _____ cm [1]

(b) The area of the rectangle is 36 cm^2 .

Show that $2x^2 - 25x + 72 = 0$.

_____ [2]

(c) Find the length and the width of the rectangle by solving this equation.

$$2x^2 - 25x + 72 = 0$$

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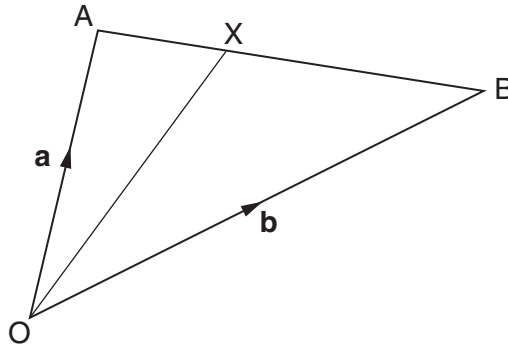
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(c) Length = _____ cm Width = _____ cm [3]

- 22 In the diagram, $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.
 The point X divides AB such that $AX : XB = 2 : 3$.



Express the following in terms of **a** and **b**.

- (a) \vec{AB}

.....

(a) _____ [1]

- (b) \vec{AX}

.....

(b) _____ [1]

- (c) \vec{OX}

Give your answer in its simplest form.

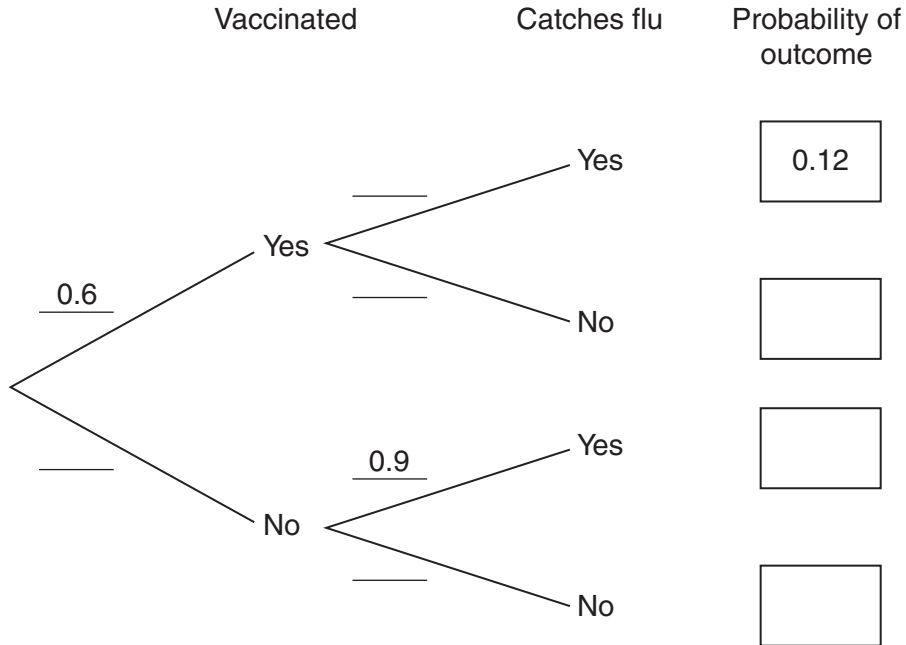
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(c) _____ [2]

TURN OVER FOR QUESTION 23

- 23** 60% of people in a village are vaccinated against flu.
 The probability that a person in the village is vaccinated **and** catches flu is 0.12.
 The probability that a person in the village who is not vaccinated catches flu is 0.9.

(a) Complete the tree diagram and fill in the boxes showing the probability of each possible outcome.



[3]

(b) Work out the probability that a person in the village, chosen at random, does not catch flu.

.....

.....

(b) _____ **[2]**



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