

Candidate Name	Centre Number				Candidate Number			
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GCSE MATHEMATICS

COMPONENT 1

Non-Calculator Mathematics

Higher Tier

SPECIMEN PAPER

2 hour 15 minutes



ADDITIONAL MATERIALS

The use of a calculator is not permitted in this examination.
A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided in this booklet.

Take π as 3.14.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the need for good English and orderly, clear presentation in your answers.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	3	
2.	4	
3.	4	
4.	6	
5.	3	
6.	4	
7.	4	
8.	4	
9.	3	
10.	5	
11.	4	
12.	5	
13.	7	
14.	6	
15.	5	
16.	10	
17.	4	
18.	4	
19.	2	
20.	5	
21.	7	
22.	6	
23.	7	
24.	8	
TOTAL	120	

Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

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

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

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

1. Given that $a = 10$, $b = 3$ and $c = -5$, find the value of each of the following expressions.

(a) b^2 [1]

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(b) $\frac{ab}{c}$ [1]

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(c) $\frac{2bc}{a}$ [1]

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2. (a) Write 6.8×10^4 in decimal notation. [1]

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- (b) Write in standard form the value of 0.0000853. [1]

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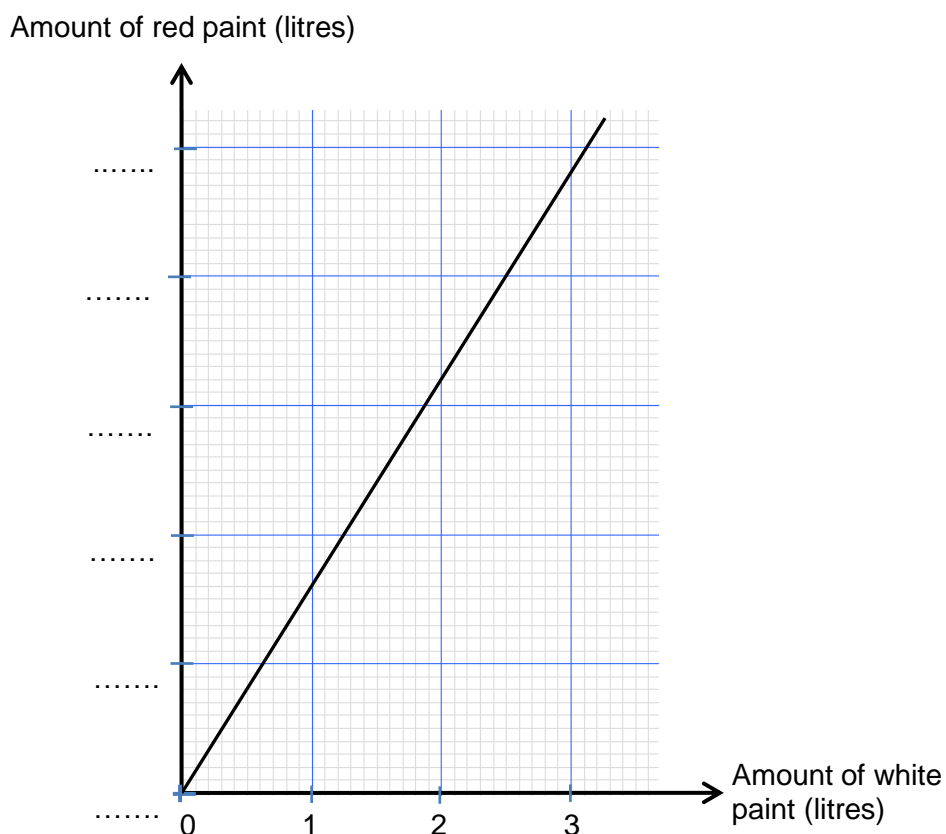
- (c) Find in standard form the value of $(3 \times 10^2) \times (5 \times 10^6)$. [2]

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3. Cherry Blossom paint is made by mixing red and white paint in a certain ratio. 4 litres of **red** paint is used to make 9 litres of Cherry Blossom paint. The diagram below shows the relationship between the amount of red paint and the amount of white paint needed to make Cherry Blossom paint.



Write down the correct scale on the 'Amount of red paint (litres)' axis.

You must put a value on each of the dotted lines on the axis.

You must show all your working to support your answer.

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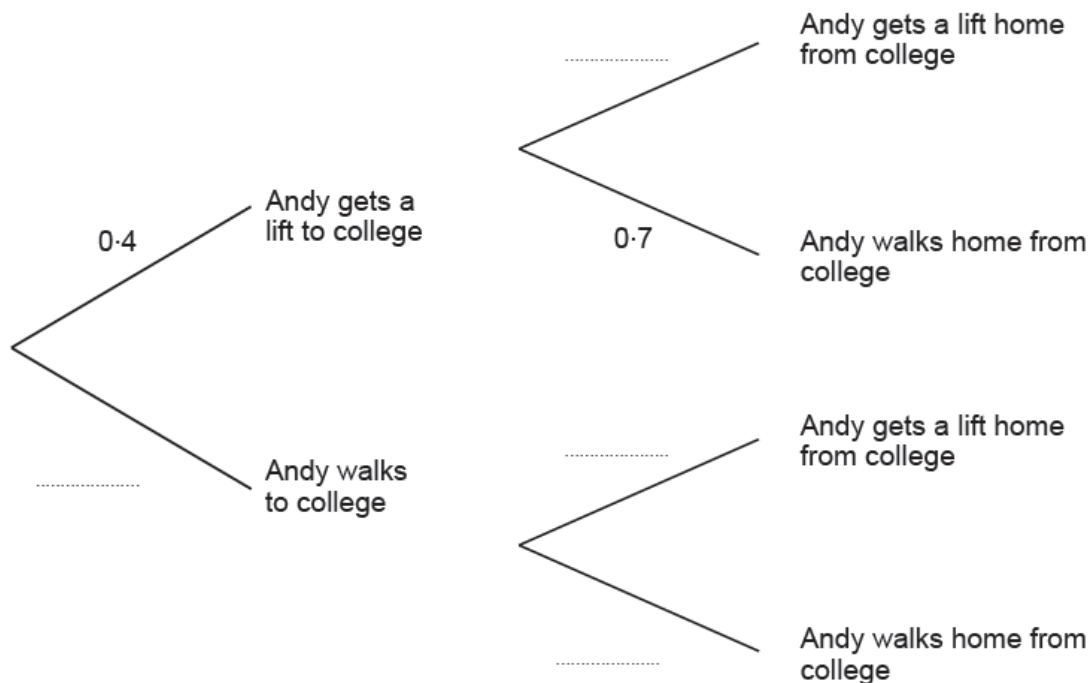
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4. Andy sometimes gets a lift to and from college.
 When he does not get a lift he walks.
 The probability that he gets a lift to college is 0.4.
 The probability that he walks home from college is 0.7.
 Getting to college and getting home from college are independent events.

(a) Complete the following tree diagram. [2]



(b) Calculate the probability that Andy gets a lift to college and walks home from college [2]

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(c) Calculate the probability that Andy **does not** get a lift to or from college. [2]

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5. Write 3600 as a product of prime factors using index notation. [3]

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6. Alex bought 3 tins of paint and 4 brushes at a total cost of £23.
Brian bought 2 tins of paint and 3 brushes at a total cost of £16.

Using an algebraic method, calculate the price of a single tin of paint and the price of one brush. [4]

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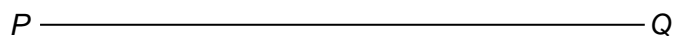
The price of a single tin of paint =

The price of one brush =

7. Using ruler and compass construction, shade the region that satisfies both of the following conditions.

- (i) The points are less than 5 cm from P
- (ii) The points are nearer to Q than to P

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8. Two brothers, Richard and Andrew, share a sum of money in the ratio 2 : 7.
Andrew gets £30 more than Richard.
Calculate how much the brothers share. [4]

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9. Factorise the following expressions.

(a) $6x^2 + 8x$ [2]

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(b) $x^2 - 100$ [1]

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10. Peter decides to cover the floor of a room with a striped carpet. A shop sells this striped carpet from a roll that is 3 m wide at a price of £25 per metre length.

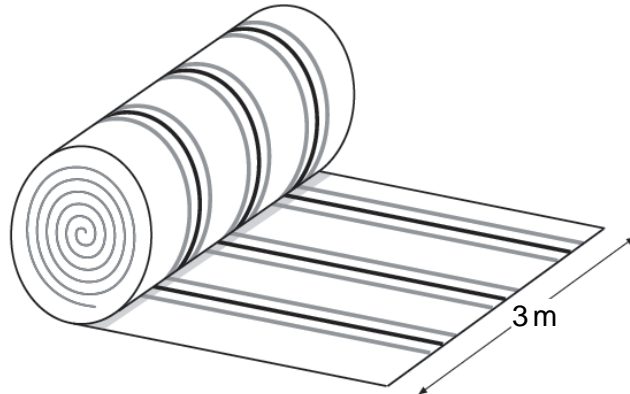


Diagram not drawn to scale

His floor is rectangular in shape with length 13 m and width 8 m.



Diagram not drawn to scale

The carpet is laid to ensure that the stripes on the carpet are parallel to two of the sides of the room and lie in one direction only.

Find the cost of the cheapest way of covering the floor, and state by how much it is cheaper.

Show all your working.

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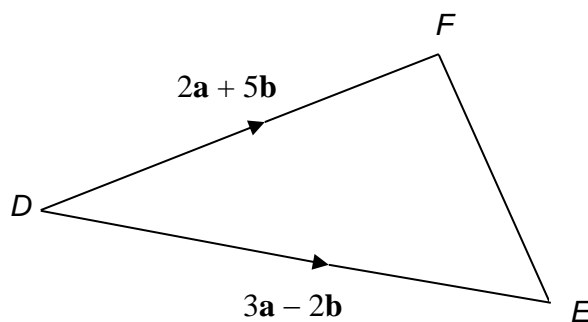
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11. Vectors **DF** and **DE** are shown in the diagram below.



Line PQ is 3 times the length of line EF .
 PQ is in the opposite direction to EF .

Find PQ in the form $m\mathbf{a} + n\mathbf{b}$.

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12. A building company used 24 workers to prepare a building site.
The site measured 30 acres and the work was completed in 10 days.

(a) The company is asked to prepare another site measuring 45 acres.
This work has to be completed in 15 days.
Calculate the least number of workers the company should employ
for this work.

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(b) State one assumption you have made in your answer to part (a).
How would your answer to part (a) change if you did not make this
assumption?

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13. The line L_1 is shown in the diagram below.
The line L_2 , which is not shown, is perpendicular to L_1 .

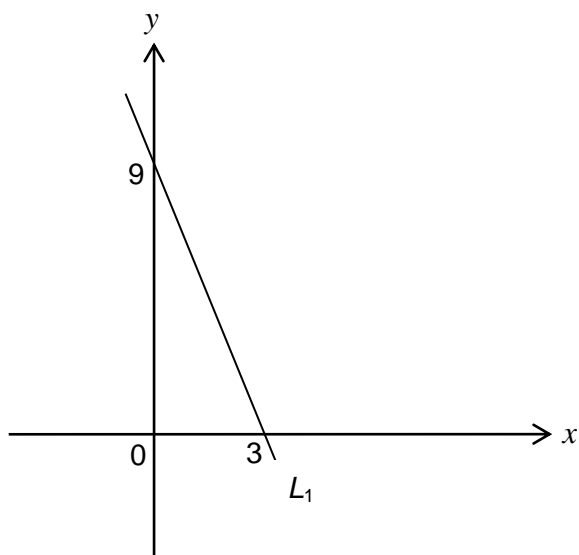


Diagram not drawn to scale

- (a) (i) Find the gradient of L_1 . [2]

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- (ii) Write down the gradient of L_2 . [1]

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- (b) The two straight lines L_1 and L_2 intersect at the point $(1, 6)$.
Find the equation of L_2 and write it in the form $ax + by + c = 0$. [4]

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- 14.** On a journey from Dover to Sheffield, Liam drove at an average speed of 40 mph for the first three hours of his journey.

The remaining 120 miles of his journey were completed at an average speed of 30 mph.

Liam told his friend that he had completed the whole journey at an average speed of 35 mph.

Check to see if Liam is correct.

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15. Triangle ABC is isosceles with $AB = AC$.

The line BP bisects $\hat{A}BC$.

The line CQ bisects $\hat{A}CB$.

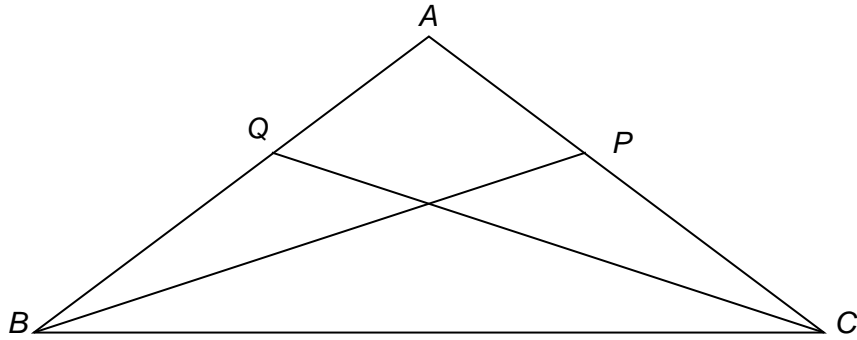


Diagram not drawn to scale

Prove that triangle BCP and triangle CBQ are congruent.
You must give reasons to support your statements.

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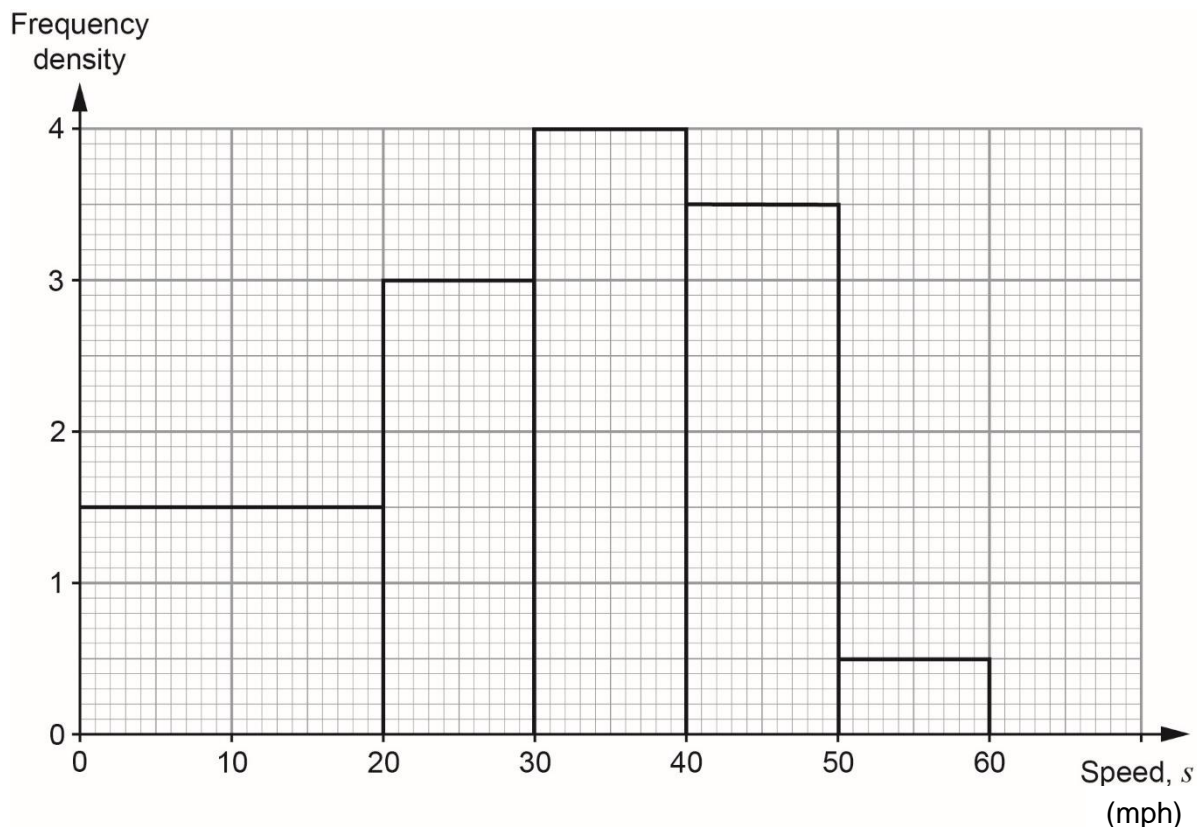
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16. A survey was carried out to record the speeds of cars entering a village. The histogram illustrates the results of the survey.



- (a) Use the histogram to complete the grouped frequency table below. [2]

Speed, s (mph)	$0 < s \leq 20$	$20 < s \leq 30$	$30 < s \leq 40$	$40 < s \leq 50$	$50 < s \leq 60$
Frequency					

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- (b) 40% of the cars surveyed were fined for exceeding a certain speed as they entered the village. Calculate an estimate of this speed. [4]

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- (c) A further survey was carried out after the placement of a speed camera warning sign.

The results are summarised in the grouped frequency distribution below.

Speed, s (mph)	$0 < s \leq 20$	$20 < s \leq 30$	$30 < s \leq 40$	$40 < s \leq 50$	$50 < s \leq 60$
Frequency	60	40	20	15	5

Draw a histogram to illustrate the results of this survey. [3]

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- (d) Compare the two histograms. Do you consider the speed camera warning sign to have been effective?

Give a reason for your answer. [1]

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17. y is inversely proportional to x .

$$y = 16 \text{ when } x = \frac{1}{2}.$$

Write an expression for y in terms of x .

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18. Simplify $\frac{3\sqrt{7}}{4 + \sqrt{7}}$ [4]

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19. Express $x^2 + 12x + 14$ in the form $(x+a)^2 + b$, where a and b are whole numbers to be found. [2]

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20. (a) Express $0.\dot{7}8$ as a fraction. [2]

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- (b) Evaluate $3^{-2} \times 9^{\frac{1}{2}}$, giving your answer as a recurring decimal. [3]

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21. The diagram below shows a composite shape formed by joining two rectangles.

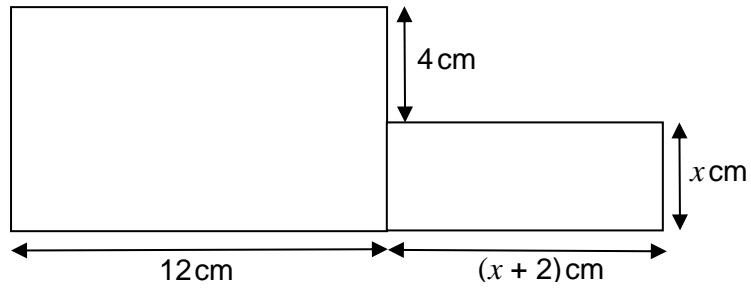


Diagram not drawn to scale

The area of the larger rectangle is 4 times the area of the smaller rectangle.

Calculate the dimensions of the smaller rectangle.
You must justify any decisions that you make.

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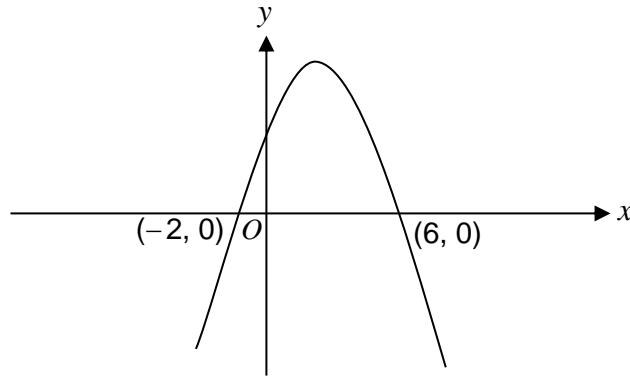
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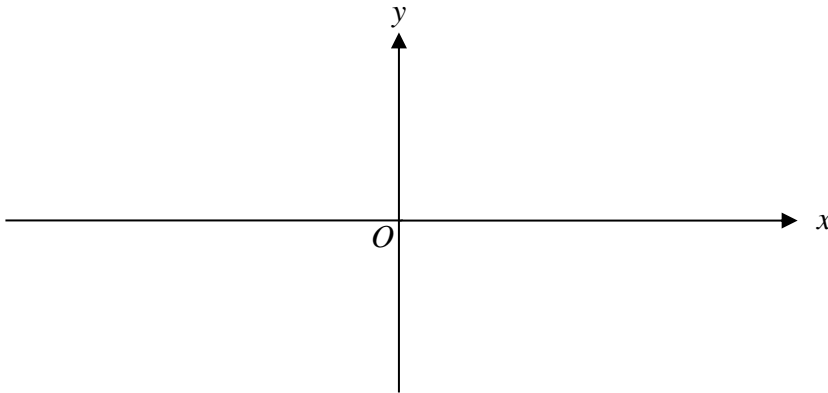
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22. (a) The diagram shows a sketch of the graph $y = f(x)$.
The graph passes through the points $(-2, 0)$ and $(6, 0)$.

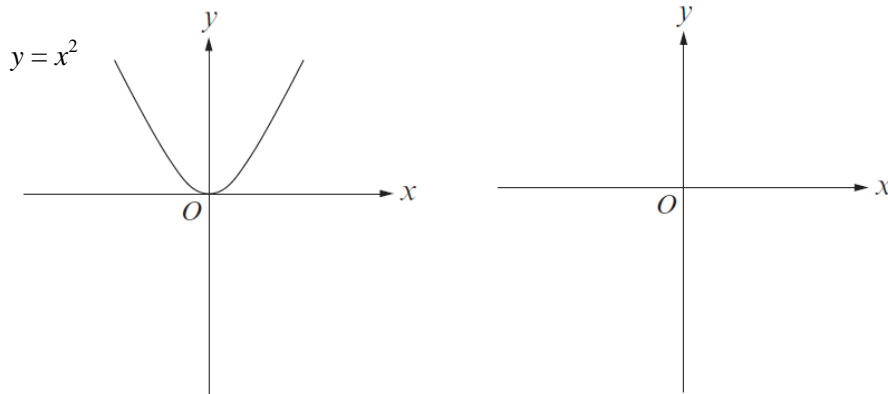


Sketch the graph of $y = f(x + 5)$ on the axes below.
You must indicate the coordinates of the points of intersection of the graph with the x -axis. [3]

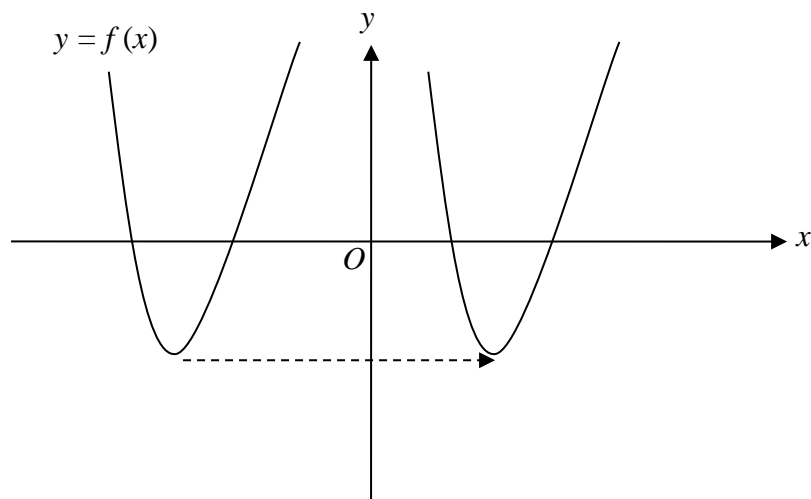


- (b) The diagram below on the left shows a sketch of the graph $y = x^2$.

Sketch the graph of $y = -x^2 + 3$ on the axes on the right.
You must indicate the coordinates of the stationary point. [2]



- (c) The function $f(x)$ has been translated, as shown in the diagram below. Explain why you cannot say exactly what translation was used. [1]



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23. (a) When Kayla shoots an arrow, the probability that she hits the target is 0.3. Each attempt is independent of any previous shot.

(i) What is the probability that she hits the target for the first time on her third attempt? [2]

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(ii) Check whether or not there is more than a 50% chance of Kayla hitting the target **once only** on her **first three** attempts. [3]

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(b) (i) A fairground game consists of removing two balls at random from a box containing 15 blue balls and 5 red balls.

A player wins the game if two red balls are removed.

John calculates that the probability of winning the game is

$$\left(\frac{1}{4}\right)^2 = \frac{1}{16}.$$

What assumption has John made for his answer to be correct? [1]

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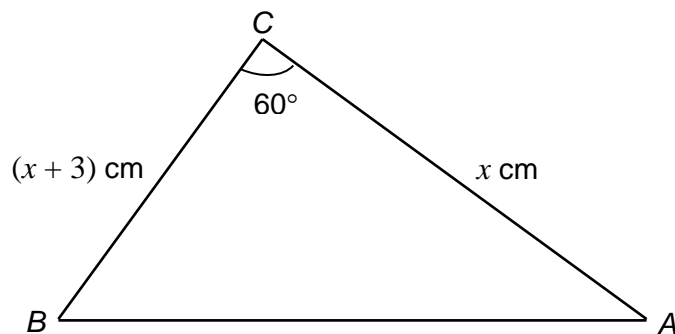
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(ii) If John's assumption was not true, what effect would this have on the probability of winning the game? [1]

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The area of the triangle is $\sqrt{300}$ cm².

Calculate the length of AB.

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