

Thursday 26 May 2016 – 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 **20** pages. Any blank pages are indicated.

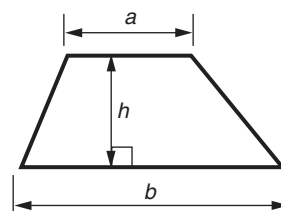
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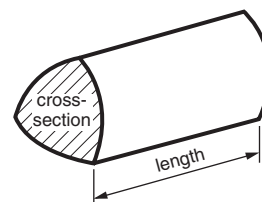
No calculator can be
used for this paper

Formulae Sheet: Higher Tier

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



Volume of prism $= (\text{area of cross-section}) \times \text{length}$

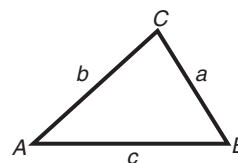


In any triangle ABC

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

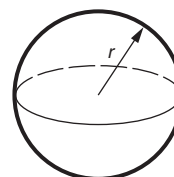
Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

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



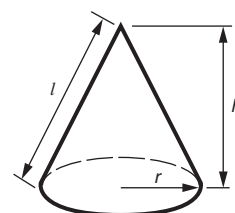
Volume of sphere $= \frac{4}{3} \pi r^3$

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

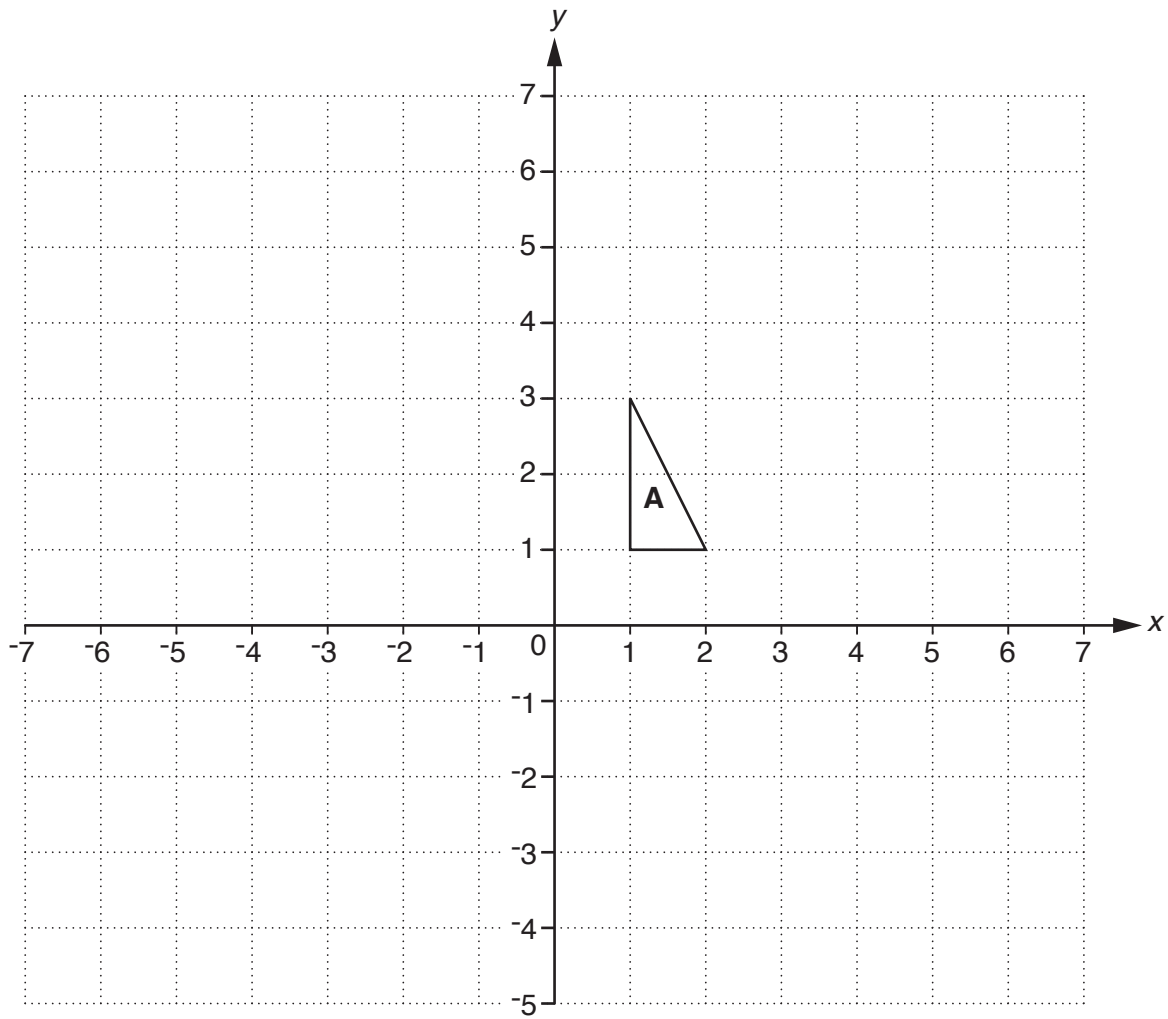
The solutions of $ax^2 + bx + c = 0$,
where $a \neq 0$, are given by

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

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

- 1 Here is a coordinate grid.



- (a) Reflect triangle **A** in the x-axis.
Label the image **B**.

[1]

- (b) Translate triangle **A** by $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$.

Label the image **C**.

[2]

- 2 (a) The table summarises information about the visitors to a library on one day.

	Under 18	18 to 60	Over 60	Total
Male	38	12		100
Female	56		45	150
Total			95	250

- (i) Complete the table. [2]

- (ii) Find the ratio of male to female visitors.
Write the ratio in its simplest form.

(a)(ii) : [2]

- (iii) What fraction of the total number of visitors were females aged over 60?
Write the fraction in its simplest form.

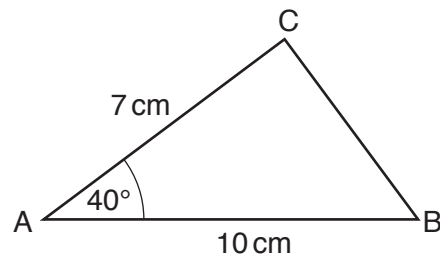
(iii) [2]

- (b) The library holds an event.
Tickets for the event cost £7.95 each.
There are 87 tickets sold for the event.

Estimate the total amount of money received from ticket sales.
Show clearly the approximations you use.

(b) £ [2]

- 3 This is a sketch of triangle ABC.



Not to scale

- (a) Draw accurately triangle ABC below.
AB is drawn for you.



[2]

- (b) On your triangle, construct the perpendicular from point C to line AB.
Leave in all your construction lines.

[2]

- (c) Work out the area of triangle ABC.
Show the measurements from your diagram that you use.

(c) cm² [2]

- 4* George takes two friends out for a meal.
George has two vouchers that he can use to save money on the price of the meal.

Voucher A
20% off the food bill

Voucher B
15% off the food and drink bill

He can only use **one** of these vouchers.

George decides which voucher to use at the end of the meal when he sees the bill.

He wants to pay as little as possible.

This is what they had and the cost of one serving of each item.

Food		Drinks	
1 Fish and chips	£12.45	2 Lemonades	£2.45 each
1 Pizza	£11.50	1 Cola	£2.60
1 Burger and chips	£12.45		
3 Ice creams	£3.70 each		

Which voucher should George use and how much does he pay for the meal?

- 5 (a) Multiply out and simplify.

$$3(p + 5) + 2(p - 3)$$

(a) [2]

- (b) Solve this inequality.

$$3x < x + 8$$

(b) [2]

- (c) Rearrange this formula to make r the subject.

$$t = \frac{r - 6}{5}$$

(c) [2]

- 6 (a) Work out the size of the exterior angle of a regular 9-sided polygon.

(a)° [2]

- (b) Hence work out the size of the interior angle of a regular 9-sided polygon.

(b)° [1]

- 7 A bag contains 200 counters.
Each counter is either red or blue.

Roma takes a counter at random from the bag, records its colour and replaces it.
She repeats this 50 times.
Here are her results.

	Tally	Frequency
Red	/// /// /// /// /// /// //	32
Blue	/// /// /// ///	18

- (a) Use Roma's results to estimate the number of blue counters in the bag.

(a) [2]

- (b) Sam does the same experiment as Roma with the same bag of counters.
Here are his results.

	Tally	Frequency
Red	/// /// /// /// /// /	26
Blue	/// /// /// /// ////	24

Sam thinks he has done something wrong because his results are different from Roma's.

- (i) Explain why Sam may not have done anything wrong.

..... [1]

- (ii) Use **both** sets of results to estimate the number of counters of each colour in the bag.

(b)(ii) red counters

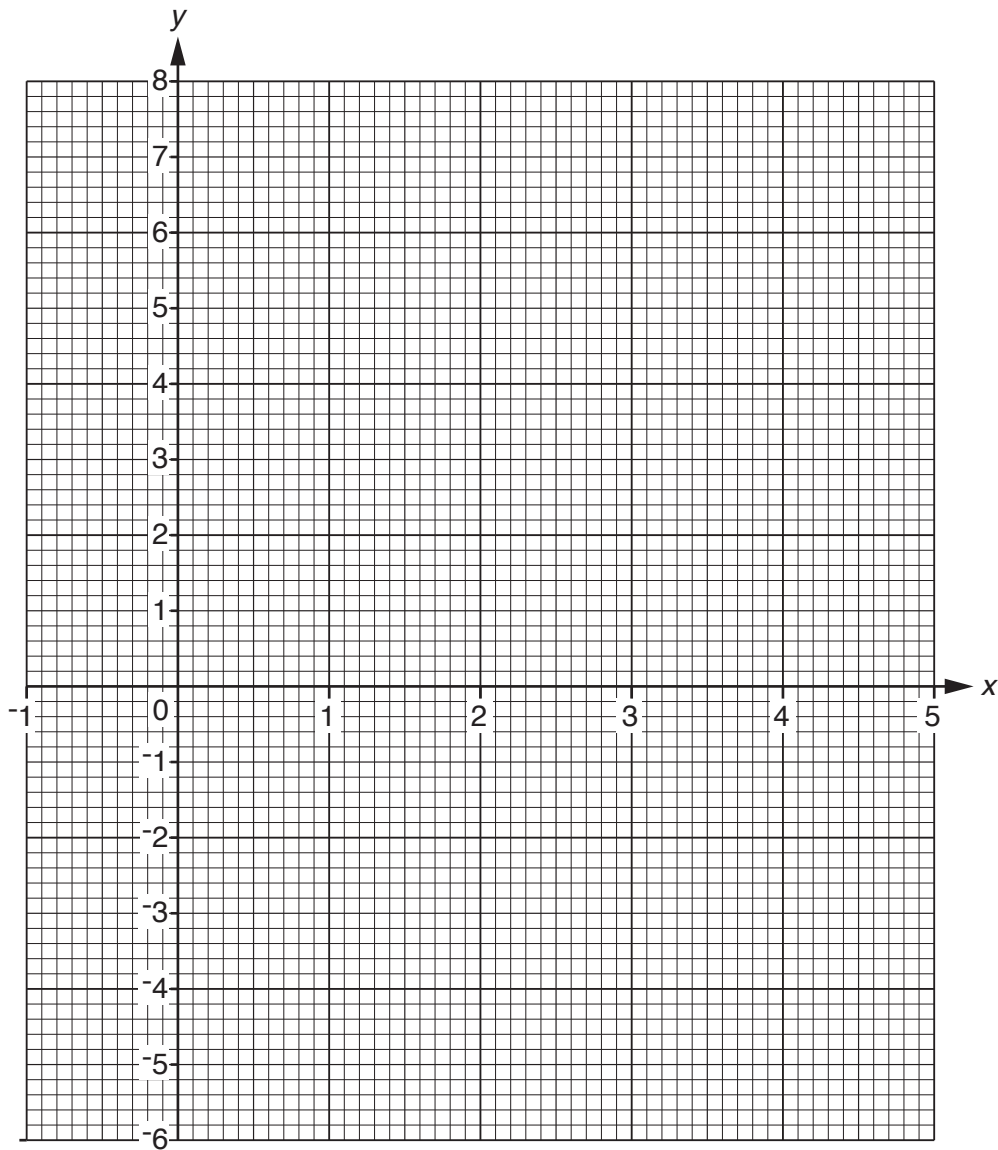
..... blue counters [2]

- 8 (a) Complete the table for $y = x^2 - 4x$.

x	-1	0	1	2	3	4	5
y		0	-3	-4	-3	0	

[2]

- (b) Draw the graph of $y = x^2 - 4x$ for values of x from -1 to 5.



[2]

- (c) Use your graph to solve the equation $x^2 - 4x = 3$.

(c) $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

9 Work out.

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

Give your answer as a mixed number in its simplest form.

..... [3]

10 Sue has three children, Alex, Dan and Eva. She gives them pocket money each week.

Dan gets twice as much pocket money as Alex.

Eva gets £5 more pocket money than Alex.

Sue gives a total of £35 each week.

Work out how much pocket money Alex gets each week.

£ [4]

- 11 The table shows the numbers of pupils at schools in England in 2012.

Type of school	Number of pupils
Primary schools	4.21×10^6
Secondary schools	3.21×10^6
Other schools	

- (a) How many **more** pupils were at primary schools than at secondary schools?

(a) [1]

- (b) The total number of pupils in England was 8 150 000.

How many pupils were at other schools?
Give your answer in standard form.

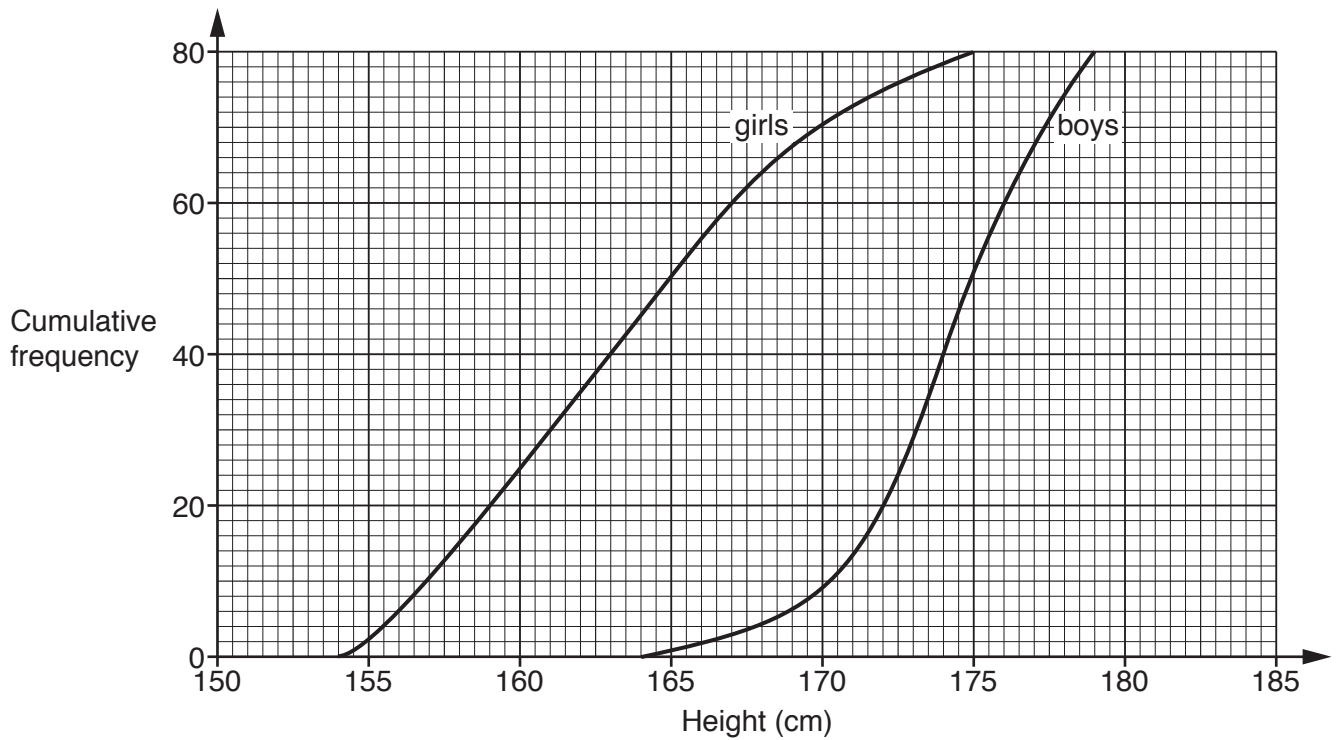
(b) [2]

- (c) There were 16 818 primary schools in England in 2012.

Work out an **estimate** of the mean number of pupils in each primary school.
Show clearly the rounded values you use.

(c) [2]

- 12** The cumulative frequency diagram shows the distribution of heights of a group of 80 Year 11 girls and 80 Year 11 boys.



(a) Use the diagram to find

(i) the median height of the girls,

(a)(i) cm [1]

(ii) the number of boys who are at least 175 cm tall.

(ii) [2]

- (b) Decide whether each statement below is true or false.
Use the cumulative frequency diagram to explain how you can tell.

Statement	True/False	Reason
More than one third of the boys are taller than the tallest girl.		
On average, the boys are taller than the girls.		
The boys' heights are more varied than the girls' heights.		

[3]

- 13 Radu and Narinder are running in a race, starting at the same place.

Radu runs at a steady speed of 3 metres per second.
Narinder runs at a steady speed of 4 metres per second.
Narinder starts 10 seconds after Radu.

How far have they travelled from the start when Narinder overtakes Radu?

..... m [4]

14 The line L has equation $2y + 3x = 1$.

(a) Find the gradient of line L .

(a) [2]

(b) Find the y -intercept of line L .

(b) [1]

(c) The line M has equation $4y + 7x = 5$.

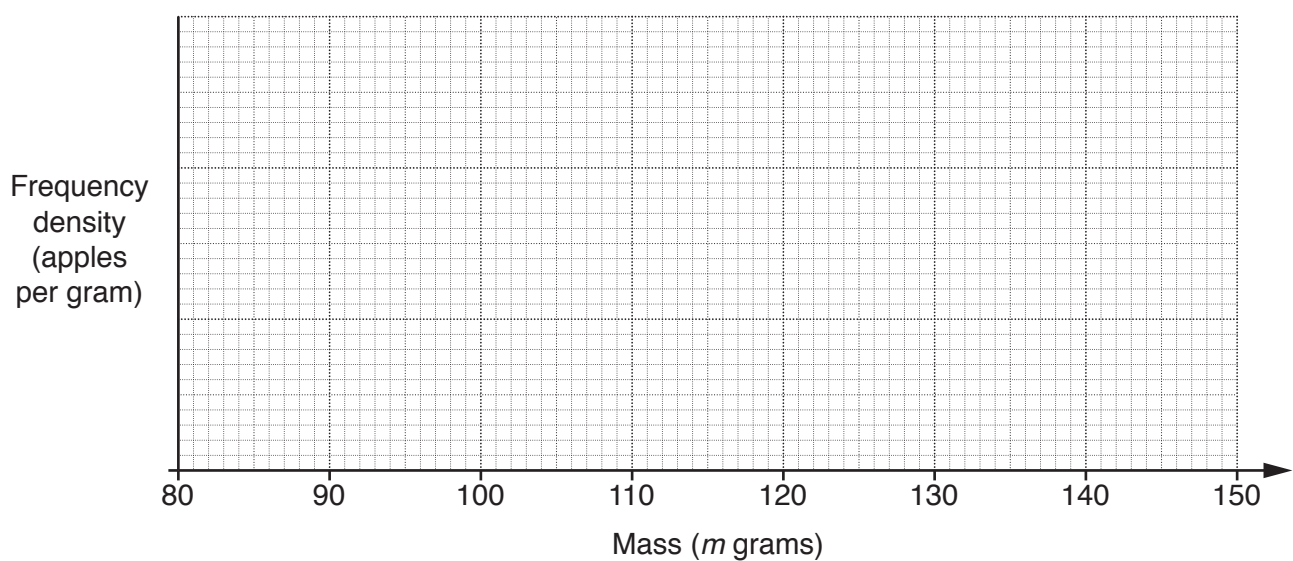
Find the coordinates of the point of intersection of lines L and M .

(c) (..... ,) [3]

- 15** Lola collects 60 apples from the trees in her garden.
The masses of the apples are summarised in the table.

Mass (m grams)	Frequency
$80 < m \leq 100$	8
$100 < m \leq 110$	15
$110 < m \leq 120$	21
$120 < m \leq 130$	10
$130 < m \leq 150$	6

- (a) (i)** Draw a histogram to represent this distribution.



[3]

- (ii)** Estimate the number of these apples with a mass under 115g.

(a)(ii) **[1]**

- (b)** Lola takes two of these apples at random.

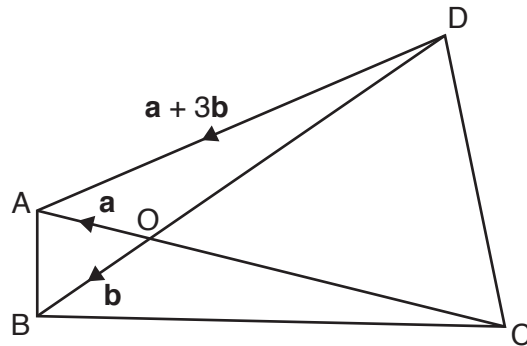
Find the probability that they both have a mass greater than 130g.

(b) **[3]**

16 ABCD is a quadrilateral.

O is the point on AC where $AO = \frac{1}{4}AC$.

$\vec{OA} = \mathbf{a}$, $\vec{OB} = \mathbf{b}$ and $\vec{DA} = \mathbf{a} + 3\mathbf{b}$.



Not to scale

(a) Find, as simply as possible, in terms of $\mathbf{a}$ and $\mathbf{b}$,

(i) $\vec{AB}$,

(a)(i) [1]

(ii) $\vec{BD}$.

(ii) [1]

(b) (i) Show that DC is parallel to AB.

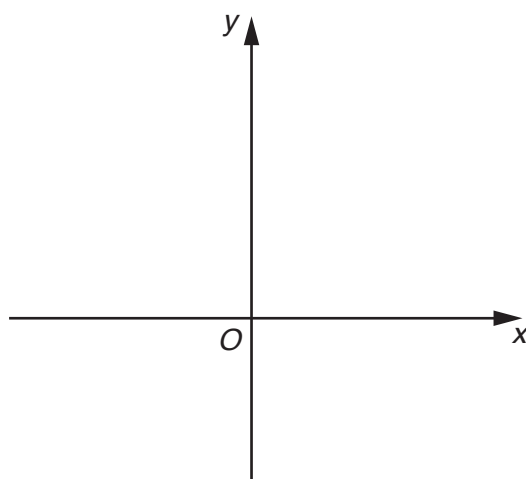
.....
 [2]

(ii) Hence prove that triangle OAB is similar to triangle OCD.

.....

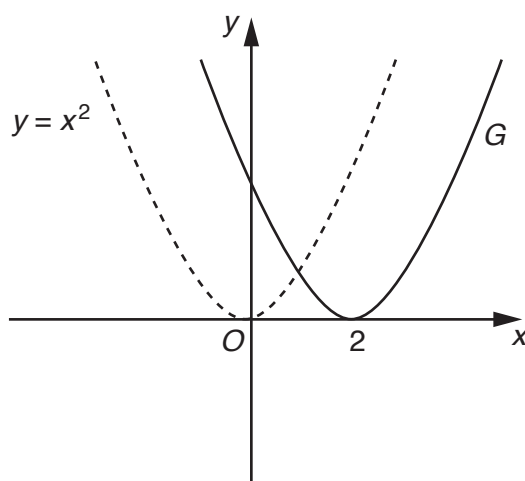
 [2]

- 17 (a) Sketch the graph of $y = 3^x$ on the axes below.



[1]

- (b) The axes below show the graph of $y = x^2$ and a translation of this graph, G .



Write down the equation of graph G .

(b) [1]

18 (a) Solve by factorising.

$$x^2 - 2x - 8 = 0$$

(a) $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

(b) Write as a single fraction in its simplest form.

$$\frac{5}{x-2} + \frac{4}{x+3}$$

(b) $\dots\dots\dots$ [3]

- 19 (a) Expand and simplify.

$$(4 + \sqrt{3})(1 + \sqrt{3})$$

(a) [2]

- (b) Find the value of k .

$$5^k \times 5^4 = 1$$

(b) $k =$ [1]

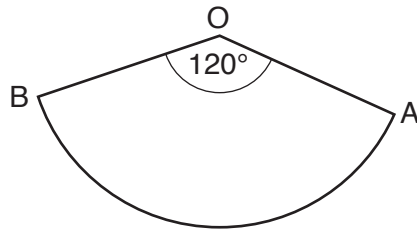
- (c) Find the value of p .

$$\sqrt[3]{2^p} = 4$$

(c) $p =$ [2]

TURN OVER FOR QUESTION 20

- 20 OAB is a sector of a circle, centre O.
Angle AOB = 120° .



Not to scale

The area of sector OAB is $3\pi \text{ cm}^2$.

Find, in terms of π , the length of the arc AB.

..... cm [4]

END OF QUESTION PAPER

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