Version 1.1

Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Secondary Education
June 2003

ASSESSMENT and QUALIFICATIONS ALLIANCE

MATHEMATICS (MODULAR) (SPECIFICATION B) 33005/H1
Module 5 Higher Tier
Paper 1 Non-Calculator

Wednesday 4 June 2003 1.30 pm to 2.45 pm

H

In addition to this paper you will require:
mathematical instruments.
You must **not** use a calculator.

For Examiner's Use	
Pages	**Mark**
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
TOTAL	
Examiner's Initials	

Time allowed: 1 hour 15 minutes

Instructions
- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this booklet.

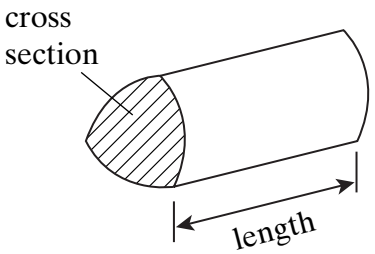
Information
- The maximum mark for this paper is 70.
- Mark allocations are shown in brackets.
- Additional answer paper, graph paper and tracing paper will be issued on request and must be tagged securely to this answer booklet.

Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

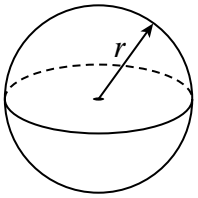
You may need to use the following formulae:

Volume of prism = area of cross section × length



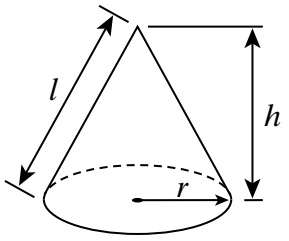
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



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

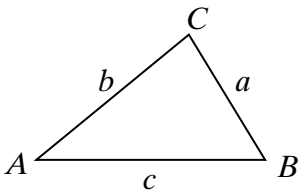
Curved surface area of cone = $\pi r l$



In any triangle ABC

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

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



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

The Quadratic Equation

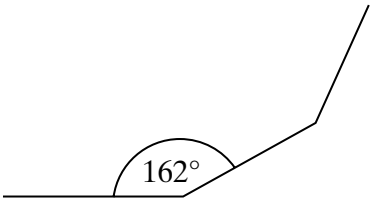
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

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

1 The diagram shows part of a regular polygon.

Each interior angle is 162°.



Not drawn accurately

Calculate the number of sides of the polygon.

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Answer ..... *(3 marks)*

2 Tom builds fencing from pieces of wood as shown below.

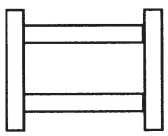

Diagram 1
4 pieces of wood

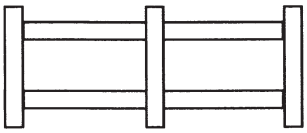

Diagram 2
7 pieces of wood

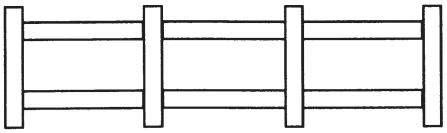

Diagram 3
10 pieces of wood

How many pieces of wood will be in Diagram *n*?

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Answer ..... *(2 marks)*

5

3 (a) Complete the table of values for $y = x^2 - 4x - 1$.

x	–1	0	1	2	3	4	5
y		–1	–4		–4	–1	4

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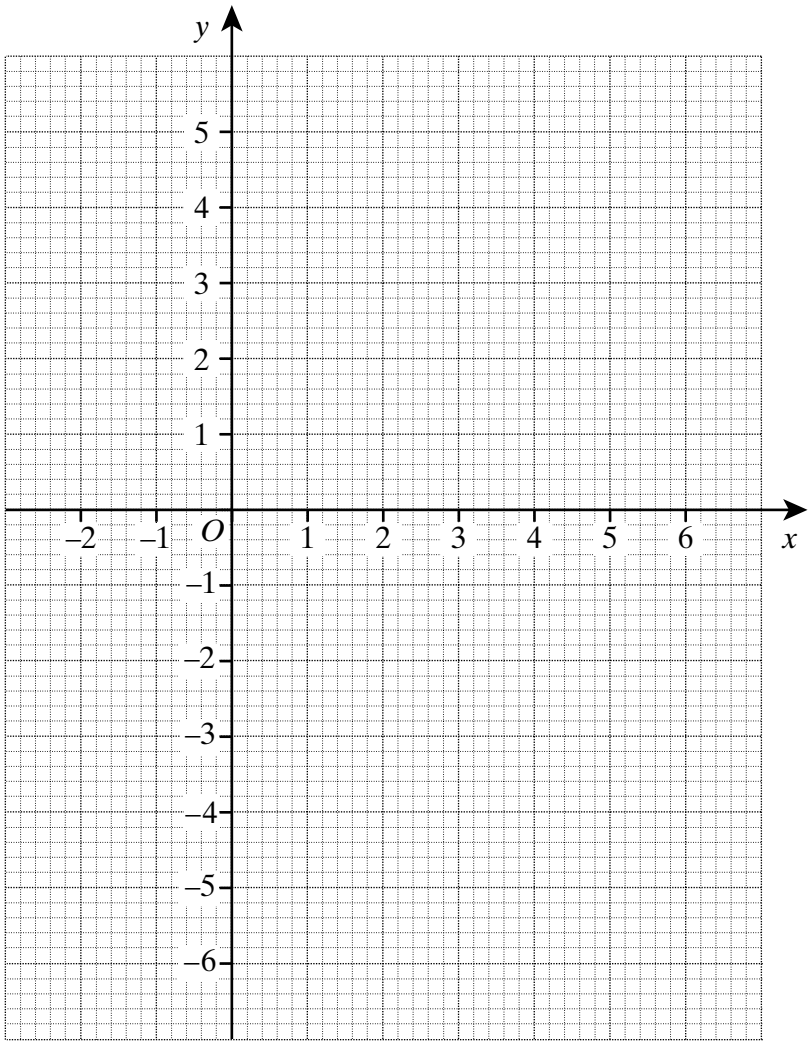
(2 marks)

(b) On the grid, draw the graph of $y = x^2 - 4x - 1$ for values of x from -1 to $+5$.



(2 marks)

(c) Use your graph to solve the equation $x^2 - 4x - 1 = 0$.

Answer ..... and ..... *(2 marks)*

4 Simplify

(a) $m^2 \times m^5$

.....

Answer ..... *(1 mark)*

(b) $p^6 \div p^3$

.....

Answer ..... *(1 mark)*

(c) $(q^4)^2$

.....

Answer ..... *(1 mark)*

5 Expand and simplify

(a) $5(2x + 1) - 3(x - 4)$

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.....

Answer ..... *(2 marks)*

(b) $(y - 4)(y - 2)$

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Answer ..... *(2 marks)*

(c) $(2t + 5)(2t - 5)$

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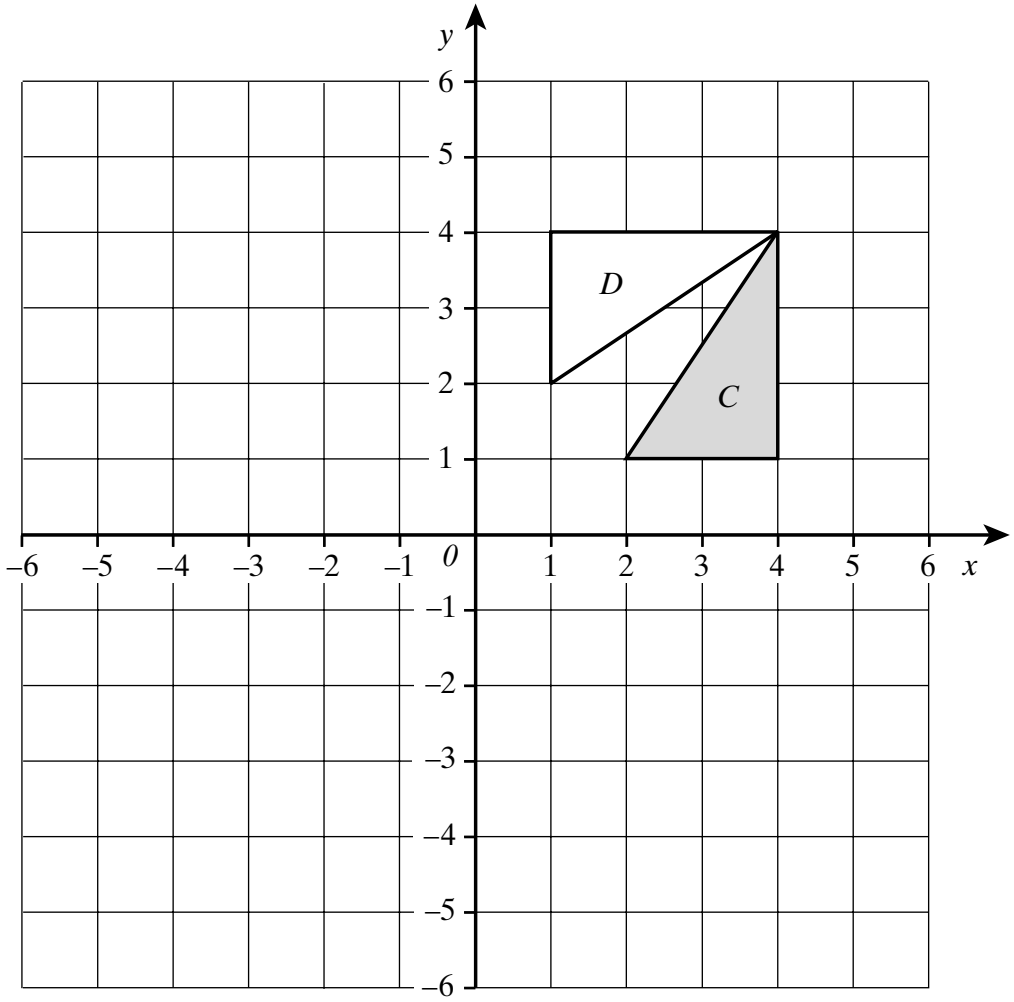
Answer ..... *(2 marks)*

6 The diagram shows two triangles, C and D.



(a) Describe fully the **single** transformation which maps triangle C to triangle D.

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(2 marks)

(b) Triangle C is translated by the vector $\begin{pmatrix} -4 \\ -3 \end{pmatrix}$ and then rotated 90° anti-clockwise about the point (0,–2).

Draw the final position of triangle C after these transformations.

(4 marks)

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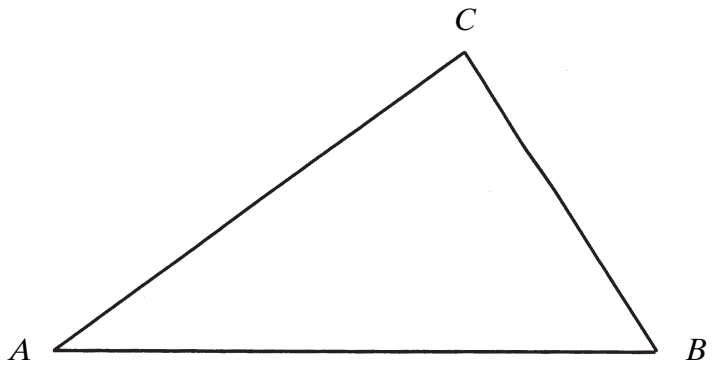
7 The diagram shows a triangle, ABC.



(a) Using a ruler and compasses only, construct the perpendicular bisector of AB.
You **must** show clearly all your construction arcs.

(2 marks)

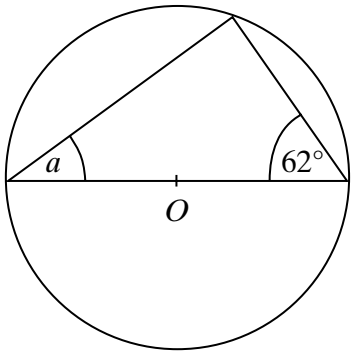
(b) (i) Repeat this construction on another side of the triangle. *(1 mark)*

(ii) The point of intersection of the two bisectors is the centre of the circle which passes through A, B and C.

Draw this circle. *(2 marks)*

11

8 (a) In the diagram, *O* is the centre of the circle.



Not drawn accurately

Calculate the value of *a*.

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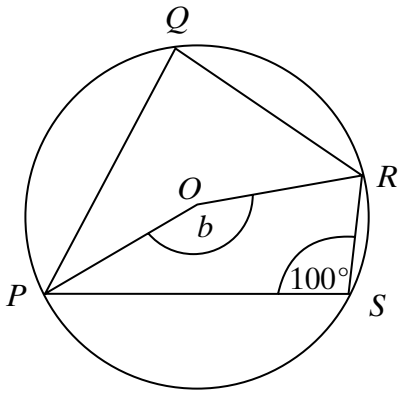
Answer ..... degrees *(2 marks)*

(b) In the diagram below, *O* is the centre of the circle and angle *PSR* = 100°.



Not drawn accurately

Calculate the value of *b*.

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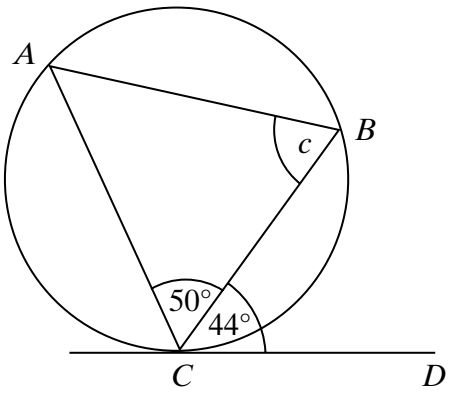
Answer ..... degrees *(2 marks)*

(c) *CD* is a tangent to the circle at *C*.



Not drawn accurately

Calculate the value of *c*.

Give reasons for your answer.

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Answer ..... degrees *(3 marks)*

9 (a) Make x the subject of $x^2 + k = 16$

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Answer $x =$ ..... *(2 marks)*

(b) Make P the subject of $A = P + \frac{PRT}{100}$

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Answer $P =$ ..... *(3 marks)*

Turn over ▶

10 (a) Factorise $2x^2 - 7x - 15$

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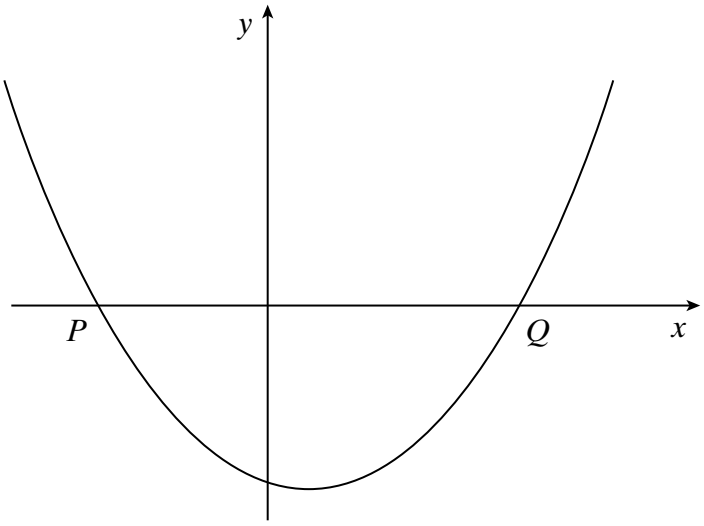
Answer ..... *(2 marks)*

(b) The graph of $y = 2x^2 - 7x - 15$ is sketched below.



Not to scale

Find the equation of the line of symmetry of this graph.

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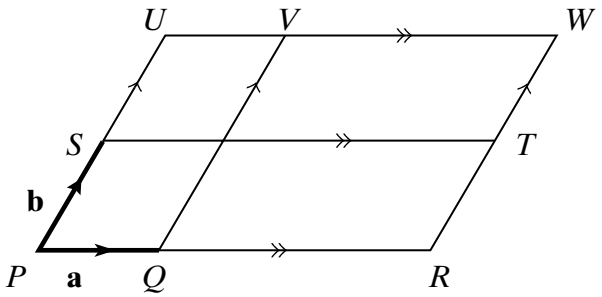
Answer ..... *(3 marks)*

11 The diagram shows two sets of parallel lines.

Vector $\overrightarrow{PQ}$ = **a** and vector $\overrightarrow{PS}$ = **b**

$\overrightarrow{PR} = 3\overrightarrow{PQ}$ and $\overrightarrow{PU} = 2\overrightarrow{PS}$



Not to scale

(a) Write the vector $\overrightarrow{PV}$ in terms of **a** and **b**

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Answer ..... *(1 mark)*

(b) Write the vector $\overrightarrow{RU}$ in terms of **a** and **b**

.....

Answer ..... *(1 mark)*

(c) Find **two** vectors that can be written as 3**a** – **b**

.....

Answer ..... and ..... *(2 marks)*

12 Solve the simultaneous equations.

$$y = x + 7$$

$$x^2 + y^2 = 25$$

You **must** show your working.

Do **not** use trial and improvement.

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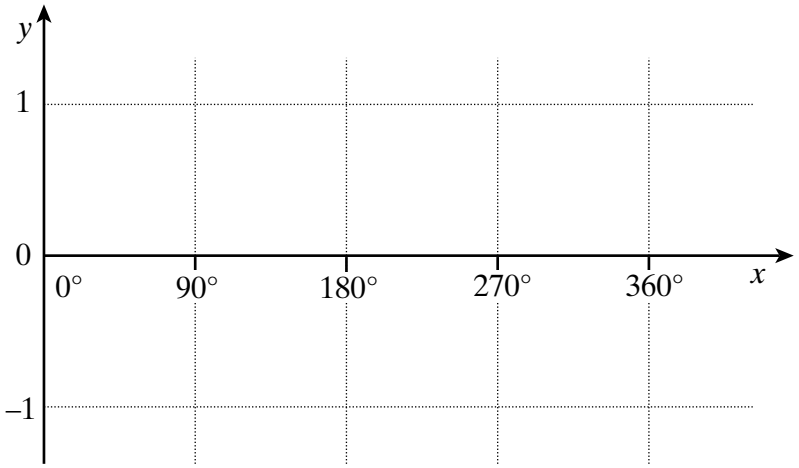
Answer ..... *(7 marks)*

13 (a) Sketch the graph of $y = \sin x$ for values of x from 0° to 360°.



(1 mark)

(b) One solution of the equation $\sin x = 0.92$ is $x = 67°$.

Use your sketch graph to find another solution of this equation.

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Answer ..... degrees *(2 marks)*

(c) Use your sketch graph to work out the value of sin 293°.

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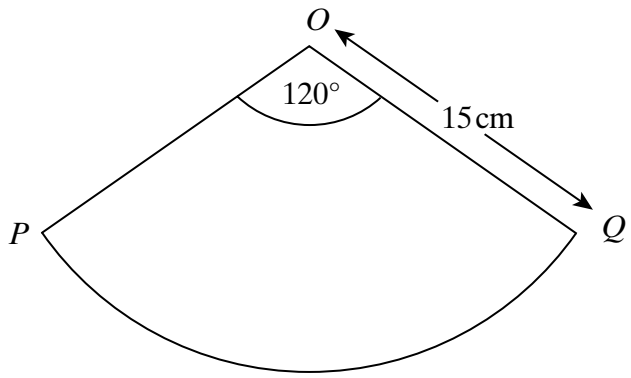
Answer ..... *(1 mark)*

TURN OVER FOR THE NEXT QUESTION

14 OQP is a sector of a circle of radius 15 cm.

The angle of the sector is 120°.



Not drawn accurately

(a) Show that the length of the arc PQ is 10π cm.

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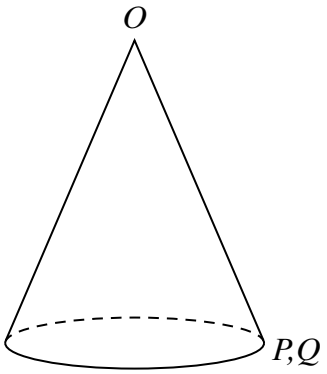
(2 marks)

The sector is folded to form a cone.



Not to scale

(b) Calculate the radius of the base of the cone.

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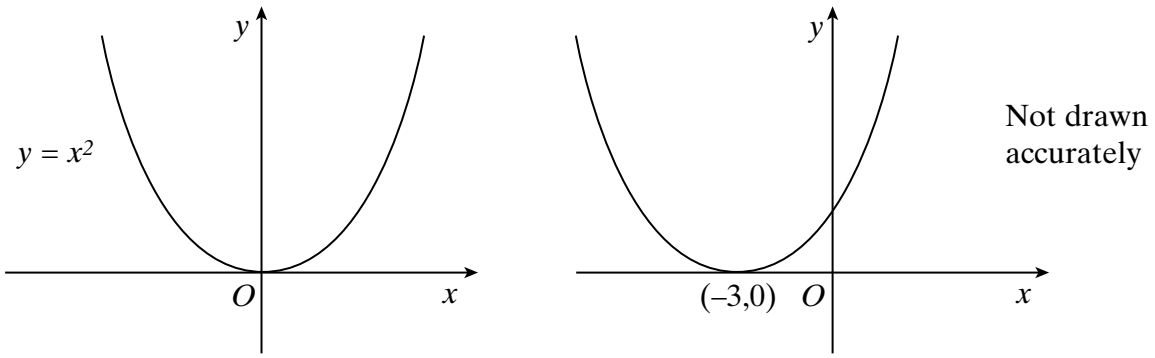
Answer ..... cm *(2 marks)*

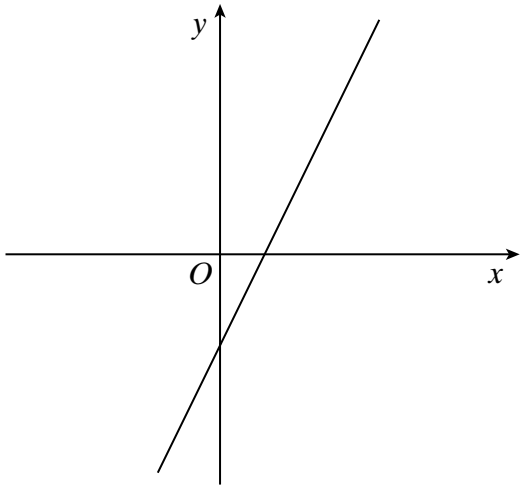
15 (a) The graph $y = x^2$ is transformed as shown.



Write down the equation of the transformed graph.

Answer $y =$ ..... *(1 mark)*

(b) The graph of $y = 3x - 2$ is sketched below.



On the same axes, sketch the graph of $y = 2 - 3x$

(2 marks)

END OF QUESTIONS