



RAFFLES INSTITUTION
MATHEMATICS DEPARTMENT
2023 YEAR 2 RP MATHEMATICS
TOPIC 6B: GRAPHS II (QUADRATIC GRAPHS)

S2Math37B Tutor

REVISION WORKSHEET

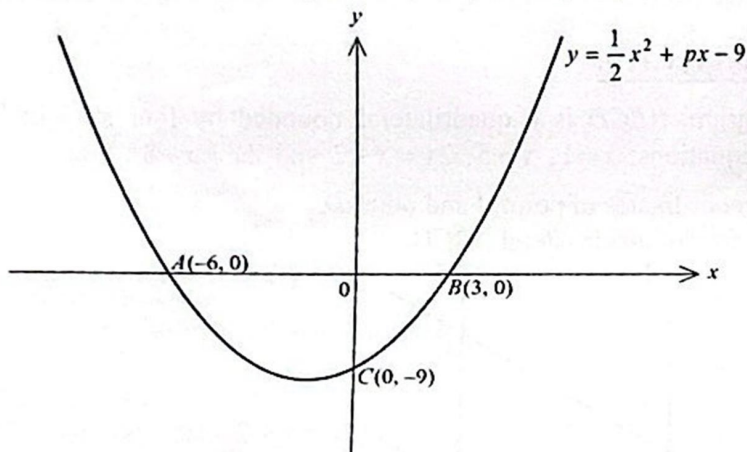
Name: _____

Class: Sec 2 () Date: _____

1 2020/Y2RP/EOY/Q15

The diagram shows the graph of $y = \frac{1}{2}x^2 + px - 9$, where p is a non-zero constant.

The parabola cuts the x -axis at points $A(-6, 0)$ and $B(3, 0)$ and the y -axis at $C(0, -9)$.



- (a) Find the value of p . [2]
- (b) Write down the equation of the line of symmetry of the parabola. [1]
- (c) Find the equation of the additional straight line that must be drawn on the graph in order to solve the equation $x^2 + 2x = 12$. [2]
- (d) Find the area of triangle ABC . [1]

[Ans: (a) $p = \frac{3}{2}$ (b) $x = -\frac{3}{2}$ (c) $y = \frac{1}{2}x - 3$ (d) $40\frac{1}{2} \text{ units}^2$]

2 2019/Y2RP/EOY/Q10

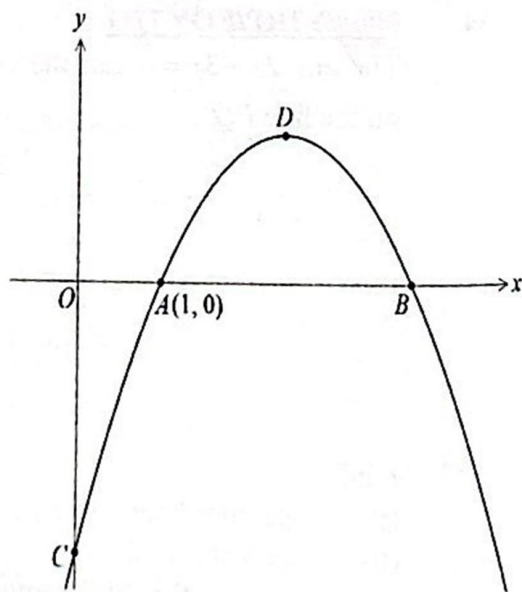
The diagram shows a quadratic curve $y = p + qx - x^2$. The curve cuts the x -axis at

A and B and the y -axis at C . A is the

point $(1, 0)$. The line $x = 2\frac{1}{2}$ passes

through the maximum point D .

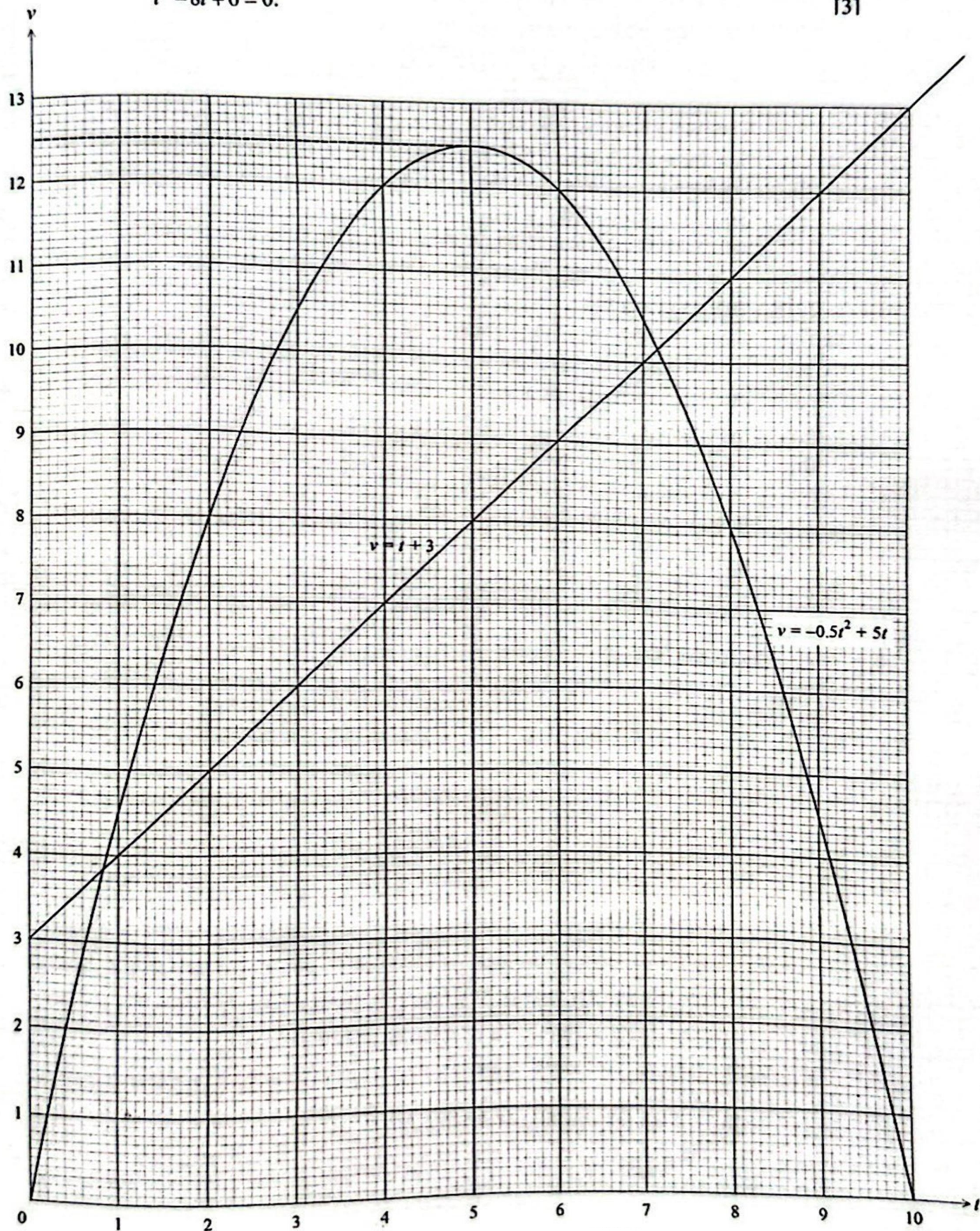
- (i) Find the values of p and q . [3]
- (ii) Find the equation of the straight line that must be drawn to solve the equation $2x^2 - 11x + 12 = 0$. [2]
- (iii) Insert the line found in (ii) on the same axes, indicating the x - and y -intercepts clearly. [1]



[Ans: (i) $p = -4$ $q = 5$ (ii) $y = -\frac{1}{2}x + 2$]

A toy car starts from a point A and moves along a straight line so that, t seconds after leaving point A , its velocity, v cm/s, can be modelled by $v = -0.5t^2 + 5t$. The diagram shows the graph of $v = -0.5t^2 + 5t$ for $0 \leq t \leq 10$.

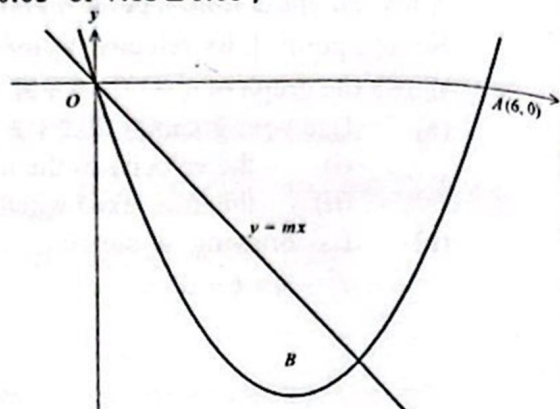
- (a) Use your graph to find
- the velocity of the toy car at point A , [1]
 - the time taken when the velocity of the toy car is a maximum. [1]
- (b) By drawing a suitable straight line graph on the same diagram, solve $t^2 - 8t + 6 = 0$. [3]



[Ans: (a)(i) 0 cm/s (ii) 5 seconds (b) 0.85 ± 0.05 or 7.15 ± 0.05]

4 **2018/Y2RP/MYCT/Q12**

The diagram shows a quadratic curve passing through the origin O and the point $A(6, 0)$.

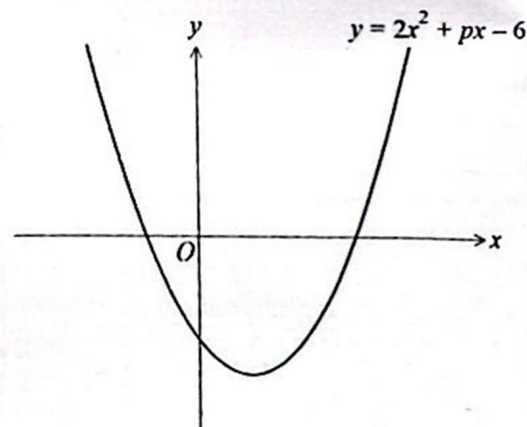


- Write down the equation of the line of symmetry of the curve. [1]
- The curve passes through another point $(1, -5)$, show that the equation of the curve is $y = x^2 - 6x$. [3]
- The line $y = mx$ intersects the curve at the origin O and the point B . Given that the x -coordinate of B is 4, find the value of m . [2]
- The line $y = mx$ intersects the curve at another point C . Given that $m < 0$, find the coordinates of the point C so that the area of the triangle OAC has a maximum value. Hence find the maximum area of the triangle OAC . [3]

[Ans: (a) $x = 3$ (c) -2 (d) $C(3, -9)$, 27 units²]

5 **2018/Y2RP/EOY/Q12**

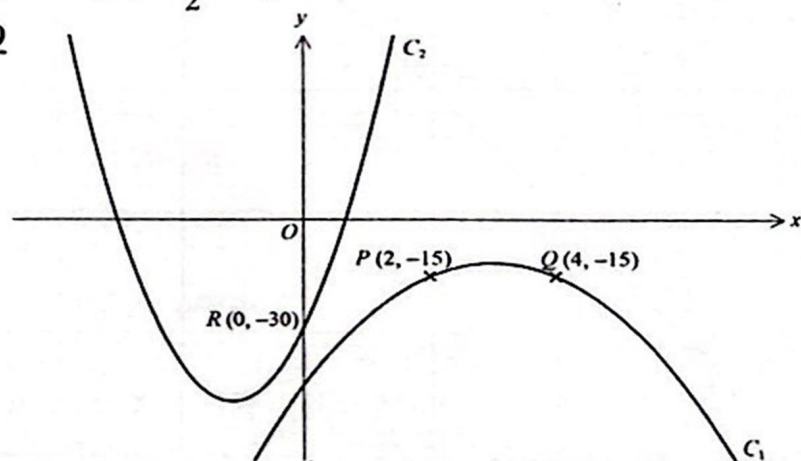
The diagram shows the graph of $y = 2x^2 + px - 6$, where p is a constant. The point $(-1, 0)$ lies on the graph. Find



- the value of p , [1]
- the minimum value of y , [3]
- the equation of the additional line that must be drawn on the graph to solve $x^2 - \frac{11}{4}x = \frac{11}{2}$. [2]

[Ans: (a) -4 (b) -8 (c) $y = \frac{3}{2}x + 5$]

6 **2017/Y2RP/MYCT/Q9**



The diagram shows part of the quadratic curves C_1 and C_2 . The curve C_1 passes through $P(2, -15)$ and $Q(4, -15)$. The curve C_2 passes through $R(0, -30)$.

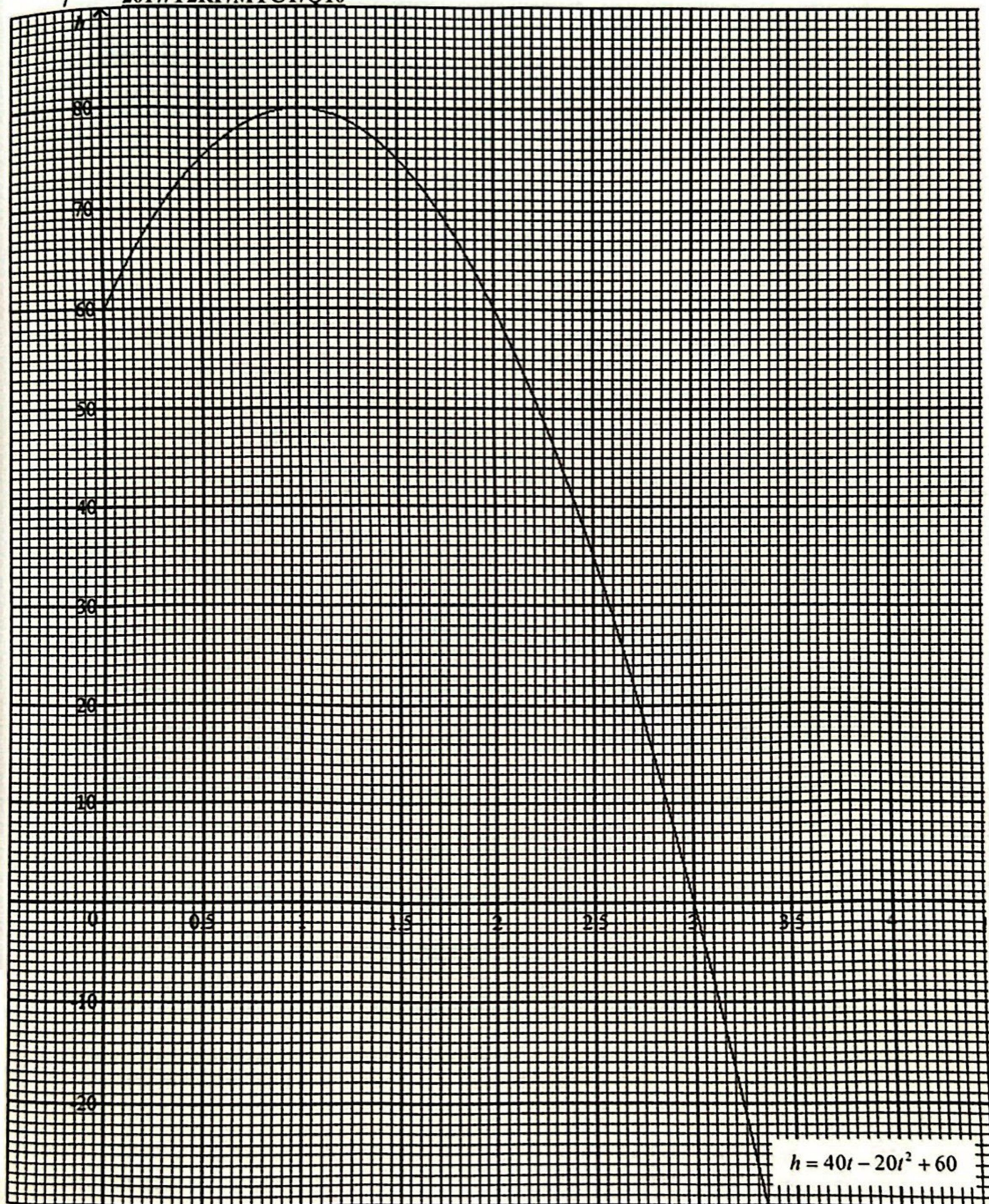
- State the equation of the line of symmetry for the curve C_1 . [1]
- State the equation of the line which is parallel to PQ and passing through R . [1]
 - Find the equation of the line RQ . [2]

- (c) Given that the x -intercepts of the curve C_2 are -3 and $\frac{2}{3}$, find the equation of the curve C_2 . [3]

[Ans: (a) $x = 3$ (b)(i) $y = -30$ (ii) $y = \frac{15}{4}x - 30$ (c) $y = 15x^2 + 35x - 30$]

7

2017/Y2RP/MYCT/Q10



A ball is tossed from the top of a cliff. The height, h metres, of the ball above sea level can be modelled by $h = 40t - 20t^2 + 60$, where t is the time in seconds after the ball is tossed.

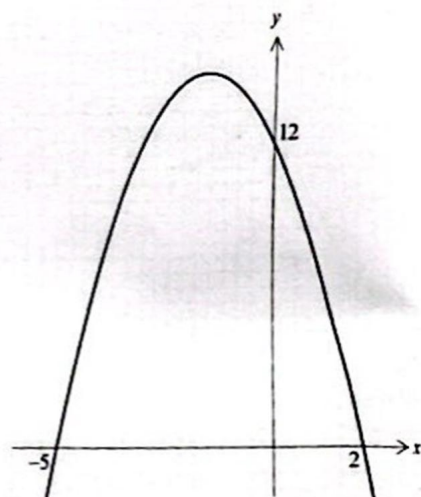
- (a) By using the graph provided on the next page, find
- the time taken by the ball when it next passes the top of the cliff, [1]
 - the vertical distance travelled by the ball when it is at sea level. [2]
- (b) By inserting an appropriate straight line to the given graph, solve $2t^2 - 3t - 5 = 0$. [3]
- (c) A point $(p, 35)$ lies on the graph. Explain the significance of the value of p . [1]

[Ans: (a)(i) 2s (ii) 100m (b) $t = 2.5$ (c) The ball is at a height of 35m above sea level after 2.5s]

8 2017/Y2RP/EOY/Q13

The diagram below shows the graph of $y = a(x-h)(x-k)$, where $k > h$. The graph cuts the x -axis at $x = -5$ and $x = 2$, and the y -axis at $y = 12$.

- (a) Write down the equation of the line of symmetry of the graph. [1]
- (b) State the value of h and show that the equation of the graph is $y = -\frac{6}{5}x^2 - \frac{18}{5}x + 12$. [4]
- (c) Find the equation of the additional line that must be drawn on the graph in order to solve $\frac{1}{4}x^2 = \frac{1}{2}x + 1$. [2]

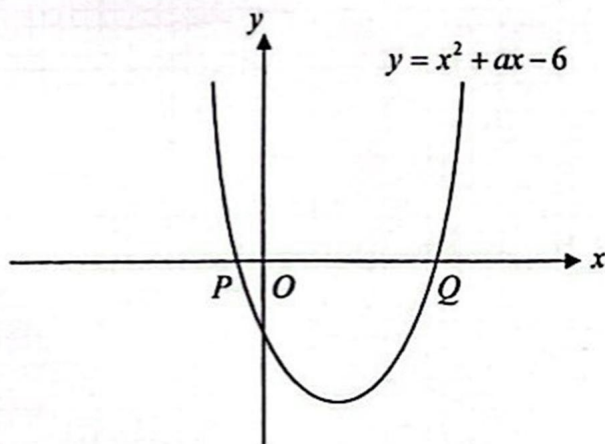


[Ans: (a) $x = -\frac{3}{2}$ (b) $h = -5$ (c) $y = -6x + 7\frac{1}{5}$]

9 2016/Y2RP/EOY/Q7

The diagram shows part of the graph of $y = x^2 + ax - 6$, where a is a constant. The graph cuts the x -axis at P and Q and passes through the point $(2, -12)$.

- (a) Find the value of a and the coordinates of P . [2]
- (b) Write down the equation of the line of symmetry and state the coordinates of the minimum point. [2]



[Ans: (a) $a = -5$, $P(-1, 0)$ (b) $x = 2.5$, $(2.5, -12.25)$]

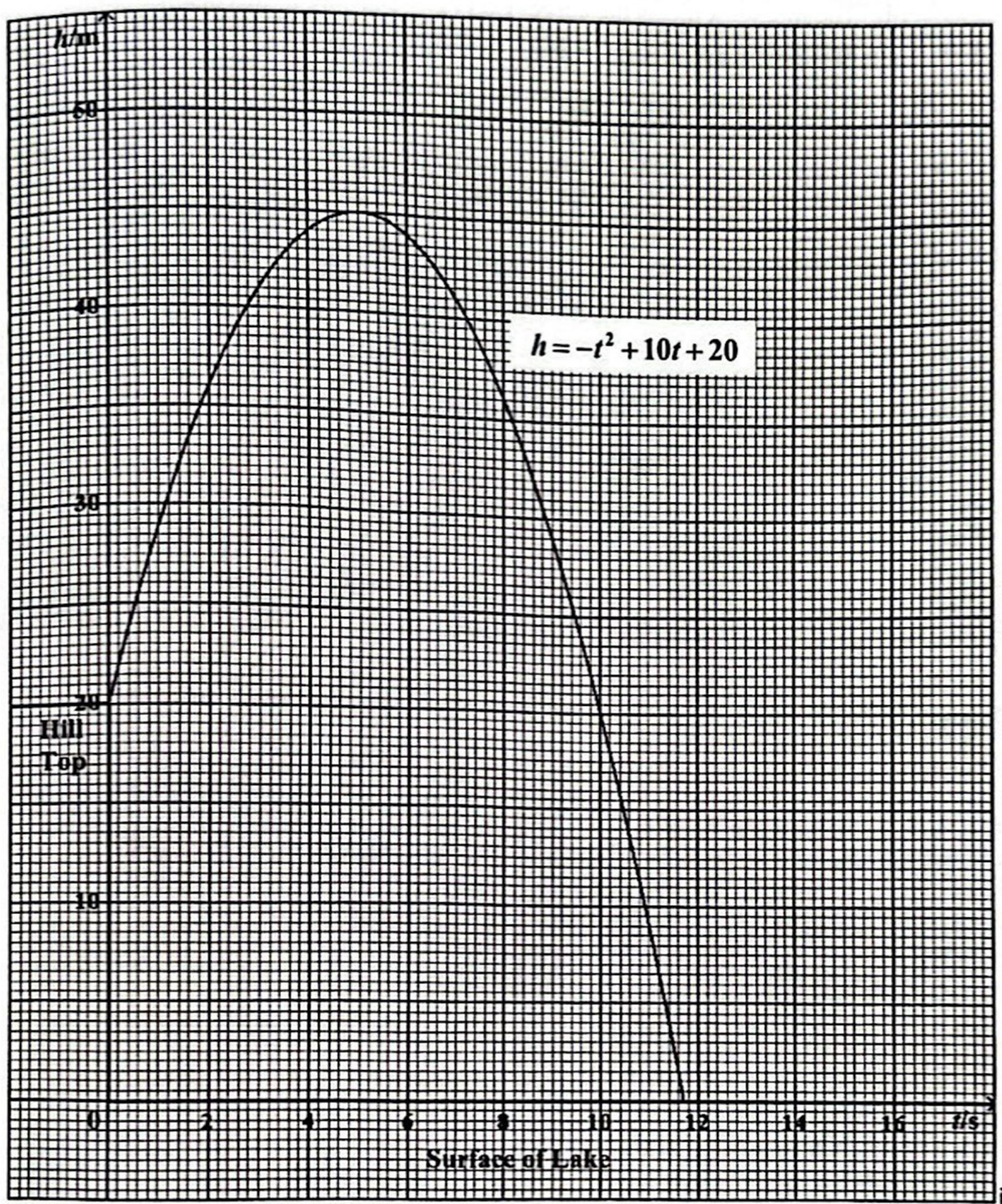
10 2016/Y2RP/EOY/Q9

A rocket is launched from a hill 20 metres above a lake. The rocket's height above the surface of the lake is given by $h = -t^2 + 10t + 20$ where h represents the height in metres and t represents the time of flight in seconds, as shown in the graph below.

- (a) From the graph, find
- the height of the rocket above the surface of the lake after 3 seconds, [1]
 - the time taken, in seconds, for the rocket to hit the surface of the lake after it is launched. [1]

- (b) Find the equation of the additional line that must be drawn on the graph in order to solve the equation $t^2 - 9t - 15 = 0$. [2]

[Ans: (a)(i) 41 m (ii) 11.7 s (b) $h = t + 5$]



11 **2015/Y2RP/EOY/Q18**

A piece of wire 36 m long is cut into two pieces. One piece is bent to form a rectangle of length $4x$ m and breadth $2x$ m. The other piece is bent to form a square.

- (a) Show that the combined area, y m², of the rectangle and the square, is given by $y = 17x^2 - 54x + 81$. [3]

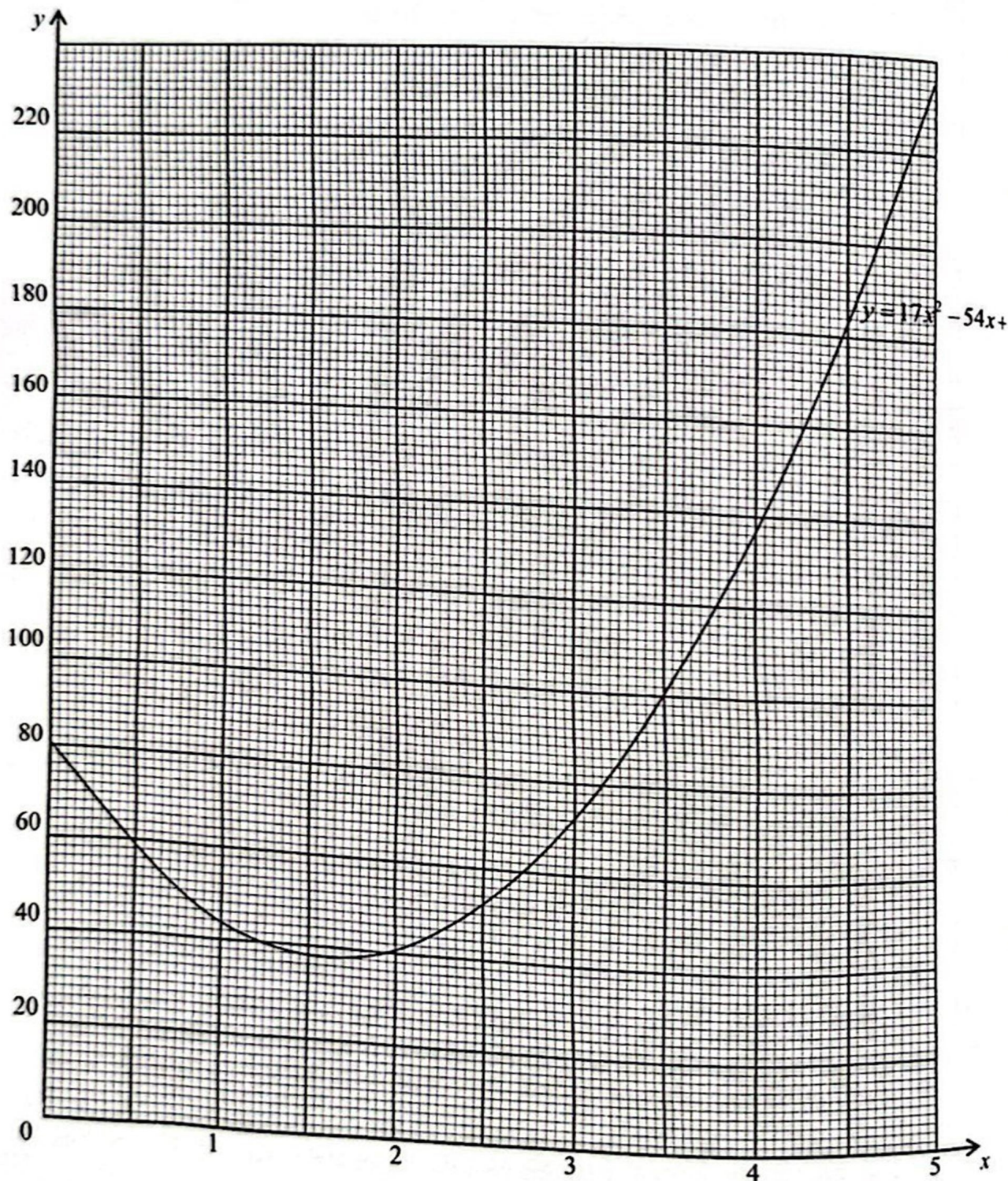
The diagram on the next page shows part of the graph of $y = 17x^2 - 54x + 81$ for $0 < x \leq 5$.

- (b) Use the graph to find
(i) the value of x for which the combined area is the minimum, [1]

- (ii) the value(s) of x for which $17x^2 - 84x + 61 = 0$. [3]
- (c) "For $x \geq a$, it is meaningless to read the values of y from the graph."
State the value of a and explain the statement. [2]
- (d) The line $y = k$ meets the curve $y = 17x^2 - 54x + 81$ at two distinct points.
State the range of values of k . [1]

[Ans: (b)(i) 1.55 to 1.65 (ii) $x = 0.85$ or 4.075 (c) $a = 3$ (d) $38 < k < 81$]

The diagram shows part of the graph of $y = 17x^2 - 54x + 81$ for $0 < x \leq 5$.

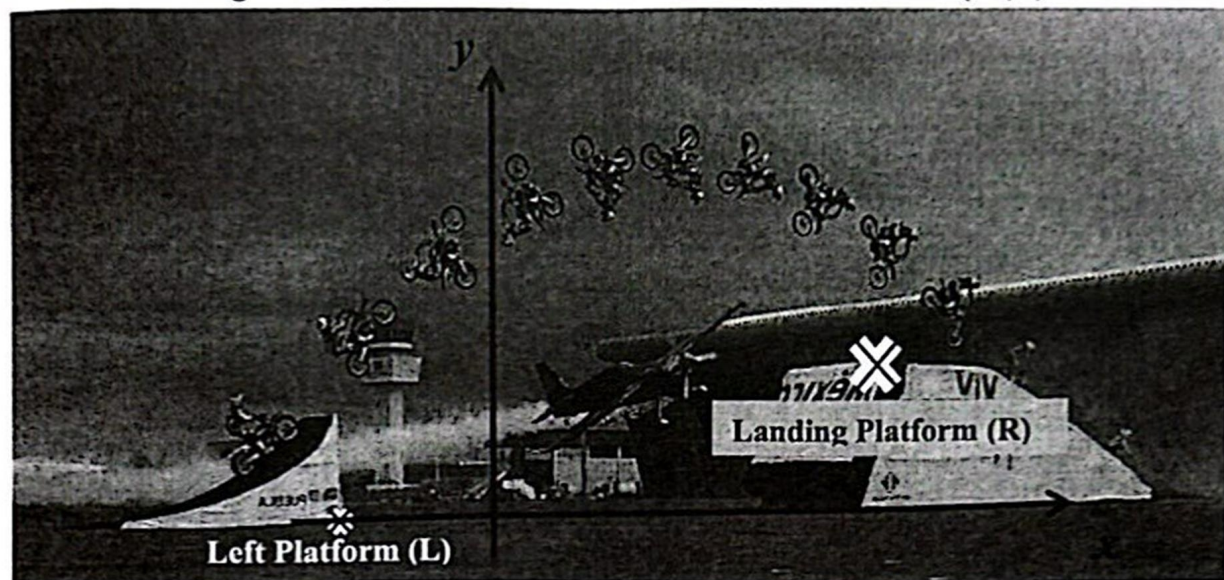


Daredevil is performing a motorcycle stunt where he drives himself off from one inclined platform on the left (L) to land safely on a platform on the right (R).

His motion in the air can be modelled by the following quadratic equation

$$y = -\frac{1}{2}x^2 + x + 6, \text{ where his vertical height from the ground is } y \text{ units and his}$$

horizontal position is x units. The left platform (L), which is marked with a cross on the diagram above, is situated on the x -axis with coordinates $(-2, 0)$.

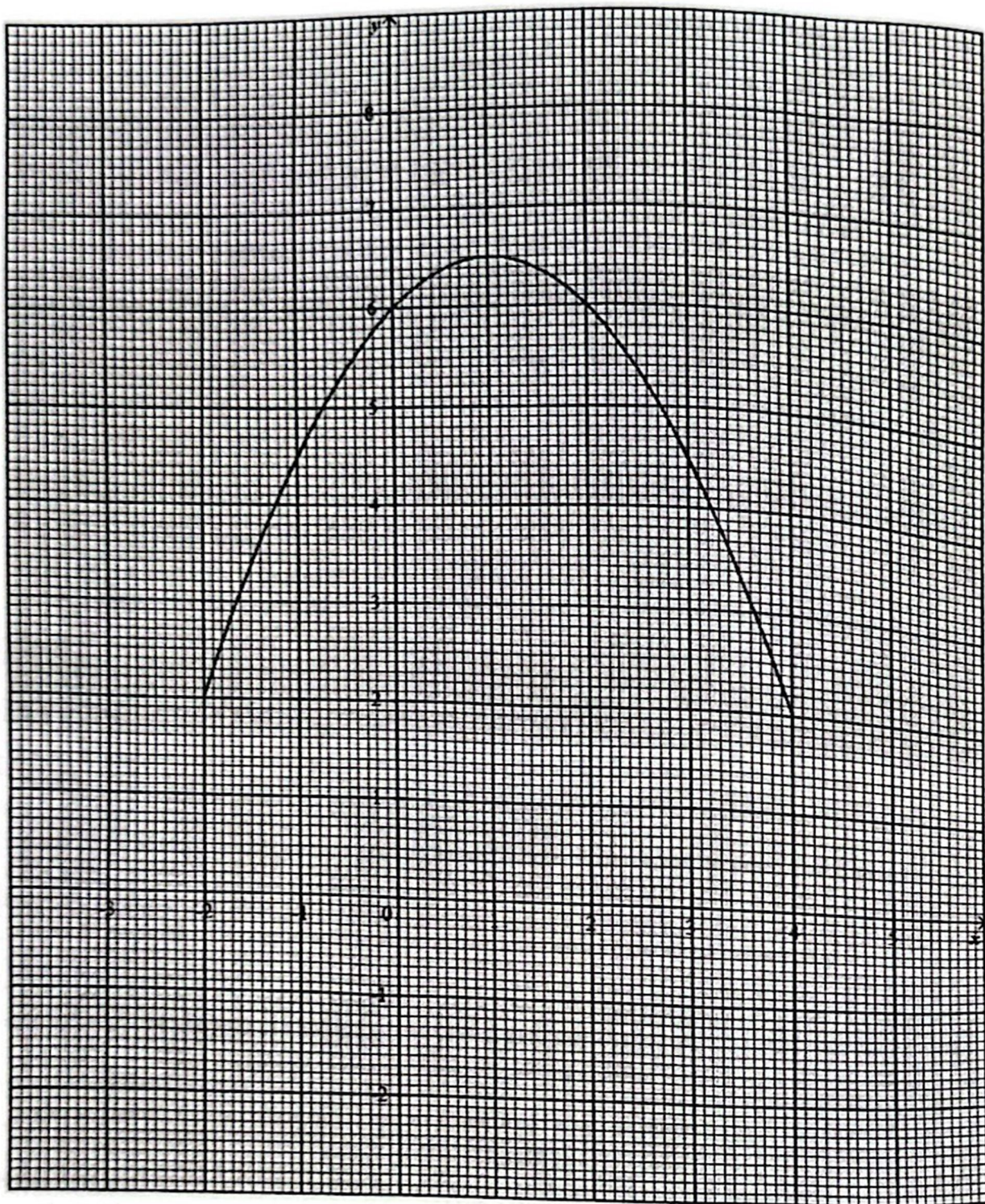


The diagram on the next page shows the graph of $y = -\frac{1}{2}x^2 + x + 6$ for $-2 \leq x \leq 4$.

Using the graph given, answer the following:

- Find the height of the left platform (L). [1]
- If the landing platform is 3.1 units high, find the distance between the two platforms for Daredevil to land safely right at the edge of the landing platform. [1]
- Write down the equation of the line of symmetry of his motion. [1]
- Find (i) the maximum vertical distance attained by Daredevil as measured from the ground and, [1]
(ii) the horizontal distance from the left platform (L) at this position, where vertical distance is maximum. [1]
- Daredevil performed the stunt a second time but his motion is then modelled by another quadratic equation $y = -x^2 + x + 8$. By drawing a suitable linear graph on the same diagram, find the horizontal distance(s) travelled by Daredevil when he is at a height of 4 units from its starting position on the left platform (L). [3]

[Ans: (a) 2 units (b) 5.6 units (c) $x = 1$ (d)(i) 6.5 units (ii) 3 units (e) 1 and 4 units]



13 2013/Y2RP/EOY/Q11

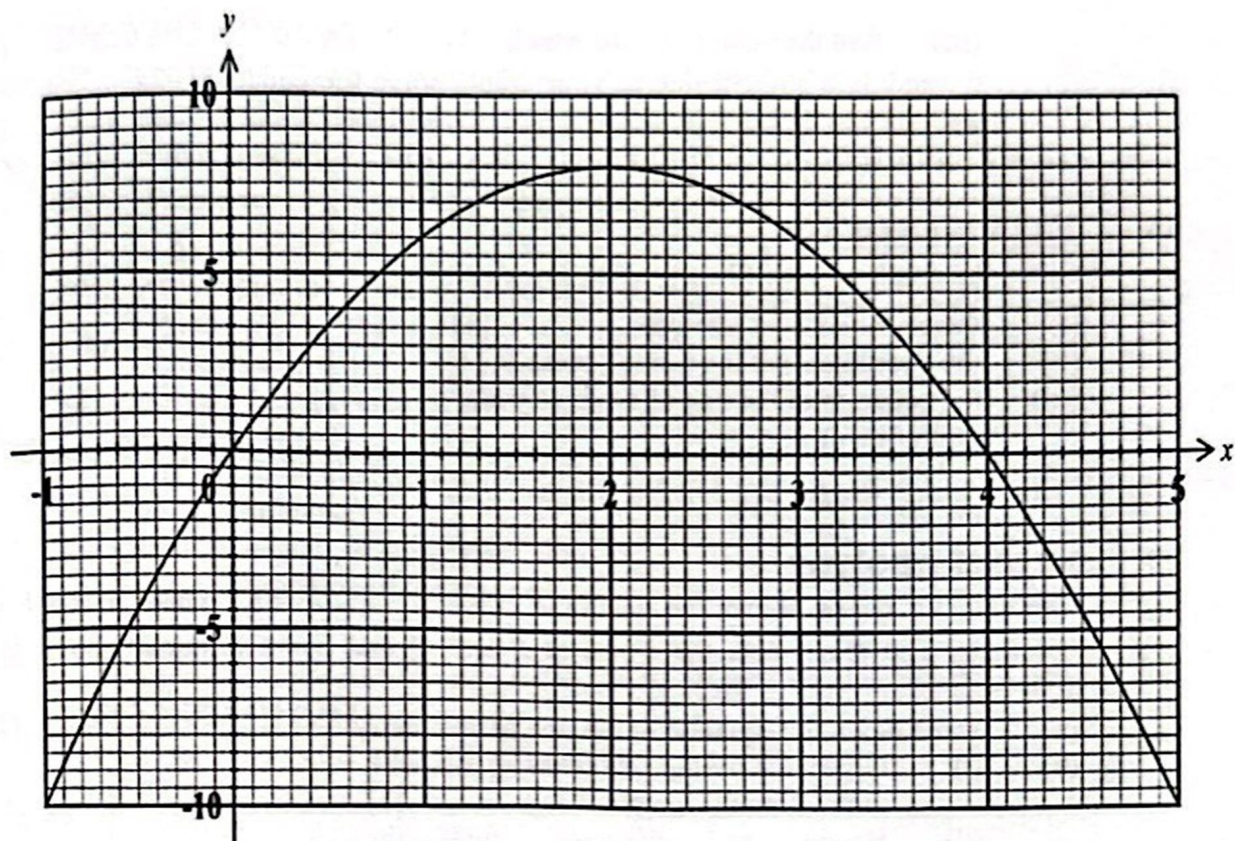
The diagram below shows the graph of $y = 8x - 2x^2$ for $-1 \leq x \leq 5$.

By drawing a suitable straight line, on the same axes for each of the following equations, solve the following:

(a) $4x - x^2 = 3$, [2]

(b) $2(x^2 + 4x + 2) = 13x + 7$. [3]

[Ans: (a) $x = 1$ or 3 (b) $x = -0.5$ or 3]

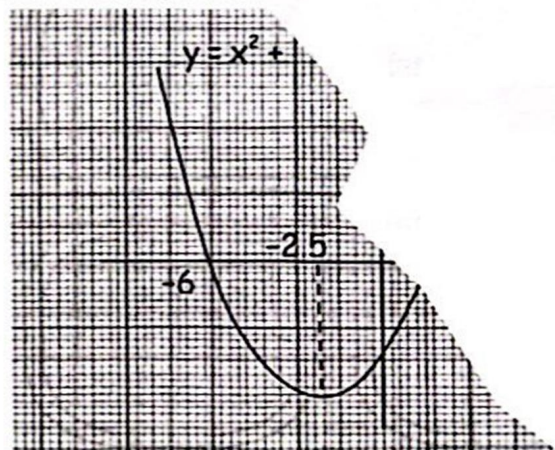


14 **2013/Y2RP/EOY/Q12**

David found a torn quadratic graph assignment while cleaning his room. The remaining parts of the graph shows that the quadratic curve cuts the x -axis at -6 , the minimum value of y occurs at $x = -2.5$, and a partial equation $y = x^2 + \dots$.

- Write down the value of the other x -intercept. [1]
- Hence find the complete equation of the quadratic graph written on the assignment. [2]

[Ans: (a) $x = 1$ (b) $y = x^2 + 5x - 6$]



15 **2012/Y2RP/MYCT/Q12**

Answer the whole of this question on a sheet of graph paper.

The variables x and y are connected by the equation $y = -2x^2 + 7x + 9$. Some corresponding values of x and y are given in the following table.

x	-1	0	1	2	3	4	4.5	5
y	0	9	14	15	12	a	0	-6

- Calculate the value of a . [1]
- Using 2 cm to represent 1 unit on the x -axis and 1 cm to represent 1 unit on the y -axis, draw the graph of $y = -2x^2 + 7x + 9$ for $-1 \leq x \leq 5$. [3]
- Write down the maximum value of y . [1]
- From your graph,
 - find the equation of the line of symmetry. [1]
 - find the values of x for which $y = 3$. [1]

(iii) find the values of x for which $-2x^2 + 7x + 9 = 0$. [1]

(e) By adding a straight line to your graph, solve the equation $-2x^2 + 5x + 3 = 0$. [2]

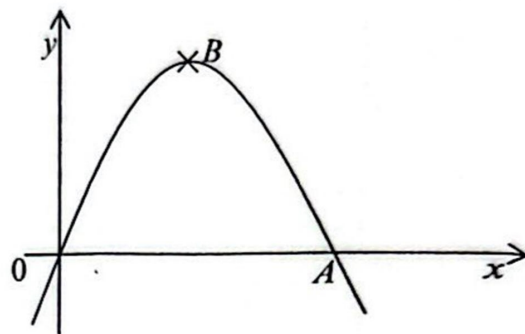
[Ans: (a) $a = 5$ (c) 15.1 (d) (i) $x = 1.75$ (ii) $x = -0.7$ or 4.2 (iii) $x = -1$ or 4.5 (e) $x = -0.5$ or 3]

16 2012/Y2RP/EOY/Q8

Given the graph of $y = x(3-x)$, write down

- the coordinates of intercept A , [1]
- the coordinates of the turning point B , [1]
- the equation of the line of symmetry of $y = x(3-x)$. [1]

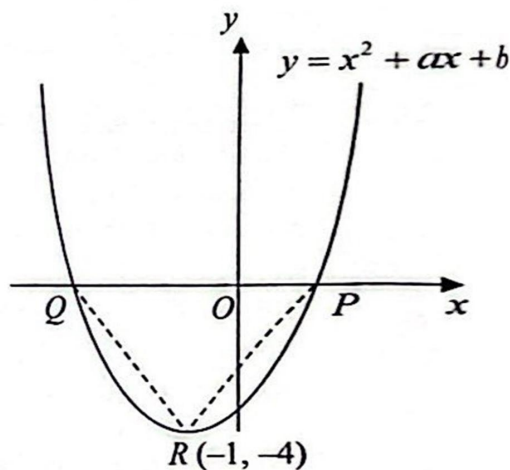
[Ans: (i) $A(3, 0)$ (ii) $B(1.5, 2.25)$ (iii) $x = 1.5$]



17 2011/Y2RP/EOY/Q7

The diagram below shows the quadratic curve $y = x^2 + ax + b$, where a and b are constants. The graph cuts the x -axis at P and Q and has a minimum point at $R(-1, -4)$.

- Write down the equation of the line of symmetry. [1]
- Given that triangle PRQ has an area of 8 units², find the length of PQ . [1]
 - Hence, or otherwise, find the coordinates of the points P and Q respectively. [2]
- State the roots of the quadratic equation $x^2 + ax + b = 0$. Hence, or otherwise, show that the values of a and b are 2 and -3 respectively. [3]
- Find the coordinates of the point where the curve cuts the y -axis. [1]
- Find the equation of the additional straight line which must be drawn on the graph in order to solve the equation $x^2 - 4x + 2 = 0$. [1]



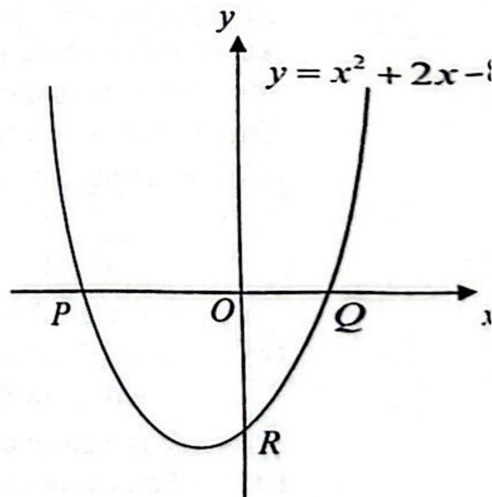
[Ans: (a) $x = -1$ (b) (i) 4 units (ii) $P(1, 0)$, $Q(-3, 0)$ (c) $x = -3$, 1 (d) $(0, -3)$ (e) $y = 6x - 5$]

18 2010/Y2RP/EOY/Q8

The diagram shows part of the graph of $y = x^2 + 2x - 8$.

The graph cuts the x -axis at P and Q and the y -axis at R .

- Find the coordinates of P , Q and R . [4]
- Write down the equation of the line of symmetry and state the coordinates of the minimum point. [2]
- Find the equation of the additional straight line which must be drawn on the graph in order to solve the equation $x^2 + 4x + 1 = 0$. [1]
- A line l cuts the curve $y = x^2 + 2x - 8$ at $x = -5$ and $x = 1$. Find the equation of line l . [4]



[Ans: (a) $P(-4, 0)$, $Q(2, 0)$ and $R(0, -8)$ (b) $(-1, -9)$ (c) $y = -2x - 9$ (d) $y = -2x - 3$]

19 2009/Y2RP/EOY/Q15

The diagram, not drawn to scale, shows the graphs of the curve $y = x^2 + (p-2)x - 2p$ and a straight line l . The curve cuts the x -axis at A and C and the line l intersects the curve at B as shown.

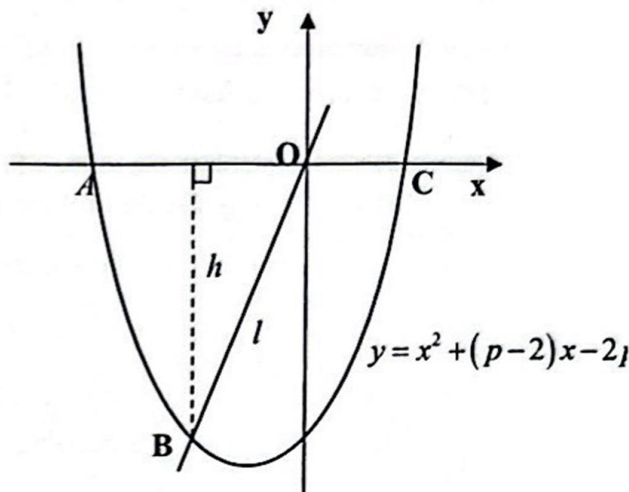
- (a) Factorise $x^2 + (p-2)x - 2p$.

[2]

- (b) Given that the equation of the line of symmetry of the curve is $x = -1$, show that $p = 4$. [2]

- (c) Given that the area of triangle AOB is 16 units²,

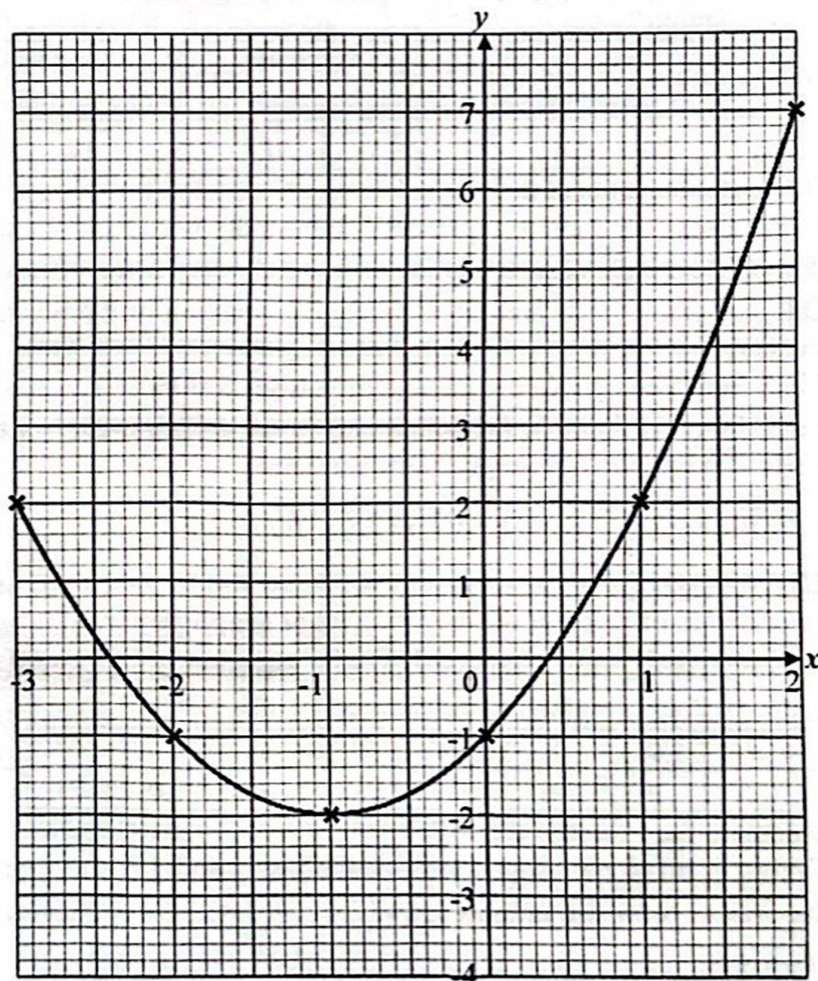
- (i) find the height, h , of the triangle, [1]
 (ii) hence, or otherwise, find the equation of the line OB . [3]



[Ans: (a) $(x-2)(x+p)$ (c) (i) 8 units (ii) $y = 4x$]

20 2008/Y2RP/EOY/Q12

The diagram shows the graph of $y = x^2 + 2x - 1$ for $-3 \leq x \leq 2$.



By drawing a suitable straight line, on the same axes, for each of the following equations, find the graphical solutions to the equations

- (c) $x^2 + 2x - 2 = 0$, [2] (d) $2x^2 + 2x - 3 = 0$. [3]

[Ans: (a) Draw $y = 1$, $x = -2.75$ or $x = 0.75$ (b) Draw $y = x + 0.5$, $x = -1.8$ or $x = 0.8$]

21 **2007/Y2RP/EOY/Q13**

Answer the whole of this question on a piece of graph paper.

The variables x and y are connected by the equation $y = \frac{1}{4}(7+5x)(3-x)$ and some corresponding values of x and y are given in the following table.

x	-2	-1	0	1	2	3
y	-3.75	a	5.25	6	4.25	b

- (a) Calculate the value of a and b . [1]
 (b) Using a scale of 4 cm to represent 1 unit on the x -axis and 2 cm to represent 1 unit on the y -axis, draw the graph of $y = \frac{1}{4}(7+5x)(3-x)$ for $-2 \leq x \leq 3$. [3]
 (c) On your graph, draw and label clearly the equation of the line of symmetry of the curve. [2]
 (d) From your graph, find the value(s) of x when $y = 3$. [1]
 (e) By adding a suitable straight line to your graph, find the solution(s) to the equation $\frac{1}{2}(7+5x)(3-x) - 2x = 0$. [3]

[Ans: (a) $a = 2, b = 0$ (c) $x = 0.8$ (d) $x = -0.75$ or 2.35 (e) Draw $y = x$; $x = -1.7$ or 2.5]

22 **2006/Y2RP/CT1/Q9**

Answer the whole of this question on a piece of graph paper.

The variables x and y are connected by the equation $y = 2x^2 - 5x + 2$ and some corresponding values of x and y are given in the following table.

x	-2	-1	0	1	2	3	4
y	20	a	2	-1	0	5	14

- (a) Calculate the value of a . [1]
 (b) Using a scale of 2 cm to represent 1 unit on the x -axis and 1 cm to represent 1 unit on the y -axis, draw the graph of $y = 2x^2 - 5x + 2$ for $-2 \leq x \leq 4$. [3]
 (c) On your graph, draw and label clearly the equation of the line of symmetry of the curve. [2]
 (d) Find, from your graph, the value(s) of x when $y = 10$. [1]
 (e) Find, from your graph, the solution(s) to the equation $2x^2 = 7x + 3$ by adding a suitable line to your graph. [3]

[Ans: (a) 9 (c) $x = 1\frac{1}{4}$ (d) $x = -1.1$ or 3.6 (e) Draw $y = 2x + 5$; $x = -0.4$ or 3.9]

23 **2005/Y2RP/CT1/Q10**

Answer the whole of this question on a sheet of graph paper.

The variables x and y are connected by the equation $y = (2x-5)(3-x)$. Some corresponding values are given in the following table.

x	0	1	2	3	4	5	6
y	a	-6	-1	0	b	-10	-21

- (a) Calculate the values of a and b . [2]
 (b) Taking 2 cm to represent 1 unit on the x -axis and 1 cm to represent 1 unit on the y -axis, draw the graph of $y = (2x-5)(3-x)$ for values of x in the range $0 \leq x \leq 6$. [3]
 (c) Find, from the graph, the value of x in the range $0 \leq x \leq 6$ when $y = -16$. [1]
 (d) Draw on the graph, the line of symmetry of the curve. Write down the equation of the line of symmetry. [2]
 (e) Use your graph to solve the equation $-2x^2 + 10x - 11 = 0$. [4]

[Ans: (a) $a = -15$, $b = -3$ (c) $x = 5.6$ (d) $x = 2.75$ (e) Draw $y = x - 4$; $x = 1.6$ or 3.4]

24 2004/Y2RP/CT2/Q9

Answer the whole of this question on a sheet of graph paper.

The table below gives the x and y coordinates of some points on the curve $y = 2x^2 + x - 15$. Some of the corresponding values of x and y are given in the following table.

x	-3	-2	-1	0	1	2	3	4
y	0	-9	a	-15	-12	b	6	21

- (a) Find the values of a and b . [1]
 (b) Taking 2 cm to represent 1 unit on the x -axis and 2 cm to represent 5 units on the y -axis, draw the graph of $y = 2x^2 + x - 15$ for the range $-3 \leq x \leq 4$. [3]
 (c) Draw the line of symmetry of the graph and write down its equation. [2]
 (d) By drawing additional straight lines on the graph, use your graph to solve

(i) $2x^2 + x = 9$ (ii) $2x^2 = 2x + 21$ [4]

[Ans: (a) $a = -14$, $b = -5$ (c) $x = -\frac{1}{4}$ (d)(i) Draw $y = -6$; $x = -2.4$ or 1.9

(d)(ii) Draw $y = 3x + 6$; $x = -2.8$ or 3.8]

25 2003/S2MA/EOY/P2/Q11

Answer the whole of this question on a piece of graph paper.

The variables x and y are connected by the equation $y = 28 + x - 2x^2$ and some corresponding values of x and y are given in the following table.

x	-4	-3	-2	-1	0	1	2	3	4
y	-8	7	a	25	28	27	22	b	0

- (a) Calculate the values of a and b . [2]
 (b) Using a scale of 2 cm to represent 1 unit on the x -axis and 2 cm to represent 5 units on the y -axis, draw the graph of $y = 28 + x - 2x^2$ for $-4 \leq x \leq 4$. [3]
 (c) Draw and label clearly the line of symmetry of the curve. [1]
 (d) From your graph, find the value(s) of x when $y = 24$. [1]
 (e) Use your graph to solve the equation $8 - 4x = 2x^2$. [3]

[Ans: (a) $a = 18$, $b = 13$ (c) $x = 0.25$ (d) $x = -1.2$ or 1.7

(e) Draw $y = 5x + 20$; $x = -3.25$ or 1.25]

26 2002/S2MA/EOY/P2/Q10

Answer the whole of this question on a piece of graph paper.

The variables x and y are connected by the equation $y = 25 + 4x - 3x^2$ and some corresponding values of x and y are given in the following table.

x	-3	-2	-1	0	1	2	3	4	5
y	-14	5	a	25	26	21	b	-7	-30

- (a) Calculate the values of a and b . [2]
 (b) Using a scale of 2 cm to represent 1 unit on the x -axis and 1 cm to represent 5 units on the y -axis, draw the graph of $y = 25 + 4x - 3x^2$ for $-3 \leq x \leq 5$. [3]
 (c) Draw the line of symmetry of the curve. [1]
 (d) From your graph, find
 (i) the value of y when $x = 2.5$, [1]
 (ii) the values of x when $y = -10$. [1]
 (e) Use your graph to solve the equation $3x^2 - 4x - 25 = 2x - 5$. [2]

[Ans: (a) $a = 18$, $b = 10$ (c) $x = 0.65$ (d)(i) $y = 16$ (ii) $x = -2.8$ or 4.15

(e) Draw $y = -2x + 5$; $x = -1.75$ or 3.75]