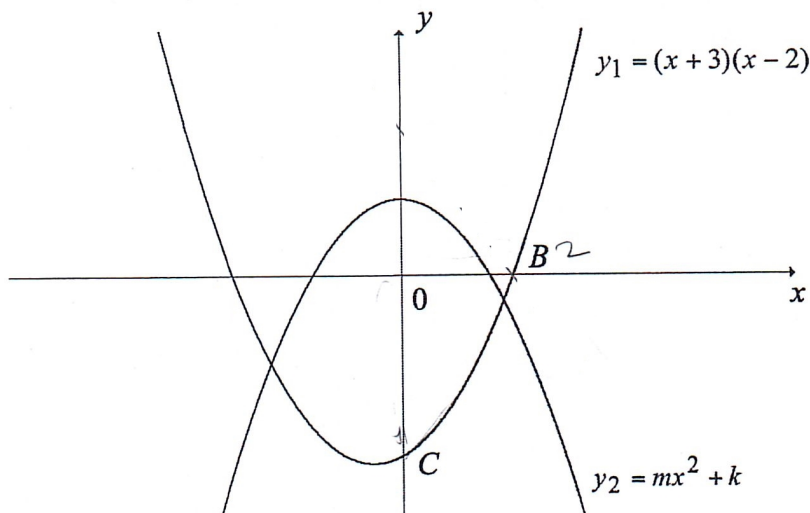
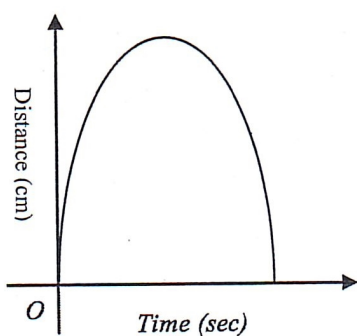


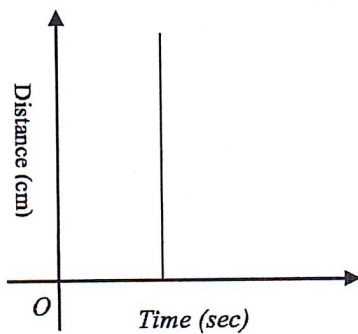
- 1 The following diagram shows the graph of $y_1 = (x+3)(x-2)$ and $y_2 = mx^2 + k$. The graph of $y_1 = (x+3)(x-2)$ cuts the x -axis at B and the y -axis at C .



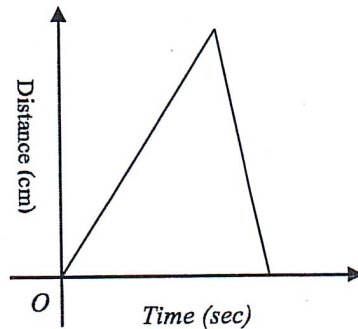
- Write down a possible value of m and a possible value of k for $y_2 = mx^2 + k$.
 - Find the coordinates of B and of C .
 - Calculate the length of BC to 2 decimal places.
 - There are two points on the graph of $y_1 = (x+3)(x-2)$ where the y -coordinate is 2 times the x -coordinate. Find the x -coordinates of the two points.
 - Find the equation of the straight line through B which is parallel to $8x + 2y = 1$.
- 2 A boy threw a ball vertically upwards then allowed it to fall. Which of the following graph best represents the ball's motion after it is thrown?



Graph A



Graph B

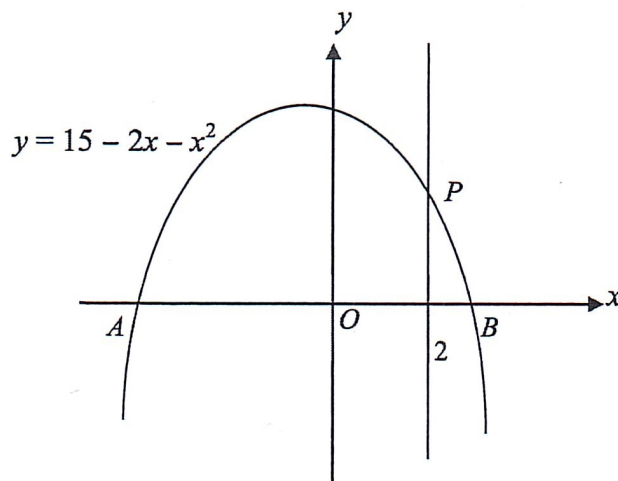


Graph C

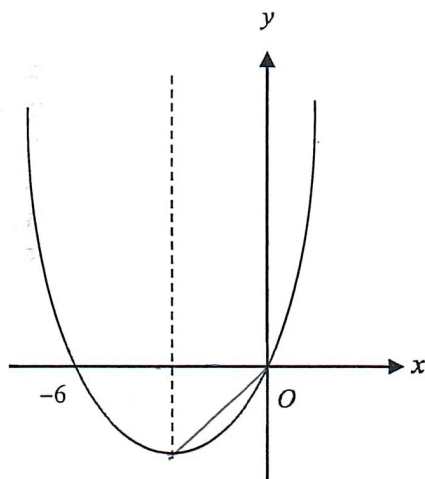
- ③ The curve $y = 15 - 2x - x^2$ cuts the x -axis at the points A and B .
(a) Write down the coordinates of A and of B .

The line $x = 2$ cuts the curve at point P as shown.

- (b) Find the coordinates of P .



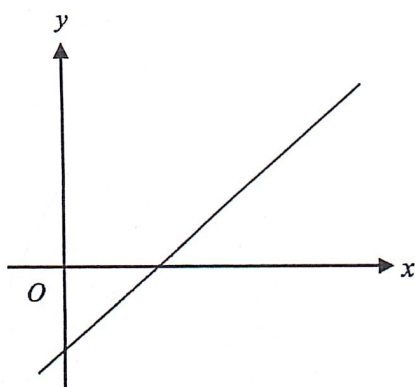
4



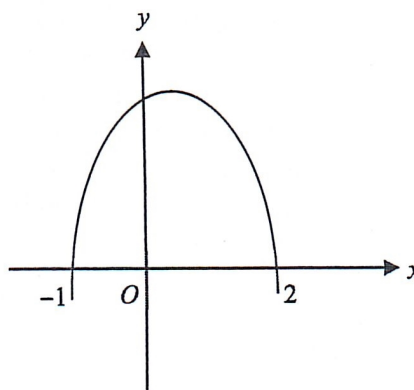
In the diagram, the x -intercepts of the graph are -6 and 0 .

- (a) If the equation of the graph is $y = x(x + A)$, state the value of A .
(b) Write down the equation of the line of symmetry.
(c) Using Pythagoras' Theorem, calculate the length of the straight line between the lowest point of the curve and the origin.

5



Graph A



Graph B

$y = 2 - x^2$	$y = (x - 1)(x + 2)$	$y = 2 - x$
$y = 2 + x - x^2$	$y = x - 2$	$y = x$

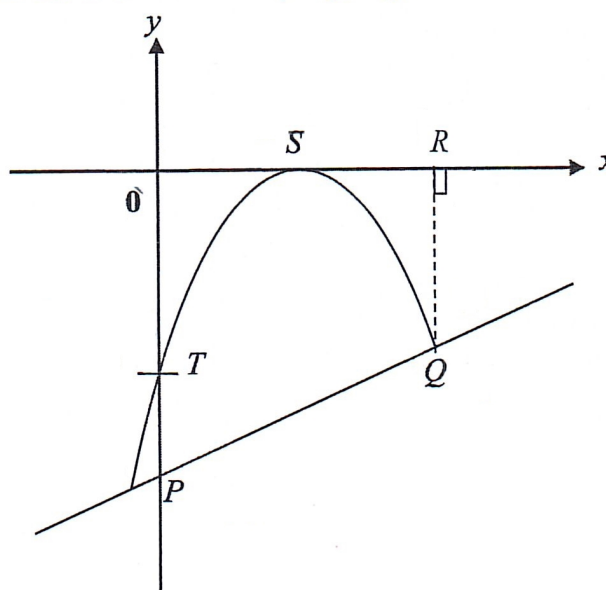
From the table above, select the equations which best describes each of the graphs in the two diagrams. Write your answers in the table below.

Diagram	Equation
Graph A	
Graph B	

6

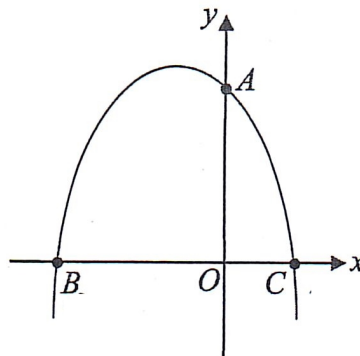
The diagram shows a sketch of part of the graph of $y = -8x^2 + 8x - 2$. The curve touches the x -axis at S and cuts the y -axis at T .

- Write down the y -coordinate of T .
- Find the coordinates of S .
- The coordinates of the point Q are $(1, q)$. Given that point Q lies on the curve, calculate the value of q .
- Given also that the straight line $y = x + k$ passes through Q , calculate the value of k .
- Hence find the area enclosed by RQ , PQ , the x -axis and the y -axis.

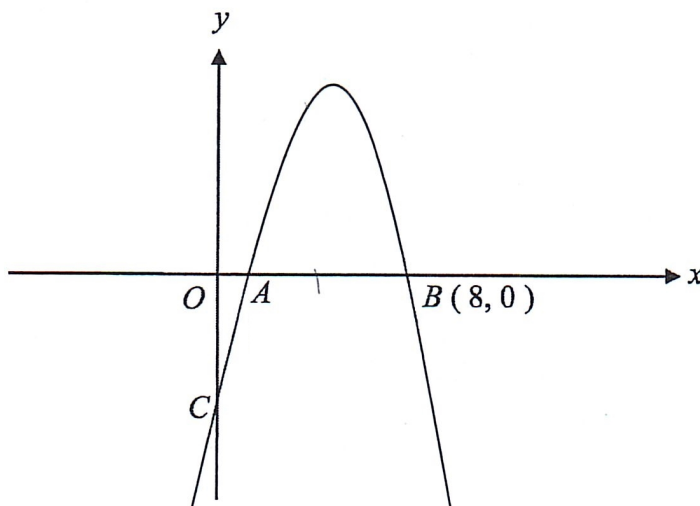


- 7 The diagram shows the graph of $y = (2 - x)(2x + 7)$.

- Write down the coordinates of A , B and C .
- Write down the equation of the line of symmetry of $y = (2 - x)(2x + 7)$.
- The point $(3, k)$ lies on the graph. Find the value of k .

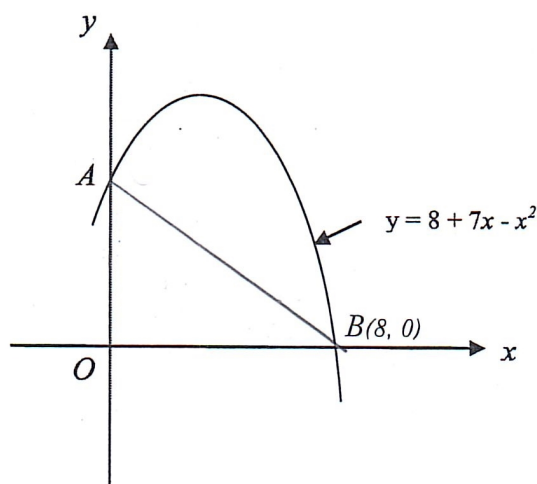


- 8 The diagram shows a sketch of part of the graph of $y = -x^2 + kx - 8$. The curve cuts the x -axis at A and B and the y -axis at C . The point B is $(8, 0)$.
- Find the value of k .
 - Find the coordinates of A and of C .
 - Find the equation of the line of symmetry of the curve.
 - Find the coordinates of the turning point of the curve.



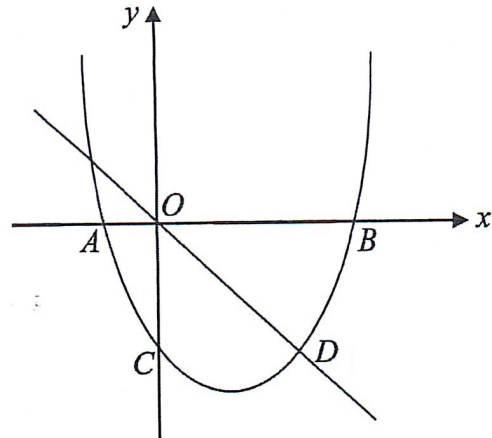
- 9 The diagram shows the graph of $y = 8 + 7x - x^2$. The graph cuts the x -axis at $B(8, 0)$ and the y -axis at A . Find

- the coordinates of A ,
- the gradient of the line joining AB ,
- the equation of the line of symmetry of the curve,
- the maximum value of y .



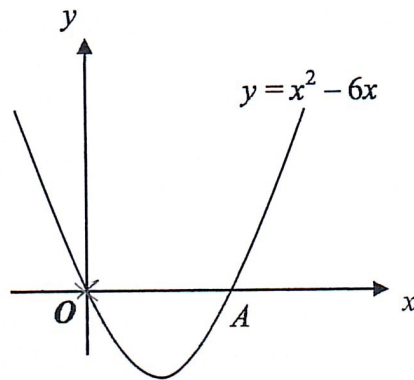
- 10 The diagram shows a sketch of part of the graph of $y = x^2 - kx - 4$. The curve cuts the x -axis at A and B and cuts the y -axis at C .

- (a) Given that B is the point $(4, 0)$, find
 (i) the value of k ,
 (ii) the coordinates of A and C .
 (b) Find the equation of the line of symmetry of the curve.
 (c) The line $y = mx$ cuts the curve at the point D .
 (d) Given that the x -coordinate of D is 3, find
 (i) the y -coordinate of D ,
 (ii) the value of m .



- 11 The diagram shows the graph of $y = x^2 - 6x$, cutting the x -axis at O , the origin and at A .

- (a) Find the coordinates of A .
 (b) Write down the equation of the line of symmetry and hence find the coordinates of the minimum point of the graph.
 (c) Given that another point P , other than $(0, 0)$, lies on the curve such that it is equidistant from the x - and y -axes, find the coordinates of P .
 (d) A straight line cuts the curve at $(-3, k)$. Find the value of k .

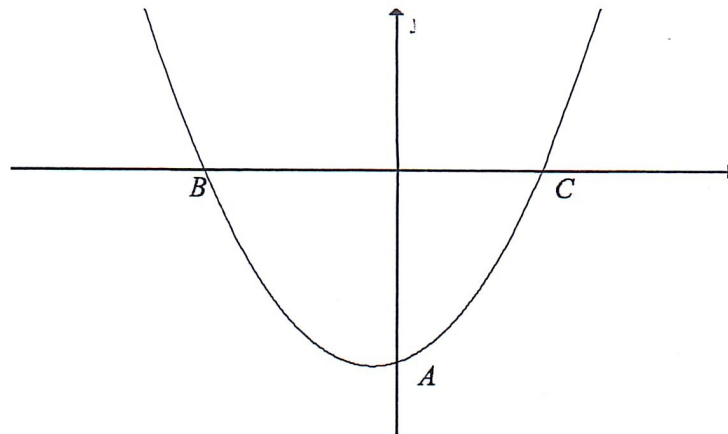


- 12 The variables x and y are connected by the equation $y = x^2 + 2x - 3$. Some corresponding values of x and y are given in the following table:

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

- (a) Calculate the values of p and q .
 (b) Taking 2 cm to represent 1 unit on both the x -axis and the y -axis, draw the graph of $y = x^2 + 2x - 3$ for values of x from -4 to 2.
 (c) From your graph, find the values of
 (i) y when $x = -2.5$,
 (ii) x when $y = 4$.
 (d) Write down the equation of the line of symmetry and the coordinates of the point where y has a minimum value.
 (e) Using the graph, solve
 (i) $3 - 2x - x^2 = 0$,
 (ii) $x^2 + 2x - 2 = 0$.

- 13 The diagram below shows the graph of $y = x^2 + x - 12$.



- (a) The graph cuts the y -axis at $A (0, k)$. Write down the value of k .
 (b) The graph cuts the x -axis at B and C . Find the coordinates of B and of C .
 (c) Find the equation of the line of symmetry of the graph.
 (d) Calculate the minimum value of y .
- 14 This table shows the values of x and y related by the equation $y = x^2 + 2x - 1$.

x	-4	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y	7	4.25	2	0.25	-1	-1.75	-2	a	-1	0.25	2	4.25	7

- (a) Calculate the value of a .
 (b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x -axis for $-4 \leq x \leq 2$. On your axes, plot the points given in the table and join them with a smooth curve.
 (c) The points $(1.2, n)$ and (m, n) lie on the curve. Use your graph to find the
 (i) value of n , (ii) value of m .
 (d) By adding a straight line to your graph, solve the equation $x^2 + 2x = 1$.
- 15 This table shows the values of x and y related by the equation $y = x^2 - 2x - 4$.

x	-2	-1.5	-1	-0.5	0	0.5	1.5	2	2.5	3	3.5
y	4	1.25	-1	-2.75	-4	-4.75	a	-4	-2.75	-1	1.25

- (a) Calculate the value of a .
 (b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x -axis for $-2 \leq x \leq 3.5$. On your axes, plot the points given in the table and join them with a smooth curve.
 (c) Write down the equation of the line of symmetry.
 (d) What is the least value of y ?
 (e) The points $(2.7, n)$ and (m, n) lie on the curve. Use your graph to find the
 (i) value of n , (ii) value of m .
 (f) By adding a straight line to your graph, solve the equation $1 + 3x - x^2 = 0$.

- 16 A company makes a profit of y thousand dollars when it produces x thousand handphone pouches. The relationship may be expressed as

$$y = \frac{1}{2}(7x - x^2).$$

The following table gives some corresponding values of x and y .

x	0	1	2	3	4	5	6	8
y	0	3	5	p	6	5	3	q

- (a) Calculate the value of p and of q .
- (b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x -axis for $0 \leq x \leq 8$. On your axes, plot the points given in the table and join them with a smooth curve.
- (c) Using your graph, find
- the number of handphone pouches the company should produce to obtain maximum profit,
 - the profit the company makes if it produces 1500 handphone pouches,
 - the number of handphone pouches the company produces if it makes a loss of \$2000.
- (d) Explain the significance of the non-zero x -intercept of your graph.
- 17 This table shows the values of x and y related by the equation $y = x^2 - 2x - 5$.

x	-2	-1.5	-1	-0.5	0	0.5	1.5	2	2.5	3	3.5
y	3	0.25	-2	-3.75	-5	a	-5.75	-5	-3.75	-2	0.25

- (a) Calculate the value of a .
- (b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x -axis for $-2 \leq x \leq 3.5$. On your axes, plot the points given in the table and join them with a smooth curve.
- (c) The points $(1.8, k)$ and (h, k) lie on the curve. Use your graph to find
- the value of k ,
 - the other value of h .
 - the least value of y .
 - the roots of the equation $5 + 2x - x^2 = 0$.
- 18 The variables x and y are connected by the equation $y = 2x^2 - 5x + 1$. Some corresponding values of x and y are given in the following table.

x	-2	-1	0	1	2	3	4
y	19	8	1	-2	-1	4	p

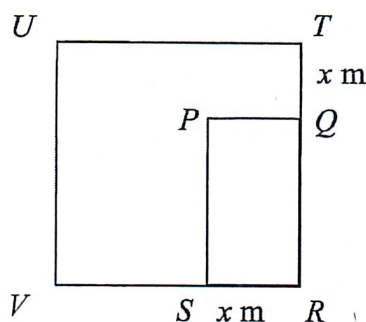
- (a) Calculate the value of p .
- (b) Using a scale of 2 cm to 1 unit on the x -axis and 4 cm to 5 units on the y -axis, draw the graph of $y = 2x^2 - 5x + 1$ for $-2 \leq x \leq 4$.
- (c) Use your graph to find the values of x for which $y = 2.5$.
- (d) Write down the lowest value of y .
- (e) On the same graph, draw the line $y = 10 - 3x$, and use your graph to solve the equation $2x^2 - 5x + 1 = 10 - 3x$.

- 19 The variables x and y are connected by the equation $y = x^2 + x - 8$. Some corresponding values of x and y are given in the following table.

x	-3	-2	-1	-0.5	0	1	2	3	4
y	-2	a	-8	-8.25	-8	-6	-2	4	12

- (a) Calculate the value of a .
- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x -axis for $-3 \leq x \leq 4$. Using a scale of 2 cm to represent 2 units, draw a vertical y -axis for $-9 \leq y \leq 12$. On your axes, plot the points given in the table and join them with a smooth curve.
- (c) Use your graph to find
- the values of x when $y = -2.8$,
 - the minimum value of the graph.
- (d) On the same axes, draw a suitable straight line for $-3 \leq x \leq 4$ to solve the equation $x^2 + x - 8 = -x$.

- 20 A gardener plans to have a rectangular flower bed $PQRS$ in a square lawn $UVRT$ of area 49 m^2 . $QT = RS = x \text{ m}$.



- (a) Show that the area of the flower bed, $A \text{ m}^2$, is given by $A = 7x - x^2$.
- (b) Some of the corresponding values of A and x are given in the table below. Find the value of a and of b .

x	0	1.5	3	4	5	7
A	0	a	12	12	b	0

- (c) Using a scale of 2 cm to represent 1 unit on the horizontal x -axis and 1 cm to represent 1 unit on the vertical A -axis, draw the graph of $A = 7x - x^2$ for $0 \leq x \leq 7$.
- (d) Use your graph to find
- the values of x for which the area of the flower bed is 9 m^2 ,
 - the value of m given that the points $(0.5, n)$ and (m, n) lie on the curve.
- (e) Write down the equation of the straight line that must be drawn to solve $x^2 = 7x - 6$.

- 21 The table below shows the values of x and y related by the equation

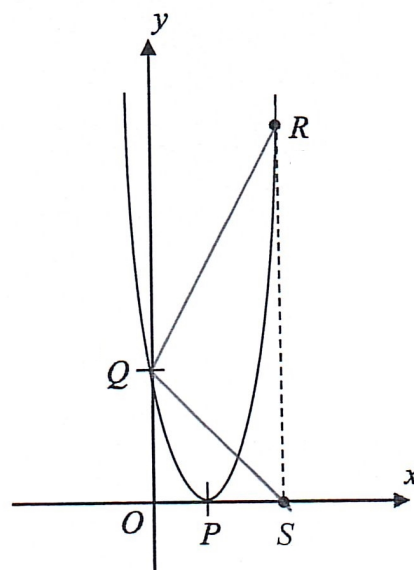
$$y = 7 - 2x - \frac{x^2}{2}.$$

x	-5	-4	-2	-1	0	1	3
y	4.5	m	9	8.5	7	4.5	-3.5

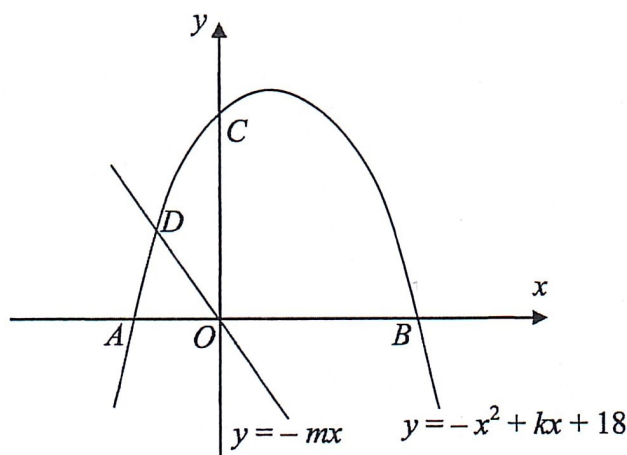
- (a) Calculate the value of m .
- (b) Taking 2 cm to represent 1 unit on the x -axis and 2 cm to represent 2 units on the y -axis, draw the graph of $y = 7 - 2x - \frac{x^2}{2}$ for $-5 \leq x \leq 3$.
- (c) The points $(0.8, k)$ and (p, k) lie on the curve. Use your graph to find the
- (i) value of k ,
- (ii) value of p .
- (d) By adding a straight line to your graph, solve the equation $1 - x - \frac{x^2}{2} = 0$.

- 22 The diagram shows a sketch of part of the graph of $y = 16x^2 - 8x + 1$. The curve touches the x -axis at P and the y -axis at Q .

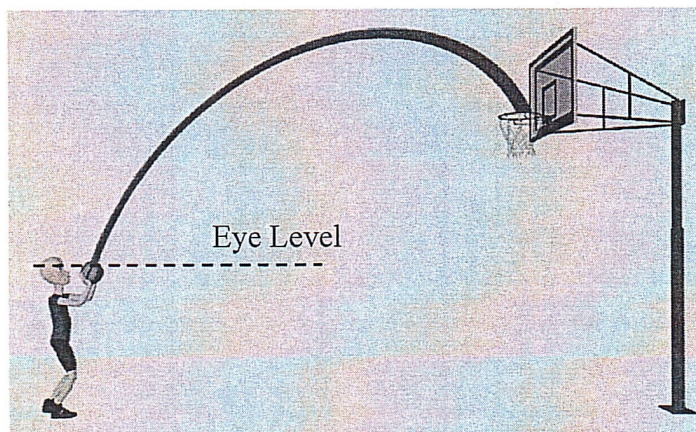
- (a) Write down the y -coordinate of Q .
- (b) Find the coordinates of P .
- (c) Given that $R(1, r)$ lies on the curve, calculate the value of r .
- (d) Given also that the straight line $y = x + k$ passes through R , calculate the value of k .
- (e) S is a point vertically below R . Find the area of the triangle QRS .



- 23 The diagram shows a sketch of part of the graph of $y = -x^2 + kx + 18$. The curve cuts the x -axis at A and B and the y -axis at C . The point B is $(6, 0)$.
- Find the value of k .
 - Find the coordinates of A and of C .
 - Find the equation of the line of symmetry of the graph.
 - Calculate the maximum value of y .
 - Write down the coordinates of the turning point.
 - The line $y = -mx$ cuts the curve at D .
Given that the x -coordinate of D is -2 , find
 - the y -coordinate of D ,
 - the value of m .

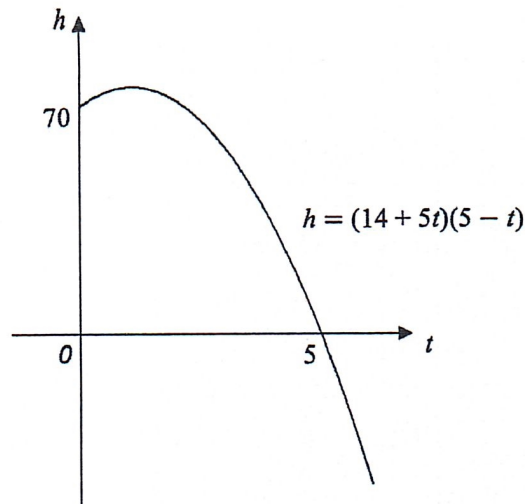


- 24 Tom shoots a basketball into a basketball net. The quadratic equation $h = -t^2 + 3t + 2$ describes the parabolic path taken by the basketball, where h is the height above ground in metres and t is the time taken in seconds after the basketball leaves Tom's hands.



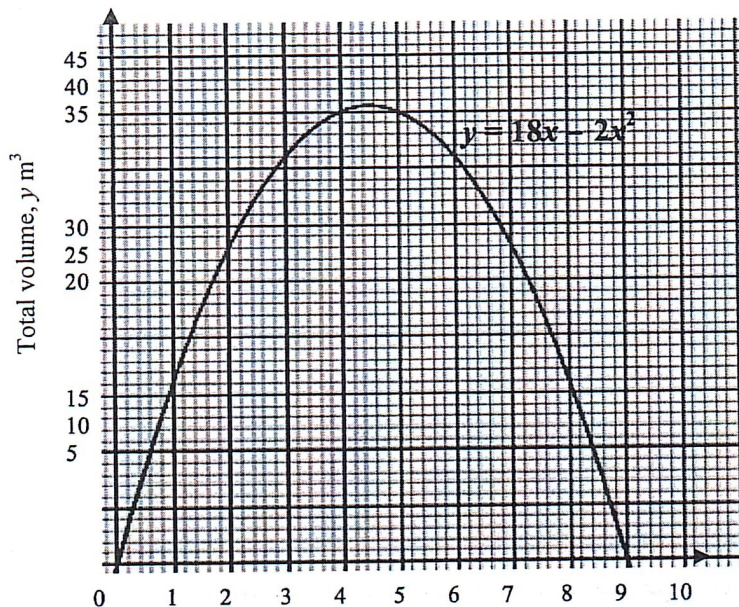
- Assuming that Tom stands upright and holds the basketball at eye level before he shoots the ball and the distance from the top of his head to his eye level is 12 cm, write down Tom's height in metres.
- It is observed that the upward parabolic motion of the basketball takes place between 0 seconds and p seconds. Calculate the value of p , where p seconds is the time when the basketball is at its maximum height.
- The basketball hoop is 3 metres above ground. Calculate the time taken for the ball to reach the hoop.

- 25** A stone is thrown from the top of a cliff next to the sea. The height, h metres, of the stone above the sea level t seconds after it is released can be modeled by the equation $h = (14 + 5t)(5 - t)$.
The diagram below shows part of the graph.



- (a) Show that the time taken for the stone to be at its highest point above the sea level is 1.1 seconds.
- (b) Find the maximum height of the stone above the sea level.
- (c) The stone is 72 m above sea level at $t = t_1$ and $t = t_2$.
These values of t are the solutions to the equation $-5t^2 + At + B = 0$.
Find the values of A and of B .
- 26** At a National Day Parade rehearsal, it is noted that quadratic function that describes a particular firework shell's parabolic path is $h = -8t^2 + 40t + 2$ where h is the height above ground in metres and t is the time in seconds after it is launched.
- (a) Find the values of t when $h = 2$.
- (b) Given that this firework shell explodes at the greatest possible height, how long will it take for it to explode after it is launched?
- (c) How high will the firework shell reach at the moment of explosion?

- 27 A solid cuboid has dimensions $(9 - x)$ m by x m by 2 m. The graph representing its total volume, $y = (18x - 2x^2) \text{ m}^3$, against x m is shown below.



- Find the value of m given that the points $(2, n)$ and (m, n) lie on the curve.
- State the significance of the point $(4.5, 40.5)$ on the above graph.
- Find the equation of the straight line that must be drawn on the above graph to solve $x^2 - \frac{21}{2}x + 15 = 0$.
- Another cuboid with x m as one of its sides has a total volume of $y = (30 - 3x) \text{ m}^3$. By inserting the straight line $y = 30 - 3x$ onto the graph above, find the value of x , where $x < 5$, when the two cuboids have the same volume.