S4 Credit Chapter 6

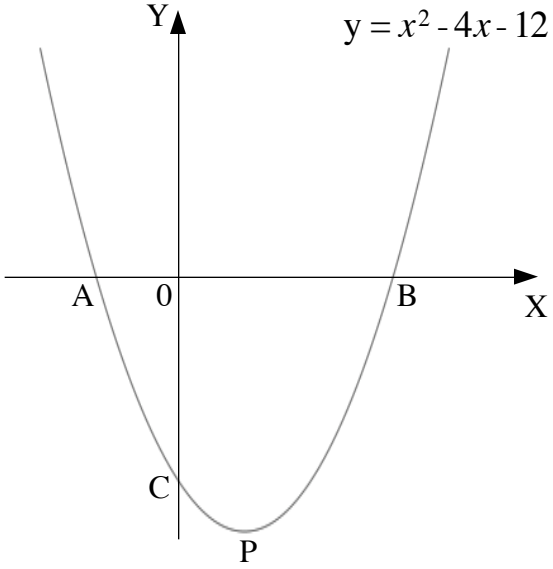
QUADRATIC GRAPHS

Examples:

(1) The parabola meets the axes at the points A, B, and C.

The minimum turning point is P.

Find the coordinates of these points.



<u>*X-axis*</u>: $y = \mathbf{0}$

$x^2 - 4x - 12 = 0$

$(x+2)(x-6) = 0$

$x+2 = 0$ or $x-6 = 0$

$x = \mathbf{-2}$ or $x = \mathbf{6}$

A(-2,0) , B(6,0)

<u>*Turning Point*</u>:

$(-2+6) \div 2 = 2$

axis of symmetry $x = \mathbf{2}$

$y = x^2 - 4x - 12$

$y = 2^2 - 4 \times 2 - 12 = \mathbf{-16}$

P(2,-16)

<u>*Y-axis*</u>: $x = \mathbf{0}$

$y = x^2 - 4x - 12$

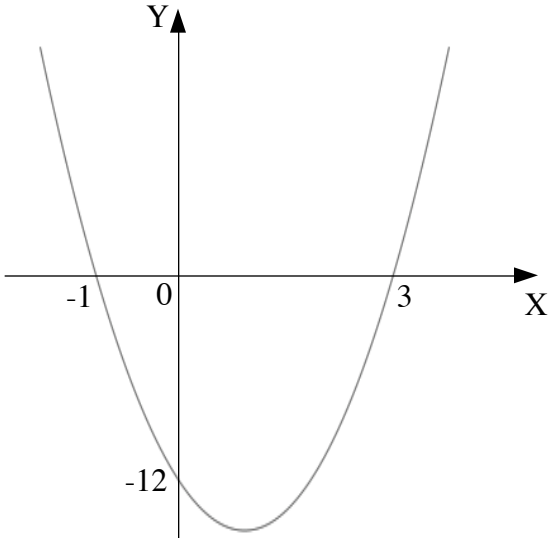
$y = 0^2 - 4 \times 0 - 12 = \mathbf{-12}$

C(0,-12)

(2) The equation of the parabola is of the form $y = k(x-a)(x-b)$.

It meets the axes at the points indicated.

Write the equation of the graph.



<u>*X-axis*</u>:

$x = -1$ and $x = 3$ from $(x+1)(x-3) = 0$

$y = k(x+1)(x-3)$

for $(0,-12)$, $x = 0$ and $y = -12$

$-12 = k(0+1)(0-3)$

$-12 = k \times 1 \times (-3)$

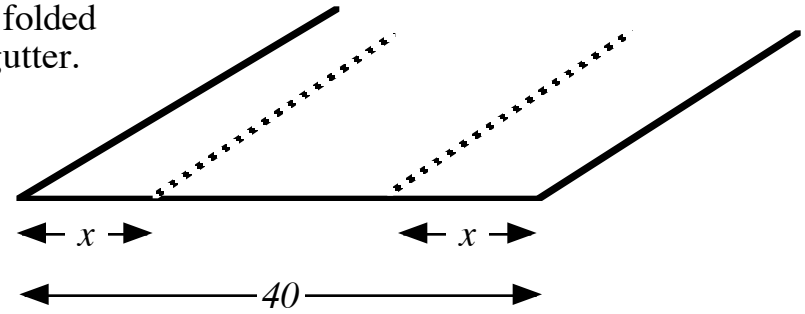
$-12 = -3k$

$k = 4$

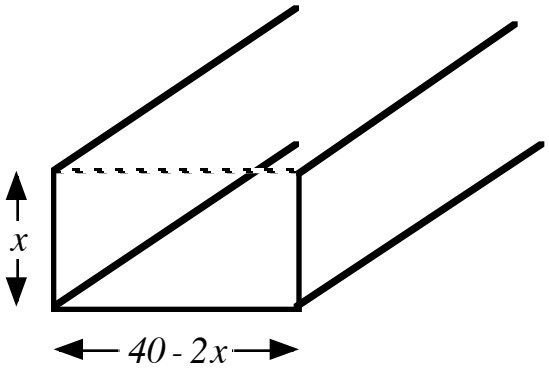
$\mathbf{y = 4(x+1)(x-3)}$

(3) A sheet of metal 40 cm. wide is folded x cm from each end to form a gutter.

To maximise water flow the rectangular cross-section should be as large as possible.



Find the maximum cross-sectional area possible.



$A = l\,b$

$\quad = x\,(40 - 2x)$

$A = 40x - 2x^2$

graph of $y = 40x - 2x^2$

<u>*X-axis*</u>: $y = \mathbf{0}$

$40x - 2x^2 = 0$

$2x\,(20 - x) = 0$

$2x = 0$ *or* $20 - x = 0$

$x = \mathbf{0}$ *or* $x = \mathbf{20}$

(0,0) , (20,0)

<u>*Turning Point*</u>:

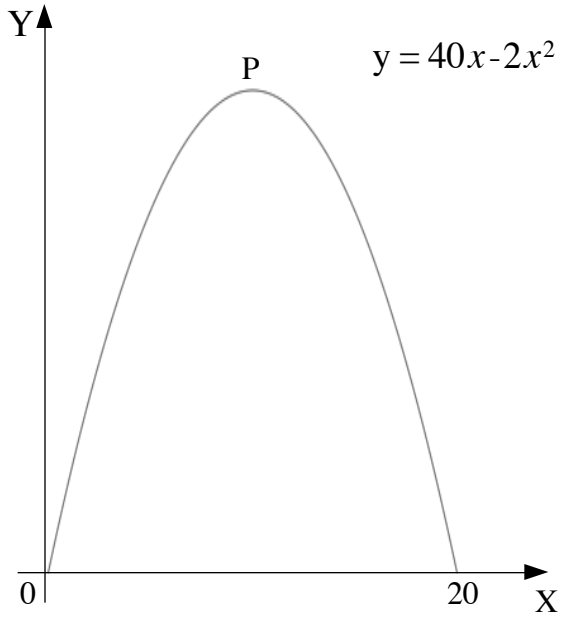
$(0 + 20) \div 2 = 10$

axis of symmetry $x = \mathbf{10}$

$y = 40x - 2x^2$

$y = 40 \times 10 - 2 \times 10^2 = \mathbf{200}$

P(10,200)



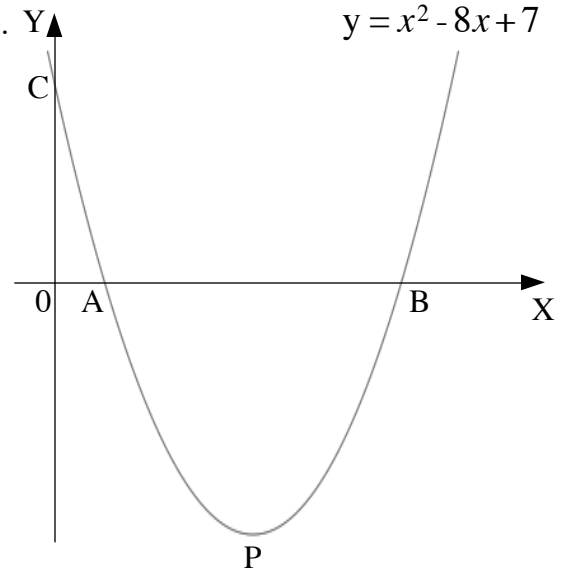
Maximum area 200 square centimetres.

In each of the following the graph of a quadratic function is shown.
The equation of the graph is given.

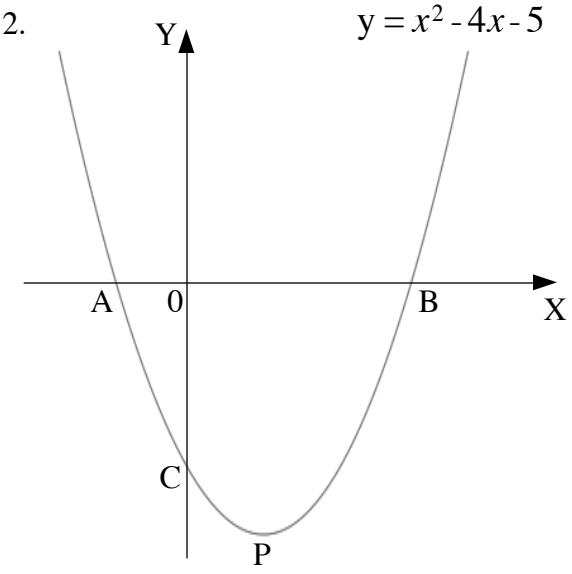
The parabola meets the axes at the points A, B and C.
Point P is either the maximum or minimum turning point of the graph.

In each question find the coordinates of the points A, B, C and P.

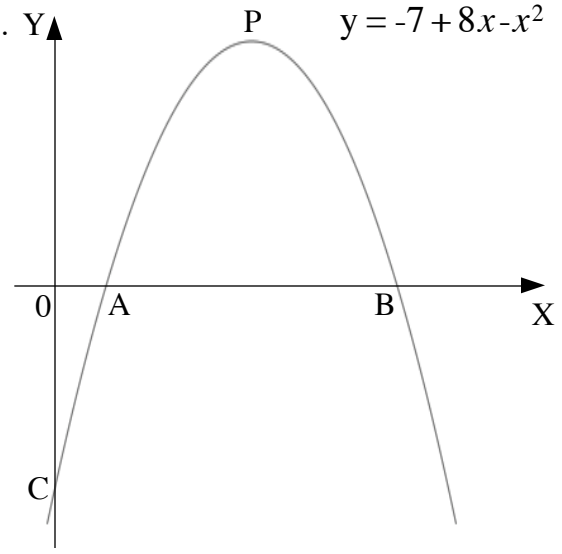
1. $y = x^2 - 8x + 7$



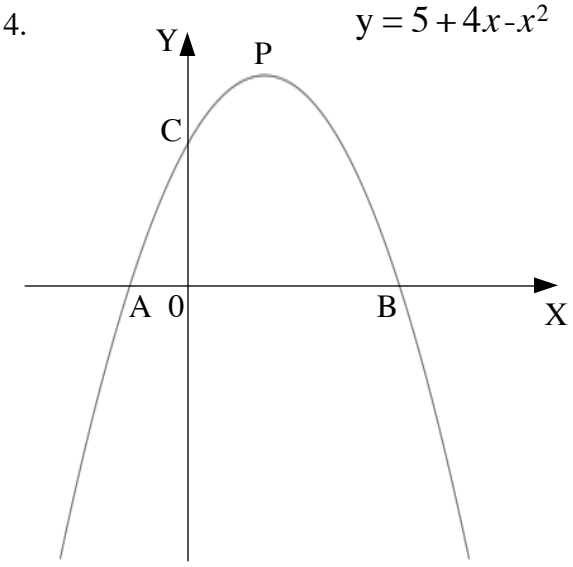
2. $y = x^2 - 4x - 5$



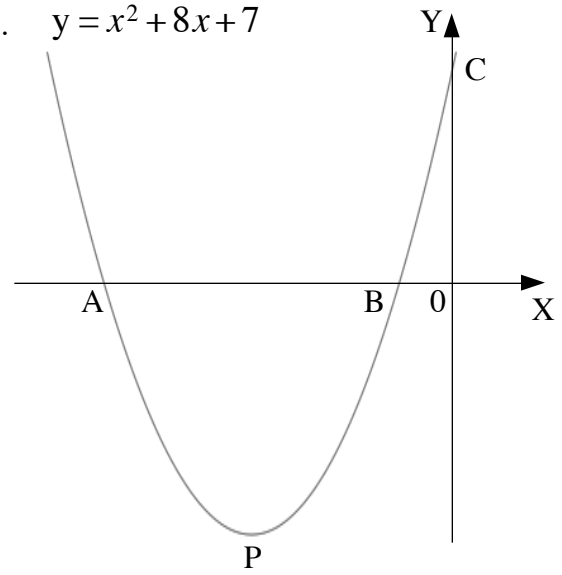
3. $y = -7 + 8x - x^2$



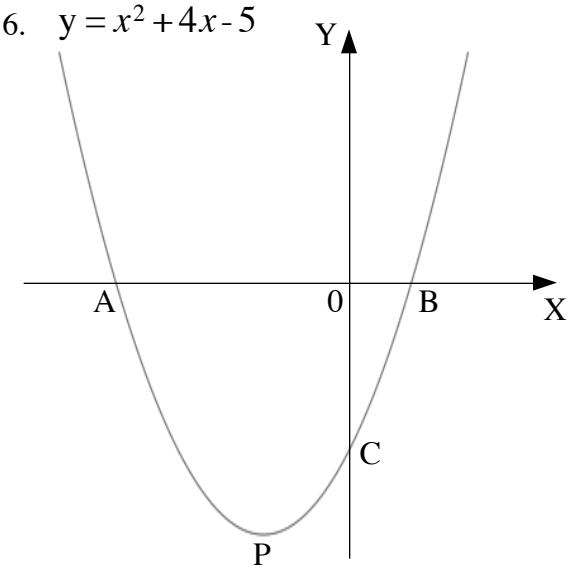
4. $y = 5 + 4x - x^2$



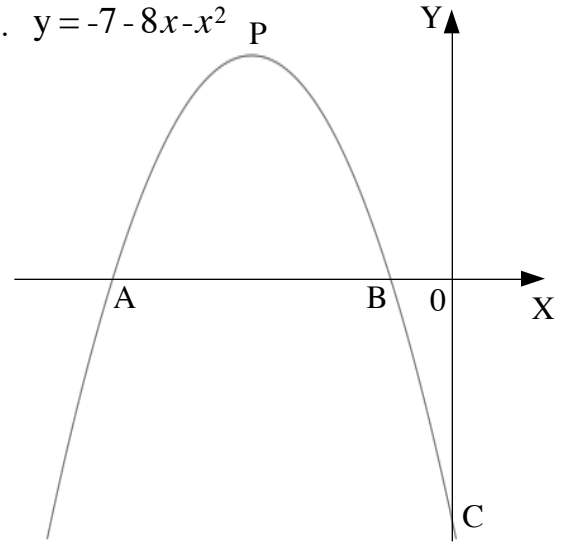
5. $y = x^2 + 8x + 7$



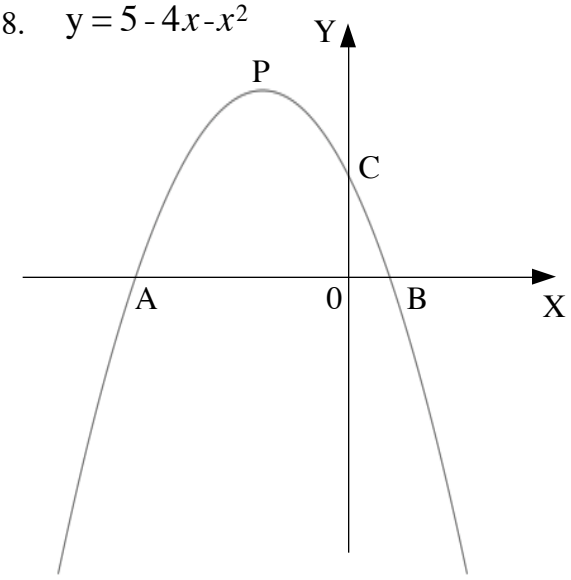
6. $y = x^2 + 4x - 5$



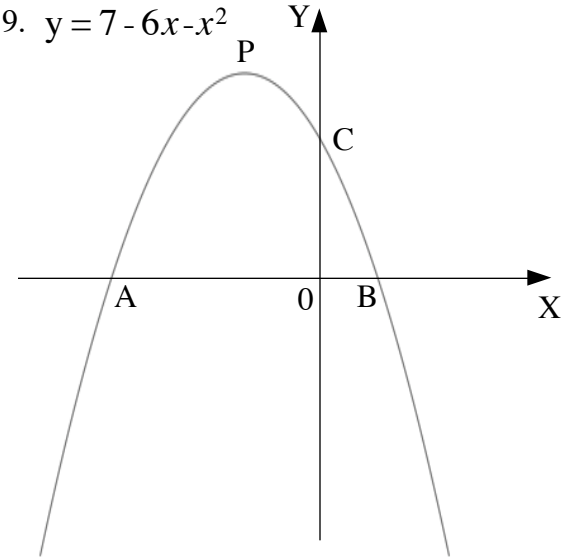
7. $y = -7 - 8x - x^2$



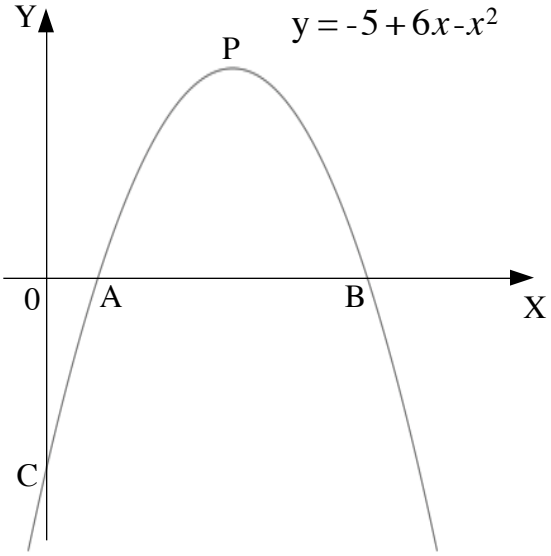
8. $y = 5 - 4x - x^2$



9. $y = 7 - 6x - x^2$



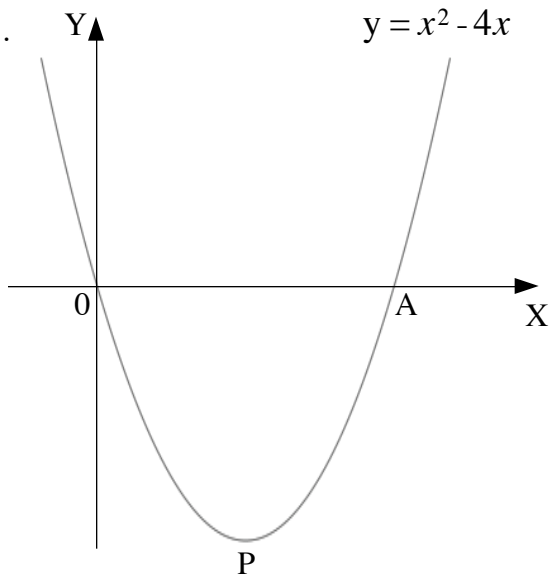
10. $y = -5 + 6x - x^2$



In each of the following the parabola meets the axes at the origin O and point A. Point P is either the maximum or minimum turning point of the graph.

In each question find the coordinates of the points A and P.

11.



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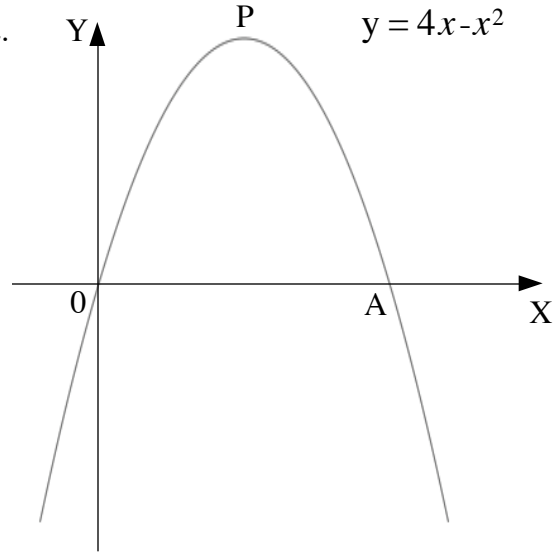

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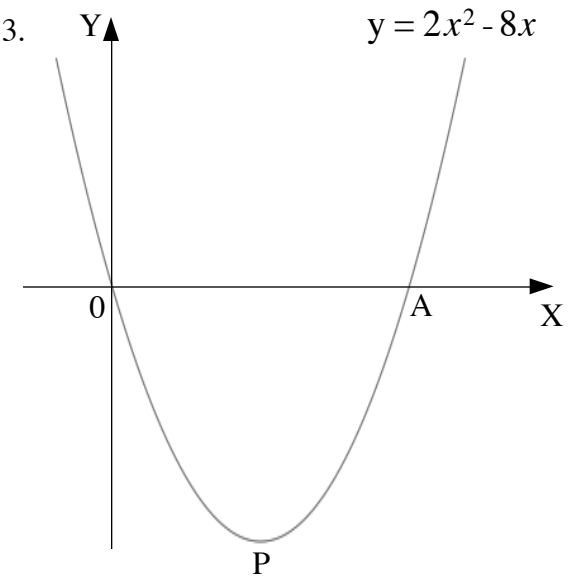

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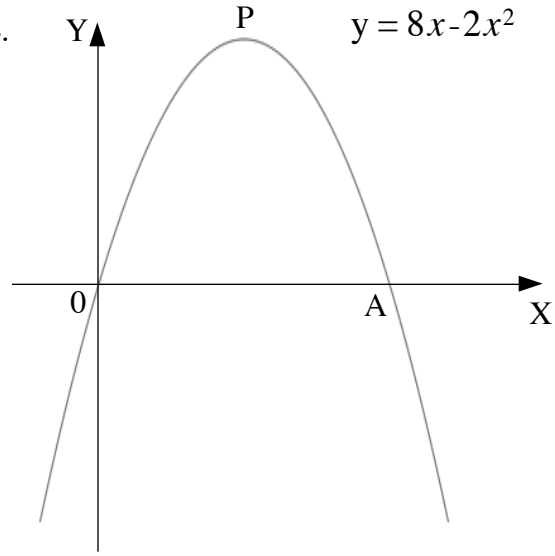
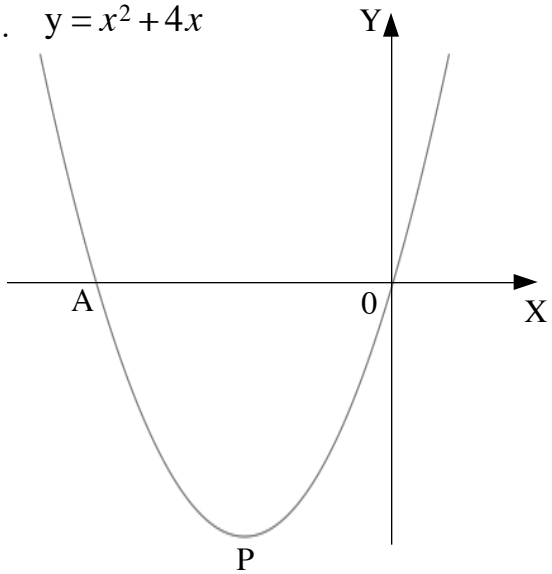
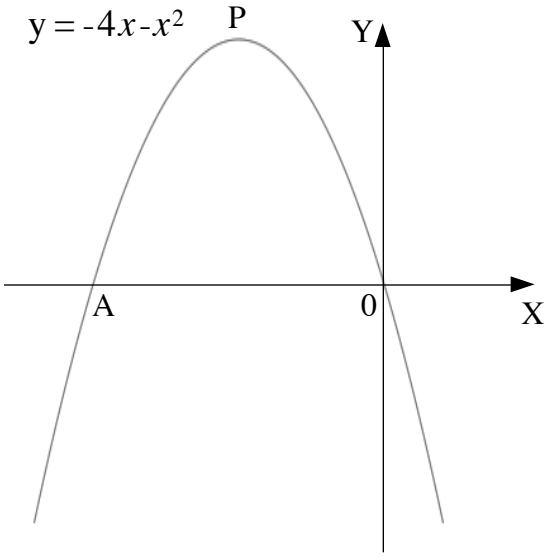


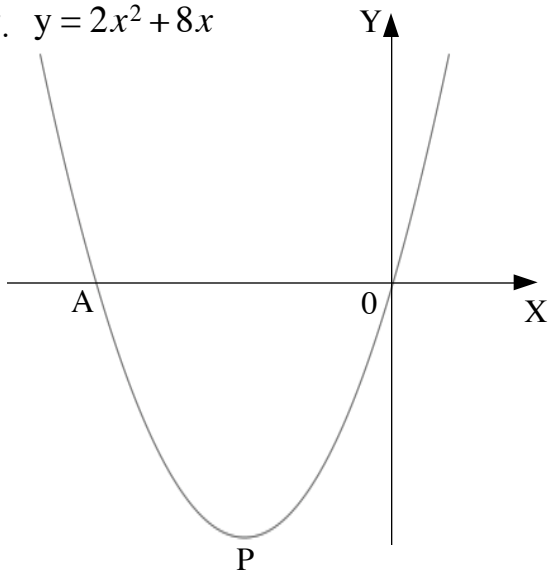
15. $y = x^2 + 4x$



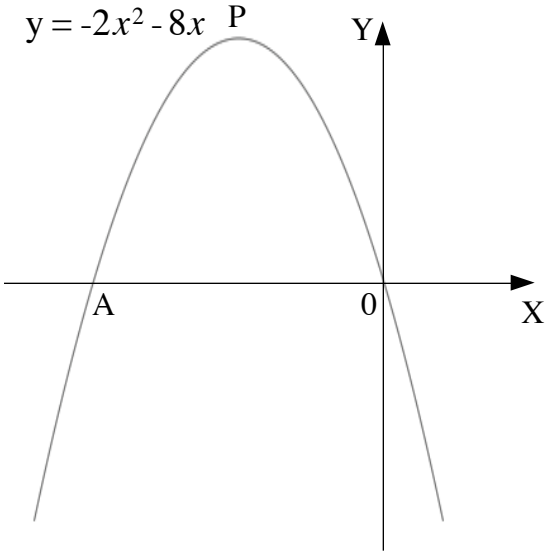
16. $y = -4x - x^2$



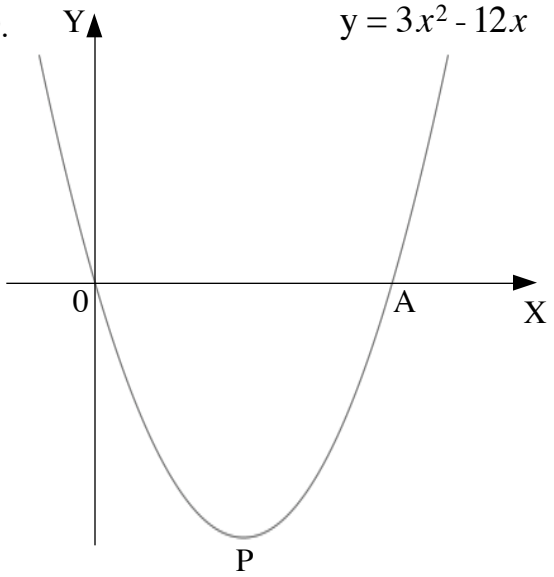
17. $y = 2x^2 + 8x$



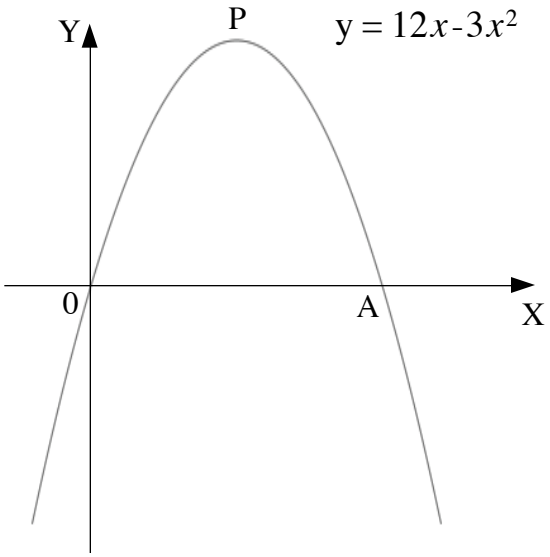
18. $y = -2x^2 - 8x$



19. $y = 3x^2 - 12x$



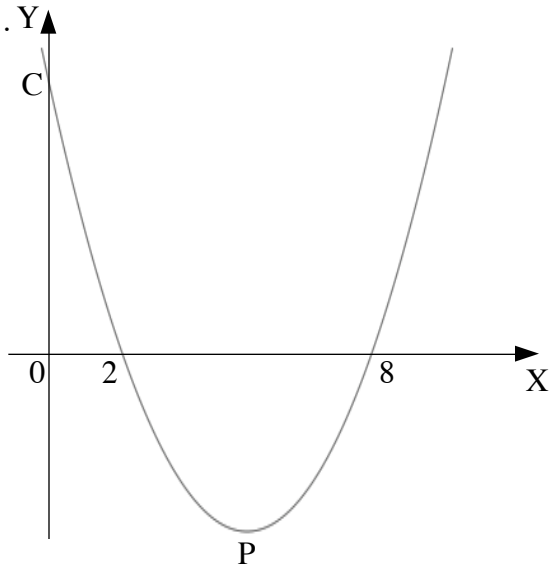
20. $y = 12x - 3x^2$



In each of the following the graph of a quadratic function is shown.
The points where the parabola meets the x-axis are given.
The parabola meets the y-axis at point C.
Point P is the minimum turning point of the graph.

The equation of the graph is of the form y = (x-a)(x-b).
Write the equation of the graph in this form and find the coordinates of points C and P.

21.



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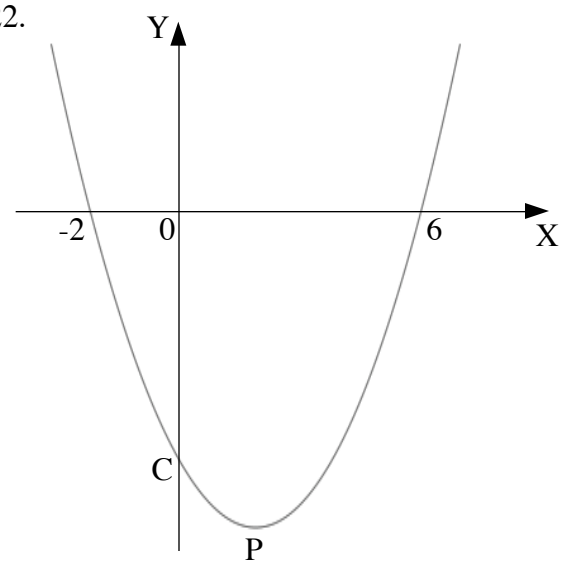

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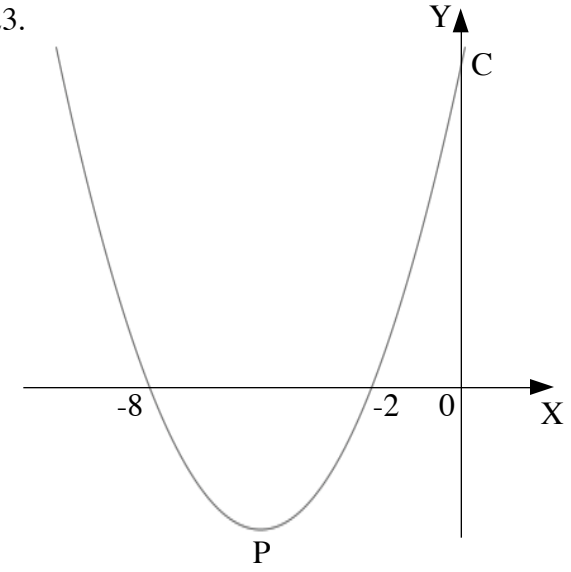

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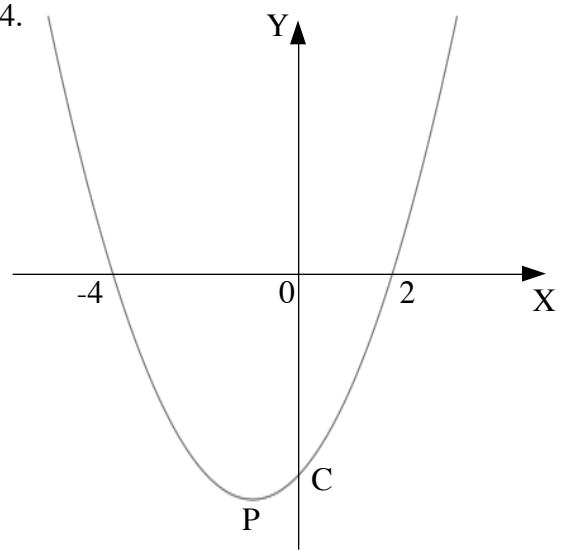
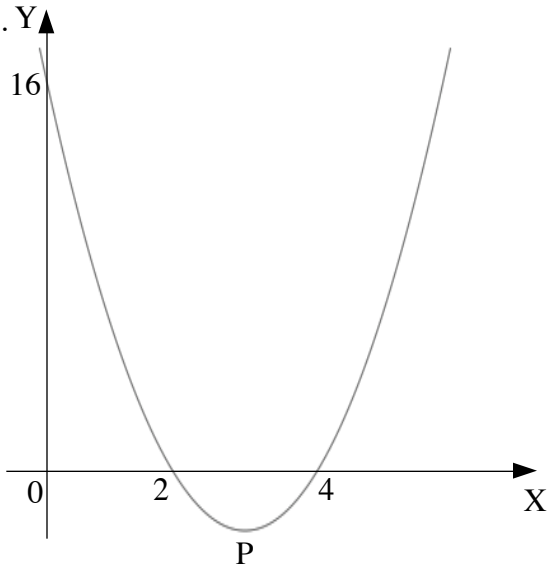


In each of the following the graph of a quadratic function is shown.
The points where the parabola meets the axes are given.
Point P is either the maximum or minimum turning point of the graph.

The equation of the graph is of the form $y = k(x-a)(x-b)$.
Write the equation of the graph in this form and find the coordinates of point P.

25.



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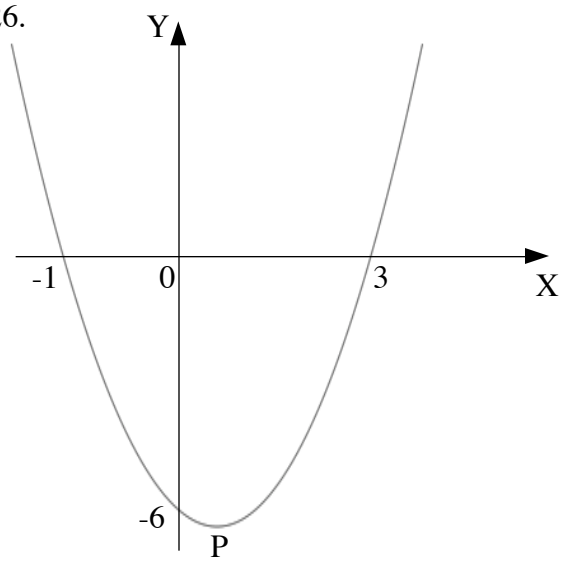

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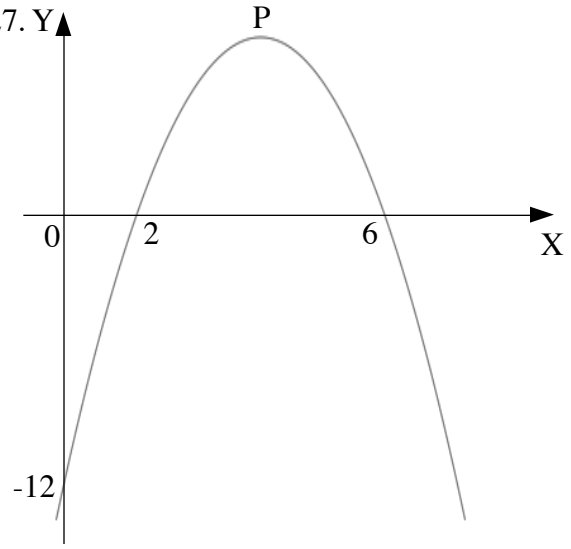

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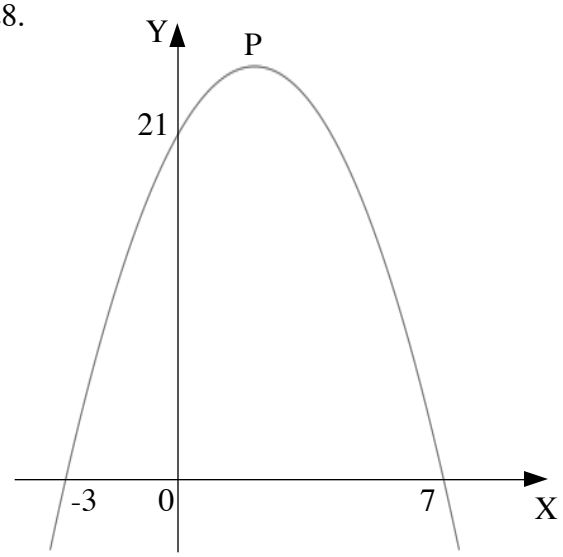
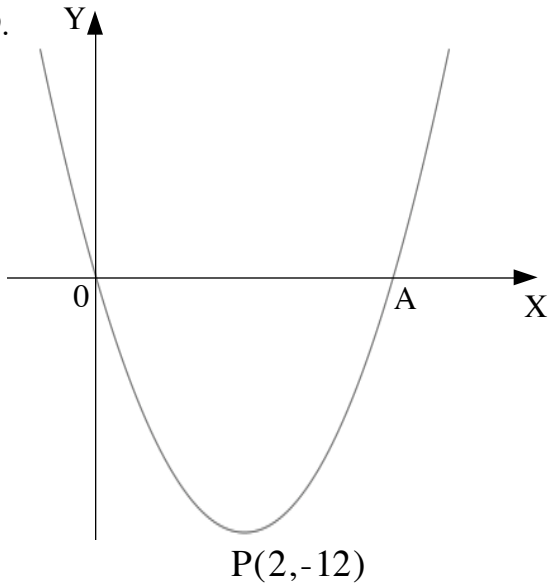


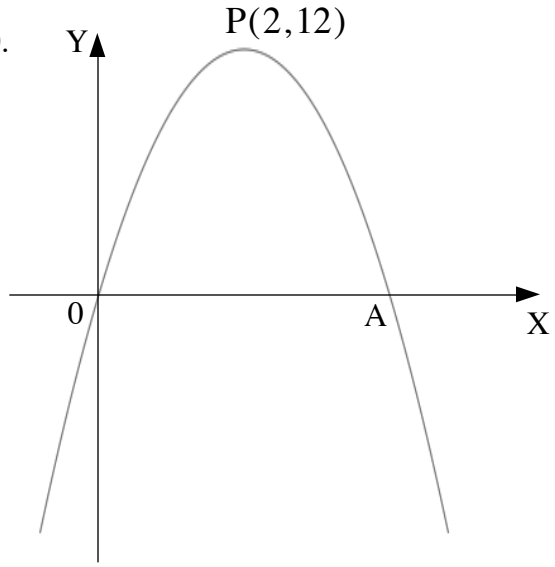
In each of the following the graph of a quadratic function is shown.
The parabola meets the x-axis at the origin O and point A.
Point P, either the maximum or minimum turning point of the graph, is given.
The equation of the graph is of the form $y = kx(x-a)$.

Find the coordinates of point A and write the equation of the graph.

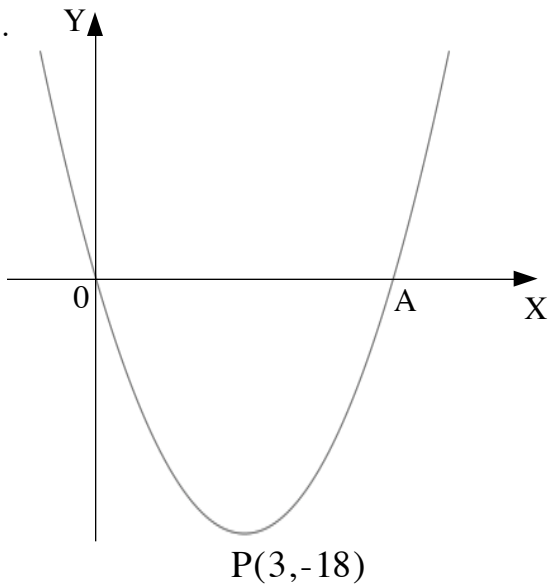
29.



30.



31.



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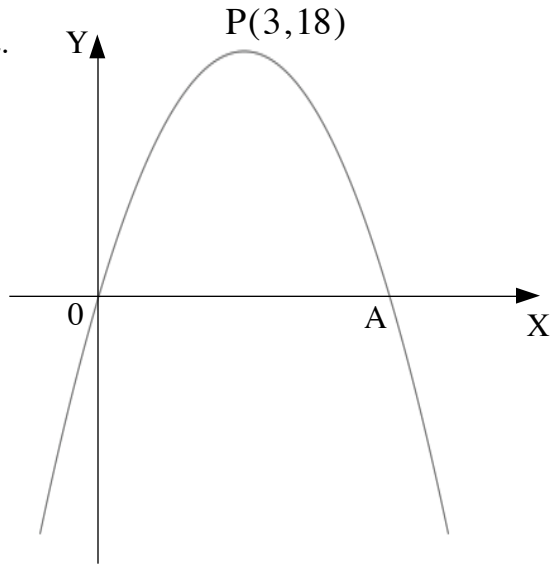

Answers

1.	A(1,0)	B(7,0)	C(0,7)	P(4,-9)
2.	A(-1,0)	B(5,0)	C(0,-5)	P(2,-9)
3.	A(1,0)	B(7,0)	C(0,-7)	P(4,9)
4.	A(-1,0)	B(5,0)	C(0,5)	P(2,9)
5.	A(-7,0)	B(-1,0)	C(0,7)	P(-4,-9)
6.	A(-5,0)	B(1,0)	C(0,-5)	P(-2,-9)
7.	A(-7,0)	B(-1,0)	C(0,-7)	P(-4,9)
8.	A(-5,0)	B(1,0)	C(0,5)	P(-2,9)
9.	A(-7,0)	B(1,0)	C(0,7)	P(-3,16)
10.	A(1,0)	B(5,0)	C(0,-5)	P(3,4)
11.	A(4,0)			P(2,-4)
12.	A(4,0)			P(2,4)
13.	A(4,0)			P(2,-8)
14.	A(4,0)			P(2,8)
15.	A(-4,0)			P(-2,-4)
16.	A(-4,0)			P(-2,4)
17.	A(-4,0)			P(-2,-8)
18.	A(-4,0)			P(-2,8)
19.	A(4,0)			P(2,-12)
20.	A(4,0)			P(2,12)
21.	$y = (x-2)(x-8)$		C(0,16)	P(5,-9)
22.	$y = (x+2)(x-6)$		C(0,-12)	P(2,-16)
23.	$y = (x+2)(x+8)$		C(0,16)	P(-5,-9)
24.	$y = (x+4)(x-2)$		C(0,-8)	P(-1,-9)
25.	$y = 2(x-2)(x-4)$			P(3,-2)
26.	$y = 2(x+1)(x-3)$			P(1,-8)
27.	$y = -1(x-2)(x-6)$			P(4,4)
28.	$y = -1(x+3)(x-7)$			P(2,25)
29.	A(4,0)	$y = 3x(x-4)$		
30.	A(4,0)	$y = -3x(x-4)$		
31.	A(6,0)	$y = 2x(x-6)$		
32.	A(6,0)	$y = -2x(x-6)$		