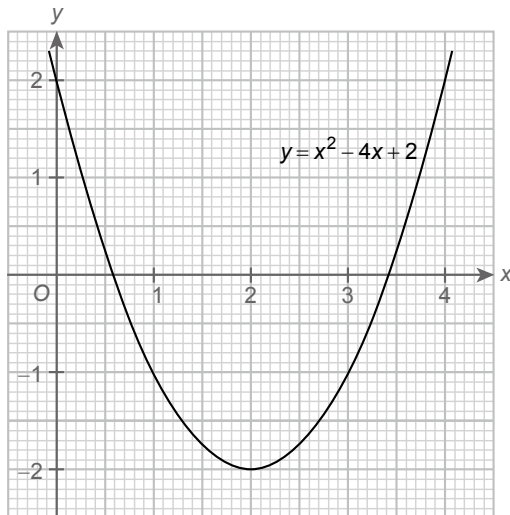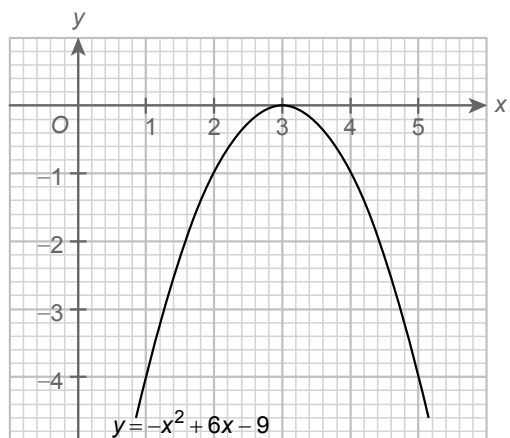## F.4 Mathematics
MC Exercise
4A4 Graphs of Quadratic Functions and their Applications

1. The figure shows the graph of $y = x^2 - 4x + 2$. Find the x-intercept(s) of the graph.
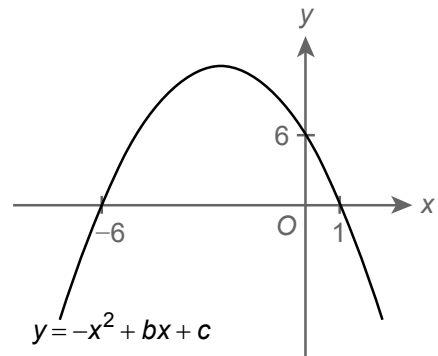

A. -2

B. 2

C. -2 and 2

D. 0.6 and 3.4 (corr. to 1 d.p.)

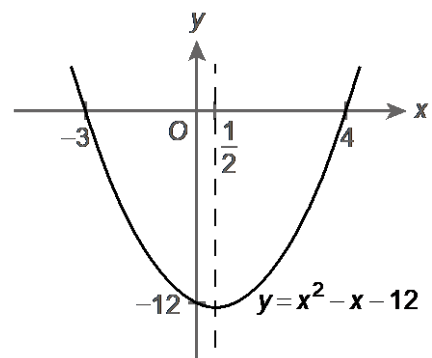2. The figure shows the graph of $y = -x^2 + 6x - 9$. Find the axis of symmetry of the graph.

A. $x = 0$

B. $y = 0$

C. $x = 3$

D. $y = 3$
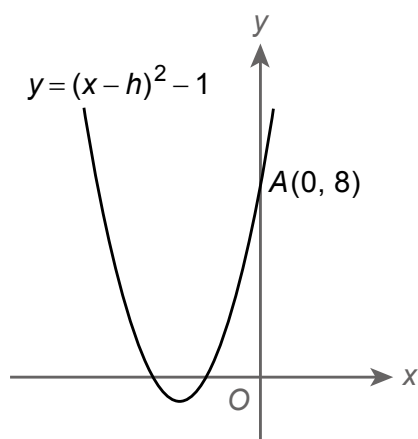
3. The figure shows the graph of $y = -x^2 + bx + c$.

Which of the following is a root of the quadratic equation $-x^2 + bx + c = 0$?

A. -1

B. 0

C. 1

D. 6

4. The figure shows the graph of $y = x^2 - x - 12$ and its axis of symmetry. Solve the equation $x(x+1) = 2(x+6)$ by the graphical method.
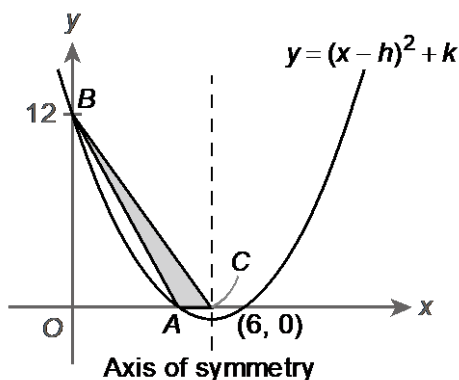

A. $x = \dfrac{1}{2}$

B. $x = 0$

C. $x = -12$

D. $x = -3$ or $x = 4$

5. In the figure, the graph of $y = (x-h)^2 - 1$ cuts the y-axis at $A(0, 8)$. Find the axis of symmetry.

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

$A(0, 8)$

A. $x = -2$

B. $x = -2\sqrt{2}$

C. $x = -3$

D. $x = -4$

6. In the figure, the graph of $y = (x-h)^2 + k$ cuts the x-axis at A and $(6, 0)$, and the y-axis at B. C is the intersection of the axis of symmetry and the x-axis. If the area of $\triangle ABC$ is 12 square units, find the coordinates of the vertex.


$y = (x-h)^2 + k$

12

B

C

O A $(6, 0)$

Axis of symmetry

A. $(3, -9)$

B. $(4, -4)$

C. $(4, -12)$

D. $(5, -1)$

**7.** Which of the following statements about the graph of $y = 2(x-2)^2 + 9$ is true?

A. The x-intercepts of the graph are -2 and 9.

B. The y-intercept of the graph is 9.

C. The axis of symmetry is $x = 2$.

D. The coordinates of the vertex are (9, 2).

8. The figure shows the graph of a quadratic function passing through the origin. If the coordinates of the vertex of the graph are (2, 8), find the function.
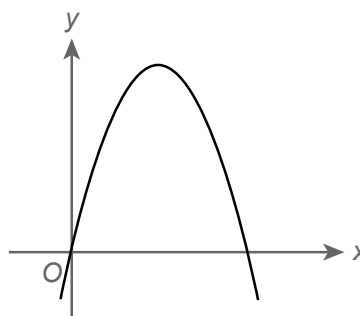
A. $y = -(x-2)^2 + 8$

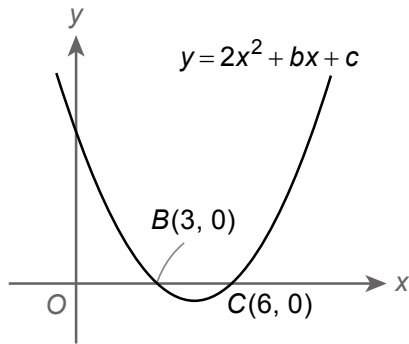B. $y = -2(x+2)^2 + 8$

C. $y = -2(x-2)^2 + 8$

D. $y = -(x-2)^2 - 8$

9. In the figure, the quadratic graph cuts the x-axis at $A(-2, 0)$ and $B(1, 0)$, and the y-intercept is -1.

$A(-2, 0)$ O $B(1, 0)$

-1
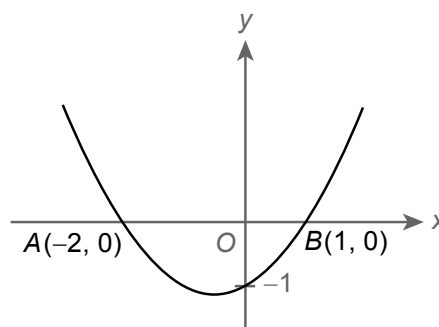
Which of the following is the equation of the graph?

A. $y = 2(x+2)(x-1)$

B. $y = \dfrac{1}{2}(x+2)(x-1)$

C. $y = 2(x-2)(x+1)$

D. $y = \dfrac{1}{2}(x-2)(x+1)$

10. In the figure, the graph of $y = 2x^2 + bx + c$ cuts the x-axis at $B(3, 0)$ and $C(6, 0)$. Find the y-intercept of the graph.


A. 18
B. 36
C. 54
D. 72

11. If the vertex of the graph of $y = 3x^2 + kx + 48$ lies on the x-axis and k is a constant, find the value(s) of k.

A. 24
B. 24 or -24
C. 12
D. 12 or -12

12. If $2x^2 - 4x + 3k > 0$ for any real number x, where k is a constant, find the range of values of k.

A. $k < \dfrac{3}{2}$

B. $k < \dfrac{2}{3}$

C. $k > \dfrac{3}{2}$

D. $k > \dfrac{2}{3}$

13. In the figure, the graph of $y = ax^2 + 4x + c$ touches the x-axis. Find the y-intercept of the graph.
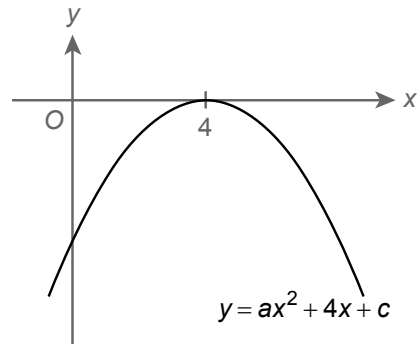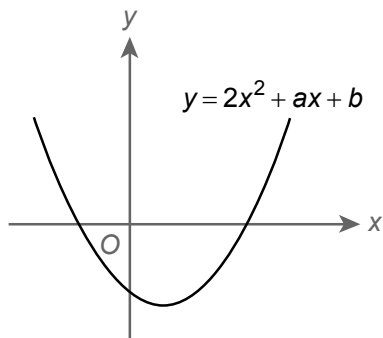

A. $-\dfrac{1}{2}$

B. -4

C. -8

D. -16

14. The figure shows the graph of $y = a(x - h)^2 + k$.
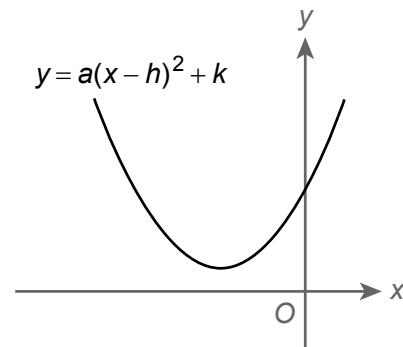
Which of the following are true?

I. $k > 0$

II. The coordinates of the vertex are $(-h, k)$.

III. $\dfrac{a}{h} < 0$

A. I and II only
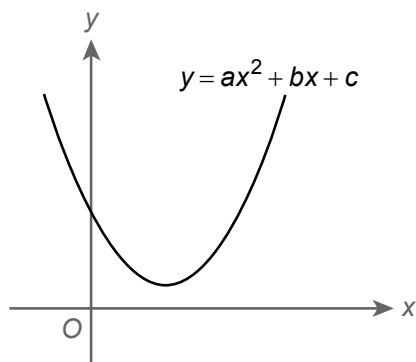B. I and III only
C. II and III only
D. I, II and III

15. The figure shows the graph of $y = 2x^2 + ax + b$.

Which of the following is true?

A. $a < 0$ and $b < 0$

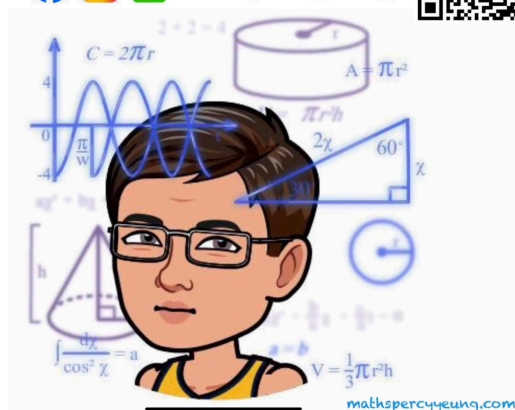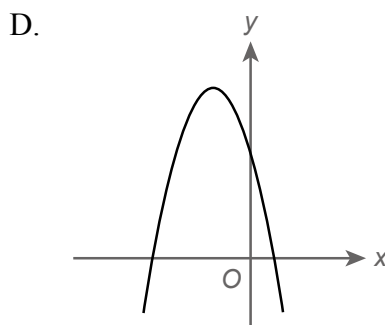B. $a < 0$ and $b > 0$
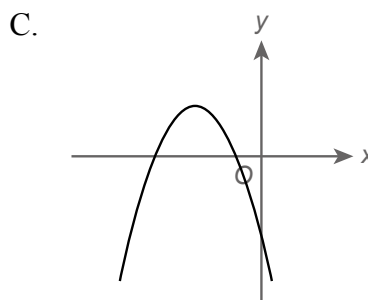
C. $a > 0$ and $b < 0$

D. $a > 0$ and $b > 0$

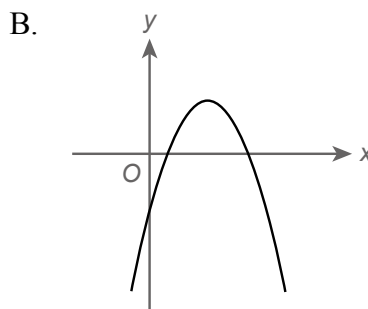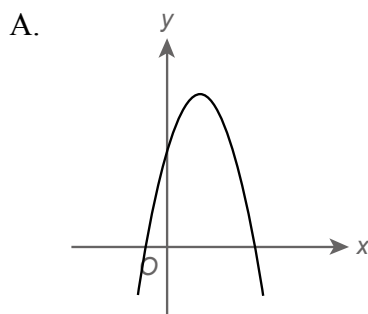**16.** The figure shows the graph of $y = ax^2 + bx + c$.
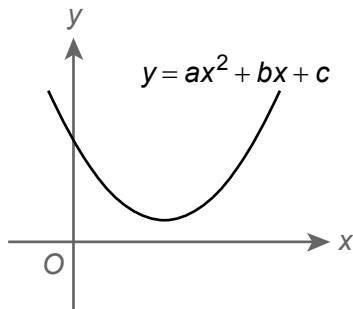

Which of the following is/are true?

I. $a > 0$

II. $b > 0$

III. $b^2 - 4ac > 0$

A. I only

B. II only

C. I and II only

D. I and III only

17. Which of the following may represent the graph of $y = ax^2 + bx + c$ where $a < 0$, $b < 0$ and $c > 0$?

A.

B.

C.

D.

18. The figure shows the graph of $y = ax^2 + bx + c$.

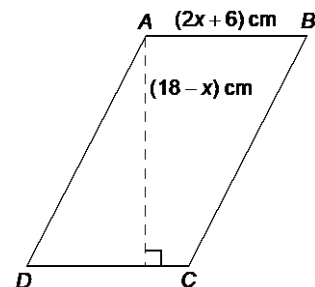Which of the following may represent the graph of $y = cx^2 + ax + b$?

A.

B.

C.

D.

19. If the minimum value of $y = x^2 - 2x + k + 2$ is -4, where k is a constant, then $k =$

   A. -5.
   B. -6.
   C. -7.
   D. -8.

20. Which of the following have the same minimum value?

   I. $y = (3 - x)^2 - 10$
   II. $y = x^2 + 4x - 6$
   III. $y = 4x^2 + 4x + 11$

   A. I and II only
   B. I and III only
   C. II and III only
   D. I, II and III

21. The figure shows a parallelogram $ABCD$. Find the maximum area of $ABCD$.

   A. 216 cm^2
   B. 220.5 cm^2
   C. 229.5 cm^2
   D. 441 cm^2

22. The difference between two numbers is 8. Which of the following is a possible value of the sum of the squares of these two numbers?

   A. 40
   B. 30
   C. 20
   D. 10

23. In the figure, the straight line L cuts the x-axis and the y-axis at P and Q respectively. If $PQ = 12$ and $OP = \sqrt{2a}$, find the maximum area of $\triangle OPQ$.
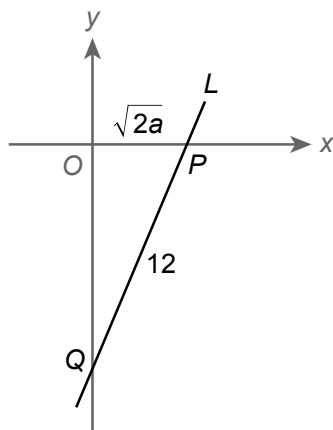

A. 18 square units

B. 36 square units

C. 72 square units

D. 144 square units

24. The figure shows an isosceles triangle ABC with $AB = AC$. It is given that the area of $\triangle ABC$ is 400 cm^2 and its height is 20 cm. $PQRS$ is a rectangle with vertices P, Q, R and S lying on the sides of $\triangle ABC$. Find the maximum area of rectangle $PQRS$.
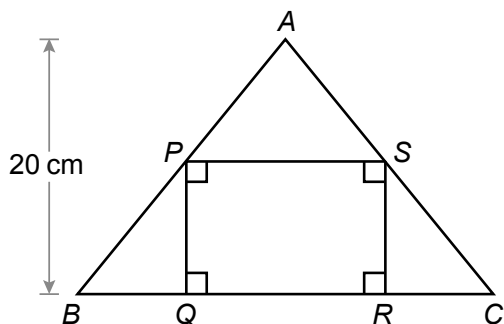
A. 100 cm^2

B. 150 cm^2

C. 200 cm^2

D. 250 cm^2

25. In the figure, $ABCD$ is a rectangular frame formed by wooden sticks. A wooden stick FH is placed in the middle of AB and CD, and a wooden stick EG is placed on AD and FH such that $AEGF$ is a square. It is known that the total length of the wooden sticks is 270 cm. Find the maximum area of $ABCD$.
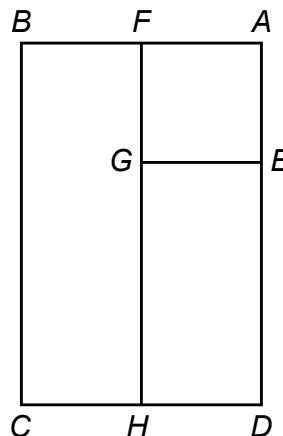
A. $2\,430 \text{ cm}^2$

B. $3\,030 \text{ cm}^2$

C. $4\,075 \text{ cm}^2$

D. $6\,075 \text{ cm}^2$