568436 - Mathematics

Guide

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2- Correction key

1	C

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6 The maximum height reached by the rocket is 75 metres.

7 The rule of correspondence that defines the parabola is $y=1/6(x-8)^2-6$

or $x^2 - 16x - 6y + 28 = 0$

or $y = \frac{1}{6}\left(x^2 - 16x + 28\right)$

or $y = \frac{1}{2}x^2 - \frac{8}{3}x + \frac{14}{3}$

or any equivalent rule of correspondence.

8 The maximum height attained by the ball is 48 m.

9 At the moment the player hits the ball, the distance between the ball and the wall is 6.4 m.

10 Example of an appropriate method

Rule of the function

x: time in minutes

f(x) = altitude in metres

$f(x) = a(x - h)^2 + k$

$f(x) = a(x - 3)^2 + 10$

$f(8) = 0$ then $0 = a(8 - 3)^2 + 10$

$0 = a(25) + 10$

$\frac{-10}{25} = a$

$-0.4 = a$

$f(x) = -0.4(x - 3)^2 + 10$

***y*-intercept**

$f(0) = -0.4(0 - 3)^2 + 10 = 6.4$

Answer The balcony is located 6.4 m off the ground.

11 Example of an appropriate solution

Equation of the parabola

According to the table of values, the coordinates of the vertex of the parabola are S(29, 150).

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

$y = a(x - 29)^2 + 150$

$54 = a(9 - 29)^2 + 150$

$-96 = 400a$

$-0.24 = a$

The equation of the parabola is $y = -0.24(x - 29)^2 + 150$.

Launching point

If $y = 0$, then $0 = -0{,}24(x - 29)^2 + 150$ Hence, $x = 4$ and $x = 54$

Since the launching point is to the left of the vertex of the parabola, the coordinates of the launching point are $x = 4$ and $y = 0$.

Position of the rocket when it exploded

If $y = 96$, then $96 = -0.24(x - 29)^2 + 150$ Hence, $x = 14$ or $x = 44$

Since the position of the rocket when it exploded is the right of the vertex of the parabola, the coordinates of the position of the rocket when it exploded are $x = 44$ and $y = 96$.

Position of the fountain

Since the rocket exploded 96 m above the fountain, the coordinates of the position of the fountain are $x = 44$ and $y = 0$.

Distance between the launching point and the fountain

$44 - 4 = 40$ m

Answer The distance between the point from which the rocket was launched and the fountain is 40 m.

12 Example of an appropriate method

Coordinates of point B

The axis of symmetry of the parabola representing f is $x = 3$.

Since the coordinates of A are A(0, 0), the coordinates of B are B(6, 0).

Rule of g

Since the zeros of function g are 6 and 10, the equation of the axis of symmetry of the parabola representing g is $x = 8$.

The coordinates of the vertex are h = 8 and k = 4.

$g(x) = a(x - 8)^2 + 4$

$0 = a(6 - 8)^2 + 4$

$0 = 4a + 4$

$-4 = 4a$

$-1 = a$

$g(x) = -1(x - 8)^2 + 4$

Answer: The rule of the function g is $g(x) = -(x - 8)^2 + 4$.

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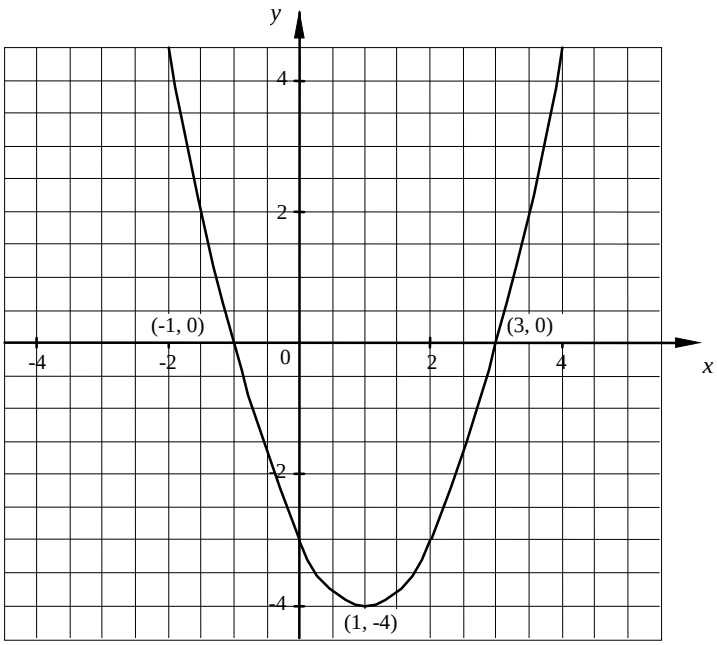
Question Booklet

1 The parabola represented below crosses the x-axis at the points (-1, 0) and (3, 0) and its vertex is the point P(1, -4).



Among the following equations, which one represents the parabola graphed above?

A) $y = 2x^2 + 2x - 3$

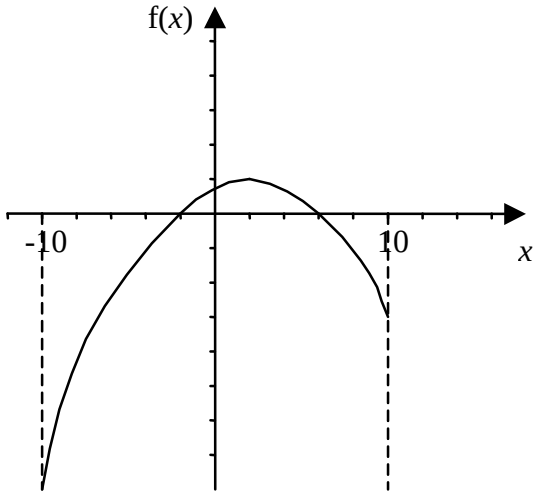
B) $y = x^2 + 2x - 3$

C) $y = x^2 - 2x - 3$

D) $y = -x^2 - 2x + 3$

2

The graph at the right illustrates a function defined in the interval [-10, 10].



For what values of x is $f(x) \geq 0$?

A) [-10, 10]

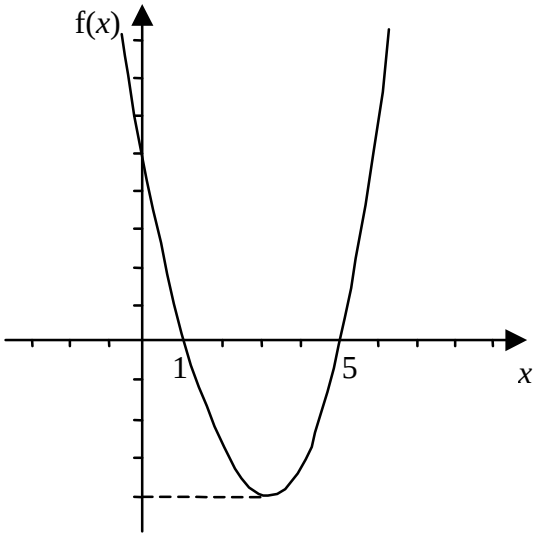
B) [-10, -2] ∪ [6, 10]

C) -∞, -2] ∪ [6, +∞

D) [-2, 6]

3

The parabola shown in the Cartesian plane intersects the *x*-axis at points (1, 0) and (5, 0) and the *y*-axis at (0, 5).



What is the rule of correspondence of this parabola?

A) $f(x) = x^2 - x + 5$

B) $f(x) = -x^2 + 6x - 5$

C) $f(x) = x^2 - 6x + 5$

D) $f(x) = -x^2 + x + 5$

4 An analysis of the value of a share bought for \$2.00 shows that, during the first 6 months, its value (v) changed according to the following rule:

$$v(t) = -\frac{1}{4}t^2 + 2t + 2$$

where *t* represents the number of months since the share was purchased.

What was the maximum value of the share during this period?

A) \$4.00

B) \$5.75

C) \$6.00

D) \$12.00

5 Given the real function defined by $f(x) = x^2 - 2x + 1$. How many zeros does this function have?

A) None

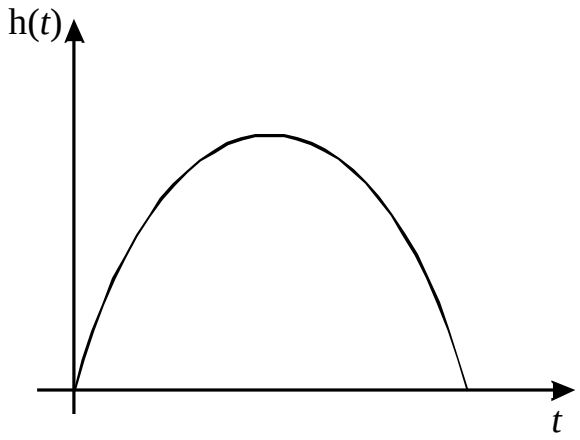
B) One

C) Two

D) An infinite number

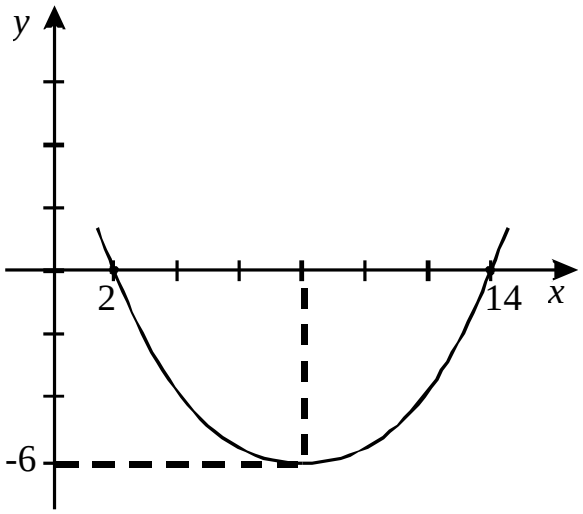
6 The trajectory of a miniature rocket is defined by the equation $h(t) = -3t^2 + 30t$ where t represents the number of seconds elapsed since launching the rocket and $h(t)$ represents the height of the rocket in metres.

This situation is graphed below.



What is the maximum height reached by this rocket?

7 An engineer sketched a parabola in the Cartesian plane.



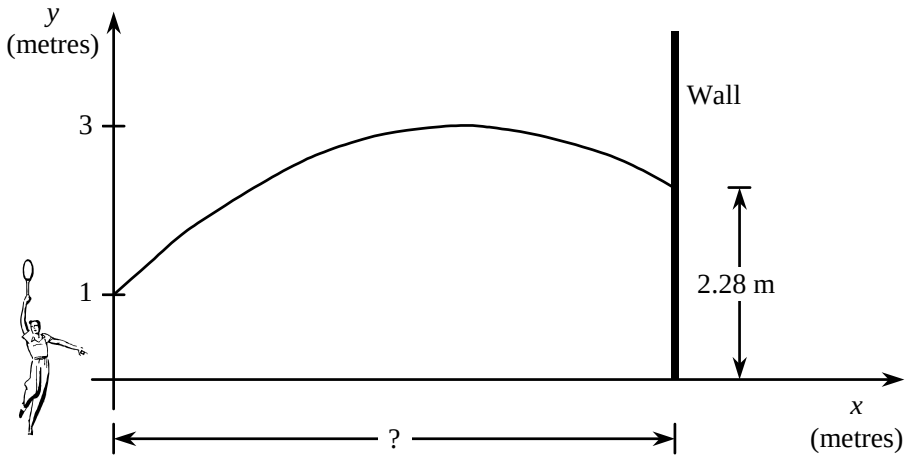
Which rule of correspondence defines this parabola?

8 The polynomial function $h(t) = 24t - 3t^2$ describes the height $h(t)$ of a ball (in metres) at time t (in seconds).

What is the maximum height attained by the ball?

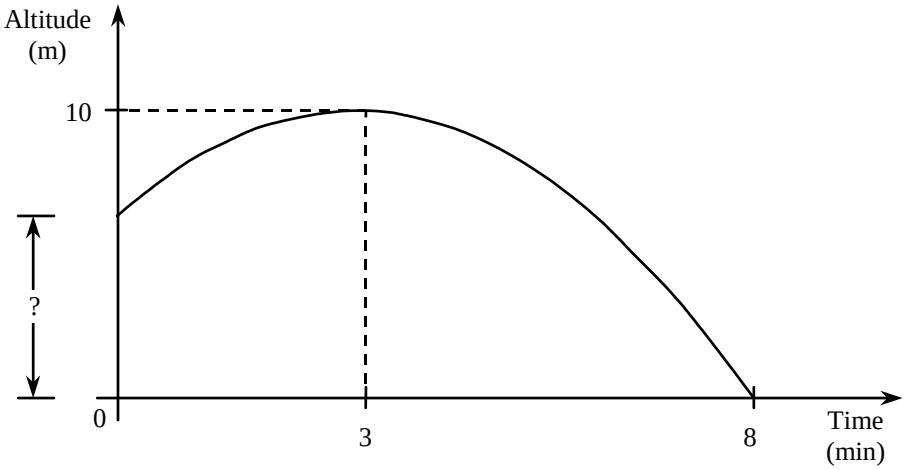
9 A tennis player hits a ball against a wall. At the moment the player hits the ball, it is 1 m above the ground. The ball reaches a maximum height of 3 m. On its way down, the ball hits the wall at a point 2.28 m above the ground. The side view of the ball's trajectory is illustrated below.

The rule representing this trajectory is $f(x) = -\frac{1}{8}(x-4)^2 + 3$.



At the moment the player hits the ball, what is the distance between the ball and the wall?

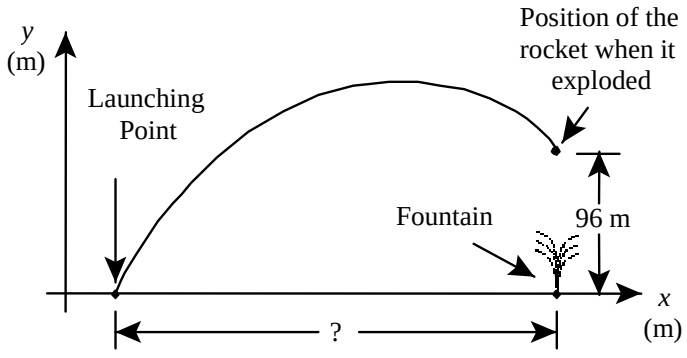
10 Melanie was playing with a remote-controlled toy airplane. The plane took off from a balcony and landed on the ground 8 minutes later. Three minutes after taking off, the plane reached a maximum altitude of 10 metres. In the graph below, the plane's altitude as a function of time is represented by a portion of a parabola.



How high off the ground is the balcony located?

11 A rocket was launched during a fireworks show. The side view of the rocket's parabolic trajectory is represented by the following table of values and graph.

x (metres)	*y* (metres)
9	54
19	126
29	150
39	126

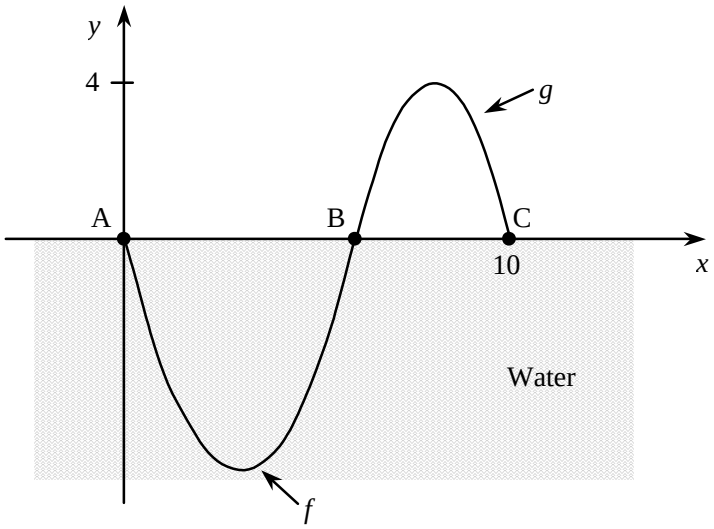


The rocket exploded 96 m above a fountain.

What is the distance between the point from which the rocket was launched and the fountain?

12 The following graph represents the side view of the path of a dolphin as it performs a trick during a show at an aquarium. This path is composed of portions of two parabolas associated with function *f* and *g* respectively.

The scale of the graph is in metres.



The rule $f(x) = \frac{5}{9}(x-3)^2 - 5$ represents the dolphin's path when it is in the water.

When it is out of the water, the dolphin reaches a maximum height of 4 metres. The distance between points A and C is 10 metres.

What is the rule of the function *g*?