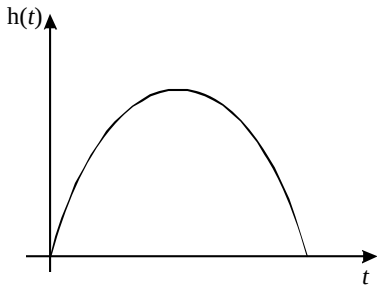
Quadratic Function Practice B Name: _____

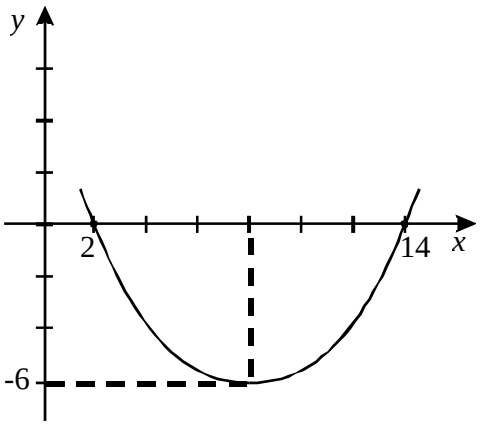
1 The trajectory of a miniature rocket is defined by the equation $h(t) = -3t^2 + 30t$ where t represents the number of seconds elapsed since launching the rocket and $h(t)$ represents the height of the rocket in metres.

This situation is graphed below.



What is the maximum height reached by this rocket?

2 An engineer sketched a parabola in the Cartesian plane.



Which rule of correspondence defines this parabola?

3 A company's profits and losses R can be represented by the equation $R(x) = x^2 - 10x + 21$ where x is the number of months since the start of the year.

For how many months did the company incur losses?

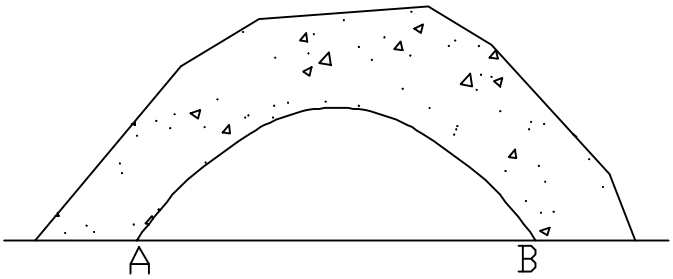
4 The polynomial function $h(t) = 24t - 3t^2$ describes the height $h(t)$ of a ball (in metres) at time t (in seconds).

What is the maximum height attained by the ball?

5 The cross section of a tunnel has the shape of a parabola defined by this rule of correspondence

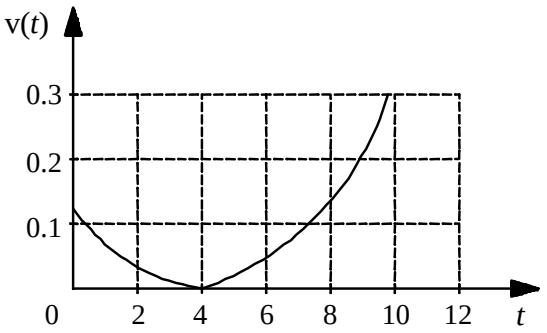
$$x^2 = -\frac{5}{2}(y - 2)$$

where x and y represent distances in metres.



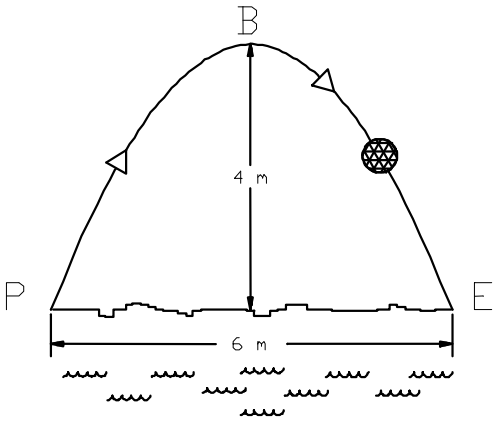
If segment AB coincides with the x-axis, what is the width of the tunnel?

6 The volume (v) of water varies between 0 °C and 10 °C as a function of the temperature (t) as shown on the adjacent graph.



Find the temperature interval in which the function describing the volume of water decreases.

7 Pascal (P) and Elaine (E) are playing with a ball in the swimming pool. The following diagram shows the parabolic trajectory of the ball thrown by Pascal.

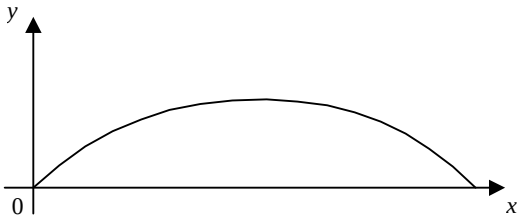


What is the rule of correspondence of this trajectory if point P is at the origin of the coordinate system, point B is the maximum height of the ball and point E has coordinates (6, 0)?

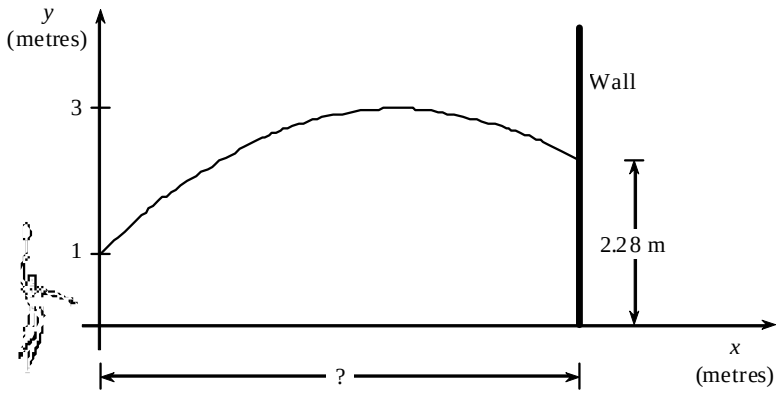
8 The trajectory of a ball thrown from Marie to Louise is parabolic. This trajectory is illustrated in the Cartesian plane below.

The distance between Marie and Louise is 12 m and the maximum height reached by the ball is 4 m.

What rule of correspondence defines the parabola?



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.

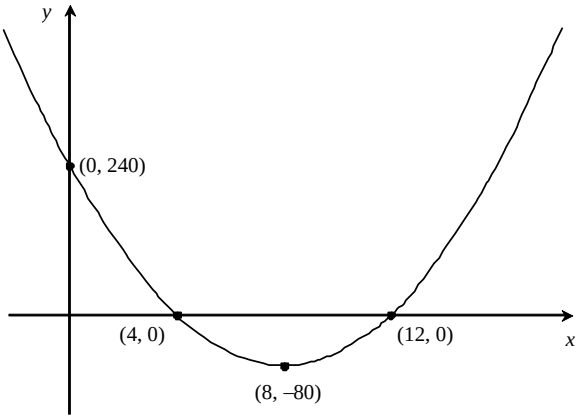


The rule representing this trajectory is

$f(x) = -\frac{1}{8}(x-4)^2 + 3$.

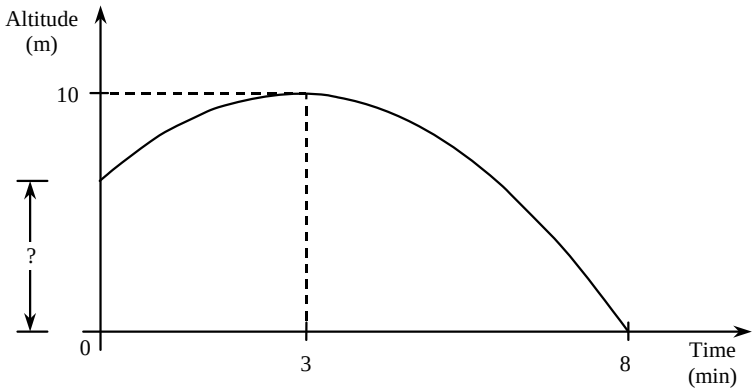
At the moment the player hits the ball, what is the distance between the ball and the wall?

10 In the Cartesian plane below, function g is represented by a parabola. The graph indicates the coordinates of four points of the parabola.



What is the rule of function g?

11 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?

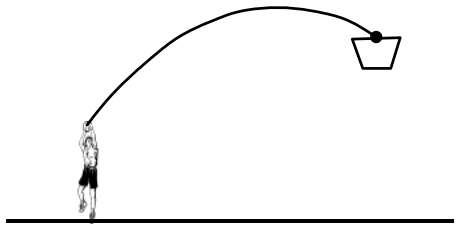
12 Caroline throws a ball toward a basket located 3 m above the ground.

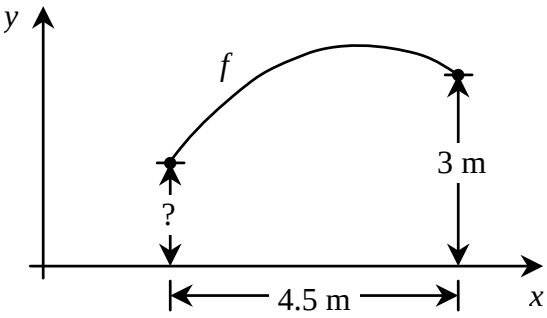
The ball reaches a maximum height. On its way down, it enters the basket.

In the Cartesian plane on the right, the side view of the ball's trajectory is represented by function *f*. The scale of this graph is in metres.

The rule associated with function *f* is $f(x) = -0.2(x - 5)^2 + 3.45$.

The horizontal distance between Caroline and the location of the basket is 4.5 m.





At the moment that Caroline throws the ball, what is the distance between the ball and the ground?

13 Functions *f* and *g* are represented by parabolas in the Cartesian plane below.

The parabola that represents function *f* passes through points B and C. The parabola that represents function *g* passes through points B and A. Point A is the vertex of the parabola that represents function *g*.

Point B is located on the *y*-axis. Point C is located on the *x*-axis.

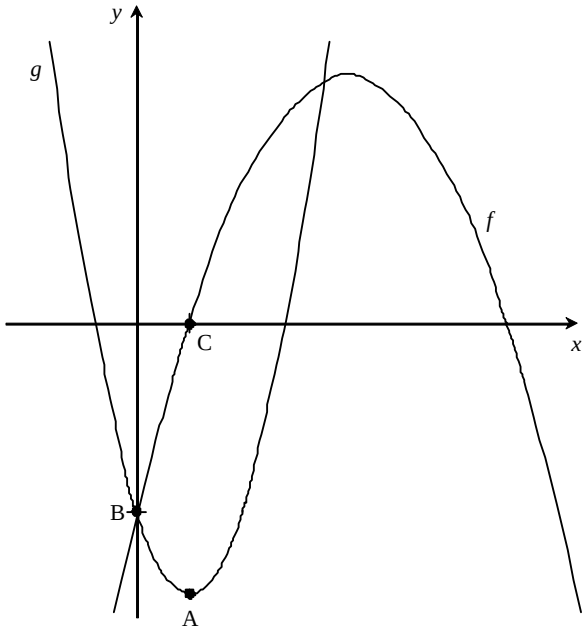
The rule of function *f* is $f(x) = -0.25x^2 + 4x - 7$.

The *x*-coordinate of point A is the same as the *x*-coordinate of point C.

The minimum of function *g* is -10.

What is the rule of function *g*?

Show all your work.



Quadratic Function Practice B Answers

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

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

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.

3 The company incurred losses for 4 months.

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

5 The width AB of the tunnel is 6 m.

6 The function decreases during the interval]0, 4] or]0, 4[.

7 The rule of correspondence of the trajectory is $y = \frac{-4}{9}\left(x^2 - 6x\right)$

8 The rule of correspondence that defines the parabola is $y = \frac{-1}{9}\left(x - 6\right)^2 + 4$

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

10 The rule of function g is $g(x) = \mathbf{5(x - 8)^2 - 80}$.

11 **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.

12 **x-coordinate of the location of the basket**

y-coordinate of the location of the basket: 3

$$-0.2(x-5)^2 + 3.45 = 3$$
$$-0.2(x-5)^2 = -0.45$$
$$(x-5)^2 = 2.25$$
$$x - 5 = -1.5 \quad \text{or} \quad x - 5 = 1.5$$
$$x = 3.5 \qquad\qquad x = 6.5$$

Since the basket is located to the right of the vertex of the parabola, $x = 6.5$.
x-coordinate of the location of the basket: 6.5

y-coordinate of the location of the ball at the moment Caroline throws it

x-coordinate of the location of the ball at the moment Caroline throws it: $6.5 - 4.5 = 2$

$$f(2) = -0.2(2-5)^2 + 3.45 = 1.65$$

y-coordinate of the location of the ball at the moment Caroline throws it: 1.65

Answer: At the moment that Caroline throws the ball, the distance between the ball and the ground is **1.65** m.

13 x-coordinate of point C

$$0 = -0.25x^2 + 4x - 7$$
$$0 = -0.25(x^2 - 16x + 28)$$
$$0 = (x-2)(x-14)$$
$$x = 2 \quad \text{or} \quad x = 14$$

The x-coordinate of point C is 2.

The x-coordinate of point A is the same as the x-coordinate of point C (i.e. 2).
The y-coordinate of point A is -10. Coordinates of point A A(2, -10)

x-coordinate of point B: 0
y-coordinate of point B: $f(0) = -7$ Coordinates of point B B(0, -7)

Rule of function g

$$g(x) = a(x-2)^2 - 10$$
$$-7 = a(0-2)^2 - 10$$
$$-7 = 4a - 10$$
$$\frac{3}{4} = a$$
$$g(x) = \frac{3}{4}(x-2)^2 - 10$$

Answer: The rule of function g is $g(x) = \frac{3}{4}(x-2)^2 - 10$