Applications of Quadratic Functions Worksheet

Name KEY

Solve each problem as indicated.

1. An object is dropped from the top of a building. The building is 480 feet tall. The function $\boldsymbol{f(t) = -16t^2 + 480}$ gives the height of the object after t seconds of falling. How long will it take the object to reach the ground?

   $t = \sqrt{30} \approx 5.5$ sec.

2. The initial upward velocity of a volleyball is 6 meters per second when leaving the server's hand 1.5 m above the floor. A model for the vertical motion of a projected object is given by the equation $\boldsymbol{h = -4.9t^2 + vt + s}$, where h is the height in meters, t is the time in seconds, v is the initial velocity in meters per second, and s is the starting height of the object in meters. If nobody else touches it, when will it hit the floor?

   $0 = -4.9t^2 + 6t + 1.5$ $\quad$ $t = \cancel{-0.21}$ ← EXTRANEOUS

   $t = 1.44$

3. The height in feet of a rocket after t seconds is given by the equation $\boldsymbol{h(t) = 256t - 16t^2}$. After how many seconds will the rocket return to the ground?

   $0 = 256t - 16t^2$ $\quad$ $t = 16$ sec.

   $0 = -16t^2 + 256t + 0$

4. A rocket is launched with an initial velocity of 107 feet per second from the top of a cliff 63 feet high. Its height is described by $\boldsymbol{h(t) = -16t^2 + 107t + 63}$. How long will the rocket take to hit the ground?

   $t = -0.544$ ← EXTRANEOUS

   $t = 7.23$ ← SOLUTION

5. A rock is thrown skyward from a cliff. The vertical distance in feet between the ground and the rock t seconds after it is thrown can be determined by the equation $\boldsymbol{d(t) = -16t^2 - 6t + 482}$. How long will the rock take to hit the ground?

   $t = -5.68$ ← EXTRANEOUS

   $t = 5.3$ ← SOLUTION

6. At a baseball training camp, a computer system plots the paths of balls hit during sessions at the batting cage and generates equations for those paths. The path of a ball hit by David is described the equation $\boldsymbol{h(t) = 48 + 4t - 4t^2}$ Find how long it would take the ball to hit the ground in an open field.

   $t = -3$ ← EXTRANEOUS

   $0 = -4t^2 + 4t + 48$ $\quad$ $t = 4$ ← SOLUTION

7. A baseball throwing machine is being used to help players catch pop flies. The machine shoots the ball straight in the air. The height of the ball after *t* seconds is found by the function $h(t) = -16t^2 + 48t + 4$. After approximately how many seconds does the ball reach its maximum height? What is the maximum height the ball reaches?

$t = \frac{-b}{2a} = \frac{-48}{2(-16)} = \frac{-48}{-32} = 1.5$ (SECONDS TO REACH MAX)

$h(1.5) = -16(1.5)^2 + 48(1.5) + 4 = 40$ ft

8. The height in feet of a rocket after *t* seconds is given by the function $h(t) = -16t^2 + 256t$. After how many seconds does the rocket reach its maximum height? What is the maximum height?

$t = \frac{-256}{2(-16)} = \frac{-256}{-32} = 8$ (SECONDS TO REACH MAX)

$h(8) = -16(8)^2 + 256(8) = 1024$

9. The height (in feet) of a ball thrown by a child is given by: $y = -\frac{1}{2}x^2 + 2x + 4$, where x is the horizontal distance (in feet) from where the ball is thrown. How high is the ball when it leaves the child's hand? (find y when x = 0). How high is the ball when it is at its maximum height? How far from the child does the ball land? (x value when y = 0)

$y = -\frac{1}{2}(0)^2 + 2(0) + 4$

$y = 4$ ft

(WHEN IT LEAVES THEIR HAND)

$x = \frac{-b}{2a} = \frac{-2}{2(-\frac{1}{2})}$

$= 2$

MAX HEIGHT

$y = \frac{-1}{2}(2)^2 + 2(2) + 4 = \boxed{6}$

$0 = -\frac{1}{2}(x)^2 + 2x + 4$

$x = 5.464$ ft

10. The path of a diver is given by $y = -\frac{4}{9}x^2 + \frac{24}{9}x + 12$ where *y* is the height in feet and x is the horizontal distance from the end of the diving board in feet. What is the maximum height of the dive?

11. Punted Football The height of a punted football can be modeled with the quadratic equation $h = -0.01x^2 + 1.18x + 2$. The horizontal distance in feet from the point of impact with the kicker's foot is **x**, and the height of the ball in feet is ***h***.

a. Find the vertex of the graph of the function.

b. What is the maximum height of the punt?

c. The nearest defensive player is 5 ft horizontally from the point of impact. How high must the player reach to block the punt?