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Quadratics Unit Re-engagement Problems

1. The equation for the projectile's height $h(t)$ at time t seconds after launch is $h(t) = -4.9t^2 + 19.6t + 58.8$, where height is in meters.

a. When does the object strike the ground?

$$x = \frac{-19.6 \pm \sqrt{(19.6)^2 - 4(-4.9)(58.8)}}{2(-4.9)}$$

$$x = \frac{-19.6 \pm \sqrt{1536.64}}{-9.8}$$

$$x = \frac{-19.6 \pm 39.2}{-9.8}$$

$$x = \frac{-19.6 + 39.2}{-9.8} \qquad x = \frac{-19.6 - 39.2}{-9.8}$$

$x = -2$ $\qquad$ $x = 6$

In 6 seconds

b. What is the object's maximum height?

$$x = \frac{-19.6}{2(-4.8)}$$

$$x = \frac{-19.6}{-9.6}$$

$x \approx 2.041\overline{6}$

$$f(2.04) = -4.9(2.04)^2 + 19.6(2.04) + 58.8$$

$$= 78.39$$

About 78.4 meters

c. When does the object reach its maximum height?

About 2 seconds after it is launched.

d. From what height was the projectile launched?

58.8 meters above ground.

2. Jack draws a rainbow which is a parabola that has the equation $y = -0.1(x - 1)^2 + 6$, where x and y are measured in centimeters.

a. How tall is the rainbow?

The rainbow is 6 centimeters tall.

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b. How far away are the end points of the rainbow from one another?

$y = -0.1(x-1)^2 + 6$

$y = -0.1(x-1)(x+1) + 6$

$y = -0.1(x^2 - 2x + 1) + 6$

$y = -0.1x^2 + 0.2x - 0.1 + 6$

$y = -0.1x^2 + 0.2x + 5.9$

$x = \frac{-0.2 \pm \sqrt{(0.2)^2 - 4(-0.1)(5.9)}}{2(-0.1)}$

$x = \frac{-0.2 \pm \sqrt{2.4}}{-0.2}$

$x = \frac{-0.2 + \sqrt{2.4}}{-0.2}$ $\quad$ $x = \frac{-0.2 - \sqrt{2.4}}{-0.2}$

$x \approx -6.75$ $\quad$ $x \approx 8.75$

About 15.5 centimeters

3. You and a friend are hiking in the mountains. You want to climb to a ledge that is 10 ft. above you. The height of the grappling hook you throw is given by the function $h(t) = (-8t + 15)(2t + 1)$.

a. What is the maximum height of the grappling hook? Can you throw it high enough to reach the ledge?

$h(t) = (-8t + 15)(2t + 1)$

$h(t) = -16t^2 - 8t + 30t + 15$

$h(t) = -16t^2 + 22t + 15$

$h(0.6875) = -16(0.6875)^2 + 22(0.6875) + 15$

$= 22.5625$

$x = \frac{-22}{2(-16)}$

$x = \frac{-22}{-32}$

$x = 0.6875$

About 22.5 feet.

Yes!