Algebra 1 | Unit 9 – Quadratic Equations | Name: Key | Practice

Day 9 – Quadratic Applications
Practice Assignment

1. The height of a ball in feet x seconds after it is thrown is given by $f(x) = -16x^2 + 32x + 5$.

a. When will the ball reach the ground? $f(x)=0$

$0 = -16x^2 + 32x + 5$

① $b^2 - 4ac = (32)^2 - 4(-16)(5) = 1344$

② $x = \frac{-b \pm \sqrt{1344}}{2a} = \frac{-32 \pm \sqrt{1344}}{2(-16)} = \frac{-32 \pm 36.66}{-32}$

$\frac{-32 + 36.66}{-32} = \cancel{-0.15}$ disregard negative time

$\frac{-32 - 36.66}{-32} = 2.15$

• It will take 2.15 seconds to reach the ground. •

b. When will the ball reach a height of 7 feet? $f(x)=7$

$7 = -16x^2 + 32x + 5$
$-7 \qquad\qquad\qquad -7$

$0 = -16x^2 + 32x - 2$

① $b^2 - 4ac = (32)^2 - 4(-16)(-2) = 896$

② $x = \frac{-b \pm \sqrt{896}}{2a} = \frac{-32 \pm \sqrt{896}}{2(-16)} = \frac{-32 \pm 29.93}{-32}$

$\frac{-32 + 29.93}{-32} = .06$

$\frac{-32 - 29.93}{-32} = 1.94$

• At 0.06 and 1.94 seconds, the ball will be 7 feet high. •

2. The fuel economy in miles per gallon of a certain vehicle is given by $f(x) = -0.01x^2 + 1.2x - 5.8$, where x is the car's speed in miles per hour. For what speed(s) does the car have a fuel economy of 22 miles per gallon? $f(x)=22$

$22 = -0.01x^2 + 1.2x - 5.8$
$-22 \qquad\qquad\qquad -22$

$0 = -0.01x^2 + 1.2x - 27.8$

① $b^2 - 4ac = (1.2)^2 - 4(-0.01)(-27.8) = 0.328$

② $x = \frac{-1.2 \pm \sqrt{0.328}}{2(-0.01)} = \frac{-1.2 \pm 0.57}{-0.02}$

→ 31.5 miles per hour

→ 88.5 miles per hour

• If a car goes about 32 mph or 89 mph, it gets 22 miles per gallon. •

3. A foul ball leaves the end of a baseball bat and travels according to the formula $h(t) = -16t^2 + 64t$ is the height of the ball in feet and t is the time in seconds.

a. Find the maximum height reached by the ball. Vertex

$$t = \frac{-b}{2a} = \frac{-64}{2(-16)} = \frac{-64}{-32} = 2 \text{ seconds}$$

$$h(t) = -16(2)^2 + 64(2)$$

$$= 64 \text{ ft}$$

At 2 seconds, the ball reaches its max height of 64 feet.

b. Determine when the foul ball will hit the ground. $h(t) = 0$

$$0 = -16t^2 + 64t$$

① $b^2 - 4ac = (64)^2 - 4(-16)(0) = 4096$

② $x = \frac{-b \pm \sqrt{\ }}{2a} = \frac{-64 \pm \sqrt{4096}}{2(-16)} = \frac{-64 \pm 64}{-32}$ → 0 seconds, → 4 seconds

The foul ball will reach the ground at 4 seconds.

c. Determine when the ball will be 48 feet high in the air.

$h(x) = 48$

$$48 = -16t^2 + 64t$$
$$-48 \qquad\qquad -48$$
$$0 = -16t^2 + 64t - 48$$

① $b^2 - 4ac = (64)^2 - 4(-16)(-48) = 1024$

② $x = \frac{-b \pm \sqrt{\ }}{2a} = \frac{-64 \pm \sqrt{1024}}{2(-16)} = \frac{-64 \pm 32}{-32}$ → 1 second, → 3 seconds

At 1 second and 3 seconds, the ball will be 48 feet high.