Unit 7 Exploring Quadratic Functions Graphically
Day 4 10.3 Solve Quadratics Word Problems Graphically

Day _____

I can . . .

. . . solve quadratic word problems graphically.

Using the graph at the right, It shows the height h in feet of a small rocket t seconds after it is launched. The path of the rocket is given by the equation: $h = -16t^2 + 128t$.

1. How long is the rocket in the air? __8 Seconds__

2. What is the greatest height the rocket reaches? __258 ft__

3. About how high is the rocket after 1 second? __105 ft__

4. After 2 seconds,
   a. about how high is the rocket? __190 ft__

   b. is the rocket going up or going down? __up__

5. After 6 seconds,
   a. about how high is the rocket? __190 ft__

   b. is the rocket going up or going down? __down__

6. Do you think the rocket is traveling faster from 0 to 1 second or from 3 to 4 seconds? Explain your answer.
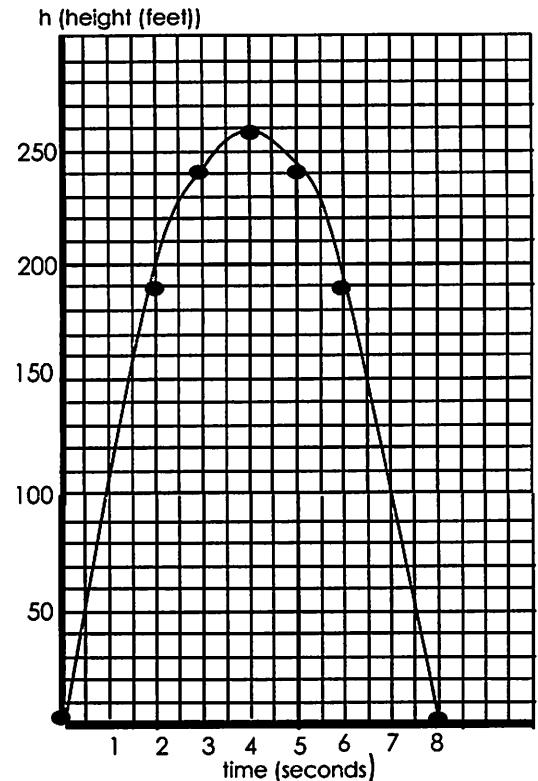
Traveling faster from 0 to 1 second. The rocket travels 105 ft compared to approximately 20 ft from 3-4 sec.

7. Use the equation to find the exact value of the height of the rocket at 2 seconds.

$$h = -16t^2 + 128t$$

$$h = -16(2)^2 + 128(2)$$

$$h = -64 + 256$$

$$h = 192 \text{ ft}$$

Example

After t seconds, a ball tossed in the air from the ground level reaches a height of h feet given by the equation $h = 144t - 16t^2$.

a. Graph $h = 144t - 16t^2$ → $h = -16t^2 + 144t$

Axis of Symmetry: $x = \dfrac{-144}{2(-16)}$ $x = 4.5$

$h = 144(4.5) - 16(4.5)^2$
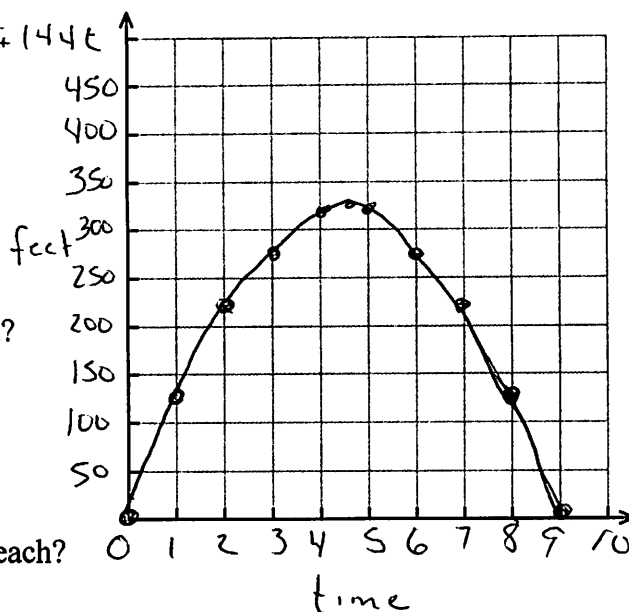
$h = 324$

b. What is the height of the ball after 3 second?

$288 \; ft$

c. What is the maximum height the ball will reach?

$324 \; ft$

d. Find the number of seconds the ball is in the air when it reaches a height of 224 feet.

2 seconds   and 7 seconds

e. After how many seconds will the ball hit the ground before rebound?

9 seconds

I GOT IT!

A ball is thrown upwards from a rooftop, 80m above the ground. It will reach a maximum vertical height and then fall back to the ground. The height of the ball from the ground at time t is h, which is given by, $h = -16t^2 + 64t + 80$.

1. What is the height reached by the ball after 1 second?

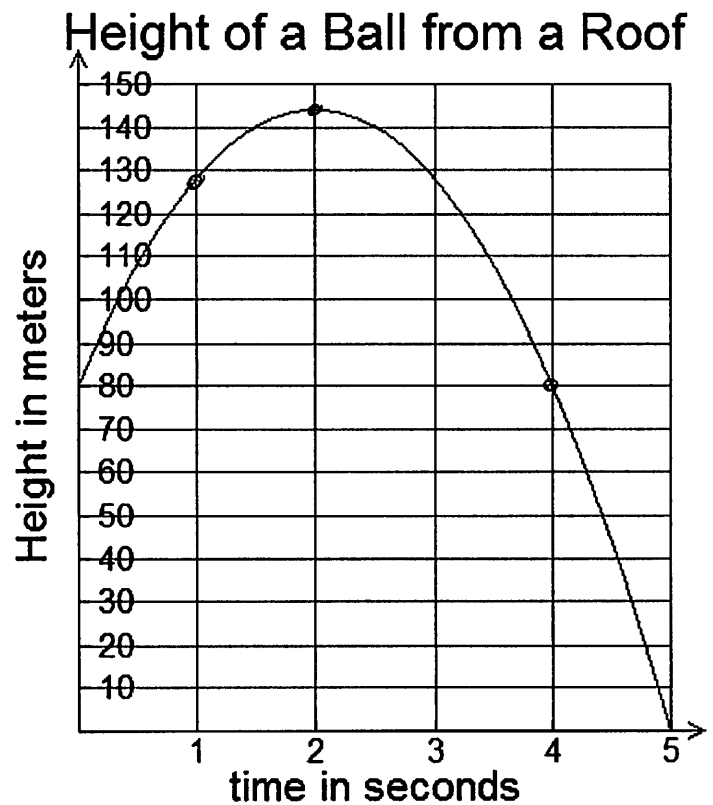   128 meters

2. What is the height of the ball at 4 seconds?

   80 meters

Height of a Ball from a Roof

Height in meters (vertical axis: 10–150)
time in seconds (horizontal axis: 1–5)

3. What is the maximum height reached by the ball?

   145 meters

4. How long will it take before hitting the ground?

   5 seconds

1. A diver is standing on a platform 24 ft above the pool. He jumps from the platform with an initial upward velocity of 8 ft/s. Use the formula $h = -16t^2 + vt + s$, where h is his height above the water, t is the time, v is his starting upward velocity, and s is his starting height. Graph the equation to determine how long it will take the diver to hit the water?
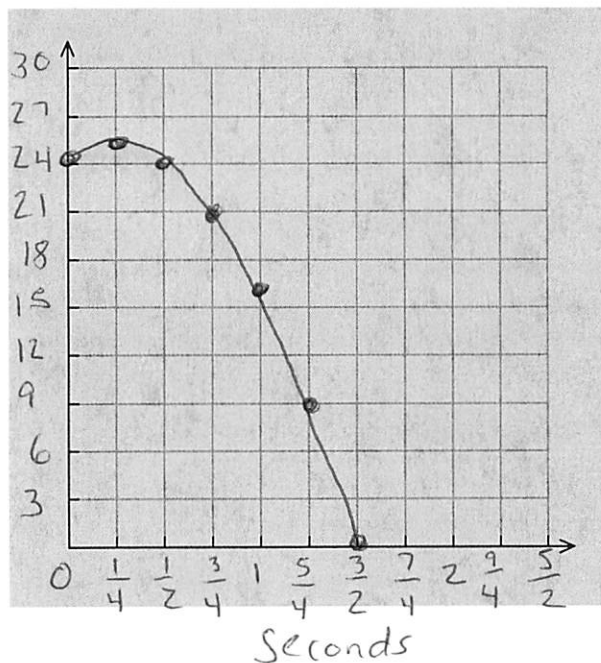
$$h = -16t^2 + 8t + 24$$

Axis of Symmetry: $x = \dfrac{-8}{2(-16)}$ $x = \dfrac{1}{4}$

$$h = -16\left(\tfrac{1}{4}\right)^2 + 8\left(\tfrac{1}{4}\right) + 24$$

$$h = -1 + 2 + 24$$

$$h = 25$$

ft

Seconds

2. Use the axis of symmetry formula to find the vertex of the equation, $y = 2x^2 + 5x - 12$.

$$x = \dfrac{-b}{2a} \rightarrow \dfrac{-5}{2(2)} = -\dfrac{5}{4} \qquad x = -\dfrac{5}{4}$$

$$y = 2\left(-\tfrac{5}{4}\right)^2 + 5\left(-\tfrac{5}{4}\right) - 12$$

$$y = \dfrac{50}{16} - \dfrac{100}{16} - \dfrac{192}{16} \rightarrow y = \dfrac{-242}{16} \text{ or } -15\tfrac{1}{8}$$

$$\boxed{\text{Vertex} \quad \left(-\tfrac{5}{4}, -15\tfrac{1}{8}\right)}$$

3. Use the axis of symmetry formula to find the vertex of the equation, $y = (x + 8)(x + 3)$.

$$y = x^2 + 11x + 24$$

$$x = \dfrac{-b}{2a} \rightarrow \dfrac{-11}{2(1)} = -5.5 \qquad x = -5.5$$

$$y = (-5.5 + 8)(-5.5 + 3)$$

$$y = (2.5)(-2.5)$$

$$y = -6.25$$

$$\boxed{\text{Vertex} \quad (-5.5, -6.25)}$$

4. Ms. Coola attended a wedding last week. As with most weddings the bride tossed her bouquet to the single ladies at the reception. Ms. Coola, being the cool math teacher that she is, challenged the guests to a math problem.

"The bride tosses a bouquet upward with an initial velocity of 20 feet per second. The height, $h(t)$, of the bouquet after t seconds is represented by the function: $h(t) = -16t^2 + 20t + 5$.
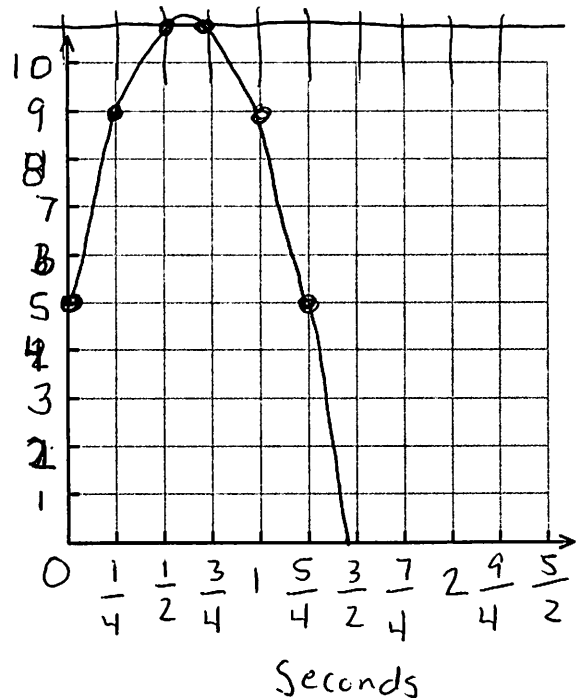
Graph $h(t) = -16t^2 + 20t + 5$.

$$X = \frac{-20}{2(-16)} \qquad X = \frac{5}{8}$$

Seconds

Determine the y-intercept and describe its meaning in terms of the context of the problem. ft

Y-intercept : $(0,5)$

Boquet was tossed from 5ft off the ground.

Determine the greatest height the bouquet reaches.

From calculator

Vertex: $\left(\frac{5}{8}, 11\frac{1}{4}\right)$

$11\frac{1}{4}$ ft is max height

About how many seconds does it take the bouquet to reach the floor?

From calculator

Positive

Zero Value

About 1.46 seconds until the boquet hits the floor