

Algebra 2 Trig H  
Quadratic Applications

Name:

Round all values to the nearest hundredth and use your calculators as much as possible!

1. An overzealous golfer hits a flop shot with a sand wedge to get out of the corner of a sand trap with an initial vertical velocity of 45 feet per second. What is the **maximum height** that the golf ball will reach?

a. 45 feet

$$h(t) = -16t^2 + 45t + 0$$

b. 13.19 feet

$$t = \frac{-45}{2 \cdot -16} = 1.4063$$

c. 31.64 feet

$$h(1.4063) = 31.64$$

d. 95.36 feet

2. After the semester is over, you discover that the math department has changed textbooks (again) so the bookstore won't buy back your nearly-new book. You and your friend Herman decide to get creative. You go to the roof of a twelve-story building and look over the edge to the reflecting pool 160 feet below. You drop your book over the edge at the same instant that Herman chucks his book straight down at 48 feet per second. By how many seconds does his book beat yours into the water?

$$0 = -16t^2 + 0t + 160$$

$$t = 3.16 \text{ s}$$

$$0 = -16t^2 - 48t + 160$$

$$t = 2.0 \text{ s}$$

$\approx 1.16$  seconds faster

3. An athlete hits a tennis ball at an initial height of 8 feet with an initial vertical velocity of  $62 \frac{\text{ft}}{\text{s}}$ .

a. After how many seconds does the ball hit the ground?

$$h(t) = -16t^2 + 62t + 8 = 0$$

After 4 seconds

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

$$t = \frac{-62}{-32} = 1.9375$$

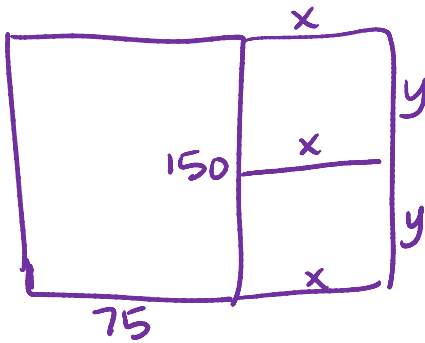
$$h(1.9375) = 68.06 \text{ feet}$$

c. At what time(s) will the ball to reach a height of 20 feet?

$$20 = -16t^2 + 62t + 8$$

$$t = 0.20 \text{ or } 3.67 \text{ s}$$

4. An elementary school is 150ft long and 75 feet wide. The principal has 240 ft of fencing and plans to use all of it to create 2 identical adjacent playground areas. The areas are made with the long side of the school as a border and have a fence to separate them. What are the dimensions of the playground that maximize the area?



$$3x + 2y = 240$$

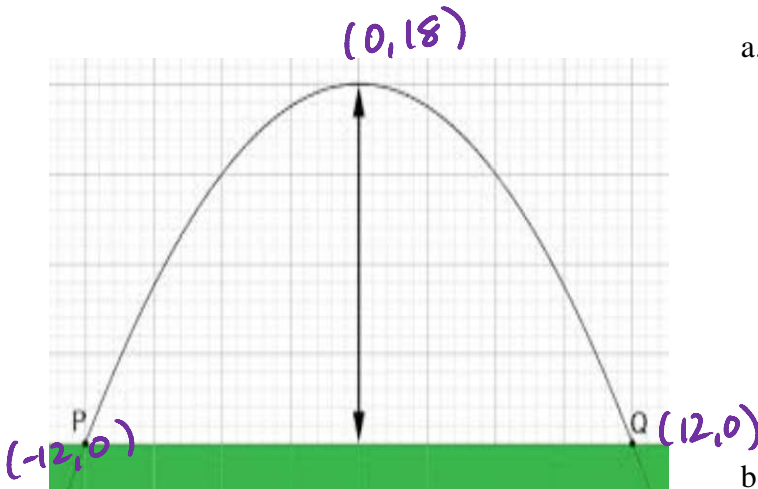
$$y = \frac{240 - 3x}{2} = 120 - \frac{3}{2}x$$

$$A = x \cdot y = x \left(120 - \frac{3}{2}x\right) \\ = -\frac{3}{2}x^2 + 120x$$

$$x = \frac{-120}{2 \cdot -\frac{3}{2}} = 40 \quad y = 60$$

Dimensions are 40 ft x 60 ft

5. A cross country Euro-train must pass through a parabolic tunnel that is 18 feet high (at its highest point) and 24 feet across at the base.



a. Write an equation that represents the height of the tunnel.

$$y = a(x - 0)^2 + 18$$

$$0 = a(12 - 0)^2 + 18$$

$$0 = 144a + 18$$

$$a = -\frac{1}{8}$$

$$y = -\frac{1}{8}(x - 0)^2 + 18$$

b. Can a train that is 10 feet wide and 14 feet tall pass through the tunnel?

substitute  $x = 5$  instead of 10

$$y = -\frac{1}{8}(5 - 0)^2 + 18$$

$$= 14.875 \text{ feet} \quad \text{yes}$$

c. What is the widest 14 ft high train that can pass through the arch?

$$14 = -\frac{1}{8}(x)^2 + 18$$

$$-4 = -\frac{1}{8}x^2$$

$$x^2 = 32$$

$$x = \pm \sqrt{32} = \pm 5.66$$

Widest train is 11.31 feet wide