Name_____Answer Key_____**Date**_____ **Section**_____

Student Activity Sheet
Bomb's Away!

Press ⌂ and open the file labeled "Bomb's Away!"

The actual path of the water balloon and the graphic model are different because the path of the water balloon illustrates the height, while the graphic model illustrates the height compared to the elapsed time.

1a. What is the height of the water balloon while Calvin is holding it? 160 feet

Explain how you know While the balloon is in Calvin's hand, the corresponding point on the parabola is at (0, 160), where 0 represents the time elapsed and 160 represents the height. When no time has passed, the initial height is 160 feet.

1b. Where is the water balloon when the point on the parabola hits its x-intercept? The water balloon is lying on the ground, presumably splattering Calvin's sister.

What does the x-value of the intercept represent in the context of the water balloon? The x-value of the intercept is 5, meaning that it took 5 seconds for the water balloon to reach a height of 0 feet.

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2a. What is the height of the balloon in 2.5 seconds? 180 feet In 4.2 seconds? 79.4 feet

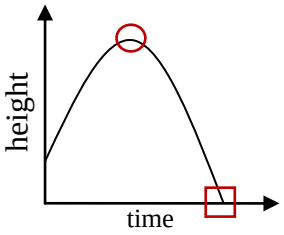
What happens when you change the x-value to 5.1 seconds? What does this mean? When x is a value of 5.1, the corresponding y-value is -11.4. This means the height of the water balloon is a negative value, which is impossible. We determined in part 1b. that the water balloon has impacted in 5 seconds.

2b. You may want to click and drag the point to answer the next questions. What is the maximum height of the water balloon? 196 feet How did you find this? By grabbing the point and dragging it to the peak until the word "maximum" is displayed.

2c. Approximately when does the water balloon reach a height 140 feet? 3.4 seconds 30 feet? 4.7 seconds

2d. Find a height that is reached twice, and determine the time(s) it takes to get to that height. Answers will vary. Any height between 160 feet and 196 feet (noninclusive) will work, with their corresponding time values.

Summary:



Graphically, what point should you be looking at when you're asked to find the time it takes an object to hit the ground? *Draw a square around the point in the above diagram*. How do you do this algebraically?

When an object has hit the ground, the height is at 0 feet, which means you are looking for the **x-intercept**.

Set the function equal to zero and solve the resulting quadratic equation.

What point is of interest when you are trying to find the maximum height an object will reach? *Draw a circle around the point in the above diagram.* How do you find this point algebraically?

The maximum occurs at the **vertex** of the parabola. Use $x = -\frac{b}{2a}$ to locate the x-value (or time), then evaluate $h\left(-\frac{b}{2a}\right)$ to find the corresponding y-value (or height)

3. The height of a projectile launched from a platform is modeled by the function **$h(t) = -16t^2 + 80t + 45$**, where **h(t) is the height of the ball (in feet) t seconds** after it is launched. Answer each question:

a. What is the height of the platform? Explain how you know.

45 feet

Evaluate h(0), because no time has passed if the projectile is still on the platform.

b. What is the height of the projectile 3 seconds after launch?

141 feet

Evaluate h(3) because the x-value (time) is 3 seconds.

c. When will the projectile hit the ground?

5.5 seconds

When the projectile is on the ground, the height, h(t) is 0 feet.

Solve the equation: $0 = -16t^2 + 80t + 45$.

(You will get two decimal answers, but the negative answer is disregarded)

d. What is the maximum height the projectile will reach and how long does it take to get there?

145-foot height is reached in 2.5 seconds.

Find the vertex by evaluating $t = -\frac{b}{2a}$ and then calculating $h\left(-\frac{b}{2a}\right)$.