Essential Question: How can we model the path of an object using a quadratic function?

Do Now:

Consider the quadratic function shown in the table below.

x	–1	0	1	2	3	4
y	3	9	11	9	3	-7

Which of the following inequalities represents the range of the function?

(a) $y \geq -7$ (b) $y \leq 4$ (c) $y \geq 3$ (d) $y \leq 11$

Which of the following inequalities represents the interval for which the function is increasing?

(a) $x \geq 1$ (b) $x \leq 1$ (c) $x > 1$ (d) $x < 1$

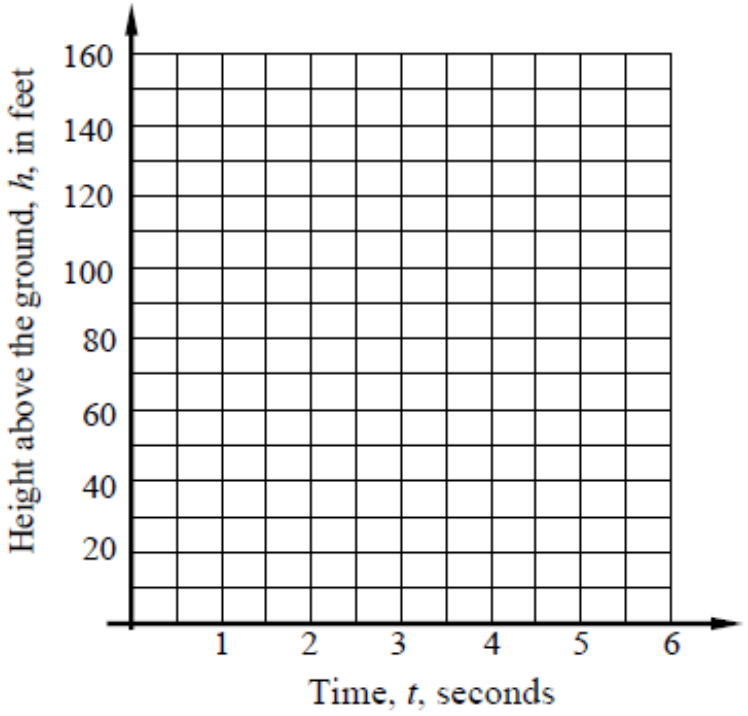
Parabolas in Real Life (https://www.youtube.com/watch?v=He42k1xRpbQ)

If the question asks…	Then calculate the…	How?
When does an object reach its maximum height?		
What is the maximum height of an object?		
How long is an object in the air? When does the object hit the ground?		
What is the initial height of an object?		

1) The height of an object that is traveling through the air can be modeled by a quadratic function that opens downward. The object is fired upward and its height in feet above the ground is modeled by the equation:

$$h(t) = -16t^2 + 64t + 80$$

a) Create a table of values and draw a graph of the object's height for all times where the object is on or above the ground.



b) What is the maximum height the object reaches (*in feet*)?

c) At what time does the object hit the ground?

d) State the domain and range of the function.

e) Over what time interval is the object's height decreasing?

f) Over what time interval is the object's height increasing?

2) A baking soda rocket is fired upwards with an initial speed of 80 feet per second. Its height above the ground, h (*in feet*), can be modeled using the equation, $h(t) = -16t^2 + 80t$, where t is the time since the launch (*in seconds*). At what time does the rocket hit the ground after being launched?

3) A player hits a baseball into the outfield. The equation $h = -0.005x^2 + x + 3$ models the path of the ball, where h is the height and x is the horizontal distance the ball travels.

(a) What is the maximum height reached by the baseball?

(b) An outfielder catches the ball three feet above the ground. How far has the ball traveled horizontally when the outfielder catches it?

4) A manufacturer is testing the durability of an object. He decides to throw the object straight up in the air; the height of the object over time can be modeled by the function $f(t) = -16t^2 + 32t + 48$.

(a) State a feasible domain for the above stated function. What does the domain of the function represent in this context?

(b) State a feasible range for the above stated function. What does the range of the function represent in this context?

(c) At what height does the object get thrown from?

(d) After how many seconds does the object hit the ground?

(e) What is the maximum height that the object reaches while in the air? How long does it take for the object to reach this height?

The coordinates of the **vertex**, the **y-intercept** and **roots** of a quadratic function help us understand the **parabolic path** of an object.

Turn and Talk

1. A ball is being thrown into the air and follows a path represented by the function $f(t) = -4(t+2)^2 + 36$, where t represents the time since the ball was thrown, in seconds. At what value of t does the ball reach the ground? Justify your response.

2. A flare is launched from the deck of a lifeboat 4 feet above the water surface. The initial velocity is 80 ft/s. The path of the ball can be modeled using the function $h(t) = -16t^2 + 80t + 4$ where t represents the time since the flare was launched, in seconds. *Algebraically*, determine how many seconds it will take for the flare to be 100 feet above the water's surface.