Lesson 4.3 Modeling with Quadratic Functions

Essential Understanding: Three noncollinear points, no two of which are in line vertically, are on the graph of exactly one quadratic function.

Ex. A parabola contains the points (0,0), (-1, -2), and (1, 6). What is the equation of this parabola in standard form?

Step 1: Substitute the (x, y) values into $y = ax^2 + bx + c$ to write a system of equations.

Use $(0, 0)$.
$y = ax^2 + bx + c$
$0 = a(0)^2 + b(0) + c$
$0 = c$

Use $(-1, -2)$.
$y = ax^2 + bx + c$
$-2 = a(-1)^2 + b(-1) + c$
$-2 = a - b + c$

Use $(1, 6)$.
$y = ax^2 + bx + c$
$6 = a(1)^2 + b(1) + c$
$6 = a + b + c$

Step 2: Solve the system to find a, b, and c.

Since $c = 0$, the resulting system has two variables. $\begin{cases} a - b = -2 \\ a + b = 6 \end{cases}$

Use elimination.
$a = 2$ and $b = 4$.

Step 3: Substitute the values into the standard form to obtain the equation $y = 2x^2 + 4x$

Ex. What is the equation of a parabola containing the points (0, 0), (1, -2), and (-1, -4)?

Ex. Find a quadratic function that goes through the points (1, 0), (2, -3), (3, -10).

1 A parabola contains the points (0, 0), (-1, 1), and (1, 5). What is the equation of this parabola in standard form?
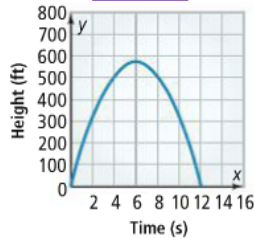
Ex. Campers at an aerospace camp launch rockets on the last day of camp. The path of Rocket 1 is modeled by the equation $h = -16t^2 + 150t + 1$ where t is time in seconds and h is the distance from the ground. The path of Rocket 2 is modeled below. Which rocket flew higher?
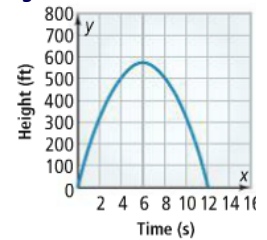
Question 1: Which rocket stayed in the air longer?

Rocket 1: $h = -16t^2 + 150t + 1$

Rocket 2:

Question 2: What is the domain and range for each rocket?

Question 3: What does the domain mean in context for each rocket?

When we did Lego My Eggo our data represented a linear regression line. Sometimes data is parabolic. We will use our calculators to find the quadratic regression equation.

Step 1: Input x-values into L1 and y-values into L2.
Step 2: Use QuadReg
Step 3: Graph the data and the function.
Step 4: Use your model to make predictions.

Ex. The table shows a meteorologist's predicted temperatures for an October day in Sacramento, CA. Find a quadratic model for this data.

Sacramento, CA

Time	Predicted Temperature (°F)
8 A.M.	52
10 A.M.	64
12 P.M.	72
2 P.M.	78
4 P.M.	81
6 P.M.	76

Ex. Use your model to predict the high temperature for the day. At what time does the high temperature occur?

Ex. The table shows a meteorologists predicted temperatures for a summer day in Denver, CO. Find the quadratic model for this data and use it to predict the high temperature for the day. At what time does the high temperature occur?

Denver, CO

Time	Predicted Temperature (°F)
6 A.M.	63
9 A.M.	76
12 P.M.	86
3 P.M.	89
6 P.M.	85
9 P.M.	76