Warm Up

1. Identify domain and range for the function $f(x) = -\sqrt{x-2} + 4$

2. What transformations change $f(x) = -\sqrt{x-2} + 4$ into $g(x) = \sqrt{x+1} - 2$.

3. Convert $y = x^2 - 2x - 3$ into vertex form by completing the square.

Warm Up

Objectives Use the graphing calculator to create a quadratic regression model.

Use a quadratic model to predict real world behavior

Homework 4-3 Practice sheet, all. Don't panic, you'll probably finish them in class.

Homework Review

PRACTICE 1 – Find the quadratic equations whose roots are -3 and 6.

$X = -3 \quad X = 6$ — Set each solution equal to x.

$X + 3 = 0 \quad X - 6 = 0$ — Subtract the constant from both sides to make the equation equal to zero.

$(x+3)(x-6) = 0$ — Create a factor equation.

$x^2 - 6x + 3x - 18 = 0$ — Foil the factors

$x^2 - 3x - 18 = 0$ — Combine Like Terms. This is our Quadratic Equation.

More Practice

1. Find the quadratic equations with the roots 20 and 2.

$(x-20)(x-2) = 0$

$x^2 - 22x + 40 = 0$

2. Find the quadratic equations with the roots -4 and 0.

$(x+4)x = 0$

$x^2 + 4x = 0$

Homework Review

PRACTICE 2– Find the quadratic equations whose solutions are $\frac{5}{3}$ and $-\frac{1}{2}$.

$5/3 = x$ $\quad -1/2 = x$ — Set each solution equal to x.

$3x = 5$ $\quad 2x = -1$ — Clear the fractions by multiplying by the denominators.

$3x - 5 = 0$ $\quad 2x + 1 = 0$ — Subtract the constant from both sides to make the equation equal to zero.

$(3x - 5)(2x + 1) = 0$ — Create a factor equation.

$6x^2 + 3x - 10x - 5 = 0$ — Foil the factors

$6x^2 - 7x - 5 = 0$ — Combine Like Terms. This is our Quadratic Equation.

More Practice

1. Find the quadratic equations with the roots 0 and $-\frac{2}{5}$.

$x(x + 2/5) = 0$

$5x^2 + 2x = 0$

2. Find the quadratic equations with the roots 2 and $\frac{2}{9}$.

$x - 2 = 0$ $\quad 9x - 2 = 0$

$(x - 2)(9x - 2) = 0$

$9x^2 - 2x - 18x + 4 = 0$, $\quad 9x^2 - 20x + 4 = 0$

Homework Review

PRACTICE 3 – Find the quadratic equations whose solutions are $\frac{2+\sqrt{3}}{4}$ and $\frac{2-\sqrt{3}}{4}$.

$x = \frac{2 \pm \sqrt{3}}{4}$ — Write as one expression equal to x.

$4x = 2 \pm \sqrt{3}$ — Clear the fractions by multiplying by the denominators.

$4x - 2 = \pm\sqrt{3}$ — Isolate the radical term.

$(4x-2)^2 = 3 \quad / \quad 16x^2 - 16x + 4 = 3$ — Square both sides and simplify

Subtract the constant from both sides to make equation equal to zero.

$16x^2 - 16x + 1 = 0$ — Our solution.

More Practice – Find the quadratic equations with the following roots.

1. $-3 \pm \sqrt{2}$

$x = -3 \pm \sqrt{2}$

$(x-3)^2 = (\pm\sqrt{2})^2$

$x^2 - 6x + 9 = 2$

$x^2 - 6x + 7 = 0$

2. $\pm\sqrt{7}$

$x = \pm\sqrt{7}$

$x^2 = 7$

$x^2 - 7 = 0$

Homework Review

PRACTICE 4 – Find the quadratic equations whose solutions are $\frac{3+5i}{2}$ and $\frac{3-5i}{2}$.

$X = \frac{3 \pm 5i}{2}$ Write as one expression equal to x.

$2X = 3 \pm 5i$ Clear the fractions by multiplying by the denominators.

$2X - 3 = \pm 5i$ Isolate the i term.

$(2X-3)^2 = 25i^2 / 4X^2 - 12X + 9 = -25$ Square both sides and simplify

Subtract the constant from both sides to make equation equal to zero.

$4X^2 - 12X + 34 = 0$ Our solution.

More Practice – Find the quadratic equations with the following roots.

1. $\pm 5i\sqrt{2}$

$X = \pm 5i\sqrt{2}$

$x^2 = (25)i^2(2)$

$x^2 = -50$

$x^2 + 50 = 0$

2. $6 \pm 4i$

$X = 6 \pm 4i$

$X - 6 = \pm 4i$

$(x-6)^2 = 16i^2 = -16$

$x^2 - 12x + 36 = -16$

$x^2 - 12x + 52 = 0$

3. $\frac{6 \pm i\sqrt{2}}{8}$

$X = \frac{6 \pm i\sqrt{2}}{8}$

$8X = 6 \pm i\sqrt{2}$

$8X - 6 = \pm i\sqrt{2}$

$(8X-6)^2 = 2i^2$

$64x^2 - 96x + 36 = -2$

$64x^2 - 96x + 38 = 0$

Building Quadratics from Roots

It's time to work backwards

We've been finding solutions to quadratic equations using factoring, graphing and the quadratic formula.

Now we'll work backwards from the solutions and create the original quadratic solution.

Building Quadratics from Roots

EXAMPLE 1 – Find the quadratic equations whose roots are 4 and -2.

Set each solution equal to x.

Subtract the constant from both sides to make the equation equal to zero.

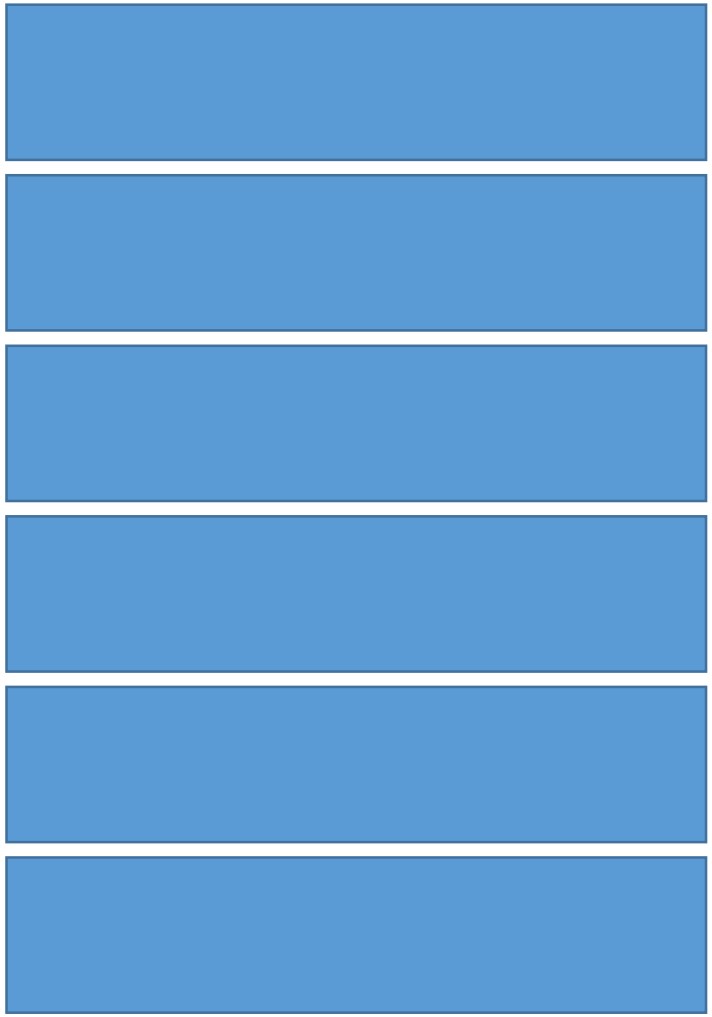
Create a factor equation. (Look familiar?)

Foil the factors.

Combine Like Terms. This is our Quadratic Equation.

Building Quadratics from Roots

EXAMPLE 2 – Find the quadratic equations whose solutions are $\frac{2}{3}$ and $\frac{3}{4}$.



Set each solution equal to x.

Clear the fractions by multiplying by the denominators.

Subtract the constant from both sides to make the equation equal to zero.

Create a factor equation.

Foil the factors.

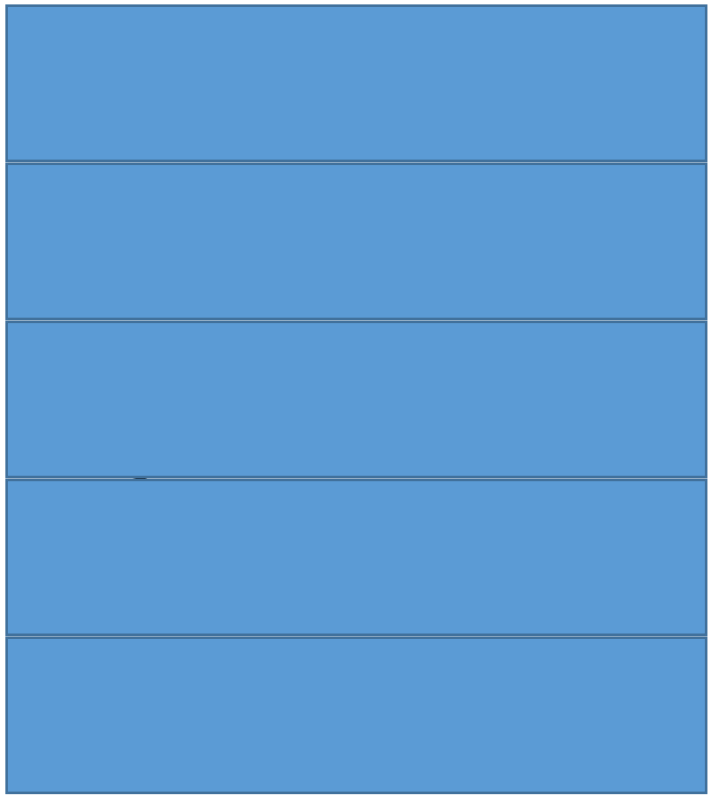
Combine Like Terms. This is our Quadratic Equation.

Building Quadratics from Roots

Complete Practice Problem 1 and 2.

Irrational Solutions

EXAMPLE 4 – Find the quadratic equations whose solutions are $2 - 5\sqrt{2}$ and $2 + 5\sqrt{2}$.



Write as one expression equal to x.

Isolate the radical term.

Square both sides and simplify.

Subtract the constant from both sides to make the equation equal to zero.

Our solution.

Building Quadratics from Roots

Complete Practice Problem 3.

Building Quadratics from Roots

Complex Solutions

EXAMPLE 5 – Find the quadratic equations whose solutions are $4-5i$ and $4+5i$.

Write as one expression equal to x.

Isolate the i term.

Square both sides and simplify.

Subtract the constant from both sides to make the equation equal to zero.

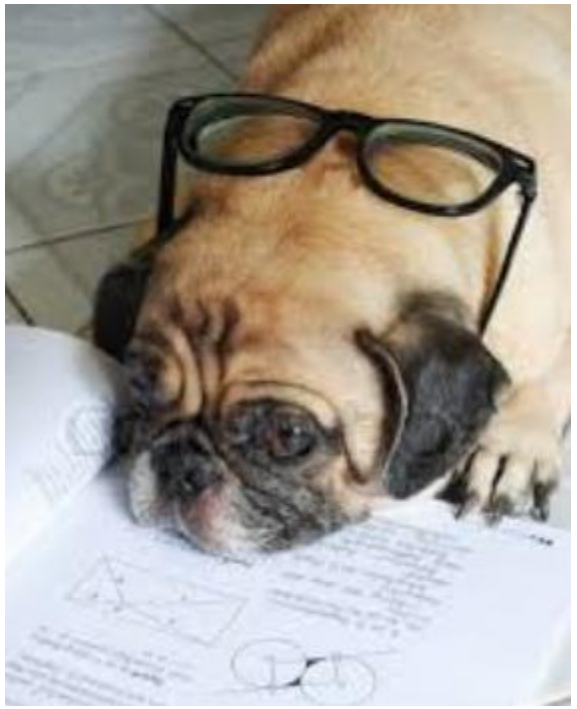
Our solution.

Building Quadratics from Roots

Complete Practice Problem 4.

Solving Radical Equations

Work on your homework.

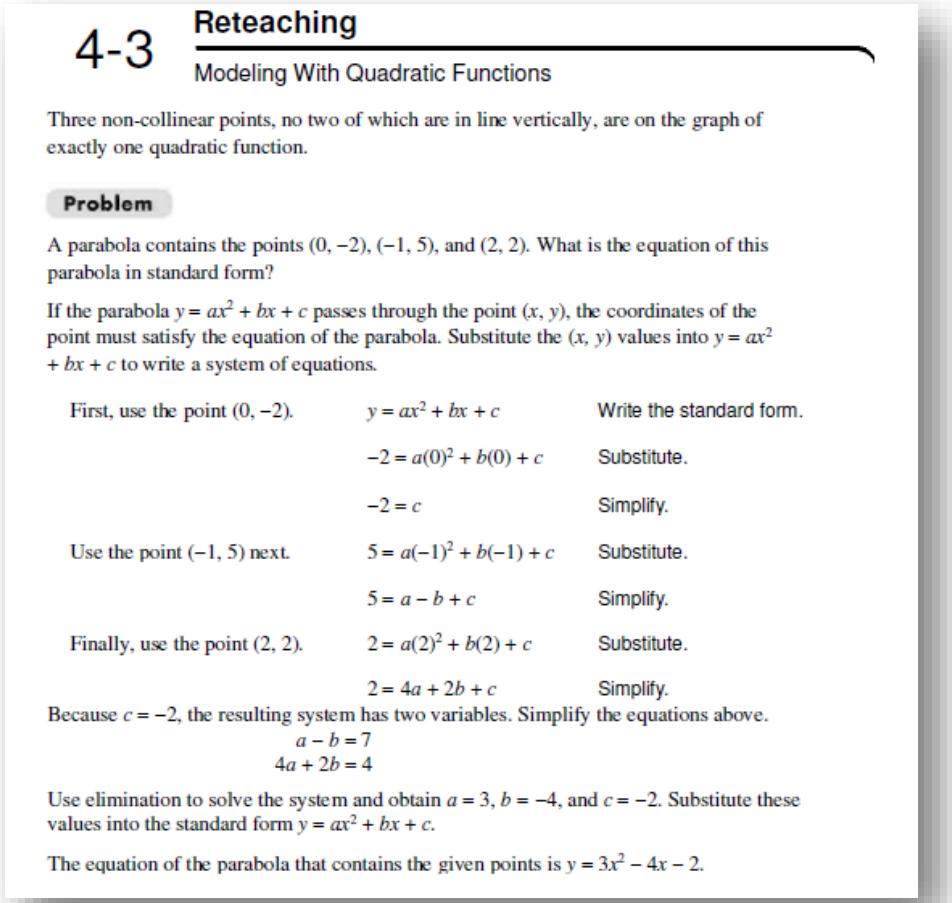


Quadratic Modeling

Today your calculator is your friend.

We'll use it to create a quadratic regression model instead of having to do it by hand.

Instead of this ->



4-3 Reteaching

Modeling With Quadratic Functions

Three non-collinear points, no two of which are in line vertically, are on the graph of exactly one quadratic function.

Problem

A parabola contains the points (0, −2), (−1, 5), and (2, 2). What is the equation of this parabola in standard form?

If the parabola $y = ax^2 + bx + c$ passes through the point (x, y), the coordinates of the point must satisfy the equation of the parabola. Substitute the (x, y) values into $y = ax^2 + bx + c$ to write a system of equations.

First, use the point (0, −2).	$y = ax^2 + bx + c$	Write the standard form.
	$-2 = a(0)^2 + b(0) + c$	Substitute.
	$-2 = c$	Simplify.
Use the point (−1, 5) next.	$5 = a(-1)^2 + b(-1) + c$	Substitute.
	$5 = a - b + c$	Simplify.
Finally, use the point (2, 2).	$2 = a(2)^2 + b(2) + c$	Substitute.
	$2 = 4a + 2b + c$	Simplify.

Because $c = -2$, the resulting system has two variables. Simplify the equations above.

$$a - b = 7$$
$$4a + 2b = 4$$

Use elimination to solve the system and obtain $a = 3$, $b = -4$, and $c = -2$. Substitute these values into the standard form $y = ax^2 + bx + c$.

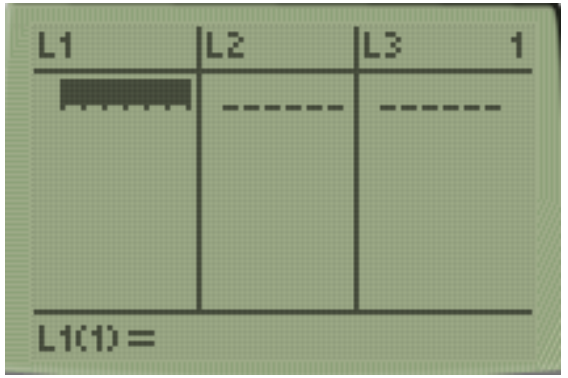
The equation of the parabola that contains the given points is $y = 3x^2 - 4x - 2$.

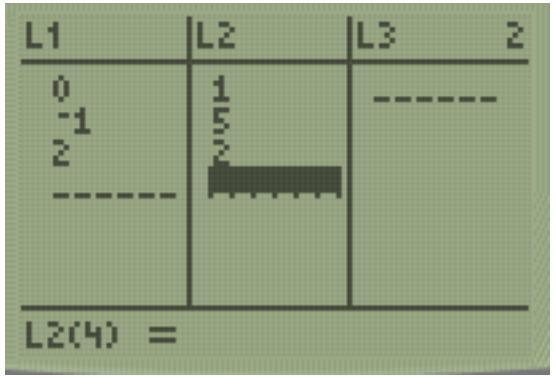
We'll do this….

Quadratic Modeling

Look at the example on 4-3, page 30. First we need to enter the data points.

Press STAT, 1,

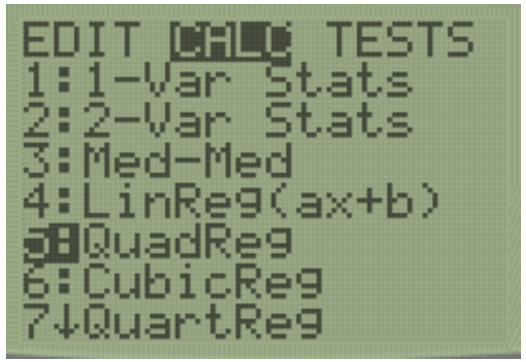




Enter the x values in L1 and the y values in L2

Now we generate our quadratic model.

Press STAT, CALC, 5

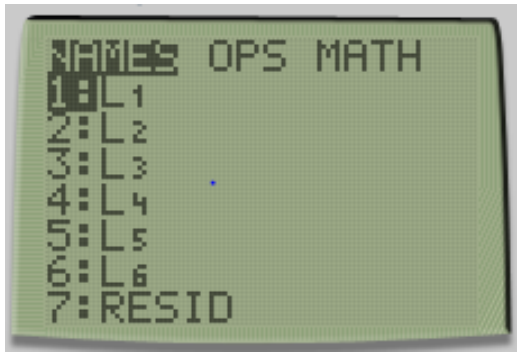


We have to tell your calculator where the data is. This is where our calculators may be different…

Quadratic Modeling

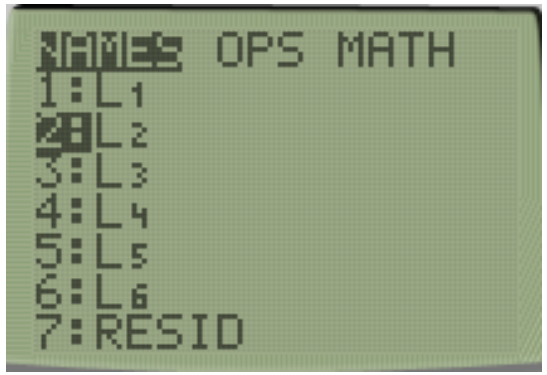
We have to tell your calculator where the data is. This is where our calculators may be different.

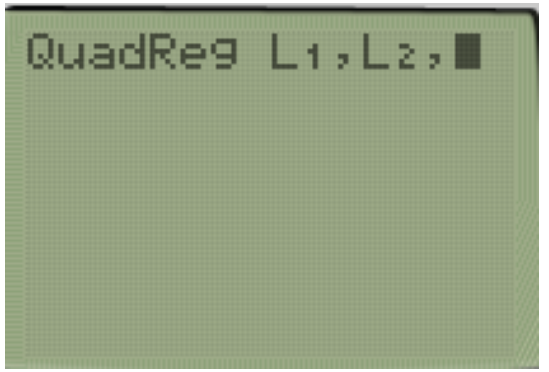
Press 2nd STAT (list)



Select L1 for x values

Press "comma"
Press 2nd STAT (list)

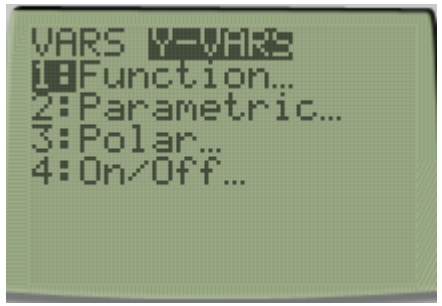


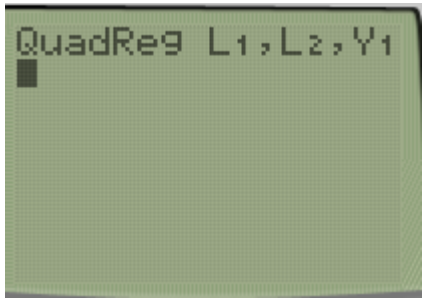


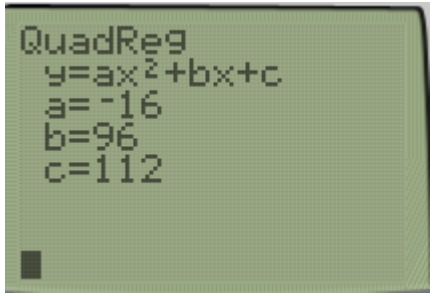
Select L2 for y values

Now we tell it where to put the regression equation. We want it in Y_1.

Press 2nd STAT (list)

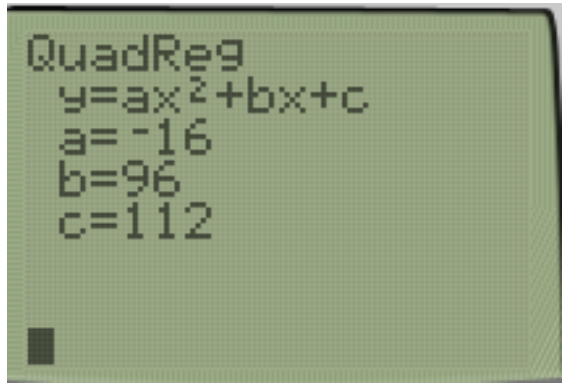






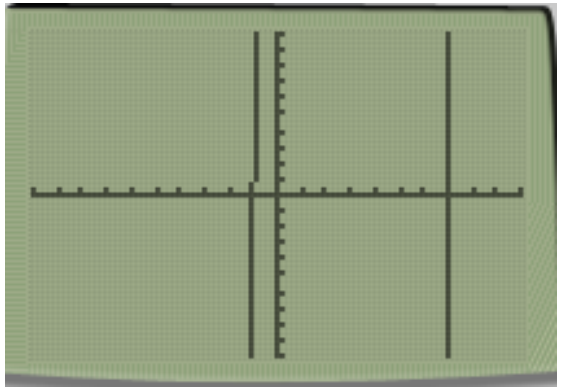
Quadratic Modeling

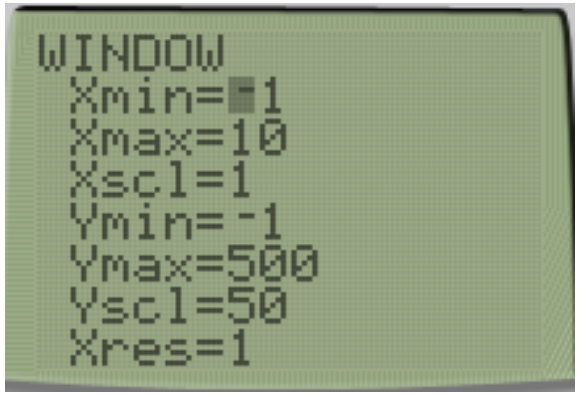
Now we have our regression equation.

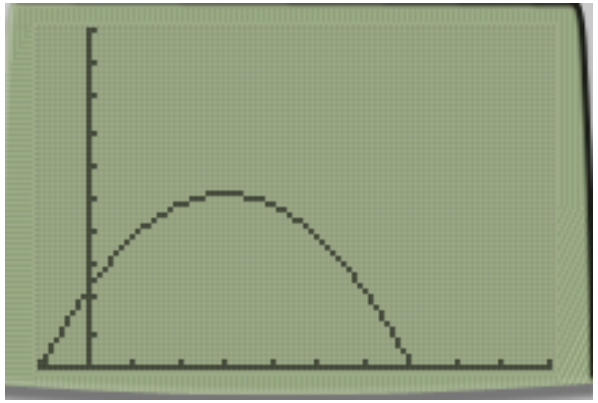


Use the table in your calculator to complete the table.

Graph the equation. What does it tell us?







How high is the building from which he throws the soccer ball? 112 seconds

How long does it take the ball to hit the ground? 7 seconds

Quadratic Modeling

Work with a partner to finish the 4-3 Practice sheet.