Warm Up

Thursday, February 19, 2015

1. Write the quadratic function with the roots $x = 1$ and $x = 2$

2. Write the quadratic function with the roots $x = \frac{2}{3}$ and $x = 3$

3. Write the quadratic function with the roots $x = 2 \pm 3i$

Hint: Look at packet pages 11-14

Warm Up

Objectives

Use the graphing calculator to create a quadratic regression model.

Use a quadratic model to predict real world behavior

Homework

Packet Page 17: 3, 5-8
Packet Page 18: all

Homework Questions?

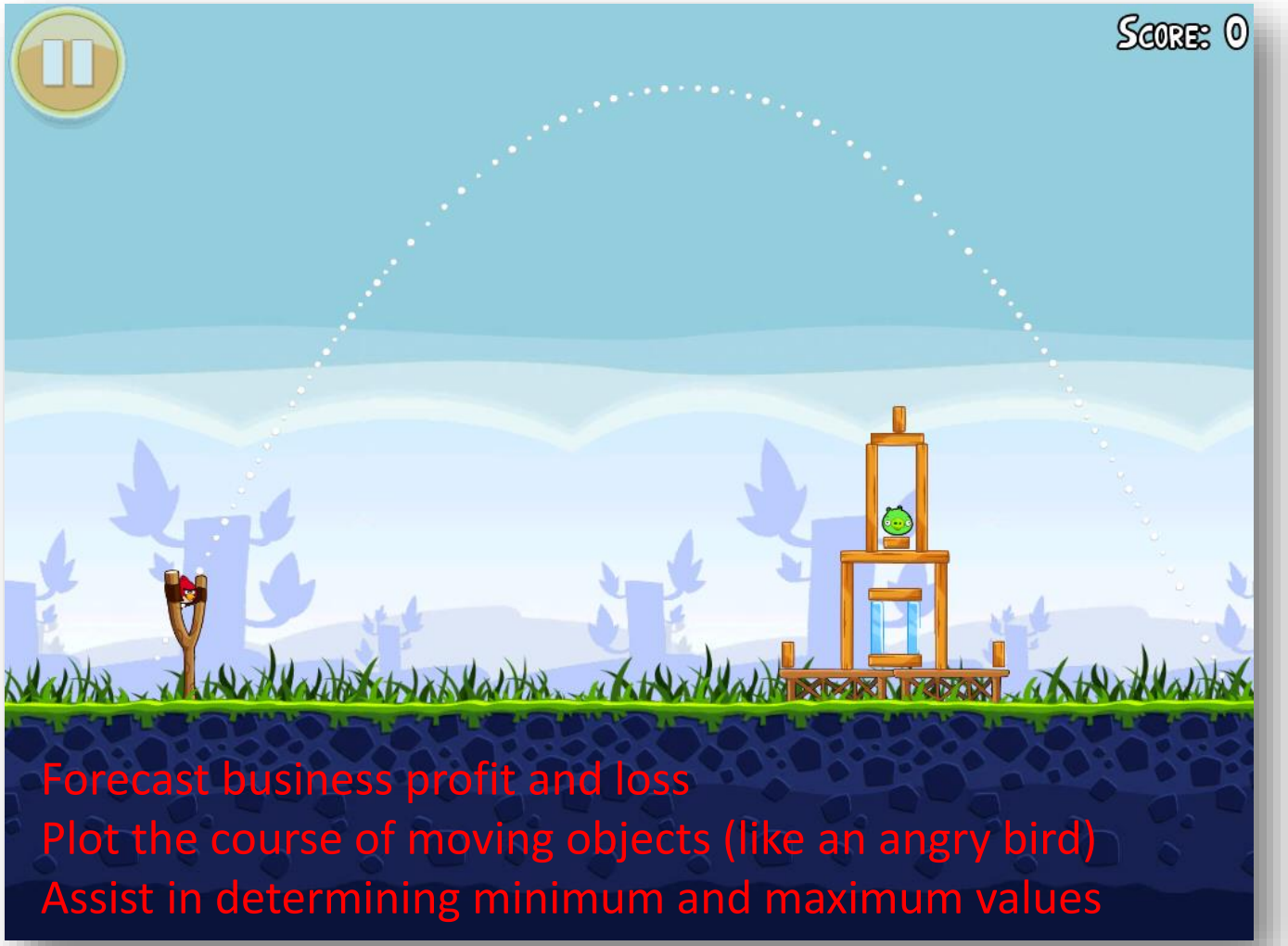
What do all these pictures have in common?

A celebration of Quadratic Functions

Widely used in science, business, and engineering

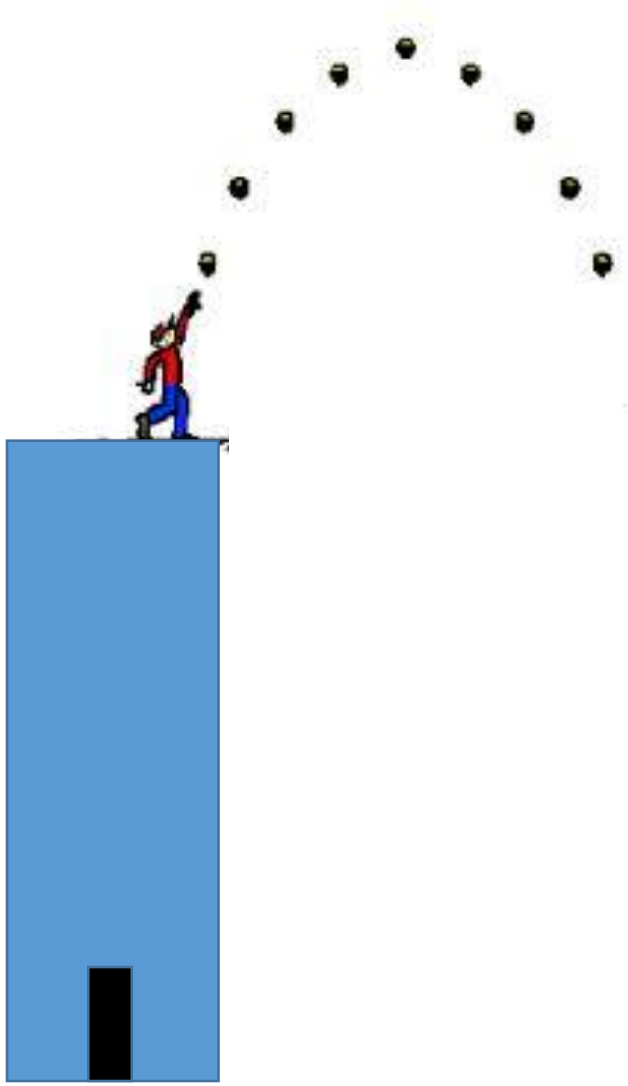
U-shape can describe the trajectories of water jets in a fountain, a bouncing ball, and angry birds

On a more serious note…



A celebration of Quadratic Functions

#1 on your worksheet



A ball is thrown vertically upward from the top of a building with an initial speed of 80 feet per second.

The height in feet above the starting point after t seconds is given by the equation

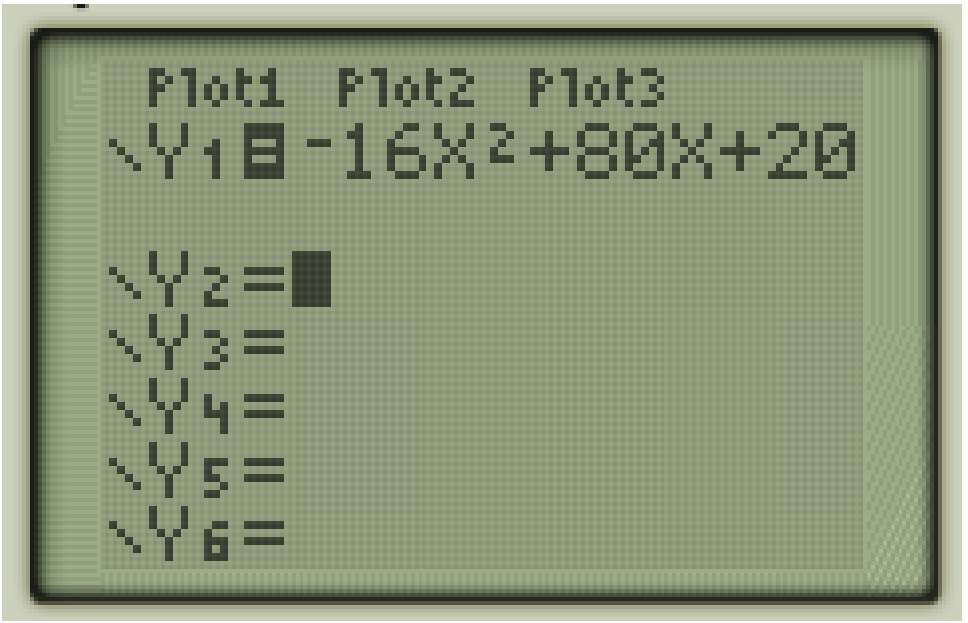
$$h(t)=-16t^2+80t+20$$

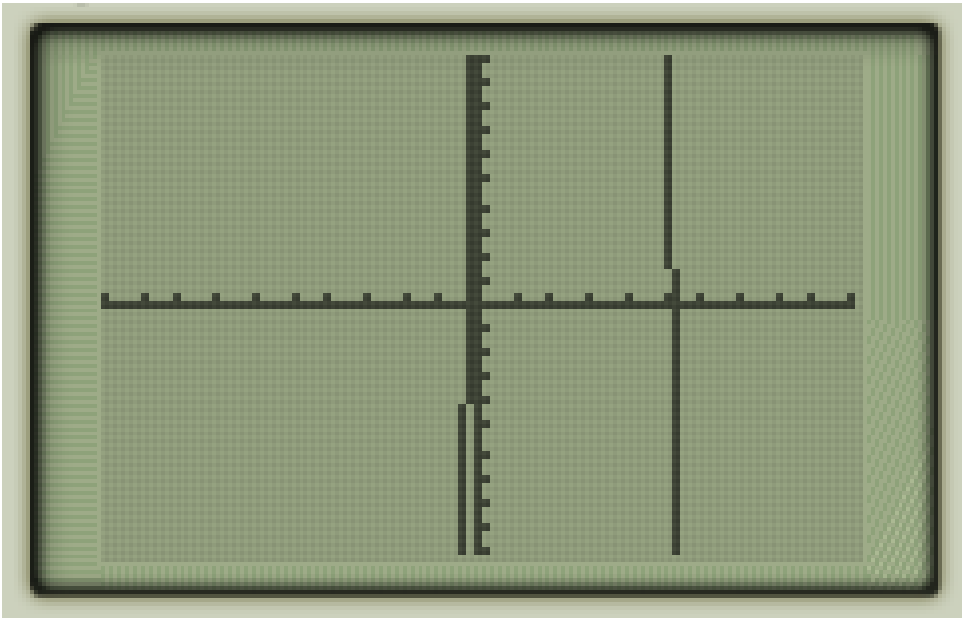
What is the maximum height reached by the ball?

Step 1: Turn on your calculator

Step 2: press [Y=] and enter the equation given.

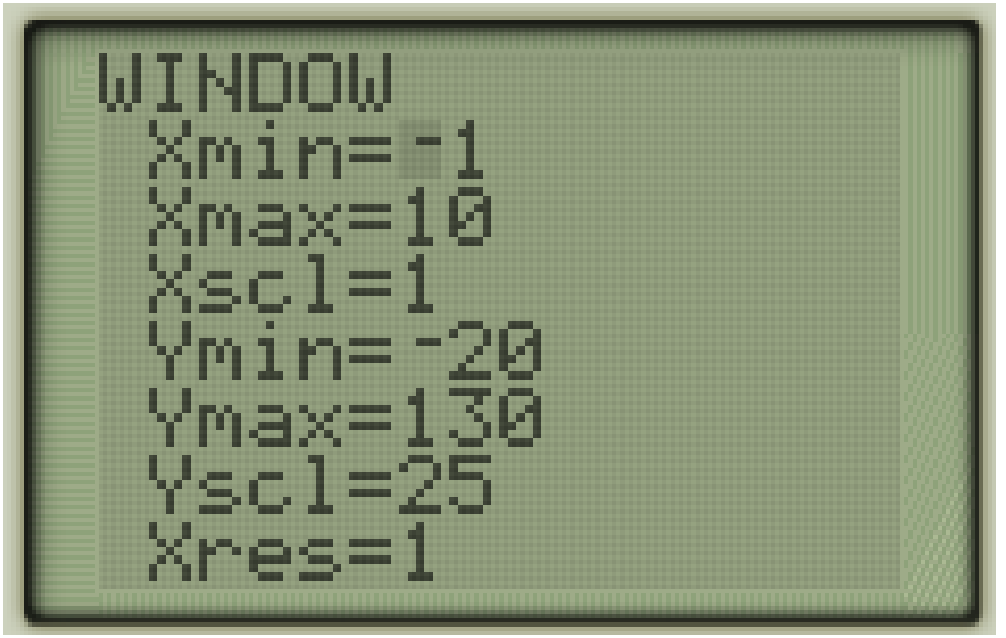
Step 3: press [GRAPH]



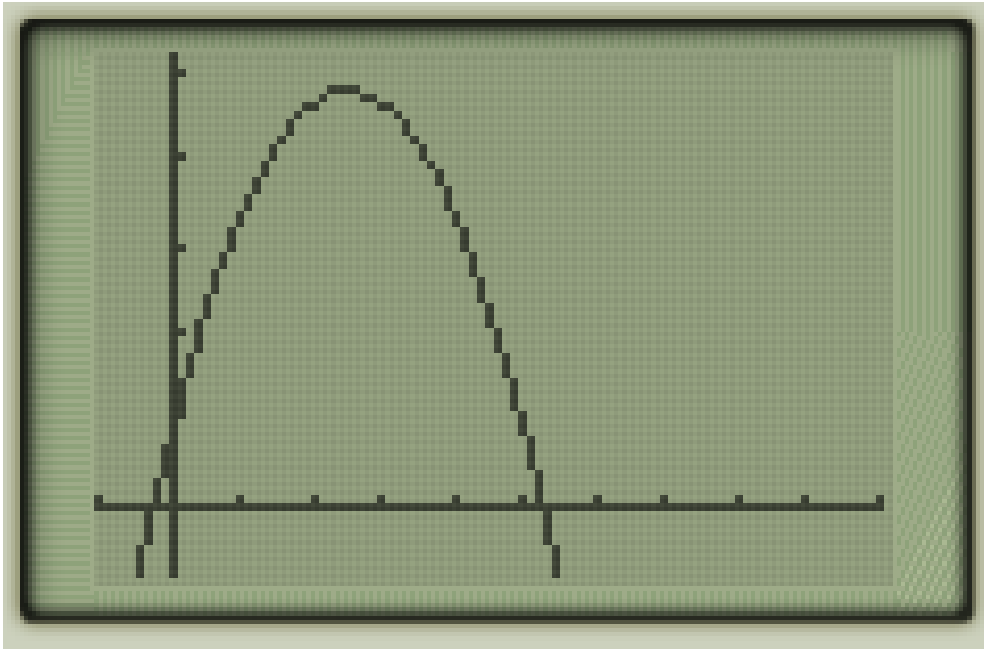


Not helpful!

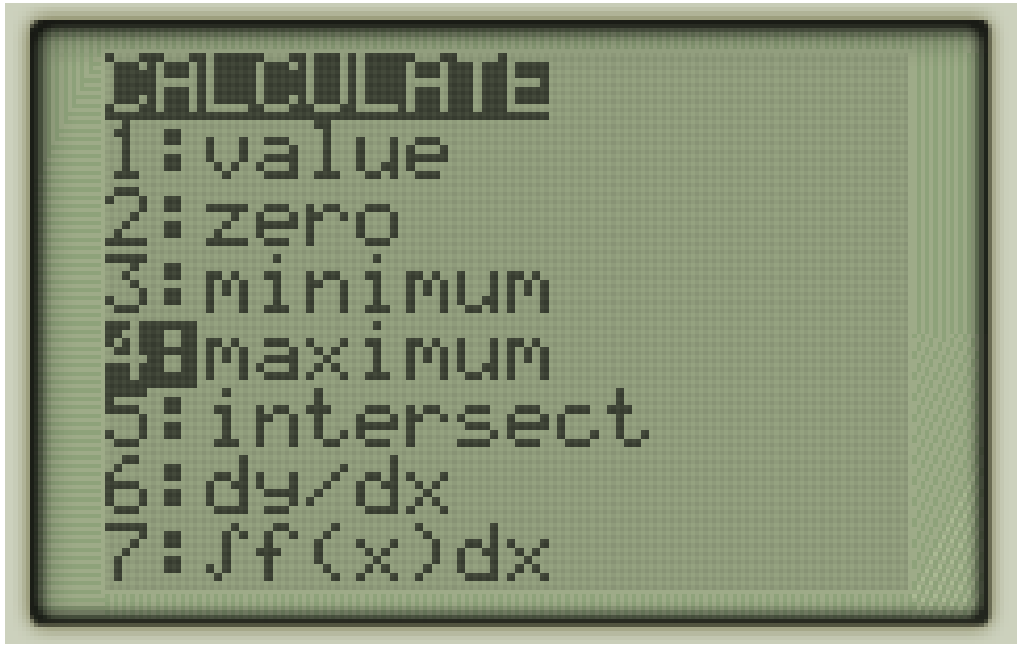
Step 4: press [WINDOW] and change the settings as indicated here.



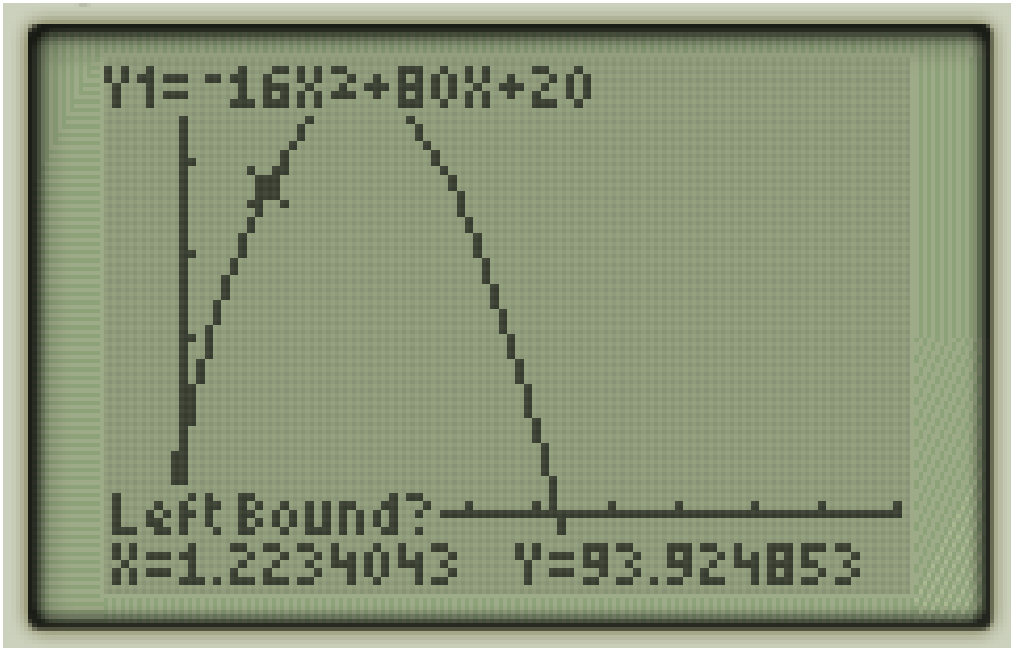
Step 5: press [GRAPH]



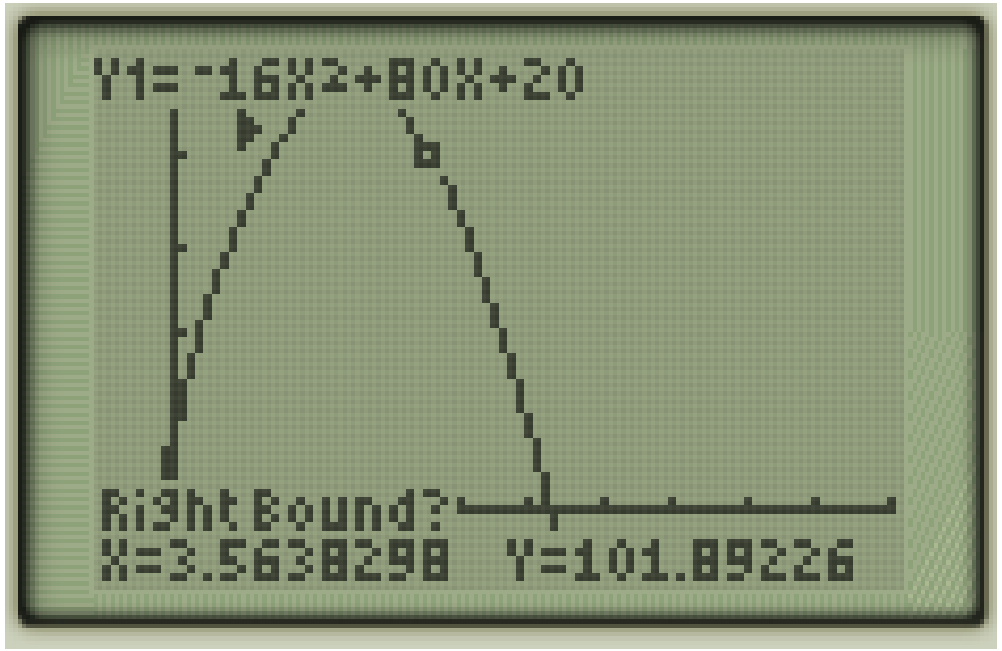
Step 6: press [2nd][TRACE] and select option [4:maximum]



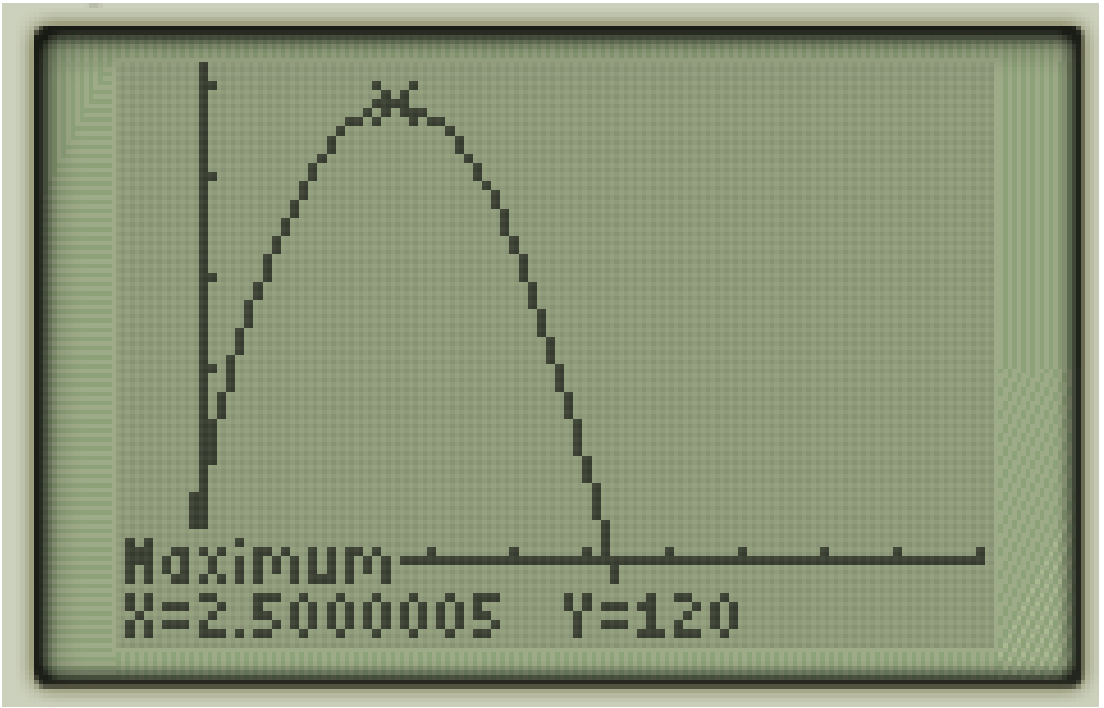
Step 7: Move the cursor using the arrow keys to the left of the maximum point on the graph and press [ENTER].

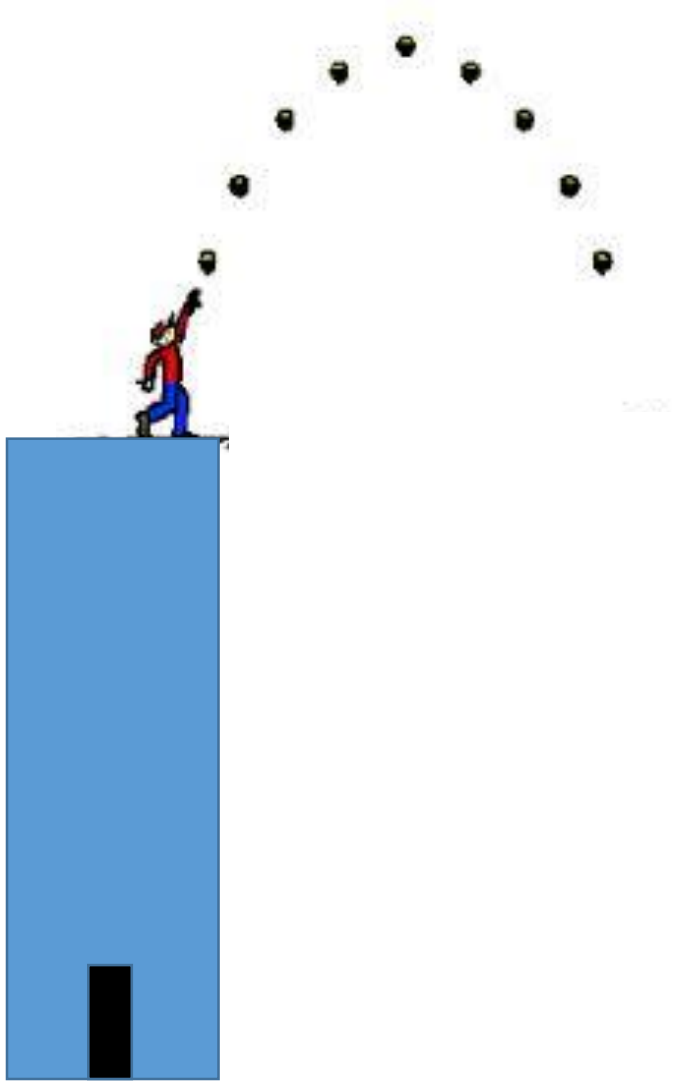


Step 8: Then move the cursor to the right of the maximum point and press [ENTER].



Step 9: Verify your maximum is between the two arrows. Then press [ENTER] again.





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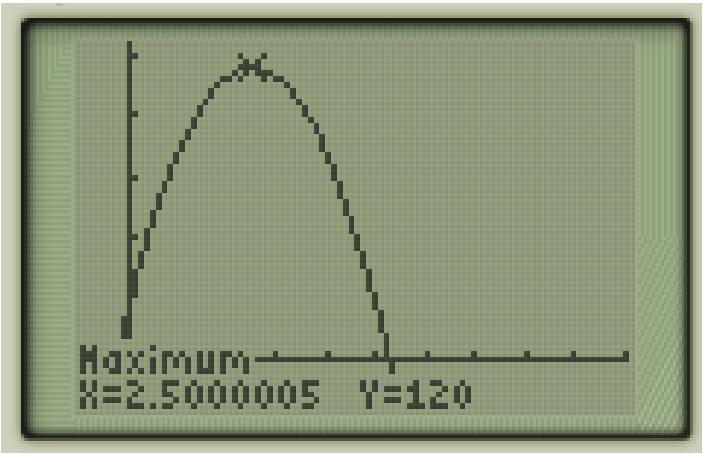
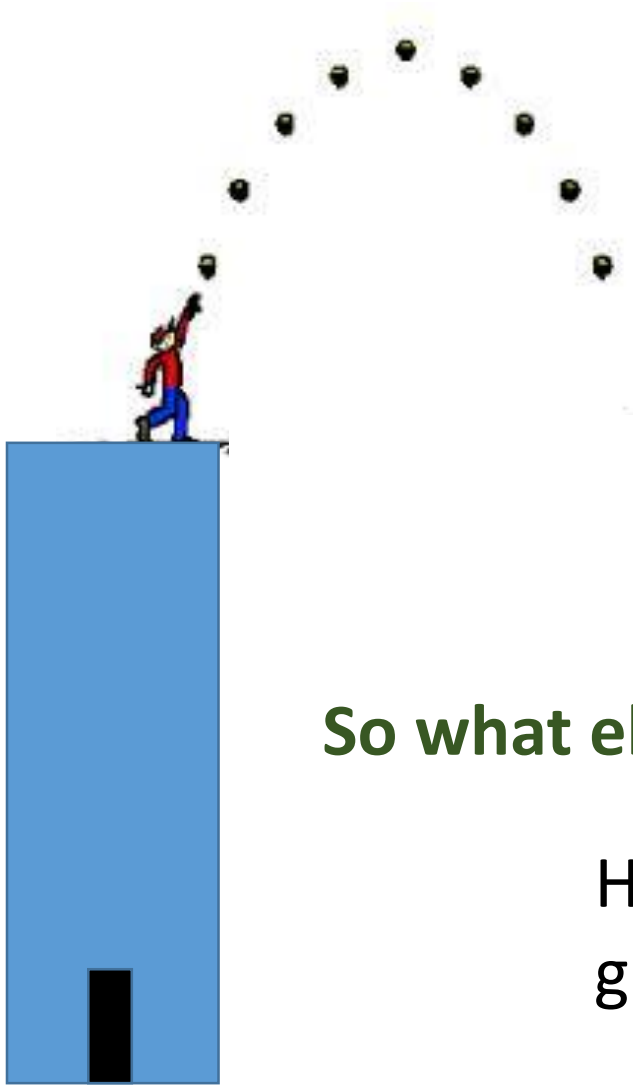
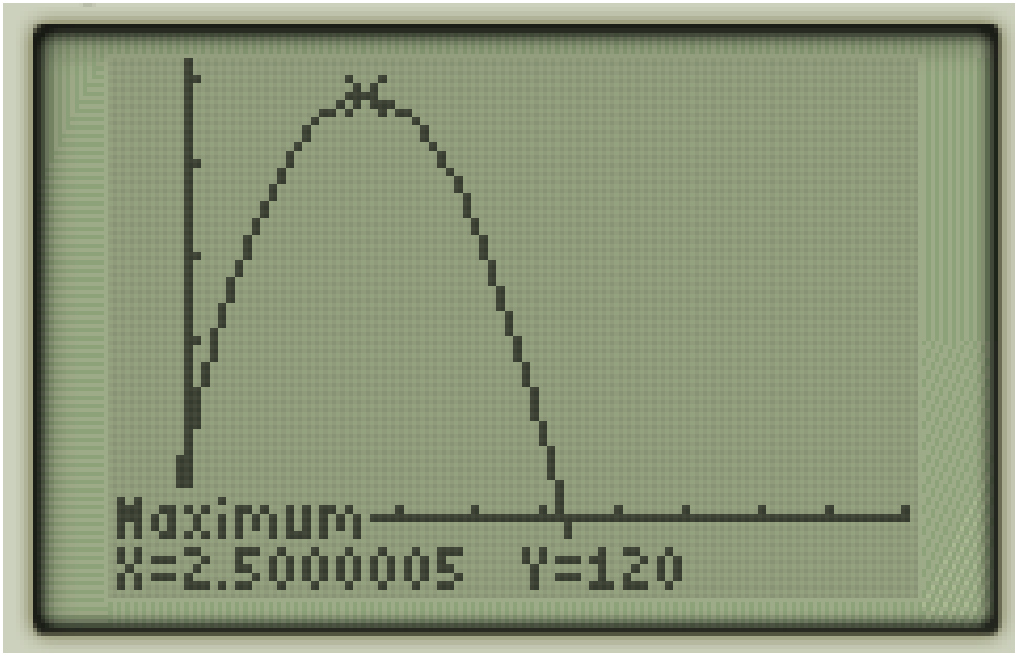


The **height** in feet above the starting point after **t seconds** is given by the equation $h(t)=-16t^2+80t+20$.



Y: HEIGHT

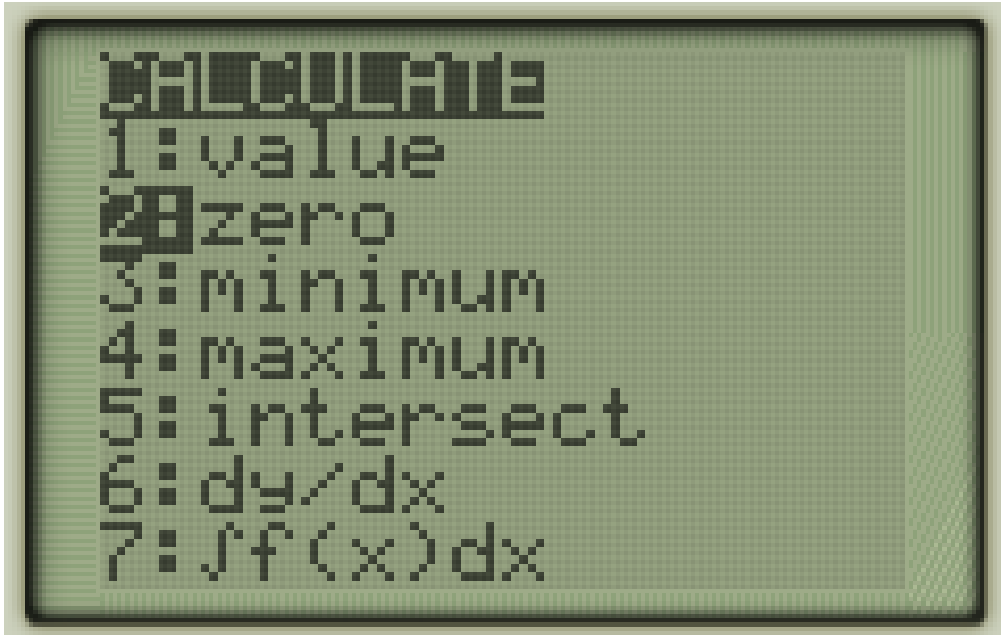


X: TIME in seconds

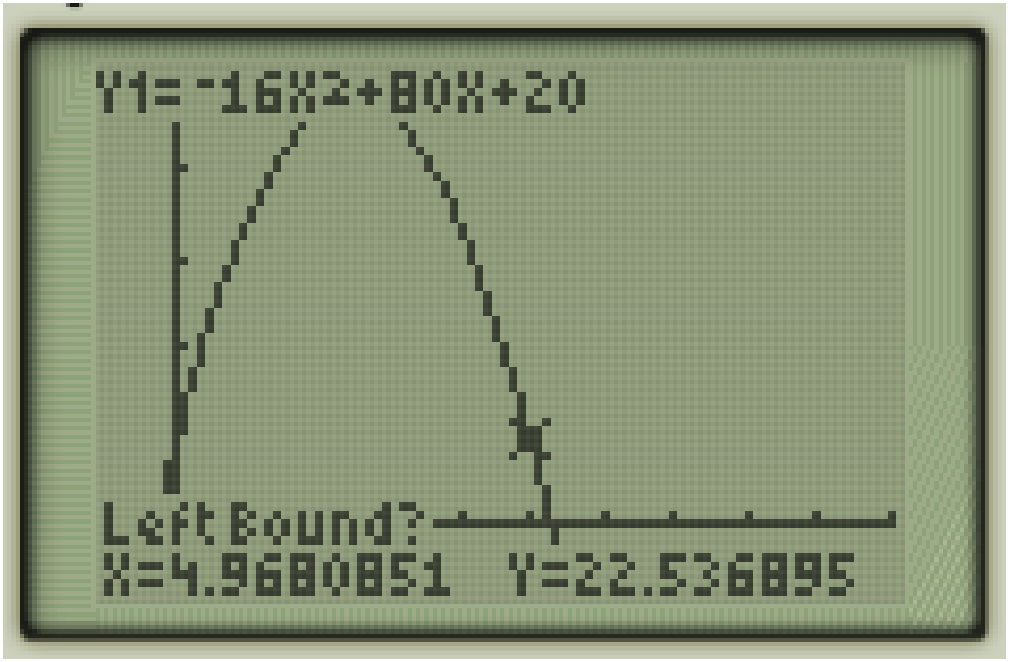
So what else can we tell from this graph?

How many seconds will have elapsed when the ball hits the ground?

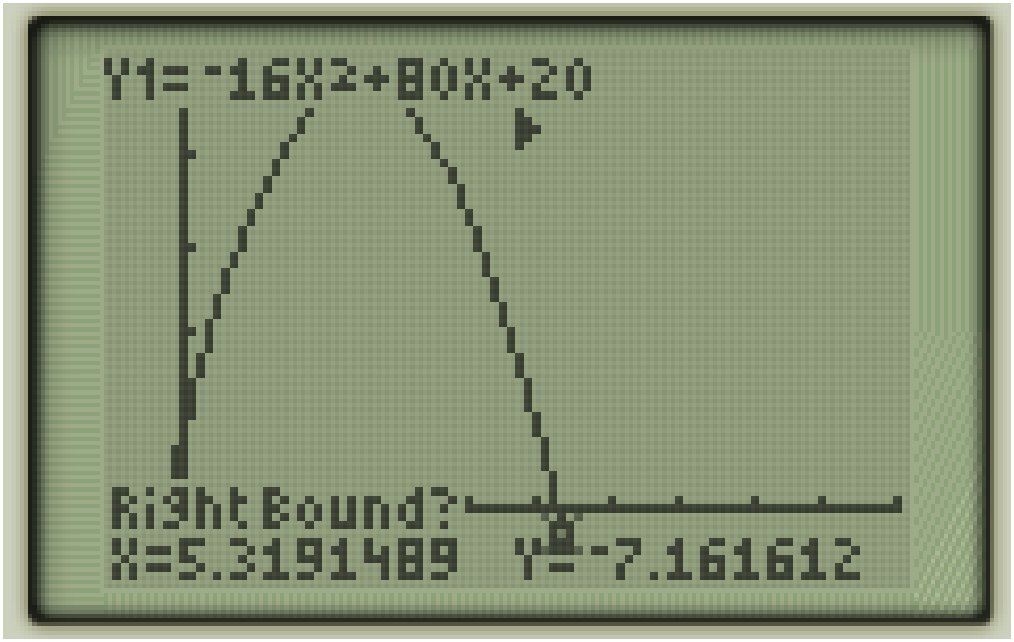
Press [2nd][TRACE] and select option [2:zero]



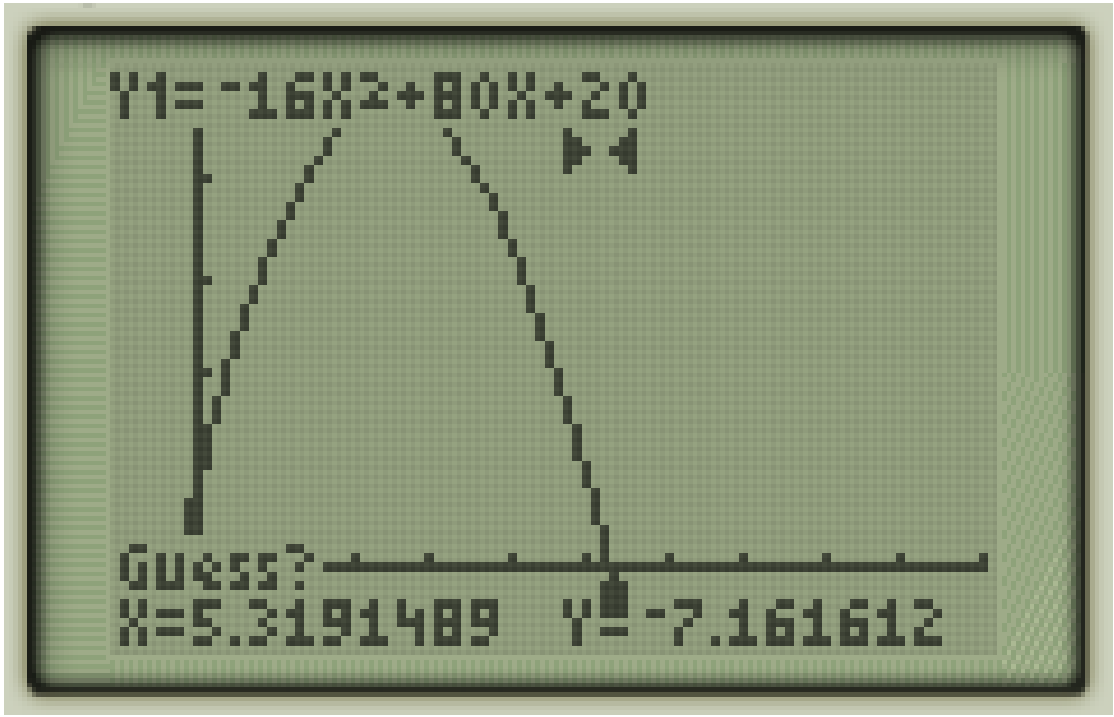
Move the cursor using left/right arrow keys above x-intercept on the graph and press [ENTER].



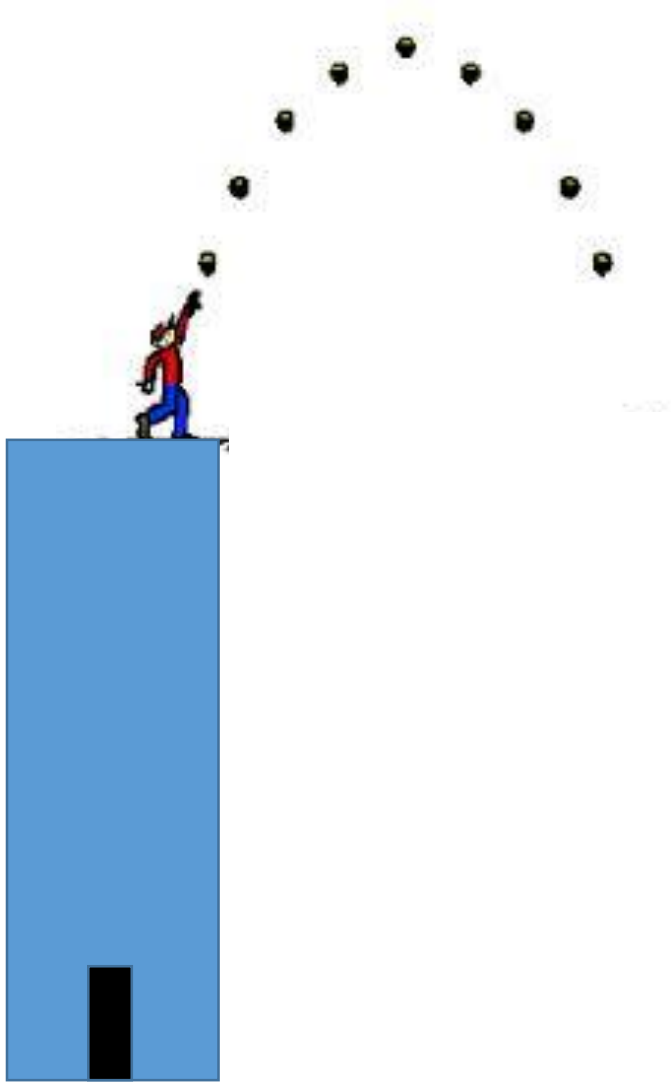
Then move the cursor below the x-intercept and press [ENTER].

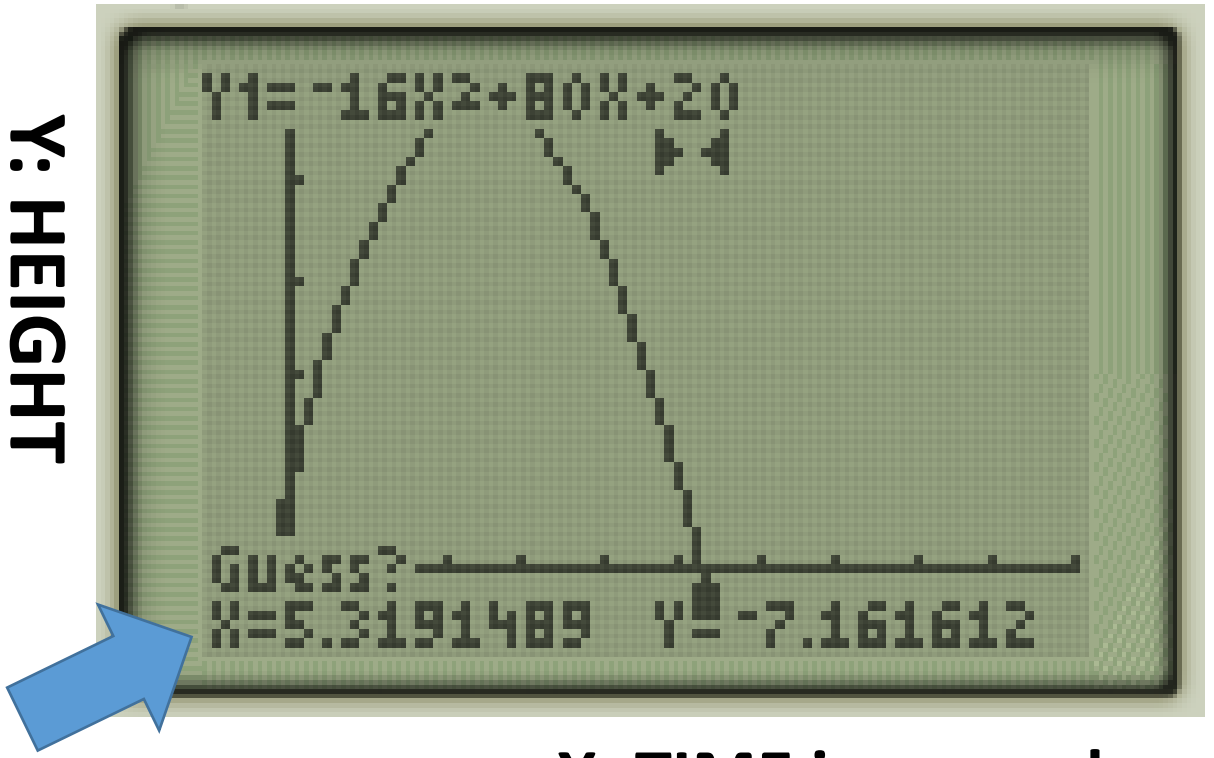


Step 9: Then press [ENTER] again.



How many seconds will have elapsed when the ball hits the ground?





Y: HEIGHT

X: TIME in seconds

A shot-put throw can be modeled using the equation

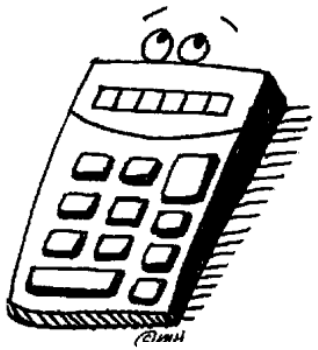
$$h(t)=-0.0241x^2+x+5.5$$

where **x** is the **distance** traveled in feet and **h(t)** is the **height** in feet.

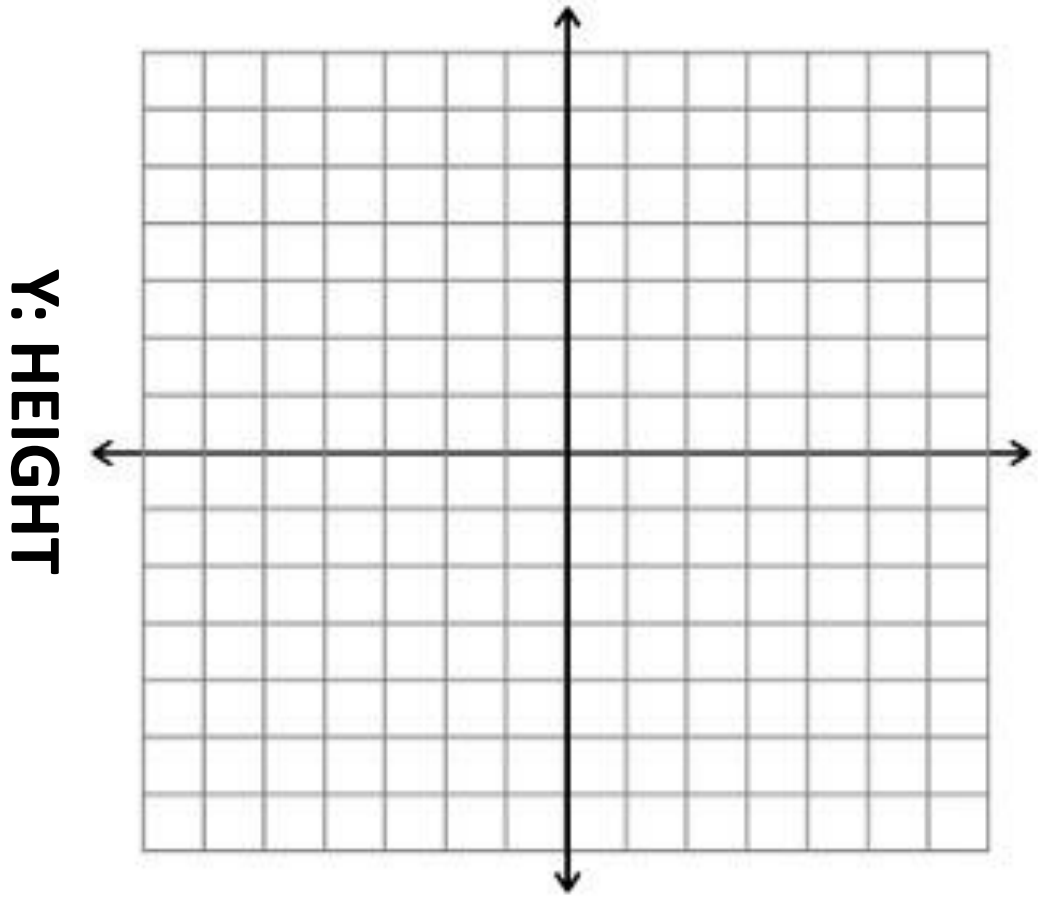
#2 on your worksheet

1. How long was the throw?

2. How high did the shot get put?

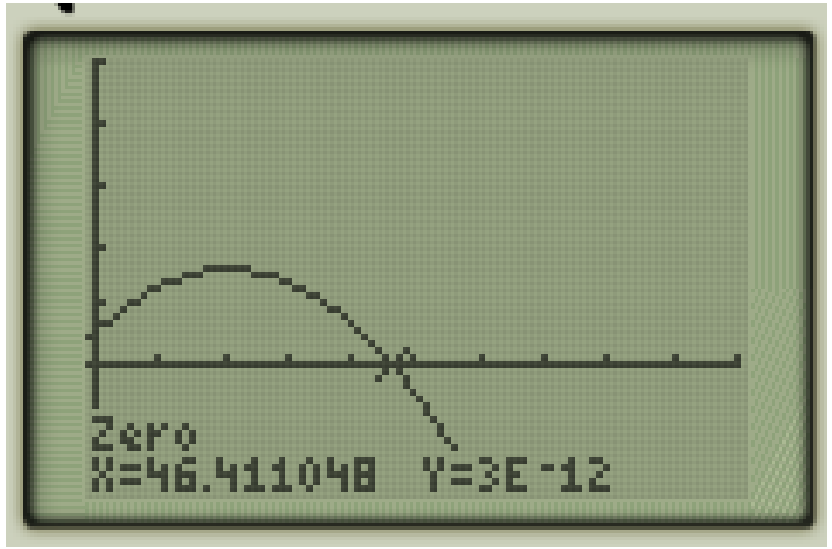


Press [Y=] and enter the function

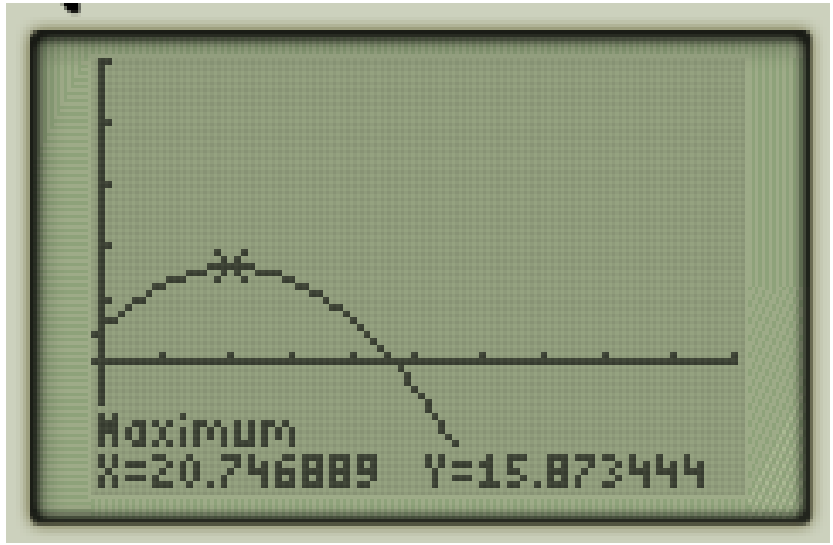


What's a realistic viewing window?

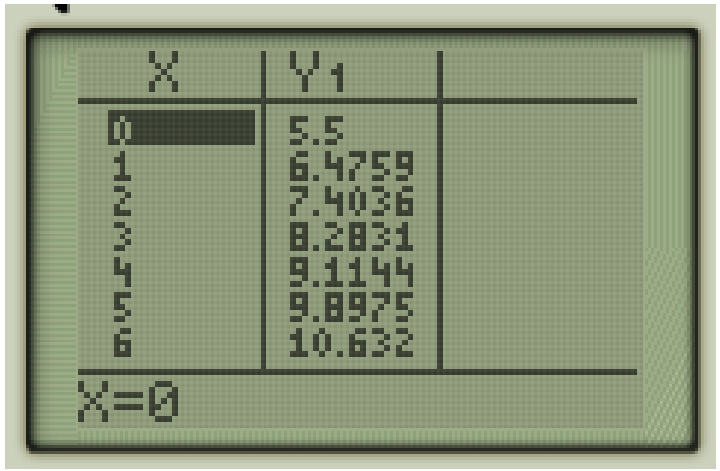
1. How long was the throw?



2. How high did the shot get put?

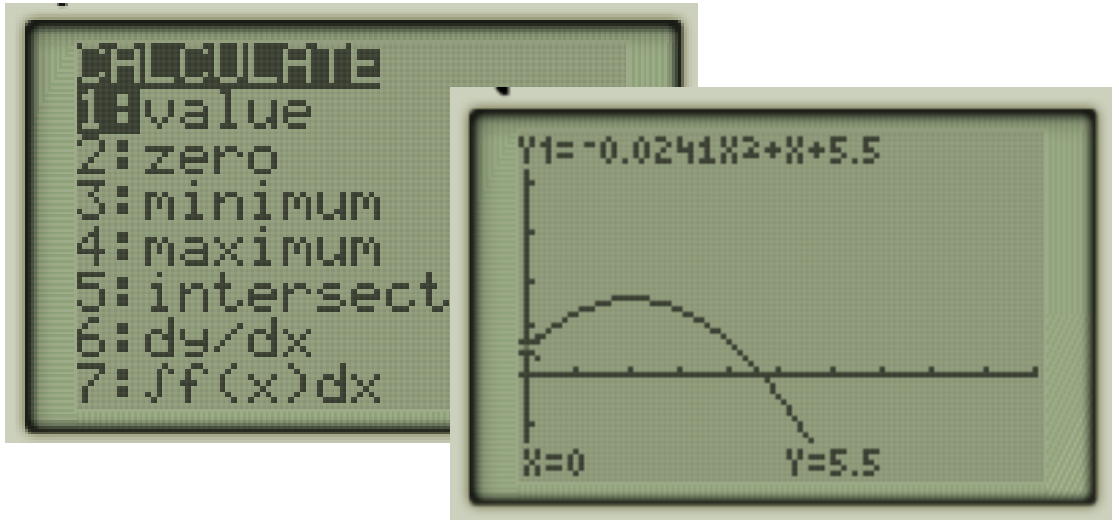


Bonus: How tall is the shot putter?



X	Y1
0	5.5
1	6.4759
2	7.4036
3	8.2831
4	9.1144
5	9.8975
6	10.632

X=0



#3 on your worksheet

A farmer has 1000 feet of fencing and a very big field. She can enclose a rectangular area with dimensions **x** feet and **500-X** feet. What is the largest rectangular area she can create?

Area = Length times Width

Area = (x)(500-x)
$=500x-x^2$

What are realistic values for x?

A farmer has 1000 feet of fencing and a very big field. She can enclose a rectangular area with dimensions **x** feet and **500-X** feet. What is the largest rectangular area she can create?

Realistic X… $0<x<500$

Can length or wide be negative? Zero?

Realistic Y…

Pick a number halfway between 0 and 500. Plug that into your area function. Use the answer to determine the Y saettings.

Area = Length times Width

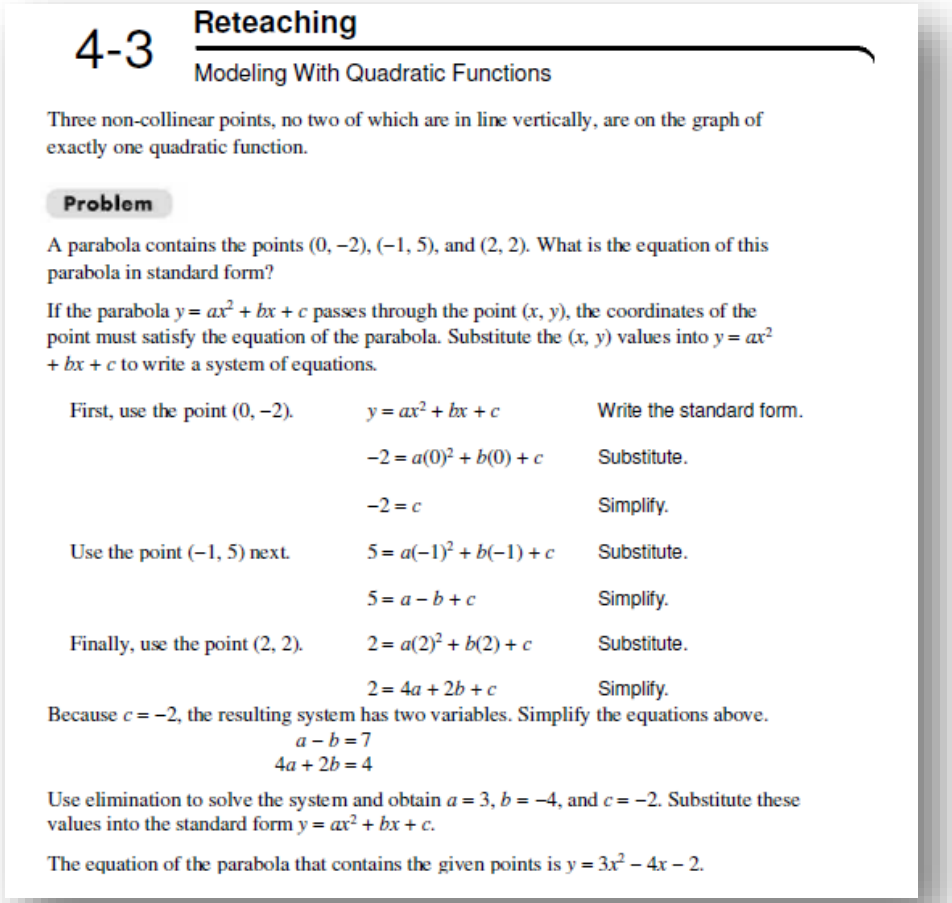
Area = (x)(500-x)
$=500x-x^2$

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 $y = ax^2 + bx + c$.

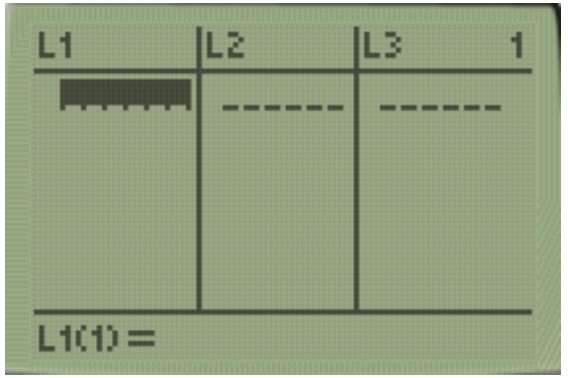
The equation of the parabola that contains the given points is $y = 3x^2 - 4x - 2$.

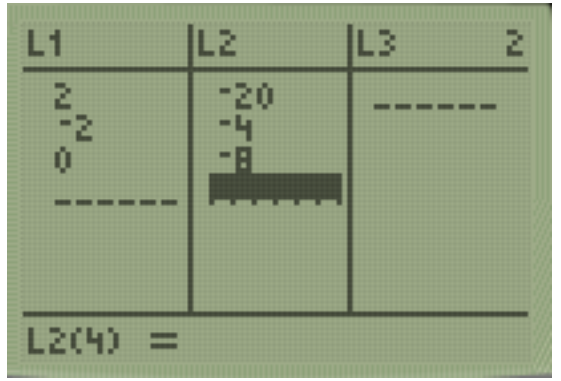
We'll do this….

Quadratic Modeling

Look at #1 on 4-3 Practice sheet . First we need to enter the data points.

Press STAT, 1,

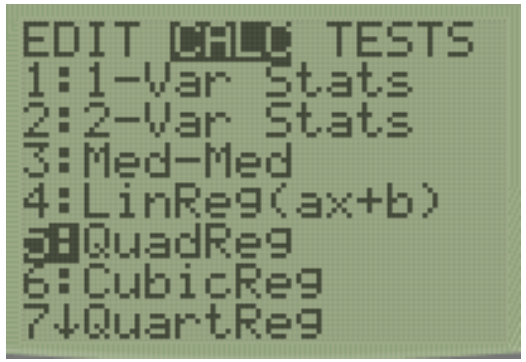




Enter the x values in L1 and the y values in L2

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

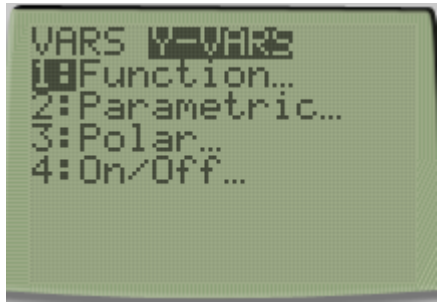
What do you see on your calculator?

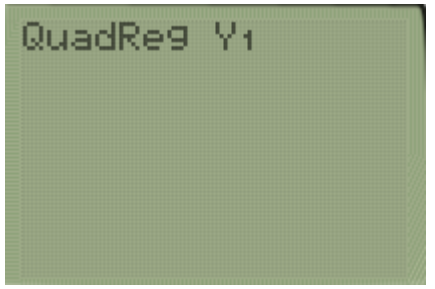
OR

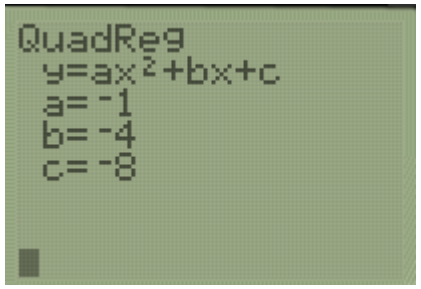
Xlist: L1
Ylist: L2
FreqList:
Store RegEQ
Calculate

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

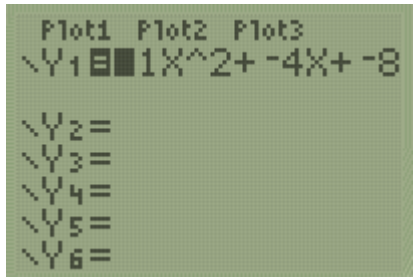
VARS

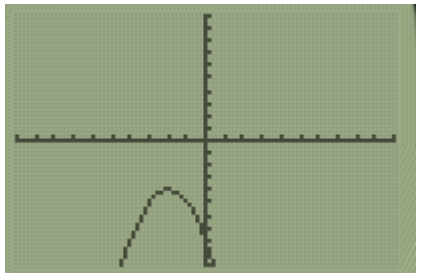






Look at your regression model.





Quadratic Modeling

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