

Name:

Class:

Quadratic Functions

Algebra 1

Topic: The vertex of quadratic formula

Time required: 60 minutes

Worksheet overview

In this worksheet, you will investigate how to analyze vertex of quadratic functions by using TI-84 plus calculator.

Objectives:

- ✓ Fonksiyonun grafiğinin tepe noktası, eksenleri kestiği noktalar ve simetri eksenini buldurulur.
- ✓ Fonksiyonun grafiğinin tepe noktası ile fonksiyonun en küçük ya da en büyük değeri ilişkilendirilir.
- ✓ $y = a(x - r)^2 + k$ ve $y = a(x - x_1)(x - x_2)$ şeklinde verilen ikinci dereceden fonksiyonların grafikleri çizilir.

Necessary materials: TI-84 Plus calculator, spreadsheet software, computers, and pencil.

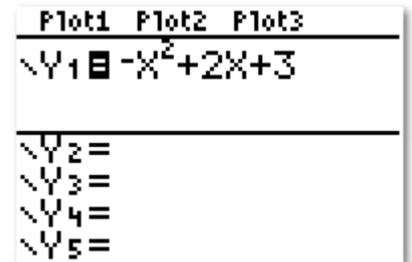
1) The height y meters, of a rocket x seconds after it is fired vertically upwards is given by $y = -x^2 + 2x + 3$, $x \geq 0$.

a) How long does it take for the rocket to reach its maximum height?

(It means what is the vertex of y .)

Consider the equation $y = -x^2 + 2x + 3$, $x \geq 0$.

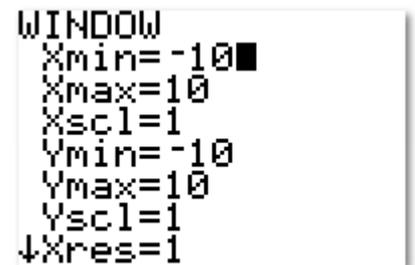
Press **Y=** and enter the equation as shown.



Press **GRAPH**. Just take a moment to examine the graph.

It would be helpful to understand the vertex of equation.

Press **WINDOW**. It would be able to see the interval of x and y values. Press **GRAPH**.



- Predict where the rocket reaches its maximum height. Approximately where is the vertex of equation?
- What do you notice about the shape of parabola?

If the different values of x correspond to same y value, the parabola will be symmetric. Press **2ND [TABLE]**. Look at the table for x values and y values. Notice that there are no repeat values of y . Try adjusting x values to correspond to repeat values of y . Press **2ND [TBLSET]** and Tbl with **2**.



Press **2ND [TABLE]**. Notice that there are repeat values of y. Each y value is corresponding two different x values. Choose a pair of x values that have the same y-value.

X	Y1	
0	3	
2	3	
4	-5	
6	-21	
8	-45	
10	-77	
12	-117	

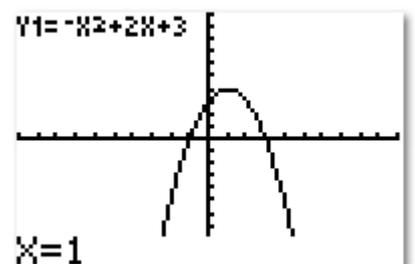
X=0

Press **2ND [QUIT]** to go home screen. Average two values of x that have the same value that has the same y-value.

$$(0+2)/2 = 1$$

- What do you notice about the average?
- What significance might this number have?

To see what the significance of the value $x=1$, investigate the graph. Press **GRAPH**. Press TRACE. In “trace” mode, type **1**, press **ENTER**.



- What point on the parabola have you found?

b) What is the maximum height reached by the rocket?

- Review the above question, how long does it take for the rocket to reach its maximum height?

- What is y for $x=1$?

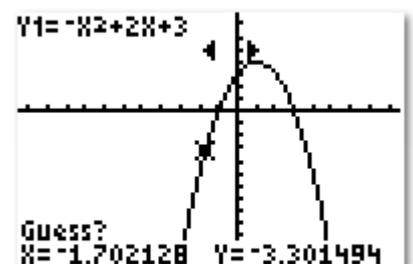
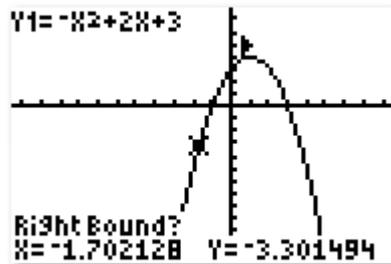
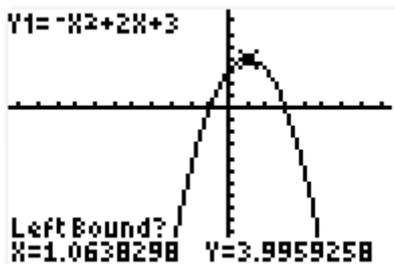
c) How long does it take for the rocket to fall back to earth?
(It means x - intercepts)

To find the x -intercepts, use the zero command found in the CALC menu. (Press **2ND [CALC]**)

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CALC
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
    
```

Move the cursor and press ENTER to input a left bound, right bound, and a guess.



- What do you think about other zero of equation?

left bound	right bound	guess

2) The photo shows the Istanbul Bosphorus Bridge in Turkey, which has the longest span of any suspension bridge in Turkey. A suspension cable of the bridge forms a curve that resembles the parabola.

The curve can be modeled with the function;

$$y = 0.0001432(x - 2130)^2,$$

where x and y are measured in feet. The origin of the function's graph is at the base of one of the two towers that support the cable. Hint: Start by drawing a graph.

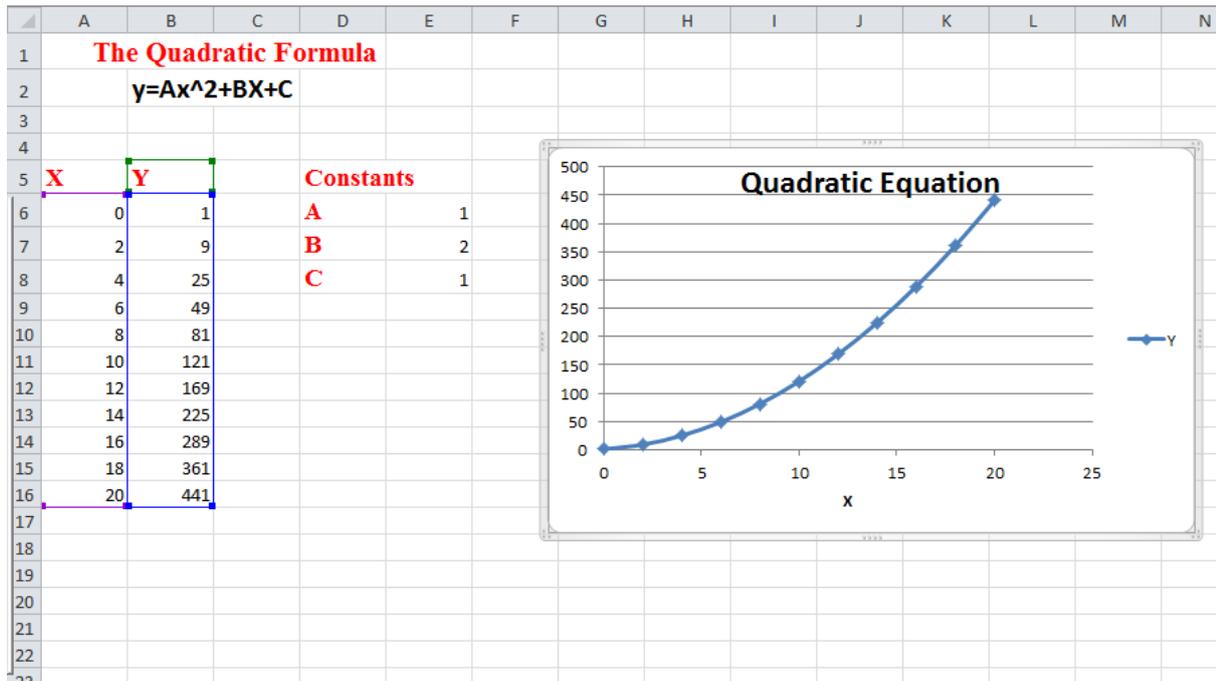


- How far apart are the towers?
- How high are they?
- Describe the steps; you would take the sketch of the graph of this function. Moreover, justify your reasoning by solving problems.

Investigation with Excel

In this part, justify your reasoning through excel program;

- Change the constant terms of quadratic formula.
- Change the x and the y.
- Graph each function.
- Label the vertex and the axis of symmetry.



- Fill in the below table with your quadratic equations which are investigated by changing values in excel.
- Each function which investigated will be written in standard form. In the second column, each function will be rewritten in vertex form. Use multiplication to verify that the functions in each row are equivalent.

Standard Form $y = ax^2 + bx + c$	$-\frac{b}{2a}$	Vertex Form $y = a(x - h)^2 + k$	h