

Graphing the Quadratic Functions

Class Level: 10th Grade

Objectives: Fonksiyonun katsayılarındaki değişimin fonksiyonun grafiği üzerine etkisi bilgi ve iletişim teknolojilerinden yararlanılarak incelenir.

Necessary Materials: TI-84 Plus calculator, pencil, spreadsheet software, and computer.

Time Required: 60 minutes

The general form of a quadratic function is $y = a(x - h)^2 + k$. Changing the value of a , h and k results in a different parabola in the family of quadratic functions. You can use a TI-84 Plus graphing calculator to analyze the effects that result from changing each of these parameters.

Problem 1: Consider a basketball shot. At time $t=0$, the basketball leaves the player's hand and gains height as time passes. Eventually the basketball will begin to lose height as time continues to pass.

- Describe the graph shape when the height of the ball is graphed as a function of the time elapsed.
- What differences would exist for the graphs of a basketball shot from the foul line and a basketball shot from the half-court line?

- Sketch the graph of such a basketball and label the axes.
- Have you encountered any mathematical rules that generate a pattern similar to this one? What did these rules have in common?

Problem 2:

$$y = x^2$$

$$y = x^2 + 4$$

$$y = x^2 - 3$$

- Using your graph calculator:
 1. Graph the each function on the same set of axes on the same screen
 2. Find the coordinates of the vertex of each function

Step 1: Load the functions into the $Y =$ menu.

```

Plot1 Plot2 Plot3
Y1=X^2
Y2=(X+6)^2-5
Y3=
Y4=
Y5=
Y6=
Y7=

```

Step 2: Push the ZOOM button and select 6: Z Standard to produce the image.

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ZOOM MEMORY
1:ZBox
2:Zoom In
3:Zoom Out
4:ZDecimal
5:ZSquare
6:ZStandard
7↓ZTrig

```

Step 3: Push 2nd TRACE to open CALCULATE menu and select 3: minimum or 4: maximum depend on your function to find the coordinates of the vertex of function.

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

```

Step 4: Use the arrow keys to select left bound and press ENTER. Secondly, use the arrow keys again to select right bound and press ENTER. Then, locate your guess and press ENTER.

- These functions are all member of the family $y = x^2 + k$ where k is constant term, what is the k on each function?
- What effect does the value of k have on:
 - i. The position of the graph
 - ii. The shape of the graph
- Where does the vertex move?

Problem 3:

$$y = x^2$$

$$y = (x + 4)^2$$

$$y = (x - 3)^2$$

- Using your graph calculator:
 1. Graph the each function on the same set of axes on the same screen
 2. Find the coordinates of the vertex of each function

Repeat the steps above for the problem 1.

- These functions are all member of the family $y = (x + h)^2$ where h is constant term, what is the h on each function?
- What effect does the value of h have on:
 - i. The position of the graph
 - ii. The shape of the graph
- Where does the vertex move?

Problem 4:

$$y = x^2$$

$$y = (x + 6)^2 - 5$$

$$y = (x - 4)^2 + 6$$

- Using your graph calculator:
 1. Graph the each function on the same set of axes on the same screen
 2. Find the coordinates of the vertex of each function

Repeat the steps above for the problem 1.

- These functions are all member of the family $y = (x + h)^2 + k$ where h, k is constant term, what is the h and k on each function?
- What effect does the value of h and k have on:
 - i. The position of the graph
 - ii. The shape of the graph
- Where does the vertex move?

Problem 5:

$$y = x^2$$

$$y = -x^2$$

- Using your graph calculator:
 1. Graph the each function on the same set of axes on the same screen
 2. Find the coordinates of the vertex of each function

Repeat the steps above for the problem 1.

- These functions are all member of the family $y = ax^2$ where a is constant term, what is the a on each function?

- What effect does the value of a have on:
 - i. The position of the graph
 - ii. The shape of the graph

- Where does the vertex move?

Problem 6:

$$y = x^2$$

$$y = 3x^2$$

$$y = \frac{1}{3}x^2$$

- Using your graph calculator:
 1. Graph the each function on the same set of axes on the same screen
 2. Find the coordinates of the vertex of each function

Repeat the steps above for the problem 1.

- These functions are all member of the family $y = ax^2$ where a is constant term, what is the a on each function?

- What effect does the value of a have on:
 - i. The position of the graph
 - ii. The shape of the graph

- Where does the vertex move?

Problem 7: What kind of transformations are applied to the parent function

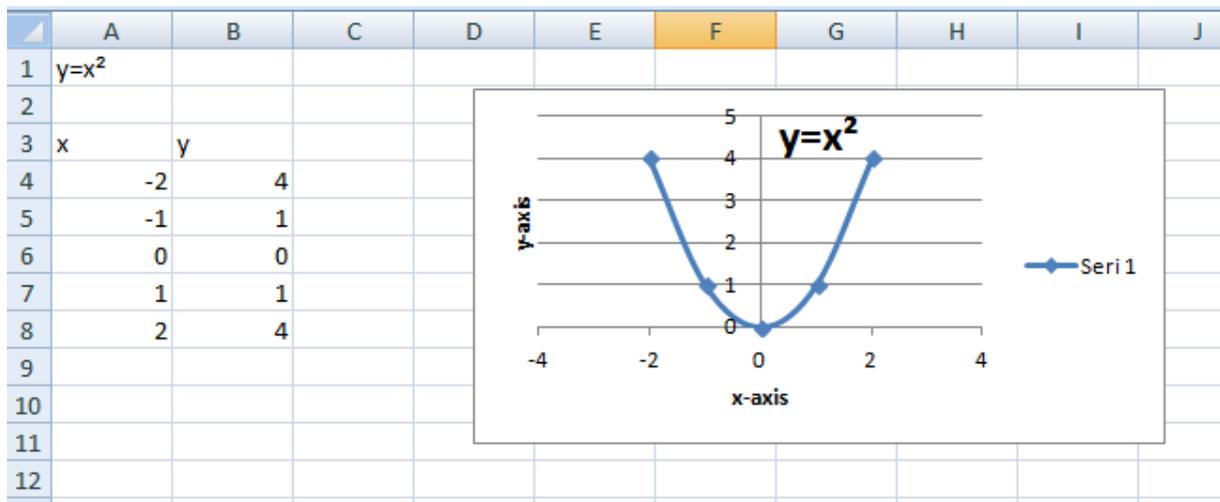
to yield $y = \frac{1}{3}(x - 3)^2 - 4$? Based on the patterns of change you discovered,

sketch the graph of the equation $y = \frac{1}{3}(x - 3)^2 - 4$.

Problem 8: Write an equation of the graph that has a vertical stretch of 2

and is shifted four units to the left and one unit up from the equation $y = x^2$?

Problem 9:



How could you use the spreadsheet to graph the quadratic equations of $y = x^2 + 5$ and $y = x^2 + 4x$? There is an example of $y = x^2$ given above that can help you.

After completing these graphs, compare each graph with the equation of $y = x^2$.