

GRAPH THE TURKISH VAN ON TI-84 PLUS

Grade Level: 12th Grade

Ministry of National Education (MoNE) Objectives:

- *İD.12.3.2. Elips, Hiperbol ve Parabolün Analitik İncelenmesi/ İD.12.3.2.1. Parabol, elips ve hiperbolü tanımlar, standart denklemlerini elde eder ve uygulamalar yapar.*
- *İD.12.3.1. Çemberin Analitik İncelenmesi /İD.12.3.1.1. Merkezi ve yarıçapı verilen çemberin denklemini oluşturur./ İD.12.3.1.2. Denklemleri verilen doğru ile çemberin birbirine göre durumlarını inceler.*

Materials needed: TI-84 plus, Spreadsheet software, computer, pencil, ruler, compass, colored pencils and two-dimensional grid paper.

Time required: 60 minutes

In this worksheet, you are asked to draw a picture of the Van cat on TI-84 Plus graphing calculators. When creating a drawing, you are supposed to be use conic sections which include lines, parabolas, circles, ellipses and hyperbolas.



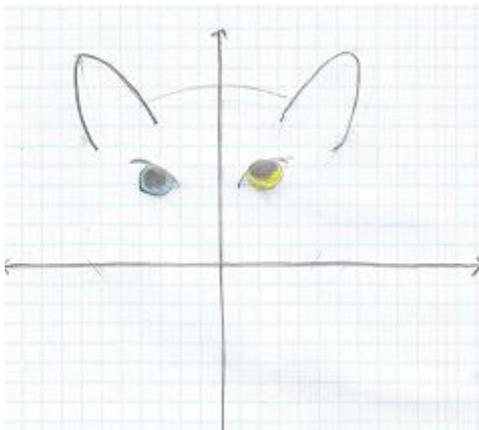
Activity 1:

Initially, you use two-dimensional grid paper to draw the picture of Turkish Van cat by using conic sections.

Conic sections formulas are stated below:

- **Parabola:** $y = a(x - h)^2 + k$
- **Ellipse:** $1 = \frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2}$
- **Hyperbola:** $1 = \frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2}$
- **Circle:** $(x - h)^2 + (y - k)^2 = r^2$
- **Line:** $y = mx + n$

To give an example, you can draw the eyes as follows:



Then you note the equation of each eye that you draw and list domain and range for each equation:

For instance:

Right (yellow) Eye: $(x - 4)^2 + (y - 5)^2 = 2$

The domain will be $\{x \mid 4 - \sqrt{2} < x < 4 + \sqrt{2}\}$

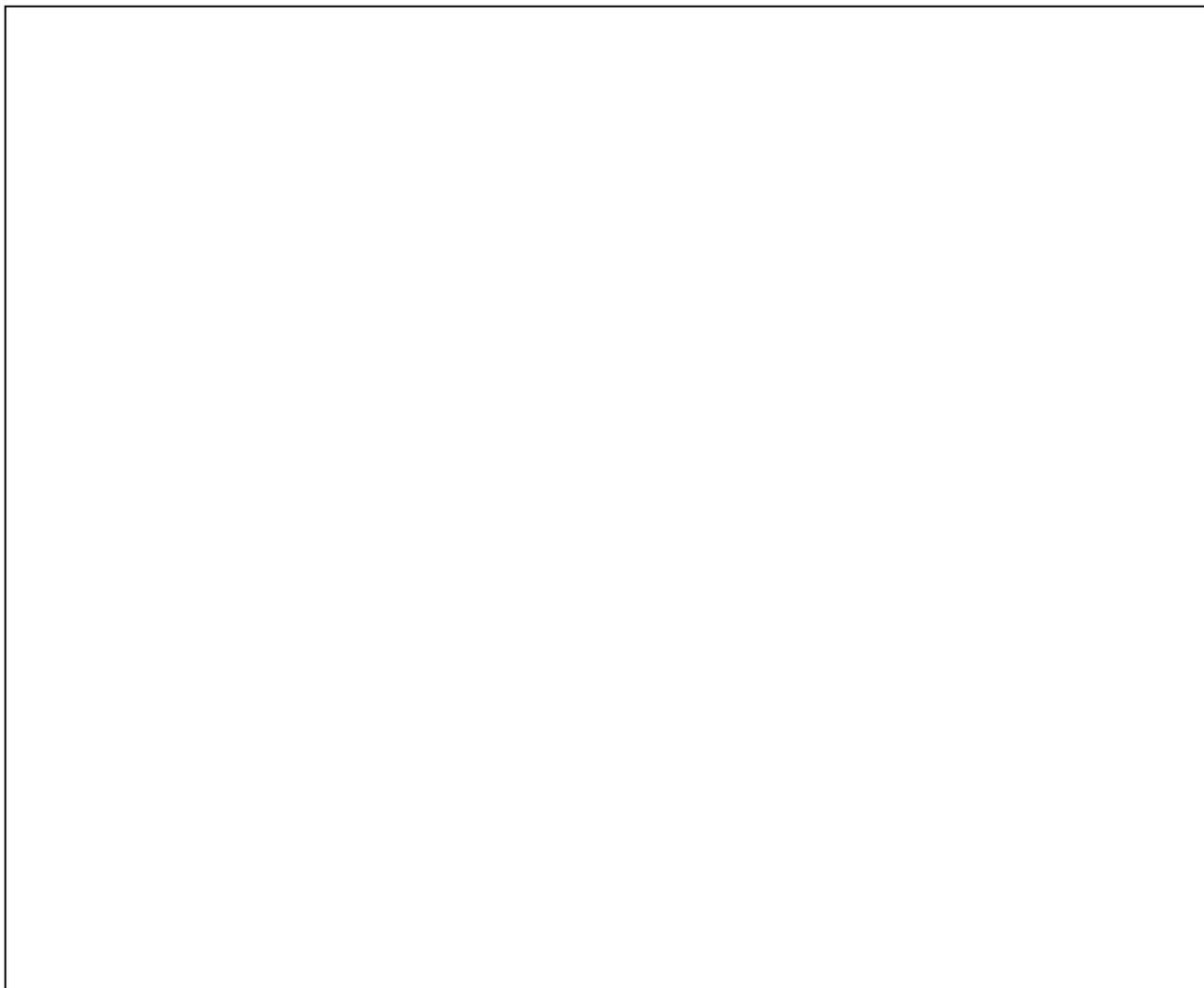
The range will be $\{y \mid 5 - \sqrt{2} < y < 5 + \sqrt{2}\}$

Retina: $(x - 4)^2 + (y - 5.5)^2 = 1$

Domain: $(4 - 1, 4 + 1)$

Range: $(5 - 1, 5 + 1)$

You are asked to write all the equations when you create the picture as above (Head, nose, mouth, left ear, right ear, whisker, etc.) and note domain and range for each equation:



Activity 2:

In this activity, you are going to enter all the equations and domains that you write in your TI-84 plus calculators.

For instance;

Right Eye: $(x - 4)^2 + (y - 5)^2 = 2$

Retina: $(x - 4)^2 + (y - 5.5)^2 = 1$

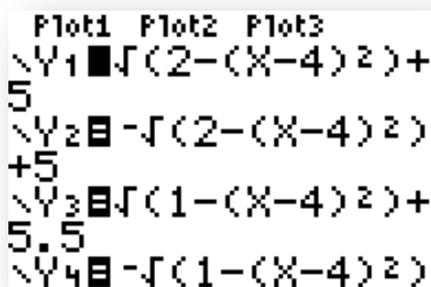
The domain: $(4-\sqrt{2}, 4+\sqrt{2})$

The domain: (3, 5)

The range $(5-\sqrt{2}, 5+\sqrt{2})$

The range: (4, 6)

- After opening the TI- calculator, press **Y=** and enter the equations as shown.



```
Plot1 Plot2 Plot3
\Y1 ■ √(2-(X-4)²)+
5
\Y2 ■ -√(2-(X-4)²)
+5
\Y3 ■ √(1-(X-4)²)+
5.5
\Y4 ■ -√(1-(X-4)²)
```

Because equations are circle forms, there is no need to state domain in graphing calculators.

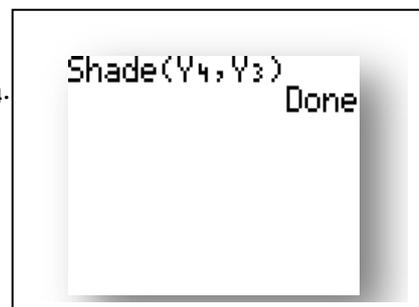
Press **[2 nd][MODE]** to go to homepage.

Then press **[2 nd][PRGM][7]** for shading between function **Y₃** and function **Y₄**.

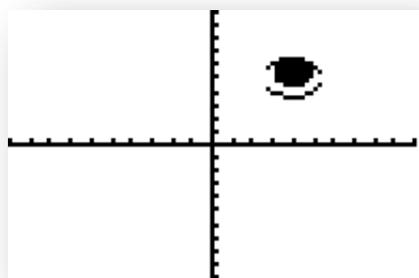
After that press **[VAR][Y-VARS][1][4]** to select the function **Y₄**.

Press **[,][VAR][Y-VARS][1][3]** to select the function **Y₃**.

Lastly press **]**.



Finally, press the **GRAPH**:



Now, you are asked to enter all the equations and domains that you create for the drawing in your graphing calculator and graph all the equations and see the picture and paste/stick it in the box provided:

Activity 3:

For this activity create the drawing in Excel.

For instance, to draw the right eye of the Van cat, take into the consideration the domain of the equation:

Right Eye: $(x - 4)^2 + (y - 5)^2 = 2$

The domain: (2.59, 5.41)

The range (3.59, 6.41)

Step1: Write x values between 2.59 and 5.41 in the first cell (cell A).

Step2: for the y values (cell B) write the formula in the insert function part:

$$f_x = \text{SQRT}((2-(A2-4)^2))+5$$

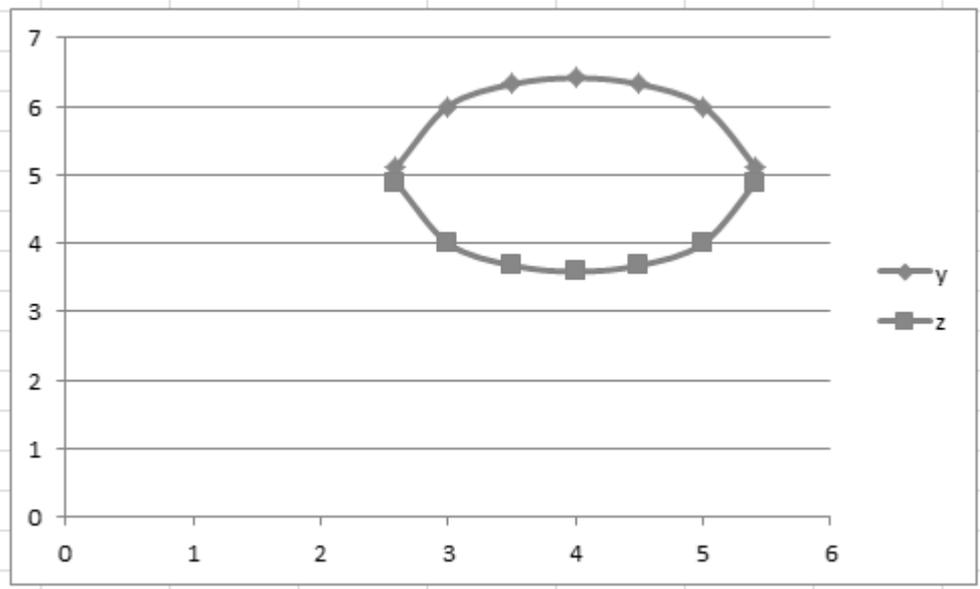
Step3: To complete the circle, for -y values (cell C) write the formula in the insert function part:

$$f_x = -1*\text{SQRT}((2-(A2-4)^2))+5$$

Values are going to be as follows:

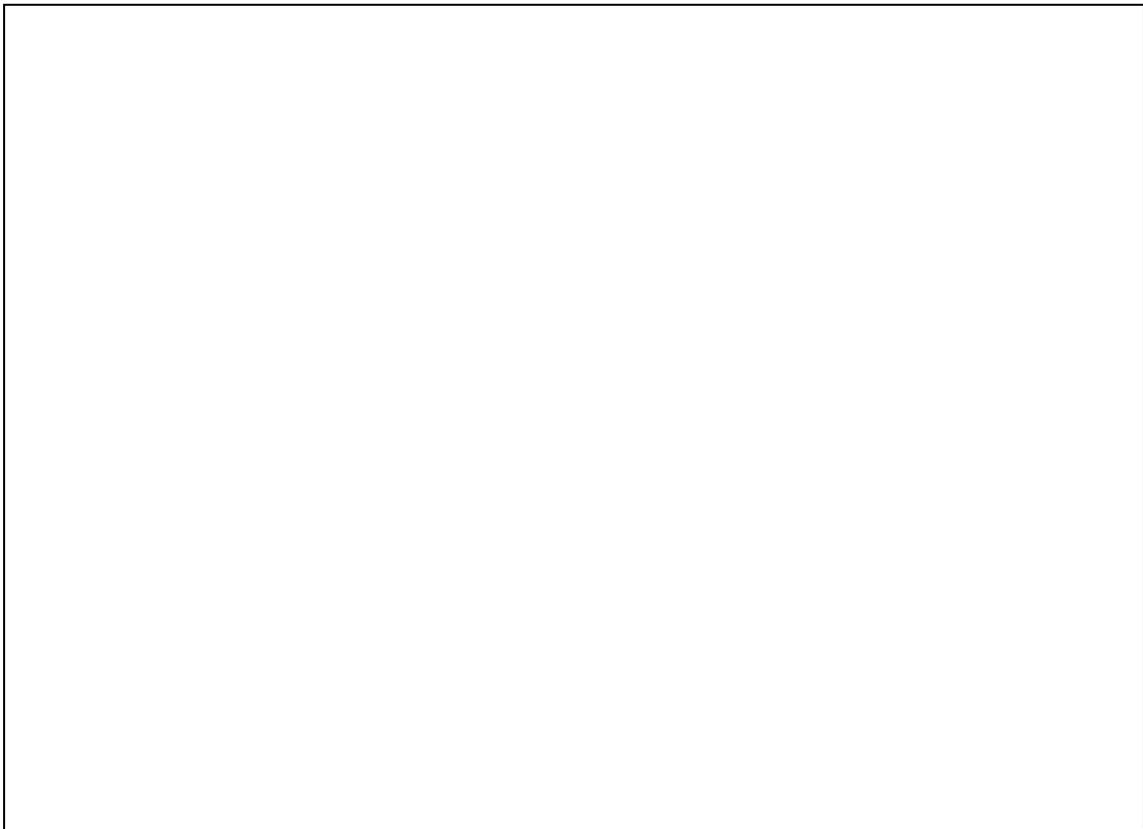
	A	B	C	D
1	x	y	z	
2	2,59	5,109087	4,890913	
3	3	6	4	
4	3,5	6,322876	3,677124	
5	4	6,414214	3,585786	
6	4,5	6,322876	3,677124	
7	5	6	4	
8	5,41	5,109087	4,890913	
9				
10				
11				

Finally, to graph the eye select all three values and click on the graphic wizard:



Follow the same steps for all the equations that you create and draw the picture in Excel.

Paste/Stick the picture in the box provided:



MY REFLECTION ON PREPARATION TI-84 WORKSHEET

This worksheet was attributed to art-based project in mathematics. I thought that through this worksheet, students can make connection between art and mathematics. Students can also integrate art skills and mathematical skills. Thus, they can improve their mathematical accuracy and success in mathematics. In addition, students enable to visualize conic sections that include circles, ellipses, hyperbolas and parabolas in this worksheet. Students can be aware of these mathematical terms and show a great interest in mathematics.

When designing this worksheet, I learned more features of TI-84 calculator such as shading option. It was hard to shade between two functions until I found out the shade option. Furthermore, I have no experience in using Microsoft Excel. Through preparation of this worksheet, I learned Microsoft Excel immediately. I also experienced how difficult to prepare a worksheet is. As a teacher you must develop empathy and prevent potential problems when students implement the activity.

Finally, when I judge my worksheet with MoNE objectives and principles outlined in MoNE curriculum, I think this worksheet can use any of private and public schools for 12th graders. Because using TI-84 or Microsoft Excel is not an option for this worksheet, students have to use them to do the worksheet. Moreover, there is not a certain answer in this worksheet. I guide students with a short example and let student do their assignment on their own.

Reference: National Council of Teachers of Mathematics (2010). Draw it, Write it, Do it. *Mathematics Teacher*, 99(3), 152-153.