

5-1 Modeling Real-World Data with Quadratic Functions

FORMS OF A SQUARE (QUADRATIC) FUNCTION

<p>Standard form:</p> $f(x) = ax^2 + bx + c, \text{ where } a \neq 0$ <p>quadratic term linear term constant</p>	<p>Vertex form:</p> $f(x) = a(x - h)^2 + k$ <p>Vertex (h, k)</p>	<p>Factored form:</p> $f(x) = a(x - r_1)(x - r_2)$ <p>Roots (zeros): r_1 & r_2</p>
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PARTS OF A PARABOLA (SQUARE FUNCTION)

TERM	DEFINITION	ILLUSTRATION
AXIS OF SYMMETRY :	The axis is a line ($x = h$) which divides the parabola equally in half.	
Y-INTERCEPT:	Where the function crosses the <u>y</u> axis. Can be found by substituting <u>0</u> in place of <u>x</u> and solving for <u>y</u> . When the equation is in general form, the y-intercept will always be <u>c</u> .	
VERTEX (h,k)	The vertex can be found when in general form by $x = -\frac{b}{2a}$ and then substituting your answer in place of <u>x</u> to find <u>y</u> .	
MAXIMUM:	The <u>highest</u> point on the graph when a is <u>negative</u>	
MINIMUM:	The <u>lowest</u> point on the graph when a is <u>positive</u>	
ZEROS OF THE FUNCTION:	The point(s) on a function where <u>y = 0</u> , which are actually the <u>x-intercepts</u> of the function. They are also called <u>roots</u> .	
CORRELATION COEFFICIENT (r^2)	Measures how well an equation fits a set of data. The closer r^2 is to 1, the stronger the correlation.	<p>Calculator: Catalog → DiagON</p>

Sketch a quadratic with one real solution	Sketch a quadratic with two real solutions	Sketch a quadratic with no real solutions

QUADRATIC FUNCTIONS IN THE REAL WORLD:

The price of gasoline at a local station throughout the month of March is modeled by $y = -.014x^2 + .448x - 2.324$, where $x = 1$ corresponds to March 1st.

$x = \text{day}$ $y = \text{\$ gas}$ $\text{MAX}(15,999, 1.26)$

- a. On what day in March did the price of gasoline reach its maximum?

March 16th

- b. What was the highest price of gasoline in March?

\\$1.26 /gallon

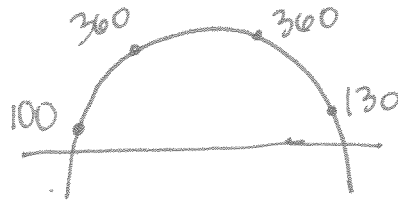
EXAMPLE A: RAINFALL & MOSQUITOES: The rainfall measurements on the right were collected in 2003 and 2004 at the Oceana Naval Air Station.

Month	Rainfall Inches 2003	Mosquitoes In thousands 2003
Jul	8.9	130
Aug	5.0	360
Sep	7.0	360
Oct	3.0	100

- Enter the data from the table to the right into your TI-83/84 using the STAT => EDIT menu.
- Describe below what your **independent** and **dependent** variables represent.
rainfall mosquitoes
Mosquito population depends on the rain
- Go to Stat Plot to create and view a scatter plot of your data. What function family member does the data appear to look like? Zoom 9
Square Function (Quadratic)

- Setup an appropriate WINDOW for viewing the data. Why did you choose these values?

Xmin= 2
Xmax= 10
Xscale= 1
Ymin= 0
Ymax= 450
Yscale= 50



- Go to STAT => CALC and choose the appropriate regression function. What type did you choose?

Quadratic Regression

- Write your equation below rounded to the nearest hundredth:

$$y = -31.79x^2 + 383.22x - 762.96$$

- Now, go to Y= and use the VARS menu to copy your regression function into Y=. View the new graph and answer the questions:

- What are the zeros of this function? 2.52 & 9.54 What do they mean?
When there is no rainfall, it is how many mosquitoes there are.

- What is the vertex of this function? (6.03, 391.94) What does it mean?

It is when there are the largest amount of mosquitoes

- Does the curve fit well? Be specific. What is your correlation coefficient and what does it mean?

$r^2 = .999$ It indicates that the data is very accurate.

EXAMPLE B: MORE MOSQUITOES: Biologists in Kentucky collected data on the number of mosquitoes (in millions) and the number of inches of rainfall in June. They found that two inches of rainfall resulted in an insect count of 16 million, four inches resulted in 24 million, and seven inches resulted in 21 million.

- Use this data to establish a quadratic function that can be used to predict the mosquito population.

$$y = -x^2 + 10x \quad r^2 = 1!$$

- Predict the mosquito count when there is one inch of rainfall in June. 9 million

When $x=1$, what is y ?