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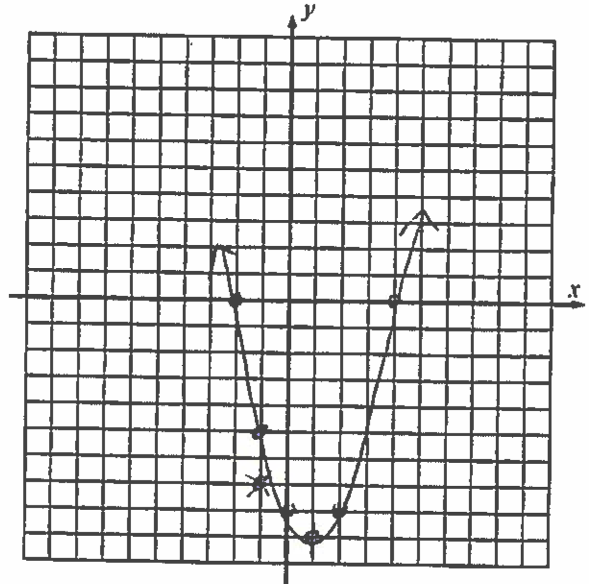
Quadratic functions can obviously be more complicated than our last example, but, strangely enough, they all have the same general shape, which is known as a **parabola**. Let's explore the next quadratic function with the help of technology. We will also introduce some important terminology.

Exercise #3: Consider the quadratic function $y = x^2 - 2x - 8$.

(a) Using your calculator to help generate a table, graph this parabola on the grid given. Show a table of values that you use to create the plot.

x	-2	-1	0	1	2	4
y	0	-5	-8	-9	-8	0



(b) State the range of this function.

$y \geq -9$

(c) Over what **domain interval** is the function **increasing**?

$x > 1$

(d) State the coordinates of the parabola's turning point (also known as its vertex and its minimum point).

$(1, -9)$

(e) Draw the axis of symmetry of the parabola and write its equation below and on the graph.

(f) What are the x-intercepts of this function? These are also known as the function's **zeroes**. Why does this name make sense? As a suggestion, write out their full xy-pair coordinates.

$(-2, 0)\ (4, 0)$ -2 and 4 are the same distance away from 1

Exercise #4: The quadratic function $f(x)$ has selected values shown in the table below.

(a) What are the coordinates of the turning point?

$(2, 13)$

(b) What is the range of the quadratic function?

$y \leq 13$

x	$f(x)$
−1	4
0	9
1	12
2	13
3	12
4	9
5	4
6	−2

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Name: KEY Date: ____________

Introduction to Quadratic Functions

We have now studied **linear** and **exponential** functions. These functions were relatively simple because they were either **always increasing** or **always decreasing** for their entire **domains**. We now will start to study other functions, most notably **quadratic functions**, which are a type of **polynomial function**. Their definition is shown below:

Quadratic Functions
Any function that can be placed in the form: $y = ax^2 + bx + c$, where $a \neq 0$, but b and c can be zero.

***Exercise* #1:** Read the definition above for quadratic functions and answer the following questions.

(a) Why is it important for the **leading coefficient** to be nonzero?

it would just be a linear function if $a = 0$

(b) Circle the choices below that are quadratic functions.

$y = x^2 - 3$ $\cancel{y = x^3 + 2x^2 - 4}$

$\cancel{y = x^2 + \sqrt{x} + 7}$ $y = 10 - x^2$

(c) Given the quadratic function $y = 10 - 3x^2 + 7x$, write it in standard form and state the value of the leading coefficient.

$y = -3x^2 + 7x + 10$

$a = -3$

(d) If $f(x) = 2x^2 - 3x + 1$, then find, without using your calculator, the value of $f(-2)$. What point must lie on this quadratic's graph based on this calculation?

$2(-2)^2 - 3(-2) + 1 = 2(4) + 6 + 1$

$= 15$ $(-2, 15)$

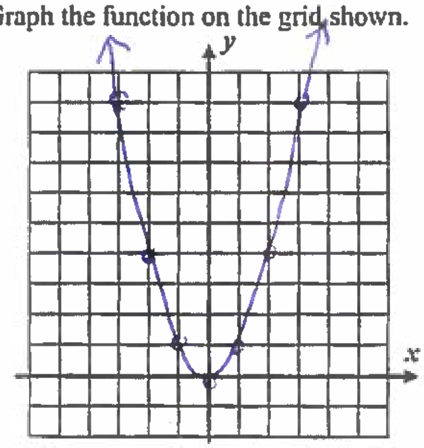
Quadratics still behave in similar ways to other functions. Inputs go in, outputs come out. But, they start to behave differently from **linear** and **exponential** functions because sometimes **outputs repeat** for quadratics.

***Exercise* #2:** Consider the simplest of all quadratic functions, $f(x) = x^2$.

(a) Fill out the table below without using your calculator.

x	-3	-2	-1	0	1	2	3
$y = x^2$	9	4	1	0	1	4	9

(b) Graph the function on the grid shown.



(c) What is the range of this quadratic function?

$y \geq 0$