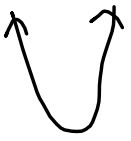
Date: _____



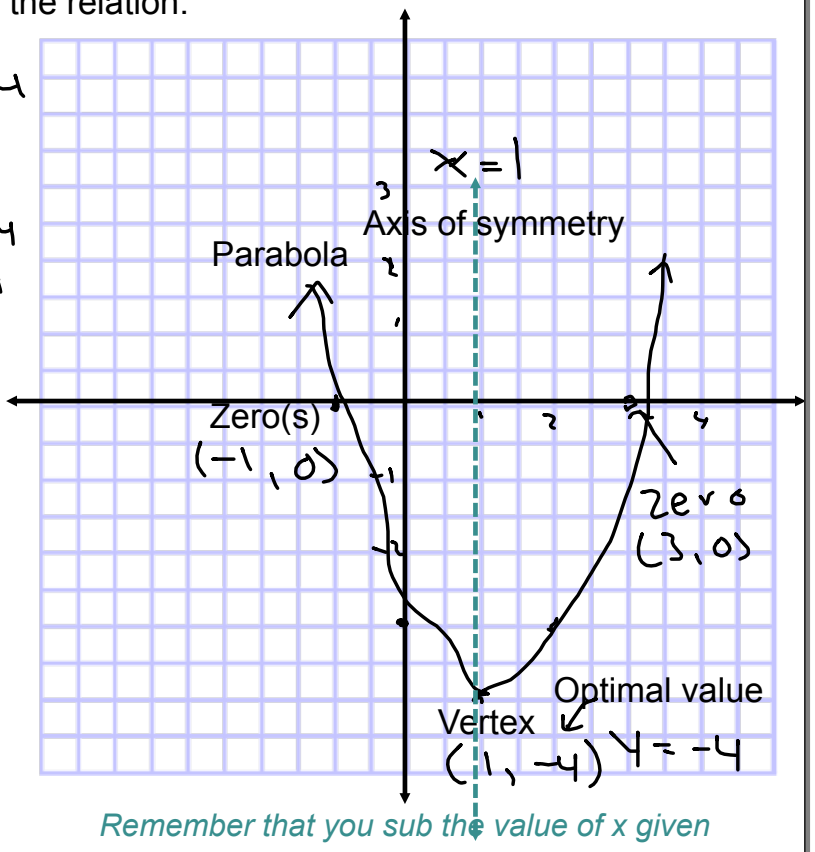
3.2 Properties of Graphs of Quadratic Relations

Create a table of values for the relation $y = (x-1)^2-4$.
Accurately (on a grid) graph the relation.

x	y
-1	0
0	-3
1	-4
2	-3
3	0

Let x = 1
$y = (1-1)^2 - 4$
$= -4$

Let x = 2
$y = (2-1)^2 - 4$
$= (1)^2 - 4$
$= -3$



1) Vocabulary

Word Bank

Important Definitions:

Remember that you sub the value of x given in the table into the equation to fill in the y-values in the table.

parabola - a symmetric, u - shaped curve that represents a quadratic function

vertex (h,k) - the maximum or minimum point in a parabola; the POI of a parabola and its axis of symmetry

axis of symmetry - the vertical line that splits a parabola into two identical parts; equation is x = h

zeros - the x - intercept(s) of a parabola; there can be none, one, or two

optimal value - the maximum or minimum value; the y-coordinate of the vertex (y=k)

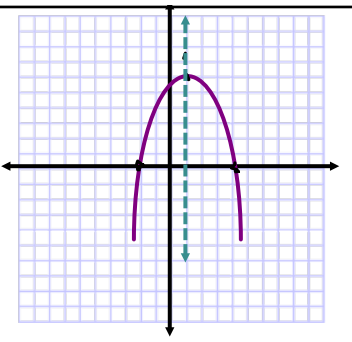
ex/ Examine the parabola shown and determine:

a) the coordinates of the vertex (1, 6)

b) the optimal value $y = 6$

c) the equation of the axis of symmetry $x = 1$

d) the zeros. $(-2, 0)$, $(4, 0)$



2) Determining the Direction of Opening

As we have already discussed, our second differences tell us which way a parabola opens. When they are positive, the parabola will open up. When they are negative, the parabola will open down. The leading coefficient (the number attached to x^2 in the equation) does the same thing (so $y = 2x^2$ opens up, and $y = -2x^2$ opens down).

***When a parabola opens down it has a maximum. When it opens up it has a minimum.**

3) Using Zeros to Find the Axis of Symmetry

The axis of symmetry is always exactly in the middle of the two zeros. To find it's equation, simply take the x - coordinates of the zeros (or any two points with the same y - coordinates), add them, and then divide by two. What formula is this part of? Midpoint

ex/ A parabola has zeros at (3, 0) and (7, 0). Write the equation of its axis of symmetry.

$x = \frac{x_1 + x_2}{2}$

$= \frac{3+7}{2}$

$x = \frac{10}{2}$

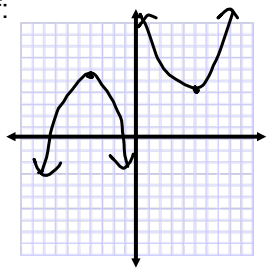
$x = 5$ ← a of s

****Remember that the equation of a vertical line has the form x = a!!****

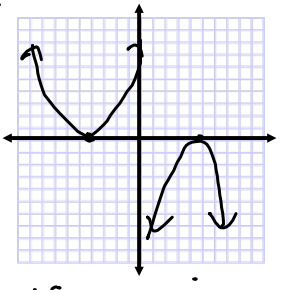
4) Determining the Sign of the Optimal Value

The optimal value (max or min) is positive (above the x - axis) if:

- it is a max w/ 2 zeros
- it is a min, w/ no zeros

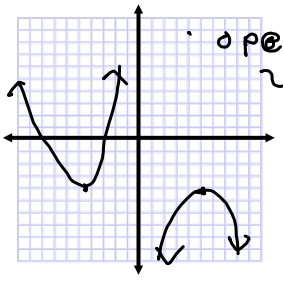


The optimal value is zero (on the x - axis) if:



- if there is one zero

The optimal value is negative (below the x - axis) if:



- opens up with 2 zeros
- opens down with no zeros