ℝ ← all reals

Common Core Math 2 Unit 1A **Modeling with Quadratics**

Properties of Parabola

- A quadratic is a function that can be written in the Standard Form of $y = ax^2 + bx + c$ where a, b, and c are real numbers and $a \neq 0$. Ex: $y = 5x^2$ $y = -2x^2 + 7$ $y = x^2 - x - 3$
- The domain of a quadratic function is $(-\infty, \infty)$ or $\mathbb{R}$. all reals
- The graph of a quadratic function is a U-shaped curve called a parabola.
- All parabolas have a vertex, the lowest or highest point on the graph (depending upon whether it opens up or down).
- The axis of symmetry is an imaginary line which goes through the vertex and about which the parabola is symmetric.

Fred

$y = -ax^2$

↑ reflect over x-axis

Characteristics of the Graph of a Quadratic Function: $y = ax^2 + bx + c$

- **Direction of Opening:** When $a > 0$, the parabola opens ___up___:

  When $a < 0$, the parabola opens ___down___:

- **Stretch:** When $|a| > 1$, the parabola is vertically ___stretched___.

  When $|a| < 1$, the parabola is vertically ___compressed___.

- **Axis of symmetry:** This is a vertical line passing through the vertex. Its equation is ___$x = -\frac{b}{2a}$___.

- **Vertex:** The highest or lowest point of the parabola is called the vertex, which is on the axis of symmetry.

  To find the vertex, plug in $x = \frac{-b}{2a}$ and solve for *y*. This yields a point (___$-\frac{b}{2a}$___, ___$f(-\frac{b}{2a})$___)

- ***x*-intercepts:** are the 0, 1, or 2 points where the parabola crosses the *x*-axis. Plug in *y* = 0 and solve for *x*.

- ***y*-intercept:** is the point where the parabola crosses the *y*-axis. Plug in *x* = 0 and solve for y: y = c.

Without graphing the quadratic functions, complete the requested information:

1.) $f(x) = 3x^2 - 7x + 1$

What is the direction of opening? Up

Is the vertex a max or min? min

Compare to $y = x^2$? narrower

2.) $g(x) = -\frac{5}{4}x^2 + x - 3$

What is the direction of opening? down

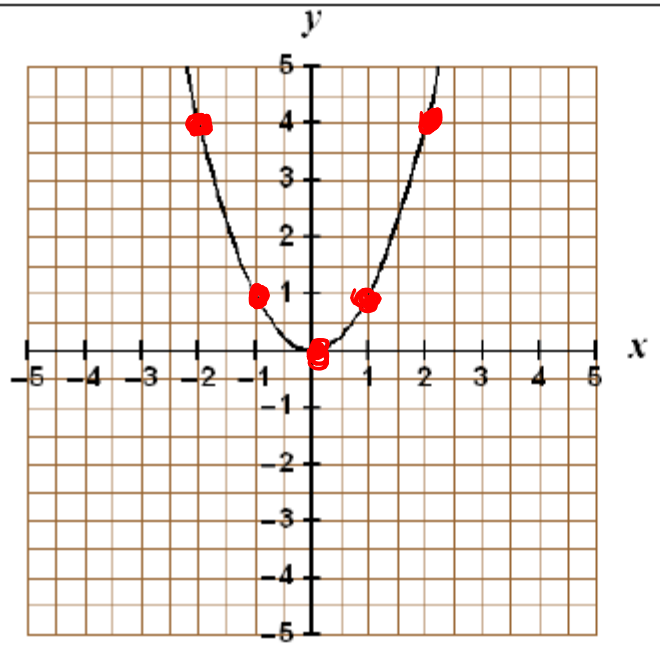
Is the vertex a max or min? max

Compared to $y = x^2$? wider

3.) The parabola $y = x^2$ is graphed to the right.

Note its vertex (0, 0) and its width.

You will be asked to compare other parabolas to this graph.



graph 5 points

Vertex	**Graphing**
- list a = ____, b = ____, c = ____ - find $x = \frac{-b}{2a}$ - plug this x-value into the function (table) - this point ($\frac{-b}{2a}$, $f(\frac{-b}{2a})$) is the vertex of the parabola	- put the vertex you found in the center of your x-y chart. - choose 2 x-values less than and 2 x-values more than your vertex. - plug in these x values to get 4 more points. - graph all 5 points

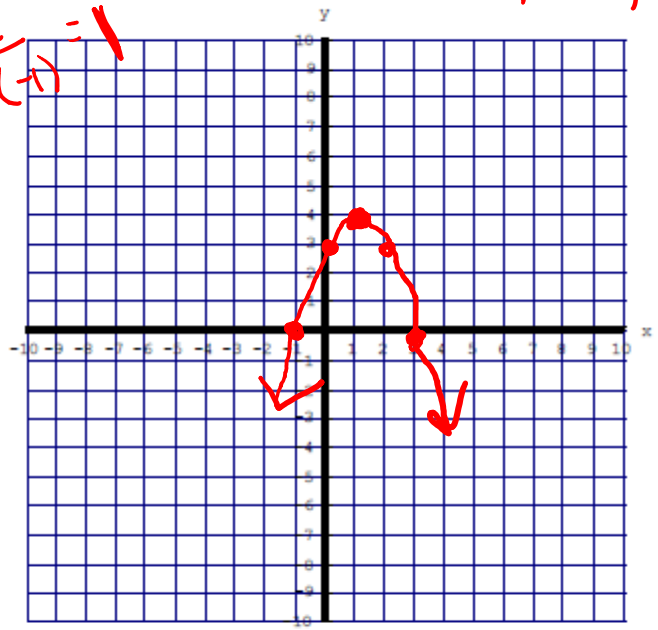
Find the vertex of each parabola. Graph the function and find the requested information

4.) $f(x) = -x^2 + 2x + 3$

$x = \frac{-b}{2a} = \frac{-2}{2(-1)} = 1$

$f(1) = -1^2 + 2(1) + 3$

$= 4$



Vertex: (1, 4)

Max or min? max

Direction of opening? down

Axis of symmetry: $x = 1$

Compare to the graph of $y = x^2$? reflected over x axis, right 1, up 4

5.) $h(x) = 2x^2 + 4x + 1$

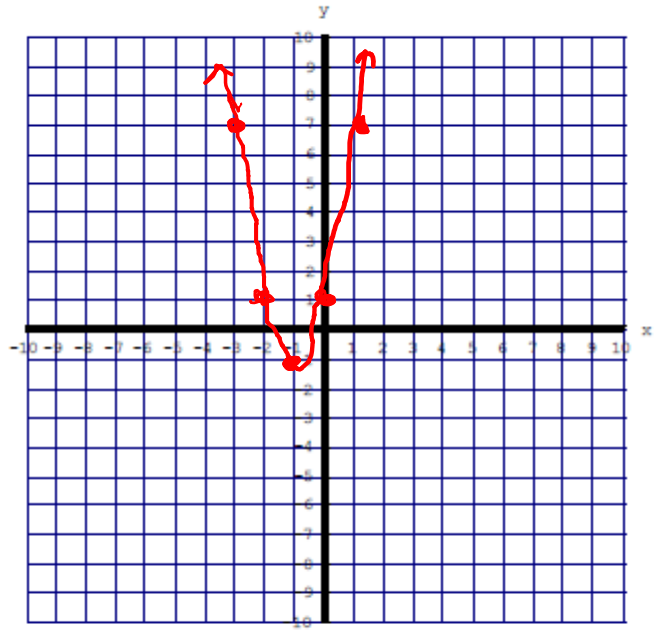
a.o.s. $x = \frac{-b}{2a} = \frac{-4}{2(2)}$

$= -1$

$h(-1) = 2(-1)^2 + 4(-1) + 1$

$2 - 4 + 1$

$h(-1) = -1$



Vertex: (-1, -1)

Max or min? min

Direction of opening? up

Axis of symmetry: $x = -1$

Compare to the graph of $y = x^2$? stretch of 2, 1 left, 1 down