

Pre-Calculus 11 Properties of Quadratic Functions again

Recall: General form of a quadratic equation $ax^2 + bx + c = 0$

If we complete the square, the equation takes the standard form

$$y = a(x - h)^2 + k$$

coords of vertex
 ↑
 min/max value

Recall:

- **V(h, k)**
- **Axis of Symmetry:** $x = h$
- **Domain:** $(-\infty, \infty)$
- **Range:** $[k, \infty)$ or $(-\infty, k]$

Ex. 1) Determine vertex, the equation of the axis of symmetry, maximum/minimum value, domain and range of the following quadratic functions.

a) $y = 2(x - 3)^2 - 4$

↑ h ↑ $k = -4$
 + (-4)

V(3, -4)

a.o.s. $x = 3$

$a > 0$
 \therefore opens up
 min @ -4

D: $(-\infty, \infty)$
 R: $[-4, \infty)$

$y = a(x - h)^2 + k$

↓ recall
 $a > 0$ (positive)
 opens up
 $a < 0$ (negative)
 opens down

b) $y = -\frac{1}{2}(x + 3)^2 + 2$

$x - (-3)$

V(-3, 2)

a.o.s. $x = -3$

$a < 0$ \therefore opens down

max @ 2

D: $(-\infty, \infty)$

R: $(-\infty, 2]$

$y \leq 2$

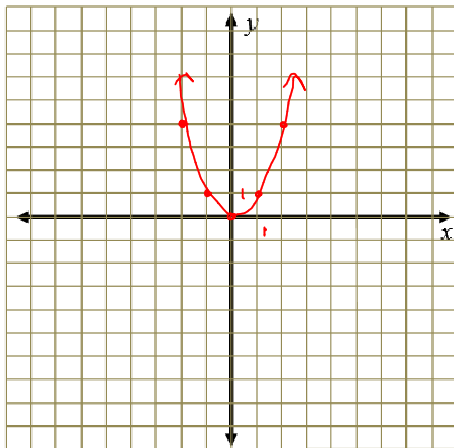
Pre-Calculus 11 Stretches/Compressions and Reflections

$y = ax^2$ Vertical stretch or compression by a factor of a

We will multiply the y-coordinates by a

- If $a > 1$ the graph will be vertically stretched
- If $0 < a < 1$, the graph will be vertically compressed

Ex. 1) Basic parabola: Sketch $y = x^2$.



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

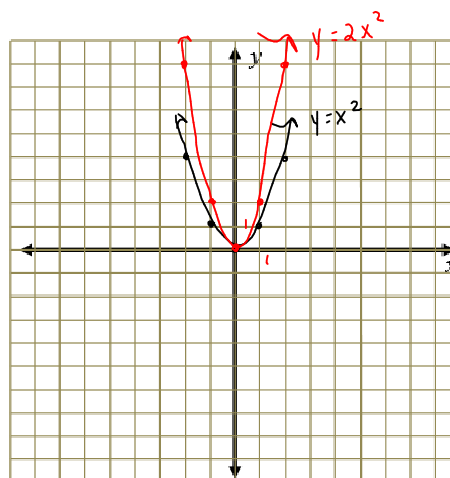
Ex. 2) Sketch the following graphs.

a.) $y = 2x^2$

↑
mult y-coords
by 2

x	$y = x^2$	$y = 2x^2$
-2	4	8
-1	1	2
0	0	0
1	1	2
2	4	8

plot



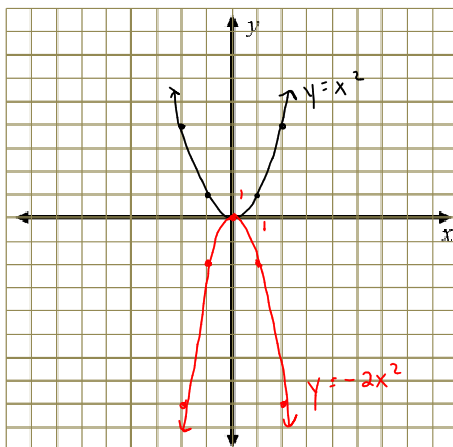
reflects graph over the x-axis

b.) $y = -2x^2$

mult y-coords by -2

x	$y = x^2$	$y = -2x^2$
-2	4	-8
-1	1	-2
0	0	0
1	1	-2
2	4	-8

plot



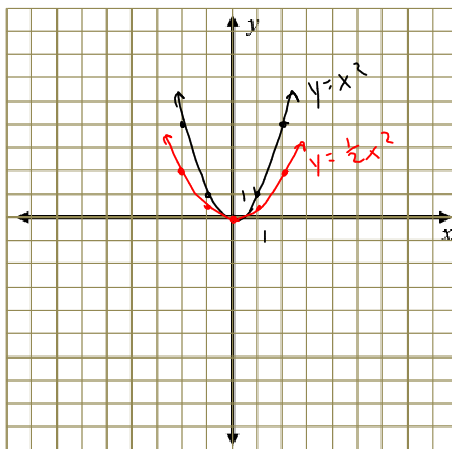
vertical compression $0 < a < 1$

c.) $y = \frac{1}{2}x^2$

mult y-coords by $\frac{1}{2}$

x	$y = x^2$	$y = \frac{1}{2}x^2$
-2	4	2
-1	1	$\frac{1}{2}$
0	0	0
1	1	$\frac{1}{2}$
2	4	2

plot



pg. 285 # 6a, 8a worksheet