Algebra 2

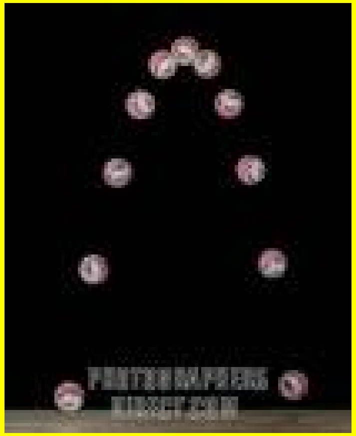
Ch. 5 Handout 5.3

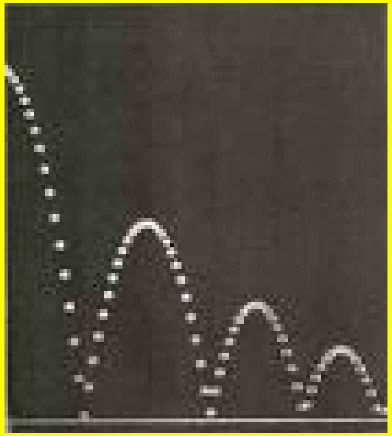
Transforming Parabolas

Parabolas occur all the time in every day life:

The cables on a suspension bridge form a parabola

An object thrown through the air follows the path of a parabola



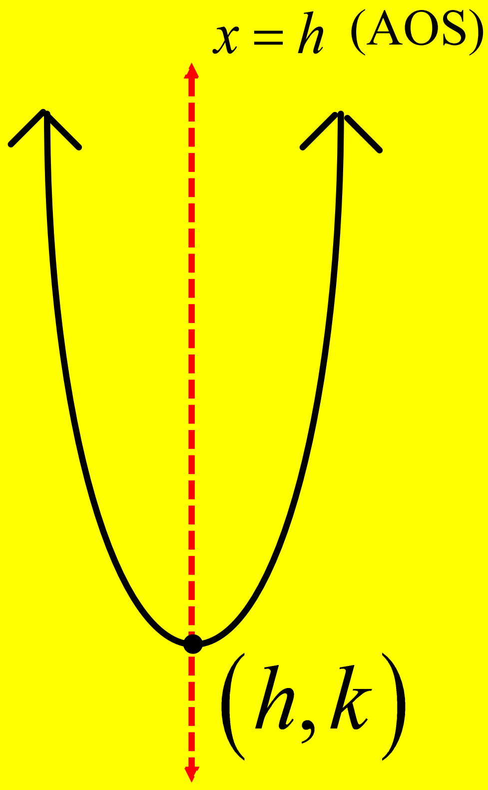


The reflector in a flashlight or an automobile headlight is a parabola

Satellite TV antennas are in the shape of a parabola.

Standard form of a quadratic equation: $y = ax^2 + bx + c$

Vertex form of a quadratic function: $y = a(x-h)^2 + k$



The graph of $y = a(x-h)^2 + k$ is the graph of $y = ax^2$ translated h units horizontally and k units vertically.

Vertex: (h, k)

Axis of symmetry is the line x = h.

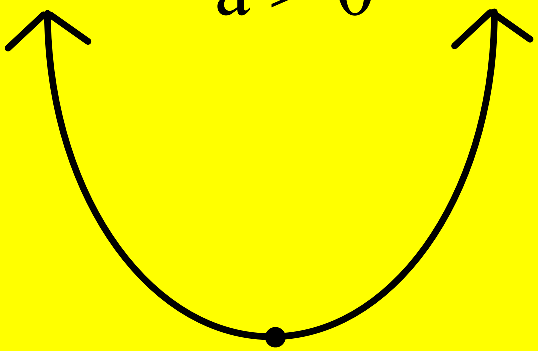
Vertex form of a quadratic function:

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

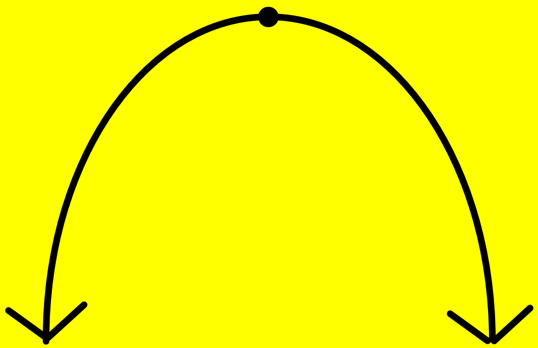
a: a > 0 parabola opens up

a < 0 parabola opens down

a > 0



a < 0



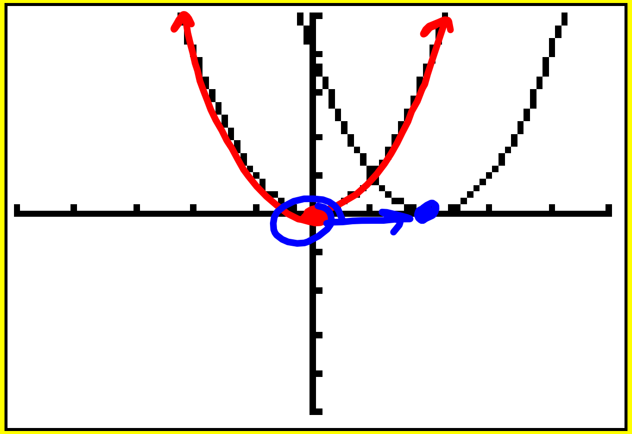
Vertex form of a quadratic function: $y = a(x-h)^2 + k$

Vertex: (h, k)

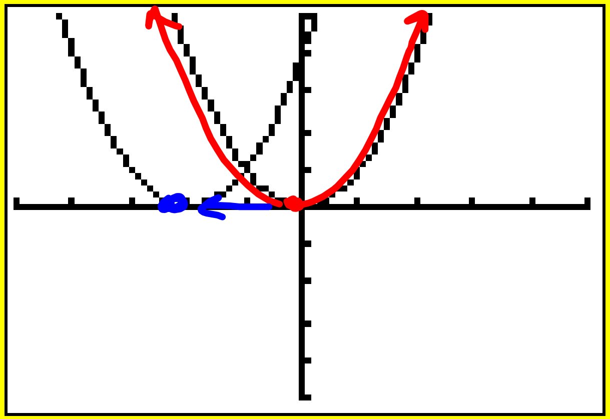
Let k = 0 then $y = a(x-h)^2$

When h is positive (h > 0) the graph shifts right.
When h is negative (h < 0) the graph shifts left.

h > 0



h < 0



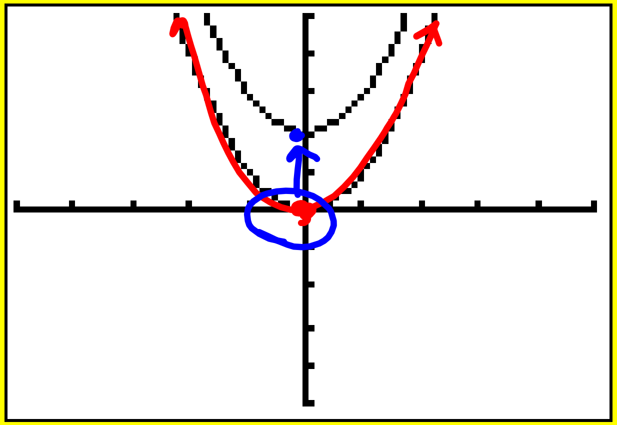
Vertex form of a quadratic function: $y = a(x-h)^2 + k$

Vertex: (h, k)

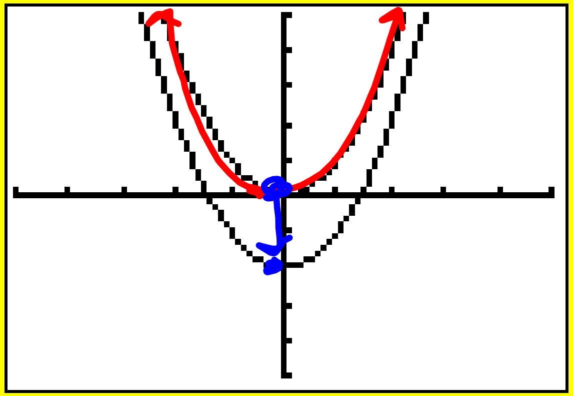
Let h = 0 then $y = ax^2 + k$

When k is positive (k > 0) the graph shifts up.
When k is negative (k < 0) the graph shifts down.

k > 0

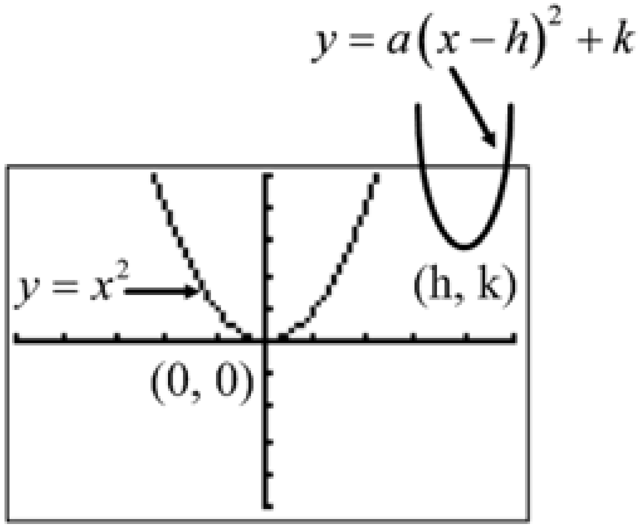


k < 0



Vertex form of a quadratic function: $y = a(x-h)^2 + k$

Vertex: (h, k)



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

h k

V(-1, -2)

AOS: x = -1

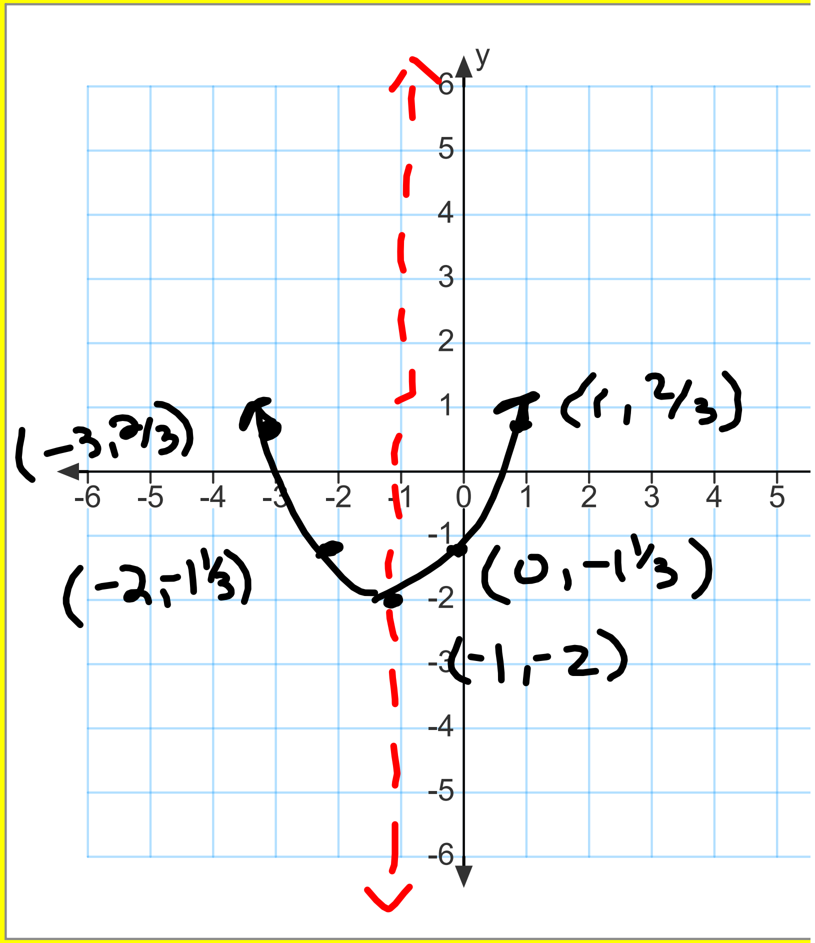
D: $(-\infty, \infty)$

R: $[-2, \infty)$

min at -2

x	$y=\frac{2}{3}(x+1)^2-2$	y
0	$=\frac{2}{3}(0+1)^2-2$ $\frac{2}{3}-\frac{6}{3}$	$-\frac{4}{3}$
1	$=\frac{2}{3}(1+1)^2-2$ $\frac{8}{3}-\frac{6}{3}$	$\frac{2}{3}$

Graph



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

h k

V (-1, 4)

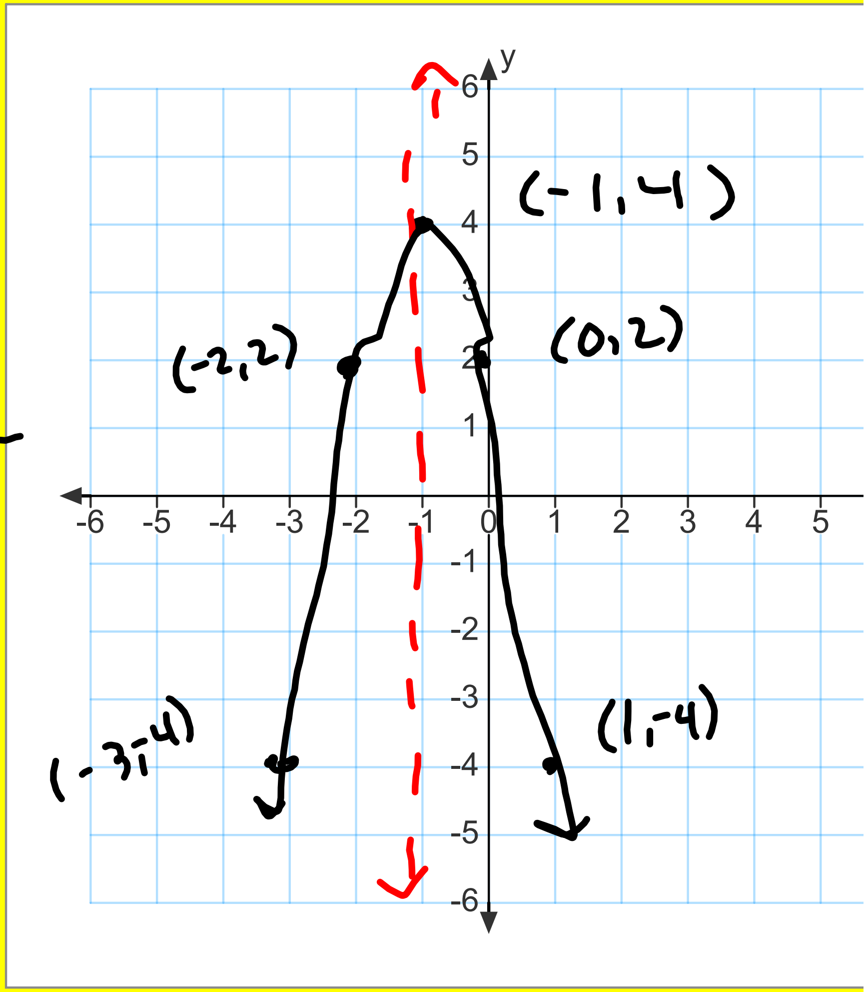
AOS: x = -1

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

R: $(-\infty, 4]$

max at 4

x	$y = -2(x+1)^2 + 4$	y
0	$= -2(0+1)^2 + 4$ $= -2 + 4$	2
1	$= -2(1+1)^2 + 4$ $= -8 + 4$	-4



Writing equations of Parabolas

Use $y = a(x-h)^2 + k$, must know a and vertex (h, k).

3. Write the equation of the parabola shown.

V(2, -5)   pt (0, -3)

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

$-3 = a(0-2)^2 - 5$

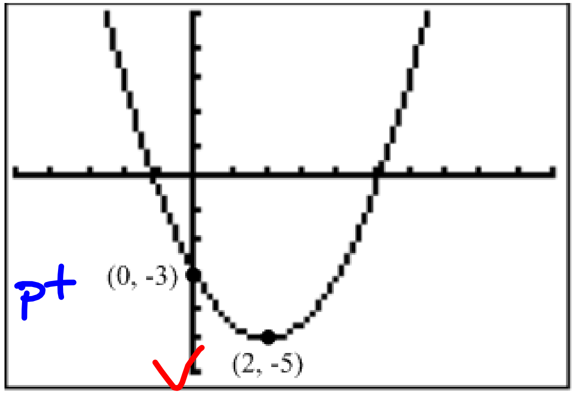
$-3 = a(-2)^2 - 5$

$-3 = a(4) - 5$

$+5 \qquad\qquad +5$

$\frac{2}{4} = \frac{4a}{4}$

$a = \frac{1}{2}$ V(2, -5)



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

$y = \frac{1}{2}(x-2)^2 - 5$

4. Write $y = -7x^2 - 70x - 169$ in vertex form.

$h = \frac{-b}{2a} = \frac{-(-70)}{2(-7)} = \frac{70}{-14} = -5$

$K = -7(-5)^2 - 70(-5) - 169 = 6$

$a = -7$ $V(-5, 6)$

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

$y = -7(x-(-5))^2 + 6$

$y = -7(x+5)^2 + 6$

5. Write equation of parabola in vertex form given vertex (-2, 2) and point (1, -1).

(h, k) (x, y)

V(-2, 2) pt (1, -1)

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

$-1 = a(1-(-2))^2 + 2$

$-2 \qquad\qquad -2$

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

$-3 = a(3)^2$

$-3 = 9a$

$a = \frac{-1}{3}$ V(-2, 2)

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

6. Write equation of parabola in vertex form given vertex (4, -1) and y-intercept 1.

(h, k)

$V(4, -1)$

(x, y)

pt $(0, 1)$

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

$1 = a(0-4)^2 - 1$

$+1 \qquad +1$

$2 = a(-4)^2$

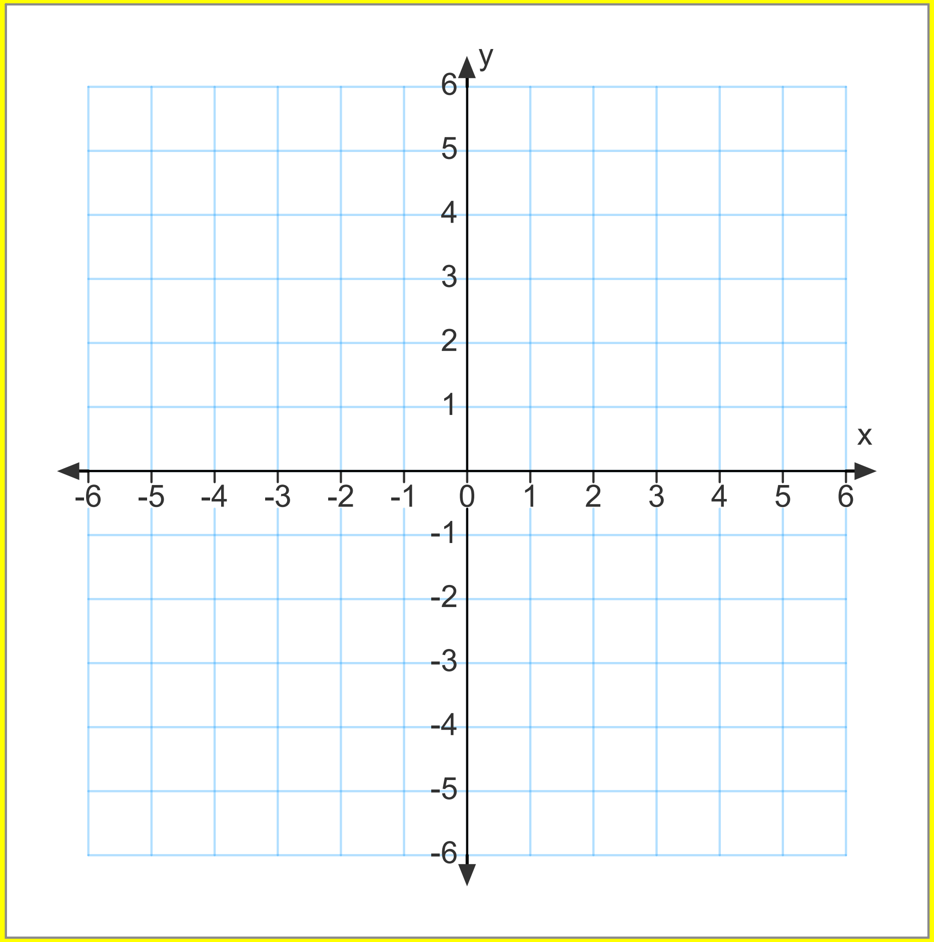
$\frac{2}{16} = \frac{a(16)}{16}$

$a = \frac{1}{8}$ $V(4, -1)$

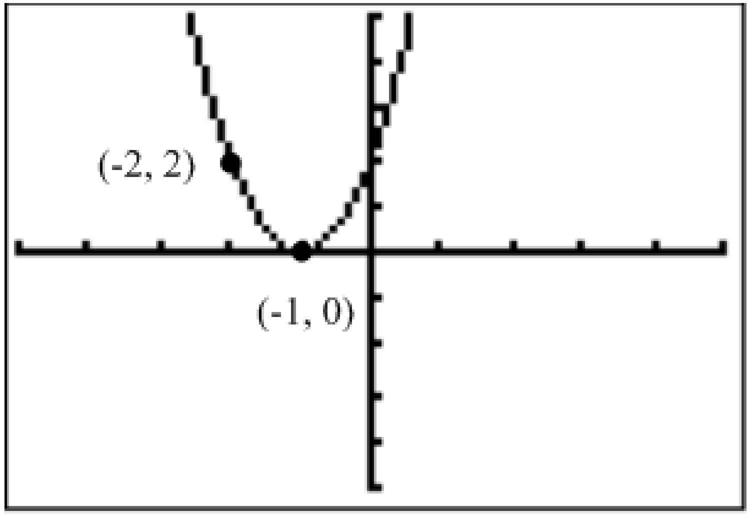
$y = \frac{1}{8}(x-4)^2 - 1$

7. A long strip of colored paper is attached as a party decoration at the top corners of a wall of a rectangular room. The strip approximates a parabola with equation $y = 0.008(x-25)^2 + 10$. The bottom left corner of the wall is the origin, and x and y aremeasured in feet. How far apart are the corners? How high are they?

8. Graph $y = 2(x+1)^2 - 4$



9. Use vertex form to write the equation of the parabola.



10. Write $y = -3x^2 + 12x + 5$ in vertex form

Assignment

Day 1: pgs 255-258 1, 4, 7, 13, 19, 22, 25, 28, 34, 38, 44, 47, 61, 64