

3.4 Graphing: Vertex Form

- Steps:
1. Plot the vertex.
 2. Up or down?
 3. Step pattern
Count over & up/downs to get 4 more points.
 4. Draw a smooth curve.

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

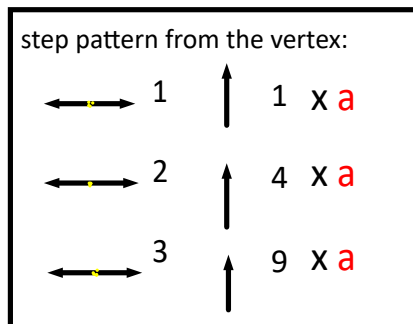
vertex (h,k)

$a > 0$, opens up (has min)
 $a < 0$, opens down (has max)

axis of symmetry is $x = h$

if $a > 1$, then there is a stretch by a factor of a

if $0 < a < 1$, then there is a compression by a factor of $\frac{1}{a}$



Ex 1: Complete the table.

values that
y can be ↘

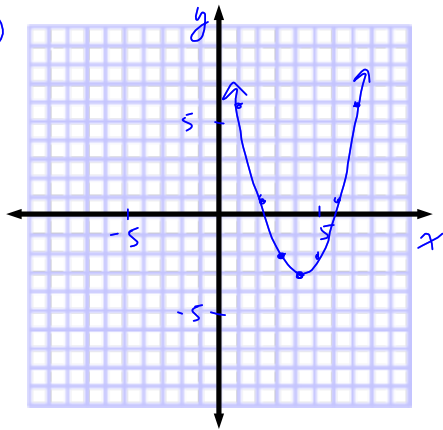
Equation	Direction of Opening	Vertex (h,k)	Equation of Axis of Symmetry $x=h$	Stretch Factor a	Range
$y = 3(x-5)^2 + 9$	up	(5,9)	$x = 5$	3	$y \geq 9$
$y = -\frac{3}{4}(x+4)^2 - 7$	down	(-4,-7)	$x = -4$	$\frac{3}{4}$	$y \leq -7$
$y = -2x^2 - 3$	down	(0,-3)	$x = 0$	2	$y \leq -3$
$y = 7(x+2)^2 + 5$	up	(-2,5)	$x = -2$	7	$y \geq 5$
$y = -4(x-4)^2 - 2$	down	(4,-2)	$x = 4$	4	$y \leq -2$

Ex 2: Graph (show at least 5 points)

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

$V(4, -3)$

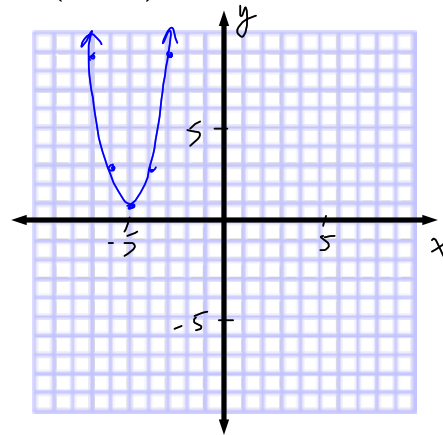
Graph



b) $y = 2(x + 5)^2 + 1$

$V(-5, 1)$

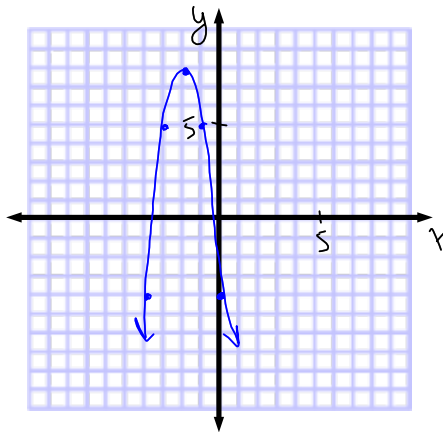
Graph



c) $y = -3(x + 2)^2 + 8$

$V(-2, 8)$

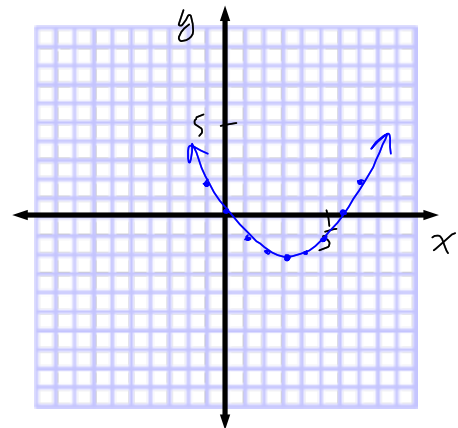
Graph



d) $y = \frac{1}{4}(x - 3)^2 - 2$

$V(3, -2)$

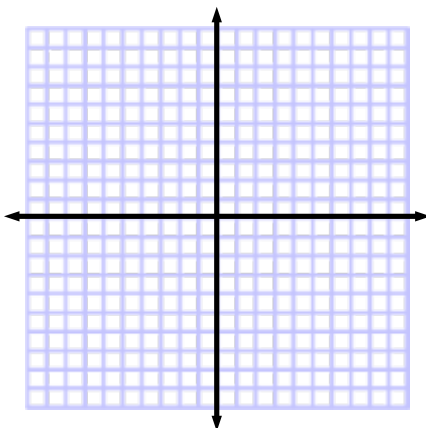
Graph



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

$V(-1, 0)$

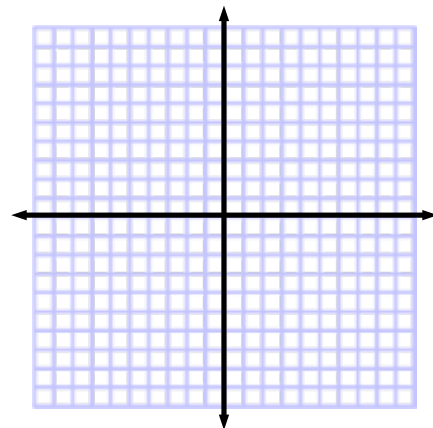
Graph



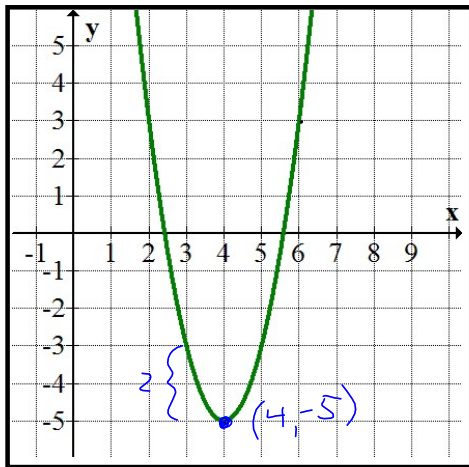
f) $y = -\frac{1}{2}x^2 + 6$

$V(0, 6)$

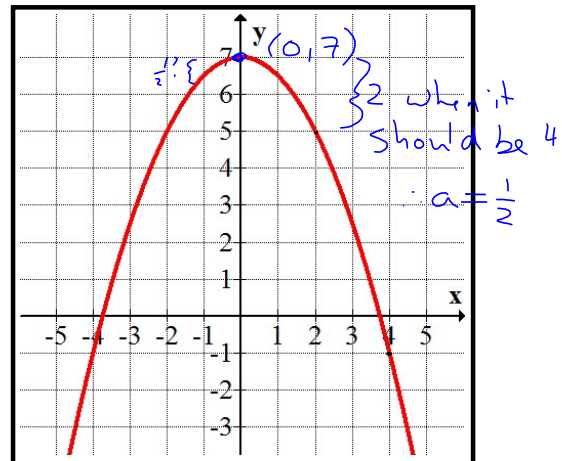
Graph



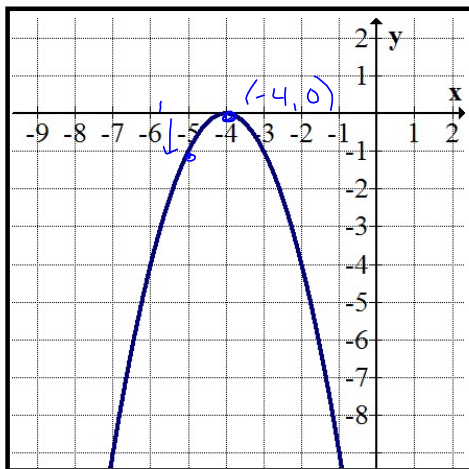
e.g.3: Write an equation for each parabola. $y = a(x-h)^2 + k$



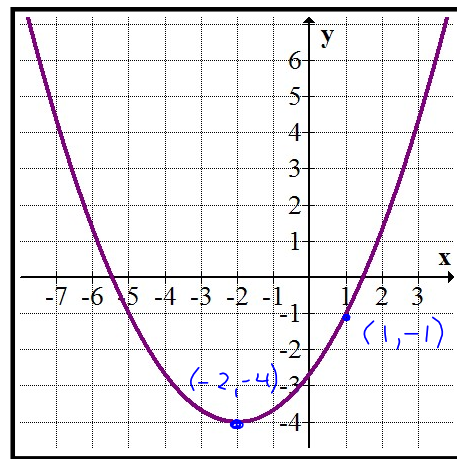
$$y = 2(x-4)^2 - 5$$



$$y = -\frac{1}{2}x^2 + 7$$



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



Can't tell a ? - Construct equation
- Use a point to solve

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

Sub in (1, -1)

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

$$-1 = a(3)^2 - 4$$

$$-1 = a(9) - 4$$

$$3 = a(9)$$

$$\frac{3}{9} = a$$

$$\frac{1}{3} = a$$

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

Ex. 4 Determine an equation for each quadratic.

a) vertex at $(-3, 4)$ through the point $(-1, -2)$

- Construct

- Sub in pt. to solve

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

Sub in $(-1, -2)$

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

$$-6 = a(4)$$

$$-\frac{6}{4} = a$$

$$-\frac{3}{2} = a$$

$$\therefore y = -\frac{3}{2}(x+3)^2 + 4$$

b) stretch by 4, reflection in x-axis, axis of symmetry at $x=-3$, through the point $(5, 1)$

$$y = -4(x+3)^2 + k$$

Sub $(5, 1)$ to solve for k

$$1 = -4(5+3)^2 + k$$

$$1 = -4(64) + k$$

$$1 = -256 + k$$

$$257 = k$$

$$\therefore y = -4(x+3)^2 + 257$$

Homework

Set 1: p. 185 #C3,1adh, 2bdfg, 3, 4, 6

Set 2: p. 185 #C3,1adh, 2bdfg, 3, 4, 6, 7

