Worksheet 4-7: Graphing Quadratic Relations $y = a(x-h)^2 + k$

Method 1: Graphing by Transformation

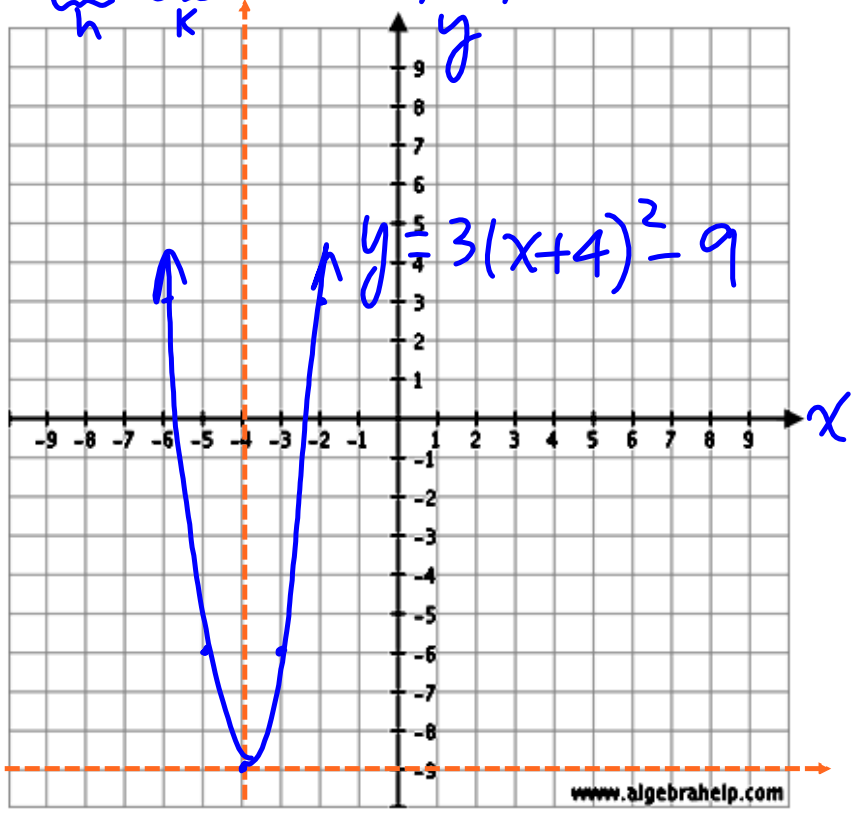
Step 1 - Plot the vertex (*Draw your transformed x- and y- axes from the vertex!*)
Step 2 - Determine the opening direction of the parabola (upward if $a > 0$; downward if $a < 0$)
Step 3 - From the vertex, graph the next four points (*assuming vertex is the origin*):
- If $a > 0$, graph next four points $(1,\ 1\times a)$, $(-1,\ 1\times a)$, $(2,\ 4\times a)$, and $(-2,\ 4\times a)$
- If $a < 0$, graph next four points $(1,\ -1\times a)$, $(-1,\ -1\times a)$, $(2,\ -4\times a)$, and $(-2,\ -4\times a)$

Step 4 - Connect all points with a smooth curve and put arrows at both end of the parabola.
Step 5 - Label the parabola and the axes

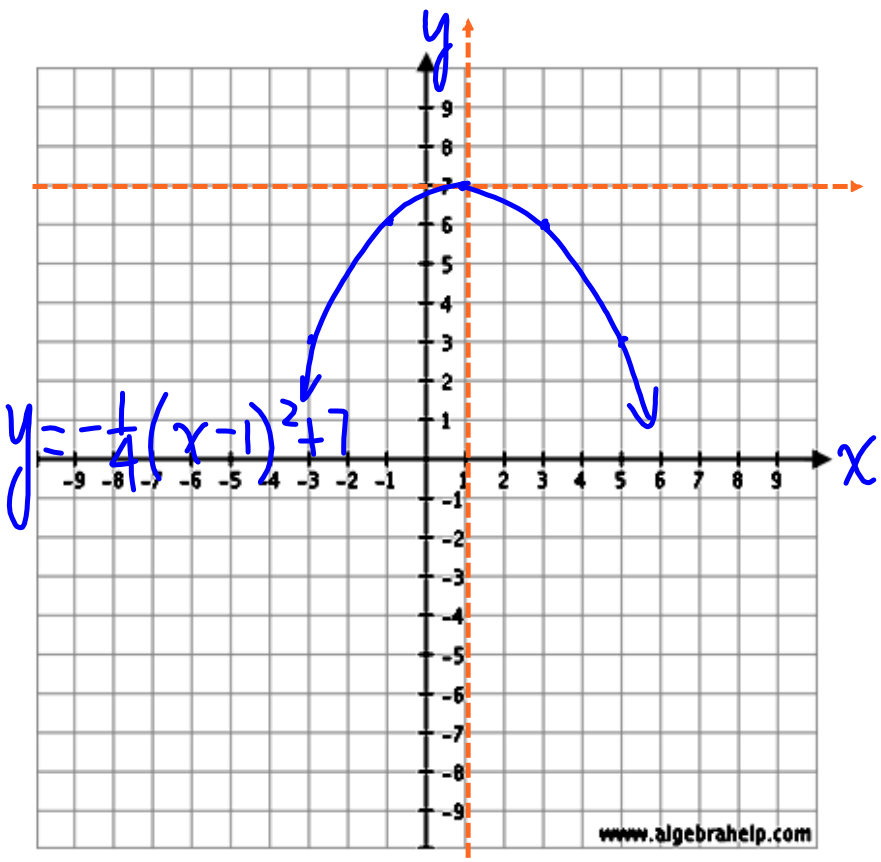
1. $y = 3(x+4)^2 - 9$ $V = (-4,-9)$ $a = 3$

x	x^2	$(3)x^2$
1	1	3

0	0	0
1	1	3
2	4	12



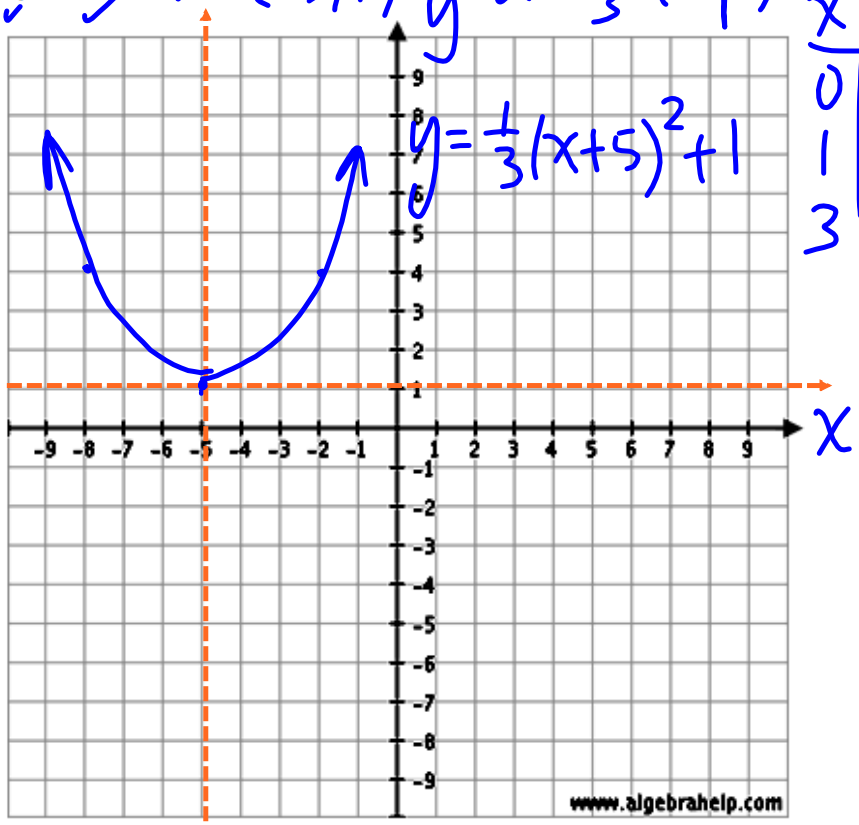
2. $y = -\frac{1}{4}(x-1)^2 + 7$ $V=(1,7)$ $a=-\frac{1}{4} \rightarrow$ opens down



x	x^2	$\frac{1}{4}x^2$
0	0	0
1	1	$\frac{1}{4}$
2	4	1
4	16	4

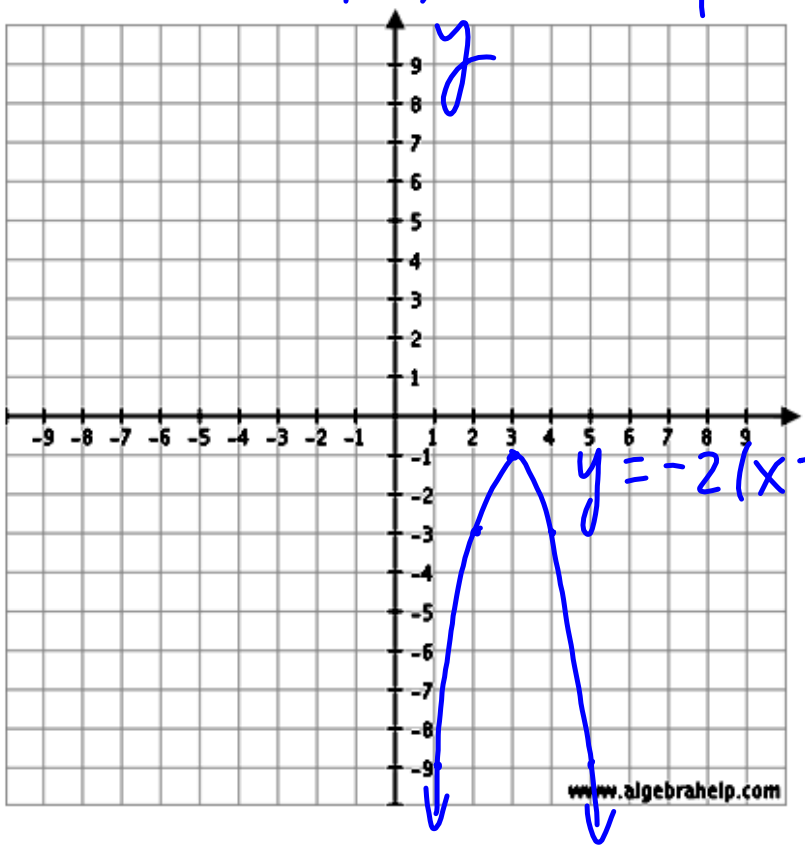
÷4

3. $y = \frac{1}{3}(x+5)^2 + 1$ ✓ ✓ $V = (-5, 1)$ $a = \frac{1}{3}$ (up)



x	x^2	$\frac{1}{3}x^2$
0	0	0
1	1	$\frac{1}{3}$
3	9	3

4. $y = -2(x-3)^2 - 1$ $V=(3,-1)$ $a=-2$ opens down



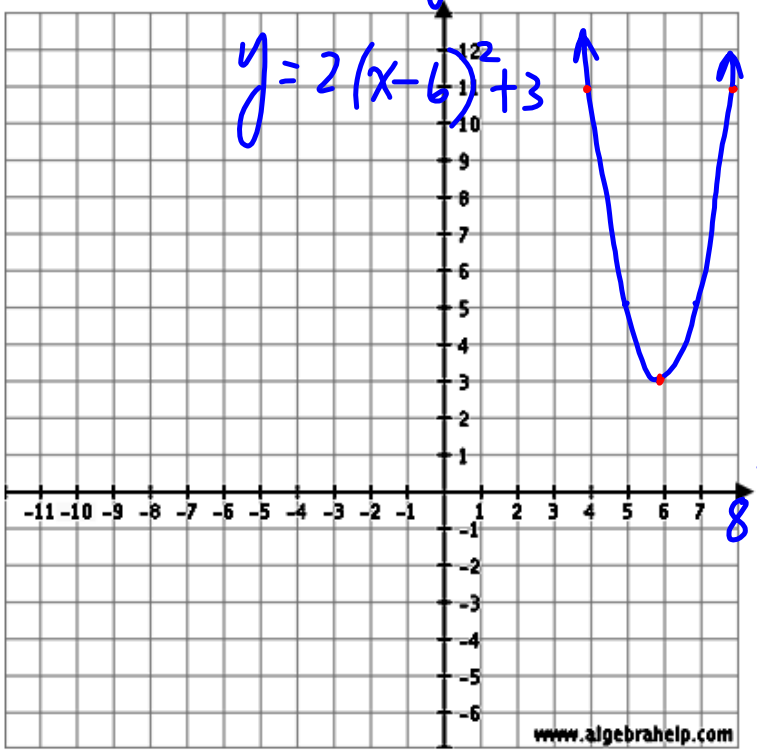
x	x^2	$-2x^2$
0	0	0
1	1	-2
2	4	-8

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

Method 2: Graphing Using Vertex and Two Points

Step 1 - Identify the coordinates of the vertex
Step 2 - Determine the x-coordinates of two other points
- 2 units to the **left** of the vertex, and 2 units to the **right** of the vertex
Step 3 - Substitute the x-values from step 2 into $y = a(x-h)^2 + k$ to find two points on the parabola
Step 4 - Plot the two points and the vertex on the same set of axes
Step 5 - Connect the points with a smooth curve and put arrows at both end of the parabola
Step 6 - Label the parabola and the axes

5. $y = 2(x-6)^2 + 3$



$V = (6, 3)$

$x = 8$

$y = 2(8-6)^2 + 3$

$= 11$ $(8, 11)$

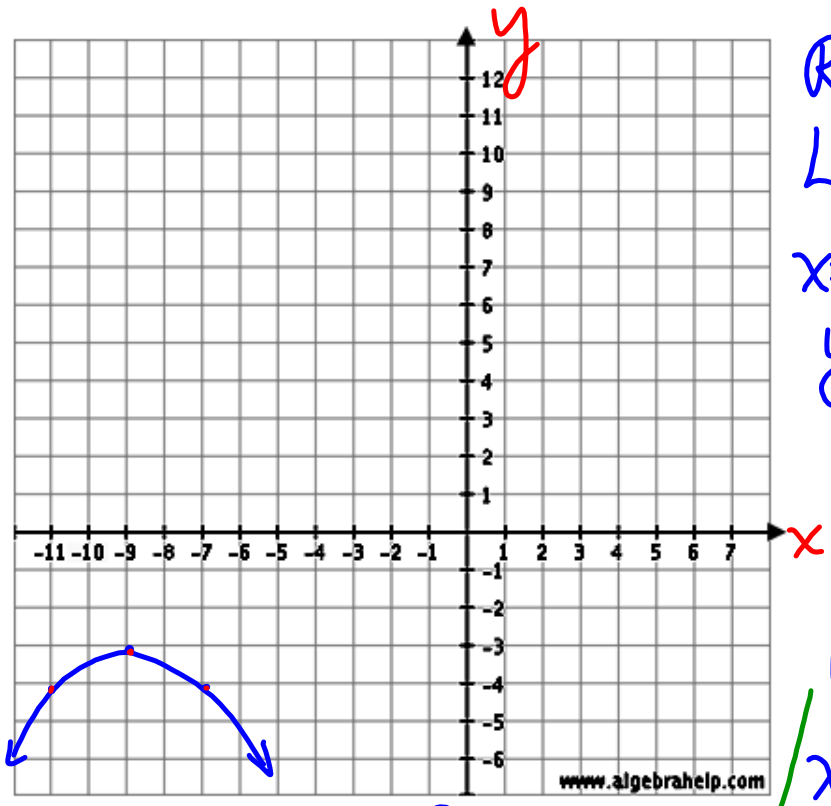
$x = 4$

$y = 2(4-6)^2 + 3$

$= 11$ $(4, 11)$

6. $y = -0.5(x+9)^2 - 2$

Vertex = $(-9, -2)$



$y = -0.5(x+9)^2 - 2$

Right → $x = -7$

Left → $x = -11$

$x = -7$,

$y = -0.5(-7+9)^2 - 2$

$= -0.5(2)^2 - 2$

$= -4$

$(-7, -4)$

$x = -11$,

$y = -0.5(-11+9)^2 - 2$

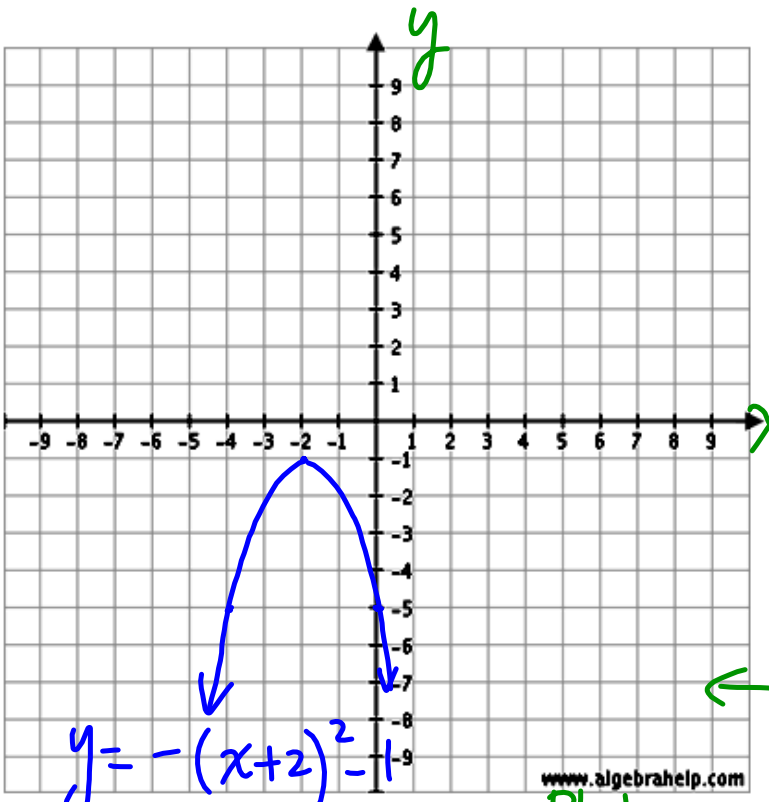
$= -0.5(-2)^2 - 2$

$= -4$

$(-11, -4)$

Plot these points

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



Vertex $(-2,-1)$

Right $\rightarrow x = 0$

Left $\rightarrow x = -4$

$x = 0$,

$y = -(0+2)^2 - 1$

$= -4 - 1$

$= -5$

$(0, -5)$

$x = -4$,

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

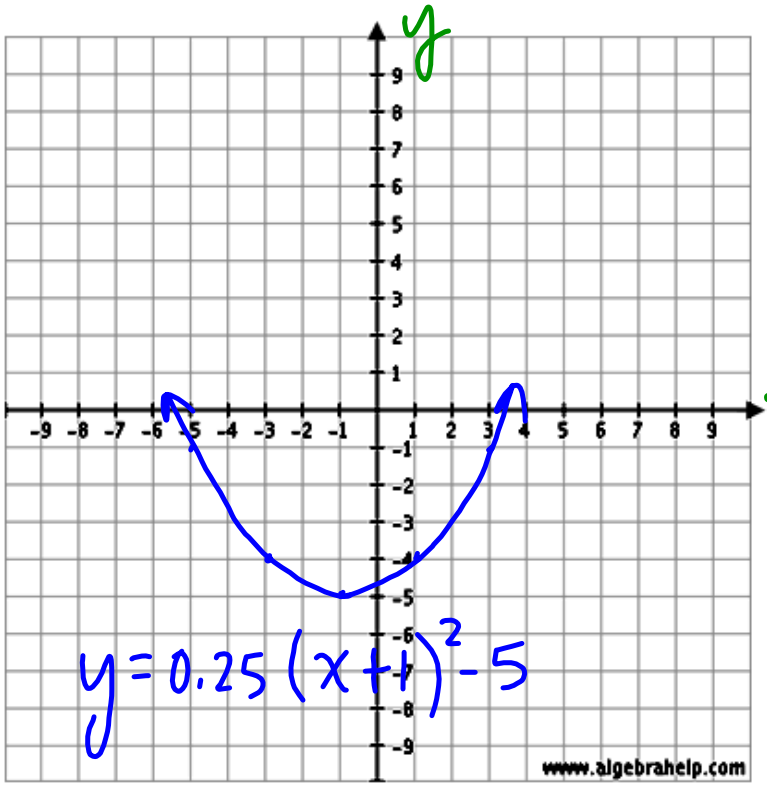
$= -4 - 1$

$= -5$

$(-4, -5)$

Plot these points

8. $y = 0.25(x+1)^2 - 5$



vertex = $(-1,-5)$

Right → $x = 1$

Left → $x = -3$

$x = 1$,

$y = 0.25(1+1)^2 - 5$

$= 0.25(2)^2 - 5$

$= 0.25(4) - 5$

$= -4$

$(1,-4)$

Plot these points

$x = -3$,

$y = 0.25(-3+1)^2 - 5$

$= 0.25(-2)^2 - 5$

$= 0.25(4) - 5$

$= 1 - 5$

$= -4$

$(-3,-4)$