(13) $y = ax^2 + K$

$(-1, 3)$
(x, y)

$\overset{x\quad y}{(3, -13)}$

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

$$\boxed{3 = a + K} \quad \text{①}$$

$-13 = a(3)^2 + K$

$\text{②} \quad \boxed{-13 = 9a + K}$
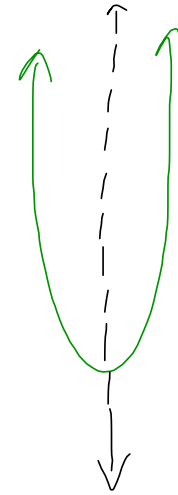
Solve for sub/elim

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

"Vertex Form"

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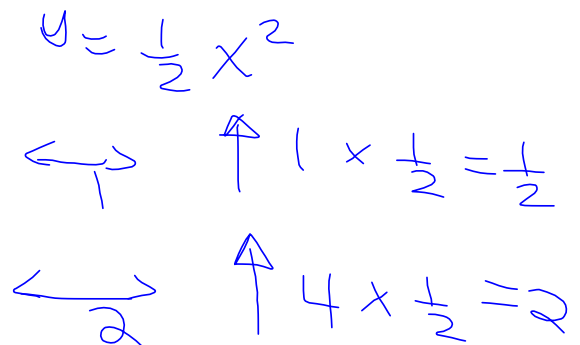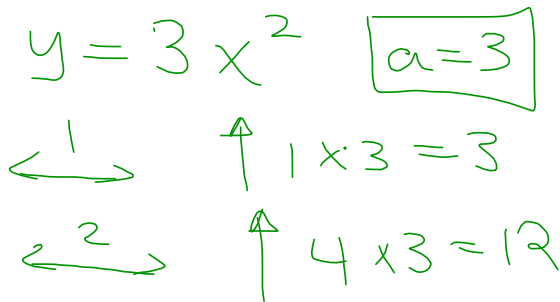4. Draw a smooth curve.

vertex (h,k)

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

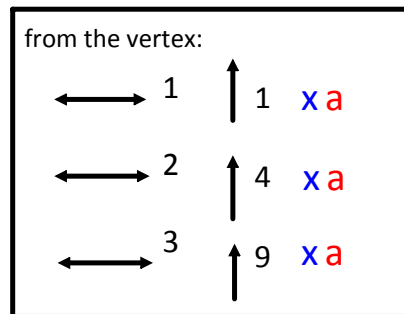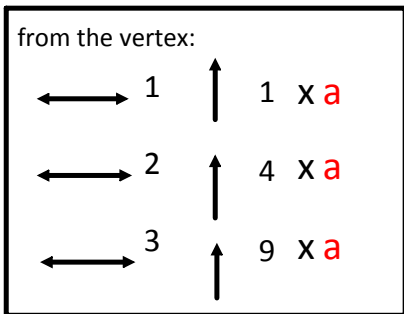$a > 0$, opens up (has min)
$a < 0$, opens down (has max)
$a \rightarrow$ stretch/compression
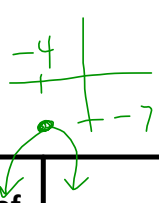
axis of symmetry
is $x = h$

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

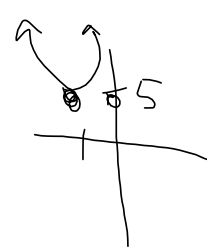if $0 < a < 1$, then there is a compression by a factor of $\dfrac{1}{a}$

from the vertex:

1   1 x a
2   4 x a
3   9 x a

from the vertex:

1   1 x a
2   4 x a
3   9 x a

$y = 3x^2$ $\boxed{a = 3}$

$\leftarrow \overset{1}{\longrightarrow}$ $\uparrow 1 \times 3 = 3$

$\leftarrow \overset{2}{\longrightarrow}$ $\uparrow 4 \times 3 = 12$

$y = \dfrac{1}{2}x^2$

$\leftarrow \overset{1}{\longrightarrow}$ $\uparrow 1 \times \dfrac{1}{2} = \dfrac{1}{2}$

$\leftarrow \underset{2}{\longrightarrow}$ $\uparrow 4 \times \dfrac{1}{2} = 2$

Ex. 1   Complete the table.

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

values that y can take
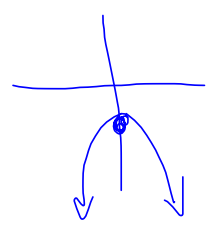
Ex. 2   Graph. (show at least 5 points)

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

→translate
right
4 units
down
3 units

Up

-5

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

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

b) $y=2(x+5)^2+1$ 4

Vertex
$(-5,-4)$

Up
Stretch
by 2

-5

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

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

$1 \rightarrow \uparrow 1\times3 = 3$

$2 \leftrightarrow \uparrow 4\times3 = 12$

-5

-5

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

d) $y=-\dfrac{1}{2}x^2+6$ $(0,6)$

$\leftarrow 1 \uparrow 1\times\frac{1}{2}$

$\leftarrow 2 \uparrow 4\times\frac{1}{2} = 2$

when
fraction

* add
2 extra
points

-5

-5
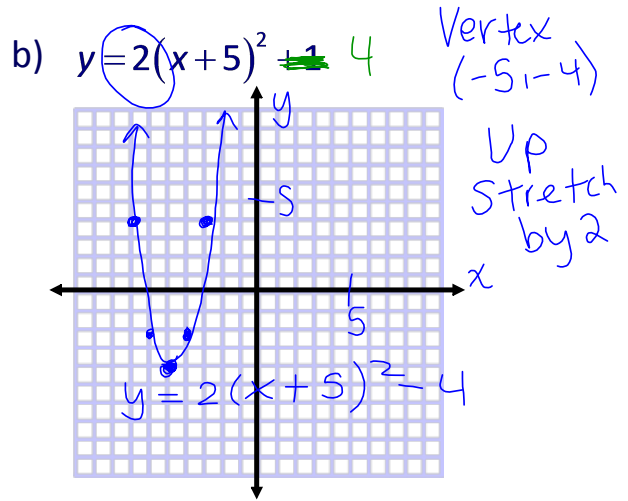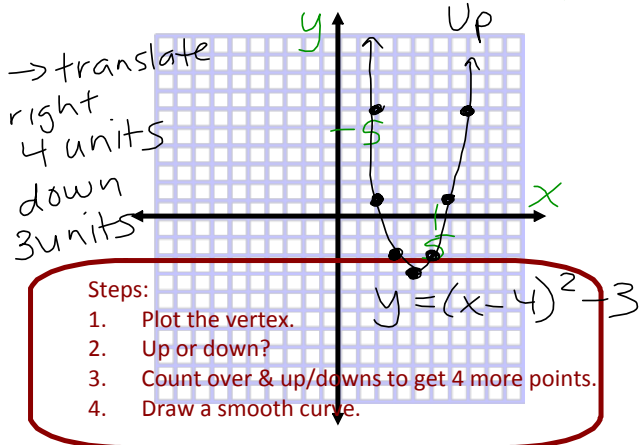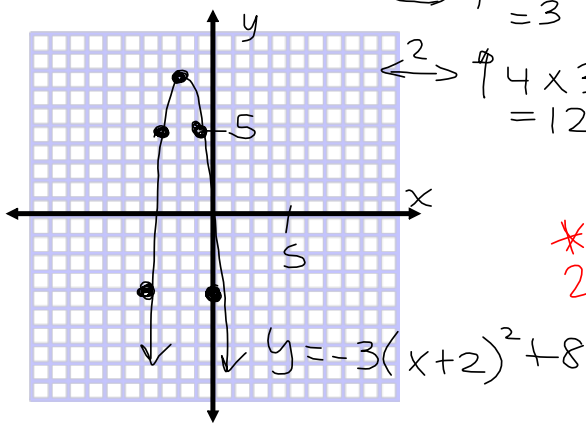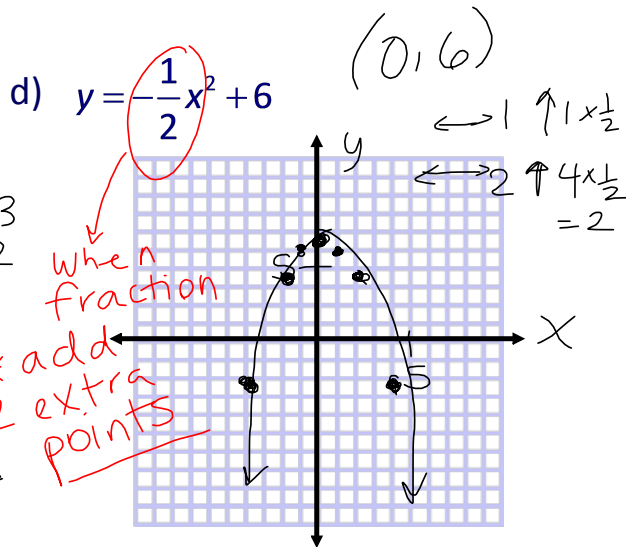
e) $y=-(x+1)^2$
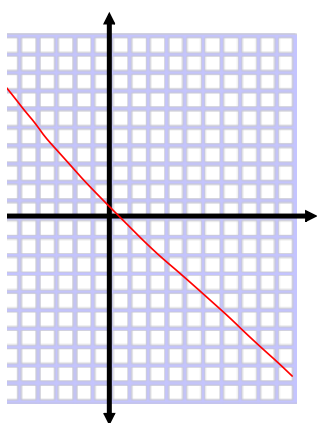
$\leftarrow 1 \rightarrow \uparrow 1\times\frac{1}{4}$

$\leftarrow 2 \rightarrow \uparrow 4\times\frac{1}{4} = 1$

$\leftarrow 4 \rightarrow \uparrow 16\times\frac{1}{4} = 4$

$\leftarrow 6 \rightarrow \uparrow 36\times\frac{1}{4} = 9$

f) $y=\dfrac{1}{4}(x-3)^2-2$ Vertex $(3,-2)$

-5

$y=\frac{1}{4}(x-3)^2-2$
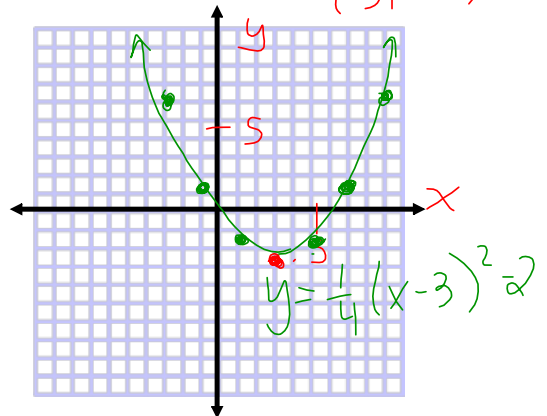
Ex. 3   Write an equation for each parabola.

$(4, -5)$

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

$(0, 7)$ $\downarrow 2$ $4 \times \frac{1}{2}$
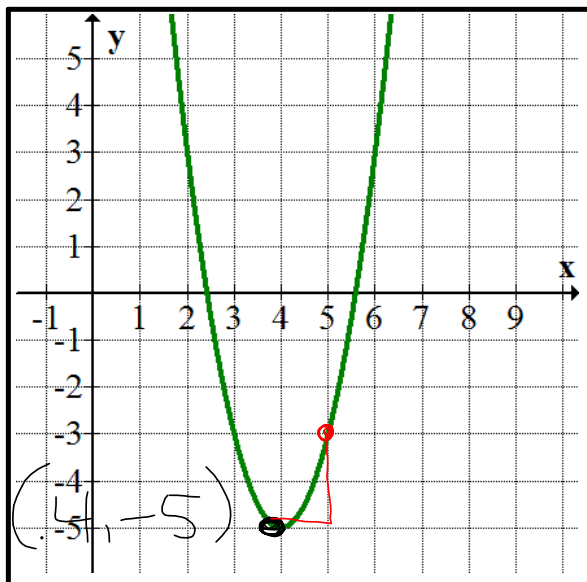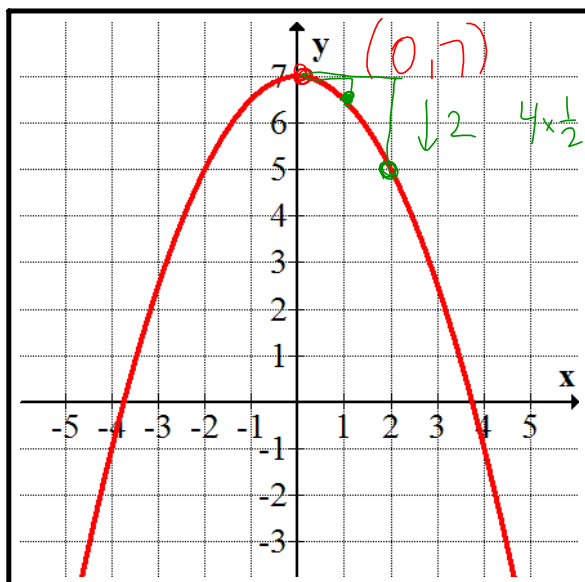
$$y = -\frac{1}{2}x^2 + 7$$
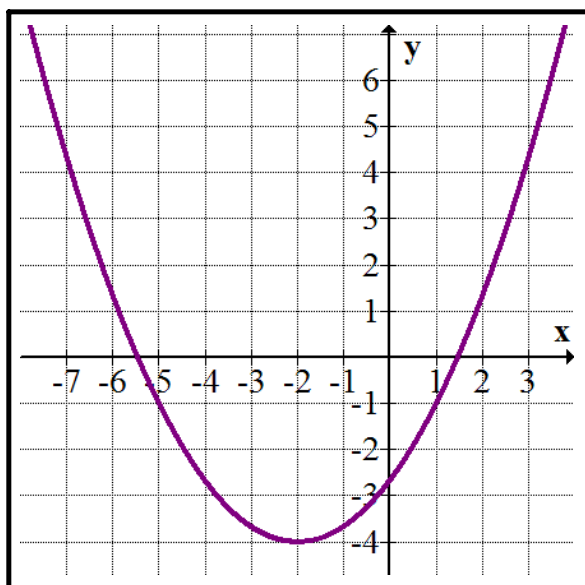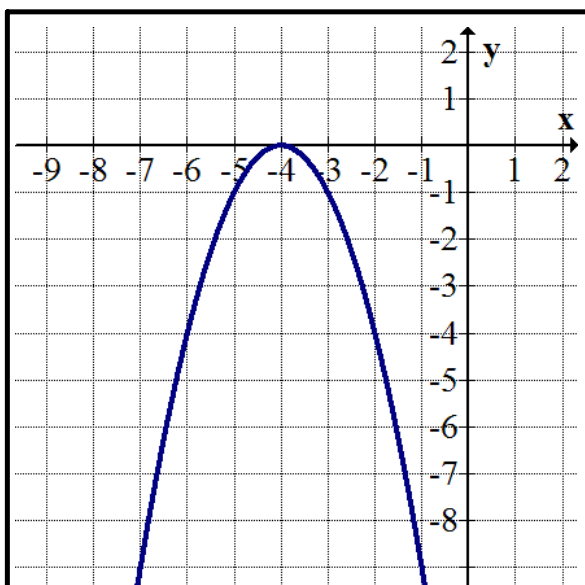
Ex. 4 Determine an equation for each quadratic.

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

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

p. something....

Attachments

4s4_Standard.gsp

4s4_Investigation.gsp