11.2- Parabolas & Modeling

Note Title

Let's first look at vertical and horizontal shifts of parabolas.

Observe the graphs of the following after making some predictions.

$y = x^2$ $\quad y = x^2 + 3$ $\quad y = x^2 - 4$

$y = x^2$ $\quad y = (x-2)^2$ $\quad y = (x+3)^2$

VERTICAL AND HORIZONTAL TRANSLATIONS OF PARABOLAS

Let h and k be positive numbers.

To graph	*shift the graph of $y = x^2$ by k units*
$y = x^2 + k$	upward.
$y = x^2 - k$	downward.

To graph	*shift the graph of $y = x^2$ by h units*
$y = (x - h)^2$	right.
$y = (x + h)^2$	left.

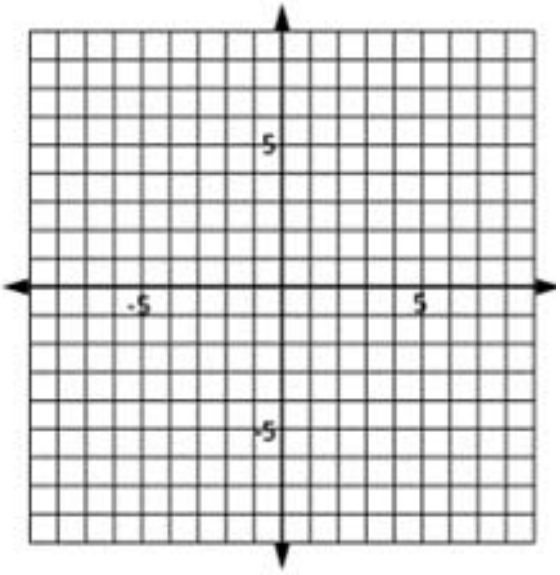
① Sketch the graphs by hand.

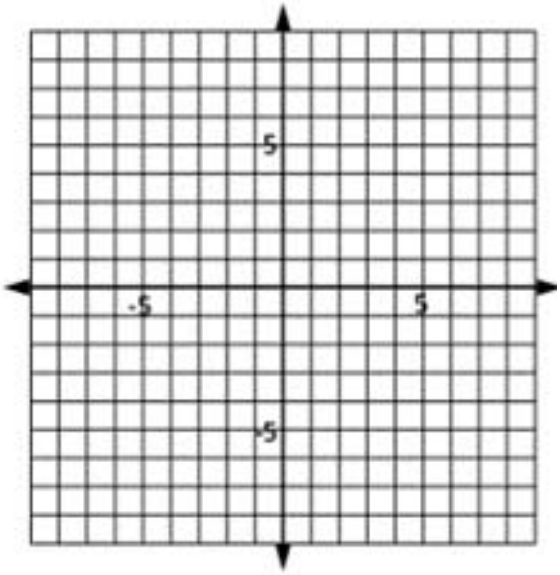
a) $f(x) = x^2 + 4$

b) $g(x) = (x+4)^2$

c) $h(x) = (x-5)^2$

d) $p(x) = x^2 - 5$





Remember how "a" affects the graph?

VERTEX FORM

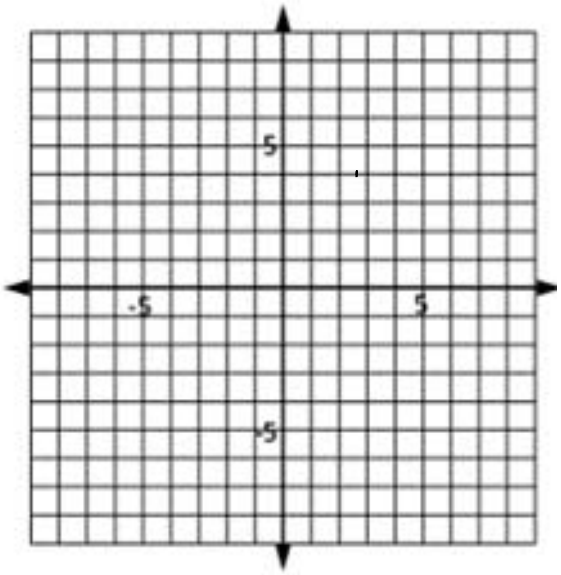
The **vertex form** of the equation of a parabola with vertex (h, k) is

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

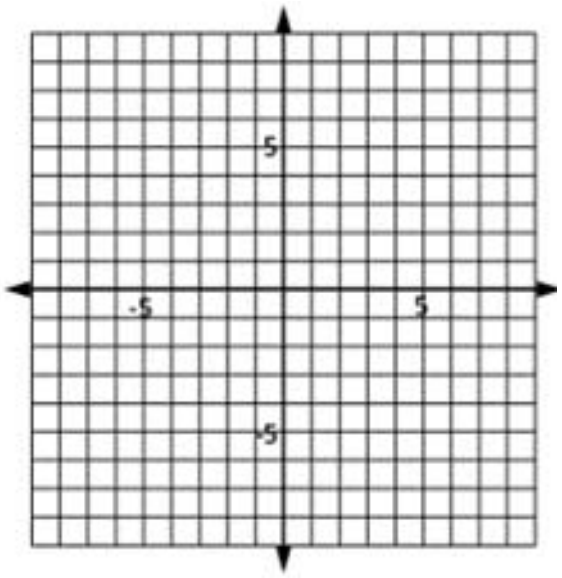
where $a \neq 0$ is a constant. If $a > 0$, the parabola opens upward; if $a < 0$, the parabola opens downward.

② Graph the equations

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



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

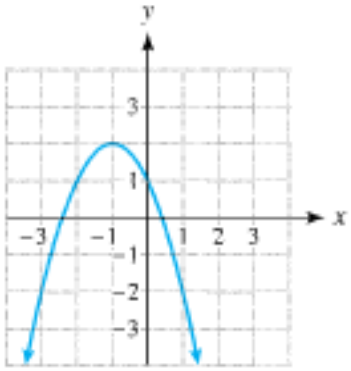


③ Write the vertex form of the parabola with $a =$ _____ and vertex (,).

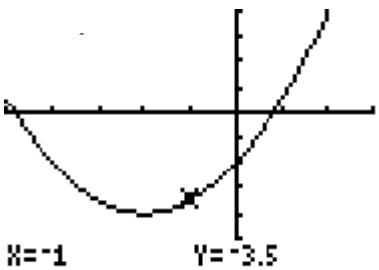
Then express the equation in the form $y = ax^2 + bx + c$

④ Write the vertex form given the graph.

a)



b)



(5) Use modeling to create a quadratic function for the following sets of real data.

a)

Year	Number of ATMs (thousands)
1991	90
1993	98
1995	119
1997	159
1999	227

b)

Cell Phone

Year	Subscribers (thousands)
1987	1.2
1988	2.1
1989	3.5
1990	5.3
1991	7.6
1992	11.0
1993	16.0
1994	24.1
1995	29.0
1996	38.2
1997	53.8
1998	60.8