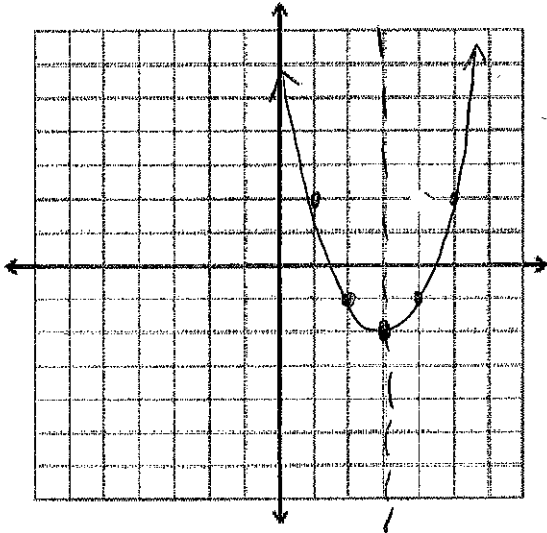


Key

GRAPHING QUADRATICS IN VERTEX FORM

EXAMPLE 1:

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



STEPS:

1) find the vertex by doing (opposite, same): (3, -2)

2) Axis of Symmetry $x = x$ -value of vertex $x = 3$

3) make a table of values, pick two values larger than the x -value of your vertex and pick two values smaller than the x -value of your vertex, find the y -values

x	y
1	$-2 = (1-3)^2 - 2$
2	$-1 = (2-3)^2 - 2$
3	-2
4	$-1 = (4-3)^2 - 2$
5	$2 = (5-3)^2 - 2$

4) plot all the points you found

* y -intercept

$$x = 0$$

$$y = (0-3)^2 - 2$$

$$y = (9) - 2$$

$$y = 7$$

$$(0, 7) = y\text{-intercept}$$

Name: _____ Date: key

Quadratics – Vertex Form

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

This is the easiest form to use to find the vertex.

Vertex: (h, k)

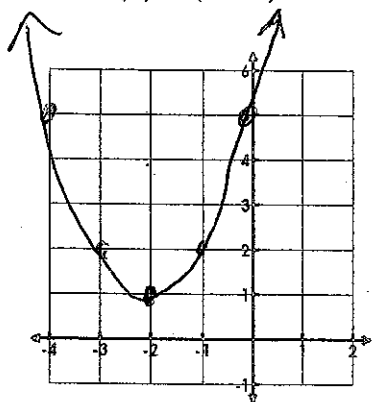
Axis of Symmetry: $x = h$

Steps to Graphing in VERTEX form:

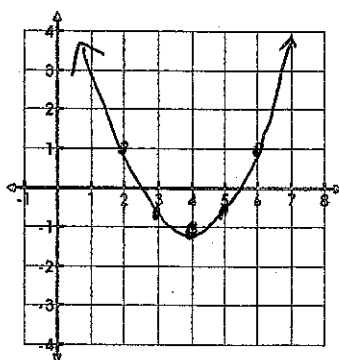
1. Find the vertex. Change the sign of h . Plot it.
2. Find the axis of symmetry. Graph this lightly as a dashed vertical line.
3. On your calculator: TABLE, EDIT FUCION, ENTER, START = <enter your h-value>, CALC, ENTER. Scroll up and down to get other ordered pairs.
4. Connect in a u-shape with arrows at each end.

Graph & identify the vertex and axis of symmetry.

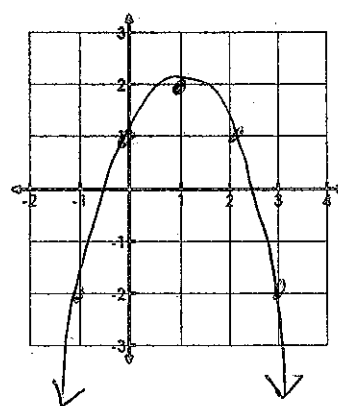
1. $f(x) = (x+2)^2 + 1$



2. $f(x) = \frac{1}{2}(x-4)^2 - 1$

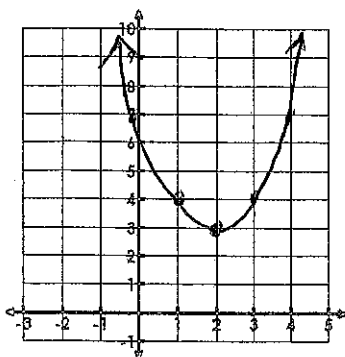


3. $f(x) = -(x-1)^2 + 2$

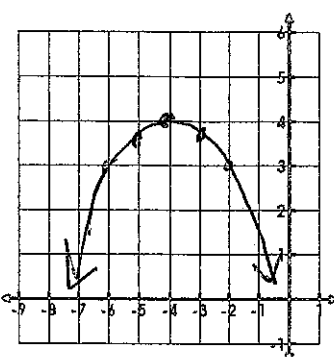


Graph & identify the vertex and axis of symmetry.

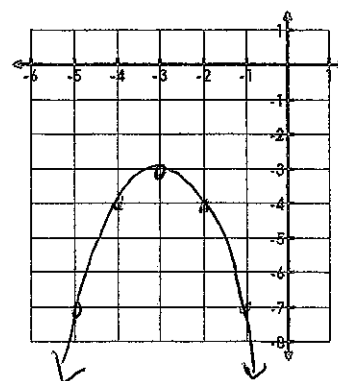
4. $f(x) = (x-2)^2 + 3$



5. $f(x) = -\frac{1}{4}(x+4)^2 + 4$



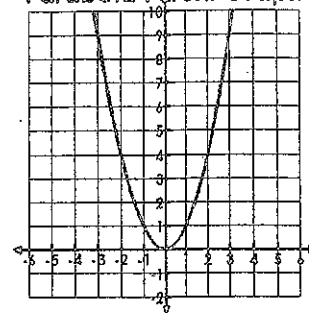
6. $f(x) = -(x+3)^2 - 3$



Transformations of Vertex Form

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

Parabola Parent Graph



What does a do to the parent graph?

- $a > 1 \rightarrow$ stretches the graph (skinner)
- $0 < a < 1 \rightarrow$ makes graph wider
- $a = 1 \rightarrow$ nothing changes $-a \rightarrow$ reflects over x -axis

What does h do to the parent graph?

- $-h \rightarrow$ shifts to the right
- $+h \rightarrow$ shifts graph to left

What does k do to the parent graph?

- $+k \rightarrow$ shifts graph up
- $-k \rightarrow$ shifts graph down

Determine what transformations are applied in the following functions.

7. $f(x) = (x-3)^2 + 5$

- shifted right 3 units
- shifted down 5 units

8. $f(x) = -(x-2)^2 + 7$

- reflected over x -axis
- right 2
- up 7

9. $f(x) = \frac{1}{3}(x+3)^2 - 2$

- shrink $\frac{1}{3}$
- left 3
- down 2

10. $f(x) = 4(x-3)^2 + 8$

- stretch 4
- right 3
- up 8

Name: _____ Date: _____

Vertex Form of a Quadratic

UNIT QUESTION: How are real life scenarios represented by quadratic functions?

Today's Question: How do we graph quadratics in vertex form using transformations? MCC9-12.F.BF.3

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

Vertex: (h,k)

Describe the transformations of the parent graph for each equation.

1. $f(x) = x^2 + 5$

- a: 1
- h: 0
- k: 5

2. $f(x) = -(x+9)^2 - 2$

- a: -1
- h: -9
- k: -2

3. $f(x) = \frac{1}{2}(x-10)^2$

- a: $\frac{1}{2}$
- h: 10
- k: 0

4. $f(x) = -5x^2 + 2$

- a: -5
- h: 0
- k: 2

5. $f(x) = \frac{2}{3}(x-8)^2$

- a: $\frac{2}{3}$
- h: 8
- k: 0

6. $f(x) = (x+1)^2 + 4$

- a: 1
- h: -1
- k: 4

Write the quadratic equation in vertex form that has been...

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

7. shifted to the right 4 and up 3

$y = -(x + 11)^2$

8. reflected over the x-axis and shifted left 11

$y = x^2 - 17$

9. moved down 17

$y = -(x + 9)^2 - 8$

10. reflected over the x-axis, shifted left 9 and down 8.

Describe the transformations and write an equation for each quadratic function.

11. Vertex: (3,0)

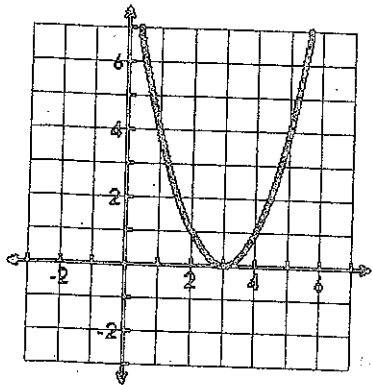
o a: 1

o h: 3

o k: 0

*slip
from vertex
to next
point*

$f(x) = (x-3)^2$



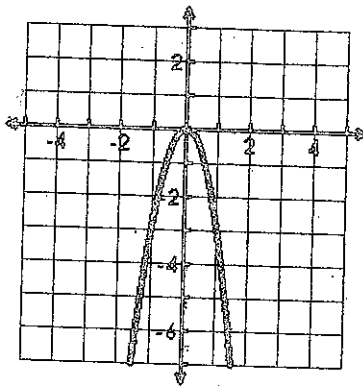
12. Vertex: (0,0)

o a: -1

o h: 0

o k: 0

$f(x) = -x^2$



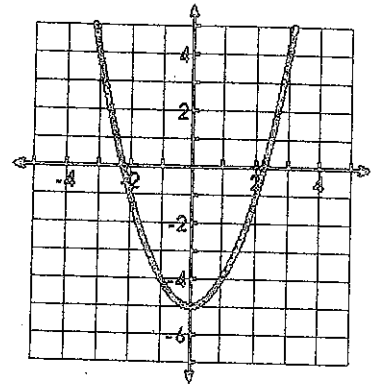
13. Vertex: (0,-5)

o a: 1

o h: 0

o k: -5

$f(x) = x^2 - 5$

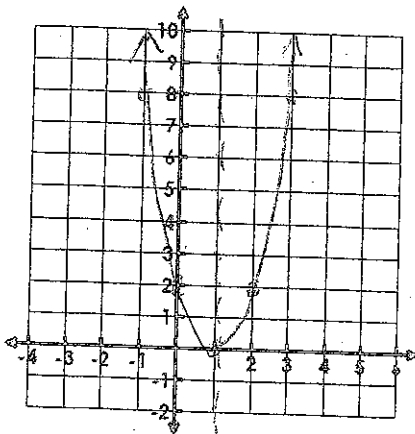


Graph the following equations Identify the vertex and the axis of symmetry.

14. $f(x) = 2(x-1)^2$

Vertex: (1,0)

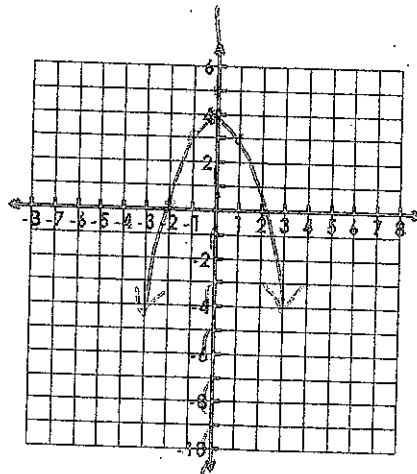
Axis of Symmetry: $x = \underline{x=1}$



15. $f(x) = -x^2 + 4$

Vertex: (0,4)

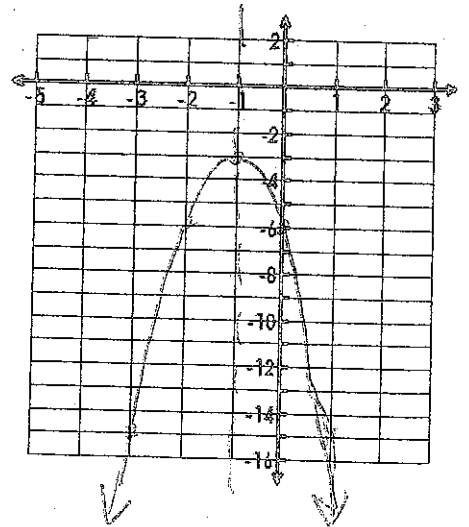
Axis of Symmetry: $x = \underline{0}$



16. $f(x) = -3(x+1)^2 - 3$

Vertex: (-1,-3)

Axis of Symmetry: $x = \underline{-1}$



Name:

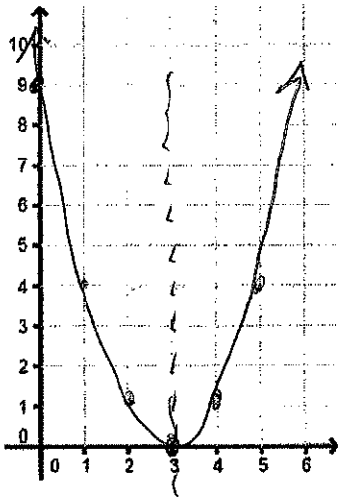
Date:

Period:

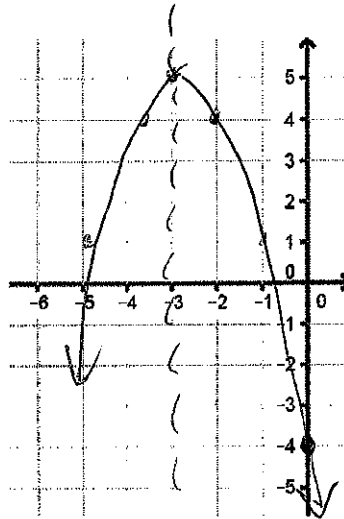
Practice Worksheet: Graphing Quadratic Functions in Vertex Form

For #1-6, label the axis of symmetry, vertex, y-intercept, and at least three more points on the graph.

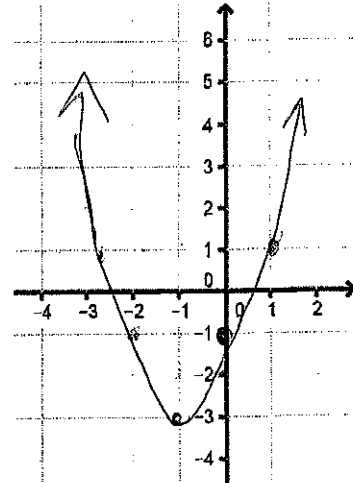
1] $y = (x - 3)^2$
 Axis of Symmetry is $x = 3$
 Vertex: $(3, 0)$
 Opens up or down?
 Slope to point one unit from the vertex is 1
 y-intercept: $(0, 9)$



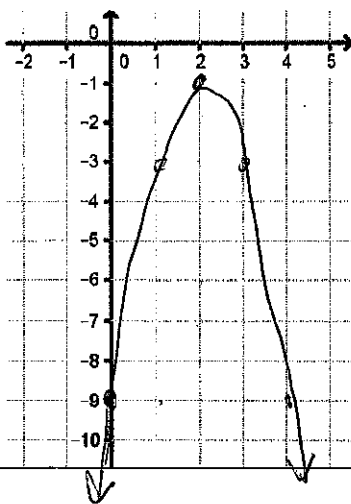
2] $y = -(x + 3)^2 + 5$
 Axis of Symmetry is $x = -3$
 Vertex: $(-3, 5)$
 Opens up or down?
 Slope to point one unit from the vertex is -1
 y-intercept: $(0, -4)$



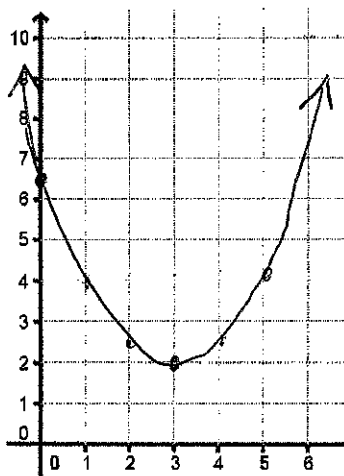
3] $y = 2(x + 1)^2 - 3$
 Axis of Symmetry is $x = -1$
 Vertex: $(-1, -3)$
 Opens up or down?
 Slope to point one unit from the vertex is 2
 y-intercept: $(0, -1)$



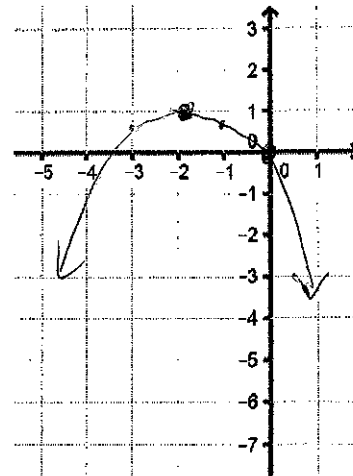
4] $y = -2(x - 2)^2 - 1$
 Axis of Symmetry is $x = 2$
 Vertex: $(2, -1)$
 Opens up or down?
 Slope to point one unit from the vertex is -2
 y-intercept: $(0, -9)$



5] $y = \frac{1}{2}(x - 3)^2 + 2$
 Axis of Symmetry is $x = 3$
 Vertex: $(3, 2)$
 Opens up or down?
 Slope to point one unit from the vertex is $\frac{1}{2}$
 y-intercept: $(0, 6.5)$

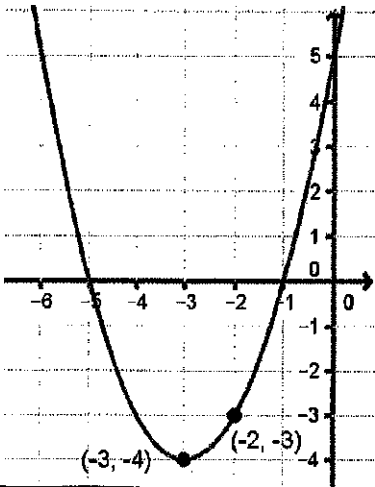


6] $y = -\frac{1}{4}(x + 2)^2 + 1$
 Axis of Symmetry is $x = -2$
 Vertex: $(-2, 1)$
 Opens up or down?
 Slope to point one unit from the vertex is $-\frac{1}{4}$
 y-intercept: $(0, 0)$

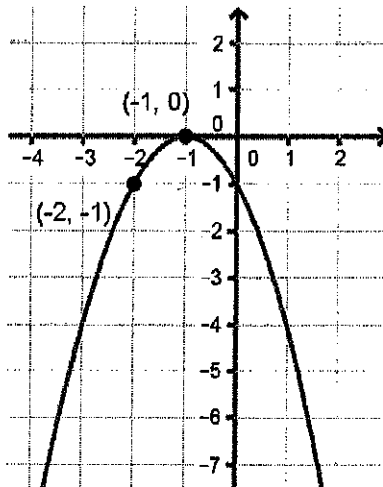


Write the equation of the parabola in vertex form.

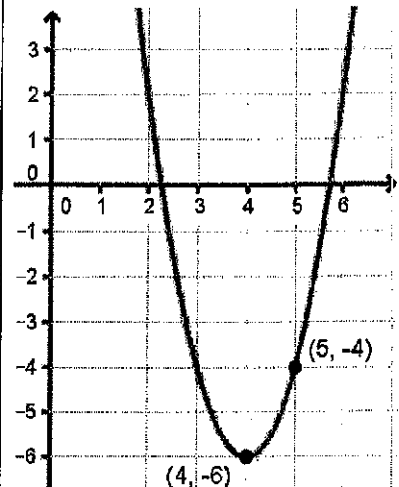
7] $y = (x+3)^2 - 4$



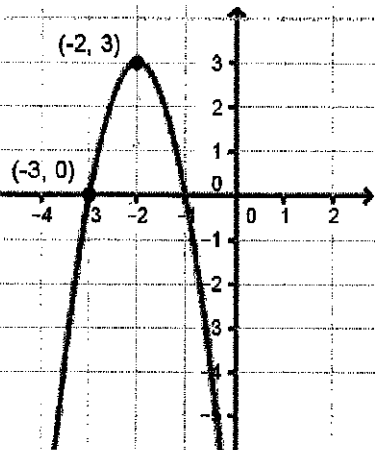
8] $y = -(x+1)^2$



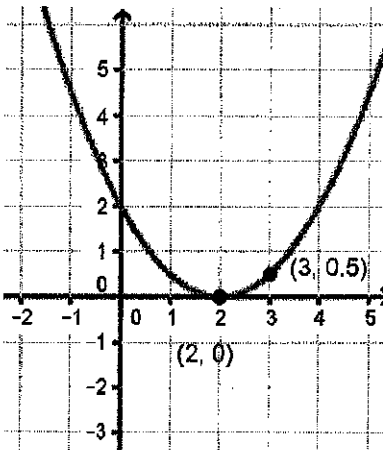
9] $y = 2(x-4)^2 - 6$



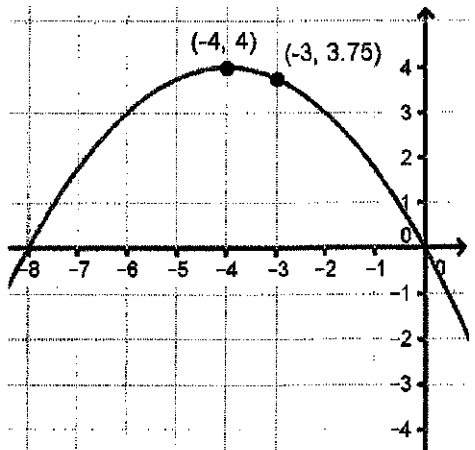
10] $y = -3(x+2)^2 + 3$



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



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



Write the quadratic function in standard form. *Can you figure out???*

13] $y = -(x+2)^2$

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

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

$$y = -x^2 - 4x - 4$$

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

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

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

$$y = x^2 - 4x + 8$$

15] $y = 2(x-3)^2 + 9$

$$y = 2(x-3)(x-3) + 9$$

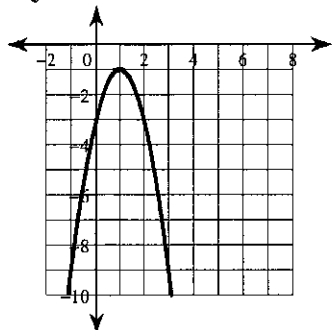
$$y = 2(x^2 - 6x + 9) + 9$$

$$y = 2x^2 - 12x + 18 + 9$$

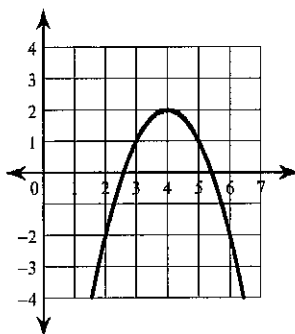
$$y = 2x^2 - 12x + 27$$

Answers to Graphing Quadratics - Vertex Form

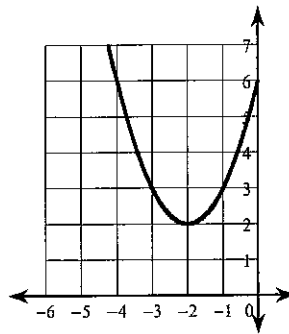
1) $y = -2(x-1)^2 - 1$



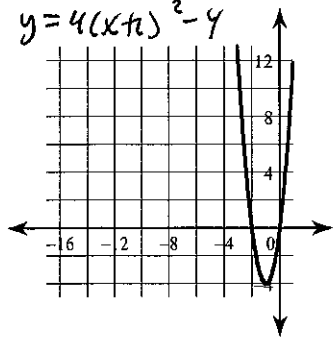
2)



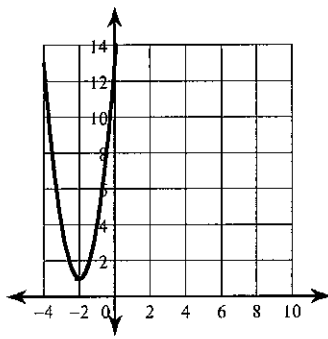
3)



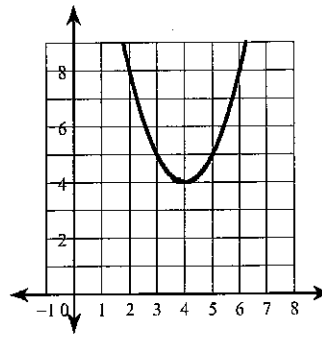
4) $y = 4(x+2)^2 - 4$



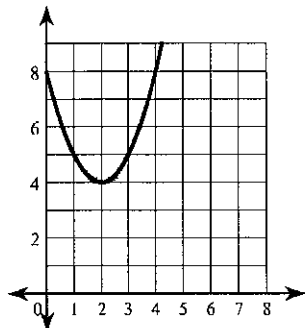
5)



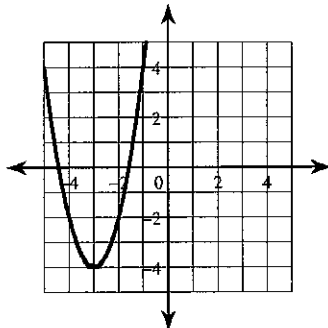
6)



7)



8)

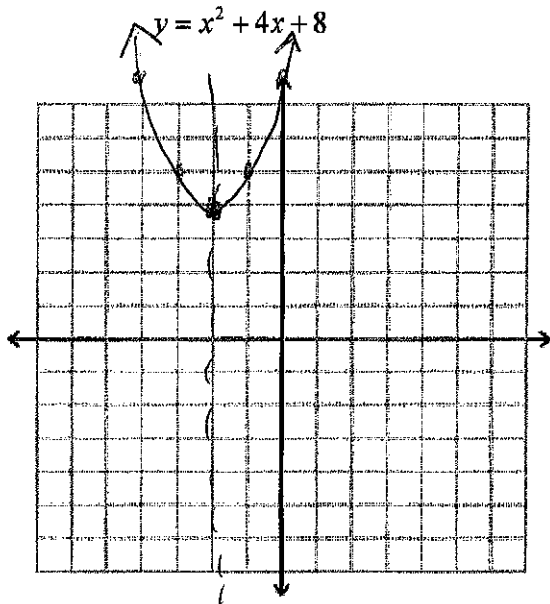


8 + 9

Key

GRAPHING QUADRATICS IN STANDARD FORM

EXAMPLE 1:



STEPS:

1) find the x-value of the vertex by: $x = -\frac{b}{2a}$

$$x = \frac{-4}{2(1)} \quad \boxed{x = -2}$$

2) Find the y-value of the vertex by substituting the x-value into equation and simplifying

$$x = -2$$

$$y = (-2)^2 + 4(-2) + 8$$

$$y = 4 - 8 + 8 = 4$$

3) Axis of Symmetry $x = x$ -value of vertex $x = -2$

4) make a table of values, pick two values larger than the x-value of your vertex and pick two values smaller than the x-value of your vertex, find the y-values

5) plot all the points you found

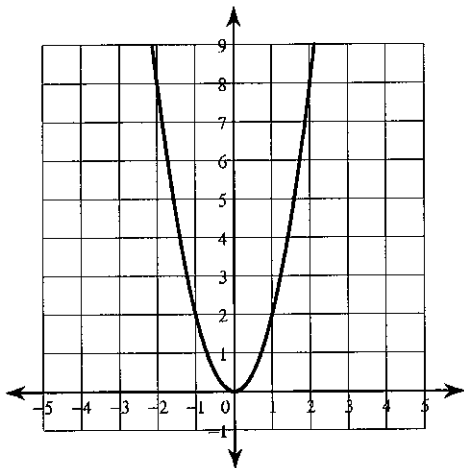
x	y	
-4	8	$= (-4)^2 + 4(-4) + 8$
-3	5	$= (-3)^2 + 4(-3) + 8$
-2	4	
-1	5	$= (-1)^2 + 4(-1) + 8$
0	8	$= (0)^2 + 4(0) + 8 = 10$

Assignment

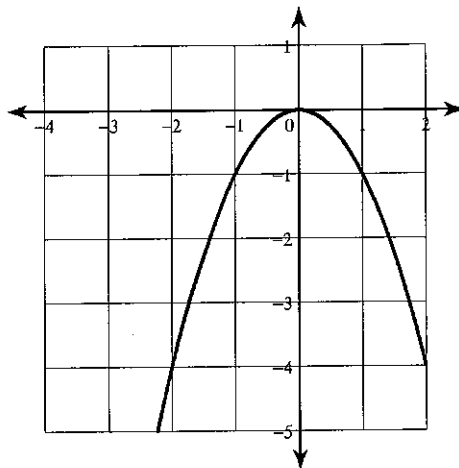
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Sketch the graph of each function. Be sure to show your table of values and your work either next to the graph or on a separate sheet of paper.

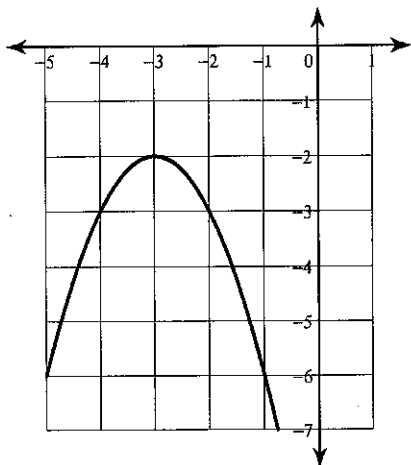
1) $y = 2x^2$



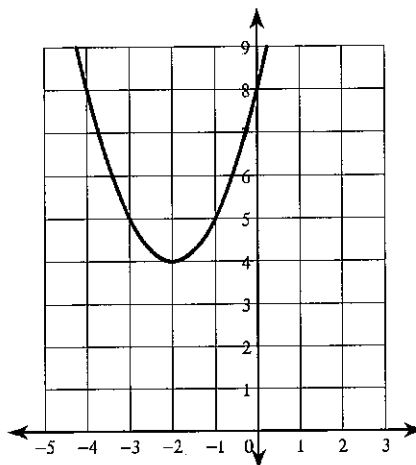
2) $y = -x^2$



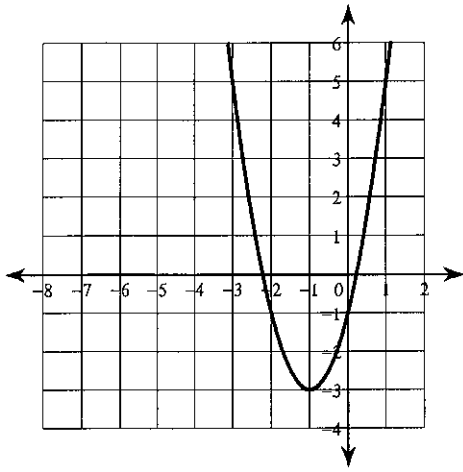
3) $y = -x^2 - 6x - 11$



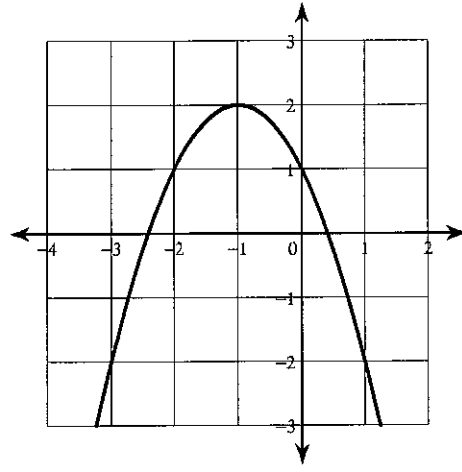
4) $y = x^2 + 4x + 8$



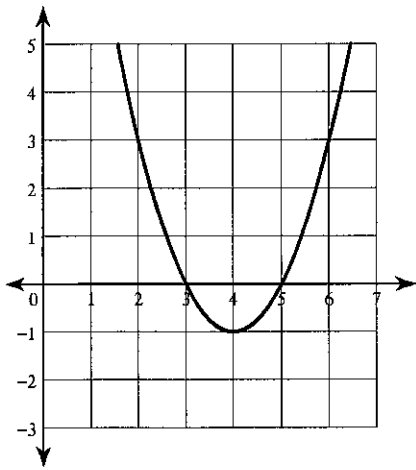
5) $y = 2x^2 + 4x - 1$



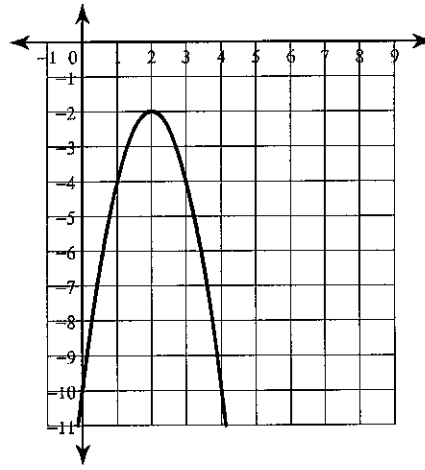
6) $y = -x^2 - 2x + 1$



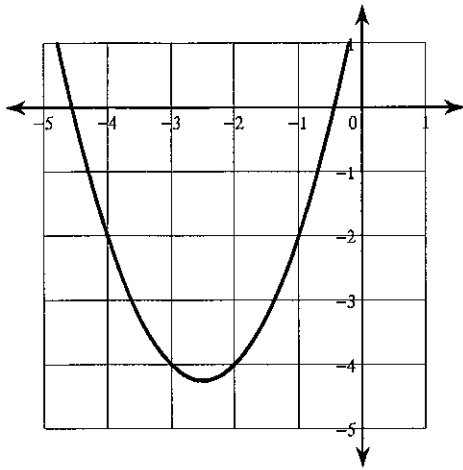
7) $y = x^2 - 8x + 15$



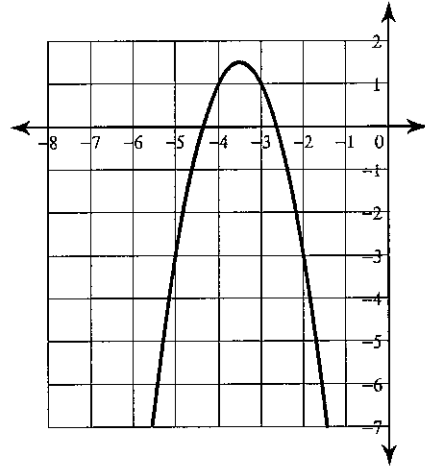
8) $y = -2x^2 + 8x - 10$



9) $y = x^2 + 5x + 2$



10) $y = -2x^2 - 14x - 23$



HW Graphing Quadratics (standard form)

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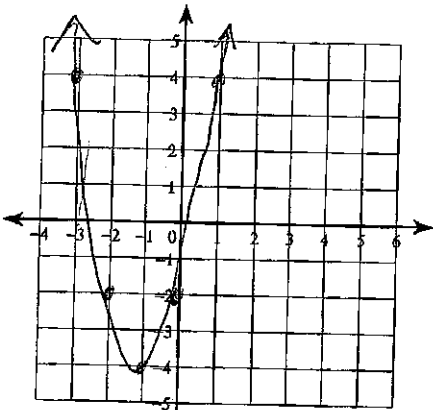
Find the discriminant of each quadratic equation then state the number and type of solutions.

1) $9x^2 + 4x + 7 = 0$ $b^2 - 4ac$
 $(4)^2 - 4(9)(7) = -236$ 2 imaginary 2) $3n^2 + 4n - 4 = 0$
 $4^2 - 4(3)(-4) = 64$ 2 real

3) $-8x^2 - 3x - 9 = 0$
 $(-3)^2 - 4(-8)(-9) = -279$ 2 imag 4) $6a^2 - a - 1 = 0$
 $(-1)^2 - 4(6)(-1) = 25$ 2 real

Sketch the graph of each function.

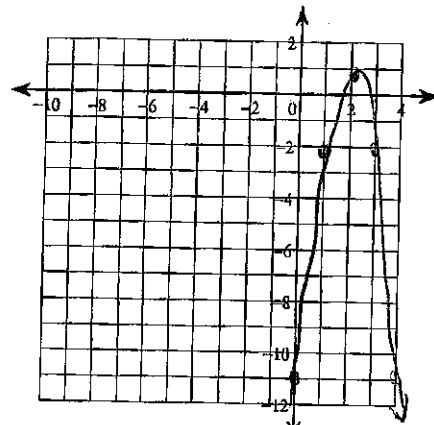
5) $y = 2x^2 + 4x - 2$ $x = -b/2a = -4/4 = -1$



X	Y
-3	4
-2	-2
-1	-4
0	-2
1	4

vertex: (-1, -4) AOS: X = -1

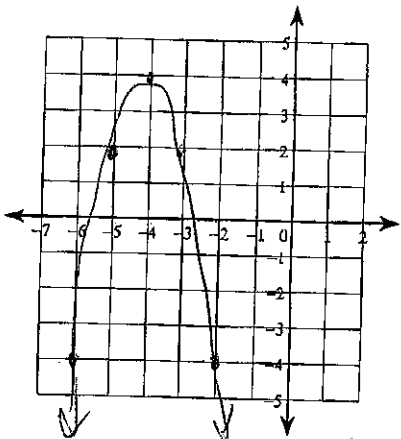
6) $y = -3x^2 + 12x - 11$ $x = -b/2a = -12/-6 = 2$



X	Y
0	-11
1	-2
2	1
3	-2
4	-11

vertex: (2, 1) AOS: X = 2

7) $y = -2x^2 - 16x - 28$

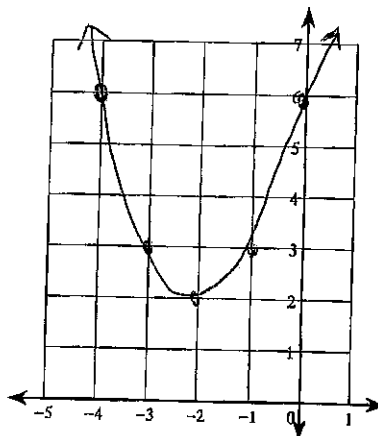


$x = -b/2a = 16/-4 = -4$

X	Y
-6	4
-5	2
-4	4
-3	2
-2	4

vertex: (-4, 4)
 AOS: X = -4

8) $y = x^2 + 4x + 6$

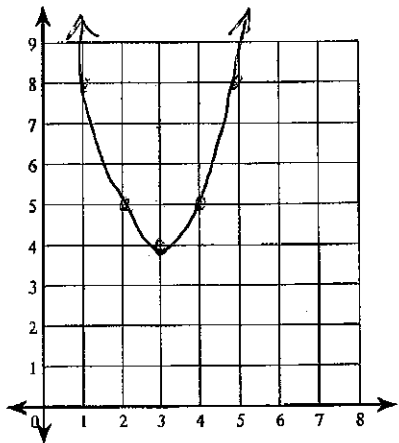


$x = -4/2 = -2$
 vertex: (-2, 2)
 AOS: X = -2

X	Y
-4	2
-3	3
-2	2
-1	3
0	6

$$x = \frac{6}{2} = 3$$

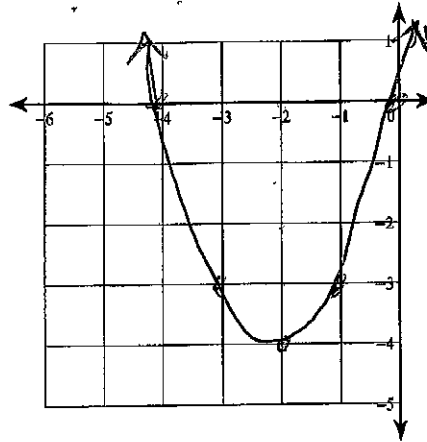
9) $y = x^2 - 6x + 13$



x	y
3	4

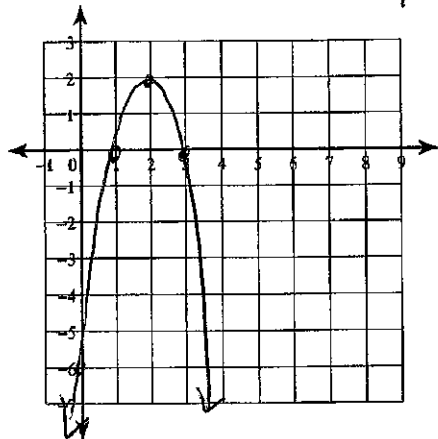
$$x = \frac{-4}{2} = -2$$

10) $y = x^2 + 4x$



vertex:
(-2, -4)

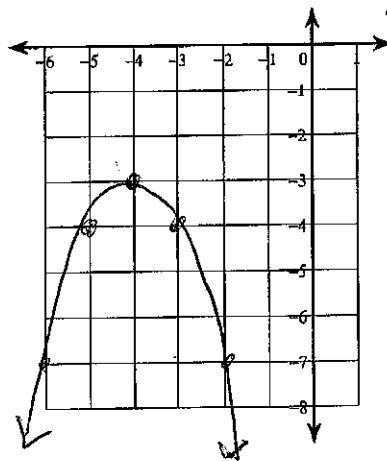
11) $y = -2x^2 + 8x - 6$ $x = \frac{8}{-4} = 2$



vertex:
(2, 2)

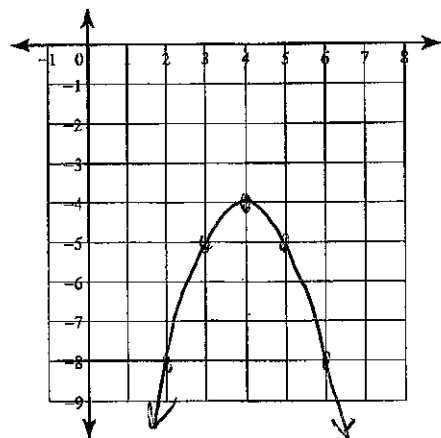
12) $y = -x^2 - 8x - 19$

$$x = \frac{8}{-2} = -4$$



vertex
(-4, -3)

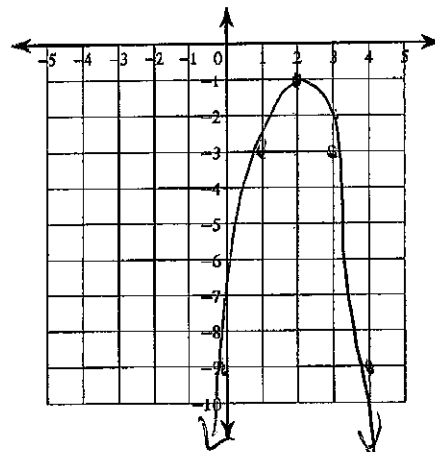
13) $y = -x^2 + 8x - 20$



$$x = \frac{-8}{-2} = 4$$

vertex: (4, -4)

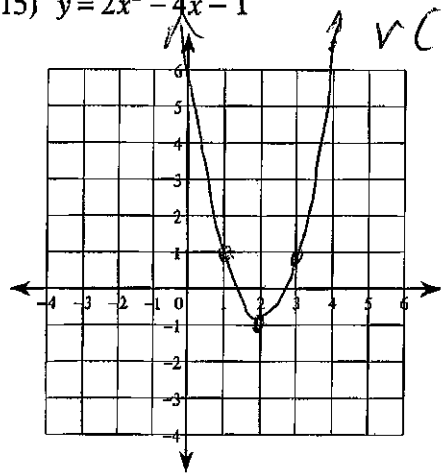
14) $y = -2x^2 + 8x - 9$



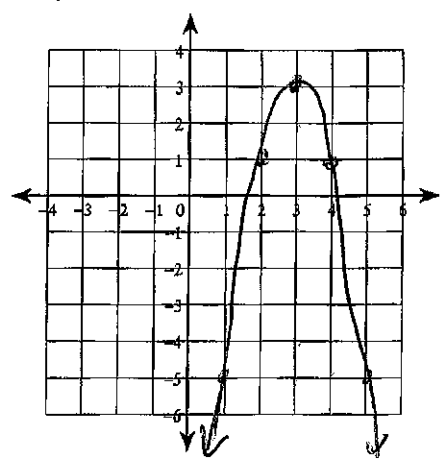
$$x = \frac{-8}{-4} = 2$$

vertex: (2, -1) 14

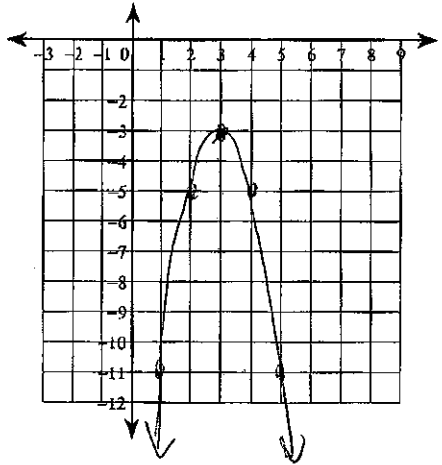
15) $y = 2x^2 - 4x - 1$ $x = \frac{4}{2} = 2$ $v(2, -1)$



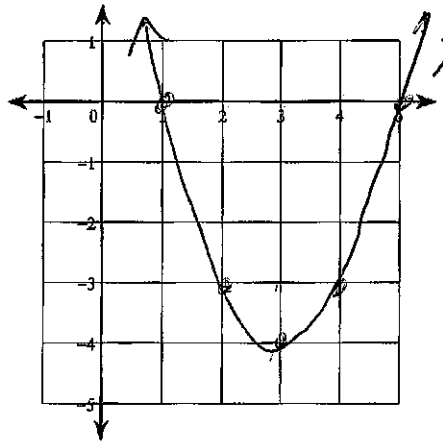
16) $y = -2x^2 + 12x - 15$ $x = \frac{-12}{-4} = 3$ $v(3, 3)$



17) $y = -2x^2 + 12x - 21$



18) $y = x^2 - 6x + 5$



$x = \frac{-12}{-4} = 3$

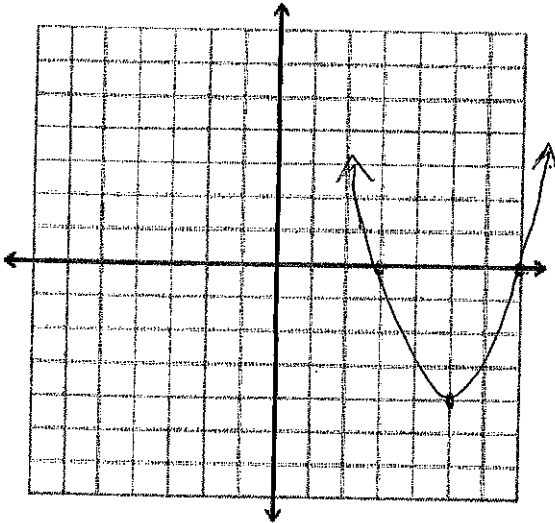
vertex
(3, -3)

GRAPHING QUADRATICS IN INTERCEPT FORM

Key

EXAMPLE 1:

$$f(x) = (x-7)(x-3)$$



STEPS:

1) Identify the x-intercepts (set each factor equal to zero and solve for x) and plot them ($y=0$)

• x-intercepts are (7, 0) (3, 0)

$$\begin{array}{ll} x-7=0 & x-3=0 \\ x=7 & x=3 \end{array}$$

2) Find the vertex and axis of symmetry

$$\bullet x = \frac{p+q}{2} \quad x = \frac{7+3}{2} = 5 \quad \text{AOS: } \underline{x=5}$$
$$x=5$$

3) Find the y-value of the vertex by plugging x-value of vertex back into equation and simplify

$$x=5$$

$$\begin{aligned} y &= (5-7)(5-3) \\ y &= (-2)(2) = -4 \end{aligned}$$

$$\text{vertex: } \underline{(5, -4)}$$

4) plot the x-intercepts and vertex, sketch graph

WS Quadratic Intercept Graphing

Sketch the parabolas using the intercepts method. $2(2)(-2)$

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

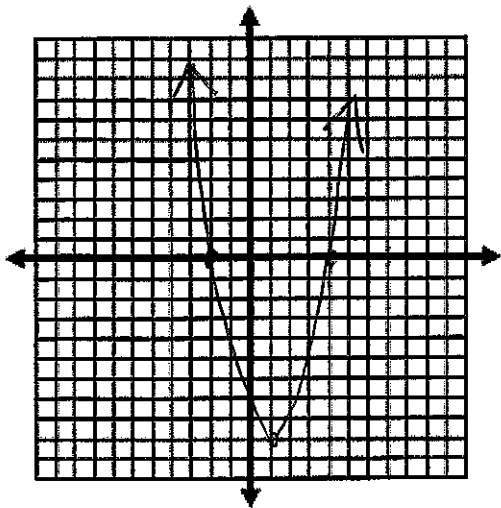
x-intercepts: $(-2, 0)$ $(4, 0)$

vertex: $(1, -9)$

axis of symmetry: $x = 1$

y-intercept: $(0, -8)$

other points: _____



b) $f(x) = 2(x + 3)(x - 1)$

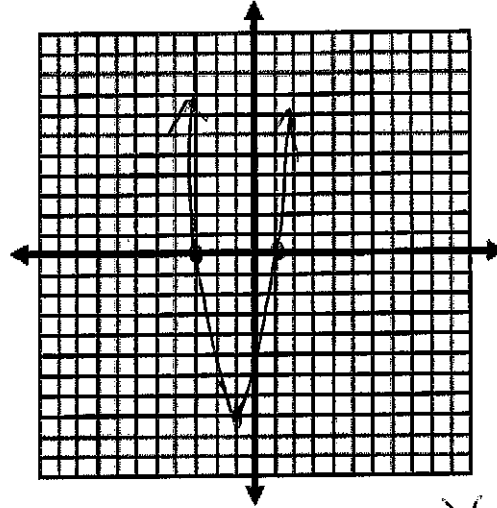
x-intercepts: $(-3, 0)$ $(1, 0)$

vertex: $(-1, -8)$

axis of symmetry: $x = -1$

y-intercept: $(0, -6)$

other points: _____



c) $f(x) = -\frac{1}{2}(x - 2)(x + 4)$

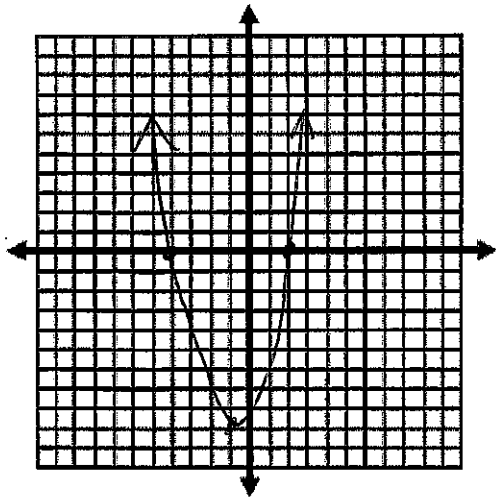
x-intercepts: $(2, 0)$ $(-4, 0)$

vertex: $(-1, 9)$

axis of symmetry: $x = -1$

y-intercept: $(0, 8)$

other points: _____



d) $f(x) = -\frac{1}{2}(x + 2)(x - 4)$

x-intercepts: $(-2, 0)$ $(4, 0)$

vertex: $(1, 4.5)$

axis of symmetry: $x = 1$

y-intercept: $(0, 4)$

other points: _____

