

Notes

Thursday, February 14, 2019 10:09 AM



Day 1 - Graphing Quadratics all 3 forms

Unit 2A - Graphing Quadratic Equations

Day 1 – Graphing in Standard Form

Agenda

Objective: I can graph quadratic equations in standard form

- **Warm Up/Test Review**
- **Intro to Quadratics Activity**
- **Graphing Quadratics - Standard Form**
- **Classwork**
- **Homework:** Finish standard form worksheet

Hey, students!

Go to student.desmos.com
and type in:

T8PJB

You can also share this link with your students:

<https://student.desmos.com/?prepopulateCo>

DEGREE - highest exponent!

Name _____

Block _____ Date _____

Linear Equation: equations with an exponent of one. Graphs are lines.

Standard Form $y = mx + b$

$AX + BY = C$

Quadratic Equations: equations with an exponent of two (squared). Graphs are parabola.

Standard Form $y = ax^2 + bx + c$

Opening up

$\uparrow\uparrow$ a - positive

Opening down (flipped)

$\downarrow\downarrow$ a - negative

a, b, c

are all real #'s



$$y = ax^2 + bx + c$$

Write the quadratic equation in standard form and determine if the graph opens up or down.

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

$a=2$ $b=1$ $c=-1$

opens up!



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

$y = -x^2 - x + 3$

$a=-1$ $b=-1$ $c=3$

opens down



3.) $y = -3x^2 + 1 - 4x$

$y = -3x^2 - 4x + 1$

$a=-3$ $b=-4$ $c=1$

opens down



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

$y = -3x^2 + 4$

$a=-3$ $b=0$ $c=4$

opens down



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

$y = 9x^2 + x + 0$

$a=9$ $b=1$ $c=0$

opens up



6.) $y = 8x^2 + 5x^2 - 3x + 2$

$y = 13x^2 - 3x + 2$

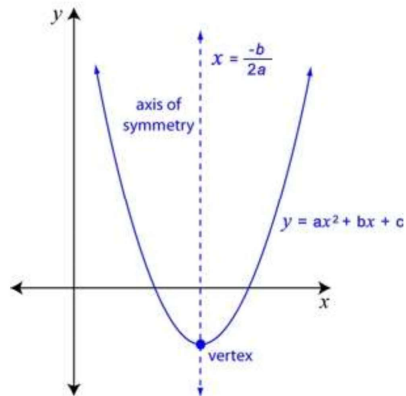
$a=13$ $b=-3$ $c=2$

opens up



Vertex: the lowest or the highest point of the graph
min. *max.*

Axis of Symmetry: the vertical line through the vertex



*Always a line
→ $x = \#$*

Axis of Symmetry and x-coordinate of the vertex

$$x = -\frac{b}{2a}$$

Always an ordered pair!

Find the axis of symmetry of the parabola.

7.) $y = 2x^2 + 4x - 1$

$$a=2 \quad b=4 \quad c=-1$$

$$x = \frac{-b}{2a}$$

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

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

$$\text{A.O.S.} = \boxed{x = -1}$$

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

$$a=-1 \quad b=2 \quad c=5$$

$$x = \frac{-b}{2a}$$

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

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

$$\text{A.O.S.} = \boxed{x = 1}$$

9.) $y = 3x^2 - 5$

$$a=3 \quad b=0 \quad c=-5$$

$$x = \frac{-b}{2a}$$

$$x = \frac{-0}{2(3)}$$

$$\boxed{x = 0}$$

Find the vertex of the parabola. Find x using formula and then plug it back into equation to find y.

10.) $y = x^2 + 2x - 1$

$$a=1 \quad b=2 \quad c=-1$$

FIND X:

$$x = \frac{-b}{2a} = \frac{-2}{2(1)} = -\frac{2}{2}$$

$$x = -1$$

FIND Y:

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

$$y = 1 - 2 - 1$$

$$y = -2$$

$$V: (-1, -2)$$

11.) $y = -x^2 + 4$

$$a=-1 \quad b=0 \quad c=4$$

FIND X:

$$x = \frac{-b}{2a} = \frac{-0}{2(-1)} = 0$$

FIND Y:

$$y = -(0)^2 + 4$$

$$y = 4$$

$$V: (0, 4)$$

12.) $y = 2x^2 + 4x$

$$a=2 \quad b=4 \quad c=0$$

FIND X:

$$x = \frac{-b}{2a} = \frac{-4}{2(2)} = -\frac{4}{4}$$

$$x = -1$$

FIND Y:

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

$$2(1) - 4$$

$$y = -2$$

$$V: (-1, -2)$$

Graph the following quadratic equations. Find the axis of symmetry and the vertex.

13. $y = x^2 - 2x + 3$
 $a = 1$ $b = -2$ $c = 3$

$x = 1$

Vertex: $(1, 2)$ up a units over right/left 1

Point: $(0, 3)$ $(2, 3)$ up 1 over 1

$(x+1, y+a)$ $(x-1, y+a)$

y -int: $0^2 - 2(0) + 3 \rightarrow (0, 3)$

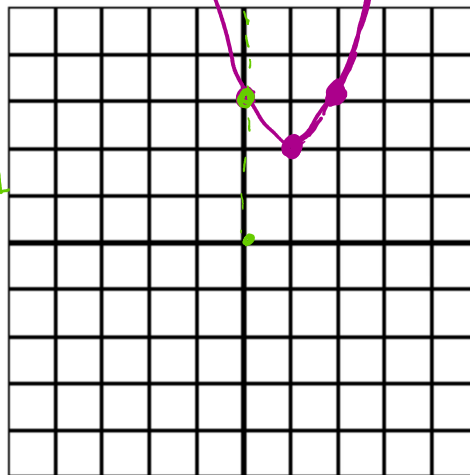
FIND x :

$$x = \frac{-b}{2a} = \frac{-(-2)}{2(1)} = \frac{2}{2} = 1$$

FIND y :

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

$$1 - 2 + 3 = -1 + 3 = 2$$



- ① Vertex
 - ② 2 other points...
- USE a

$$a=1 \quad b=5 \quad c=-6$$

$$14. \quad y = x^2 + 5x - 6$$

$$x = \underline{-2.5}$$

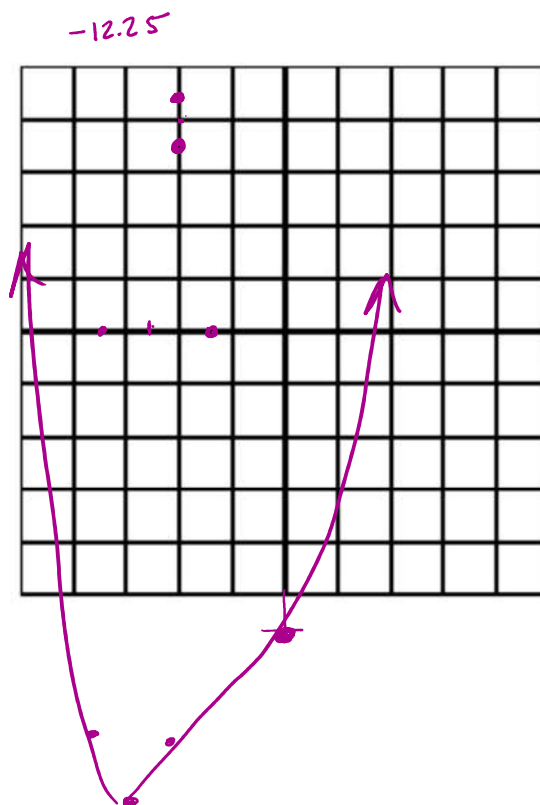
$$\text{Vertex: } \underline{(-2.5, -12.25)}$$

$$\text{Point: } \underline{(-3.5, -11.25)} \quad \underline{(-1.5, -11.25)}$$

$$y\text{-int: } \underline{(0, -6)}$$

$$x: \quad x = \frac{-b}{2a} = \frac{-5}{2(1)} = \frac{-5}{2}$$

$$y: \quad (-2.5)^2 + 5(-2.5) - 6 \\ = -12.25$$



$$15. y = -x^2 + 4x - 2 \quad a = -1 \quad b = 4 \quad c = -2$$

$$x = \underline{2}$$

$$\text{Vertex: } (2, 2)$$

$$\text{Point: } (1, 1) \quad (3, 1)$$

$$\text{y-int: } (0, -2)$$

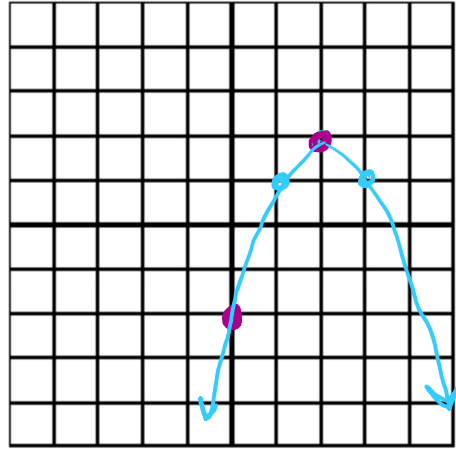
$$x = \frac{-b}{2a} = \frac{-4}{2(-1)} = \frac{-4}{-2} = 2$$

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

$$-4 + 8 - 2$$

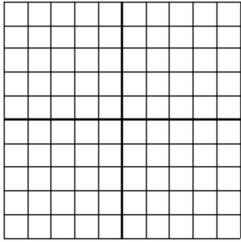
$$4 - 2$$

$$2$$

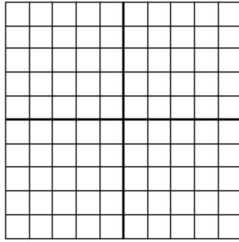


Standard Form: Practice Problems: pg 253 #20-25

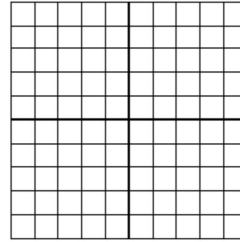
20.) $y = x^2 - 2x - 1$



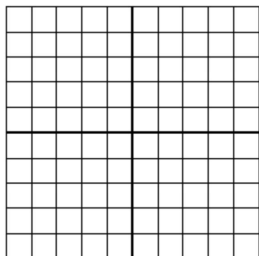
21.) $y = 2x^2 - 12x + 19$



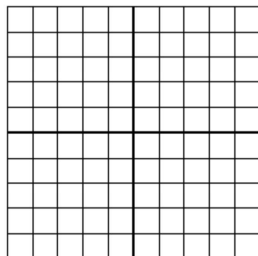
22.) $y = -x^2 + 4x - 2$



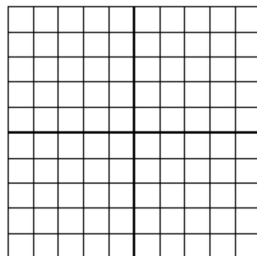
23.) $y = -3x^2 + 5$



24.) $y = \frac{1}{2}x^2 + 4x + 5$



25.) $y = -\frac{1}{6}x^2 - x - 3$

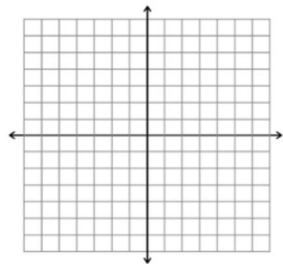


Find the vertex of each parabola, then sketch the graph.

1.) $y = -x^2 - 6x - 3$

Vertex: _____

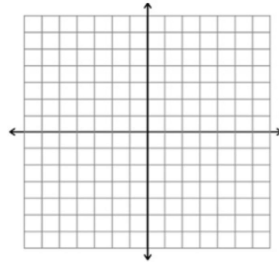
Points: _____



2.) $y = 4x^2 - 8x - 3$

Vertex: _____

Points: _____



Warm up

Vertex Form

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

Opening up

a positive

Opening down (flipped)

a negative

$$3(x - (-2))^2 - 5$$

Determine if the graph opens up or down. ↑

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

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

3.) $y = -2(x - 1)^2 + 0$

a=1 h=2 k=3

a=3 h=-2 k=-5

a=-2 h=1 k=0



Axis of Symmetry and x-coordinate of the vertex
 $x = h$

Vertex
~~Intercept Form Vertex: (h, k)~~

Find the axis of symmetry of the parabola.

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

$a = 2$ $h = 5$ $k = 3$

$x = \underline{5}$

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

$a = -4$ $h = 0$ $k = -5$

$x = \underline{0}$

6.) $y = 7(x + 9)^2 + 2$

$a = 7$ $h = -9$ $k = 2$

$x = \underline{-9}$

Find the vertex of the parabola (h, k) .

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

$a = 1$ $h = 3$ $k = 3$

$V: (h, k)$

$V: (3, 3)$

8.) $y = \frac{1}{2}(x - 6)^2$

$a = \frac{1}{2}$ $h = 6$ $k = 0$

$V: (6, 0)$

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

$a = 1$ $h = -1$ $k = -7$

$V: (-1, -7)$

Graph the following quadratic equations. Find the axis of symmetry and the vertex.

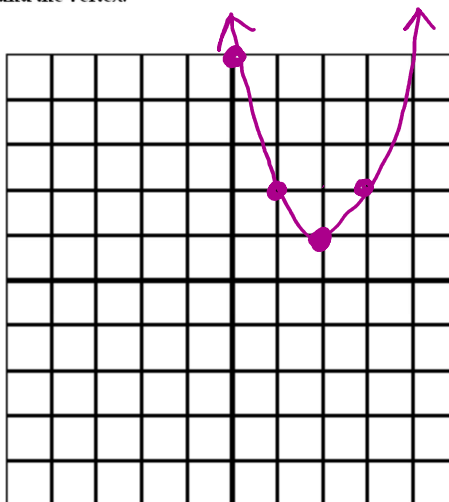
10. $y = (x - 2)^2 + 1$ $a=1$ ↻

$x = 2$ $h=2$

Vertex: $(2,1)$ $k=1$

Point: $(1,2)$ $(3,2)$

Y-int: $(0-2)^2 + 1$
 $(-2)^2 + 1$
 $4 + 1$
 5
 $(0,5)$



Graph the following quadratic equations. Find the axis of symmetry and the vertex.

11. $y = 3(x + 3)^2 + 2$

$a = 3$ up 3 over 1

$h = -3$

$x = -3$

Vertex: $(-3, 2)$

$k = 2$

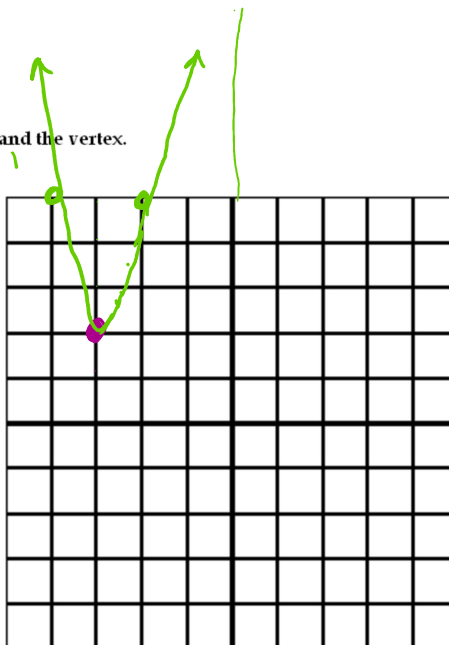
Point: $(-2, 5)$ $(-4, 5)$

y-int: $3(0+3)^2 + 2$

$3(9) + 2$

$27 + 2$

$(0, 29)$



Graph the following quadratic equations. Find the axis of symmetry and the vertex.

12. $y = -(x - 1)^2 + 3$ $a = -1$ ✖

$x = \frac{1}{1}$

Vertex: $(1, 3)$

Point: $(0, 2)$ $(2, 2)$

y -int: $-(0-1)^2 + 3$

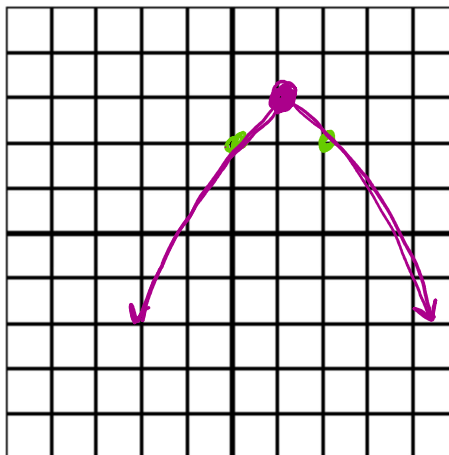
$-1 + 3$

2

$(0, 2)$

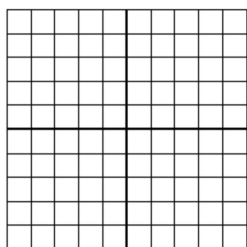
$h = 1$

$k = 3$

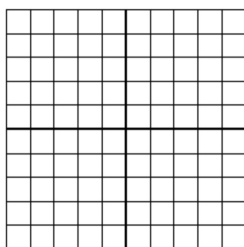


Vertex Form: Practice Problems: pg 253 #26-31

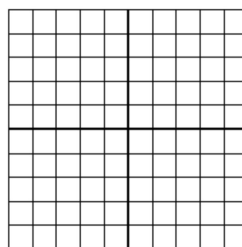
26.) $y = (x - 1)^2 + 2$



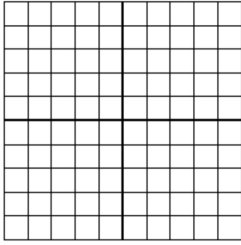
27.) $y = -(x - 2)^2 - 1$



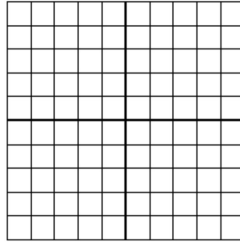
28.) $y = -2(x + 3)^2 - 4$



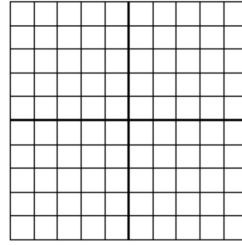
29.) $y = 3(x + 4)^2 + 5$



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



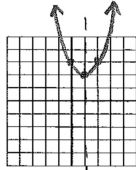
31.) $y = \frac{5}{4}(x - 3)^2$



Vertex Form: Practice Problems: pg 253 #26-31

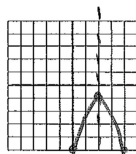
26.) $y = (x-1)^2 + 2$

$x = 1$
 Vertex: $(1, 2)$
 Point: $(0, 3)$



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

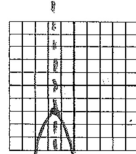
$x = 2$
 Vertex: $(2, -1)$
 Point: $(0, -5)$



count by 2

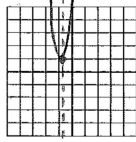
28.) $y = -2(x+3)^2 - 4$

$x = -3$
 Vertex: $(-3, -4)$
 Point: $(0, -22)$



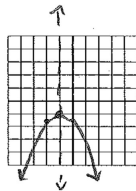
29.) $y = 3(x+4)^2 + 5$

$x = -4$
 Vertex: $(-4, 5)$
 Point: $(0, 53)$
 count by 5



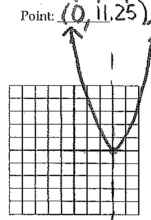
30.) $y = -1/3(x+1)^2 - 1$

$x = -1$
 Vertex: $(-1, -1)$
 Point: $(0, -1.3)$



31.) $y = 5/3(x-3)^2$

$x = 3$
 Vertex: $(3, 0)$
 Point: $(0, 11.25)$



Intercept Form $y = a(x-p)(x-q)$ → p and q are the x-intercepts

Opening up a positive

Opening down (flipped) a negative

Determine if the graph opens up or down.

1.) $y = (x-2)(x+3)$

$a = 1$

$p = 2$

$q = -3$



2.) $y = -2(x-1)(x-4)$

$a = -2$ $p = 1$ $q = 4$



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

$a = 2$ $p = 0$ $q = 3$

$p = 3$ $q = 0$

$2(x-0)(x-3)$

Axis of Symmetry and x-coordinate of the vertex

x is half way between p and q

$$x = \frac{p+q}{2}$$

Find the axis of symmetry of the parabola.

4.) $y = -2(x-1)(x-5)$

5.) $y = 3(x+2)(x-4)$

6.) $y = -x(x+5)$

Axis of Symmetry and x-coordinate of the vertex
x is half way between p and q

Find the vertex of the parabola. Find x by counting half way between p and q. Find y by plugging x into the given equation.

7.) $y = (x + 5)(x - 3)$

$\rightarrow a = 1 \quad p = -5 \quad q = 3$

$x = \frac{p+q}{2} = \frac{-5+3}{2} = \frac{-2}{2}$

$x = -1$

$y = (-1+5)(-1-3)$

$4(-4)$

$y = -16$

$V: (-1, -16)$

8.) $y = -4(x + 1)(x - 1)$

$a = -4 \quad p = -1 \quad q = 1$

$x = \frac{p+q}{2} = \frac{-1+1}{2} = \frac{0}{2}$

$x = 0$

$y = -4(0+1)(0-1)$

$-4(1)(-1)$

$y = 4$

$V: (0, 4)$

9.) $y = 3(x - 6)(x - 4)$

$a = 3 \quad p = 6 \quad q = 4$

$x = \frac{p+q}{2} = \frac{6+4}{2} = \frac{10}{2}$

$x = 5$

$y = 3(5-6)(5-4)$

$3(-1)(1)$

-3

$V: (5, -3)$

X-intercepts: $(p,0)$ $(q,0)$

Graph the following quadratic equations. Find the axis of symmetry and the vertex.

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

$a = -2$ $p = -2$ $q = 4$

$x = \frac{1}{2}$

Vertex: $(1, 18)$

Point $(-2, 0)$ $(4, 0)$

x-ints!

Y int: $(0, 16)$

$-2(0+2)(0-4)$

$-2(2)(-4)$

$-4 \cdot -4$

16

$x = \frac{p+q}{2}$

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

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

$x = 1$

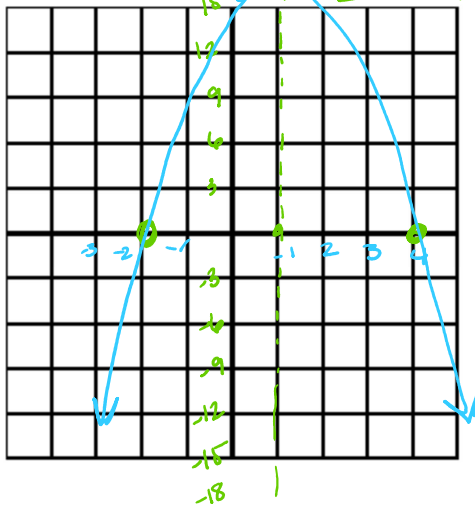
$y = -2(3)(-3)$

$-6 \cdot -3$

18

$0 = -2(x+2)(x-4)$

$x+2=0$ $x-4=0$
 $x=-2$ $x=4$



Graph the following quadratic equations. Find the axis of symmetry and the vertex.

11.) $y = -x(x+2)$ $a = -1$ $p = 0$ $q = -2$
 $(p, 0)$ $(q, 0)$
 x -int

$x = \frac{-1}{-1}$

Vertex: $(-1, 1)$

Point: $(0, 0)$ $(-2, 0)$

$V: x = \frac{p+q}{2} = \frac{0+(-2)}{2} = \frac{-2}{2} = -1$

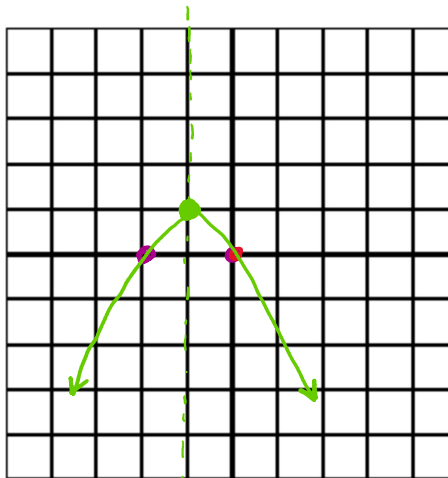
$y = -(-1)(-1+2)$

$1(1)$

1

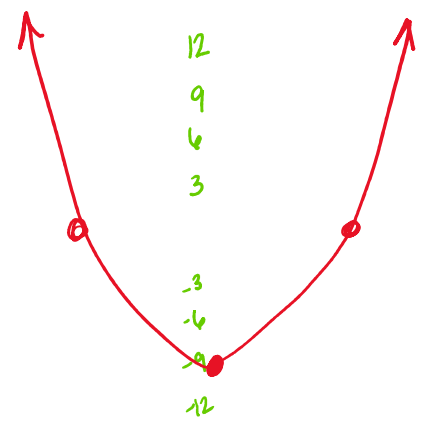
y -int: $-0(0+2)$

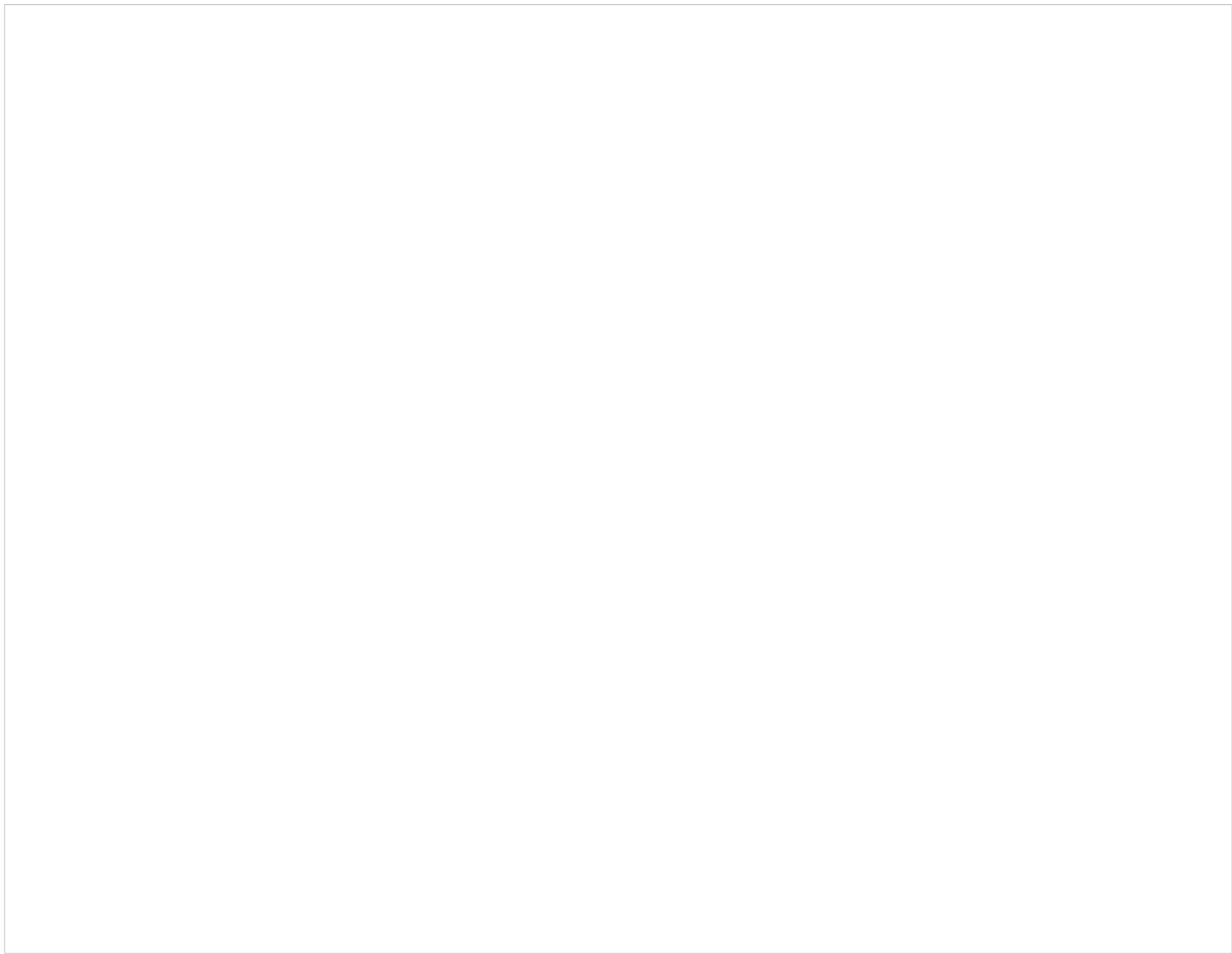
0



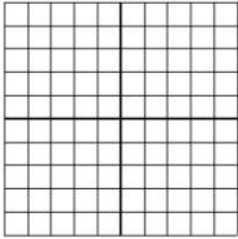
$$a=1 \quad p=-3 \quad q=3$$
$$x = \frac{-3 \pm 3}{2}$$
$$x=0$$
$$y = 3(-3)$$
$$-9$$

0
(0, -9)
(-3, 0) (3, 0)
y-int: (0, -9)

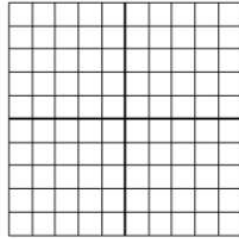




35.) $y = \frac{1}{3}(x + 4)(x + 1)$



36.) $y = -\frac{1}{2}(x - 3)(x + 2)$



37.) $y = -3x(x - 2)$

