Algebra 2/Trig1

Graphing Quadratic Equations

Name KEY

Block _____ Date _____

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

Standard Form $y = mx + b$

Quadratic Equations: equations with an exponent of two (squared). Graphs are parabolas (U-shaped).

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

Opening up: positive a

Opening down (flipped): negative a

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

1.) $y = 2x^2 + x - 1$ — UP

2.) $y = 3 - x - x^2$ → $y = -x^2 - x + 3$ — DOWN

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

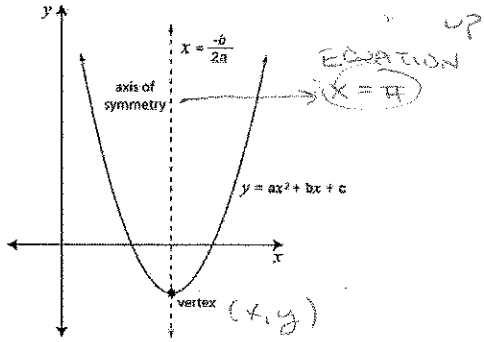
4.) $y = 4 - 3x^2$ → $y = -3x^2 + 4$ — DOWN

5.) $y = x + 9x^2$ → $y = 9x^2 + x$ — UP

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

Vertex: the lowest or the highest point of the graph (end of U-shape)

Axis of Symmetry: the vertical line through the vertex



Axis of Symmetry and x-coordinate of the vertex

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

$y = ax^2 + bx + c$

Find the axis of symmetry of the parabola.

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

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

$x = -1$ (-1,)

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

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

$x = 1$

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

$y = 3x^2 + 0x - 5$

$x = \frac{-0}{2 \cdot 3} = \frac{-0}{6} = 0$

$x = 0$

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

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

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

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

$y = 1 - 2 - 1$

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

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

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

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

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

$y = 4$ (0, 4)

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

$x = \frac{-4}{2 \cdot 2} = \frac{-4}{4} = -1$

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

$y = 2 - 4$

(-1, -2)

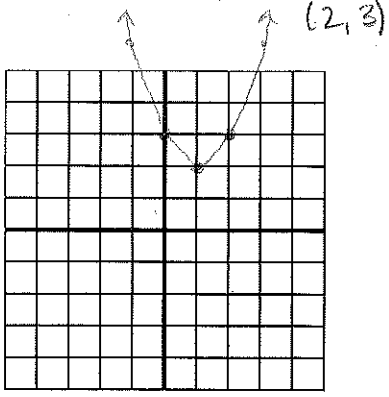
Graph the following quadratic equations. Find the axis of symmetry and the vertex.

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

$x =$ 1

Vertex: (1, 2)

Point: (0, 3) (2, 3)



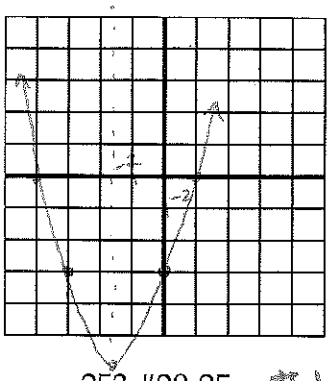
~~14.~~ $y = x^2 + 5x - 6$

$x =$ -2.5

Vertex: (-2.5, -12.25)

Point: (0, -6) (-5, -6)

(1, 0)



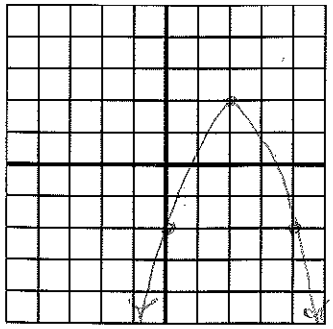
15. $y = -x^2 + 4x - 2$

$x =$ 2

Vertex: (2, 2)

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

(1, 1) (3, 1)



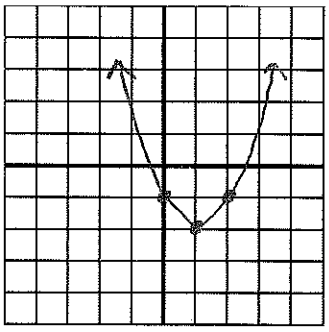
Standard Form: Practice Problems: pg 253 #20-25 *17-19 (17) C (18) A (19) B

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

$x =$ 1

Vertex: (1, -2)

Point: (0, -1) (2, -1)

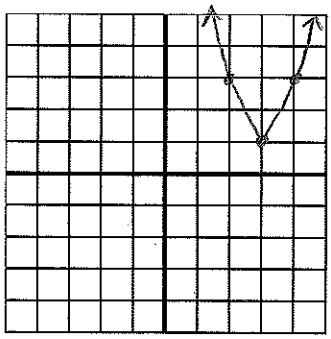


21.) $y = 2x^2 - 12x + 19$

$x =$ 3

Vertex: (3, 1)

Point: (2, 3) (4, 3)

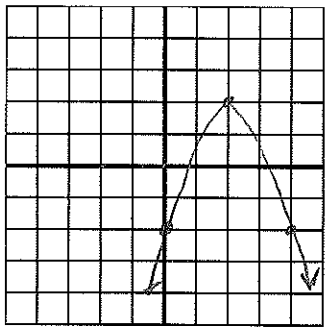


22.) $y = -x^2 + 4x - 2$

$x =$ 2

Vertex: (2, 2)

Point: (0, -2)

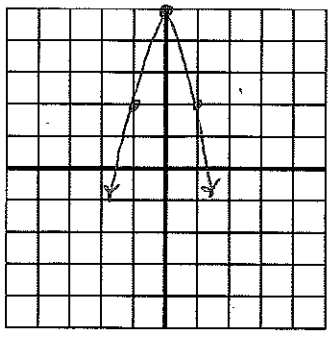


23.) $y = -3x^2 + 5$

$x =$ 0

Vertex: (0, 5)

Point: (1, 2) (-1, 2)

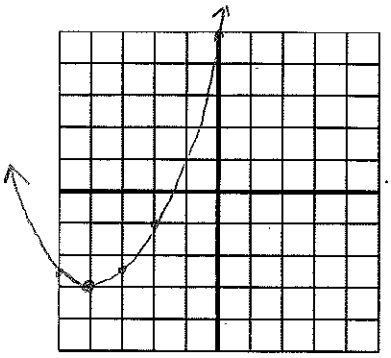


24.) $y = \frac{1}{2}x^2 + 4x + 5$

$x =$ -4

Vertex: (-4, -3)

Point: (-3, -2.5) (-5, -2.5)

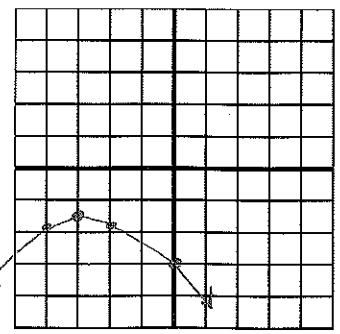


25.) $y = -\frac{1}{6}x^2 - x - 3$

$x =$ -3

Vertex: (-3, -1.5)

Point: (-4, -1 2/3) (-2, -1 2/3)



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

Opening up — positive a

Opening down (flipped) — negative a

Determine if the graph opens up or down.

1.) $y = (x-2)^2 + 3$ — a = 1 UP

2.) $y = 3(x+2)^2 - 5$ — UP

3.) $y = -2(x-1)^2$ — DOWN

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

Intercept Form Vertex: (h,k)

Find the axis of symmetry of the parabola.

4.) $y = 2(x-5)^2 + 3$ — x = 5

5.) $y = -4(x)^2 - 5$ — $y = -4(x-0)^2 - 5$ — x = 0

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

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

7.) $y = (x-3)^2 + 3$ — (3, 3)

8.) $y = \frac{1}{2}(x-6)^2 + 0$ — (6, 0)

9.) $y = (x+1)^2 - 7$ — (−1, −7)

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

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

x = 2

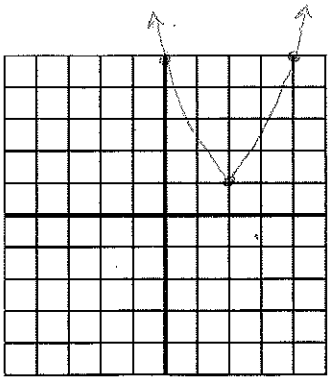
Vertex: (2, 1)

Point: ~~(0, 5)~~ (1, 2) (3, 2)

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

$y = 4 + 1$

$y = 5$

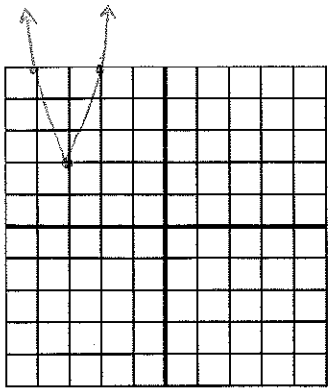


11. $y = 3(x+3)^2 + 2$

x = −3

Vertex: (−3, 2)

Point: ~~(0, 29)~~ (−2, 5) ~~(−2, 5)~~ (−4, 5)

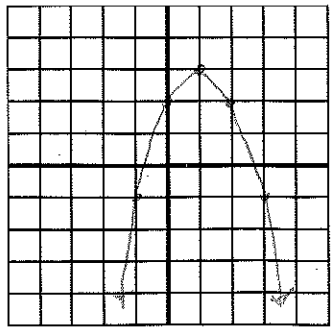


12. $y = -(x-1)^2 + 3$

x = 1

Vertex: (1, 3)

Point: (0, 2) (2, 2) ~~(1, 4)~~



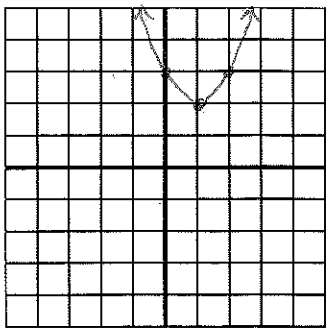
Vertex Form: Practice Problems: pg 253 #26-31

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

x = 1

Vertex: (1, 2)

Point: (0, 3) (2, 3)



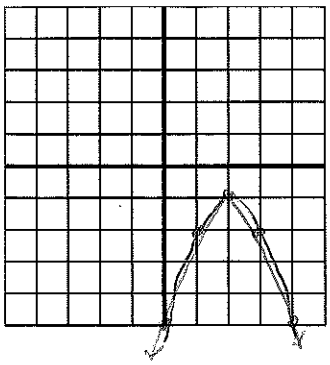
27.) $y = -(x - 2)^2 - 1$

x = 2

Vertex: (2, -1)

Point: ~~(0, -5)~~

(1, -2) (3, -2)



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

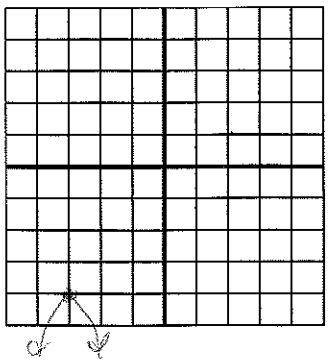
x = -3

Vertex: (-3, -4)

Point: ~~(0, -22)~~

(-2, -6)

(-4, -6)



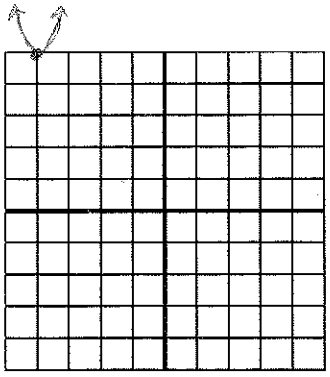
~~29.~~) $y = 3(x + 4)^2 + 5$

x = -4

Vertex: (-4, 5)

Point: ~~(0, 53)~~

(-3, 8), (-2, 8)



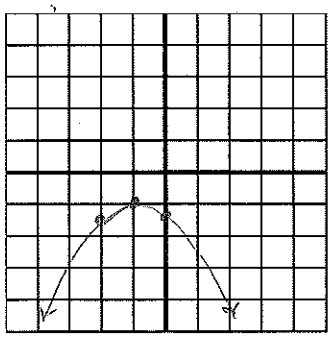
30.) $y = -\frac{1}{3}(x + 1)^2 - 1$

x = -1

Vertex: (-1, -1)

Point: $(0, -1\frac{1}{3})$

$(-2, -1\frac{1}{3})$



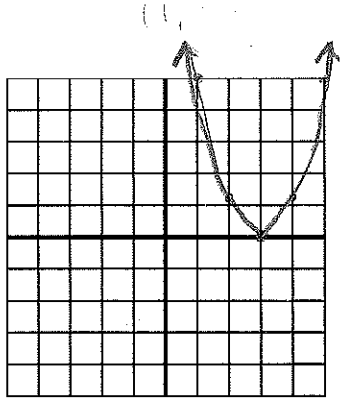
31.) $y = \frac{5}{4}(x - 3)^2 + 0$

x = 3

Vertex: (3, 0)

Point: (2, 1 1/4)

(1, 1 1/4)



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

Opening up — positive a

Opening down (flipped) — negative a

Determine if the graph opens up or down.

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

a = 1

up

(p = 2, q = -3)

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

down

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

up

$y = a(x-p)(x-q)$

Axis of Symmetry and x-coordinate of the vertex

x is half way between p and q

$x = \frac{p+q}{2}$ → write on flipchart

Find the axis of symmetry of the parabola.

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

$p = 1 \quad q = 5$

$x = \frac{1+5}{2} = \frac{6}{2} = 3$

$x = 3$

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

$p = -2 \quad q = 4$

$x = \frac{-2+4}{2} = \frac{2}{2} = 1$

$x = 1$

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

$y = (-x+0)(x+5)$

$p = 0 \quad q = 5$

$x = \frac{0+5}{2} = \frac{5}{2}$

$x = -5/2$

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

$p = -5 \quad q = 3$

$x = \frac{-5+3}{2} = \frac{-2}{2} = -1$

$x = -1$

V: $(-1, -16)$

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

$p = -1 \quad q = 1$

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

$x = 0$

V: $(0, 4)$

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

$p = 6 \quad q = 4$

$x = \frac{6+4}{2} = \frac{10}{2} = 5$

$x = 5$

$(5, -3)$

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

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

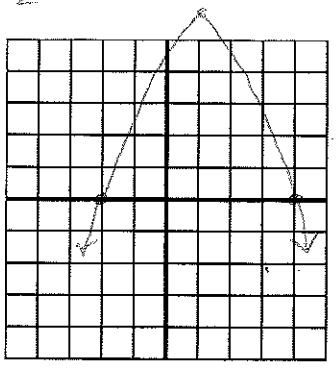
$x =$ 1

Vertex: (1, 18)

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

$p = -2 \quad q = 4$

$x = \frac{-2+4}{2} = \frac{2}{2} = 1$



11.) $y = -x(x+2)$ $y = -(x-0)(x+2)$

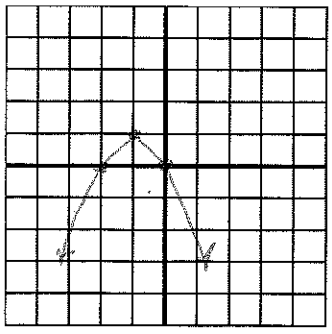
$x =$ -1

Vertex: (-1, 1)

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

$p = 0 \quad q = -2$

$x = \frac{0-2}{2} = \frac{-2}{2} = -1$



12.) $y = (x+3)(x-3)$

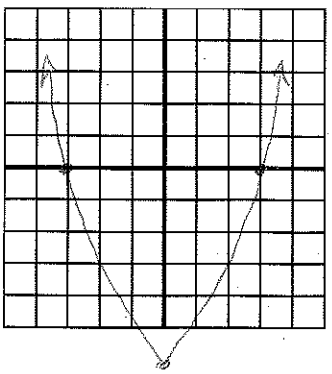
$x =$ 0

Vertex: (0, -9)

Point: (-3, 0) (3, 0)

$p = -3 \quad q = 3$

$x = \frac{-3+3}{2} = \frac{0}{2} = 0$



$\frac{-3+-5}{2} = \frac{-8}{2} = -4$

Intercept Form: Practice Problems: pg 254 #32 – 37

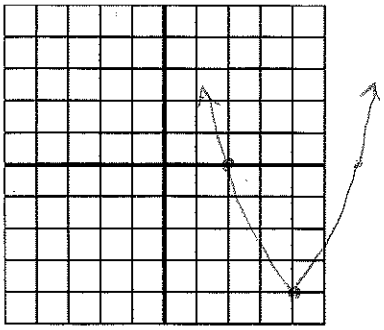
32.) $y = (x - 2)(x - 6)$

$x =$ 4

Vertex: (4, −4)

Point: (2,0) (6,0)

$p = 2 \quad q = 6$



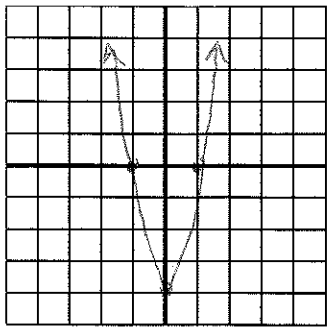
33.) $y = 4(x + 1)(x - 1)$

$x =$ 0

Vertex: (0, −4)

Point: (−1,0) (1,0)

$p = -1 \quad q = 1$

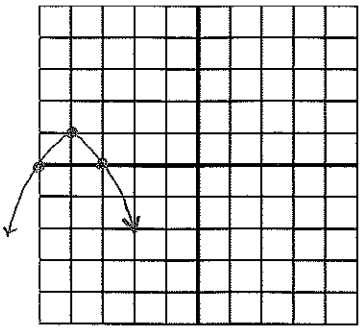


34.) $y = -(x + 3)(x + 5)$

$x =$ −4

Vertex: (−4, 1)

Point: (−3,0) (−5,0)



$\frac{-4+-1}{2}$

$\frac{3+-2}{2} = \frac{1}{2}$

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

35.) $y = 1/3(x + 4)(x + 1)$

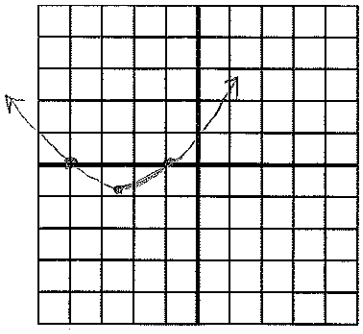
$x =$ $-5/2$

Vertex: $(-5/2, -3/4)$

Point: (−4,0) (−1,0)

$\frac{1}{3}(-2.5+4)(-2.5+1)$

$\frac{1}{3}(1\frac{1}{2})(-1\frac{1}{2}) = \frac{1}{3} \cdot \frac{3}{2} \cdot \frac{3}{2} = \frac{9}{12} = -\frac{3}{4}$



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

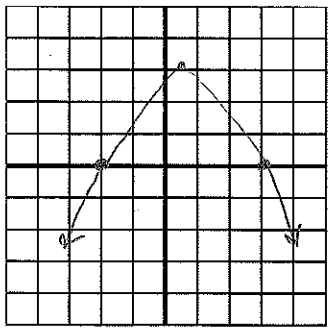
$x =$ $\frac{1}{2}$

Vertex: $(\frac{1}{2}, 3\frac{1}{8})$

Point: (3,0) (−2,0)

$-\frac{1}{2}(\frac{1}{2}-3)(\frac{1}{2}+2)$

$-\frac{1}{2}(-2.5)(2.5) = -\frac{1}{2} \cdot -\frac{5}{2} \cdot \frac{5}{2} = \frac{25}{8}$



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

$x =$ 1

Vertex: (1, 3)

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