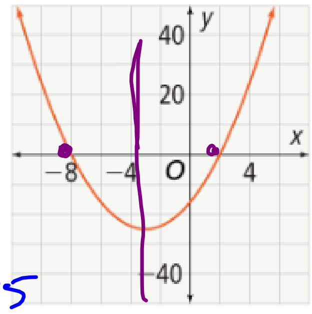
Your Name
Mrs. Theo
/ /
Notes

Lesson 2-3

INTERCEPT FORM QUADRATIC FUNCTIONS

CRITIQUE & EXPLAIN

Corey wrote an equation in factored form, $y = (x + 8)(x - 2)$, to represent a quadratic function. Kimberly wrote the equation $y = x^2 + 6x - 16$, and Joshua wrote the equation $y = (x + 3)^2 - 25$.



A. Reason Do all three equations represent the same function? If not, whose is different? Explain algebraically.

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

$y = x^2 - 2x + 8x - 16$

$y = x^2 + 6x - 16$ ✓

$y = (x+3)^2 - 25$

$y = (x+3)(x+3) - 25$

$y = x^2 + 3x + 3x + 9 - 25$

$y = x^2 + 6x - 16$ ✓

B. How else could you determine if all three equations represent the same function?

$y = (x+3)^2 - 25$ (h, k)

Vertex: $(-3, -25)$

$a = 1$ ✓

$y = x^2 + 6x - 16$

$x = \frac{-(6)}{2(1)} = \frac{-6}{2} = -3$

$y = (-3)^2 + 6(-3) - 16$

$y = -25 \rightarrow V: (-3, -25)$ ✓

$a = 1$ ✓

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

$0 = (x+8)(x-2)$

$x + 8 = 0 \qquad x - 2 = 0$

$-8 \;\; -8 \qquad +2 \;\; +2$

$x = -8 \qquad x = 2$

Vert $(-3, -25)$

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

$5 \cdot -5 = -25$

C. What information can Corey's form help you find that is more difficult to find using Kimberly's or Joshua's form?

x intercepts / roots

Vertex Form

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

Vertex: (h,k)

h- horizontal shift

k- vertical shift

Dilation: a

a is negative: Reflection

$0 < a < 1$: shrink

$a > 1$: stretch

Axis of Symmetry:

$x = h$

Easily Translatable

Intercept Form

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

X intercepts/

Solutions/Roots/Zeros:

$x = p$ and $x = q$

Dilation: a

Axis of Symmetry:

Half way between the roots

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

To find Vertex: input the axis of symmetry x value, h, in the function, the y value will be the k

Standard Form

$f(x) = ax^2 + bx + c$

Axis of Symmetry:

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

To find Vertex: input the axis of symmetry x value, h, in the function, the y value will be the k

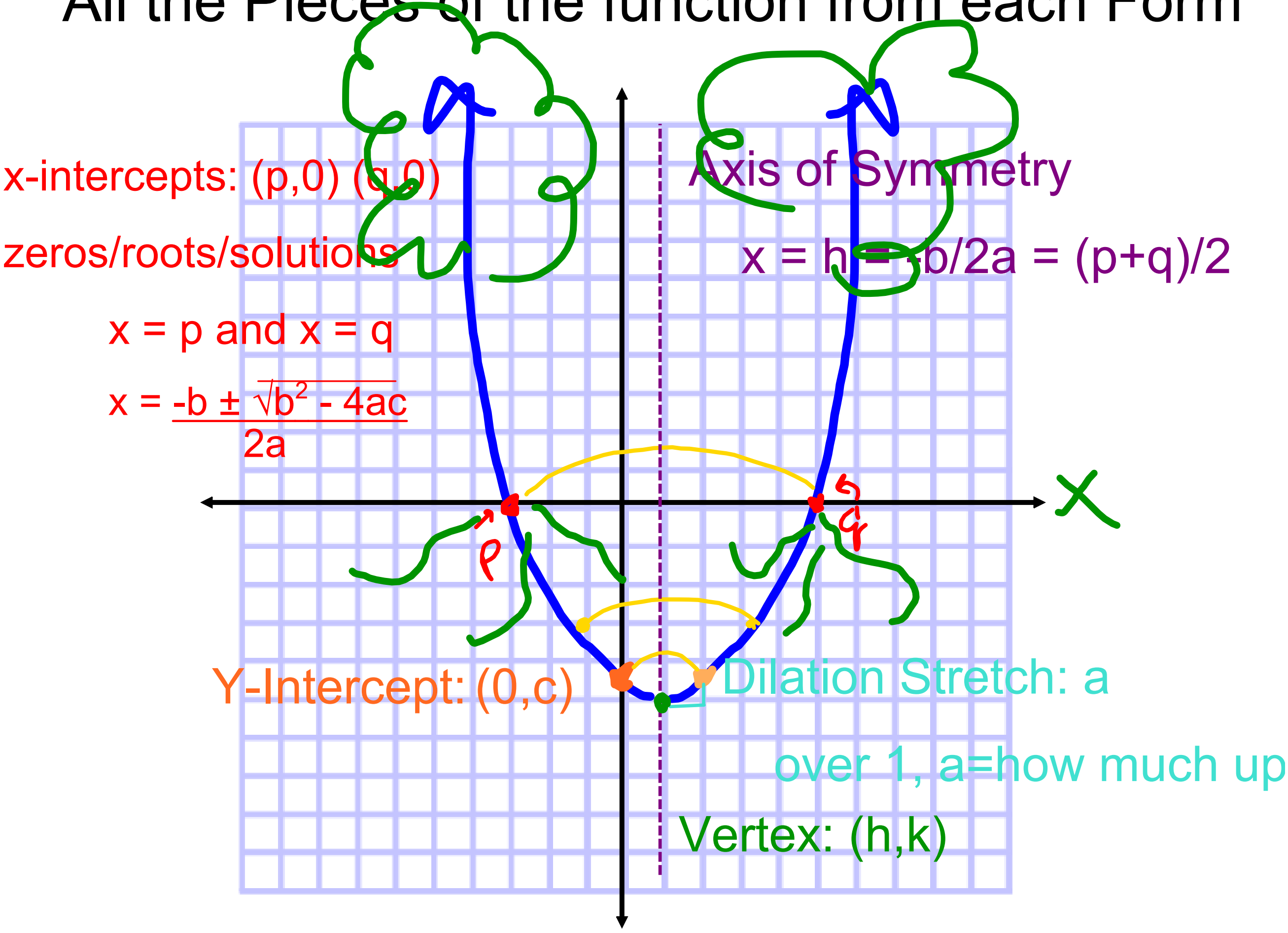
Dilation: a

Y Intercept: (0,c)

X intercepts/Roots

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

All the Pieces of the function from each Form



Try It!

2-1 Vertex Form pg. 40

1. Factor the expression.

a. $x^2 - 9$

$\sqrt{x^2} = x$

$\sqrt{9} = 3$

$(x+3)(x-3)$

$(x+\ )(x-\ )$

Difference of Squares

b. $3x^2 - 7x + 2$

$3x^2 - 6x - x + 2$

$3x(x-2) - 1(x-2)$

$(x-2)(3x-1)$

$ax^2 + bx + c$ trinomial

ac · b +

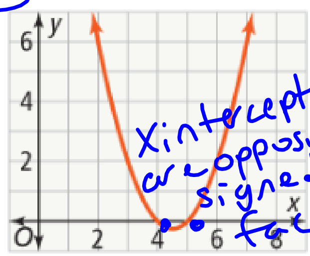
6 · -6 -1 + -7

split middle term

Factor by grouping

Try It!

2. The graph shows the function $y = x^2 - 9x + 20$. Identify the zeros of the function. How do the zeros relate to the factors of $x^2 - 9x + 20$?



x intercepts are opposite signed than factors

Zeros are x intercepts when $y = 0$

$0 = x^2 - 9x + 20$

20 · -4 -5 + -9

$0 = (x-4)(x-5)$

$x - 4 = 0$ $\quad$ $x - 5 = 0$

$+4 \ +4$ $\quad$ $+5 \ +5$

$x = 4$ $\quad$ $x = 5$

$(4, 0)$ $\quad$ $(5, 0)$

$1x^2 + bx + c$

$(x+m)(x+n)$

c · m n + b

Try It!

2-1 Vertex Form pg. 40

1. Factor the expression.

a. $x^2 - 9$

$\sqrt{x^2} = x$

$(x+3)(x-3)$ $\sqrt{9} = 3$

$(x+\quad)(x-\quad)$

b. $3x^2 - 7x + 2$

Bottoms Up

$a \cdot c$

$3 \cdot 2$

6

$-6 \quad -1$

-7

b

$(x \frac{-6}{3})(x \frac{-1}{3})$

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

$(x-2)(3x-1)$

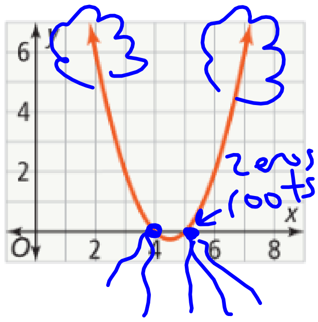
Put in factors then divide by 'a'

Try It!

2. The graph shows the function $y = x^2 - 9x + 20$. Identify the zeros of the function. How do the zeros relate to the factors of $x^2 - 9x + 20$?

Zeros are the x-intercepts when $y=0$

$0 = x^2 - 9x + 20$



20

$-4 \quad -5$

-9

$x^2 - 9x + 20 = 0$

$(x-4)(x-5) = 0$

$x-4=0$ $\quad$ $x-5=0$

$x=4$ $\quad$ $x=5$

$(4,0)$ $\quad$ $(5,0)$

c

b

Factors have opposite sign than zeros

CONCEPT Zero Product Property

The **Zero Product Property** states that if a product of real-number factors is 0, then at least one of the factors must be 0.

In the case of two factors, if $ab = 0$, then either $a = 0$ or $b = 0$, or both.

To use the Zero Product Property, rewrite the equation so that it is an expression equal to 0, then factor and solve.

Try It!

3. Solve the equation by factoring.

a. $x^2 + 8x = 20$

$-20 \quad -20$

$x^2 + 8x - 20 = 0$

$(x-2)(x+10) = 0$

-20, -2, 10, 8

$x - 2 = 0 \qquad x + 10 = 0$

$+2 \; +2 \qquad -10 \; -10$

$x = 2 \qquad x = -10$

$(2, 0) \qquad (-10, 0)$

b. $2x^2 = 3x + 2$

$-3x \; -2$

$2x^2 - 3x - 2 = 0$

$a \cdot c$: -4, -4, 1, -3, b

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

$2x(x-2) + 1(x-2) = 0$

$(x-2)(2x+1) = 0$

$x - 2 = 0 \qquad 2x + 1 = 0$

$+2 \; +2 \qquad -1 \; -1$

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

$\boxed{x = 2} \qquad x = -\frac{1}{2}$

CONCEPT Zero Product Property

The **Zero Product Property** states that if a product of real-number factors is 0, then at least one of the factors must be 0.

In the case of two factors, if $ab = 0$, then either $a = 0$ or $b = 0$, or both.

To use the Zero Product Property, rewrite the equation so that it is an expression equal to 0, then factor and solve.

Try It!

3. Solve the equation by factoring.

a. $x^2 + 8x = 20$

-20

$x^2+8x-20=0$

$(x+10)(x-2)$

$x+10=0 \quad x-2=0$

$-10 \quad -10 \quad +2 \quad +2$

$x=-10, 2$

$(-10, 0) \quad (2, 0)$

b. $2x^2 = 3x + 2$

$a \cdot c$

$2 \cdot -2$

-4

$2x^2-3x-2=0$

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

$\frac{\quad}{2} \quad \frac{\quad}{2}$

$1 \quad -4$

$+ \quad -3$

$(2x+1)(x-2)=0$

$2x+1=0 \quad x-2=0$

$2x=-1 \quad x=2$

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

$(-\frac{1}{2}, 0) \quad (2, 0)$

Intercept Form Features to graph:

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

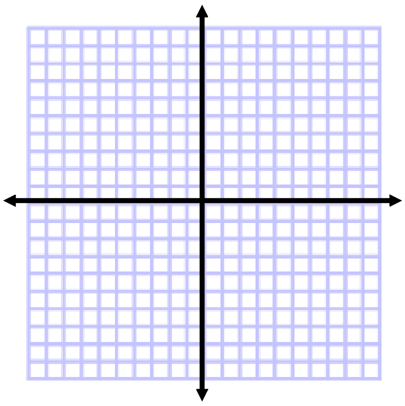
X-Intercepts:

Stretch:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:



$f(x)= -1/4(2x - 5)(x - 1)$

X-Intercepts: $2x-5=0$ $\quad x-1=0$

$x = 5/2$ $\quad x = 1$

Stretch: $|-\frac{1}{4}| = \frac{1}{4} < 1$

shrink by $\frac{1}{4}$

Reflection/Opens: up or down

a is negative

Axis of Symmetry:

halfway between roots

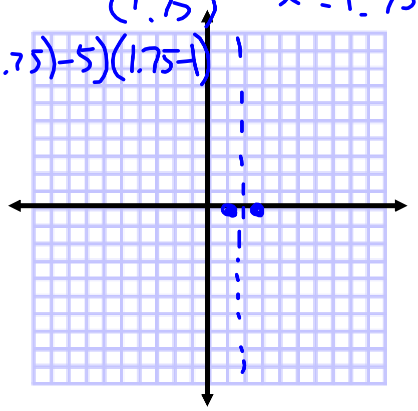
$\frac{\frac{5}{2}+1}{2}$

$x = 1.75$

Vertex: $(1.75, \;)$

$y = -\frac{1}{4}(2(1.75)-5)(1.75-1)$

$y =$



$f(x) = 1/2(x + 4)(x - 2)$

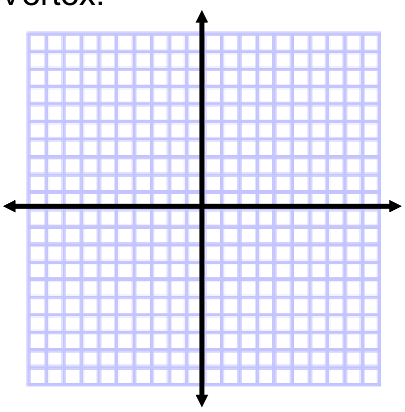
X-Intercepts:

Stretch:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:



$0= -3x(x + 7)$

X-Intercepts:

$-3x=0$ $\quad x+7=0$

$x=(0,0)$ $\quad x=(-7,0)$

Stretch: $|a|=|-3|>1$

stretch by 3

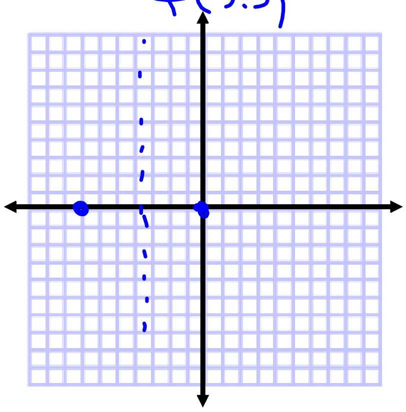
Reflection/Opens: up or down

a is negative

Axis of Symmetry:

$x = \frac{p+q}{2}$ $\quad \frac{0+7}{2} = 3.5$

Vertex: $f(3.5)$



Factoring GCF – A – Squares Notes/Homework

Name

Date

Factor out GCF

$15x + 35$ $-5 - x$ $14 - 7x$

$55p^2 - 11p^4 + 44p^5$ $14x^3 - 42x^5 - 49x^4$ $30mn^2 + m^2n - 6n$

$3x^2 - 4x = 0$ $27x^3 - 108x = 0$ $45s^3 - 18s^2 = 0$

Factor by Grouping

$12ax + 3xz + 4ay + yz$ $4m^2 + 4mn + 3mn + 3n^2$

$14y^3 - 28y^2 + 3y + 6$

$6y^2 - 4y + 3y - 2 = 0$ $12a^4 + 3a^2 - 8a^2 = 2$

Factoring Trinomial when a = 1

$x^2 - x - 2$ $x^2 - 4x + 3$ $c^2 + 7c - 8$

$x^2 + 5x = -6$ $x^4 + 6 = 5x^2$ $x^6 = 24 - 10x^3$

Factoring Trinomial when a is not 1

$16r^2 - 8r + 1$ $18x^2 - 27x - 5$ $18 + 12y^4 + 2y^8$

$48x^2 + 22x = 15$ $8m^6 - 44m^3 + 48 = 0$ $-4c^4 + 20c^2 = 21$

Difference of Squares

$x^2 - 144$ $25d^2 - 100$ $4a^3 - 64a$

$3b^3 - 27b = 0$ $9x^3 = 25x$ $7a^3 = 175a$

Factoring GCF – A – Squares Notes/Homework

Name

Date

Greatest Common Factor

Factor out GCF

GCF·(leftovers)

$15x + 35$

$5\cdot3\cdot x + 5\cdot7$

$5(3x+7)$

$-5 - x$

$-1\cdot5 + -1\cdot x$

$-1(5+x)$

$-1(x+5)$

can factor out −1 to change signs

$14 - 7x$

$55p^2 - 11p^4 + 44p^5$

$11\cdot5\cdot p\cdot p - 11\cdot pppp + 11\cdot4ppppp$

$11p^2(5 - p^2 + 4p^3)$

$14x^3 - 42x^5 - 49x^4$

$30mn^2 + m^2n - 6n$

$n(\quad)$

$3x^2 - 4x = 0$

$27x^3 - 108x = 0$

the highest exponent determines # of roots

$3\cdot9xxx - 3\cdot9\cdot4x = 0$

$27x(x^2-4)=0$

$\frac{27x}{27}=\frac{0}{27}$ $\quad x^2-4=0$

$\sqrt{x^2}=\sqrt{4}$

$x=0 \quad x=\pm2$

Undo x^2 with $\pm\sqrt{\ }$

$45s^3 - 18s^2 = 0$

Factor by Grouping

$12ax + 3xz + 4ay + yz$

$3x(4a+z)+y(4a+z)$

$(4a+z)(3x+y)$

1) break up into pairs
2) Factor GCF out of each pair
3) Factor out GCF Factor

$4m^2 + 4mn + 3mn + 3n^2$

$14y^3 - 28y^2 + 3y + 6$

$14y^2(y-2)+3(y+2)$

not same

not factorable by grouping

Rewrite

$14y^3-28y^2-3y+6$

$14y^2(y-2)-3(y-2)$

$\boxed{(y-2)(14y^2-3)}$

Factor by Grouping and Solve

$6y^2 - 4y + 3y - 2 = 0$

$2y(3y-2)+1(3y-2)=0$

$(3y-2)(2y+1)=0$

Sometimes you need to factor out 1 or −1

$3y-2=0 \qquad 2y+1=0$

$3y=2 \qquad 2y=-1$

$\frac{3y}{3}=\frac{2}{3} \qquad \frac{2y}{2}=-\frac{1}{2}$

$y=\frac{2}{3} \qquad y=-\frac{1}{2}$

$12a^4 + 3A^2 - 8A^2 = 2$

Factoring GCF – A – Squares Notes/Homework

Name

Date

Greatest Common Factor

GCF • (leftovers)

Factor out GCF

$15x + 35$

$5\cdot3\cdot x + 5\cdot 7$

$\boxed{5(3x+7)}$

$-5 - x$

$-1\cdot5 + -1\cdot x$

$-1(5+x)$

$-1(x+5)$

can factor out −1 to change signs

$14 - 7x$

$55p^2 - 11p^4 + 44p^5$

$14x^3 - 42x^5 - 49x^4$

$30mn^2 + m^2n - 6n$

$3x^2 - 4x = 0$

Degree determines # of roots

$27x^3 - 108x = 0$

$3\cdot9\, x\cdot x\cdot x - 3\cdot9\cdot4\, x$

$27x(x^2-4)=0$

$27x = 0$ $x^2 - 4 = 0$

$\frac{27x}{27} = \frac{0}{27}$ $\sqrt{x^2} = \sqrt{4}$

$\boxed{x=0}$ $\boxed{x=\pm2}$

$45s^3 - 18s^2 = 0$

Factor by Grouping

$12ax + 3xz + 4ay + yz$

$3x(4a+z) + y(4a+z)$

$(4a+z)(3x+y)$

1) break up into pairs
2) Fact GCF from each pair
3) Pull out GCF factor again • (leftovers)

$4m^2 + 4mn + 3mn + 3n^2$

$14y^3 - 28y^2 + 3y + 6$ → Rewrite $14y^3 - 28y^2 - 3y + 6$

$14\,y\,y\,y - 14\,2\,y\cdot y$

$14y^2(y-2) + 3(y+2)$

not the same so not factorable by grouping

Factor by Grouping and Solve

$6y^2 - 4y + 3y - 2 = 0$

$2y(3y-2) + 1(3y-2) = 0$

$(3y-2)(2y+1) = 0$

$3y - 2 = 0$ $2y + 1 = 0$

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

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

Sometimes you must factor out a 1 or −1

$12a^4 + 3a^2 - 8a^2 = 2$

$12a^4 + 3a^2 - 8a^2 - 2 = 0$

$3a^2(4a^2+1) - 2(4a^2+1) = 0$

$(4a^2+1)(3a^2-2) = 0$

$4a^2 + 1 = 0$ $3a^2 - 2 = 0$

$\sqrt{a^2} = \sqrt{\frac{-1}{4}}$ $\sqrt{a^2} = \sqrt{\frac{2}{3}}$

$a = \pm\frac{1}{2}i$ $a = \pm\sqrt{\frac{2}{3}}$

Quadratic Form

middle exponent is half biggest

$1x^2+bx+c$

$(x+m)(x+n)$

Factoring Trinomial when a = 1

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

$x^2 - x - 2$

$\boxed{(x+1)(x-2)}$

$x^2 - 4x + 3$

$(x-3)(x-1)$

$c^4 + 7c^2 - 8$

$(c^2+8)(c^2-1)$

$x^2 + 5x = -6$

$x^6 + 6 = 5x^3$

$x^8 = 24 - 10x^4$

Factoring Trinomial when a is not 1

1. $a \cdot c$
2. Split middle Term
3. Factor by grouping

ax^2+bx+c

$16r^2 - 8r + 1$

$16r^2-4r-4r+1$

$4r(4r-1)-1(4r-1)$

$(4r-1)(4r-1)$

$18x^2 - 27x - 5$

$18 + 12y^4 + 2y^8$

$(y^4+3)(2y^4+6)$

$48x^4 + 22x^2 = 15$

$48x^4+22x^2-15=0$

$48x^4+40x^2-18x^2-15$

$8x^2(6x^2+5)-3(6x^2+5)$

$0=(6x^2+5)(8x^2-3)$

$x^2=-\frac{5}{6} \qquad x^2=\frac{3}{8}$

$x=\pm i\sqrt{5/6} \qquad x=\pm\sqrt{3/8}$

$8m^6 - 44m^3 + 48 = 0$

$-4c^8 + 20c^4 = 21$

Difference of Squares

binomial w/subtraction

$(x+\sqrt{c})(x-\sqrt{c})$

$x^2 - 144$

$(x+12)(x-12)$

$25d^2 - 100$

$(5d+10)(5d-10)$

$4a^3 - 64a$

$3b^3 - 27b = 0$

$9x^3 = 25x$

$-25x \quad -25x$

$9x^3-25x=0$

$x(9x^2-25)=0$

$x(3x-5)(3x+5)=0$

$7a^3 = 175a$

$1x^2+bx+c$ $\quad$ $m \times n \to (x+m)(x+n)$ or

Quadratic Form

x^2	bx
bx	c

Factoring Trinomial when a = 1

$x^2 - x - 2$ $\quad b=-1 \quad c=-2$

$(x-2)(x+1)$

$x^2 - 4x + 3$

$(x-3)(x-1)$

	x	-3
x	x^2	$-3x$
-1	$-1x$	3

$-4x$

$c^4 + 7c^2 + 8$

$x^2 + 5x = -6$

$x^6 + 6 = 5x^3$ $\quad$ must $=0$

$x^6 - 5x^3 + 6 = 0$

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

	x^3	-2
x^3	x^6	$-2x^3$
-3	$-3x^3$	6

$-5x^3$

$x^3-3=0 \quad x^3-2=0$

$\sqrt[3]{x^3}=\sqrt[3]{3} \quad \sqrt[3]{x^3}=\sqrt[3]{2}$

$x=\sqrt[3]{3} \quad x=\sqrt[3]{2}$ and 4 imaginary

$x^8 = 24 - 10x^4$ $\quad$ double

Factoring Trinomial when a is not 1

AC Method $\quad ax^2+bx+c$

1) $a \cdot c$ / b
2) Split middle Term
3) Factor by grouping

$16r^2 - 8r + 1$

$16r^2 - 4r - 4r + 1$

$r(4r-1) - 1(4r-1)$

$\boxed{(4r-1)(4r-1)}$

$18x^2 - 27x - 5$

$18 + 11y^4 + 2y^8$ $\quad 12y^4$

	y^4	3
$2y^4$	$2y^8$	$6y^4$
6	$6y^4$	18

$12y^4$

$(y^4+3)(2y^4+6)$

$48x^4 + 22x^2 = 15$

$8m^6 - 44m^3 + 48 = 0$

$-4c^8 + 19c^4 + 21$ $\quad 20c^4$

Difference of Squares

binomial of Perfect Squares no bx

$x^2 - 144$ $\quad b=0 \quad c=-144$

$(x+12)(x-12)$

$25d^2 - 100$ $\quad (\sqrt{a}x+\sqrt{c})(\sqrt{a}x-\sqrt{c})$

$(5d+10)(5d-10)$

$4a^3 - 64a$

$3b^3 - 27b = 0$

$9x^3 = 25x$

$7a^3 = 175a$

Factoring GCF – A – Squares Notes/Homework

Name

Date

Factor out GCF

GCF (leftovers)
greatest common factor

☆ $15x + 35$
$5(3x+7)$
$5 \cdot 3x + 5 \cdot 7$

☆ $-5 - x$
$-1(x+5)$
can factor out -1 to change signs

$14 - 7x$
$-7(2+x)$
$-7(x+2)$

☆ $55p^2 - 11p^4 + 44p^5$
$11p^2(5 - p^2 + 4p^3)$
$11p^2(4p^3 - p^2 + 5)$

$14x^3 - 42x^5 - 49x^4$
$7x^3(2 - 6x^2 - 7x)$
$-7x^3(6x^2 + 7x - 2)$
want 1st exponent to be positive

$30mn^2 + m^2n - 6n$
$n(30mn + m^2 - 6)$
$n(m^2 + 30mn - 6)$

☆ $3x^2 - 4x = 0$
$3 \cdot x \cdot x - 4 \cdot x$
$x(3x - 4) = 0$
$\boxed{x = 0}$ $3x - 4 = 0$ $\boxed{x = \frac{4}{3}}$
exponent determines # of solutions

☆ $27x^3 - 108x = 0$
$3 \cdot 9 \cdot x \cdot x \cdot x - 3 \cdot 9 \cdot 4 \cdot x$
$27x(x^2 - 4) = 0$
$27x = 0$, $\frac{27x}{27} = \frac{0}{27}$, $\boxed{x = 0}$
$x^2 - 4 = 0$, $\sqrt{x^2} = \sqrt{4}$, $\boxed{x = \pm 2}$

$45s^3 - 18s^2 = 0$
$9s^2(5s - 2) = 0$
$9s^2 = 0$, $s^2 = 0$, $\boxed{s = \pm 0}$ 0 repeated twice
$5s - 2 = 0$, $5s = 2$, $\boxed{s = \frac{2}{5}}$

Factor by Grouping

1) break up terms into pairs
2) Factor GCF of pairs
3) Common factor • leftovers pulled out

☆ $12ax + 3xz + 4ay + yz$
$3x(4a + z) + y(4a + z)$
$(4a + z)(3x + y)$

$4m^2 + 4mn + 3mn + 3n^2$
$4m(m + n) + 3n(m + n)$
$(m + n)(4m + 3n)$

$14y^3 - 28y^2 + 3y + 6$
$14y^2(y - 2) + 3(y + 2)$
if not same can't factor

☆ rewrite ☆
$14y^3 - 28y^2 - 3y + 6$
$14y^2(y - 2) - 3(y - 2)$
$(y - 2)(14y^2 - 3)$

Factor by Grouping and Solve

$6y^2 - 4y + 3y - 2 = 0$
$2y(3y - 2) + 1(3y - 2) = 0$
$(3y - 2)(2y + 1) = 0$
$3y - 2 = 0$ $2y + 1 = 0$
$\boxed{y = \frac{2}{3} \quad y = -\frac{1}{2}}$

sometimes you need to just factor out 1 or -1

$12a^4 + 3a^2 - 8a^2 = 2$
$-2 \quad -2$
$12a^4 + 3a^2 - 8a^2 - 2 = 0$
$3a^2(4a^2 + 1) - 2(4a^2 + 1) = 0$
$4a^2 + 1 = 0$, $a^2 = -\frac{1}{4}$, $a = \pm \frac{i}{2}$
$3a^2 - 2 = 0$, $a^2 = \frac{2}{3}$, $a = \pm\sqrt{\frac{2}{3}} =$

x^2+bx+c

Factoring Trinomial when a = 1

$\to (x+m)(x+n)$ or

$x^2 - x - 2$ $b=-1$, $c=-2$

$(x-2)(x+1)$

$x^2 - 4x + 3$

$(x-3)(x-1)$

Quadratic Form

$c^4 + 7c^2 - 8$

$(c^2-1)(c^2+8)$

$x^2 + 5x = -6$

$+6 \quad +6$

$x^2+5x+6=0$

$(x+3)(x+2)=0$

$x=-3 \quad x=-2$

if b term exponent is half of a term exponent

$x^6 + 6 = 5x^3$

$x^6-5x^3+6=0$

$(x^3-6)(x^3+1)$

$x^3-6=0 \quad x^3+1=0$

$x^3=6 \quad x^3=-1$

$x=\sqrt[3]{6} \quad x=-1$

6 answers

(and 4 imaginary solutions)

$x^8 = 24 - 10x^4$

$x^8+10x^4-24=0$

$(x^4+12)(x^4-2)=0$

$x^4+12=0 \quad x^4-2=0$

$x^4=-12 \quad x^4=2$

$x=\pm\sqrt[4]{12} \quad x=\pm\sqrt[4]{2}$

and 4 imaginary solutions

Factoring Trinomial when a is not 1

1) multiply a·c
2) split middle term
3) factor by grouping

$16r^2 - 8r + 1$

$16r^2-4r-4r+1$

$4r(4r-1)-1(4r-1)$

$(4r-1)(4r-1)$

$18x^2 - 27x - 5$

$18x^2-3x+30x-5$

$3x(6x+1)-5(6x+1)$

$(6x+1)(3x-5)$

$18 + 12y^4 + 2y^8$

$2y^8+12y^4+18$

$(y^4+3)(2y^4+6)$

multiply a·c, split middle term

Factor GCF out first, too

$48x^4 + 22x^2 = 15$

$48x^4+22x^2-15=0$

$48x^4+40x^2-18x^2-15=0$

$8x^2(6x^2+5)-3(6x^2+5)=0$

$6x^2+5=0 \quad 8x^2-3=0$

$6x^2=-5 \quad 8x^2=3$

$x=\pm i\sqrt{5/6} \quad x=\pm\sqrt{3/8}$

$8m^6 - 44m^3 + 48 = 0$

$4(2m^6-11m^3+12)=0$

$4(2m^6-3m^3-8m^3+12)=0$

$4(m^3(2m^3-3)-4(2m^3-3))=0$

$4(2m^3-3)(m^3-4)=0$

$2m^3-3=0 \quad m^3-4=0$

$2m^3=3 \quad m^3=4$

$m=\sqrt[3]{3/2} \quad m=\sqrt[3]{4}$ and 4 imaginary solutions

$4c^8 + 20c^4 = 21$

$4c^8-20c^4+21=0$

$4c^8-6c^4-14c^4+21=0$

$2c^4(2c^4-3)-7(2c^4-3)=0$

$(2c^4-3)(2c^4-7)=0$

$2c^4-3=0 \quad 2c^4-7=0$

$c^4=3/2 \quad c^4=7/2$

$c=\pm\sqrt[4]{3/2} \quad c=\pm\sqrt[4]{7/2}$ and 4 imaginary solutions

Difference of Squares

Subtracting two perfect squares

$x^2 - 144$

$b=0$, $c=-144$

$(\sqrt{a}\,x+\sqrt{c})(\sqrt{a}\,x-\sqrt{c})$

$(x+12)(x-12)$

$25d^2 - 100$

$(5d+10)(5d-10)$

$4a^3 - 64a$

$4a(a^2-16)$

$4a(a+4)(a-4)$

Look to Factor GCF out first

$3b^2 - 27b = 0$

$3b(b^2-9)=0$

$3b(b-3)(b+3)=0$

$3b=0 \quad b-3=0 \quad b+3=0$

$b=0 \quad b=3 \quad b=-3$

$9x^3 = 25x$

$-25x \quad -25x$

$9x^3-25x=0$

$x(9x^2-25)=0$

$x(3x-5)(3x+5)=0$

$x=0 \quad x=5/3 \quad x=-5/3$

$7a^3 = 175a$

$7a^3-175a=0$

$7a(a^2-25)=0$

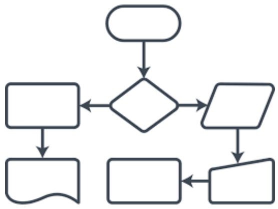
$7a(a-5)(a+5)=0$

$7a=0 \quad a-5=0 \quad a+5=0$

$a=0 \quad a=5 \quad a=-5$

How do you know which method to use?

Flow Chart



In your groups: Make a mini poster which includes:

1. An example of given type
2. Worked out process
3. Written out brief/concise steps
4. One tip or formula, if there is one

Helpful tips for posters:

1. Sketch out poster in pencil first
2. highlight different steps or ideas in different colors
3. Dark colors can be seen better from far away

A Teacher Liason: Asks teacher for help for group, participates and coaches Tean

B Facilitator: Makes sure all requirements are met, assigns tasks, participates

C Recorder/Reporter: Person who writes final work and will present group's poster

D Questioner: guides group in process by asking questions and asks people to explain what they are saying.

Try It!

4. A baseball is thrown from the upper deck of a stadium, 128 ft above the ground. The function $h(x) = -16x^2 + 32x + 128$ gives the height of the ball x seconds after it is thrown. How long will it take the ball to reach the ground?

$h(x) = 0$

$$0 = -16x^2 + 32x + 128$$

$$0 = -16(x^2 - 2x - 8)$$

$$0 = -16(x-4)(x+2)$$

-8

-4 2

-2

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

$$\boxed{x = 4 \text{ seconds}} \qquad \cancel{x = -2 \text{ seconds}}$$

can't have negative time

Identify the interval(s) on which the function $y = x^2 - 2x - 3$ is positive.

The y-values of a quadratic function can only turn from positive to negative or from negative to positive when the graph crosses the x-axis. Find the zeros of the function to identify these points.

$0 = x^2 - 2x - 3$	Set expression equal to 0.
$0 = (x - 3)(x + 1)$	Factor.
$x - 3 = 0$ or $x + 1 = 0$	Zero Product Property.
$x = 3$ or $x = -1$	Solve.

The zeros of the function are $x = 3$ and $x = -1$.

Two zeros create three intervals. Choose an x-value to test in each interval. Substitute the x-value into the original expression to determine if the corresponding y-value is positive or negative.

$x < -1$	$-1 < x < 3$	$x > 3$
Choose $x = -3$. $(-3)^2 - 2(-3) - 3$ $= 9 + 6 - 3$ $= 12$	Choose $x = 1$. $(1)^2 - 2(1) - 3$ $= 1 - 2 - 3$ $= -4$	Choose $x = 6$. $(6)^2 - 2(6) - 3$ $= 36 - 12 - 3$ $= 21$
Positive	Negative	Positive

or...

Try It!

5. Identify the interval(s) on which the function $y = x^2 - 4x - 21$ is negative.

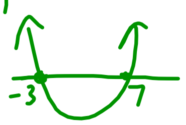
1) Find zeros

$0 = (x-7)(x+3)$

$x = 7$ $x = -3$

2) sketch graph
- is 'a' positive?
- is a negative?

$a = 1$



3) put x axis at intercepts

- function is positive
  $-\infty < x < 3 \cup 7 < x < \infty$
- function is negative
  $3 < x < 7$

EXAMPLE 6 Write the Equation of a Parabola in Factored Form

Write an equation of a parabola with x-intercepts at $(-2, 0)$ and $(-1, 0)$ and which passes through the point $(-3, 20)$.

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

$X = -2$ $x = -1$

$+2 \ +2$ $+1 \ +1$

$x+2=0$ $x+1=0$

$y = a(x+2)(x+1)$

$20 = a(-3+2)(-3+1)$

$20 = a(-1)(-2)$

$\frac{20}{2} = \frac{2a}{2} \rightarrow a = 10$

$\boxed{y = 10(x+2)(x+1)}$

Try It!

6. Write an equation of a parabola with x-intercepts at $(3, 0)$ and $(-3, 0)$ and which passes through the point $(1, 2)$.

$X = 3$ $x = -3$

$y = a(x-3)(x+3)$

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

$2 = a(-2)(4)$

$\frac{2}{-8} = \frac{-8a}{-8}$

$-\frac{1}{4} = a$

$\boxed{y = -\frac{1}{4}(x-3)(x+3)}$

Intercept Form Features to graph:

$f(x) = 1(x - 3)(x + 1) = 0$

X-Intercepts: $x - 3 = 0$ or $x + 1 = 0$

$+3 \quad +3 \qquad -1 \quad -1$

$x = 3 \qquad x = -1$

$(3,0) \qquad (-1,0)$

Stretch: $a = 1$ No stretch

~~Reflection~~/Opens: up or down a is positive

Axis of Symmetry: $x = \frac{3 + -1}{2} = 1$

Vertex: $(1, -4)$

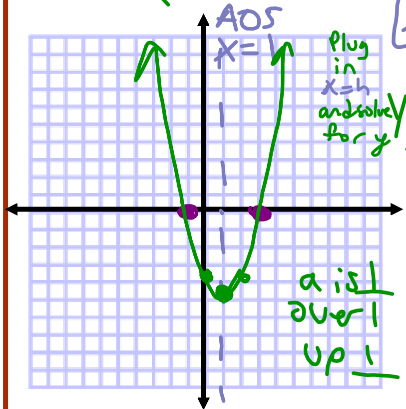
$\boxed{x = 1}$ Vertical line

Plug in $x = h$ and solve for y

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

$y = (-2)(2)$

$y = -4$



a is 1: over 1 up 1

$f(x) = -1/4(2x - 5)(x - 1)$

$0 = -\frac{1}{4}(2x-5)(x-1)$

X-Intercepts: $2x - 5 = 0$ or $x - 1 = 0$

$+5 \quad +5 \qquad +1 \quad +1$

$\frac{2x}{2} = \frac{5}{2} \qquad x = 1$

$x = 5/2 = 2.5 \qquad (2.5, 0) \qquad (1, 0)$

Stretch: $a = -\frac{1}{4}$ shrink by 1/4

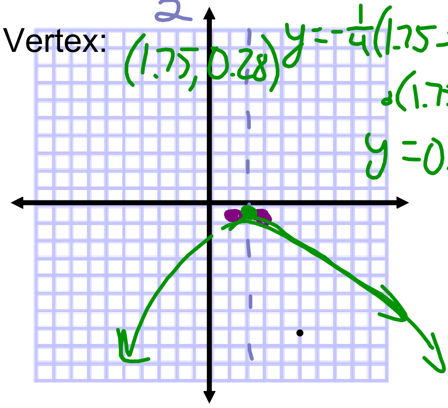
Reflection/Opens: up or down a is negative

Axis of Symmetry: $x = \frac{2.5 + 1}{2} = 1.75$

Vertex: $(1.75, 0.28)$

$y = -\frac{1}{4}(1.75 - 5) \cdot (1.75 - 1)$

$y = 0.28$



$f(x) = 1/2(x + 4)(x - 2)$

X-Intercepts: $x + 4 = 0 \qquad x - 2 = 0$

$-4 \quad -4 \qquad +2 \quad +2$

$x = -4 \qquad x = 2$

y is 0 $(-4, 0) \qquad (2, 0)$

Stretch: $-1 < \frac{1}{2} < 1$ shrink by $\frac{1}{2}$

~~Reflection~~/Opens: up or down

No Axis of Symmetry: $\boxed{x = -1}$

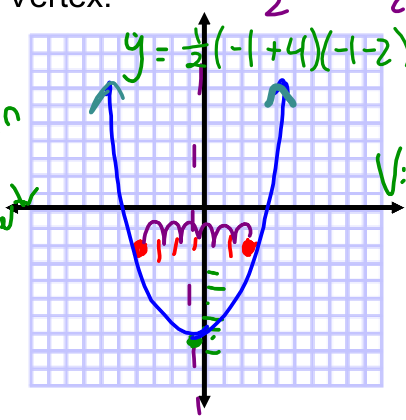
$x = h = \frac{-4 + 2}{2} = \frac{-2}{2} = -1$

Vertex:

$y = \frac{1}{2}(-1+4)(-1-2) = \frac{1}{2} \cdot 3 \cdot -3 = -4.5$

$V: (-1, -4.5)$

Need y value so plug in Axis of Symmetry



$0 = -3x(x + 7)$

X-Intercepts: $-3(x)(x+7)$

$x = 0 \qquad x + 7 = 0$

$-7 \quad -7$

$x = -7$

Stretch: $(0,0)$ stretch $(-7,0)$ by 3

Reflection/Opens: up or down

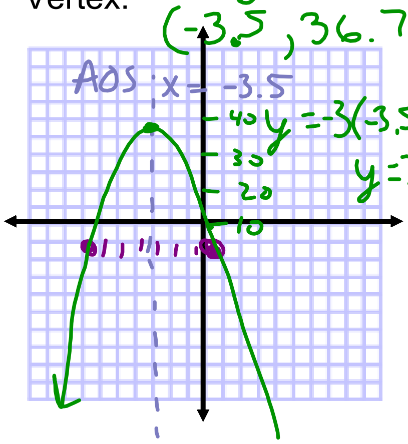
Axis of Symmetry: a is negative

$x = \frac{0 + -7}{2} = -3.5$

Vertex: $(-3.5, 36.75)$

$y = -3(-3.5)(-3.5+7)$

$y = 36.75$



Homework: Intercept Form Features to graph:

1. $f(x) = (x - 5)(x + 1)$

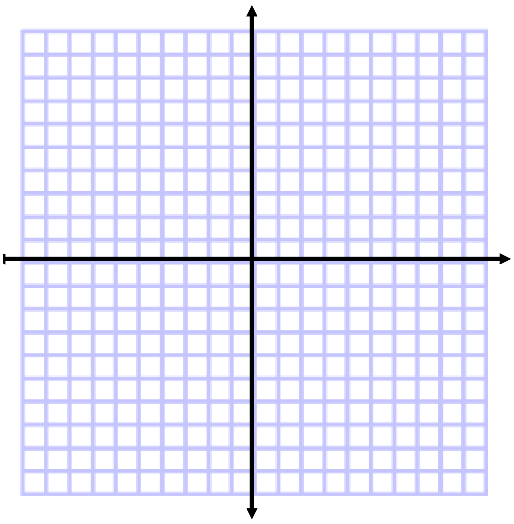
X-Intercepts:

Stretch:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:



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

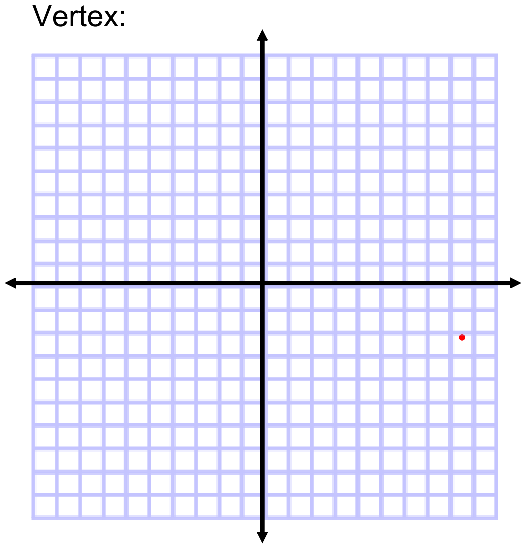
X-Intercepts:

Stretch:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:



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

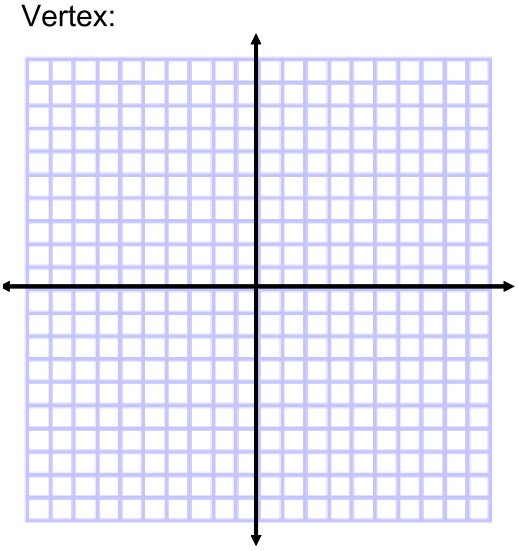
X-Intercepts:

Stretch:

Reflection/Opens: up or down

Axis of Symmetry:

Vertex:



4. $y= -1/3(2x - 1)(3x - 12)$

X-Intercepts: $x = \frac{1}{2}$ $\quad x = \frac{12}{3} = 4$

Stretch: shrink $\frac{1}{3}$

Reflection/Opens: up or down

Axis of Symmetry: $\frac{\frac{1}{3}+4}{2} =$

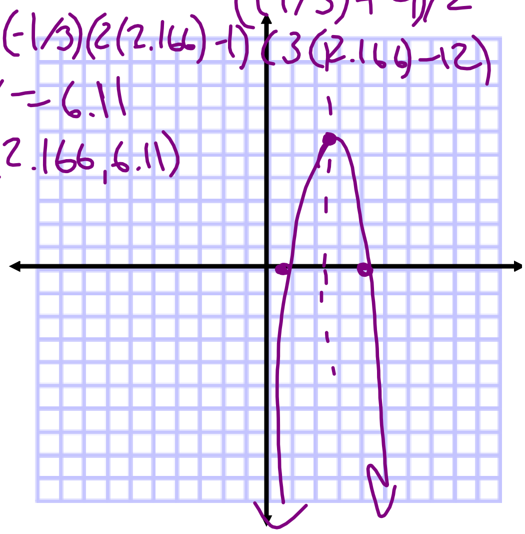
$x = 2.166$

Vertex: $((1/3)+4)/2$

$y=(-1/3)(2(2.166)-1)(3(2.166)-12)$

$y = 6.11$

$(2.166, 6.11)$



Homework **Key**: Intercept Form Features to graph:

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

1. $f(x) = (x - 5)(x + 1)$

X-Intercepts: $x=5$, $x=-1$

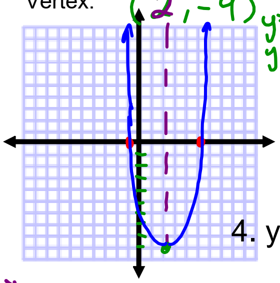
Stretch: No stretch or shrink

Reflection/Opens: up or down

Axis of Symmetry: $x=\frac{5+-1}{2}$, $x=2$

Vertex: $(2,-9)$

$y=(2-5)(2+1)$
$y=(-3)(3)$
$y=-9$



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

X-Intercepts: $x=-6$, $x=4$

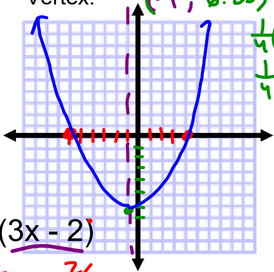
Stretch: shrink by $\frac{1}{4}$

Reflection/Opens: up or down

Axis of Symmetry: $x=\frac{-6+4}{2} \Rightarrow x=-1$

Vertex: $(-1,-6.25)$

$\frac{1}{4}(-1+6)(-1-4)$
$\frac{1}{4}(5)(-5)$
-6.25



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

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

X-Intercepts: $x=0$, $x=5$

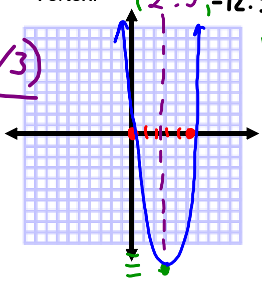
Stretch: stretch by 2

Reflection/Opens: up or down

Axis of Symmetry: $x=\frac{0+5}{2} \Rightarrow x=2.5$

Vertex: $(2.5,-12.5)$

$y=2(2.5)(2.5-5)$
$y=2(2.5)(-2.5)$
$y=-12.5$



4. $y= -1/3(2x - 1)(3x - 2)$

X-Intercepts: $x=\frac{1}{2}$ $x=\frac{2}{3}$

Stretch: shrink by $\frac{1}{3}$ $|a|<1$

Reflection/Opens: up or down a is neg

Axis of Symmetry: $x=\frac{0.5+0.\overline{6}}{2}$

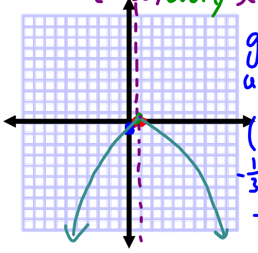
Vertex: $(0.58, 0.014)$ $x=0.58$

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

$-\frac{1}{3}\neq 0$

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

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



get another point $(0,?)$
$-\frac{1}{3}(0-1)(0-2)$
$-\frac{2}{3}$

$-(1/3)(2(0.58)-1)(3(0.58)-2)$