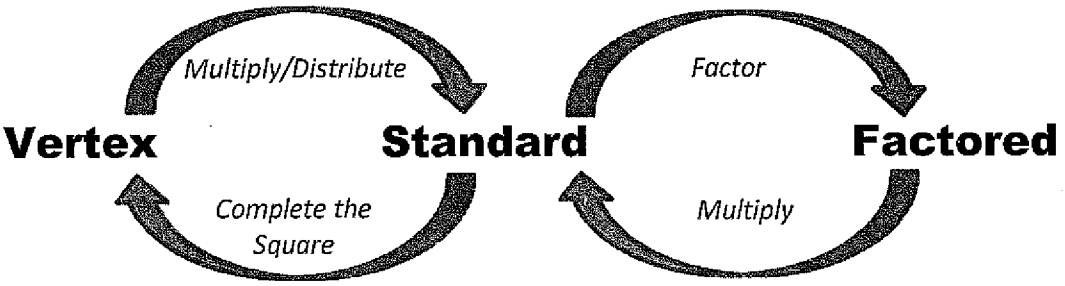
NOTES 7-1

Vertex Form: $a(x-h)^2+k$
Standard Form: ax^2+bx+c
Factored Form: $y=(x-m)(x-n)$



To change from Standard → Factored, you must FACTOR.

1. $6x^2-13x+5$

30 | -13
X | +
-10 · -3 | -10 + -3

$\frac{6x^2-10x}{2x} \quad \frac{-3x+5}{-1}$

$2x(3x-5)-1(3x-5)$

$\boxed{(3x-5)(2x-1)}$

OYO: $3x^2+22x+7$

2. $x^2-13x+40$

40 | -13
X | +
-8 · -5 | -8 + -5

$\frac{x^2-8x}{x} \quad \frac{-5x+40}{-5}$

$x(x-8)-5(x-8)$

$\boxed{(x-8)(x-5)}$

OYO: $x^2+28x+96$

3. $4x^2-29x+7$

28 | -29
X | +
-1 · -28 | -1 + -28

$\frac{4x^2-1x}{x} \quad \frac{-28x+7}{-7}$

$x(4x-1)-7(4x-1)$

$\boxed{(4x-1)(x-7)}$

OYO: $25x^2-16$ (What term is missing?)

$\left(\frac{b}{2}\right)^2$

To change from Standard → Vertex, you must COMPLETE THE SQUARE.

1. $x^2-12x-24$ $\left(\frac{-12}{2}\right)^2=(-6)^2=36$ OYO: $x^2+2x+16$

$(x^2-12x+36)-24-36$

$(x-6)^2-60$

3. $x^2-10x+4$ $\left(\frac{-10}{2}\right)^2=(-5)^2=25$ OYO: $x^2+8x-14$

$(x^2-10x+25)+4-25$

$(x-5)^2-21$

5. x^2-6x-5 $\left(\frac{-6}{2}\right)^2=(-3)^2=9$ OYO: $x^2+14x-41$

$(x^2-6x+9)-5-9$

$(x-3)^2-14$

To change from Vertex → Standard, you must SIMPLIFY.

1. $(x+7)^2-5$

$(x+7)(x+7)-5$

$x^2+7x+7x+49-5$

$x^2+14x+44$

2. $(x-3)^2+18$

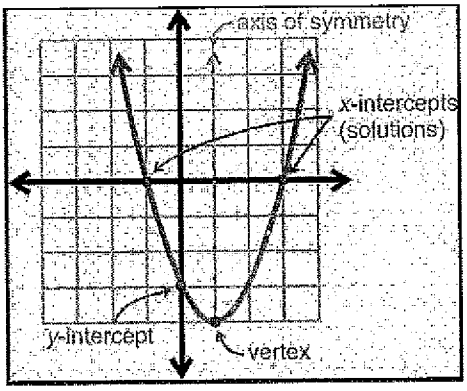
$(x-3)(x-3)+18$

$x^2-3x-3x+9+18$

$x^2-6x+27$

OYO: $(x+4)^2-7$

NOTES 7-2



Forms that we may write quadratic equations in are:

Standard Form: $ax^2 + bx + c$	Vertex Form: $a(x-h)^2 + k$	Factored Form: $y = (x-m)(x-n)$
c: y-intercept (0, c)	**a:** V. Reflection V. Stretch or Compress **(h, k):** vertex **h:** axis of symmetry x = h	**m & n:** x-intercepts / roots / zeros / solutions (m, 0) and (n, 0)

1 Given VERTEX FORM: v(x) = $(x-1)^2 - 4$ Parabola opens up or down? up

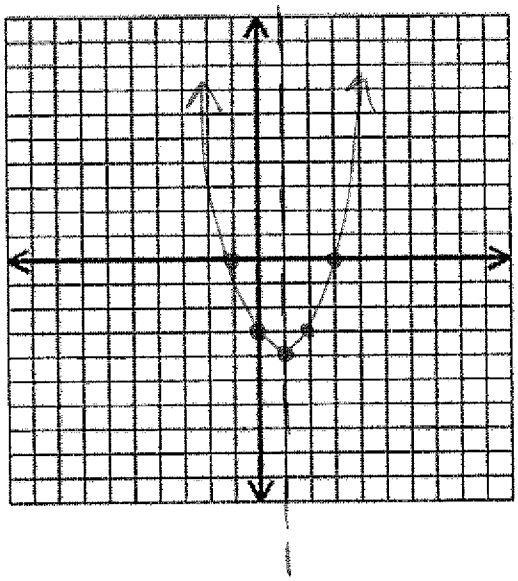
From vertex form list the transformations and write the vertex and axis of symmetry:

Describe the **transformations**:

1. Right 1 2. Down 4

Vertex: (1 , −4)

Axis of Symmetry is the x value of the vertex: x = 1



*Now simplify v(x) = $(x-1)^2 - 4$ to get standard form:

$(x-1)(x-1) - 4$

$x^2 - 1x - 1x + 1 - 4$

STANDARD FORM: p(x) = $x^2 - 2x - 3$

The "c" term in standard form is the **y intercept** (0, −3)

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

-3	-2
X	+
$-3 \cdot 1$	$-3+1$

*Now factor the equation you have in standard form above.

FACTORED FORM: f(x) = $(x-3)(x+1)$

Set each factor = 0 and solve, the solutions are the roots:

$x-3=0$ $\quad x=3$ $\qquad$ $x+1=0$ $\quad x=-1$

Roots: (3 , 0) and (−1 , 0)

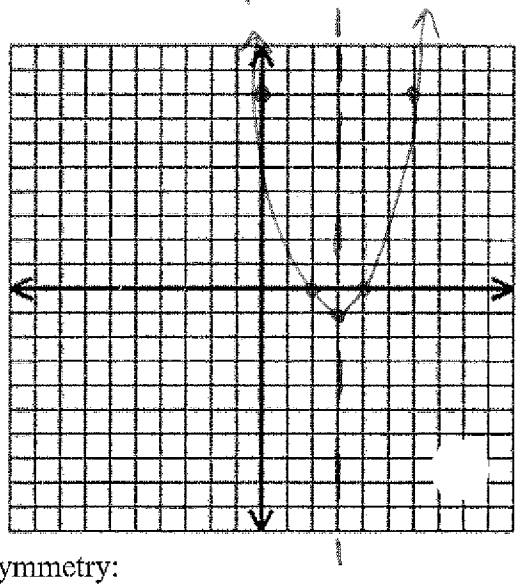
$\frac{x^2-3x}{x} + \frac{1x-3}{1}$

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

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

#2: Given STANDARD FORM: $p(x) = x^2 - 6x + 8$ Parabola opens up or down? up

The " c" term in standard form is the **y intercept** (0, 8)



*Now complete the square $p(x) = x^2 - 6x + 8$ to change to vertex form

$\left(\frac{-6}{2}\right)^2 = (-3)^2 = 9$ $\qquad (x^2-6x+9)+8-9$

$(x-3)^2 - 1$

VERTEX FORM: v(x) = $(x-3)^2 - 1$

From vertex form list the transformations and write the vertex and axis of symmetry:

Describe the **transformation**:

1. Right 3 $\qquad$ 2. Down 1

Vertex: (3 , −1)

Axis of Symmetry is the x value of the vertex: x = 3

*Now go back to standard form $p(x) = x^2 - 6x + 8$ and factor to get factored form

$(x-4)(x-2)$

8	-6
X	+
$-4 \cdot -2$	$-4+-2$

FACTORED FORM: f(x) = $(x-4)(x-2)$

Set each factor = 0 and solve, the solutions are the roots:

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

Roots: (4 , 0) and (2 , 0)

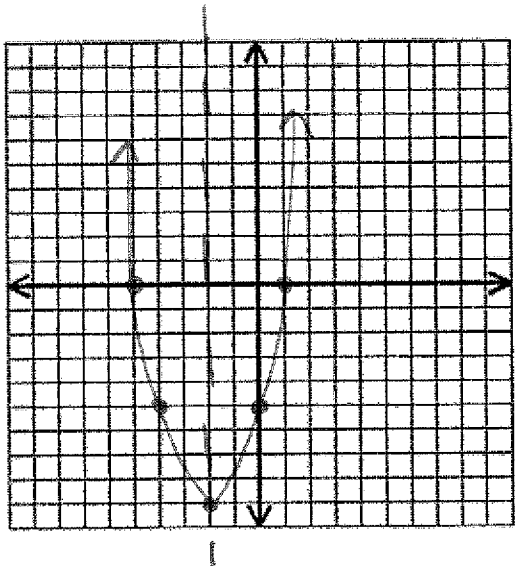
* Find any points symmetrical to those you graphed

#3: Given FACTORED FORM: $f(x) = (x + 5)(x - 1)$ Parabola opens up or down? up

Set each factor = 0 and solve, the solutions are the roots:

$x+5=0$ $\quad x=-5$ $\qquad$ $x-1=0$ $\quad x=1$

Roots: $(-5, 0)$ and $(1, 0)$



*Now Multiply: $f(x) = (x + 5)(x - 1)$ to get to standard form

$x^2 - 1x + 5x - 5$

STANDARD FORM $p(x) = x^2 + 4x - 5$

The " c" term in standard form is the **y intercept** $(0, -5)$

*Now complete the square from the equation in standard form above change to vertex form

$\left(\frac{4}{2}\right)^2 = (2)^2 = 4$ $\qquad (x^2 + 4x + 4) - 5 - 4$

$(x+2)^2 - 9$

VERTEX FORM: $v(x) = (x+2)^2 - 9$

From vertex form list the transformations and write the vertex and axis of symmetry:

Describe the **transformation**:

1. Left 2 $\qquad$ 2. Down 9

Vertex: $(-2, -9)$

Axis of Symmetry is the x value of the vertex: $x = -2$

What form do you need to find the x- intercepts? factored

What form do you need to find the transformations? vertex

What form do you need to find the vertex? vertex

What form do you need to find the y- intercept? Standard

1. Given $v(x) = -\frac{1}{2}(x+4)^2 + 2$ what are the transformations?

1. V. Reflection 2. V. Compression of 1/2 3. Left 4 4. Up 2

2. Given $v(x) = -\frac{1}{2}(x+4)^2 + 2$ what is the y – intercept? y – intercept (0, -6)

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

$-\frac{1}{2}(x^2+4x+4x+16)+2$

$-\frac{1}{2}(x^2+8x+16)+2$

$-\frac{1}{2}x^2-4x-8+2$

$-\frac{1}{2}x^2-4x-6$

3. Given $f(x) = -3(x-7)(3x-2)$ What are the roots? (7, 0) (2/3, 0)

$x-7=0$ $3x-2=0$

$x=7$ $3x=2$

$x=2/3$

4. Given $f(x) = -3(x-7)(3x-2)$ what is the y –intercept? y –intercept: (0, -42)

$-3(3x^2-2x-21x+14)$

$-3(3x^2-23x+14)$

$-9x^2+69x-42$

5. Given $p(x) = x^2 + 2x - 8$ What is the y – intercept? (0, -8)

6. Given $p(x) = x^2 + 2x - 8$ What are the roots? Roots: (-4, 0) (2, 0)

-8	2
x	+
4, -2	4, -2

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

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

$x=-4$ $x=2$

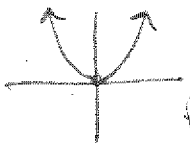
7. Given $p(x) = x^2 + 2x - 8$ What is the vertex? Vertex: (-1, -9)

$(\frac{2}{2})^2 = (1)^2 = 1$

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

$(x+1)^2-9$

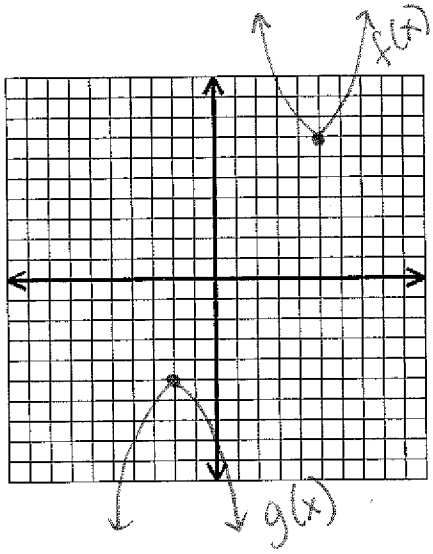
Algebra II UNIT 7 Analyze Quadratics



parent (0,0) opens up

NOTES 7-3

ist the transformations for f(x) and g(x), from the parent function of a quadratic.



Example 1:

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

1. Right 5
2. Up 7

$g(x) = -(x+2)^2 - 5$

1. V. Reflection
2. Left 2
3. Down 5

***Sketch** f(x) and g(x) on the same coordinate plane.*

Identify the Domain and Range for f(x) and g(x).

f(x)

D: $\mathbb{R}$ $(-\infty, \infty)$

R: $[7, \infty)$

g(x)

D: $\mathbb{R}$

R: $(-\infty, -5]$

Describe the transformation of $f(x) \rightarrow g(x)$ [how do we get from f to g?]

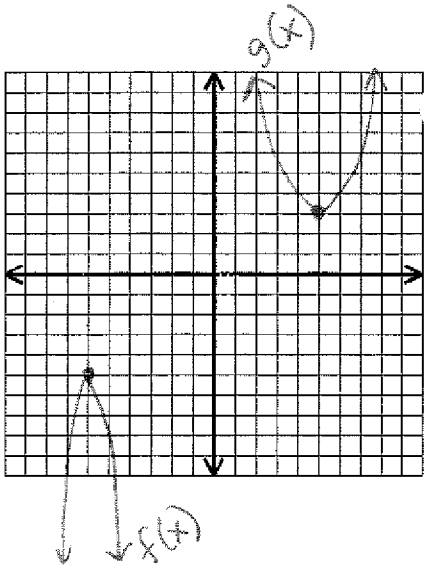
1. V. Reflection
2. Down 12
3. Left 7

Rewrite g(x) in terms of f(x) using the transformations listed above. $g(x) = af(x-h)+k$

$g(x) = -f(x+7) - 12$

List the transformations for f(x) and g(x), from the parent function of a quadratic.

Example 2:



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

1. V. Reflection
2. V. Stretch of 3
3. Left 6
4. Down 5

$g(x) = (x-5)^2 + 3$

1. Right 5
2. Up 3

***Sketch** f(x) and g(x) on the same coordinate plane.*

Identify the Domain and Range for f(x) and g(x).

f(x)

D: $\mathbb{R}$

R: $(-\infty, -5]$

g(x)

D: $\mathbb{R}$

R: $[3, \infty)$

Describe the transformation of $f(x) \rightarrow g(x)$ [how do we get from f to g?]

1. V. Reflection
2. V. Compression of $1/3$
3. Up 8
4. Right 11

Rewrite g(x) in terms of f(x) using the transformations listed above. $g(x) = af(x-h)+k$

$g(x) = -\frac{1}{3} f(x-11) + 8$

NOTES 7-4

Example 1:

Describe the transformations required to turn $f(x)$ to $g(x)$, then describe the transformations required to turn $g(x)$ to $f(x)$

$$f(x) = -(x-6)^2 + 1$$

$$g(x) = (x-3)^2 + 2$$

$f(x) \rightarrow g(x)$

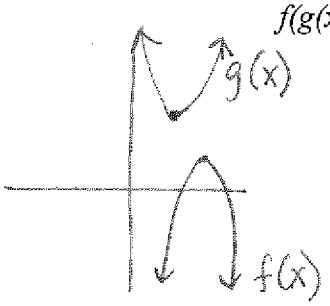
1. V. Reflection
2. Left 3
3. Up 1

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

$g(x) \rightarrow f(x)$

1. V. Reflection
2. Right 3
3. Down 1

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



Example 2:

Describe the transformations required to go from $f(x)$ to $g(x)$, then describe the transformations required to go from $g(x)$ to $f(x)$.

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

$$g(x) = (x-4)^2$$

$f(x) \rightarrow g(x)$

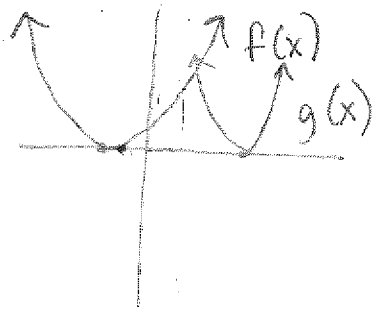
1. V. Stretch of 4
2. Right 6

$g(f(x)) = 4 \cdot f(x-6)$

$g(x) \rightarrow f(x)$

1. V. Compression of 1/4
2. Left 6

$f(g(x)) = 1/4 \cdot g(x+6)$



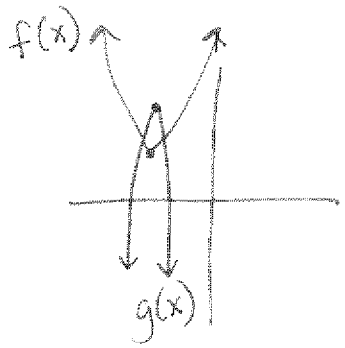
Example 3:

g(x) is a transformation of *f(x)* using the following rules:

reflected across the x-axis

vertically stretched by a factor of 3

translated up 2 units



Provide the transformation equation of *g(x)* in terms of *f(x)* and provide the equation of *g(x)*.

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

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

g(x) in terms of *f(x)* $g(f(x)) = -3f(x) + 2$

Example 4:

j(x) is a transformation of *h(x)* using the following rules:

reflected across the x-axis

vertically compressed by a factor of ½

translated right 5 units

Provide the transformation equation of *j(x)* in terms of *h(x)* and provide the equation of *j(x)*.

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

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

j(x) in terms of *h(x)* $j(h(x)) = -\frac{1}{2}h(x-2)$