NAME:____

U3:L5 Factoring Quadratic Equations

Factoring equations always starts with factoring out common factors, if possible.

$$20x^2+40x+60$$

$$20(x^2+2x+3)$$

Secondly, you can expand the second term to find similar terms for your first and third, to group.

$\oplus -1$ $\otimes -12$

$1x\ -12$
$-1x\ 12$
$2x\ -6$
$-2x\ 6$
$3x\ -4$
$-3x\ 4$

$$2x^2-1x-6$$

$$\underbrace{2x^2-4x}+\underbrace{3x-6}$$

This allows you to again, factor out common factors to simplify:

$$2x(x-2)+3(x-2)$$

$$(2x+3)(x-2)$$

Perfect square trinomials with a positive b, will factor following the pattern:

$$a^2+2ab+b^2$$

$$(a+b)^2$$

Whereas, perfect square trinomials with negative b, will factor as:

$$a^2-2ab+b^2$$

$$(a-b)^2$$

You can factor a difference of squares as:

$$a^2-b^2$$

$$(a+b)(a-b)$$

Examples:

$a^2+2ab+b^2$

$(a+b)^2$

$a^2+2ab+b^2$

$\sqrt{4x^2} + 12x + \sqrt{9}$

$a=2x$ ✓ $b=3$

$2ab$

$2(2x)(3)$

$4x(3)$

$12x$

$$\boxed{(2x+3)^2}$$

$a^2-2ab+b^2$

$(a-b)^2$

$\sqrt{9x^2} - 24x + \sqrt{16}$

$a=3x$ $b=4$

$2ab$

$2(3x)(4)$

$6x(4)$

$-24x$

$$\boxed{(3x-4)^2}$$

a^2-b^2

$(a+b)(a-b)$

$\sqrt{\frac{4}{9}x^2} - \sqrt{16y^2}$

$a=\frac{2}{3}x$ $4y=b$

$$\boxed{\left(\frac{2}{3}x+4y\right)\left(\frac{2}{3}x-4y\right)}$$

Factoring Polynomials with a Quadratic Pattern

With a quadratic equation in standard form, such as:

$$3(x+2)^2 - 13(x+2) + 12$$

You can factor the same way, by replacing your (x+2) value with a variable.

$\rightarrow a$

$\times\ 36$

$-1 \cdot -36$
$-2 \cdot -18$
$-3 \cdot -12$
$-4 \cdot -9$
$-6 \cdot -6$

$$3a^2 - 13a + 12$$

$$\underbrace{3a^2 - 9a}\ \underbrace{-4a + 12}$$

$$3a(a-3) - 4(a-3)$$

$$\boxed{(3a-4)(a-3)}$$

Then, plug your (x+2) back in…

$$(3a-4)(a-3)$$

$$(3(x+2)-4)((x+2)-3)$$

$$(3x+6-4)(x+2-3)$$

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

EXAMPLE:

$$2x^2 - 2x - 12$$

$\times\ -24$

-1×24
-2×12
-3×8
-4×6
1×-24
2×-12
3×-8
4×-6

$$\underbrace{2x^2 + 4x}\ \underbrace{-6x - 12}$$

$$2x(x+2) - 6(x+2)$$

$$\boxed{(2x-6)(x+2)}$$

$$-2(n+3)^2 + 12(n+3) + 14$$

$(n+3) = r$

$$-2r^2 + 12r + 14$$

$\times\ -28$

-1×28
-2×14

$$\underbrace{-2r^2 - 2r}\ \underbrace{+14r + 14}$$

$$-2r(r+1) + 14(r+1)$$

$$(-2r+14)(r+1)$$

$$(-2(n+3)+14)((n+3)+1)$$

$$(-2n-6+14)(n+3+1)$$

$$\boxed{(-2n+8)(n+4)}$$

Factoring the Difference of Squares

You can factor a "difference of squares" polynomial as:

$$\boxed{P^2 - Q^2 = (P - Q)(P + Q)}$$

When P and Q are any expression. For example:

$a^2 - b^2$

$(a+b)(a-b)$

EXAMPLE:

$\sqrt{9x^2} - \sqrt{0.64y^2}$

$a = 3x$ $\quad b = 0.8y$

$$\boxed{(3x + 0.8y)(3x - 0.8y)}$$

$\qquad a^2 \qquad\qquad b^2$

$\sqrt{4(x-2)^2} - \sqrt{0.25(y-4)^2}$

$a = 2(x-2)$ $\quad b = 0.5(y-4)$

$a^2 - b^2$

$(a+b)(a-b)$

$(2(x-2) + 0.5(y-4))(2(x-2) - 0.5(y-4))$

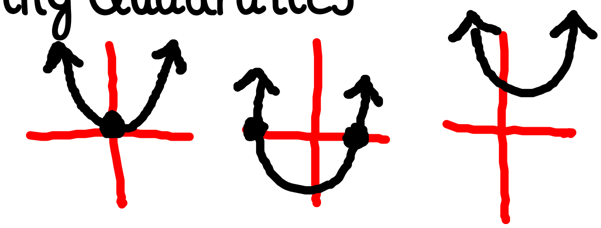
$(2x - 4 + 0.5y - 2)(2x - 4 - 0.5y + 2)$

$$\boxed{(2x + 0.5y - 6)(2x - 0.5y - 2)}$$

Zeroes — x-intercept

Determining $\boxed{\text{Roots}}$ with Factoring Quadratics

$\to$ when $y=0$



$x^2+6x+9=y$

$x^2+6x+9=0$

$\times 9$

$\boxed{3 \cdot 3}$

$$\underbrace{x^2+3x}+\underbrace{3x+9}=0$$

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

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

$$\sqrt{(x+3)^2}=0$$

$$x+3=0$$

$$-3 \quad -3$$

$$\boxed{x=-3}$$

Root is -3

$\times -10$

1×-10

$2x^2-9x-5=0$

$$\underbrace{2x^2+x}-\underbrace{10x-5}=0$$

$$x(2x+1)-5(2x+1)=0$$

$$(x-5)(2x+1)=0$$

$x-5=0$

$\boxed{x=5}$ ←Two Roots→

$2x+1=0$

$2x=-1$

$\boxed{x=-1/2}$

PRACTICE: Page 229 Questions 1-10 (only letter a)