Integrated Math 3
Unit 6: Polynomials
6.2

Name: ____________________

Date: __________ Period: _____

Objective: to solve polynomial equations by factoring.

Warm-up: Factor each of the following polynomials.

a. $n^2 + 7n + 10 = \boxed{(n+2)(n+5)}$

Mult: $10n^2$
Add: $7n$

	n	5
n	n^2	$5n$
2	$2n$	10

b. $6m^2 - 18m + 12 = 6(m^2 - 3m + 2)$

$= \boxed{6(m-1)(m-2)}$

Mult: $2m^2$
Add: $-3m$

	m	-2
m	m^2	$-2m$
-1	$-1m$	2

General Factoring Strategies

1. Check for common factors. If the terms have common factors, factor out the GCF.
2. Determine the number of terms in the polynomial.
   - Factor four-term polynomials by grouping
   - Factor trinomials using the "box method" or the AC method
   - Factor binomials using the *Difference of Squares:* $a^2 - b^2 = (a+b)(a-b)$
3. Look for factors that can be factored further.
4. Check by multiplying to make sure you can return to the original expression.

What does "solving" mean?

For our purposes, solving means finding the **"roots"** (or zeros/x-intercepts). A root is where the function is **equal to zero**.

Examples: Solve each of the following polynomials.

a. $6x^2 + x - 15 \Rightarrow (3x-5)(2x+3)$

Mult: $-90x^2$
Add: x

$(3x+5)(2x-3) = 0$

	$3x$	$+5$
$2x$	$6x^2$	$-10x$
-3	$-9x$	-15

$3x + 5 = 0$
$-5 \quad -5$
$\frac{3x}{3} = \frac{-5}{3}$
$x = -\frac{5}{3}$

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

$\boxed{\text{Roots: } (-5/3, 0),\ (+3/2, 0)}$

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

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

$\boxed{\text{Root: } (-\tfrac{1}{2}, 0)}$

c. $3x^2 - 11x - 4 \Rightarrow (3x+1)(x-4) = 0$

Mult: $-12x^2$
Add: $-11x$

$3x+1=0$, -1 -1: $\frac{3x}{3} = \frac{-1}{3}$, $x = -\frac{1}{3}$

$x-4=0$, $+4$ $+4$: $x=4$

	x	-4
$3x$	$3x^2$	$-12x$
1	$1x$	-4

$\boxed{\text{Roots: } (-1/3, 0), (4,0)}$

d. $x^3 - 3x^2 \Rightarrow x^2(x-3) = 0$

$\sqrt{x^2} = \sqrt{0}$, $x = \pm\sqrt{0}$, $x = \pm 0$

$x-3=0$, $+3$ $+3$: $x=3$

$\boxed{\text{Roots: } (0,0), (3,0)}$

e. $x^3 + 8x^2 = -16x$ $\quad$ $+16x$

must equal zero!

$x^3 + 8x^2 + 16x = 0$

$x(x^2+8x+16) = 0 \Rightarrow$ Mult: $16x^2$, Add: $8x$

$x\underbrace{(x+4)(x+4)} = 0$

$x=0$

$x+4=0$, -4 -4: $x=-4$

	x	4
x	x^2	$4x$
4	$4x$	16

$\boxed{\text{Roots: } (0,0), (-4,0)}$

f. $x^2 - 11x + 19 = -5$ $\quad$ $+5$ $+5$

$x^2 - 11x + 24 = 0 \Rightarrow$ Mult: $24x^2$, Add: $-11x$

$(x-8)(x-3) = 0$

$x-8=0$, $+8$ $+8$: $x=8$

$x-3=0$, $+3$ $+3$: $x=3$

	x	-3
x	x^2	$-3x$
-8	$-8x$	24

$\boxed{\text{Roots: } (8,0), (3,0)}$

g. $(16x^3 + 32x^2)(-9x - 18)$ $\quad$ *factor by grouping*

$16x^2(x+2) - 9(x+2)$ $\leftarrow$ factor out the GCF

$(16x^2 - 9)(x+2)$

difference of squares so factor further

$(4x+3)(4x-3)(x+2) = 0$

$4x+3=0$, -3 -3: $\frac{4x}{4} = \frac{-3}{4}$, $x = -\frac{3}{4}$

$4x-3=0$, $+3$ $+3$: $\frac{4x}{4} = \frac{3}{4}$, $x = \frac{3}{4}$

$x+2=0$, -2 -2: $x=-2$

$\boxed{\text{Roots: } (-3/4, 0), (3/4, 0), (-2,0)}$