Objectives:

- Solve polynomial equations using the Zero-Product Property.
- Solve equations involving polynomial functions.
- Model and solve problems involving polynomials.

SOLVING POLYNOMIAL EQUATIONS USING THE ZERO-PRODUCT PROPERTY

Zero-Product Property:

If the product of two (or more) numbers is zero, then at least one of the numbers is 0.

$$If \;\; ab = 0, \;\; then \;\; a = 0$$

$$or \; b = 0, or \; both \; a \; and \; b \; equal \; 0.$$

This property helps us solve polynomial equations, because when we factor, we make a *product* of factors, and if the product of factors equals 0, then one or more factors must equal 0.

Lesson 5.8: Polynomial Equations

Example 1: Solve by using the Zero Property

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

$x-4=0$

$+4 \quad +4$

$x=4$

$3x+2=0$

$-2 \quad -2$

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

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

STEPS TO SOLVING POLYNOMIAL EQUATIONS BY FACTORING:

Step 1: Write the equation in standard form -- all terms are on one side of the equation, and the equation is equal to zero. $ax^2 + bx + c = 0$

Step 2: Completely factor the polynomial expression on the left side of the equation.

Step 3: Set each factor found in Step 2 equal to zero (apply the zero-product property and split them up.)

Step 4: Solve each new equation for the variable.

Step 5: CHECK your answers by substituting each solution into the *original* equation.

Lesson 5.8: Polynomial Equations

Example 2: Solve by using the Zero Property

$$2x^2 + x = 6$$

$-6 \quad -6$

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

$4 \cdot -3 = -12$

$4 + -3 = 1$

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

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

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

$x+2=0 \qquad 2x-3=0$

$x = -2 \qquad x = \frac{3}{2}$

Example 3: Solve by using the Zero Property

BE CAUTIOUS! Don't set each factor = 6x!

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

$-6x \quad -6x$

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

$$2x^2-6x+5x-15-6x=0$$

$$2x^2-7x-15=0$$

$-10 \cdot 3 = -30$

$-10 + 3 = -7$

$$2x^2-10x+3x-15=0$$

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

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

$x-5=0 \qquad 2x+3=0$

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

Example 4: Solve by using the Zero Property

$$n^3 + 4n^2 - 9n = 36$$

$-36 \quad -36$

$n^3 + 4n^2 - 9n - 36 = 0$

$n^2(n+4) - 9(n+4) = 0$

$(n+4)(n^2-9) = 0$

$(n+4)(n+3)(n-3) = 0$

$n+4=0 \quad n+3=0 \quad n-3=0$

$n = -4 \quad n = -3 \quad n = 3$

SOLVING EQUATIONS CONTAINING POLYNOMIAL FUNCTIONS:

Example 5: Suppose $f(x) = x^2 - 4x + 6$

A) find the values of x such that $f(x) = 11$

$11 = x^2 - 4x + 6$

$-11 \qquad -11$

$0 = x^2 - 4x - 5$

$-5 \cdot 1 = -5$

$-5 + 1 = -4$

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

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

$x = 5 \qquad x = -1$

Check:

$f(5) = \ldots$

Example 5: Suppose $f(x) = x^2 - 4x + 6$

$f(x) = 11$

B) What points are on the graph of **f** ?

$x = 5, -1$

(5, 11)
(-1, 11)

Lesson 5.8: Polynomial Equations

Definition:	A **zero** of a function $f(x)$ is any value of x such that $f(x) = 0$.
mean same thing	In addition, if x is a zero of a function, it is **also an x-intercept** of that function (the point on the x-axis where the graph crosses it).

Example 6: Find the zeros of $f(x) = 3x^2 - 8x - 35$

What are the x-intercepts of the graph?

$0 = 3x^2 - 8x - 35$

$-15 \cdot 7 = -105$

$-15 + 7 = -8$

$0 = 3x^2 - 15x + 7x - 35$

$0 = 3x(x-5) + 7(x-5)$

$0 = (x-5)(3x+7)$

$(5, 0)$

$\left(-\frac{7}{3}, 0\right)$

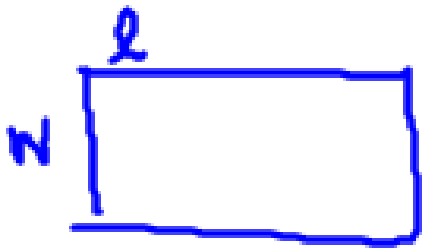
$x - 5 = 0 \qquad 3x + 7 = 0$

$x = 5 \qquad x = -\frac{7}{3}$

MODELING & SOLVING PROBLEMS INVOLVING POLYNOMIALS:

Example 7: The width of a rectangle is 7 feet less than its length. If the area of the rectangle is 78 square feet, what are the dimensions of the rectangle?

If the width (w) is 7 feet less than the length, we can say that $w = \ell - 7$



$A = \ell \cdot w$

$78 = \ell(\ell - 7)$

$0 = \ell(\ell - 7) - 78$

$0 = \ell^2 - 7\ell - 78$

$0 = (\ell + 6)(\ell - 13)$

$\ell + 6 = 0 \quad \ell - 13 = 0$

$6 \cdot -13 = -78$

$6 + -13 = -7$

$\ell = -6 \quad \ell = 13$

doesn't make sense to have length of -6

$\ell = 13$ ft

$w = 6$ ft

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Homework:

Pg. 432: # 9, 11, 13, 17, 19, 21, 33, 37, 43, 47, 49, 51, 55, 59, 61, 73, 77, 83, 85, 91

AND

Pg. 444: # 117-129 odds