3-4

Solving by Factoring

Objective: I can solve quadratic equations by factoring and using the zero-product property.

I can write a quadratic equation given the zeros or x-intercepts

Vocabulary: Zeros/Roots, X-Intercepts, Zero-Product Propery, Solve,

What does it mean to "solve" an equation?

$2x^2 + 3x + 9$

$f(x) = x^2 + 3x + 9$

The Zero-Product Property

If $ab = 0$, then $a = 0$ or $b = 0$ or both a and b are 0

Solve

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

$x+5=0$ $\quad -5 \; -5$

$x = -5$

$2x-3=0$ $\quad +3 \; +3$

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

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

Solve

$x(x + 9) = 0$

$x = 0$

$x+9=0$ $\quad -9 \; -9$

$x = -9$

Your turn! Solve

$(x - 1)(4x + 7) = 0$

$x-1=0$

$x = 1$

$4x+7=0$

$x = -\frac{7}{4}$

Solve by factoring

$2x^2 - 5x = 3$

$-3 \quad -3$

$2x^2 - 5x - 3 = 0$

-6, $1 \cdot 6$, $-2 + 3$

$(2x^2 + 1x - 6x - 3) = 0$

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

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

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

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

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

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

$x = 3$

$x = -\frac{1}{2}, 3$

Solve by factoring

$x^2 + 10x + 15 = -6$

$+6 \quad +6$

$x^2 + 10x + 21 = 0$

21, $1 \cdot 21$, $3 + 7$

$(x^2 + 3x + 7x + 21) = 0$

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

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

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

$x = -3, -7$

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

$-4 \quad -4$

$x^2 - 5x = 0$

$x(x-5) = 0$

$x = 0$

$x-5=0$

$x = 5$

Your Turn!

Solve by factoring

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

$x=-1 \quad x=-4$

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

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

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

$2x^2+12x = -18$

$2x^2+12x+18=0$

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

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

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

$x+3=0$

$-3 \quad -3$

$x=-3$

Fundamental Theorem of Algebra

TASK: Solve $x^2 + 6x + 5 = 0$ by factoring

$(x^2+x)+(5x+5)=0$

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

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

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

$x=-1 \quad x=-5$

Graph $f(x) = x^2 + 6x + 5$

Graph $f(x) = (x + 1)(x + 5)$

What do you notice about the solution and the graphs?

TASK: Solve $x^2 - x - 12 = 0$ by factoring

Graph $f(x) = x^2 - x - 12$

Graph $f(x) = (x + 3)(x - 4)$

What do you notice about the solution and the graphs?

When we solve a quadratic equation, this is called finding the zeros. In mathematics, a **zero**, sometimes called a **root**, of a function *f* is a member, *x,* of the domain of *f* such that $f(x)=0$.

Find the zeros of the function by factoring and *check* with your calculator

$y = x^2 + 5x - 14$

-14

$1, 14$

$-2, 7$

$0=x^2+5x-14$

$0=(x^2-2x)+(7x-14)$

$0=x(x-2)+7(x-2)$

$0=(x-2)(x+7)$

$x-2=0 \quad x+7=0$

$x=2 \quad x=-7$

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

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

Your Turn!

Find the zeros of the function by factoring and check with your calculator

~~$f(x) = 2x^2 + 3x - 20$~~

$y = x^2 - 16$

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

$x = -4, 4$

Write a function with zeros of -1 and 3

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

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

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

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

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

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

Write a function with zeros of -2 and -6

$x = -2 \quad x = -6$

$+2 \quad +2 \quad +6 \quad +6$

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

$x^2 + 6x + 2x + 12 \quad f(x) = x^2 + 8x + 12$

Your turn: Write a function with zeros of -4 and 10

Your turn: Write a function with zeros of 5 and -2

The product of 2 consecutive integers is 156. Find the two integers.

156

1, 156

21

12, 13

-12, -13

The length of a rectangle is 8 feet more than its width. If the area of the rectangle is 84 square feet, what are the dimensions of the rectangle?

$w(w+8) = 84$

$w^2 + 8w = 84$

$-84 \quad -84$

$w^2 + 8w - 84 = 0$

$(w^2 - 6w) + (14w - 84) = 0$

$w(w-6) + 14(w-6) = 0$

$(w-6)(w+14) = 0$

$w = 6$

$l = 14$

$w \neq -14$

84

1, 84

2, 42

3, 28

4, 21

-6, -14

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Check

Solve by factoring: $2x^2 + 13x = -15$

Find the zeros of the function: $y = x^2 - 2x - 15$

Write an equation with zeros of 1/2 and -5

Vocabulary: Zeros/Roots, X-Intercepts, Zero-Product Propery, Solve,