KEY

# Pre-Calculus 11
## Lesson 4.2 ~ Factoring Quadratic Equations

The first algebraic method we will learn for solving quadratic equations is by factoring. Before we begin solving equations, let's practice factoring expressions.

Example #1: Factor the following expressions.

a) $3x^2 + 3x - 6$

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

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

b) $0.49r^2 - 36t^2$

$\boxed{(0.7r + 6t)(0.7r - 6t)}$

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

let $k = n+3$

then $-2k^2 + 12k + 14$

$-2(k^2 - 6k - 7)$

$-2(k+1)(k-7)$

and $-2(n+3+1)(n+3-7)$

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

d) $4(x-2)^2 - 0.25(y-4)^2$

let $a = x-2$ & $b = y-4$

then $4a^2 - 0.25b^2$

$(2a + 0.5b)(2a - 0.5b)$

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

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

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

The Zero Product Property states that for any real numbers $a$ and $b$, if $ab=0$, then $a=0$, $b=0$, or both $a=b=0$.

Solve the quadratic equation $x^2+7x+12=0$ by factoring.

$$x^2+7x+12=0$$
$$(x+3)(x+4)=0$$

$(x+3)=0$ or $(x+4)=0$

$x=-3$ $\quad$ $x=-4$

**Check: $(-3)^2+7(-3)+12=0?$ $\quad$ $(-4)^2+7(-4)+12=0?$

$9-21+12=0?$ ☑ $\quad$ $16-28+12=0?$ ☑

Example #2: Solve the quadratic equation $x^2-4x-32=0$

$(x-8)(x+4)=0$

$x-8=0$ or $x+4=0$

$+8 \quad +8$ $\quad$ $-4 \quad -4$

$\boxed{x=8}$ $\quad$ $\boxed{x=-4}$

verify: $8^2-4(8)-32=0?$ $\quad$ $(-4)^2-4(-4)-32=0?$

$64-32-32=0?$ $\quad$ $16+16-32=0?$

$0=0$ ✓ $\quad$ $0=0$ ✓

Example #3: Solve the quadratic equation $3x^2+5x=0$ by factoring.

$x(3x+5)=0$

$\boxed{x=0}$ or $3x+5=0$

$-5 \quad -5$

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

$\boxed{x=-5/3}$

verify: $3(0)^2+5(0)=0?$ $\quad$ $3(-5/3)^2+5(-5/3)=0?$

$0+0=0?$ $\quad$ $3(25/9)+-25/3=0?$

$0=0$ ✓ $\quad$ $25/3+-25/3=0?$

$0=0$ ✓

Example #4: Solve the quadratic equation $2x^2 + 3 = 5x + 1$ by factoring.

$2x^2 + 3 = 5x + 1$

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

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

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

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

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

$2x - 1 = 0$ $\qquad$ $x - 2 = 0$

$2x = 1$ $\qquad$ $\boxed{x = 2}$

$\boxed{x = 1/2}$

verify: $2(1/2)^2 + 3 = 5(1/2) + 1$?

$2(1/4) + 3 = 5/2 + 1$?

$2/4 + 3 = 5/2 + 1$?

$1/2 + 6/2 = 5/2 + 2/2$?

$7/2 = 7/2$ ✓

$2(2)^2 + 3 = 5(2) + 1$?

$8 + 3 = 10 + 1$?

$11 = 11$ ✓

Example #5: The area of a rectangular Ping Pong table is 45 ft². The length is 4 ft more than the width. What are the dimensions of the table?

Let $l$ = length, $w$ = width, & $A$ = area. Then


$A = 45 = lw$

$45 = (w+4)(w)$

$45 = w^2 + 4w$

$0 = w^2 + 4w - 45$

$0 = (w+9)(w-5)$

$w = -9$ $\qquad$ $w = 5$

can't be a negative length

width = $\boxed{5 \text{ ft}}$

length = $5 + 4 = \boxed{9 \text{ ft}}$

area = $5 \times 9 = 45$ ✓