MATH 1010 ~ Intermediate Algebra

Chapter 5: POLYNOMIALS AND FACTORING

Section 5.6: Solving Polynomial Equations by Factoring

Objectives:

- Use the zero-factor property to solve equations.
- Solve quadratic equations by factoring.
- Solve higher-degree polynomial equations by factoring.
- Solve application problems by factoring.

$2x-1=0$

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

$x=?$

$x^3-4x=2x^2-8$

Solving Polynomial Equations by Factoring

Zero-Factor Property

if $ab=0$, then $a=0$ or $b=0$.

If 2 (or more) things multiply to give zero, one of them must be zero.

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

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

$2x+1=0$ or $x-5=0$

$2x=-1$ $\quad x=5$

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

b) $4x^3 - 32x^2 + 64x = 0$

$4x(x^2-8x+16)=0$

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

$4x=0$ or $x-4=0$

$x=0$, $x=4$

c) $x^3 - 3x^2 - 4x + 12 = 0$

$(x^3-3x^2)-(4x-12)=0$

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

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

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

$x-3=0$ or $x-2=0$ or $x+2=0$

$x=3$ $\quad x=2$ $\quad x=-2$

① EXAMPLE:

Solve for x.

$2 \cdot -12 = -24$

$-8, 3$

	x	-4
$2x$	$2x^2$	$-8x$
3	$3x$	-12

a) $2x^2 - 3x = 2x + 12$

$-2x-12 \quad -2x-12$

$2x^2 - 5x - 12 = 0$

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

$2x+3=0$ or $x-4=0$

$2x=-3$ $x=4$

$x=-3/2$

b) $x^2 + 8x + 16 = 0$

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

$(x+4)^2 = 0$

$x+4=0$

$x=-4$

c) $(x-6)(x+4) = -9$

$x^2 + 4x - 6x - 24 = -9$

$+9 \quad +9$

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

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

$x-5=0$ or $x+3=0$

$x=5$ $x=-3$

② EXAMPLE:

Solve for x.

a) $4x^2(3x-1) = 9(3x-1)$

$-9(3x-1) \quad -9(3x-1)$

$4x^2(3x-1) - 9(3x-1) = 0$

$(3x-1)(4x^2-9) = 0$

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

$3x-1=0$ or $2x-3=0$ or $2x+3=0$

$3x=1$ $2x=3$ $2x=-3$

$x=1/3$ $x=3/2$ $x=-3/2$

b) $x^3 + 18x^2 = -45x$

$+45x \quad +45x$

$x^3+18x^2+45x=0$

$x(x^2+18x+45)=0$

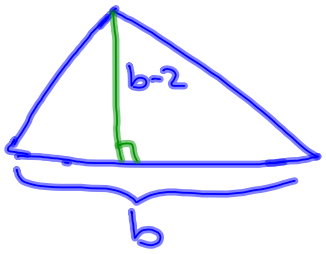
$x(x+3)(x+15)=0$

$x=0$ or $x+3=0$ or $x+15=0$

$x=-3$ $x=-15$

Applications:

a) The height of a triangle is 2 inches less than its base.
The area of the triangle is 60 square inches.
Find the base and height of the triangle.



$A = 60\ in^2$

$60 = \frac{1}{2}b(b-2)$

$2(60) = \left(\frac{1}{2}b^2 - b\right)2$

$120 = b^2 - 2b$

$-120 \quad -120$

$0 = b^2 - 2b - 120$

$0 = (b+10)(b-12)$

$b+10=0$ or $b-12=0$

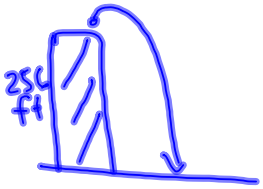
~~$b=-10$~~ $b=12$ in

height

10 in

b) A penny is dropped from the roof of a building 256 feet above the ground.
The height *(h)* in feet of the penny after *t* seconds is modeled by the equation $h=-16t^2+256$.
How long does it take to hit the ground?

$t = ?$ when $h = 0$



$h = -16t^2 + 256$

$0 = -16t^2 + 256$

$0 = -16(t^2 - 16)$

$\frac{0}{-16} = \frac{-16(t-4)(t+4)}{-16}$

$-16 \neq 0$

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

$t-4=0$ or $t+4=0$

$t = 4$ sec

~~$t=-4$~~