Subject: Math
Created by: Tomee Luu
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Basic Rules for Algebra

I. Quadratic Equation:

The standard formula: $\mathbf{ax^2 + bx + c = 0}$ (a, b, c are known values, a≠0; x is unknown variable)

Example: $x^2 + 5x + 6$ is a quadratic equation. a=1, b=5, c=6

$3x^2 + 5x$ is a quadratic equation; a=3, b=5, c=0

$5x + 7$ is NOT a quadratic equation because a=0 (there is no x^2)

To solve quadratic equations:

1. *Quadratic formula*: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Example: $x^2 - 5x + 6 = 0$. a=1, b=5, c=6

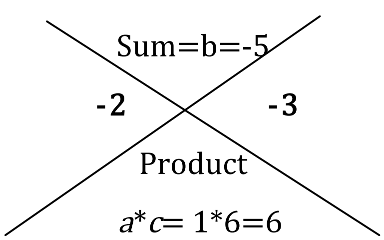
$x = \frac{-5 \pm \sqrt{5^2 - 4.1.5}}{2.1}$ so x= -2 or x= -3

2. *Factoring by grouping or Diamond Method*

Find 2 numbers that have the Sum of *b* and the Product of *a* times *c*. After you get the two numbers, you will get the factors $\mathbf{(x + \mathit{constant\ 1})*(x + \mathit{constant\ 2})}$

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

So we need to find 2 constants that have the sum of -5 and product of 6



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

$\mathbf{(x + (-2))*(x + (-3)) = 0}$

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

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

$x = 2$ or $x = 3$

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II. Special Factors

Difference of Two Squares

$x^2 - y^2 = (x - y)(x + y)$ Example: $x^2 - 9 = (x - 3)(x + 3)$

Difference of Two Cubes

$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$ Example: $x^3 - 8 = (x - 2)(x^2 + 2x + 4)$

Sum of Two Cubes

$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$ Example: $x^3 + 8 = (x + 2)(x^2 - 2x + 4)$

III. Binomial Theorem

Definition: a quick way of expanding a binomial that is raised to any positive integer power

$(x + y)^2 = x^2 + 2xy + y^2$ Example: $(x + 2)^2 = x^2 + 2(x)(2) + 2^2 = x^2 + 4x + 4$

$(x - y)^2 = x^2 - 2xy + y^2$ Example: $(x - 2)^2 = x^2 - 2(x)(2) + 2^2 = x^2 - 4x + 4$

$(x + y)^3 = x^3 + y^3 + 3xy^2 + 3x^2y$ Example: $(x + 3)^3 = x^3 + 3^3 + 3(x)(3)^2 + 3(x)^2 3 = x^3 + 2$
$+ 27x + 9x^2$

$(x - y)^3 = x^3 - y^3 + 3xy^2 - 3x^2y$ Example: $(x - 3)^3 = x^3 - 3^3 + 3(x)(3)^2 - 3(x)^2 3 = x^3 -$
$27 + 27x - 9x^2$

IV. Logarithmic Rules

Definition: Logarithms are the opposite of exponentials. With $a > 0$ and $a \neq 1$

$\log_a x = y$ is equivalent to $x = a^y$

Example: $\log_2 x = 3 \rightarrow x = 2^3 = 8$ Example: $10^3 = 1000 \rightarrow \log_{10} 1000 = 3$

Common Logarithm: $\log x = \log_{10} x$

Natural Logarithm: $\ln x = \log_e x$

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Properties of Logs

$\log_a 1 = 0$ Example: $\log_7 1 = 0$ (because $7^0 = 1$)

$\log_a a = 1$ Example: $\log_5 5 = 1$ (because $5^1 = 5$)

$\log_a a^x = x$ Example: $\log_5 5^8 = 8$ (because $5^8 = 5^8$)

$a^{\log_a x} = x$ Example: $5^{\log_5 12} = 12$

Laws of Logarithms

$\log_a (AB) = \log_a A + \log_a B$ Example: $\log_2(6x) = \log_2 6 + \log_2 x$

Example: $\log_4 2 + \log_4 32 = \log_4 (2*32) = \log_4 64 = 3$

$\log_a (A/B) = \log_a A - \log_a B$ Example: $\log_5(x/3) = \log_5 x - \log_5 3$

Example: $\log_2 80 - \log_2 5 = \log_2(80/5) = \log_2 16 = 4$

$\log_a A^c = c \log_a A$ Example: $\log_3 x^2 = 2 \log_3 x$

Example: $3 \log_4 x = \log_4 x^3$

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References - The following works were referred to during the creation of this handout: Valle Verde Tutorial Support Service Handout.