F U N C T I O N S

Standard Form of Quadratic Equation

$$ax^2 + bx + c = 0$$

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$a \neq 0$$

Factoring by Guessing and Checking

$$2x^2 + 11x - 15 = 0$$

1. **Find integers *r* and *s* such that**

   rs = (coeff. of x^2) (constant term) = ac = $(2)(15)$

   r + ***s*** = coeff. of x = b = 11

   r = 6 , ***s*** = 5

2. **Rewrite *bx* as *rx* + *sx***

   $$2x^2 + 11x + 15 = 2x^2 + 6x + 5x + 15$$

3. **Factor by grouping**

   $$\underline{2x^2 + 6x} + \underline{5x + 15}$$

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

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

Arithmetic Operations

$$ab + ac = a(b+c) \qquad a\left(\frac{b}{c}\right) = \frac{ab}{c}$$

$$\frac{\left(\frac{a}{b}\right)}{c} = \frac{a}{bc} \qquad \frac{a}{\left(\frac{b}{c}\right)} = \frac{ac}{b}$$

$$\frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd} \qquad \frac{a}{b} - \frac{c}{d} = \frac{ad-bc}{bd}$$

$$\frac{a-b}{c-d} = \frac{b-a}{d-c} \qquad \frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$$

$$\frac{ab+ac}{a} = b + c, a \neq 0 \qquad \frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)} = \frac{ad}{bc}$$

Exponent Properties

$$a^n a^m = a^{n+m} \qquad \frac{a^n}{a^m} = a^{n-m} = \frac{1}{a^{m-n}}$$

$$(a^n)^m = a^{nm} \qquad a^0 = 1, a \neq 0$$

$$(ab)^n = a^n b^n \qquad \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

$$a^{-n} = \frac{1}{a^n} \qquad \frac{1}{a^{-n}} = a^n$$

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n = \frac{b^n}{a^n} \qquad a^{\frac{n}{m}} = \left(a^{\frac{1}{m}}\right)^n = (a^n)^{\frac{1}{m}}$$

Logarithmic Properties

$y = \log_b x$ is equivalent $x = b^y$

$$\log_b b^x = x \qquad b^{\log_b x} = x \qquad \log_b(1) = 0$$

$$\log_b(x^y) = y \cdot \log_b(x) \qquad \ln x = \log_e x$$

$$\log_b(xy) = \log_b x + \log_b y$$

$$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$$

Absolute Value Properties

$|a| = a$ if $a \geq 0$ $\qquad$ $|a| = -a$ if $|a| \leq 0$

$|a| \geq 0$ $\qquad$ $|-a| = |a|$

$$|ab| = |a||b| \qquad \left|\frac{a}{b}\right| = \frac{|a|}{|b|}$$

$|x| = a \Rightarrow x = a$ **OR** $|x| = -a$

$$-|a| \leq a \leq |a|$$

$|a+b| \leq |a| + |b|$ **(Triangle Inequality)**

Properties of Radicals

$$\sqrt[n]{a} = a^{\frac{1}{n}} \qquad \sqrt[n]{ab} = \sqrt[n]{a}\sqrt[n]{b}$$

$$\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a} \qquad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$$

$\sqrt[n]{a^n} = a$, if n is odd $\qquad$ $\sqrt[n]{a^n} = |a|$, if n is even

Solving the Quadratic Equation Completing the Square

$$3x^2 + 6x - 15 = 0$$

1. **Divide by the coefficient of x^2**

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

2. **Move the constant to the other side**

   $$x^2 + 2x = 5$$

3. **Half the coefficient of *x*, square it, and add it to both sides**

   $$x^2 + 2x + \left(\frac{2}{2}\right)^2 = 5 + \left(\frac{2}{2}\right)^2$$

4. **Factor the left side**

   $$x^2 + 2x + 1 = 6$$

   $$(x+1)^2 = 6$$

5. **Use Square Root Property**

   $$|x+1| = \sqrt{6}$$

6. **Use Absolute Value Property**

   $$x + 1 = \pm\sqrt{6}$$

7. **Solve for x**

   $$x = -1 \pm \sqrt{6}$$

Functions

Inverse Functions $f^{-1}(x)$

1. **Set function = y**
2. **Interchange x- and y-variables**
3. **Solve for y**

Composition of Functions

$$(f \circ g)(x) = f(g(x))$$

$$(g \circ f)(x) = g(f(x))$$

$$(f \circ f^{-1})(x) = x$$

Algebra of Functions

$$(f+g)(x) = f(x) + g(x) \qquad (f-g)(x) = f(x) - g(x)$$

$$(f \cdot g)(x) = f(x) \cdot g(x) \qquad \left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$$

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