Equation Solving Toolbox

Linear Equations

Addition and Subtraction Property of Equality

Use to isolate a variable term.

$$\begin{array}{r} 3x + 7 = 20 \\ \underline{-7 \quad -7} \\ 3x = 13 \end{array}$$

Multiplication and Division Property of Equality

Use to isolate a variable.

$$\begin{array}{r} 5x = 70 \\ \frac{5x}{5} = \frac{70}{5} \\ x = 14 \end{array}$$

Systems of Equations

Substitution Method

Use when a variable is isolated or can be easily isolated.

$$\begin{array}{r} y = 6x + 8 \\ 2x + 4y = 30 \\ 2x + 4(6x + 8) = 30 \end{array}$$

Elimination Method

Use when the equations are in general form.

$$\begin{array}{r} 5x - 7y = 42 \\ 2x + 4y = 30 \\ 4(5x - 7y) = 4(42) \\ 7(2x + 4y) = 7(30) \\ 20x - 28y = 168 \\ \underline{14x + 28y = 210} \\ 34x \qquad = 378 \end{array}$$

Linear Inequalities

Addition and Subtraction Properties of Inequalities

Use to isolate a variable term.

$$\begin{array}{r} 4x + 5 < 21 \\ \underline{-5 \quad -5} \\ 4x < 16 \end{array}$$

Multiplication and Division Properties of Inequalities

Use to isolate a variable. When multiplying or dividing by a negative number, reverse the inequality symbol.

$$\begin{array}{ll} -3x < 21 & 5x < 45 \\ \frac{-3x}{-3} > \frac{21}{-3} & \frac{5x}{5} < \frac{45}{5} \\ x > -7 & x < 9 \end{array}$$

Quadratic Equations

Square Root Property

Use when there is a squared term but no first degree term. Isolate the squared term and use a plus or minus symbol to indicate both answers.

$$\begin{array}{r} x^2 = 25 \\ x = \pm\sqrt{25} \\ x = \pm 5 \end{array}$$

Completing the Square

Use if the vertex form is required. Finish solving with the square root property.

$$\begin{array}{r} x^2 + 6x + 4 = 0 \\ x^2 + 6x = -4 \\ x^2 + 6x + 9 = -4 + 9 \\ x^2 + 6x + 9 = 5 \\ (x + 3)^2 = 5 \end{array}$$

Factoring

Use when the quadratic equation has small coefficients that factor easily. Set the quadratic equal to zero, factor and then use the zero factor property to write two or more simpler equations.

$$\begin{array}{r} x^2 + 7x + 10 = 0 \\ (x + 5)(x + 2) = 0 \\ x + 5 = 0 \quad or \quad x + 2 = 0 \end{array}$$

Quadratic Formula

Use when the quadratic equation has fractions, decimals, or large numbers. Set the quadratic equal to zero.

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

Rational Equations

Multiply by the LCD

Multiply both sides of the equation by the least common denominator. This will clear all fractions from the equation.

$$\begin{array}{r} \frac{3}{x + 1} = \frac{2}{x} \\ (x + 1)(x) \cdot \frac{3}{x + 1} = \frac{2}{x} \cdot (x + 1)(x) \\ 3x = 2x + 2 \end{array}$$

Radical Equations

Raise Both Sides to the Reciprocal Exponent

Isolate a radical on one side of the equation and then square both sides of the equation. This may need to be done more than once to clear multiple radicals.

$$\begin{array}{r} \sqrt{x + 2} - 7 = 2 \\ \sqrt{x + 2} = 9 \\ (\sqrt{x + 2})^2 = 9^2 \\ x + 2 = 81 \end{array}$$