

Solving equations

- ✓ **Inverse operations:** undo addition with subtraction, multiplication with division, a square with a square root
- ✓ **Reverse PEMDAS:** undo addition and subtraction first, then multiplication and division
- ✓ **Exception:** one side is a fraction? Multiply by its denominator first: $\frac{x+45}{7} = 5x - 13$
- ✓ **Solve for y in terms of x:** isolate the variable named first
- ✓ **Hidden similarity:** $5x + 35 = 15$ gives $x + 7 = 3$ in one step

Inequalities

- ✓ **Multiply or divide by a negative:** flip the symbol
- ✓ Graph: **dashed** line for $<$ or $>$; **solid** for $\leq$ or $\geq$
- ✓ $y > \dots$: shade **above** the line; $y < \dots$: shade **below**
- ✓ **Plug in numbers**, especially **0**: if 0 works, keep only the choices that include 0
- ✓ Systems of inequalities: test points, or graph both in Desmos and read the overlap

Linear equations

- ✓ Slope $m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$
- ✓ **Slope-intercept:** $y = mx + b$; b is the y -intercept
- ✓ **Standard form:** $Ax + By = C$, slope $-\frac{A}{B}$
- ✓ Lines:
 - **Parallel:** same slope
 - **Perpendicular:** negative reciprocal slopes
- ✓ A linear equation in one variable has:
 - **one** solution: $3x + 7 = 12$
 - **none:** $3x + 7 = 3x + 12$
 - **infinitely many:** $3x + 7 = 3x + 7$
- ✓ **Reflect** over the x -axis: negate y ; over the y -axis: negate x

Systems of equations

Approach	Works best when
Substitution: isolate a variable, plug it into the other equation	One variable is already alone, or nearly
Elimination: scale so one variable has opposite coefficients, then add	The coefficients line up: often the fastest by hand
Graphing in Desmos: read the intersection	Almost always: the fastest for most students
Backsolving: test each choice in both equations	Nothing else looks quick

- ✓ **Same sign, subtract** the equations; opposite signs, add
- ✓ How many solutions?
 - Lines **cross**: one
 - **Parallel** (same slope, different intercept): none
 - **Same line** (one equation a multiple of the other): infinitely many

Modeling with a line

- ✓ In $y = mx + b$: m is the **rate of change**, b the **starting value**, x the input (usually time)
- ✓ $g(t) = 18,000 - 150t$: starts at 18,000 gallons, drains 150 an hour, empty when $g(t) = 0$: $t = 120$

Absolute value

- ✓ An equation splits in two: $|2x + 7| = 9 \rightarrow 2x + 7 = 9$ or $2x + 7 = -9$
- ✓ So does an inequality, the second with the symbol reversed: $|2x + 7| > 9 \rightarrow 2x + 7 > 9$ or $2x + 7 < -9$

Rates and proportions

- ✓ distance = rate $\times$ time; for work, **work** = rate $\times$ time, and two workers' rates **add**
- ✓ **Proportion:** $\frac{a}{b} = \frac{c}{d} \rightarrow ad = bc$
- ✓ **Convert units** with fractions that cancel:
 $\frac{x}{6} \text{ hr} \times \frac{60 \text{ min}}{1 \text{ hr}} = 10x \text{ min}$
- ✓ **Ratio total:** 2 red to 7 blue means $P(\text{red}) = \frac{2}{2+7} = \frac{2}{9}$
- ✓ **Inverse variation:** one rises as the other falls; their **product** stays the same