



Expressions • Equations • Linear Functions

Basic Algebra for 8th Grade

$$x + 3 = 8$$

You Will Learn

- Simplify expressions using structure
- Solve linear equations in one variable
- Connect $y = mx + b$ to graphs and real situations

California Standards — CA CCSS-M

8.EE.C.7: Solve linear equations in one variable. • 8.EE.C.7.B:
Includes rational coefficients, distributing, and collecting like terms.

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Algebra Building Blocks: Variables, Terms, and Expressions



Variable

A letter that stands for a number, like x or n .

Term

A number, variable, or product of numbers and variables, like $7x$.

Coefficient

The number multiplying a variable. In $7x$, the coefficient is 7.

Expression

A math phrase without an equals sign, like $3x + 5$.

Like Terms

Same variable part (same letters and exponents).

$4x$ and $-9x$ ✓ $4x$ and $4x^2$ ✗

Simplify by Combining Like Terms

$$3x + 5 + 2x - 8 = (3x + 2x) + (5 - 8) = 5x - 3$$

Visual: Like-Term Sorting

x-terms

constants

$6x$ -2 3 $-x$ $10x$



Distributive Property + Simplifying

Distributive Property

Multiply a number by every term inside parentheses:

$$a(b + c) = ab + ac$$

8.MP7

Use the structure of an expression to make algebra moves visible and efficient.

Example 1

$$4(2x - 3) = 8x - 12$$

Example 2 — Distribute + Combine Like Terms

$$2(3x + 1) - (x - 5)$$

1. Distribute: $2(3x + 1) = 6x + 2$
2. Subtract parentheses (flip signs): $-(x - 5) = -x + 5$
3. Combine: $6x + 2 - x + 5 = 5x + 7$

Visual: Arrow Distribution

$$-3(2x - 4)$$

$$-3 \times 2x = -6x$$

$$-3 \times (-4) = +12$$

$$= -6x + 12$$

Solving Linear Equations in One Variable



Equation

A math sentence with an equals sign, such as $2x + 7 = 19$.

Goal

Isolate the variable using inverse operations (undoing).

Balance Rule

Do the same operation to both sides to keep the equation balanced.

Worked Example

$$5x - 3 = 2x + 12$$

1. Subtract $2x \rightarrow 3x - 3 = 12$
2. Add 3 $\rightarrow 3x = 15$
3. Divide by 3 $\rightarrow x = 5$

Special Cases

ONE solution $\rightarrow x = a$

INFINITELY MANY $\rightarrow a = a$ (always true)

NO solution $\rightarrow a = b$ (false)

$$2(x + 3) = 2x + 6 \rightarrow 6 = 6$$

$$3x + 1 = 3x + 4 \rightarrow 1 = 4$$

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Linear Functions: Understanding $y = mx + b$

Function

A rule that gives exactly one output for each input.

Linear Function

Constant rate of change; graph is a straight line.

$y = mx + b$

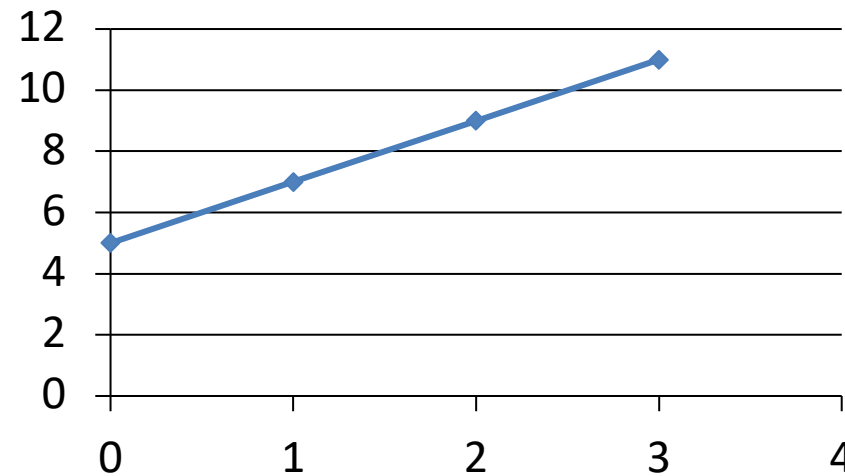
m = slope (rate of change)
 b = y-intercept ($x = 0$)

Real Situation

Streaming service:
\$5 sign-up fee + \$2 per month

Equation: $y = 2x + 5$
 $m = 2 \rightarrow$ cost increases \$2 each month
 $b = 5 \rightarrow$ starting cost is \$5

$$y = 2x + 5$$



$$b = 5 \rightarrow (0, 5)$$

$$m = 2/1 \rightarrow \text{rise 2, run 1}$$

Nonlinear Check

$A = s^2$ is NOT linear — it curves upward as s increases.