

Pre-Algebra Formula and Strategy Guide

The bridge between arithmetic and Algebra 1: integers, fractions, ratios, one- and two-step equations, exponents, and the geometry and data skills that come with them. Work a section, then try the matching questions in the practice worksheet.

SECTIONS	8	WORKED EXAMPLES	6	FORMAT	Print friendly
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How to use this guide

A formula you cannot place is not knowledge yet. Work the recall drill below before the questions.

- Say the rule out loud before applying it — 'same sign, add and keep the sign' is worth more than the answer.
- Write every step. Pre-Algebra mistakes are almost always a skipped step, not a misunderstood idea.
- Check a solved equation by substituting the answer back into the original problem.

1. Integers

NAME	FORMULA	WHEN TO USE
Adding same sign	add absolute values, keep the sign	Both numbers are positive or both negative.
Adding different signs	subtract absolute values, keep sign of the larger	One positive, one negative.
Subtracting integers	$a - b = a + (-b)$	Turn subtraction into addition of the opposite.
Multiplying/dividing	same sign $\rightarrow$ positive, different sign $\rightarrow$ negative	Any integer product or quotient.
Absolute value	distance from zero, always ≥ 0	Comparing distances, ignoring direction.

WORKED EXAMPLE

Evaluate $-8 + 5 - (-3)$.

- $-8 + 5 = -3$
- Subtracting a negative adds: $-3 - (-3) = -3 + 3$
- $-3 + 3 = 0$

Check: Rewriting as $-8 + 5 + 3$ also gives 0.

2. Fractions, decimals, percents

NAME	FORMULA	WHEN TO USE
Fraction to decimal	divide numerator by denominator	Comparing a fraction and a decimal directly.
Percent to decimal	divide by 100	Preparing a percent for a calculation.

NAME	FORMULA	WHEN TO USE
Percent of a number	$(\text{percent}/100) \times \text{number}$	Finding a part given a whole and a percent.
Percent change	$(\text{new} - \text{old})/\text{old} \times 100\%$	Describing an increase or decrease as a percent.
Adding/subtracting fractions	common denominator first	Combining fractional quantities.
Multiplying fractions	multiply straight across	No common denominator needed.
Dividing fractions	multiply by the reciprocal	Flip the second fraction, then multiply.

WORKED EXAMPLE

A \$40 jacket is on sale for 25% off. Find the sale price.

- Discount = $0.25 \times 40 = 10$
- Sale price = $40 - 10$
- Sale price = 30

Check: 25% off means paying 75%: $0.75 \times 40 = 30$. Matches.

3. Ratios, rates, proportions

NAME	FORMULA	WHEN TO USE
Ratio	a to b, or a:b, or a/b	Comparing two quantities of the same kind.
Unit rate	rate per 1 unit	Comparing prices or speeds fairly.
Proportion (cross products)	$a/b = c/d \rightarrow ad = bc$	Two ratios are set equal and one value is unknown.
Scale factor	ratio of a copy's size to the original	Maps, models, and scale drawings.

WORKED EXAMPLE

If 3 notebooks cost \$6.75, what do 8 notebooks cost at the same rate?

- Unit rate = $6.75/3 = 2.25$ per notebook
- $8 \times 2.25 = 18$

Check: $3/6.75 = 8/18$ cross-multiplies to $3(18) = 54$ and $6.75(8) = 54$. Equal.

4. Expressions and equations

NAME	FORMULA	WHEN TO USE
Combining like terms	add/subtract coefficients of matching variables	Simplifying before solving.
Distributive property	$a(b + c) = ab + ac$	A quantity is multiplied across a sum or difference.
One-step equation	apply the inverse operation to both sides	A single operation separates x from its value.

NAME	FORMULA	WHEN TO USE
Two-step equation	undo addition/subtraction, then multiplication/division	Two operations must be undone in order.

WORKED EXAMPLE**Solve $3x - 7 = 14$.**1. Add 7 to both sides: $3x = 21$ 2. Divide by 3: $x = 7$ Check: $3(7) - 7 = 21 - 7 = 14$.

5. Inequalities

NAME	FORMULA	WHEN TO USE
Solving an inequality	same steps as an equation	Isolating the variable.
Flipping the sign	multiplying/dividing by a negative flips it	The coefficient of x is negative.
Graphing on a number line	open circle for $<$ or $>$, closed for $\leq$ or $\geq$	Showing a solution set visually.

6. Exponents and roots

NAME	FORMULA	WHEN TO USE
Product rule	$a^m \times a^n = a^{m+n}$	Multiplying powers with the same base.
Power of a power	$(a^m)^n = a^{mn}$	A power raised to another power.
Square root	$\sqrt{a} \times \sqrt{a} = a$	Undoing a square, or finding a side length from an area.
Scientific notation	$a \times 10^n$, where $1 \leq a < 10$	Writing a very large or very small number compactly.

WORKED EXAMPLE**Write 47,000 in scientific notation.**

1. Move the decimal point so one nonzero digit remains: 4.7

2. Count the places moved: 4

3. $47,000 = 4.7 \times 10^4$ Check: $4.7 \times 10,000 = 47,000$.

7. Geometry

NAME	FORMULA	WHEN TO USE
Pythagorean theorem	$a^2 + b^2 = c^2$	A right triangle's third side is unknown.
Area of a triangle	$1/2 \times \text{base} \times \text{height}$	Finding the surface inside a triangle.

NAME	FORMULA	WHEN TO USE
Circumference	$2 \times \pi \times r$	The distance around a circle.
Area of a circle	$\pi \times r^2$	The surface inside a circle.
Volume of a rectangular prism	length x width x height	A box's capacity.

WORKED EXAMPLE

A right triangle has legs 6 and 8. Find the hypotenuse.

- $6^2 + 8^2 = c^2$
- $36 + 64 = 100$
- $c = \sqrt{100} = 10$

Check: 6-8-10 is a scaled 3-4-5 triple.

8. Probability and statistics

NAME	FORMULA	WHEN TO USE
Probability	favorable outcomes / total outcomes	A single event's likelihood.
Independent events	$P(A \text{ and } B) = P(A) \times P(B)$	Two events don't affect each other.
Mean	sum of values / number of values	A typical value with no major outliers.
Median	middle value of ordered data	A typical value when outliers are present.

Notes and tutor hand-off

Bring this page to your next session so the tutor can start from what actually blocked you.

Which formula did you need to look up more than once?

One integer or fraction rule you keep mixing up:

Worksheet question numbers to review with a tutor:
