

Algebra 1 Formula and Strategy Guide

Every relationship you are expected to recognise in Algebra 1, paired with the moment it is actually useful. Read a section, then attempt the matching questions in the practice worksheet and mark the ones you could not finish.

SECTIONS	7	WORKED EXAMPLES	7	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.

- Cover the formula column and try to state the formula from the situation in the last column. That is the recall a test actually asks for.
- Write the formula before substituting numbers. An error becomes visible one line earlier.
- Check your answer against the original sentence, not against your own second line of working.

1. Linear equations and lines

NAME	FORMULA	WHEN TO USE
Slope from two points	$m = (y_2 - y_1)/(x_2 - x_1)$	Two points are given and a rate of change is wanted.
Slope-intercept form	$y = mx + b$	You know the rate and the starting value, or must read a graph.
Point-slope form	$y - y_1 = m(x - x_1)$	You know the slope and one point but not the intercept.
Standard form	$Ax + By = C$	Intercepts are wanted quickly, or the problem is a constraint.
x-intercept	set $y = 0$, solve for x	Asked where a line crosses the horizontal axis.
y-intercept	set $x = 0$, solve for y	Asked for the starting value or initial amount.
Parallel lines	equal slopes	Deciding whether two lines ever meet.
Perpendicular lines	slopes multiply to -1	A right angle is described or implied.

WORKED EXAMPLE

A gym charges a \$20 joining fee plus \$4 per class. Write the cost model and find the cost of 9 classes.

1. Fixed amount = 20, rate per class = 4
2. $c = 4n + 20$
3. $c = 4(9) + 20$
4. $c = 36 + 20 = 56$

Check: 9 classes at \$4 is \$36, plus the \$20 fee, so \$56.

2. Inequalities and absolute value

NAME	FORMULA	WHEN TO USE
Inequality direction	flip when multiplying/dividing by a negative	A negative coefficient is removed.
Compound 'and'	solution is the overlap	A value must satisfy both conditions.
Compound 'or'	solution is the union	A value may satisfy either condition.
Absolute value equation	$ x = a \rightarrow x = a \text{ or } x = -a$	Distance from zero is fixed.
Absolute value $< a$	$-a < x < a$	The quantity stays within a tolerance.
Absolute value $> a$	$x < -a \text{ or } x > a$	The quantity falls outside a tolerance.

WORKED EXAMPLE

Solve $-3x + 4 > 19$.

- $-3x > 15$
- Divide by -3 and flip the sign
- $x < -5$

Check: Test $x = -6$: $-3(-6) + 4 = 22$, which is greater than 19.

3. Systems of equations

NAME	FORMULA	WHEN TO USE
Substitution	isolate a variable, then insert	One equation already has an isolated variable.
Elimination	add or subtract to cancel a variable	Coefficients match or can be scaled to match.
One solution	different slopes	The lines cross exactly once.
No solution	same slope, different intercept	Parallel lines; the system is inconsistent.
Infinitely many	same slope and same intercept	Both equations describe the same line.

WORKED EXAMPLE

Solve the system $2x + y = 11$ and $x - y = 1$.

- Add to eliminate y :
- $(2x + y) + (x - y) = 11 + 1$
- $3x = 12 \rightarrow x = 4$
- Substitute: $4 - y = 1 \rightarrow y = 3$

Check: $2(4) + 3 = 11$ and $4 - 3 = 1$, so $(4, 3)$ satisfies both.

4. Exponents and polynomials

NAME	FORMULA	WHEN TO USE
Product rule	$a^m \cdot a^n = a^{m+n}$	Multiplying powers with the same base.
Quotient rule	$a^m / a^n = a^{m-n}$	Dividing powers with the same base.
Power of a power	$(a^m)^n = a^{mn}$	A power is raised to another power.
Zero exponent	$a^0 = 1, a \neq 0$	Simplifying before comparing terms.
Negative exponent	$a^{-n} = 1/a^n$	Moving a factor across the fraction bar.
Difference of squares	$a^2 - b^2 = (a+b)(a-b)$	Two perfect squares separated by a minus.
Square of a binomial	$(a+b)^2 = a^2 + 2ab + b^2$	Expanding or spotting a perfect-square trinomial.
Factoring by grouping	split the middle term, then group	A leading coefficient other than 1.

WORKED EXAMPLE

Factor completely: $x^2 - 9x + 20$.

- Two numbers with product 20 and sum -9
- 4 and -5 work
- $(x - 4)(x - 5)$

Check: Expanding gives $x^2 - 5x - 4x + 20 = x^2 - 9x + 20$.

5. Quadratics

NAME	FORMULA	WHEN TO USE
Standard form	$y = ax^2 + bx + c$	Reading the y-intercept c directly.
Quadratic formula	$x = (-b \pm \sqrt{b^2 - 4ac}) / (2a)$	Factoring fails or roots are not integers.
Discriminant	$b^2 - 4ac$	Asked how many real solutions exist, without solving.
Axis of symmetry	$x = -b / (2a)$	Locating the vertex or the maximum/minimum input.
Vertex form	$y = a(x-h)^2 + k$	The vertex (h, k) is wanted, or a shift is described.
Zero product property	$pq = 0 \rightarrow p = 0 \text{ or } q = 0$	A factored quadratic equals zero.

WORKED EXAMPLE

Solve $x^2 - 6x + 8 = 0$ **and state the axis of symmetry.**

- $(x - 2)(x - 4) = 0$
- $x = 2$ or $x = 4$
- Axis: $x = -b/2a = 6/2 = 3$

Check: $x = 3$ sits exactly halfway between the roots 2 and 4.

6. Functions, sequences and exponential change

NAME	FORMULA	WHEN TO USE
Function notation	$f(x)$ = output for input x	Evaluating, or reading a value from a graph.
Domain and range	inputs allowed; outputs produced	Asked what values are permitted or reached.
Average rate of change	$(f(b) - f(a))/(b - a)$	A rate across an interval, not at a point.
Arithmetic sequence	$a_n = a_1 + (n-1)d$	The same amount is added each step.
Geometric sequence	$a_n = a_1 * r^{n-1}$	Each step multiplies by a constant factor.
Exponential model	$y = a * b^x$	Growth or decay by a percentage, not a fixed amount.
Growth vs decay	$b > 1$ grows; $0 < b < 1$ decays	Deciding which way a model moves.

WORKED EXAMPLE

A culture starts at 200 cells and increases 15% per hour. Model it and find the count at 3 hours.

1. Percentage growth multiplies: $b = 1.15$
2. $y = 200 * 1.15^x$
3. $y = 200 * 1.15^3 = 200 * 1.520875$
4. $y = 304.175$, about 304 cells

Check: Growth compounds, so the result must exceed $200 + 3(30) = 290$. It does.

7. Statistics and data

NAME	FORMULA	WHEN TO USE
Mean	sum / count	A typical value when no extreme outliers exist.
Median	middle value of ordered data	Outliers are present and would distort the mean.
Range	maximum - minimum	A quick measure of spread.
Line of best fit	$y = mx + b$ through a scatterplot	Describing a trend and predicting from it.
Correlation	direction and strength of a trend	Describing a scatterplot in words.
Two-way table	counts across two categories	Comparing relative frequency between groups.

WORKED EXAMPLE

Scores: 12, 15, 15, 18, 40. Find the mean and median and say which represents the data better.

1. Mean = $100/5 = 20$
2. Ordered; middle value is 15
3. 40 sits far above the rest

Check: Four of five scores are below the mean of 20, so the median of 15 is fairer.

Notes and tutor hand-off

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

Which section above did you have to re-read?

Write one formula you could not recall without looking:

Which worked example would you struggle to reproduce alone?

Worksheet question numbers to review with a tutor:
