ACT Math Formula Sheet

Three forms of a line

Slope-intercept	$y = mx + b$
Point-slope	$y - y_1 = m(x - x_1)$
Standard	$Ax + By = C$

Read m and b in slope-intercept form. Use point-slope when a point and slope are given.
A and B are not both zero. A vertical line cannot be written as y = mx + b.

Linear equations and systems

Slope-intercept	$y = mx + b$
Point-slope	$y - y_1 = m(x - x_1)$
Example intersection	$y = 2x + 1;\ y = x + 4$

For the example, set the expressions equal: x = 3 and y = 7.
A solution must work in both equations.

Find and count roots

Discriminant	$D = b^2 - 4ac$
Roots when D is nonnegative	$x = (-b \pm \sqrt{(D)})/(2a)$
Sum of roots	$r_1 + r_2 = -b/a$
Product of roots	$r_1\, r_2 = c/a$

For real coefficients, D > 0 gives two real roots, D = 0 one repeated root, D < 0 no real roots.

Fractional powers & roots

Square root	$a^{1/2} = \sqrt{(a)}$
General positive base	$a^{m/n} = (a^{1/n})^m$
Example	$27^{2/3} = 3^2 = 9$
Square root of a square	$\sqrt{(x^2)} = \lvert x \rvert$

For the general rule use a > 0 and positive integer n. An even real root cannot have a negative radicand.

Rational expressions & equations

Exclude original denominator zeros
$(x^2 - 4)/(x - 2) = x + 2,\ x \neq 2$

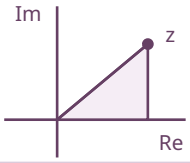
Equation example	$6/(x - 1) = 2 \Rightarrow x = 4$
Check candidate	$6/(4 - 1) = 2$

Cancel factors after factoring, and keep the restrictions from the original expression.

Complex numbers

Imaginary unit	$i^2 = -1$
Conjugate of a + bi	$a - bi$
Conjugate product	$(a + bi)(a - bi) = a^2 + b^2$
Example	$(2 + 3i)(2 - 3i) = 13$

The real part of a + bi is a. The imaginary part is the real coefficient b.



Compose, invert and transform

Composition	$(f \text{ composed with } g)(x) = f(g(x))$
Inverse on one-to-one domain	$g(f(x)) = x$
Transform a parent function	$y = A\, f(B(x - h)) + k$

In composition, g(x) must belong to the domain of f.
For B != 0, move right by h and scale horizontal distances by 1/|B|.

Rates and percent models

Distance at a constant rate	$d = rt$
Scale a quantity	$new = old \times (1 + r)$
Find signed change	$r = (new - old)/old$
Example: 80 to 68	$r = -12/80 = -15\%$

For a positive original value, a negative r is a decrease.
Compare units before solving.

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Coordinate geometry

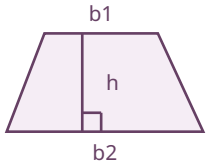
Slope	$m = (y_2 - y_1) / (x_2 - x_1)$
Midpoint	$((x_1 + x_2)/2, (y_1 + y_2)/2)$
Squared distance	$d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$

Take the nonnegative square root to get d. A vertical line has no defined slope.

Area of plane figures

Triangle	$A = \frac{1}{2}bh$
Rectangle or parallelogram	$A = bh$
Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$

Measure h perpendicular to the base.
The trapezoid bases are parallel.
Use square units.



Volume

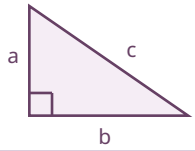
Prism or cylinder	$V = Bh$
Pyramid or cone	$V = Bh / 3$
Sphere	$V = (4/3)\pi r^3$

B is the area of one base. h is perpendicular height.
Use cubic units.

Special triangles and angle rules

45°–45°–90° side ratios	$1 : 1 : \sqrt{2}$
30°–60°–90° side ratios	$1 : \sqrt{3} : 2$
Triangle interior sum	$A + B + C = 180°$
Polygon interior sum	$(n - 2)180°$

In a 30°–60°–90° triangle, the shortest side is opposite 30°.



Right triangle trigonometry

Sine	sin(angle) = opposite / hypotenuse
Cosine	cos(angle) = adjacent / hypotenuse
Tangent	tan(angle) = opposite / adjacent
Side lengths	$a^2 + b^2 = c^2$

Choose the acute angle before naming the legs. In the side rule, c is the hypotenuse.

Center and spread

Mean	sum / count
Median	middle of the ordered data
Range	maximum − minimum

For an even count, the median is the mean of the two middle values.
Example: 1, 4, 7, 8 has median 5.5.

Basic probability

Equally likely outcomes	P(A) = favorable / total
Complement	P(not A) = 1 − P(A)
Example: fair die	P(even) = 3/6 = ½

The favorable count comes from the group named in the question.

Matrix operations and shapes

Addition	add entries for equal shapes
Scalar multiplication	multiply each entry by the scalar
Transpose	rows become columns
Product transpose	$(AB)^T = B^T A^T$

The transpose of an m by n matrix is n by m.