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# Math Formulas on the ACT

[PDF]

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# The ACT Math Test

The ACT Math Test assesses the mathematical skills students are expected to obtain before grade 12 (meaning through advanced algebra and basic trigonometry, but not calculus).

## What to Know

It's the second section of the ACT

- You have a 60-minute time limit

- You will face 60 multiple choice questions

- You get to use a calculator for the whole test (but it must be an approved one)

## What to Study

Geometry formulas for the area, volume, and surface area of basic shapes  
(unlike the SAT, the ACT won't give you these!)

Multiple-choice math test strategies such as “backsolving” the problem using the answer choices, substituting in numbers, and estimating.

Pre-Algebra

- decimals, fractions, integers, positive and negative numbers, square roots, scientific notation, factors, ratios, proportions, percents, charts and graphs of statistics

Elementary Algebra

- exponents, evaluating algebraic expressions through substitution, using variables to express relationships, algebraic operations, and factoring quadratic equations

Intermediate Algebra

quadratic formula, rational and radical expressions, absolute value equations and inequalities, sequences and series, systems of equations, quadratic inequalities, functions, matrices, roots of polynomials, probability, and complex numbers

#### Coordinate Geometry

evaluating points and lines on a graph, polynomials, circles and other curves, graphing inequalities, slope, parallel and perpendicular lines, distance, midpoints, and conics

#### Plane Geometry

angles and relationships among perpendicular and parallel lines, properties of circles, ellipses, rectangles, triangles, parallelograms, trapezoids, transformations, area, volume, three-dimensional geometry

#### Trigonometry (on a very basic level)

trigonometric relations in right angles, values and properties of trig functions, graphing trig functions, using trig identities, solving trig equations

## What Not to Study

Trigonometry beyond the very basics. However, you **should** know:

SOH-CAH-TOA

how to solve right triangles

the unit circle

$\tan \theta = \sin \theta / \cos \theta$

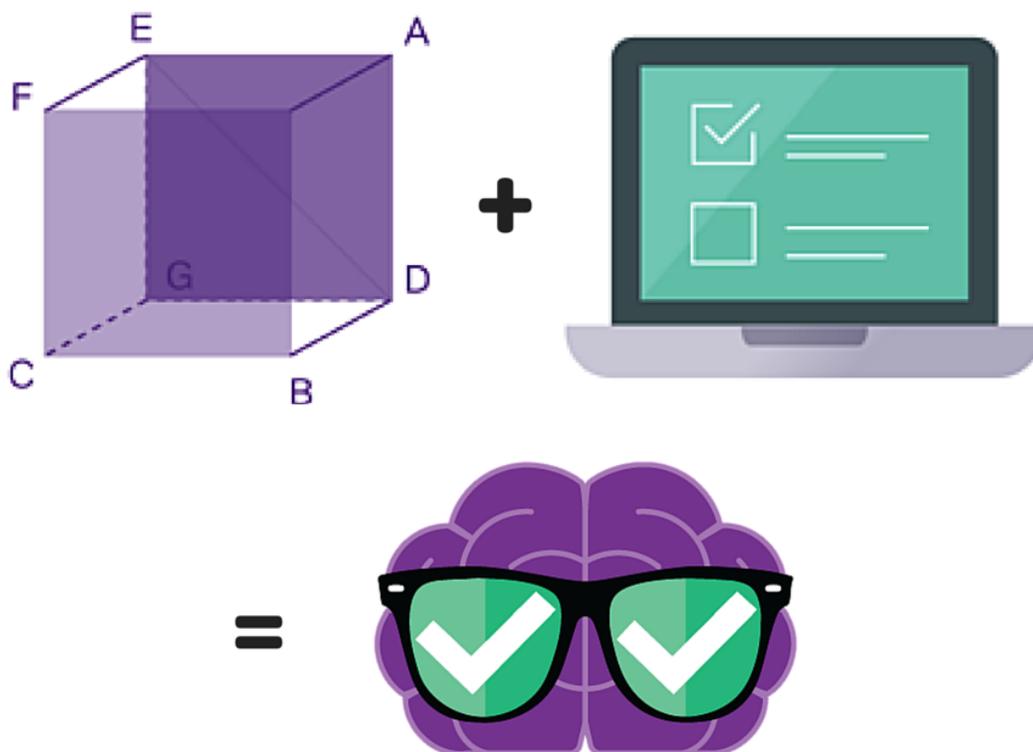
$\sin^2 \theta + \cos^2 \theta = 1$

what sine, cosine, and tangent graphs look like

## Where to Start

With the formulas! Unlike the SAT, the ACT does not give you a list of formulas at the beginning of the math test. That means that you absolutely must memorize some formulas. This PDF contains a list of math formulas the the ACT commonly tests.

**Print this out and carry it with you.** That way, you can study a bit here and there and - before you know it - you'll have all the useful formulas memorized. Brilliant.



# Must Know ACT Math Formulas

## Average

S/T

(Average = Sum/Number of things)

It's also good to think of it as Sum = Average x Number of Things as the test will often give you the average and not the sum.

## Lines

### Slope intercept form

$y = mx + b$  (where  $m$  is the slope and  $b$  is the y-intercept)

### Slope

$$\frac{y_2 - y_1}{x_2 - x_1}$$

Given two points  $(x_1, y_1)$  and  $(x_2, y_2)$

## Quadrilaterals

### Perimeter of a rectangle

$2l + 2w$  (where  $l$  is the length and  $w$  is the width)

### Area of a rectangle

$lw$  (length x width)

### Volume of a box

$lwh$  (length x width x height)

### Surface area of a rectangular solid

$2lw + 2wh + 2lh$

### Diagonal in a rectangular solid

Apply the Pythagorean theorem twice or

$$l^2 + w^2 + h^2 = d^2$$

## Triangles

### Area of a triangle

$\frac{1}{2}bh$  ( $\frac{1}{2}$  base x height)

## Circles and Spheres

### Area of a circle

$\pi r^2$  (where  $r$  is the radius of the circle)

### Circumference of a circle

$2\pi r$  ( $2\pi$  x radius)

## Volume of a sphere

$$\frac{4}{3} r^3$$

## Cylinders:

### Volume of a cylinder

$r^2h$  (where  $r$  is the radius and  $h$  is the height)

## Pythagorean Theorem

$a^2 + b^2 = c^2$  (where  $a$  and  $b$  are the lengths of the sides that form the right angle, and  $c$  is the hypotenuse)

## Trigonometry

### SOHCAHTOA

$\sin x = \text{opposite/hypotenuse}$

$\cos x = \text{adjacent/hypotenuse}$

$\tan x = \text{opposite/adjacent}$

### Tangent Identity

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

### Pythagorean Identity

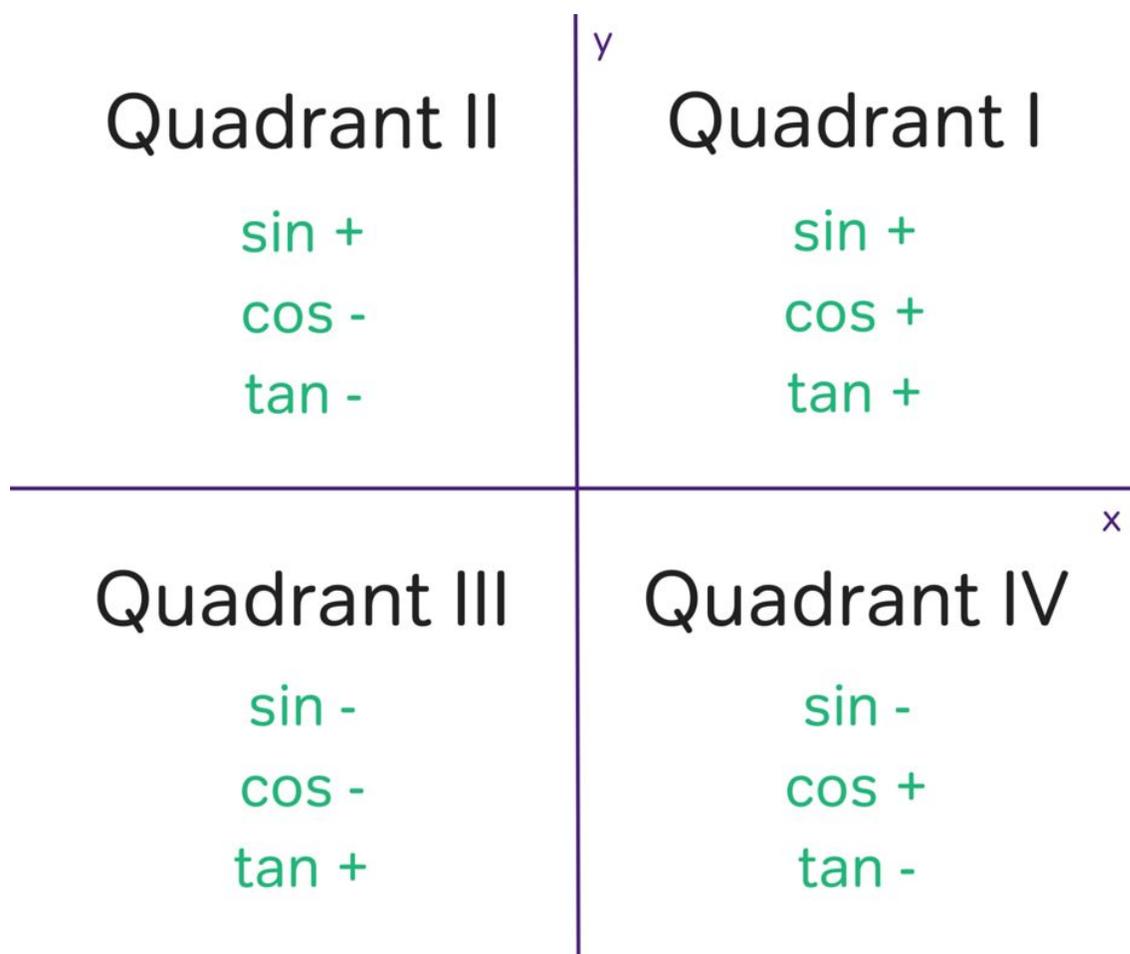
$$\sin^2 \theta + \cos^2 \theta = 1$$

## Reciprocal Identities

$$\sin \theta = \frac{1}{\csc \theta} \quad \cos \theta = \frac{1}{\sec \theta} \quad \tan \theta = \frac{1}{\cot \theta}$$

$$\csc \theta = \frac{1}{\sin \theta} \quad \sec \theta = \frac{1}{\cos \theta} \quad \cot \theta = \frac{1}{\tan \theta}$$

You should also know your quadrants and where sine, cosine, and tangent are positive or negative:



## Probability

### Probability

Number of desired outcomes / number of total outcomes

### Factorials (e.g. 8!)

To find the factorial of any integer, multiple it by every positive integer below it, e.g.:

$$8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

### Fundamental Counting Principle

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$a \cdot b$  [  $a \cdot c \cdot d$  ] (if there are **U** ways for one activity to occur and **V** ways for a second activity to occur, then there are a  $a \cdot b$  ways for both to occur)

Think about when Bob has 4 shirts, 3 pants, and 2 jackets, how many outfits can he make?  $4 \times 3 \times 2 = 24$

## Geometry Formulas that are Good to Know

### Equation of a circle

$$(x - h)^2 + (y - k)^2 = r^2 \text{ (where the center of the circle is (h,k) )}$$

### Volume of a cone

$$V = \frac{1}{3} \pi r^2 h$$

### Volume of a pyramid

$$V = \frac{1}{3} Bh \text{ (where } B = \text{base area and } h = \text{height)}$$

## Arithmetic sequences

$$t_n = t_1 + d(n - 1)$$

## Geometric sequences

$$t_n = t_1 \times r^{n-1}$$

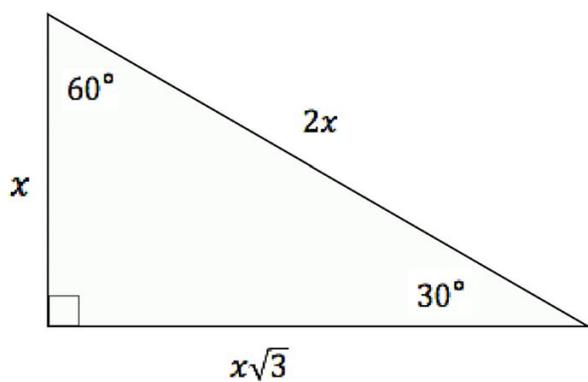
## Area of a trapezoid

$$\frac{b_1 + b_2}{2} h$$

(Add the bases, divide by two, then multiply by the height.)

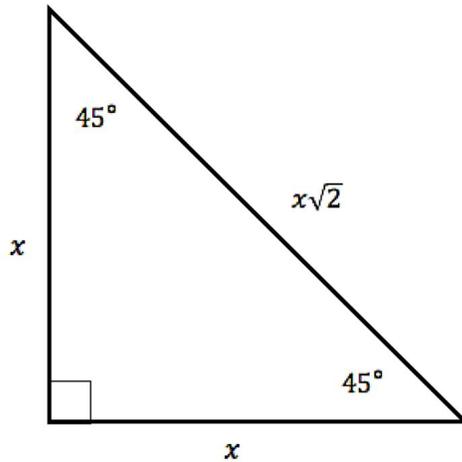
## 30-60-90 Triangle Ratio

$$1 : \sqrt{3} : 2$$



## 45-45-90 Triangle Ratio

$$1:1:\sqrt{2}$$



## Logarithms

### Definition

$$\text{If } \log_a b = c \text{ then } a^c = b$$

### Change of base rule

$$\log_a b = \left( \frac{\log b}{\log a} \right)$$

## Simple Interest

$$I = PRT$$

Where  $I$  = Interest,  $P$  = principal (starting value),  $R$  = rate each year, and  $T$  = time in years

## Exponential Growth Formula

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

Where P = principal (starting value), r = rate of growth, n = number of months, t = time in years, and A = new amount.

## Bonus Formulas to Know

### Quadratic Equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Often, you will be better off applying a strategy such as backsolving to solve a complicated algebra problem, but if you are comfortable with the quadratic equation, keep it in the back of your mind.

### Permutations

$$\frac{n!}{(n-r)!}$$

### Combinations

$$\frac{n!}{r!(n-r)!}$$

