

ASVAB MATH CRAM SHEET

MATHEMATICAL SYMBOLS

Phrase	Symbol
equal, is, was, will be, has, costs, gets to, is the same as, becomes	=
times, of, multiplied by, product of, twice, doubles, halves, triples	×
divided by, per, ratio of/to, out of	÷
plus, added to, sum, combined, and, more than, totals of	+
subtracted from, less than, decreased by, minus, difference between	-
what, how much, original value, how many, a number, a variable	$x, n, \text{etc.}$


Lesser Known Symbols

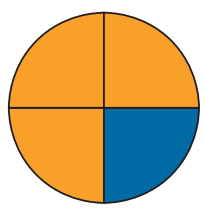
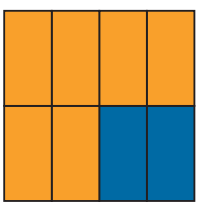
The Golden Ratio: ϕ
 Infinity: ∞
 Euler's Number: e
 Universal Quantifier: \forall
 Membership Sign: \in

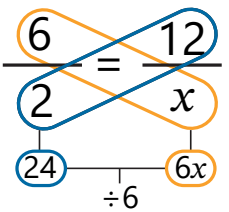
RATIOS AND PROPORTIONS

Ratios of Two Items

Items	Ratio	Fraction	Written	Simplified Ratio
6 oranges, 8 apples	6:8	$\frac{6}{8}$	6 oranges to 8 apples	3:4
8 trains, 14 cars	8:14	$\frac{8}{14}$	8 trains to 14 cars	4:7
4 feet, 3 feet	4:3	$\frac{4}{3}$	4 feet to 3 feet	4:3

Ratios				
	Part to part		Part to whole	
	2:1	1:2	2:3	1:3
	$\frac{2}{1}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{3}$
	2 to 1	1 to 2	2 to 3	1 to 3

Proportions				
	3:4	=	6:8	
	3:4	::	6:8	
	3 is to 4	as	6 is to 8	

Calculating Proportions
$\frac{6}{2} = \frac{12}{?}$

$\frac{24}{6} = x$
$\frac{6}{2} = \frac{12}{4}$

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FRACTIONS

Proper Fraction

$\frac{1}{8}$ Numerator is less than the denominator

Improper Fraction

$\frac{8}{3}$ Numerator is greater than the denominator

Mixed Number

$3\frac{1}{8}$ Whole number and proper fraction together

Add or subtract fractions with different denominators

1. Change to equivalent fractions with common denominators using a scale factor
2. Add or subtract following the rules for fractions with the same denominators

$$\frac{A}{B} + \frac{C}{D} = \frac{AD}{BD} + \frac{BC}{BD} = \frac{AD + BC}{BD}$$

$$\frac{A}{B} - \frac{C}{D} = \frac{AD}{BD} - \frac{BC}{BD} = \frac{AD - BC}{BD}$$

Add or subtract fractions with the same denominators

1. Add or subtract the numerators
2. Keep the denominator the same
3. Simplify if possible

$$\frac{A}{B} + \frac{C}{B} = \frac{A + C}{B}$$

$$\frac{A}{B} - \frac{C}{B} = \frac{A - C}{B}$$

Multiply fractions

1. Multiply the numerators
2. Multiply the denominators
3. Simplify

$$\frac{A}{B} \times \frac{C}{D} = \frac{A \times C}{B \times D}$$

Divide fractions

1. Keep the first fraction as is
2. Change from division to multiplication
3. Flip the second fraction to its reciprocal
4. Follow multiplication of fractions rules

$$\frac{A}{B} \div \frac{C}{D} = \frac{A}{B} \times \frac{D}{C} = \frac{A \times D}{B \times C}$$

Convert Mixed Number

$$4\frac{2}{8} = \frac{(4 \times 8) + 2}{8} = \frac{34}{8} = \frac{17}{4}$$

Keep the original denominator when converting a mixed number to an improper fraction.

Simplify if needed.

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PERCENTS, FRACTIONS, AND DECIMALS

Percent Increase

$$\left(\frac{\text{new value} - \text{original value}}{\text{original value}} \right) \times 100$$

Percent Decrease

$$\left(\frac{\text{original value} - \text{new value}}{\text{original value}} \right) \times 100$$

Percent to Fraction/Decimal

$$\frac{\text{Percentage}}{100}$$

Fraction to Decimal

$$\frac{\text{numerator}}{\text{denominator}}$$

Fraction to Percent

$$\left(\frac{\text{numerator}}{\text{denominator}} \right) \times 100$$

Decimal to Fraction

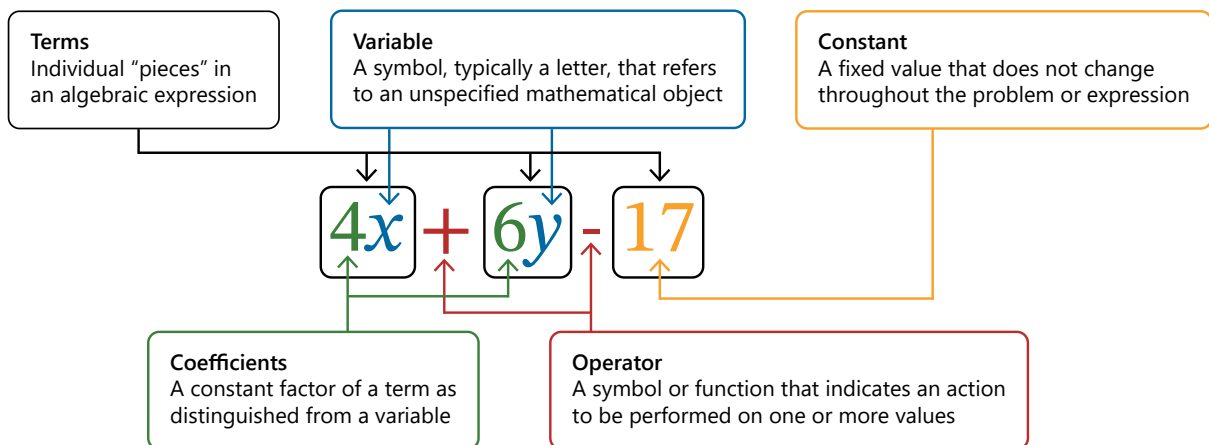
$$\frac{\text{decimal}}{1} \times \frac{10^n}{10^n}$$

n is the number of places behind the decimal point

Decimal to Percent

$$\text{decimal} \times 100$$

ALGEBRAIC EXPRESSION



PEMDAS

PEMDAS helps to remember that we start simplifying the expression from left to right, just like we read "PEMDAS" from left to right.

Equation

$$6 + 2 \times (5 - 1)^2$$

Parentheses

$$()$$

$$6 + 2 \times (5 - 1)^2 \rightarrow 6 + 2 \times 4^2$$

Exponents

$$x^2$$

$$6 + 2 \times 4^2 \rightarrow 6 + 2 \times 16$$

Multiplication/Division

$$\times \div$$

$$6 + 2 \times 16 \rightarrow 6 + 32$$

Solution

$$38$$

Addition/Subtraction

$$+ -$$

$$6 + 32 \rightarrow 38$$

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RULES OF EXPONENTS

Property	Description
$a^1 = a$	Any number to the power of 1 is equal to itself
$1^n = 1$	The number 1 raised to any power is equal to 1
$a^0 = 1$	Any number raised to the power of 0 is equal to 1
$a^n \times a^m = a^{n+m}$	Add exponents to multiply powers of the same base number
$a^n \div a^m = a^{n-m}$	Subtract exponents to divide powers of the same base number
$(a^n)^m = a^{n \times m}$	When a power is raised to a power, the exponents are multiplied
$(a \times b)^n = a^n \times b^n$	Multiplication operations inside parentheses can be raised to a power
$(a \div b)^n = a^n \div b^n$	Division operations inside parentheses can be raised to a power
$a^{-n} = 1/a^n$	A negative exponent is the same as the reciprocal of a positive exponent

SCIENTIFIC NOTATION

The coefficient must be greater than or equal to 1 and less than 10

Scientific Notation	Moving The Decimal	New Number
1×10^0	1	1
1.3×10^1	1.3	13
1.34×10^2	1.34	134
7.38×10^9	7.380000000	7,380,000,000
1×10^{-1}	01.	0.1
1×10^{-2}	001.	0.01
5.5×10^{-7}	00000005.5	0.00000055

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FOIL METHOD

Using the FOIL method on binomials: $(x + 2)$ and $(x - 3)$

F	Multiply the first terms of each binomial	$(x + 2)(x + (-3))$	→	$(x)(x)$	$= x^2$
O	Multiply the outer terms	$(x + 2)(x + (-3))$	→	$(x)(-3)$	$= -3x$
I	Multiply the inner terms	$(x + 2)(x + (-3))$	→	$(2)(x)$	$= 2x$
L	Multiply the last terms of each binomial	$(x + 2)(x + (-3))$	→	$(2)(-3)$	$= -6$

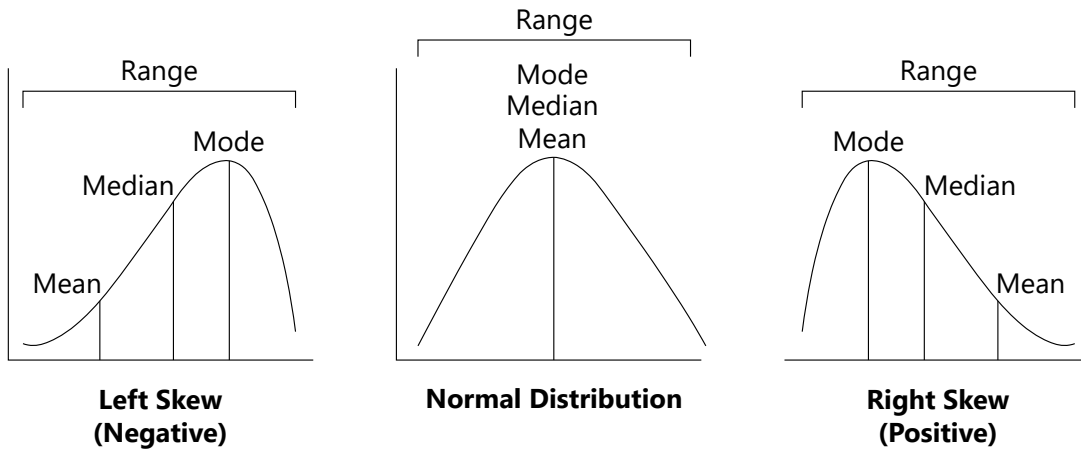
STATISTICS

Mean
 $\frac{\text{sum of all items}}{\text{total number of items}}$

Range (Spread)
 Distance between
 smallest and largest item

Mode
 Most/common item

Median
 Middle item when ordered
 from least to greatest



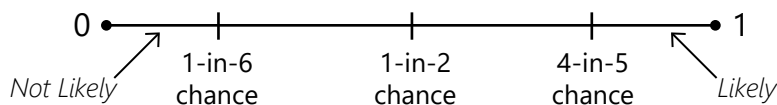
PROBABILITY

$$P(A) = \frac{\text{Number of acceptable outcomes}}{\text{Number of possible outcomes}}$$

Impossible Event
 $P(A) = 0$

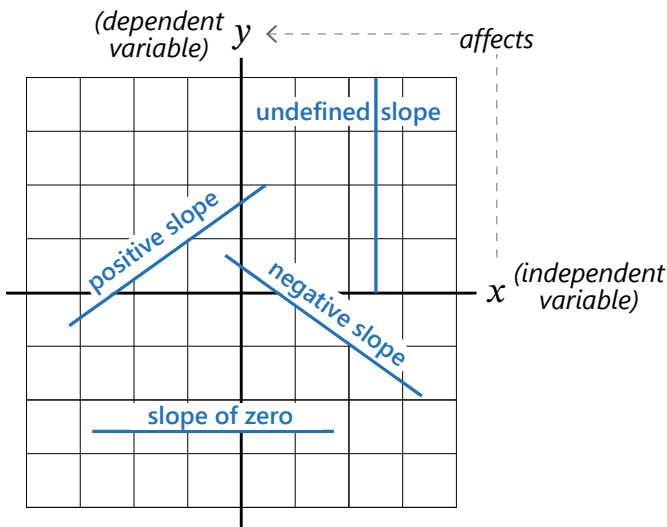
The Probability of an Event
 $0 \leq P(A) \leq 1$

Certain Event
 If $P(A) = 1$



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SLOPE AND LINEAR EQUATIONS



Slope

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$$

Slope Intercept Form

$$y = mx + b$$

m = slope
 b = y-intercept

Distance Formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Point-Slope Form

$$y - y_1 = m(x - x_1)$$

m = slope
 (x_1, y_1) = point coordinates

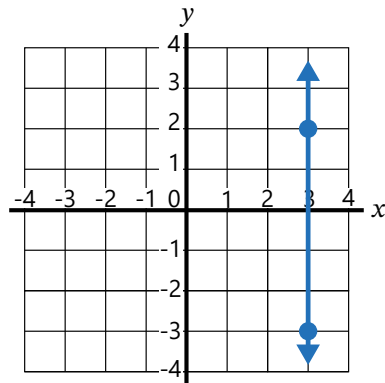
Midpoint Formula

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Undefined Slope

$$m = \frac{-3 - 2}{3 - 3} = \frac{-5}{0}$$

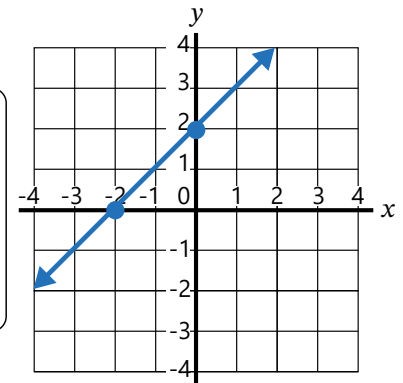
$m = \text{undefined}$



Positive Slope

$$m = \frac{2 - 0}{0 - (-2)} = \frac{2}{2}$$

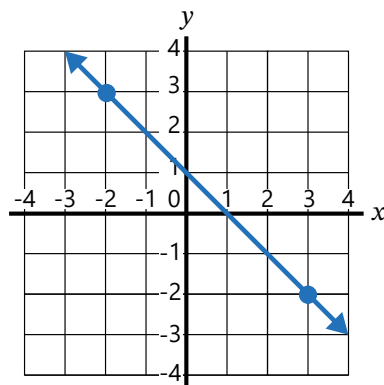
$m = 1$



Negative Slope

$$m = \frac{-2 - 3}{3 - (-2)} = \frac{-5}{5}$$

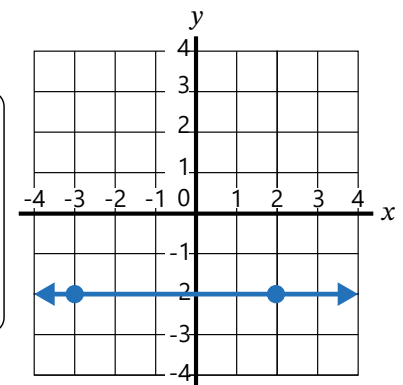
$m = -1$



Slope of Zero

$$m = \frac{-2 - (-2)}{-3 - 2} = \frac{0}{-5}$$

$m = 0$

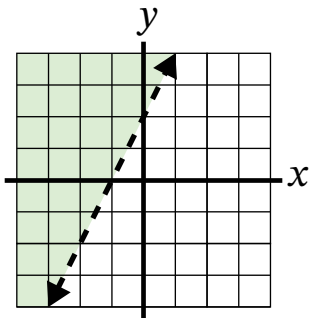


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GRAPHING LINEAR EQUATIONS

Greater Than

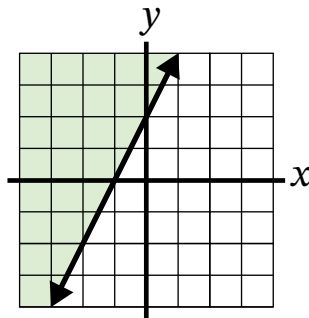
$>$



$$y > 2x + 2$$

Greater Than or Equal To

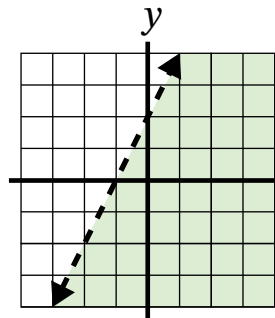
\geq



$$y \geq 2x + 2$$

Less Than

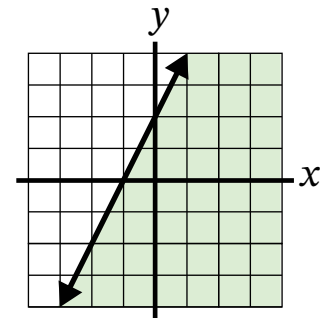
$<$



$$y < 2x + 2$$

Less Than or Equal To

\leq

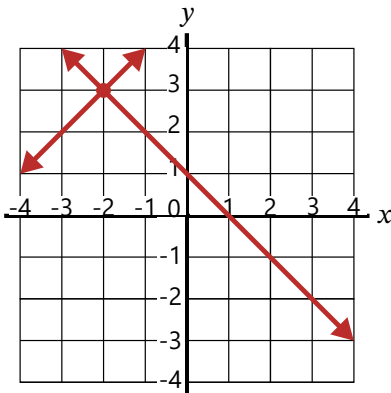


$$y \leq 2x + 2$$

SYSTEMS OF EQUATIONS

One Solution

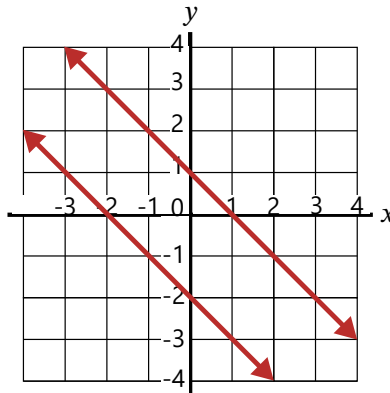
$$\begin{aligned} y &= -x + 1 \\ y &= x + 5 \end{aligned}$$



Consistent Independent

No Solutions

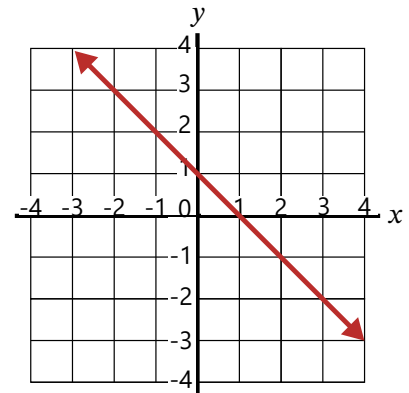
$$\begin{aligned} y &= -x + 1 \\ y &= -x - 2 \end{aligned}$$



Inconsistent

Infinitely Many Solutions

$$\begin{aligned} y &= -x + 1 \\ 3y &= -3x + 3 \end{aligned}$$

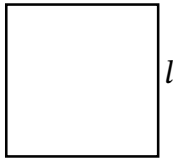


Consistent Dependent

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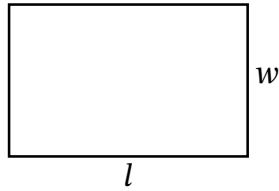
AREA

Square



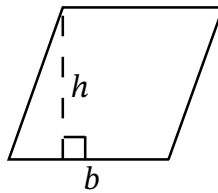
$$A = l^2$$

Rectangle



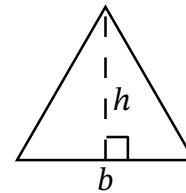
$$A = lw$$

Parallelogram



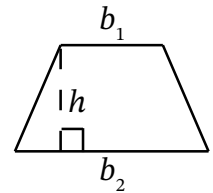
$$A = bh$$

Triangle



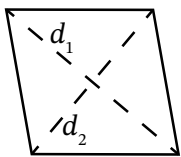
$$A = \frac{1}{2}bh$$

Trapezoid



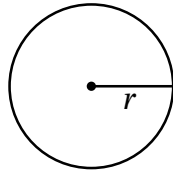
$$A = \frac{1}{2}(b_1 + b_2)h$$

Rhombus



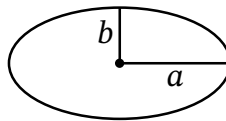
$$A = \frac{1}{2}(d_1 \times d_2)$$

Circle



$$A = \pi r^2$$

Ellipse



$$A = \pi ab$$

Perimeter

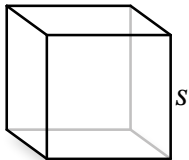
The sum of all sides of a shape

Circumference

The distance around a circle ($C=2\pi r$)

VOLUME AND SURFACE AREA

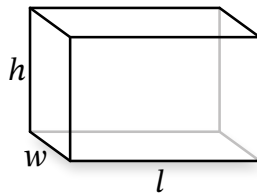
Cube



$$V = s^3$$

$$SA = 6s^2$$

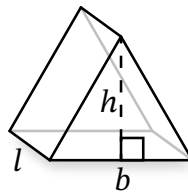
Rectangular Prism



$$V = l \times w \times h$$

$$SA = 2(lw + lh + hw)$$

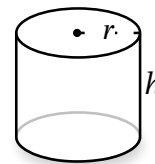
Triangular Prism



$$V = \frac{b \times h_1 \times l}{2}$$

$$SA = lsa + 2(\text{area of base})$$

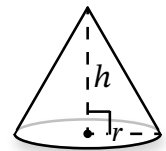
Cylinder



$$V = \pi r^2 h$$

$$SA = 2\pi r(r + h)$$

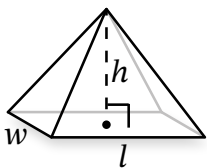
Cone



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

$$SA = \pi rs + \pi r^2$$

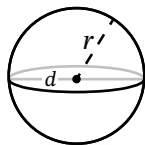
Rectangular Pyramid



$$V = \frac{l \times w \times h}{3}$$

$$SA = lsa + \text{area of base}$$

Sphere



$$V = \frac{4}{3}\pi r^3$$

$$SA = 4\pi r^2$$

LSA (Lateral Surface Area)

The sides of a three-dimensional shape, excluding any bases

Base

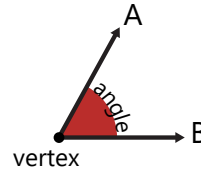
The face of a shape perpendicular to the direction height is measured

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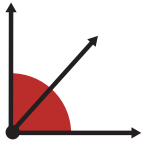
ANGLES

An angle is formed when two lines or line segments meet at a point

A vertex is the point at which two segments or rays meet to form an angle.

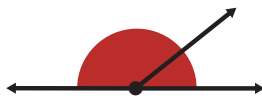


Complementary



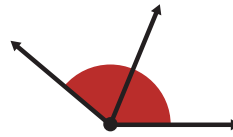
Two angles whose sum is exactly 90°

Supplementary



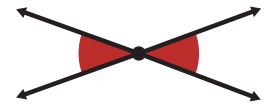
Two angles whose sum is exactly 180°

Adjacent



Two angles that have the same vertex and share a side

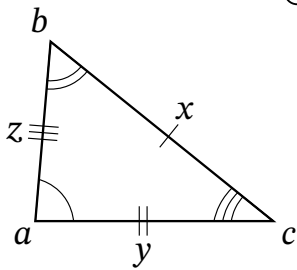
Vertical



Angles that are not adjacent due to sharing a vertex and have no common side

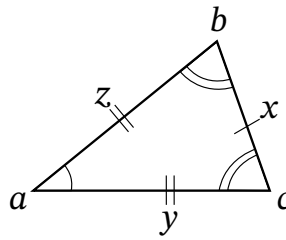
TRIANGLES

The sum of the interior angles of any triangle is always 180 degrees.



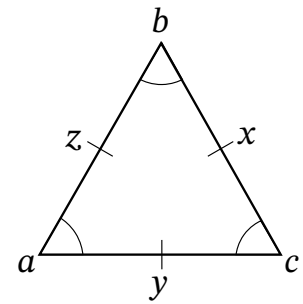
Scalene Triangle

No equal side lengths or angles



Isosceles Triangle

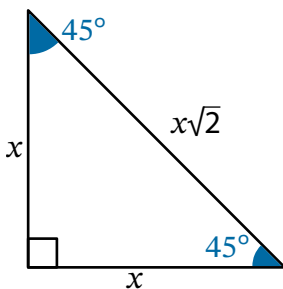
Two equal side lengths and angles



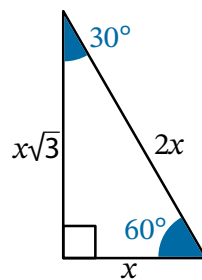
Equilateral Triangle

Three equal side lengths and angles

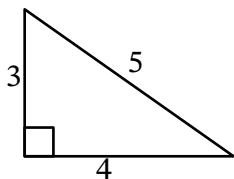
Special Right Triangles



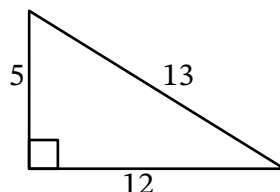
45-45-90



30-60-90



3-4-5



5-12-13

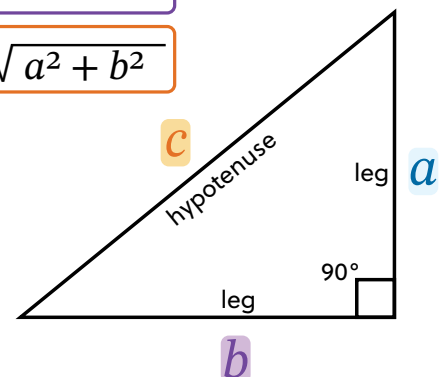
Pythagorean Theorem

$$c^2 = a^2 + b^2$$

$$a = \sqrt{c^2 - b^2}$$

$$b = \sqrt{c^2 - a^2}$$

$$c = \sqrt{a^2 + b^2}$$



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