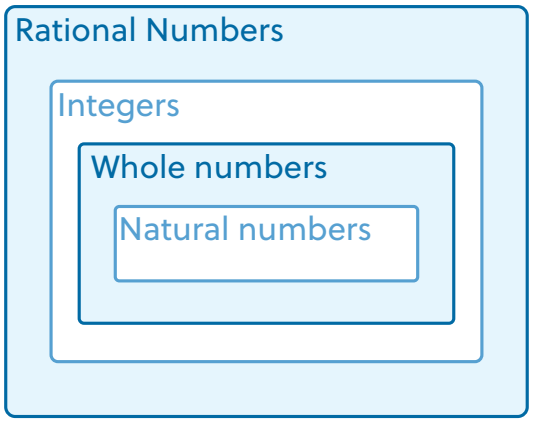
GED® MATH CRAM SHEET

NUMBER CLASSIFICATION

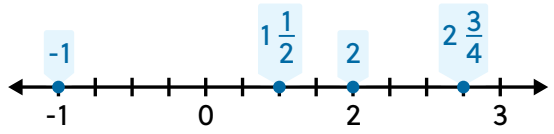


Each number system is a subset another.

A rational number is also a real number, a real number is also a complex number, etc.

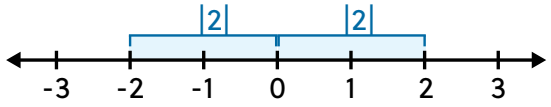
Number Class	Definition	Examples
Natural numbers	The number 1 or any number obtained by adding 1 to it one or more times.	1, 2, 3, 4, 5, ...
Whole Numbers	Whole numbers do not include fractions or decimal parts and is a positive integer or zero.	0, 1, 2, 3, 4, 5, ...
Integers	Any whole number or its opposite.	..., −5, −4, −3, −2, −1, 0, 1, 2, 3, 4, 5, ...
Rational numbers	A number can that be expressed as a ratio or fraction.	• 2/10.6 • 3/10 • 2.957
Real Numbers	A number that has no imaginary part. All real numbers can be located on a number line.	• −92 • 5/9 • √2
Complex Numbers	$a + bi$ where a and b are real numbers and i (imaginary number) is a formal square root of −1 (i= √-1, i^2 = -1)	• -1 + 2i • 7 - 9i • -6i

NUMBER LINES



Standard Number Line
Number lines may have a point for zero and may show negative numbers on the left side of the line.

Any positive numbers are placed on the right side of the line.



Absolute Value
Absolute value is the distance away from zero a number is on the number line. It is always positive and is written $|x|$.

For example, the absolute value of 2 is written as |2|.

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, etc.

Lesser Known Symbols

The Golden Ratio: φ
Inifinity: ∞
Euler's Number: e
Universal Quantifier: ∀
Membership Sign: ∈

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FACTORS

What is a factor?

A whole number is a factor of another whole number if it divides it evenly.

Greatest common factor (GCF)

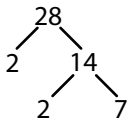
The greatest common factor of two or more whole numbers is the largest number that is a factor of them all.

7: 1, 7

28: 1, 2, 7, 14

GCF: 7

Factor Tree



MULTIPLES

What is a multiple?

A whole number is a multiple if it is the result of multiplying another whole number by an integer.

Least Common Multiple (LCM)

The least common multiple of two or more whole numbers is the smallest number that is a multiple of them all.

3: 3, 6, 9, 12, 15, 18, 21, 24

7: 7, 14, 21, 28, 35, 42, 49, 56

LCM: 21

Multiples of 3

×	1	2	3	4	5	6	7	8	multiplication
1	1	2	3	4	5	6	7	8	3 × 1 = 3
2	2	4	6	8	10	12	14	16	3 × 2 = 6
3	3	6	9	12	15	18	21	24	3 × 3 = 9
4	4	8	12	16	20	24	28	32	3 × 4 = 12
5	5	10	15	20	25	30	35	40	3 × 5 = 15
6	6	12	18	24	30	36	42	48	3 × 6 = 18
7	7	14	21	28	35	42	49	56	3 × 7 = 21
8	8	16	24	32	40	48	56	64	3 × 8 = 24

Multiples of 7

×	1	2	3	4	5	6	7	8	multiplication
1	1	2	3	4	5	6	7	8	7 × 1 = 7
2	2	4	6	8	10	12	14	16	7 × 2 = 14
3	3	6	9	12	15	18	21	24	7 × 3 = 21
4	4	8	12	16	20	24	28	32	7 × 4 = 28
5	5	10	15	20	25	30	35	40	7 × 5 = 35
6	6	12	18	24	30	36	42	48	7 × 6 = 42
7	7	14	21	28	35	42	49	56	7 × 7 = 49
8	8	16	24	32	40	48	56	64	7 × 8 = 56

RATIOS

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

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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 . 3 4	134
7.38×10^{9}	7 . 3 8 0 0 0 0 0 0 0	7,380,000,000
1×10^{-1}	0 1 .	0.1
1×10^{-2}	0 0 1 .	0.01
5.5×10^{-7}	0 0 0 0 0 0 0 5 . 5	0.00000055

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

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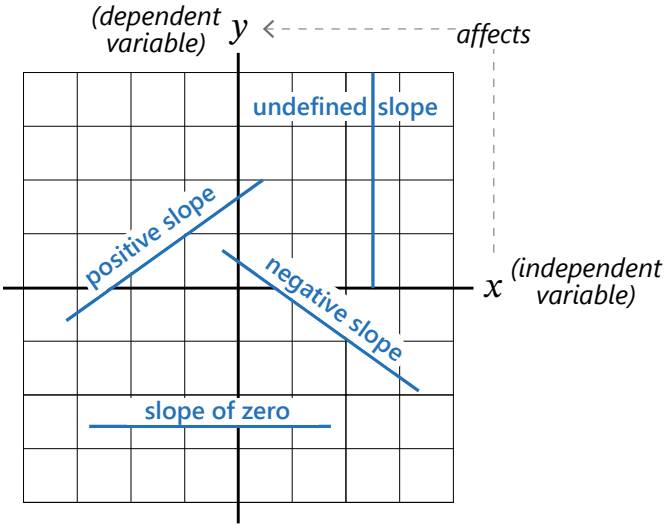
SLOPE AND LINEAR EQUATIONS



Slope

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

Slope Intercept Form

$y = mx + b$

m = slope
b = y-intercept

Distance Formula

$d = (x_2 - x_1)^2 + (y_2 - y_1)^2$

Point-Slope Form

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

m = slope
(x_1, y_1) = point coordinates

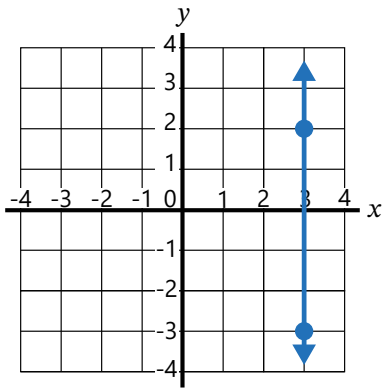
Midpoint Formula

$\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}$

Undefined Slope

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

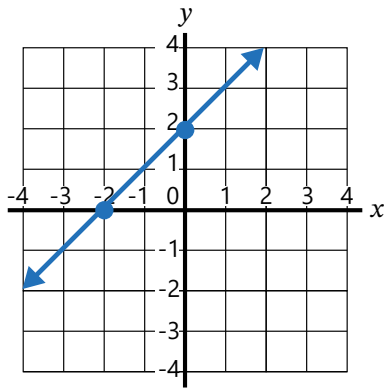
m = undefined



Positive Slope

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

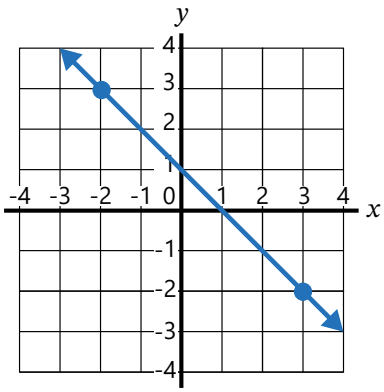
m = 1



Negative Slope

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

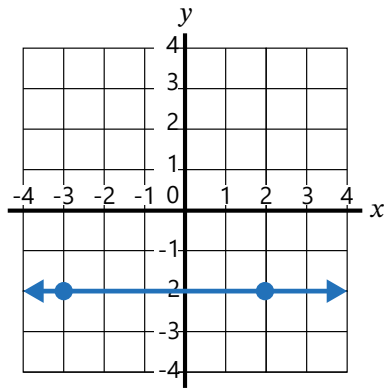
m = -1



Slope of Zero

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

m = 0



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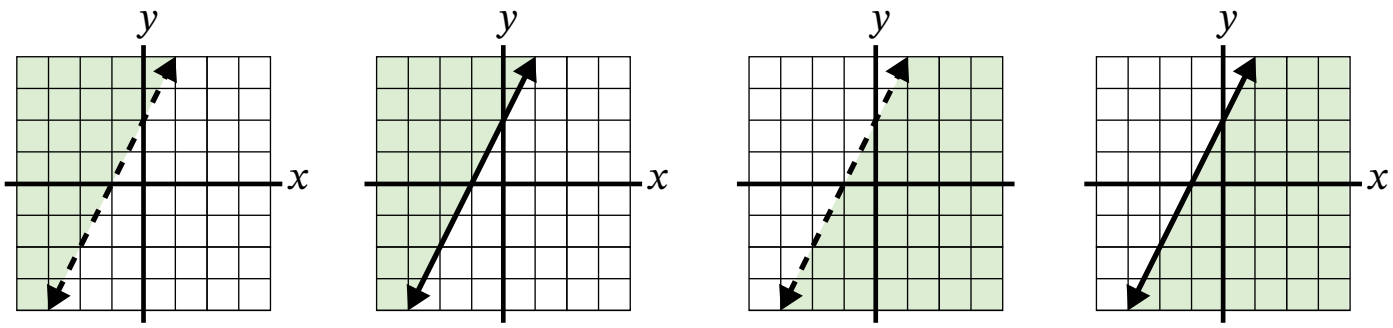
GRAPHING LINEAR EQUATIONS

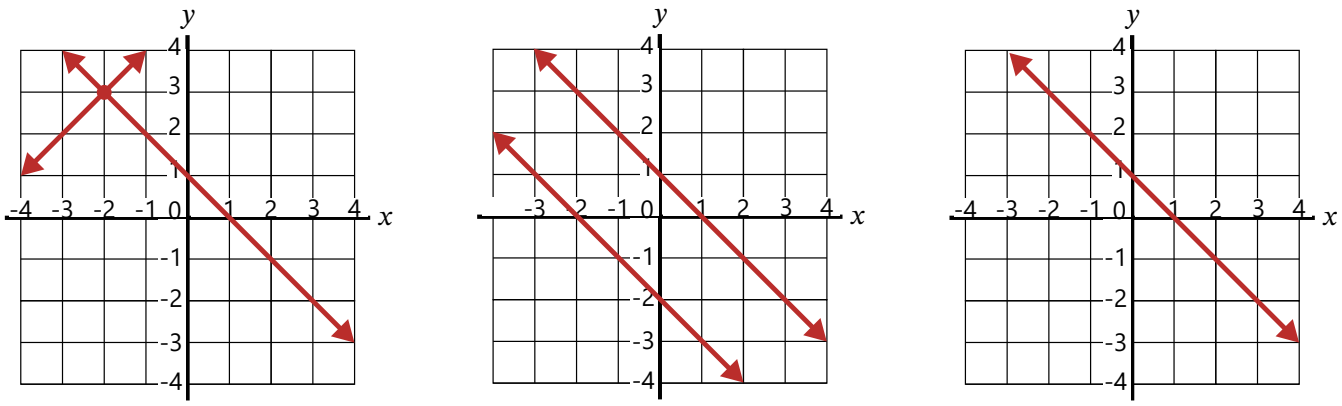
Greater Than	Greater Than or Equal To	Less Than	Less Than or Equal To
$>$	$\geq$	$<$	$\leq$



$y > 2x + 2$	$y \geq 2x + 2$	$y < 2x + 2$	$y \leq 2x + 2$

SYSTEMS OF EQUATIONS

One Solution	No Solutions	Infinitely Many Solutions
$y = -x + 1$ $y = x + 5$	$y = -x + 1$ $y = -x - 2$	$y = -x + 1$ $3y = -3x + 3$



Consistent Independent | *Inconsistent* | *Consistent Dependent*

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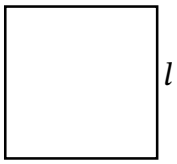
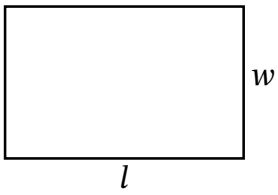
AREA

Square



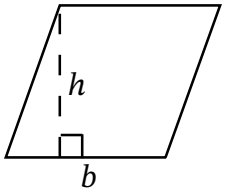
$A = l^2$

Rectangle



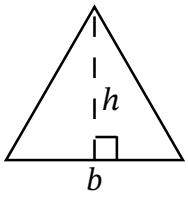
$A = lw$

Parallelogram



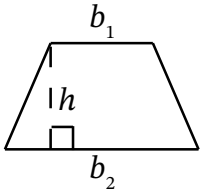
$A = bh$

Triangle



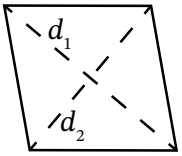
$A = \frac{1}{2}bh$

Trapezoid



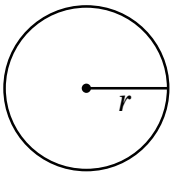
$A = \frac{1}{2}(b_1 + b_2)h$

Rhombus



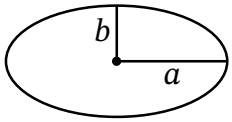
$A = \frac{1}{2}(d_1 \times d_2)$

Circle



$A = \pi r^2$

Ellipse



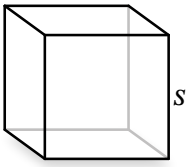
$A = \pi ab$

Perimeter
The sum of all sides of a shape

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

VOLUME AND SURFACE AREA

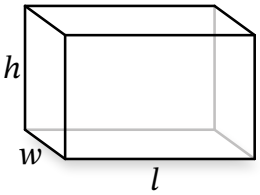
Cube



$V = s^3$

$SA = 6s^2$

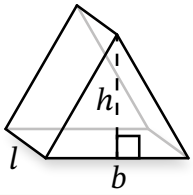
Rectangular Prism



$V = l \times w \times h$

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

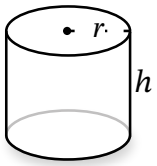
Triangular Prism



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

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

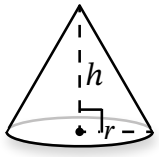
Cylinder



$V = \pi r^2 h$

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

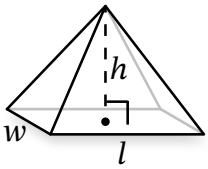
Cone



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

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

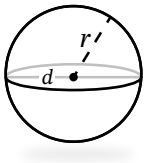
Rectangular Pyramid



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

$SA = lsa + area\ of\ base$

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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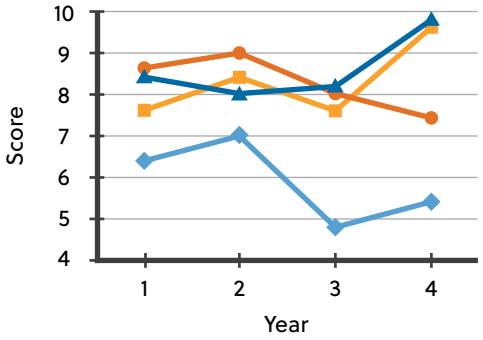
CHARTS

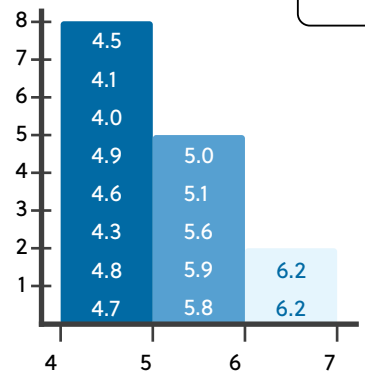
Line Graph

Shows trends in data collected over time



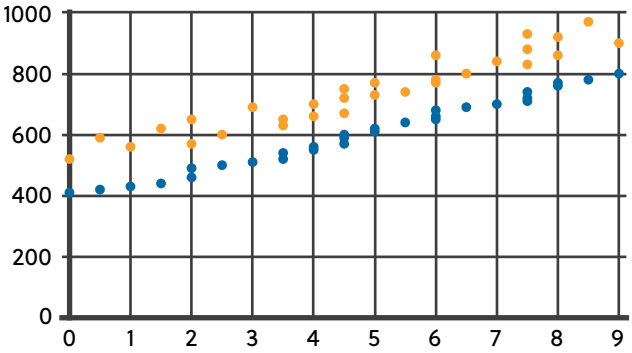
Histogram

Shows distrubtion of data collected over time.



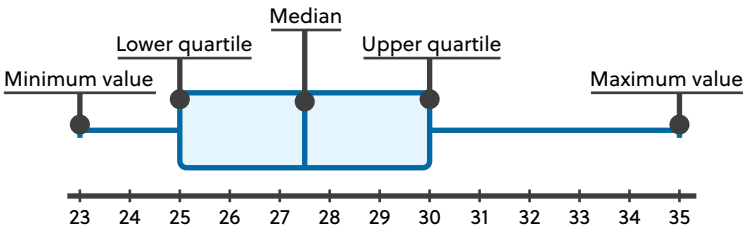
Scatter Plot

Shows relationship between two variables



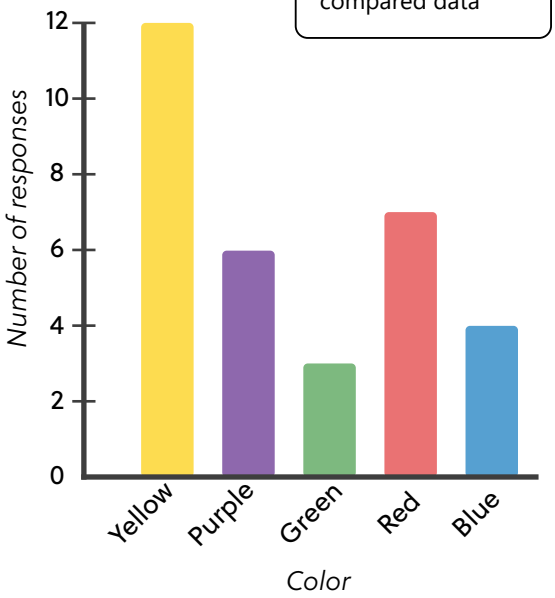
Box Plot

Shows statistical distribution



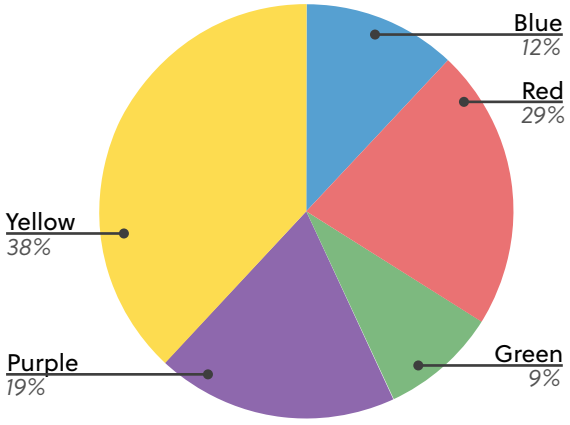
Bar Chart

Shows categorically compared data



Pie Chart

Shows proportional parts of data collected



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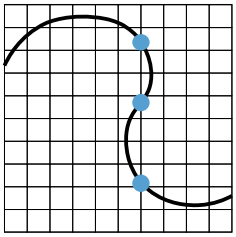
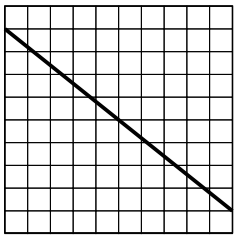
FUNCTIONS

Function	Formula
Constant Functions	$f(x) = a$
The Identity Function	$f(x) = x$
Linear Functions	$f(x) = ax + b$
The Squaring Function	$f(x) = x^2$
Quadratic Functions	$f(x) = ax^2 + bx + c$
Polynomial Functions	$f(x) = a^n x^n + a^{n-1}x^{n-1} + \cdots + a_2x^2 + a_1x + a_0$
Rational Functions	$f(x) = P(x)/Q(x)$
The Square Root Function	$f(x) = \sqrt{x}$

A function is a relation between a set of inputs and a set of outputs where each input is related to exactly one output.



Not a function



Function

QUADRATIC EQUATION

An equation where the variable x represents an unknown number, and a, b, and c represent known numbers, where $a \neq 0$

Quadratic Formula: Standard Form

$$ax^2 + bx + c = 0$$

Quadratic Formula: Equivalent Form

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

POLYNOMIALS

Polynomials are mathematical expressions consisting of variables, coefficients, and constants combined using addition, subtraction, and multiplication.

Polynomial Type	Number of Terms	Example
Monomial	One term	$5x^3$
Binomial	Two terms	$x + 2$
Trinomial	Three terms	$x^2 + 3x - 4$

PERMUTATION AND COMBINATION

n = the number of objects available
r = the number of objects selected

Permutation
An arrangement of a specific number of a set of objects in a specific order.

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

Combination
No restrictions regarding the order of the elements.

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

$$_nC_r = \frac{_nP_r}{r!}$$

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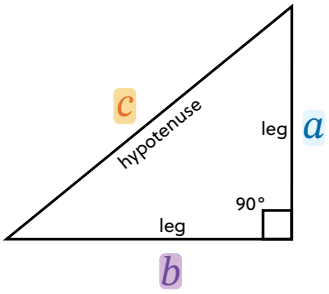
PYTHAGOREAN THEOREM



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

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

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

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

OTHER FORMULAS

Formula Name	Formula
Simple Interest	$I = Prt$ (I = interest, P = principal, r = rate, t = time)
Distance Formula	$d = rt$ (d = distance, r = rate, t = time)
Total Cost	total cost = (units) × (unit price)

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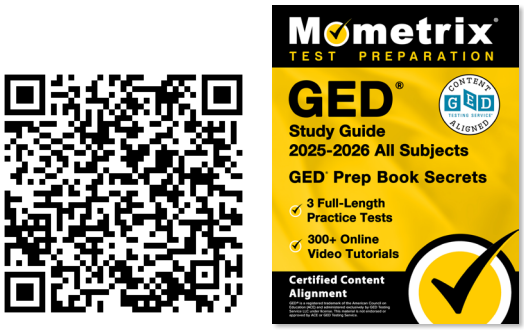

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