Algebra Formula Reference

Exponents:

$x^0 = 1$ $\qquad x^{-m} = \frac{1}{x^m}$

$x^m \bullet x^n = x^{m+n}$ $\qquad (x^n)^m = x^{n \bullet m}$

$\frac{x^m}{x^n} = x^{m-n}$ $\qquad \left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$

$(xy)^n = x^n \bullet y^n$

Complex Numbers:

$\sqrt{-1} = i$ $\qquad \sqrt{-a} = i\sqrt{a}; a \geq 0$

$i^2 = -1$ $\qquad i^{14} = i^2 = -1$ divide exponent by 4, use remainder, solve.

$(a+bi)$ conjugate $(a-bi)$

$(a+bi)(a-bi) = a^2 + b^2$

$|a+bi| = \sqrt{a^2+b^2}$ absolute value=magnitude

Logarithms

$y = \log_b x \Leftrightarrow x = b^y$

$\ln x = \log_e x$ natural log

$e = 2.71828\ldots$

$\log x = \log_{10} x$ common log

Change of base formula:

$\log_b a = \frac{\log a}{\log b}$

Properties of Logs:

$\log_b b = 1$ $\qquad \log_b 1 = 0$

$\log_b (mn) = \log_b m + \log_b n$

$\log_b \frac{m}{n} = \log_b m - \log_b n$

$\log_b (m^r) = r \log_b m$

Domain: $\log_b x$ is $x > 0$

Factoring:

Look to see if there is a GCF (greatest common factor) first. $ab + ac = a(b+c)$

$x^2 - a^2 = (x-a)(x+a)$

$(x+a)^2 = x^2 + 2ax + a^2$

$(x-a)^2 = x^2 - 2ax + a^2$

Factor by Grouping:

$x^3 + 2x^2 - 3x - 6$

$(x^3 + 2x^2) - (3x + 6)$ group

$x^2(x+2) - 3(x+2)$ factor each

$(x^2 - 3)(x+2)$ factor

Exponentials $e^x = \exp(x)$

$b^x = b^y \rightarrow x = y$ $(b > 0$ and $b \neq 1)$

If the bases are the same, set the exponents equal and solve.

Solving exponential equations:

1. Isolate exponential expression.
2. Take *log* or *ln* of both sides.
3. Solve for the variable.

$\ln(x)$ and e^x are inverse functions

$\ln e^x = x$ $\qquad e^{\ln x} = x$

$\ln e = 1$ $\qquad e^{\ln 4} = 4$

$e^{2\ln 3} = e^{\ln 3^2} = 9$

Quadratic Equations: $ax^2 + bx + c = 0$ (Set = 0.)

Solve by factoring, completing the square, quadratic formula.

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

$b^2 - 4ac > 0$ two real unequal roots

$b^2 - 4ac = 0$ repeated real roots

$b^2 - 4ac < 0$ two complex roots

Square root property: If $x^2 = m$, then $x = \pm\sqrt{m}$

Completing the square: $x^2 - 2x - 5 = 0$

1. If other than one, divide by coefficient of x^2
2. Move constant term to other side $x^2 - 2x = 5$
3. Take half of coefficient of x, square it, add to both sides

$$x^2 - 2x + \boxed{1} = 5 + \boxed{1}$$

4. Factor perfect square on left side. $(x-1)^2 = 6$
5. Use square root property to solve and get two answers. $x = 1 \pm \sqrt{6}$

Sum of roots: $r_1 + r_2 = -\frac{b}{a}$ **Product of roots:** $r_1 r_2 = \frac{c}{a}$

Variation: always involves the constant of proportionality, k. Find k, and then proceed.

Direct variation: $y = kx$

Inverse variation: $y = \frac{k}{x}$

Varies jointly: $y = kxj$

Combo: Sales vary directly with advertising and inversely with candy cost. $y = \frac{ka}{c}$

Absolute Value: $|a| > 0$

$$|a| = \begin{cases} a; & a \geq 0 \\ -a; & a < 0 \end{cases}$$

$|m| = b \Rightarrow m = -b$ or $m = b$

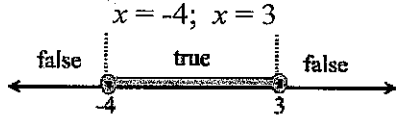
$|m| < b \Rightarrow -b < m < b$

$|m| > b \Rightarrow b > m$ or $b <= m$

Inequalities: $x^2 + x - 12 \leq 0$ Change to =, factor, locate critical points on number line, check each section.

$(x + 4)(x - 3) = 0$

$x = -4;\ x = 3$



ANSWER: $-4 \leq x \leq 3$ or $[-4, 3]$ (in interval notation)

Perimeter: add the distances around the outside.

Circumference: $C = 2\pi r = \pi d$

Pythagorean Theorem:
Right Triangles only. $c^2 = a^2 + b^2$
Triples: 3, 4, 5
5, 12, 13
8, 15, 17
7, 24, 25

Trig: Right triangles only

$\sin \measuredangle A = \frac{o}{h}$; $\cos \measuredangle A = \frac{a}{h}$; $\tan \measuredangle A = \frac{o}{a}$

Angle of elevation: from horizontal line of sight up.
Angle of depression: from horizontal line of sight down.

Area:

$A_{triangle} = \frac{1}{2}bh$

$A_{equilateral\ triangle} = \frac{s^2\sqrt{3}}{4}$

$A_{rectangle} = bh$

$A_{square} = bh = s^2$

$A_{parallelogram} = bh$

$A_{rhombus} = bh = \frac{d_1 \cdot d_2}{2}$

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

$A_{circle} = \pi r^2$

$A_{sector\ of\ circle} = \frac{n}{360}\pi r^2$

$A_{semicircle} = \frac{1}{2}\pi r^2$

$A_{quarter\ circle} = \frac{1}{4}\pi r^2$

Volume and Surface Area:

$V_{rectangular\ solid} = l \cdot w \cdot h$

$SA_{rectangular\ solid} = 2lh + 2hw + 2lw$

$V_{cylinder} = \pi r^2 h$

$SA_{closed\ cylinder} = 2\pi rh + 2\pi r^2$

Error in Measurement:
Relative error = $\frac{|\text{measure-actual}|}{\text{actual}}$
% of Error = Relative • 100%

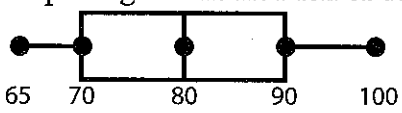
Permutations:
Arrangement in specific order.

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

Data:
5 Statistical Summary: minimum, maximum, median, 1st quartile, 3rd quartile
Quartiles divide data into 4 equal parts.
Percentiles divide data into 100 equal parts.
Percentile rank of score $x = \frac{number\ of\ scores\ below\ x}{n} \cdot 100$, where n is the number of scores.
Mean = average.
Mode = most often (may be more than one answer).
Median = middle.
Outliers = values that are far away from the rest of the data.
Median best describes data if outliers exist.
Range = difference between the maximum and minimum values.

Probability: P(A') = 1 – P(A) complement
P(A and B) = P(A)•P(B) independent
P(A and B) = P(A)•P(B/A) dependent
P(A or B) = P(A) + P(B) mutually exclusive
P(A or B) = P(A) + P(B) – P(A and B) not exclusive
P(B/A) = P(A and B)/P(A) conditional probability
P(B/A) means probability of B given A has occurred.

Box and Whisker Plot: 1st and 3rd quartiles are at the ends of the box, median is a vertical line in the box, and the max/min are at the ends of the whiskers.
Helpful in interpreting the distribution of data.



Literal equations:
$a = b + cd$, solve for c.
$a - b = cd$
$\frac{a-b}{d} = c$
Use same strategies as for solving equations.

Sets:
$A \cap B$ Union - all elements in both sets.
$A \cap B$ Intersection - elements where sets overlap.
A' Complement - elements not in the set.
{ } or ∅ means null set.

Exponential Growth and Decay:
Decay: $y = ab^x$ where $a > 0$ and $0 < b < 1$

Growth: $y = ab^x$ where $a > 0$ and $b > 1$

Algebra Formula Reference

Radicals: Remember to use fractional exponents.

$\sqrt[a]{x} = x^{\frac{1}{a}}$ $\qquad x^{\frac{m}{n}} = \sqrt[n]{x^m} = \left(\sqrt[n]{x}\right)^m$

$\sqrt[n]{a^n} = a$ $\qquad \sqrt[n]{ab} = \sqrt[n]{a}\cdot\sqrt[n]{b}$ $\qquad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

Simplify: look for perfect powers.

$\sqrt{x^{12}y^{17}} = \sqrt{x^{12}y^{16}y} = x^6y^8\sqrt{y}$

$\sqrt[3]{72x^9y^8z^3} = \sqrt[3]{8\cdot 9x^8xy^8z^3} = 2x^2y^2z\sqrt[3]{9x}$

Use conjugates to rationalize denominators:

$$\frac{5}{2+\sqrt{3}}\cdot\frac{2-\sqrt{3}}{2-\sqrt{3}} = \frac{10-5\sqrt{3}}{4-2\sqrt{3}+2\sqrt{3}-\sqrt{9}} = 10-5\sqrt{3}$$

Equations: isolate the radical; square both sides to eliminate radical; combine; solve.

$2x-5\sqrt{x}-3=0 \quad \rightarrow \quad (2x-3)^2 = (5\sqrt{x})^2$

$4x^2-12x+9 = 25x \quad \rightarrow \; solve: x=9;\; x=1/4$

CHECK ANSWERS. Answer only $x = 9$.

Functions: A function is a set of ordered pairs in which each x-element has only ONE y-element associated with it.

Vertical Line Test: is this graph a function?
Domain: x-values used; **Range:** y-values used
Onto: all elements in B used.
1-to-1: no element in B used more than once.
Composition: $(f\circ g)(x) = f(g(x))$
Inverse functions f & g: $f(g(x)) = g(f(x)) = x$
Horizontal line test: will inverse be a function?

Transformations:
$-f(x)$ over x-axis; $f(-x)$ over y-axis
$f(x+a)$ horizontal shift; $f(x)+a$ vertical shift
$f(ax)$ stretch horizontal; $af(x)$ stretch vertical

Working with Rationals (Fractions):
Simplify:
remember to look for a factoring of -1:

$$\frac{3x-1}{1-3x} = \frac{-1(-3x+1)}{1-3x} = -1$$

Add: Get the common denominator.
Factor first if possible:
Multiply and Divide: Factor First

Rational Inequalities

$\frac{x^2-3x-15}{x-2} \geq 0$ The critical values from factoring the numerator are -3, 5.
The denominator is zero at $x = 2$.
Place on number line, and test sections.

Sequences
Arithmetic: $a_n = a_1 + (n-1)d$

$$S_n = \frac{n(a_1+a_n)}{2}$$

Geometric: $a_n = a_1 \cdot r^{n-1}$

$$S_n = \frac{a_1(1-r^n)}{1-r}$$

Recursive: Example:
$a_1 = 4; \quad a_n = 2a_{n-1}$

Binomial Theorem:

$$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k}b^k$$

Solving Rational Equations:
Get rid of the denominators by mult. all terms by common denominator.

$$\frac{22}{2x^2-9x-5} - \frac{3}{2x+1} = \frac{2}{x-5}$$

multiply all by $2x^2-9x-5$ *and get*

$22-3(x-5) = 2(2x+1)$

$22-3x+15 = 4x+2$

$37-3x = 4x+2$

$35 = 7x$

$5 = x$

Great! But the only problem is that $x = 5$ does not CHECK!!!! There is no solution. Extraneous root.
Motto: Always CHECK ANSWERS.

Equations of Circles: $x^2+y^2=r^2$ center origin
$(x-h)^2+(y-k)^2=r^2$ center at (h,k)
$x^2+y^2+Cx+Dy+E=0$ standard form

Complex Fractions:
Remember that the fraction bar means divide:
Method 1: Get common denominator top and bottom

$$\frac{\frac{2}{x^2}-\frac{4}{x}}{\frac{4}{x}-\frac{2}{x^2}} = \frac{\frac{2-4x}{x^2}}{\frac{4x-2}{x^2}} = \frac{2-4x}{x^2} \div \frac{4x-2}{x^2} = \frac{2-4x}{x^2}\cdot\frac{x^2}{4x-2} = -1$$

Method 2: Mult. all terms by common denominator for all.

$$\frac{\frac{2}{x^2}-\frac{4}{x}}{\frac{4}{x}-\frac{2}{x^2}} = \frac{x^2\cdot\frac{2}{x^2}-x^2\cdot\frac{4}{x}}{x^2\cdot\frac{4}{x}-x^2\cdot\frac{2}{x^2}} = \frac{2-4x}{4x-2} = -1$$

Algebra Formula Reference

Scientific Notation:
3.2×10^{13}
The first number must be $1 \le n < 10$

Factorial:
$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$
$1! = 1$
FYI: $0! = 1$

Absolute Value:
$|-5| = 5$
$|5| = 5$
Represents distance

Undefined:
$\frac{6}{7-x}$ is undefined when $x = 7$ since the denominator $= 0$.

Multiply: (distribute or FOIL)
$(x+3)(x+2) = x \cdot x + x \cdot 2 + 3 \cdot x + 3 \cdot 2$
$= x^2 + 5x + 6$
$(a+b)^2 = a^2 + 2ab + b^2$
$(a-b)^2 = a^2 - 2ab + b^2$

Add Fractions:
Get the common denominator:
$\frac{5x}{6} + \frac{3x}{2} = \frac{5x}{6} + \frac{9x}{6} = \frac{14x}{6} = \frac{7x}{3}$

Inequalities:
$5 - 3x \le 13 + x$ Remember to
$-3x \le 8 + x$ change direction
$-4x \le 8$ of inequality when
$x \ge -2$ mult/div by a negative.

x = abscissa, y = ordinate

Slope:
$m = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$.

Exponents:
$(-3)^2 \ne -3^2$
$2^0 = 1$
$4^{-3} = \frac{1}{4^3}$
$x^m \cdot x^n = x^{m+n}$
$(x^n)^m = x^{n \cdot m}$
$\frac{x^m}{x^n} = x^{m-n}$
$(xy)^n = x^n \cdot y^n$

Polygons and sides:
triangle – 3
quadrilateral – 4
pentagon – 5
hexagon – 6
septagon – 7
octagon – 8
nonagon – 9
decagon – 10
dodecagon - 12

Direct Variation:
$y = kx$ where k = constant of variation
$k = y/x$

Factor:
Look for a GCF (greatest common factor)
Factor binomial or trinomial.
$a^2 - b^2 = (a+b)(a-b)$

Systems:

$y - 2x = 1$ $y + 2x = 9$	*Linear:* substitute; add to eliminate one variable or graph.
$y = x^2 - x - 6$ $y = 2x - 2$	*Linear Quadratic:* substitute or graph

For inequality systems, graph.

Equations of Lines: m = slope
$y = mx + b$ slope-intercept
$y - y_1 = m(x - x_1)$ point-slope

Properties of Real Numbers:

Commutative Property:	$a + b = b + a$	$ab = ba$
Associative Property:	$a+(b+c) = (a+b)+c$	$a(bc) = (ab)c$
Distributive Property:	$a(b+c) = ab + ac$	
Identity:	$a + 0 = a$	$a \cdot 1 = a$
Inverse:	$a + (-a) = 0$	$a \cdot (1/a) = 1$
Zero Property:		$a \cdot 0 = 0$

Degree:
Degree of monomial = sum of exponents
$4x^3$ is of degree 3
x^2y^3 is of degree 5

Solving Equations:
1. Deal with any parentheses in the problem.
2. Combine similar terms on same side of = sign.
3. Get the needed variables on the same side of = sign.
4. Isolate the needed variable by add or subtract.
5. Find the needed variable by divide or multiply.

Quadratic Equation:
$x^2 - 5x + 6 = 0$ Set = 0.
$(x-3)(x-2) = 0$ Factor.
$x = 3; \quad x = 2$ Find roots

Interval Notation:
$(1,5) \leftrightarrow 1 < x < 5$
$[1,5] \leftrightarrow 1 \le x \le 5$

Function: Passes the vertical line test. A set of ordered pairs in which each x element has only one y element associated with it.
$f(x) = 3x + 4$
$f(3) = 3 \cdot 3 + 4 = 13$

Parallel and Perpendicular:
Parallel: slopes are equal.
Perpendicular: slopes are negative reciprocals (flip over and negate)

Parabola:
$y = ax^2 + bx + c$
Axis of symmetry:
$x = \frac{-b}{2a}$
Roots: where the graph crosses the x-axis.

Geometry Formula Reference - Page 1

3-D Figures:

Prism: $V = Bh$

Pyramid: $V = \frac{1}{3}Bh$

Cylinder: $V = \pi r^2 h$; $SA = 2\pi rh + 2\pi r^2$

Cone: $V = \frac{1}{3}\pi r^2 h$; $SA = s\pi r + \pi r^2$

Sphere: $V = \frac{4}{3}\pi r^3$; $SA = 4\pi r^2 = \pi d^2$

Polygon Interior/Exterior Angles:

Sum of int. angles = $180(n-2)$

Each int. angle (regular) = $\frac{180(n-2)}{n}$

Sum of ext. angles = 360

Each ext. angle (regular) = $\frac{360}{n}$

Related Conditionals:

Converse: switch if and then

Inverse: negate if and then

Contrapositive: inverse of the converse (contrapositive has the same truth value as the original statement)

Pythagorean Theorem:

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

Converse: If the sides of a triangle satisfy $c^2 = a^2 + b^2$ then the triangle is a right triangle.

Regular Solids:

Tetrahedron – 4 faces
Cube – 6 faces
Octahedron – 8 faces
Dodecahedron – 12 faces
Icosahedron – 20 faces

Triangles:

By Sides:

Scalene – no congruent sides
Isosceles – 2 congruent sides
Equilateral – 3 congruent sides

By Angles:

Acute – all acute angles
Right – one right angle
Obtuse – one obtuse angle
Equiangular – 3 congruent angles(60°)
Equilateral ↔ Equiangular

Exterior angle of a triangle equals the sum of the 2 non-adjacent interior angles.

Mid-segment of a triangle is parallel to the third side and half the length of the third side.

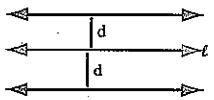
Similar Triangles:

AA
SSS for similarity
SAS for similarity
Corresponding sides of similar triangles are in proportion.

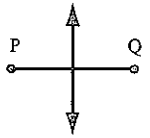
Locus Theorems:

Fixed distance from point.

Fixed distance from a line.

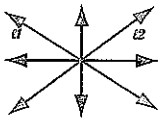


Equidistant from 2 points.



Equidistant 2 parallel lines.

Equidistant from 2 intersecting lines



Congruent Triangles

SSS
SAS
ASA
AAS
HL (right triangles only)

NO donkey theorem (SSA or ASS)

CPCTC (use after the triangles are congruent)

Inequalities:

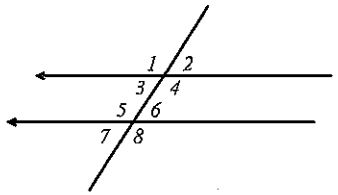
--Sum of the lengths of any two sides of a triangle is greater than the length of the third side.
--Longest side of a triangle is opposite the largest angle.
--Exterior angle of a triangle is greater than either of the two non-adjacent interior angles.

Mean Proportional in Right Triangle:

Altitude Rule: $\frac{\text{part of hyp}}{\text{altitude}} = \frac{\text{altitude}}{\text{other part hyp}}$

Leg Rule: $\frac{\text{hypotenuse}}{\text{leg}} = \frac{\text{leg}}{\text{projection}}$

Parallels: If lines are parallel …



Corresponding angles are equal.
m<1=m<5, m<2=m<6, m<3=m<7, m<4=m<8
Alternate Interior angles are equal.
m<3=m<6, m<4=m<5
Alternate Exterior angles are equal.
m<1=m<8, m<2=m<7
Same side interior angles are supp.
m<3+m<5=180, m<4+m<6=180

Quadrilaterals:

Parallelogram: opp sides parallel
opp sides =
opp angles =
consec. angles supp
diag bis each other
Rectangle: add 4 rt angles, diag. =
Rhombus: add 4 = sides, diag. perp, diag bisect angles.
Square: All from above.

Trapezoid: Only one set parallel sides.

Median of trap is parallel to both bases and = ½ sum bases.:
Isosceles Trap: legs =
base angles =
diagonals =
opp angles supp

Transformations:

$r_{x\text{-}axis}(x,y)=(x,-y)$
$r_{y\text{-}axis}(x,y)=(-x,y)$
$r_{y=x}(x,y)=(y,x)$
$r_{y=-x}(x,y)=(-y,-x)$
$r_{origin}(x,y)=(-x,-y)$

$T_{a,b}(x,y)=(x+a,y+b)$
$D_k(x,y)=(kx,ky)$

$R_{90}(x,y)=(-y,x)$
$R_{180}(x,y)=(-x,-y)$
$R_{270}(x,y)=(y,-x)$

Glide reflection is composition of a reflection and a translation.

Isometry – keeps length.

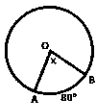
Orientation – label order

Circle Segments

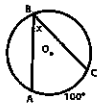
In a circle, a radius perpendicular to a chord bisects the chord.
Intersecting Chords Rule:
(segment part)•(segment part) =
(segment part)•(segment part)
Secant-Secant Rule:
(whole secant)•(external part) =
(whole secant)•(external part)
Secant-Tangent Rule:
(whole secant)•(external part) = (tangent)^2
Hat Rule: Two tangents are equal.

Circle Angles:

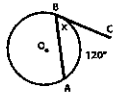
Central angle = arc



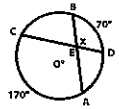
Inscribed angle = half arc



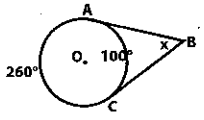
Angle by tangent/chord = half arc

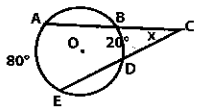


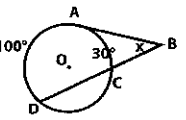
Angle formed by 2 chords = half the sum of arcs



Angle formed by 2 tangents, or 2 secants, or a tangent/secant = half the difference of arcs







Slopes and Equations:

$$m=\frac{\text{vertical change}}{\text{horizontal change}}=\frac{y_2-y_1}{x_2-x_1}$$

$y=mx+b$ slope-intercept

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

Coordinate Geometry Formulas:

Distance Formula:

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

Midpoint Formula:

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

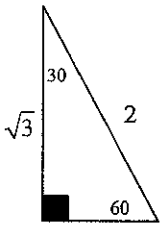
Circles:

Equation of circle center at origin:
$x^2+y^2=r^2$ where r is the radius.
Equation of circle not at origin:
$(x-h)^2+(y-k)^2=r^2$ where (h,k) is the center and r is the radius.

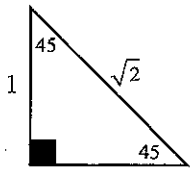
Trigonometry Formula Reference

Arc Length of a Circle $= \theta r$ (in radians)

Special Right Triangles



30°-60°-90° triangle
side opposite 30° = ½ hypotenuse
side opposite 60° = ½ hypotenuse $\sqrt{3}$



45°-45°-90° triangle
hypotenuse = leg $\sqrt{2}$
leg = ½ hypotenuse $\sqrt{2}$

Law of Sines: uses 2 sides and 2 angles

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$ Has an ambiguous case.

Law of Cosines: uses 3 sides and 1 angle

$c^2 = a^2 + b^2 = 2ab\cos C$

Area of triangle: $A = \frac{1}{2}\, ab \sin C$

Area of parallelogram: $A = ab \sin C$

Pythagorean Identities:

$\sin^2\theta + \cos^2\theta = 1 \quad \tan^2\theta + 1 = \sec^2\theta$

$1 + \cot^2\theta = \csc^2\theta$

Radians and Degrees

Change to radians multiply by $\frac{\pi}{180}$

Change to degrees multiply by $\frac{180}{\pi}$

Quadrantal angles – 0, 90, 180, 270

CoFunctions: examples

$\sin\theta = \cos(90° - \theta)$; $\tan\theta = \cot(90° - \theta)$

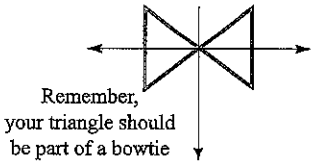
Inverse notation:

$\arcsin(x) = \sin^{-1}(x)$

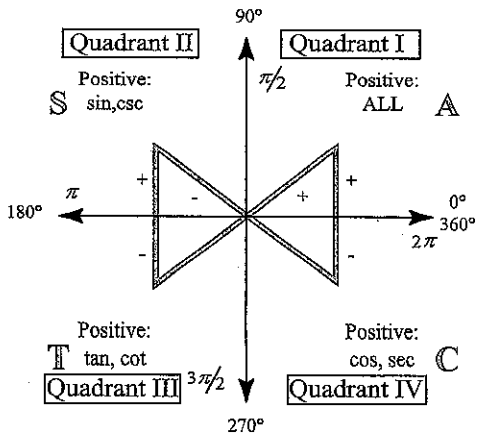
$\arccos(x) = \cos^{-1}(x)$

$\arctan(x) = \tan^{-1}(x)$

Reference triangles are drawn to the x-axis



Remember, your triangle should be part of a bowtie



Trig Functions

$\sin\theta = \frac{o}{h}$; $\cos\theta = \frac{a}{h}$; $\tan\theta = \frac{o}{a}$

$\csc\theta = \frac{h}{o}$; $\sec\theta = \frac{h}{a}$; $\cot\theta = \frac{a}{o}$

Reciprocal Functions

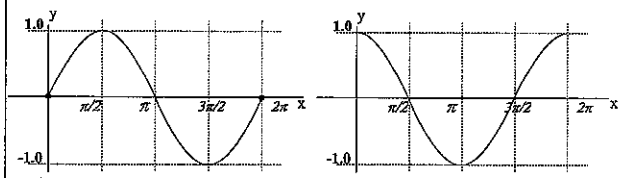
$\sin\theta = \frac{1}{\csc\theta}$; $\cos\theta = \frac{1}{\sec\theta}$; $\tan\theta = \frac{1}{\cot\theta}$

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

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

Trig Graphs

$\sin x$ $\qquad$ $\cos x$



amplitude = ½ | max − min | *(think height)*

period = horizontal length of 1 complete cycle

frequency = number of cycles in 2π

sinusoidal curve = any curve expressed as

$y = A\sin(B(x - C)) + D$

phase shift = measure of horizontal shifting

Statistics and Probability - Formulas and Tips

Statistics:

$$mean = \bar{x} = \frac{x_1 + x_2 + \ldots + x_n}{n} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

median = middle number in ordered data
mode = value occurring most often

range = difference between largest and smallest

mean absolute deviation (MAD):

$$population\ MAD = \frac{1}{n}\sum_{i=1}^{n}|x_i - \bar{x}|$$

variance:

$$population\ \text{variance} = (\sigma x)^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$$

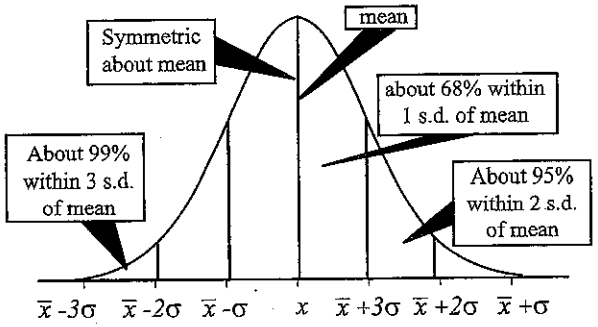
standard deviation:

population standard deviation =

$$\sigma x = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Sx = sample standard deviation
σ_x = population standard deviation

Normal Distribution and Standard Deviation



Binomial Probability

${}_nC_r \cdot p^r \cdot q^{n-r}$ exactly r times

or $\binom{n}{r} \cdot p^r \cdot (1-p)^{n-r}$

When computing **"at least"** and **"at most"** probabilities, it is necessary to consider, in addition to the given probability,

- all probabilities larger than the given probability ("at least")
- all probabilities smaller than the given probability ("at most")

Probability

Permutation: without replacement and order matters

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

Combination: without replacement and order does not matter

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

Empirical Probability

$$P(E) = \frac{\#\text{ of times event } E \text{ occurs}}{\text{total \# of observed occurrences}}$$

Theoretical Probability

$$P(E) = \frac{n(E)}{n(S)} = \frac{\#\text{ of outcomes in } E}{\text{total \# of outcomes in } S}$$

$P(A \text{ and } B) = P(A) \cdot P(B)$

$P(A') = 1 - P(A)$

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
for not mutually exclusive

$P(A \text{ or } B) = P(A) + P(B)$
for mutually exclusive

$$P(B \mid A) = \frac{P(A \text{ and } B)}{P(A)} \quad \text{(conditional)}$$

English	Spanish
Absolute Value	Valor absoluto
Addition	Adición
Algebra	Álgebra
Algebraic Expression	Expresión algebraica
Altitude, Height	Altitud, Altura
Angle	Ángulo
Area	Área
Arrays	Ordenaciones
Associative Property	Propiedad asociativa
Attributes/Properties	Atributos/Propiedades
Bar Graph	Gráfica de Columnas
Base	Base
Box-and-Whisker Plot	Diagrama de Caja y Bigote
Capacity vs. Volume	Capacidad vs. Volumen
Cardinal Number	Número cardinal
Cartesian Coordinate System	Sistema de Coordinadas Cartesianas
Celsius vs. Fahrenheit	Celsio vs. Fahrenheit
Chord	Cuerda
Circle	Círculo
Circle Graph, Pie Chart	Gráfica Circular, Diagrama en forma de Torta
Closed Polygon	Polígono Cerrado
Commutative Property	Propiedad conmutativa
Complimentary Angles	Ángulos Complementarios
Composite	Entero compuesto
Concave Polygon	Polígono Cóncavo
Congruent, Congruence	Congruente, Congruencia
Convex polygon	Polígono Convexo
Cartesian Coordinate System	Sistema de Coordinadas Cartesianas
Counting Numbers/Natural Numbers	Números Contables, Números Naturales
Cube	Cubo
Customary Measurement System	Sistema de Medidas Usual
Data	Datos
Decimal Fraction	Fracción Decimal
Diagonal	Diagonal
Diameter	Diámetro
Digit	Dígito
Digital vs. Analog Clock	Reloj Digital vs. Análogo
Directional, Positional Words	Palabras Posicionales, Direccionales
Distributive Property	Propiedad Distributiva
Division	División
Edge	Borde
Ellipse	Elipse
Equation	Ecuación
Equation/Number Sentence	Ecuación/Frase Numérica
Equivalent	Equivalente
Equivalent Fractions	Fracciones Equivalentes
Estimate	Estimación

English	Spanish
Exponent	Exponente
Extraneous Information	Información Ajena
Face	Cara
Factor	Factor
Fair Share	Partición Justa
Fractional Form	Forma Fraccional
Fundamental Counting Principle	Principio de Contar Fundamental
Graphs	Gráficas
Greatest Common Factor GCF, (a, b)	Factor Común Mayor (FCM), (a, b)
Grid	Cuadrículas
Heptagon	Heptagon
Hexagon	Hexágono
Histogram	Histograma
Identity Property; Identity Element	Propiedad de Identidad; Elemento De Identidad
Improper Fraction	Fracción Impropia
Integers	Enteros
Interval	Intervalos
Inverse	Inverso
Isosceles Triangle; Isosceles Trapezoid	Triángulo Isósceles; Trapezoide Isósceles
Kite	Cometa
Least Common Multiple, LCM, [a, b]	Múltiplo Común Menor, MCM, [a, b]
Likely: More, Less, Equally	Probablemente: Mas, Menos, Igual
Line	Línea
Line Graph	Gráfica de Líneas
Line Plot	Diagrama de Línea
Locus	Locus
Lowest Terms	Términos Menores
Mean	Término Medio
Median, 2nd Quartile, 50th Percentile	Mediana, 2o Cuartil, 50avo percentil
Midpoint	Punto medio
Mixed numbers	Números mixtos
Mode	Modo
Model/Modeling	Modelar
Multiple	Múltiplo
Multiplication	Multiplicación
Multi-step Problem	Problema con varias etapas
Non-standard Units of Measure	Unidades de Medida no estándar
Number vs. Numeral	Número vs. Numeral
Octagon	Octágono
Odd vs. Even	Impar vs. Par
One to One (1-1) Correspondence	Correspondencia exacta (1-1)
Open Figure	Figura Abierta
Open Sentence	Frase Abierta

Español	Inglés
Adición	Addition
Adición Repetida	Repeated Addition
Álgebra	Algebra
Altitud, Altura	Altitude, Height
Ángulo	Angle
Ángulos Complementarios	Complimentary Angles
Ángulos Suplementarios	Supplementary Angles
Área	Area
Atributos/Propiedades	Attributes/Properties
Base	Base
Borde	Edge
Capacidad vs. Volumen	Capacity vs. Volume
Cara	Face
Celsio vs. Fahrenheit	Celsius vs. Fahrenheit
Círculo	Circle
Cometa	Kite
Congruente, Congruencia	Congruent, Congruence
Conjunto	Set
Correspondencia exacta (1-1)	One to One (1-1) Correspondence
Cuadrículas	Grid
Cuadriláteros	Quadrilaterals
Cuartil	Quartile
Cubo	Cube
Cuenta	Tally
Cuerda	Chord
Datos	Data
Diagonal	Diagonal
Diagrama de Caja y Bigote	Box-and-Whisker Plot
Diagrama de Línea	Line Plot
Diagrama de Tallo y Hoja	Stem-and-Leaf Plot
Diagrama de Venn	Venn Diagram
Diagrama Disperso	Scatter Plot
Diámetro	Diameter
Dígito	Digit
División	Division
Ecuación	Equation
Ecuación/Frase Numérica	Equation/Number Sentence
El Sistema Métrico	The Metric System
Elipse	Ellipse
Entero compuesto	Composite
Enteros	Integers
Equivalente	Equivalent
Escala	Range
Estadística	Statistics
Estimación	Estimate
Exponente	Exponent
Expresión algebraica	Algebraic Expression

Español	Inglés
Factor	Factor
Factor Común Mayor (FCM), (a, b)	Greatest Common Factor GCF, (a, b)
Figura Abierta	Open Figure
Figuras Planas	Plane figures
Figuras sólidas	Solid Figures
Forma estándar vs. Forma Expandida	Standard Form vs. Expanded Form
Forma Fraccional	Fractional Form
Fracción Decimal	Decimal Fraction
Fracción Impropia	Improper Fraction
Fracciones Equivalentes	Equivalent Fractions
Frase Abierta	Open Sentence
Gráfica Circular, Diagrama en forma de Torta	Circle Graph, Pie Chart
Gráfica de Columnas	Bar Graph
Gráfica de Líneas	Line Graph
Gráfica pictórica, Pictográfica	Picture Graph, Picto-Graph
Gráficas	Graphs
Heptagon	Heptagon
Hexágono	Hexagon
Histograma	Histogram
Impar vs. Par	Odd vs. Even
Información Ajena	Extraneous Information
Intervalos	Interval
Inverso	Inverse
Lado	Side
Línea	Line
Líneas oblicuas	Skew Lines
Líneas Paralelas	Parallel Lines
Líneas Perpendiculares	Perpendicular Lines
Locus	Locus
Mediana, 2o Cuartil, 50avo percentil	Median, 2nd Quartile, 50th Percentile
Modelar	Model/Modeling
Modelos	Patterns
Modo	Mode
Multiplicación	Multiplication
Múltiplo	Multiple
Múltiplo Común Menor, MCM, [a, b]	Least Common Multiple, LCM, [a, b]
Número cardinal	Cardinal Number
Número entero	Whole Number
Números mixtos	Mixed Numbers
Número Ordinal	Ordinal Number
Número vs. Numeral	Number vs. Numeral
Números Contables, Números Naturales	Counting Numbers/Natural Numbers
Números Racionales	Rational Numbers
Octágono	Octagon