Fraction Rules

Common Denominators

a/b + c/d = ad + bc/bd

Multiplication

a/b * c/d = ac/bd

Reciprocal

1/(a/b) = b/a

Lines

Given point (c,d) and slope m, the unique line that satisfies this is the set of all points (x,y) such that

m = y-d/x-c

slope is change in y/change in x

Parallel, Perpendicular

y=2x+4 and y=2x+3 are parallel

y=2x+4 and 2y=4x+8 are same line

y=2x+4 and y = 1/2x+6 meet perpendicularly

Parallel lines never meet, same slope

Perpendicular lines meet once at right angles and slopes are negative reciprocals

Quadratic Functions: Parabolas

$f(x) = ax^2 + bx + c$

Zeros given by the quadratic formula:

-b +/- sqrt(b^2 - 4ac)/2a

Coordinate point (-b/2a,($-b^2$ +4ac)/4a)

Geometric Equations

Circles: Circumference 2(pi)r Area $(pi)r^2$

Cylinders: Surface area 2(pi)r x h + $2(pi)r^2$

Volume: $(pi)r^2h$

Sphere: Surface area $4(pi)r^2$ Volume $4/3(pi)r^3$

Geometric Formulas

SOHCAHTOA

SOH = sin(x) = a/c

CAH = cos(x) = b/c

TOA = tan(x) = a/b

180 degrees = (pi)rad

Divide arclength by radius to get radian measure

Special Angles

Degree Radian Cosine Sine Tangent

0 0 1 0 0

30 (pi)/6 sqrt3/2 1/2 1/sqrt3

45 (pi)/4 1/sqrt(2) 1/sqrt(2) 1

60 (pi)/3 1/2 sqrt(3)/2 sqrt(3)

90 (pi) 0 1 undefined

Theory of Geometric Series

$S = p + pr + pr^2 + pr^3 + ... + pr^n$

$Sr = p + pr + pr^2 + pr^3 + ... + pr^n + pr^{n+1}$

S - Sr = p - pr^n+1

$S = p\text{-}pr^{n+1}/1\text{-}r$

Negative Exponents

$a^{-m} = 1/a^m$

$1/a^{-m} = a^m$

Multiplication and Scientific Notation

Multiplication and Division:

- Convert into scientific notation
- Add/subtract exponents
- Multiply/divide coefficients
- Convert to scientific notation
- 2.3E4 x 9.5E7/1.6E10 = 2.3x9.5/1.6E(4+7-10)

Absolute Values

Absolute Values often generate "and" and "or" situations.

Examples:

|x|<1: -1<x and x<1 -1<x<1

|x|>1: x>1 or x<-1

|2x+3|> 1: 2x+3>1 or -(2x+3)>1

x>-1 or x<-2

Exponential Rules

exp(a)exp(b) = exp(a+b)

[exp(a)]^b = exp(ab)

exp(-a) = 1/exp(a)

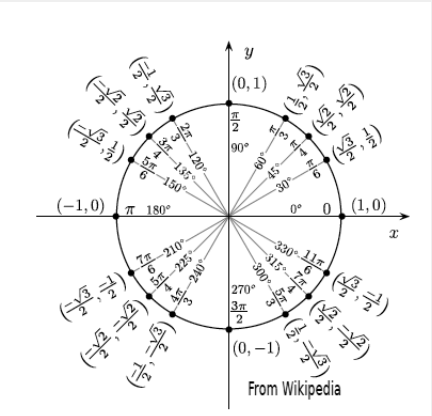
Domain: all real numbers

Range: all positive numbers

Pythagorean Theorem

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

Unit Circle



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Secant, Cosecant, Cotangent

Secant: 1/cos(x)
Cosecant = 1/sin(x)
Cotangent = 1/tan(x) = cos(x)/sin(x)

Trigonometric Identities

$\cos^2 x + \sin^2 x = 1$
$\tan^{-1} x$ = arctan x
cot(x) = 1/tan x
e^{10} = cos x + isin x

Basic Facts

Total human population: 7 billion
USA population: 300 million
Distance from NY to LA: 2500 miles
Distance to the moon: 2.4E5 miles
Distance to the Sun: 1E8 miles
Distance around the equator: 2.5E4 miles
Area of the US: 4E6 square miles
Surface area of the Earth: 2E8 square miles

Distance Between Points

The distance between two points on the plane is based on the Pythagorean Theorem
$|A-B| = \sqrt{(Xa-Xb)^2 + (Ya - Yb)^2}$
A=(Xa,Ya) B=(Xb,Yb)

Function Variables

Domain = valid inputs to function
Range = what can the function produce
Zeros or Roots = where is f(x)=0
Intersections = Where is f(x) = g(x)
Local maximum is largest value around itself
Local minimum is smallest value around itself
Global is largest overall

Logarithms

Logarithms are the functional inverses of the exponential
y = b^x is equivalent to logb(y) = x
log(mn) = log(m) + log(n)
log(m^n) = nlog(m)
log(1/m) = -log(m)
loga(m) = logb(m)/logb(a)
exp(a)exp(b) = exp(ab)
exp(-a) = 1/exp(a)
$e^{2.3} = 10$, $e^{12} = e^{2.3*5.2} = (e^{2.3})^{5.2} = 10^{5.2}$ = 2E5

Sine

Sine is the y component as theta spins
Domain is all real numbers
Range -1</ y </ 1
Maxima at pi/2 + 2kpi, Minima at 3pi/2 + 2kpi
Zeros at kpi
Period 2pi

Cosine

Cosine is the x component as theta spins
Domain is all real numbers
Range is -1</ y </ 1
Max is 2kpi, Minima (2k + 1)pi
Zeros at pi/2 + kpi
Period is 2pi

Tangent

Tangent is the slope of the line with angle theta
Domain is all real numbers except pi/2 + kpi
Range is all real numbers
No max or min. asymptotes at undefined points
Zeros at kpi
Period is pi

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