Name: Date: Number: A

Stuff You Must Know Cold – Algebra 1

Powers

13^2 169
$14^2 = 196$
$15^2 = 225$
$16^2 = 256$
$17^2 = 289$
$18^2 = 324$
$19^2 = 361$
$20^2 = 400$
$21^2 = 441$
$22^2 = 484$
$23^2 = 529$
$24^2 = 576$
$25^2 = 625$
$2^3 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$
$8^3 = 512$
$9^3 = 729$
$10^3 = 1000$
$11^3 = 1331$
$12^3 = 1728$
$2^4 = 16$
$3^4 = 81$
$4^4 = 256$
$5^4 = 625$

Fractions (varies)

Integers (varies)

Powers

$2^5 = 32$
$3^5 = 243$
$4^5 = 1024$
$5^5 = 3125$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$
$2^{11} = 2048$
$2^{12} = 4096$

Factorials

$0! = 1$
$1! = 1$
$2! = 2$
$3! = 6$
$4! = 24$
$5! = 120$
$6! = 720$
$7! = 5040$

Linear Equations

Parent Function: $y = x$

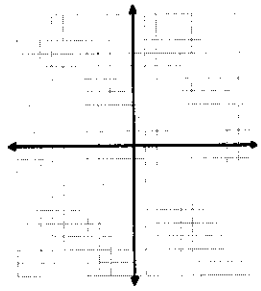
Standard Form: $ax + by = c$

Slope-Intercept Form: $y = mx + b$

Point-Slope Form: $y - y_1 = m(x - x_1)$

Slope: $\frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{\text{rise}}{\text{run}}$

Graph $y =$ (varies)



label 3 points

Quadratic Equations

Parent Function: $y = x^2$

General Form: $y = ax^2 + bx + c$

Standard Form:
$y = a(x - h)^2 + k$

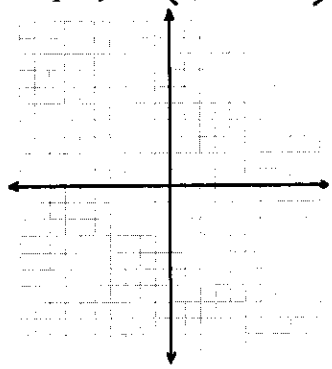
Intercept Form:
$y = a(x - p)(x - q)$

Vertex:
(h, k)

Axis of Symmetry:
$x = -\frac{b}{2a}$

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

Graph $y =$ (varies)



label 3 points

Inequality Meanings

$<$ less than

$\leq$ less than or equal to

$>$ greater than

$\geq$ greater than or equal to

Three ways to solve a system of equations

1. Graphing
2. Substitution
3. Elimination or Matrices

Name: Date: Number: B

Stuff You Must Know Cold – Algebra 1

Order of Operations

1. ( )
2. Exponents
3. Multiplication/Division
4. Addition/Subtraction

Absolute Value

$a \geq 0$

$|a| = a$

$|-a| = a$

Function Definitions

Domain: The set of all possible input values (usually x)

Range: The set of all possible output values (usually y)

Function: The relation for which each element of the domain corresponds to exactly one element of the range

Direct Variation: a relationship between two variables in which one is a constant multiple of the other $y = kx$

Indirect Variation: a relationship between two variables in which the product is a constant $y = \frac{k}{x}$

Roots: A number at which a polynomial has the value zero; where the graph crosses the x-axis.

Distance Formula (physics)

$d = r \cdot t$

Pythagorean Theorem

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

Properties (use a, b, c)

Commutative
Addition:
$a + b = b + a$
Multiplication:
$a \cdot b = b \cdot a$

Associative
Addition: $a + (b + c) = (a + b) + c$

Multiplication:
$a \cdot (b \cdot c) = (a \cdot b) \cdot c$

Distributive:
Addition
$a \cdot (b + c) = ab + ac$

Measures of Central Tendency

Mean: arithmetic mean or average

Median: The middle number when a set of numbers are put in order

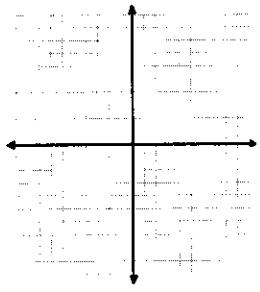
Mode: The number that occurs the most often in a list

Range: The difference between the largest and smallest numbers

Piecewise Graph

(Varies)

$f(x) = \begin{cases} \\ \\ \end{cases}$



label 3 points

Distance Formula (between two points)

$d = \sqrt{(\Delta x)^2 + (\Delta y)^2}$

Midpoint Formula

$(m_1, m_2) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Parallel and Perpendicular Lines

If $y = mx + b$

Parallel line slope: $m_1 = m_2$

Perpendicular line slope:

$m_1 = \frac{-1}{m_2}$

Dimensional Analysis

($°C \Leftrightarrow °F, in \Leftrightarrow cm, ft \Leftrightarrow mi, etc.$)

Convert (varies)

Solve The System

(varies)

x =
y =

Discriminant

Formula: $b^2 - 4ac$

Natue of roots:

>0 2 real roots

<0 2 imaginary roots

$=0$ 1 real root

Name: Date: Number: A

Stuff You Must Know Cold – Geometry

Pythagorean Theorem:

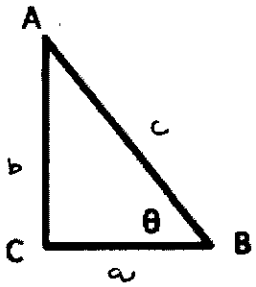
$a^2 + b^2 = c^2$

Trigonometry:

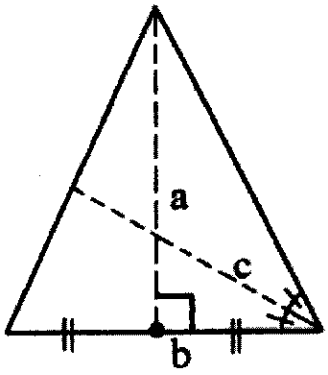
$\sin\theta = \frac{b}{c}$

$\cos\theta = \frac{a}{c}$

$\tan\theta = \frac{b}{a}$



Parts of a Triangle:



a: altitude or height

b: base (midpoint)

c: angle bisector

Similarity

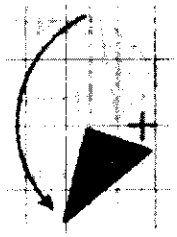
Ratio of sides	a:b
Ratio of perimeters	a : b
Ratio of areas	$a^2 : b^2$
Ratio of volumes	$a^3 : b^3$

Triangle Congruence:

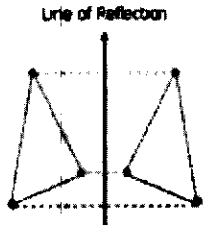
1. SSS
2. AAS
3. SAS
4. ASA
5. HL

Transformations:

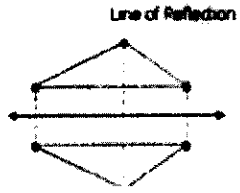
Translations:



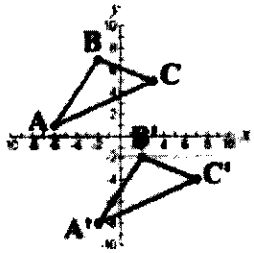
is a rotation



horizontal reflection



vertical reflection



is a translation

Logic (varies)

Conditional Statement: $P \rightarrow Q$

Converse: $Q \rightarrow P$

Inverse: $\sim P \rightarrow \sim Q$

Contrapositive: $\sim Q \rightarrow \sim P$

Perimeter Formulas:

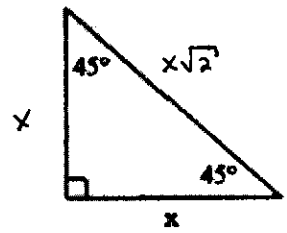
Square: $4s$

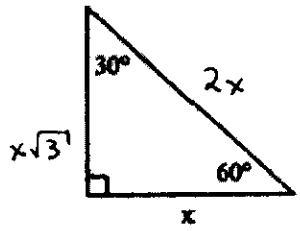
Rectangle: $2l + 2w$

Circumference of a Circle:

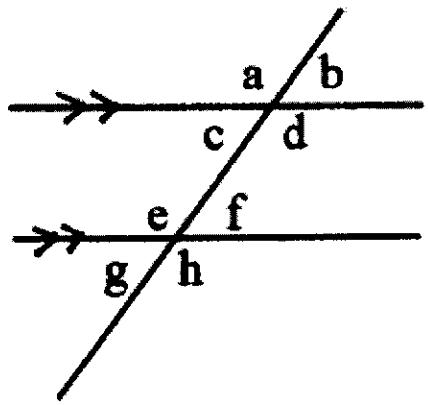
$2\pi r$

Special Right Triangles:





Parallel Lines:



a is congruent to: d, e, h

a is supplementary to:

c, b, f, g

Name: Date: Number: B

Stuff You Must Know Cold – Geometry

Area Formulas:

Square: s^2

Rectangle: $l \cdot w$

Parallelogram: $b \cdot h$

Trapezoid: $\frac{1}{2}(b_1+b_2)h$

Circle: πr^2

Right Triangle: $\frac{1}{2}bh$

Any Triangle (Heron's Formula):

$\sqrt{s(s-a)(s-b)(s-c)}$

Equilateral Triangle:

$\frac{s^2\sqrt{3}}{4}$

Regular Polygon:

$\frac{1}{2}ap$

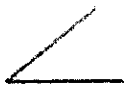
Surface Area Formulas:

Cube: $6s^2$

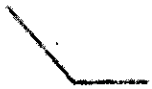
Sphere: $4\pi r^2$

Cylinder: $2\pi r^2 + 2\pi rh$

Angles:



is an acute angle



is an obtuse angle

Complementary angles add up to 90°

Supplementary angles add up to 180°

Volume Formulas:

Cube: s^3

Prism: $B \cdot h$

Cylinder: $\pi r^2 \cdot h$

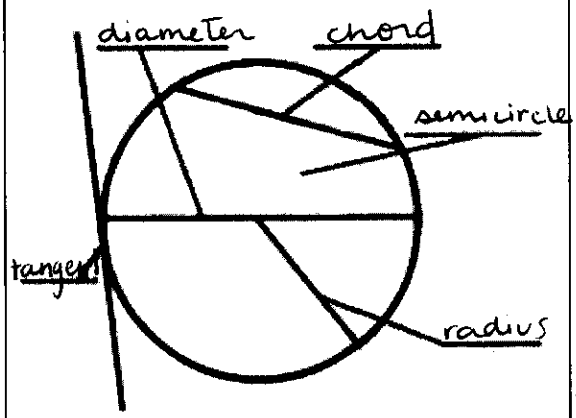
Pyramid: $\frac{1}{3}B \cdot h$

Cone: $\frac{1}{3}\pi r^2 \cdot h$

Sphere: $\frac{4}{3}\pi r^3$

Volume is measured in cubic units

Parts of a Circle:



Polygon Interior Angle Sums:

Triangle: 180°

Quadrilateral: 360°

Regular Polygon: $180°(n-2)$

Arc and Sector

Arc Length: $S = \theta \cdot r$ (θ: radians)

Sector Area: $\frac{1}{2}r^2\theta$

Roots to Know:

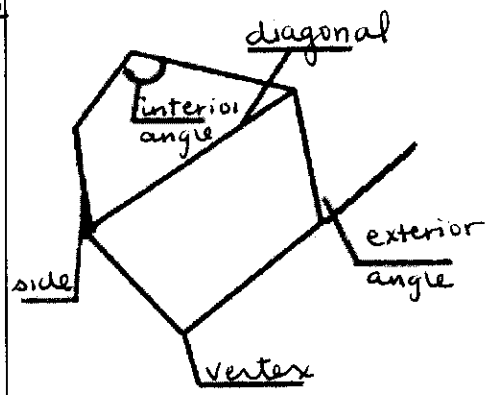
$\sqrt{2} = 1.4$

$\sqrt{3} = 1.7$

Polygon Names:

Sides:	Name:
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
7	heptagon (septagon)
8	octagon
9	nonagon
10	decagon

Polygon Parts:



Lines:

is a line segment

is a ray

= parallel lines

Y = 2/3x + 4

Give a equation of a line Parallel: $y = \frac{2}{3}x + b$

Give a line Perpendicular: $y = -\frac{3}{2}x + b$

A

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Stuff You Must Know Cold – Algebra II

Exponents and Radicals

$a^0 = 1 \quad , a \neq 0$

$(ab)^n = a^n b^n$

$a^x a^y = a^{x+y}$

$\sqrt{a} = a^{1/2}$

$\frac{a^x}{a^y} = a^{x-y}$

$\sqrt[n]{a} = a^{1/n}$

$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$

$\sqrt[n]{a^m} = a^{\frac{m}{n}}$

$a^{-x} = \frac{1}{a^x}$

$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b} = a^{1/n} \cdot b^{1/n}$

$(a^x)^y = a^{(x \cdot y)}$

$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \frac{a^{1/n}}{b^{1/n}}$

Interest/Half-Life

Compound Interest:

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

Continuously Compounded:

$A = Pe^{rt}$

Exponential Growth/Decay:

$y = a \cdot b^x$

Logarithm Rules

Change from log to exponential

$\log_b y = x$

$y = b^x$

$\ln y = x$

$y = e^x$

$\log y = x$

$y = 10^x$

Change from exponential to log

$b^x = y$

$x = \log_b y$

More log rules

$\log_a a = 1$

$\log_a 1 = 0$

$\log_a a^n = n \cdot \log_a a = n$

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

$\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$

$\log_b m^n = n \log_b m$

Change of base formula

$\log_c a = \frac{\log a}{\log c}$

Intercepts

To find the x-intercept of any function:

set $y = 0$, solve for x

To find the y-intercept of any function:

set $x = 0$, solve for y

Conics (standard forms)

Circle:

$(x-h)^2 + (y-k)^2 = r^2$

Parabola

Vertical:

$(x-h)^2 = 4p(y-k)$

Horizontal:

$(y-k)^2 = 4p(x-h)$

Ellipse

Vertical:

$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$

Horizontal:

$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

Hyperbola

Vertical:

$-\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$

Horizontal:

$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$

Complete the Square:

(varies)

Factoring

Difference of Squares

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

Difference of Cubes

$a^3 - b^3 = (a-b)(a^2+ab+b^2)$

Sum of Cubes

$a^3 + b^3 = (a+b)(a^2-ab+b^2)$

Perfect Square Trinomial

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

$a^2 + 2ab + b^2 = (a+b)^2$

Grouping

$ac + ad + bc + bd =$

$a(c+d) + b(c+d) = (a+b)(c+d)$

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Stuff You Must Know Cold – Algebra II

Arithmetic Series

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

$S_n = \frac{n}{2}(2t_1 + d)$

$= \frac{n}{2}(t_1 + t_n)$

Geometric Series

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

$S_n = \frac{t_1(1-r^n)}{1-r}$

$S = \frac{t_1}{1-r}$

Probability and Statistics

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

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

Basic Counting Principle with m,n, and l different items =

$m \cdot n \cdot l$

Transformations (a,b,h,k >0)

$y=f(x)-k$ down k units

$y=f(x-h)$ right h units

$y=-f(x)$ reflect over x axis

$y=f(-x)$ reflect over y axis

$y=f^{-1}(x)$ (inverse) reflect over $y=x$

$y=af(x)$ vertical expansion/compression

$y=f(bx)$ horizontal expansion/compression

Fractions

$\frac{0}{\#} = 0$

$\frac{0}{0} =$ indeterminant

$\frac{\#}{0} =$ undefined

Conjugate

of a + b is $a-b$

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

Horizontal Asymptote Rules:

$$y = \frac{ax^m + \ldots}{bx^n + \ldots}$$

1. $m>n$, no HA
2. $m<n$, $y=0$
3. $m=n$, $y=\frac{a}{b}$

Vertical Asymptote Rules:

- simplify
- set denominator $=0$
- roots are VA

Imaginary Numbers:

$\sqrt{-1} = i$

$i^2 = -1$

$i^3 = -i$

$i^4 = 1$

Arithmetic Operations

$ab+ac = a(b+c)$

$\frac{a}{b}+\frac{c}{d} = \frac{ad+bc}{bd}$

$\frac{a+b}{c} = \frac{a}{c}+\frac{b}{c}$

$\frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)} = \frac{ad}{bc}$

$\frac{\left(\frac{a}{b}\right)}{c} = \frac{a}{bc}$

$\frac{a}{\left(\frac{b}{c}\right)} = \frac{ac}{b}$

$a\left(\frac{b}{c}\right) = \frac{ab}{c}$

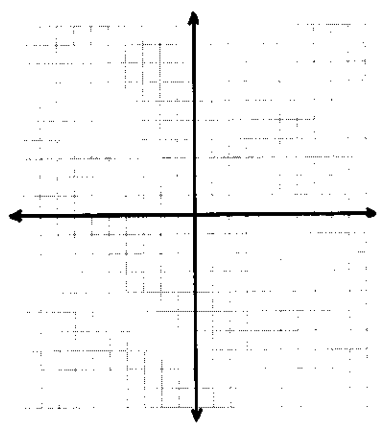
$\frac{a-b}{c-d} = \frac{b-a}{d-c}$

$\frac{ab+ac}{a} = b+c$

Parent Functions

Graph

$y =$ (varies)



A

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Stuff You Must Know Cold – Pre-Cal

Even – Odd Functions

If $f(x)$ is even, then

$F(-x) = f(x)$

If $f(x)$ is odd, then

$F(-x) = -f(x)$

Composite Functions

$f(x) =$ (varies)

$g(x) =$

$f(g(x)) =$

Triangles

Law of Cosines:

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

Law of Sines:

$\frac{\sin A}{a} = \frac{\sin B}{b}$

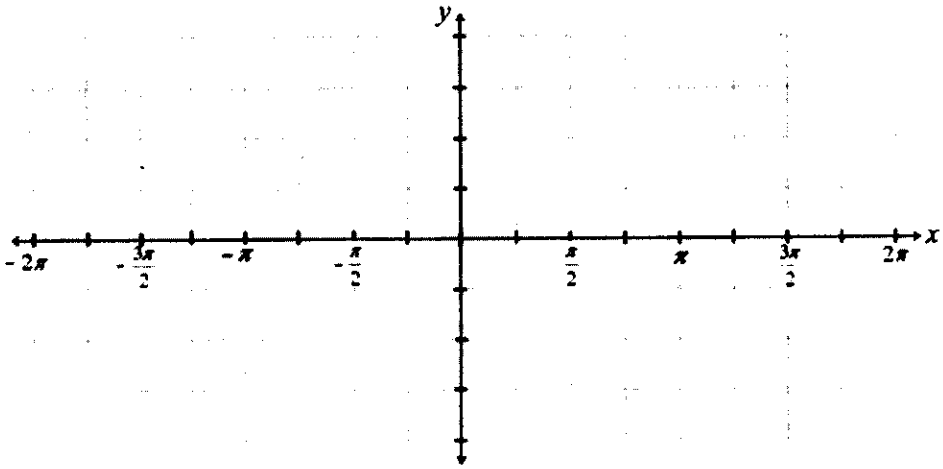
Values of Trigonometric Functions for Common Angles

θ	$\sin\theta$	$\cos\theta$	$\tan\theta$
0°	0	1	0
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
$\frac{\pi}{2}$	1	0	und
π	0	-1	0

*Know both the **inverse trig** and the **trig** values. E.g.* $\tan^{-1}(1)$

Trig Graph

$y =$ (varies)

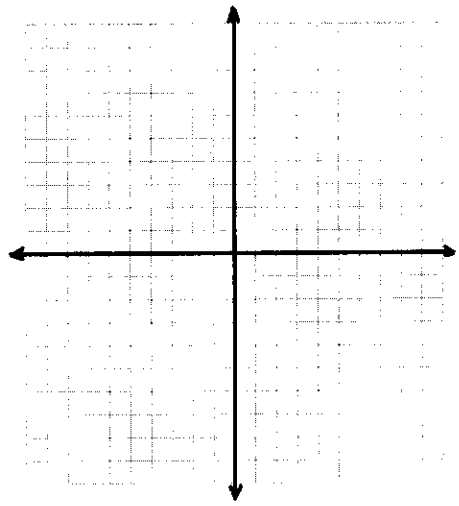


Parametric Equations

Graph

$x(t) =$ (varies)

$y(t) =$



Polar Equations

Standard Formulas

$x = r\cos\theta$

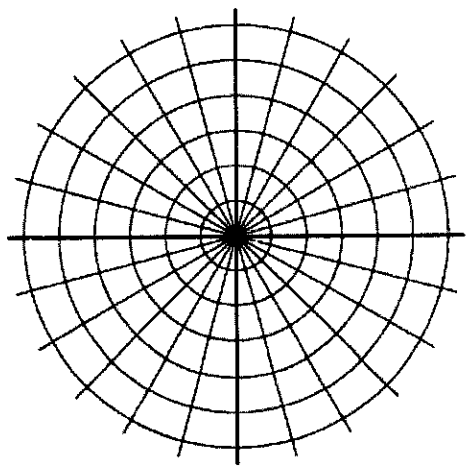
$y = r\sin\theta$

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

$x^2 + y^2 = r^2$

Graph

$r =$ (varies)



B

Name: Date: Number:

Stuff You Must Know Cold – Pre-Cal

Trig Identities

Double Angle

$\sin(2x) = 2\sin x \cos x$

$\cos(2x) = \cos^2 x - \sin^2 x$

$= 2\cos^2 x - 1$

$= 1 - 2\sin^2 x$

Power Reduction

$\sin^2 x = \frac{1 - \cos 2x}{2}$

$\cos^2 x = \frac{1 + \cos 2x}{2}$

Pythagorean

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

$1 + \tan^2 x = \sec^2 x$

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

Reciprocal

$\sec x = \frac{1}{\cos x}$

$\cos x \cdot \sec x = 1$

$\csc x = \frac{1}{\sin x}$

$\sin x \cdot \csc x = 1$

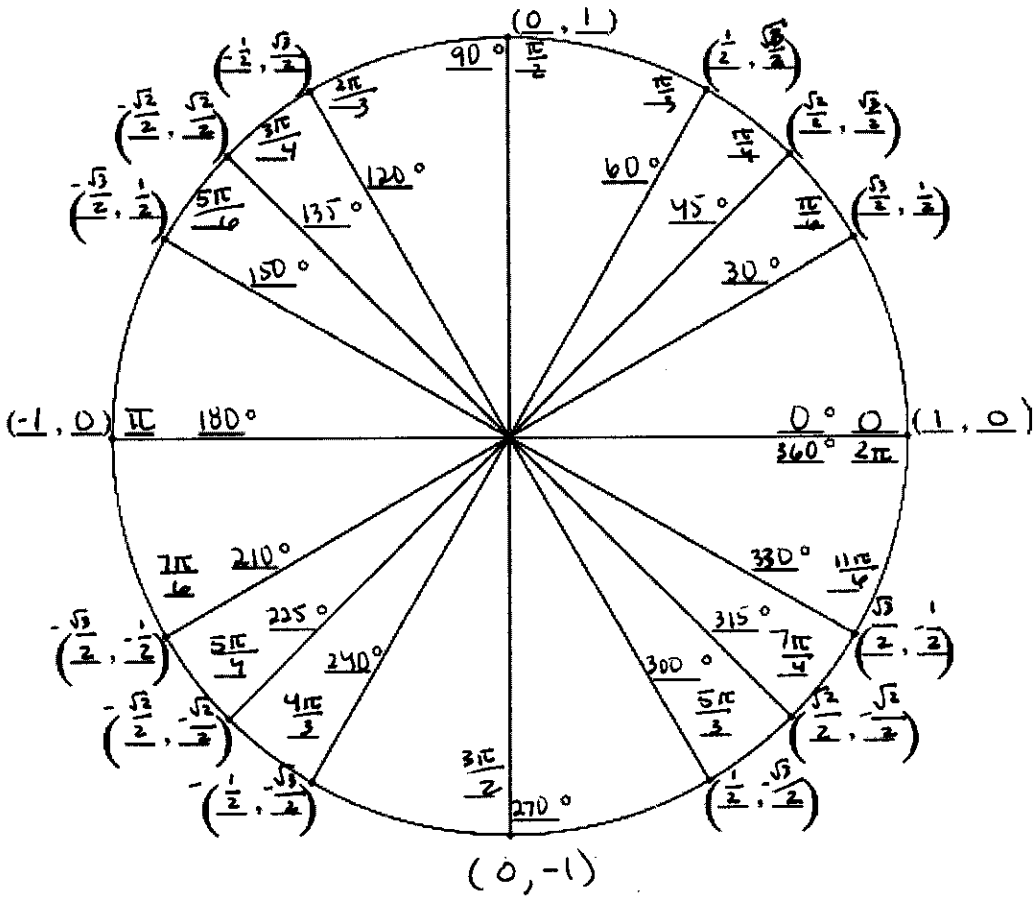
Even/Odd

$\sin(-x) = -\sin x$

$\cos(-x) = \cos x$

$\tan(-x) = -\tan x$

Trig Unit Circle

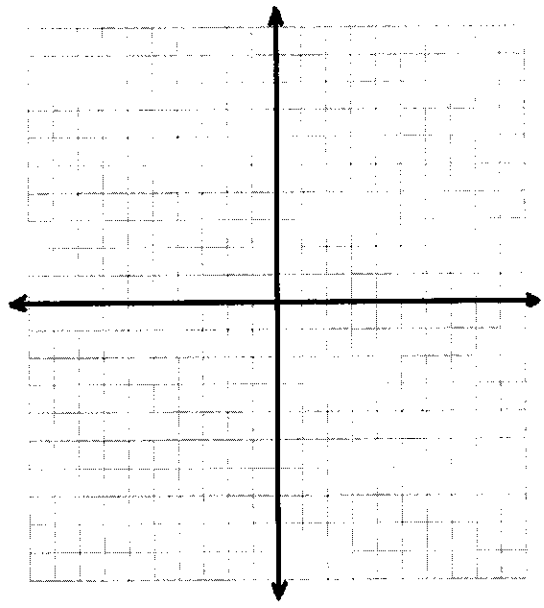


Vectors (varies)

$\vec{u} = \langle \quad , \quad \rangle$

$\|\vec{u}\| =$

Graph $\vec{u}$



C

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Stuff You Must Know Cold – Pre-Cal

Sequences and Series

$\sum_{i=}$ (varies)

Perfect Squares

$(u+v)^2 = u^2 + 2uv + v^2$

$(u-v)^2 = u^2 - 2uv + v^2$

Perfect Cubes

$(u+v)^3 = u^3 + 3u^2v + 3uv^2 + v^3$

$(u-v)^3 = u^3 - 3u^2v + 3uv^2 - v^3$

Binomial Theorem

$(\quad) = (\text{varies})$

+ − × ÷ Rational Functions

(varies)

Matrices (varies)

$A = [\quad]$

$B = [\quad]$

$A - B = [\quad]$

$AB = [\quad]$

Decomposition of Fractions

$\_\_\_\_\_ =$ (varies)

$\sqrt{x^2} = |x|$

$e \approx 2.718$

$\pi \approx$ at least three decimal places

Synthetic Division

$\_\_\_\_\_ =$

(varies)

$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \sin\beta\cos\alpha$

$\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$

Projectile Motion

feet

$x(t) = v_0 t \cos\theta$

$y(t) = h + v_0 t \sin\theta - 16t^2$

meters

$x(t) = v_0 t \cos\theta$

$y(t) = h + v_0 t \sin\theta - 4.9t^2$

A

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Limits

Notation for:

Limit from the left of $f(x)$ as $x \to a$

$\lim_{x \to a^-} f(x)$

Limit from the right of $f(x)$ as $x \to a$

$\lim_{x \to a^+} f(x)$

Theorems:

$\lim_{x \to a} f(x) = F$ *and* $\lim_{x \to a} g(x) = G$

$\lim_{x \to a}(f(x) + g(x)) =$ F + G

$\lim_{x \to a}(f(x) - g(x)) =$ F - G

$\lim_{x \to a}(f(x) \cdot g(x)) =$ F · G

$\lim_{x \to a}(f(x))^n =$ F^n

$\lim_{x \to a} \frac{f(x)}{g(x)} =$ $\frac{F}{G}$

$\lim_{x \to 0} \frac{\sin x}{x} =$ 1

$\lim_{x \to 0} \frac{1 - \cos x}{x} =$ 0

Definition of Continuity:

A function is continuous at the point x=a if and only if:

1. f(a) is defined
2. $\lim_{x \to a^-} f(x) = \lim_{x \to a^+} f(x)$
3. $f(a) = \lim_{x \to a} f(x)$

Extreme Value Theorem

continuous on [a, b]

$a \le c \le b$, $a \le d \le b$

$f(d) \le f(x) \le f(c)$

Curve Sketching and Analysis

Critical Points: $f'(x) = 0$ or $\frac{\#}{0}$

look at endpoints

Global Min: check critical points

$f''(x) > 0$

Global Max: check critical points

$f''(x) < 0$

Point of Inflection: $f''(x) = 0$ or $\frac{\#}{0}$

concavity changes

Derivatives

Definition of Derivative

$\frac{d}{dx}(f(x)) =$

$\lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$

Alternate Form of Def. of Derivative

$\frac{d}{dx}(f(x))$ *at* $x = a$

$\lim_{x \to a} \frac{f(x) - f(a)}{x - a}$

Chain Rule

$\frac{d}{dx}[f(u)] =$ $f'(u) \cdot u'$

Product Rule

$\frac{d}{dx}(uv) =$ $uv' + vu'$

Quotient Rule

$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{vu' - uv'}{v^2}$

Where u and v are functions of x

More Derivatives

Where u is a function of x and a is a constant

$\frac{d}{dx}(x^n) = nx^{n-1}$

$\frac{d}{dx}(\sin u) = \cos u\,(u')$

$\frac{d}{dx}(\cos u) = -\sin u\,(u')$

$\frac{d}{dx}(\tan u) = \sec^2 u\,(u')$

$\frac{d}{dx}(\cot u) = -\csc^2 u\,(u')$

$\frac{d}{dx}(\sec u) = \sec u\,(\tan u)\,u'$

$\frac{d}{dx}(\csc u) = -(\csc u)(\cot u)\,u'$

$\frac{d}{dx}(\ln u) = \frac{u'}{u}$

$\frac{d}{dx}(e^u) = e^u \cdot u'$

$\frac{d}{dx}(\sin^{-1} u) = \frac{u'}{\sqrt{1 - u^2}}$

$\frac{d}{dx}(\cos^{-1} u) = \frac{-u'}{\sqrt{1 - u^2}}$

$\frac{d}{dx}(\tan^{-1} u) = \frac{u'}{1 + u^2}$

$\frac{d}{dx}(\cot^{-1} u) = \frac{-u'}{1 + u^2}$

$\frac{d}{dx}(a^u) = a^u \cdot \ln u \cdot u'$

$\frac{d}{dx}(\log_a u) = \frac{d}{dx}\left(\frac{\ln u}{\ln a}\right)$

Intermediate Value Theorem

continuous on [a, b]

There is at least one number x = c in the open interval (a, b) such that

$f(c) = y$

B

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The Mean Value Theorem
(derivatives) continuous $[a,b]$

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

Rolle's Theorem continuous $[a,b]$
if $f(a) = f(b)$, Then There's at least one number $x = c$ in (a,b) such that $f'(c) = 0$

The Fundamental Theorem of Calculus

$$\int_a^b f(x)\,dx = F(b) - F(a)$$

where $F'(x) = f(x)$

Corollary to FTC

$$\frac{d}{dx}\int_a^{g(x)} f(t)\,dt =$$

$$f(g(x)) \cdot g'(x)$$

Area Under The Curve (Trapezoids)
add up the trapezoidal area in each subinterval

Mean Value Theorem for Integrals
(Average Value) continuous $[a,b]$
$x = c$ on (a,b)

$$f(c) = \frac{\int_a^b f(x)\,dx}{b - a}$$

Solids of Revolution and Friends
Disk Method

$$V = \pi \int_a^b [R(x)]^2\,dx$$

Washer Method

$$V = \pi \int_a^b \left([R(x)]^2 - [r(x)]^2\right)dx$$

General volume equation

$$V = \int_a^b \text{Area}(x)\,dx$$

Arc Length (rectangular)

$$L = \int_a^b \sqrt{1 + [f'(x)]^2}\,dx$$

Distance, Velocity, and Acceleration
$s(t)$ is the position function,
$\langle x(t), y(t) \rangle$ is the position in parametric

velocity = $s'(t)$

acceleration = $v'(t) = s''(t)$

velocity vector = $\langle x'(t), y'(t) \rangle$

acceleration vector = $\langle x''(t), y''(t) \rangle$

speed (rectangular and parametric) =

$$|v| = \sqrt{(x'(t))^2 + (y'(t))^2}$$

displacement = $\int_a^b v\,dt$

distance (rectangular and parametric) =

$$\int_a^b |v|\,dt \qquad \int_a^b \sqrt{(x')^2 + (y')^2}\,dt$$

average velocity =

$$\frac{\Delta s}{\Delta t}$$

l'Hôpital's Rule (Bernoulli's Rule)

If $\frac{f(a)}{g(a)} = \frac{0}{0}$ or $\frac{\infty}{\infty}$

then $\lim_{x \to a} \frac{f(x)}{g(x)} = \lim_{x \to a} \frac{f'(x)}{g'(x)}$

Euler's Method

$$x_{new} = x_{old} + \Delta x$$

$$y_{new} = y_{old} + \frac{dy}{dx}\Big|_{(x_{old}, y_{old})}$$

Integration by Parts

$$\int u\,dv = uv - \int v\,du$$

Logistics

$$\frac{dP}{dt} = kP(c - P)$$

Parametric Equations

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$$

$$\frac{d^2y}{dx^2} = \frac{\frac{d}{dt}\left(\frac{dy}{dx}\right)}{\frac{dx}{dt}}$$

Polar Curves

Area = $\int_a^b \frac{1}{2} r^2\,d\theta$

Slope = $\frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}$

Taylor Series centered at $x = a$

$$f(x) \approx f(a) + f'(a)(x - a) + \frac{f''(a)}{2!}(x - a)^2 + \ldots + \frac{f^n(a)}{n!}(x - a)^n$$

Maclaurin Series
about $x = 0$

$$f(x) \approx f(0) + f'(0)(x) + f''(0) + \ldots$$

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \ldots$$

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \ldots$$

$$\frac{1}{1 - x} = 1 + x + x^2 + x^3 + \ldots$$

$$\ln(x + 1) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \ldots$$

Series Tests/Error Bound
(varies)