Name:

Stuff You Must Know Cold – Calc BC

Limits

$\lim_{x \to a} f(x)$ *exists if* :

=

Theorems:

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

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

Steps:

1.
2.
3.

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

1.
2.

3.

Vertical Asymptotes:

$\lim_{x \to c} f(x) =$

from either side of c.

Horizontal Asymptotes:

$\lim_{x \to \pm\infty} f(x) =$

Intermediate Value Theorem

Extreme Value Theorem

Rolle's Theorem

Derivatives
Definition of Derivative

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

Alternate Form of Def. of Derivative

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

Equation of a tangent line at x=a

Chain Rule

f(g(x))	

Product Rule

f · g	

Quotient Rule

$\frac{f}{g}$	

Curve Sketching and Analysis

Critical Points:
Increasing:
Decreasing:

Relative Min:

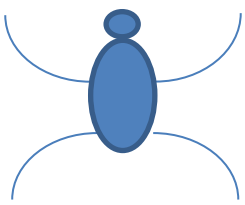
Relative Max:

Absolute Extrema:
Check endpoints! Candidates test or global argument.

Concave Up:

Concave Down:

Point of Inflection:



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

function	derivative
x^n	
sin u	
cos u	
tan u	
csc u	
sec u	
cot u	
arcsin u	
arccos u	
arctan u	
arccsc u	
arcsec u	
arccot u	
e^u	
ln u	
a^u	
$\log_a u$	

Derivative of an Inverse

(a,b) on f(x)
$g(x) = f^{-1}(x)$
$g'(b) =$

The Mean Value Theorem
(derivatives)

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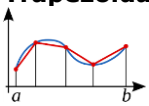
Riemann Sums:

3 types of Riemann Sums

left side | midpoint side | right side

Trapezoidal Sum:



Area of a trapezoid: $\left(\frac{f(c_1)+f(c_2)}{2}\right)(\Delta x)$

Limit definition of an Integral:

Area $= \int_a^b f(x)dx =$

$\lim_{n\to\infty}\sum_{i=1}^{n}[f(c_i)\Delta x]; \quad \Delta x = \frac{b-a}{n}$

The Fundamental Theorem of Calculus

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

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

Corollary to FTC

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

$f[g(x)]g'(x) - f[h(x)]h'(x)$

Mean Value Theorem for Integrals
(Average Value)

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

Other integration rules:

$\int x^n dx = \frac{x^{n+1}}{n+1}+C$

$\int \tan u du = -\ln|\cos u|+C$

$\int \sec u du = \ln|\sec u+\tan u|+C$

$\int \csc u du = -\ln|\csc u+\cot u|+C$

$\int \cot u du = \ln|\sin x|+C$

$\int a^u du = \frac{a^u}{\ln a}+C$

Integration by Parts

$\int udv = uv - \int vdu$

l'Hôpital's Rule :

$\lim_{x\to c}\frac{f(x)}{g(x)}$

If $\lim_{x\to c} f(x) = 0$ *or* ∞, *and* $\lim_{x\to c} g(x) = 0$ *or* ∞,

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

Euler's Method

N	X_n	Y_n	$\left.\frac{dy}{dx}\right\|_n$

$x_{n+1} =$

$y_{n+1} =$

Logistics

$\frac{dP}{dt} =$ $\quad P =$

$b =$ $\quad \lim_{t\to\infty} P(t) =$

Population is increasing the fastest at

Area between two curves:

Volumes of Known Cross Sections:

$\int_a^b (Area\ with\ respect\ to\ s)dx$

$s = Top - Bottom$

(Perpendicular to x-axis)

$\int_a^b (Area\ with\ respect\ to\ s)dy$

$s = Right - Left$

(Perpendicular to y-axis)

Squares:

Rectangles:

Equilateral Triangles:

Isosceles Right Triangles:

Semicircles:

Series Convergence Tests:

Solids of Revolution

Disk Method

Washer Method

Arc Length

(rectangular)

(parametric)

(polar)

Parametric Equations

$\frac{dy}{dx} =$

$\frac{d^2y}{dx^2} =$

Distance, Velocity, and Acceleration

s(t) is the position function,

$< x(t), y(t) >$ is the position vector

velocity =

acceleration =

speed = =

velocity vector =

acceleration vector =

Speed is increasing_____

_____.

position=

Total distance

average velocity =

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Polar Curves

Area =

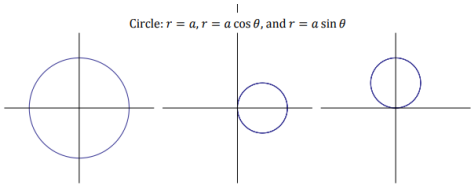
$\frac{dy}{dx} =$

x = y =

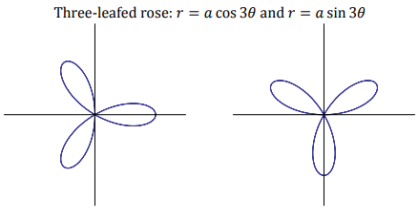
Slope =

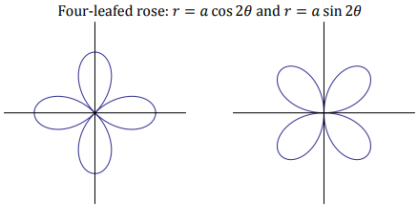
Basic Polar Curves:

Cirlce:

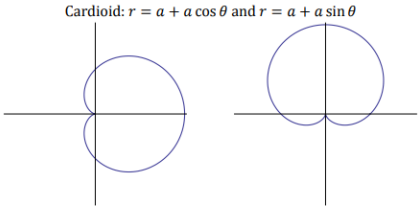


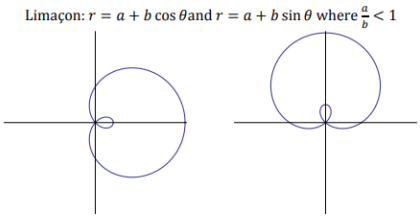
Rose:



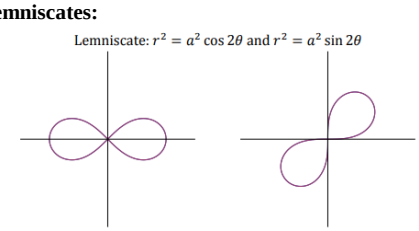


Limacons:





Lemniscates:



Nth Term

Geometric

P-Series

Alternating Series Test

Direct Comparison

Limit Comparison

Integral Test

Ratio Test

Taylor Series

y = sin x

Maclaurin Series

Series you need to memorize:

$e^x =$

$\cos x =$

$\sin x =$

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

Alternating Remainder

Lagrange Error

Trig

Signs: All Students Take Calculus

sin csc	All functions are positive
tan cot	cos sec

Values:

	30°	45°	60°
sin θ			
cos θ			
tan θ			

Quadrantals

(cos, sin)
tan = sin/cos

Trig Graphs:

y = cos x

y = tan x

Pythagorean Identities:

- **Reciprocal Identities:**

Double Angles:

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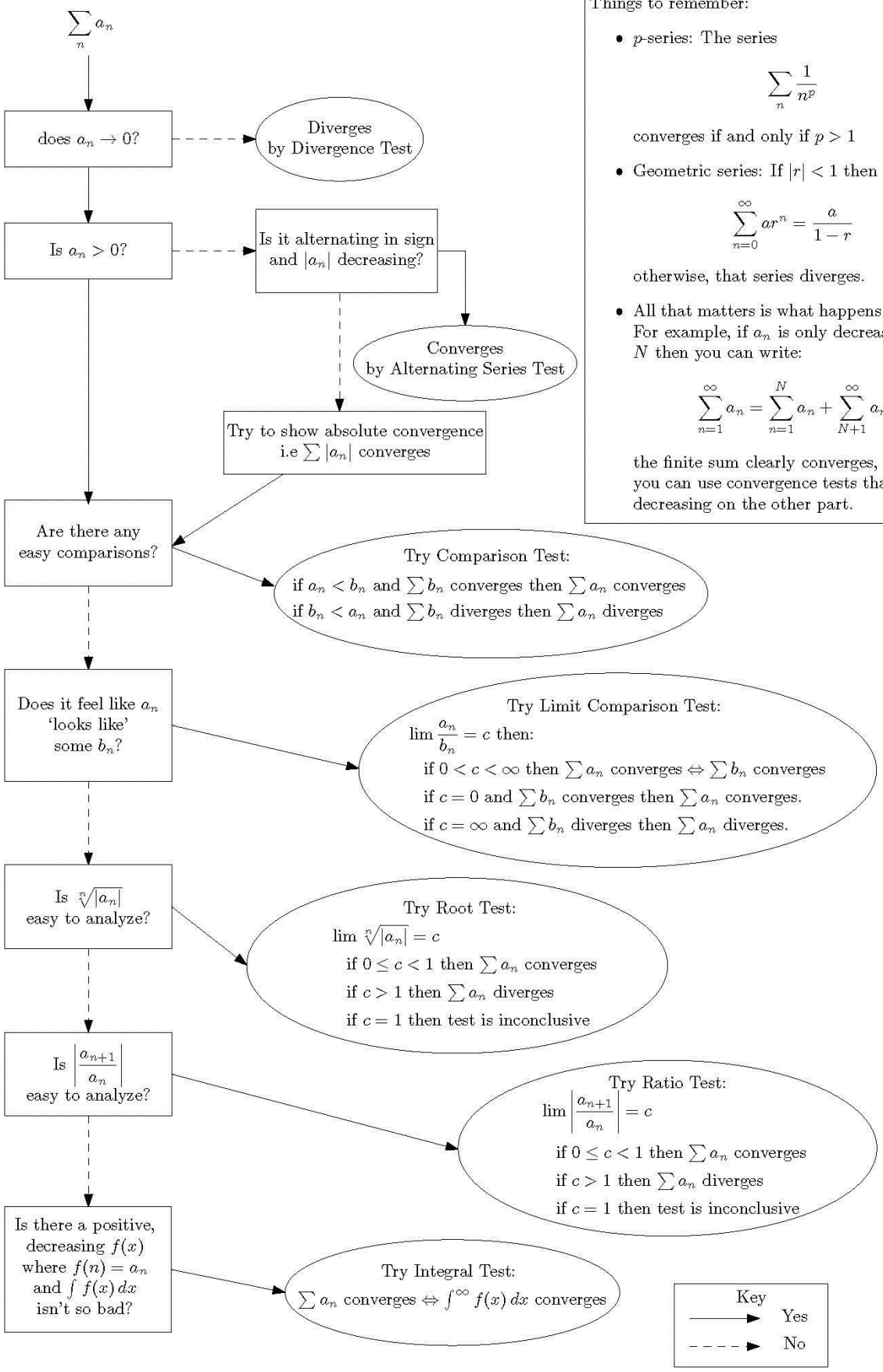
Series Convergence Flowchart



Things to remember:

- p-series: The series

$$\sum_n \frac{1}{n^p}$$

converges if and only if $p > 1$

- Geometric series: If $|r| < 1$ then

$$\sum_{n=0}^{\infty} ar^n = \frac{a}{1-r}$$

otherwise, that series diverges.

- All that matters is what happens on a tail. For example, if a_n is only decreasing after N then you can write:

$$\sum_{n=1}^{\infty} a_n = \sum_{n=1}^{N} a_n + \sum_{N+1}^{\infty} a_n$$

the finite sum clearly converges, and then you can use convergence tests that require decreasing on the other part.