

Things I Should Know Before I Get to Calculus Class

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

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

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

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

$$\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$$

$$\cos(x + y) = \cos x \cos y - \sin x \sin y$$

$$\cos(x - y) = \cos x \cos y + \sin x \sin y$$

$$\sin 2x = 2 \sin x \cos x$$

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

$$\cos 2x = 2 \cos^2 x - 1$$

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

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

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

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

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

slope-intercept form $y = mx + b$

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

vertical line equation $x = a$

horizontal line equation $y = b$

Absolute value of a number x is the number $|x| = \sqrt{x^2} = x$ if x is greater than or equal to 0 and $-x$ if $x < 0$

$$f(x) = a \sin\left(\frac{2\pi}{b}\right)(x - c) + d$$

|a| = amplitude

|b| = period

|c| = horizontal shift

|d| = vertical shift

Symmetry

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

x-axis $f(-x) = -f(x)$

origin $f(-x, -y) = f(x, y)$

origin symmetry contains x and y symmetry

horizontal asymptote $\lim_{x \rightarrow \infty} f(x)$ OR

1. higher exponent on top—no horizontal asymptote
2. higher exponent on bottom— $y=0$
3. Exponents same—ratio of coefficients

Vertical asymptotes—zeros of the denominator

Properties of $y = \ln(x)$

Domain: all positive reals

Range: all Real numbers

Continuous

Always concave down

One-to-one (has an inverse)

$\ln 1 = 0$

$\ln e = 1$

$$\ln(ab) = \ln a + \ln b$$

$$\ln \frac{a}{b} = \ln a - \ln b$$

$$\ln a^n = n \ln a$$

Properties of $y = e^x$

$$e = \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$$

$$\ln e^n = n \ln e = n$$

$$y = e^x \Leftrightarrow x = \ln y$$

$$\ln e^x = x$$

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

inverse of $\ln x$

Domain: all real numbers

Range: $y > 0$

Continuous

Always increasing

$$(e^x)(e^x) = e^{2x}$$

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

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

Exponential Growth and Decay

$$A = Ce^{kt}$$

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

x-intercepts are zeros of the function

Translations

$f(x-h)$ shifts $f(x)$ h units to the right

$f(x+h)$ shifts $f(x)$ h units to the left

$f(x) + k$ shifts $f(x)$ k units upward

$f(x)-k$ shifts $f(x)$ k units downward

The graph of an odd function is symmetric about the origin.

The graph of an even function is symmetric about the y-axis.

Horizontal line test—if passes, the function has an inverse.

A closed interval $[,]$ contains the endpoints, an open interval $(,)$ does not.

Volume Formulas

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

Cylinder $\pi r^2 h$

Rectangular box lwh

sphere $\frac{4}{3}\pi r^3$

Surface area

Sphere $4\pi r^2$

box with a top area of four sides + area of top and bottom

cylinder with closed top $2\pi r^2 + 2\pi rh$

cylinder with open top $\pi r^2 + 2\pi rh$

Trigonometric Identities

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

$\cot x = \frac{\cos x}{\sin x}$

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

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

Table of Trigonometric Values

Radians	Degrees	Sine	Cosine
0	0	0	1
$\frac{\pi}{6}$	30	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$
$\frac{\pi}{4}$	45	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$
$\frac{\pi}{3}$	60	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$
$\frac{\pi}{2}$	90	1	0
π	180	0	-1
$\frac{3\pi}{2}$	270	-1	0