

MATH 112 Formula Sheet

Basic Trigonometry:

θ	$\sin \theta$	$\cos \theta$	$\tan \theta$
0	0	1	0
$\pi/6$	1/2	$\sqrt{3}/2$	$\sqrt{3}/3$
$\pi/4$	$\sqrt{2}/2$	$\sqrt{2}/2$	1
$\pi/3$	$\sqrt{3}/2$	1/2	$\sqrt{3}$
$\pi/2$	1	0	undef.

$$\begin{aligned} \tan \theta &= \frac{\sin \theta}{\cos \theta} & \sec \theta &= \frac{1}{\cos \theta} \\ \cot \theta &= \frac{\cos \theta}{\sin \theta} & \csc \theta &= \frac{1}{\sin \theta} \end{aligned}$$

Pythagorean Identities:

1. $\sin^2 x + \cos^2 x = 1$
2. $\tan^2 x + 1 = \sec^2 x$
3. $1 + \cot^2 x = \csc^2 x$

Half Angle Identities:

$$\sin^2 x = \frac{1}{2}(1 - \cos 2x) \qquad \cos^2 x = \frac{1}{2}(1 + \cos 2x)$$

Other Identities:

1. $\sin A \cos B = \frac{1}{2}[\sin(A - B) + \sin(A + B)]$
2. $\sin A \sin B = \frac{1}{2}[\cos(A - B) - \cos(A + B)]$
3. $\cos A \cos B = \frac{1}{2}[\cos(A - B) + \cos(A + B)]$

Inverse Trig Functions:

$f(x)$	Domain	Range	Derivative
$\sin^{-1} x$	$[-1, 1]$	$[-\pi/2, \pi/2]$	$f'(x) = \frac{1}{\sqrt{1-x^2}}$
$\cos^{-1} x$	$[-1, 1]$	$[0, \pi]$	$f'(x) = \frac{-1}{\sqrt{1-x^2}}$
$\tan^{-1} x$	$(-\infty, \infty)$	$(-\pi/2, \pi/2)$	$f'(x) = \frac{1}{1+x^2}$

Integration Formulas:

$$\int \tan x \, dx = \ln |\sec x| + C \qquad \int \sec x \, dx = \ln |\sec x + \tan x| + C$$

Trigonometric Substitution:

Form	Substitution	Identity
$\sqrt{a^2 - x^2}$	$x = a \sin \theta$	$1 - \sin^2 \theta = \cos^2 \theta$
$\sqrt{a^2 + x^2}$	$x = a \tan \theta$	$1 + \tan^2 \theta = \sec^2 \theta$
$\sqrt{x^2 - a^2}$	$x = a \sec \theta$	$\sec^2 \theta - 1 = \tan^2 \theta$

Error Bounds:

Suppose $|f''(x)| \leq K$ for $a \leq x \leq b$. If E_T and E_M are the errors in the Trapezoid and Midpoint Rules, then

$$|E_T| \leq \frac{K(b-a)^3}{12n^2} \quad \text{and} \quad |E_M| \leq \frac{K(b-a)^3}{24n^2}$$