

TRIGONOMETRY IDENTITIES

RECIPROCAL IDENTITIES

- 1) $\sin x = \frac{1}{\csc x}$
- 2) $\cos x = \frac{1}{\sec x}$
- 3) $\tan x = \frac{1}{\cot x}$
- 4) $\cot x = \frac{1}{\tan x}$
- 5) $\sec x = \frac{1}{\cos x}$
- 6) $\csc x = \frac{1}{\sin x}$

COFUNCTION IDENTITIES

- 7) $\sin x = \cos\left(\frac{\pi}{2} - x\right)$ OR $\sin x = \cos(90^\circ - x)$
- 8) $\cos x = \sin\left(\frac{\pi}{2} - x\right)$ OR $\cos x = \sin(90^\circ - x)$
- 9) $\tan x = \cot\left(\frac{\pi}{2} - x\right)$ OR $\tan x = \cot(90^\circ - x)$
- 10) $\cot x = \tan\left(\frac{\pi}{2} - x\right)$ OR $\cot x = \tan(90^\circ - x)$
- 11) $\sec x = \csc\left(\frac{\pi}{2} - x\right)$ OR $\sec x = \csc(90^\circ - x)$
- 12) $\csc x = \sec\left(\frac{\pi}{2} - x\right)$ OR $\csc x = \sec(90^\circ - x)$

QUOTIENT IDENTITIES

- 13) $\tan x = \frac{\sin x}{\cos x}$
- 14) $\cot x = \frac{\cos x}{\sin x}$

PYTHAGOREAN IDENTITIES

- 15) $\sin^2 x + \cos^2 x = 1$
- 16) $\tan^2 x + 1 = \sec^2 x$
- 17) $\cot^2 x + 1 = \csc^2 x$

EVEN/ODD IDENTITIES

- 18) $\sin(-x) = -\sin x$
- 19) $\cos(-x) = \cos x$
- 20) $\tan(-x) = -\tan x$
- 21) $\cot(-x) = -\cot x$
- 22) $\sec(-x) = \sec x$
- 23) $\csc(-x) = -\csc x$

SUM AND DIFFERENCE FORMULAS

- 24) $\sin(x + y) = \sin x \cos y + \cos x \sin y$
- 25) $\sin(x - y) = \sin x \cos y - \cos x \sin y$
- 26) $\cos(x + y) = \cos x \cos y - \sin x \sin y$

$$27) \cos(x - y) = \cos x \cos y + \sin x \sin y$$

$$28) \tan(x + y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}$$

$$29) \tan(x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$$

DOUBLE-ANGLE FORMULAS

- 30) $\sin 2x = 2 \sin x \cos x$
- 31) $\cos 2x = \cos^2 x - \sin^2 x$
- 32) $\cos 2x = 2 \cos^2 x - 1$
- 33) $\cos 2x = 1 - 2 \sin^2 x$
- 34) $\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$

HALF-ANGLE FORMULAS

- 35) $\sin \frac{x}{2} = \pm \sqrt{\frac{1 - \cos x}{2}}$
- 36) $\cos \frac{x}{2} = \pm \sqrt{\frac{1 + \cos x}{2}}$
- 37) $\tan \frac{x}{2} = \pm \sqrt{\frac{1 - \cos x}{1 + \cos x}}$
- 38) $\tan \frac{x}{2} = \frac{1 - \cos x}{\sin x}$
- 39) $\tan \frac{x}{2} = \frac{\sin x}{1 + \cos x}$

POWER-REDUCING FORMULAS

- 40) $\sin^2 x = \frac{1 - \cos 2x}{2}$
- 41) $\cos^2 x = \frac{1 + \cos 2x}{2}$
- 42) $\tan^2 x = \frac{1 - \cos 2x}{1 + \cos 2x}$

SUM-TO-PRODUCT FORMULAS

- 43) $\sin x + \sin y = 2 \sin\left(\frac{x + y}{2}\right) \cos\left(\frac{x - y}{2}\right)$
- 44) $\sin x - \sin y = 2 \cos\left(\frac{x + y}{2}\right) \sin\left(\frac{x - y}{2}\right)$
- 45) $\cos x + \cos y = 2 \cos\left(\frac{x + y}{2}\right) \cos\left(\frac{x - y}{2}\right)$
- 46) $\cos x - \cos y = -2 \sin\left(\frac{x + y}{2}\right) \sin\left(\frac{x - y}{2}\right)$

PRODUCT-TO-SUM FORMULAS

- 47) $\sin x \sin y = \frac{1}{2} [\cos(x - y) - \cos(x + y)]$
- 48) $\cos x \cos y = \frac{1}{2} [\cos(x - y) + \cos(x + y)]$
- 49) $\sin x \cos y = \frac{1}{2} [\sin(x - y) + \sin(x + y)]$
- 50) $\cos x \sin y = -\frac{1}{2} [\sin(x - y) - \sin(x + y)]$