

1. 10 pts. Find the exact value of  $\cos^{-1}\left[\cos\left(-\frac{5\pi}{3}\right)\right]$  and  $\csc\left[\tan^{-1}(-2)\right]$ .
2. 10 pts. Find the inverse function  $f^{-1}$  of

$$f(x) = 2 \tan x - 3; \quad -\frac{\pi}{2} < x < \frac{\pi}{2}.$$

Also find the range of  $f$ , and the domain and range of  $f^{-1}$ .

3. 10 pts. each Solve each trigonometric equation on the interval  $0 \leq \theta < 2\pi$ .
- (a)  $4 \cos^2 \theta - 3 = 0$
- (b)  $\sqrt{3} \cot \theta + 1 = 0$
- (c)  $(\cot \theta + 1)\left(\csc \theta - \frac{1}{2}\right) = 0$
- (d)  $\tan \theta = 2 \sin \theta$

4. 10 pts. each Establish the identity.

(a)  $\tan^3 x + \tan x = \sec^2 x \tan x$

(b)  $1 - \frac{\sin^2 u}{1 + \cos u} = \cos u.$

5. 10 pts. Find the exact value using a sum or difference formula:

$$\sin \frac{\pi}{18} \cos \frac{5\pi}{18} + \cos \frac{\pi}{18} \sin \frac{5\pi}{18}$$

6. 10 pts. Find the exact value of  $\sin 195^\circ$  using a double-angle or half-angle formula.
7. 10 pts. The hypotenuse of a right triangle is 3 meters. If one leg is one meter, find the degree measure of each angle.
8. 10 pts. The angle of elevation of the sun is  $35.1^\circ$  at the instant the shadow cast by the Washington Monument is 789 feet long. Use this information to find the height of the monument to the nearest tenth of a foot.
9. 10 pts. each Solve the triangle, rounding to the tenths place.
- (a)  $C = 46^\circ 32'$ ,  $a = 56.2$  m,  $c = 22.1$  m.
- (b)  $A = 10^\circ$ ,  $a = 3$ ,  $b = 10$ .
- (c)  $a = 4$ ,  $b = 3$ ,  $c = 6$ .

## TRIGONOMETRIC IDENTITIES

$$\sin(u \pm v) = \sin u \cos v \pm \cos u \sin v$$

$$\cos(u \pm v) = \cos u \cos v \mp \sin u \sin v$$

$$\tan(u \pm v) = \frac{\tan u \pm \tan v}{1 \mp \tan u \tan v}$$

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

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

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$$

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

$$\cos \frac{x}{2} = \pm \sqrt{\frac{1 + \cos x}{2}}$$

$$\tan \frac{x}{2} = \frac{\sin x}{1 + \cos x}$$

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

$$\cos x \cos y = \frac{1}{2}[\cos(x - y) + \cos(x + y)]$$

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

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

$$\sin x + \sin y = 2 \sin \frac{x + y}{2} \cos \frac{x - y}{2}$$

$$\sin x - \sin y = 2 \cos \frac{x + y}{2} \sin \frac{x - y}{2}$$

$$\cos y + \cos x = 2 \cos \frac{x + y}{2} \cos \frac{x - y}{2}$$

$$\cos y - \cos x = 2 \sin \frac{x + y}{2} \sin \frac{x - y}{2}$$