

1. 5 pts. each Find the exact value of each expression, or state that it is undefined.

(a)  $\tan^{-1}\left(\tan\frac{4\pi}{5}\right)$

(b)  $\sin(\sin^{-1} 1.3)$

(c)  $\sec\left(\tan^{-1}\frac{1}{2}\right)$

(d)  $\cos^{-1}\left(\sin\frac{7\pi}{6}\right)$

2. 10 pts. each Solve each trigonometric equation on the interval  $0 \leq \theta < 2\pi$ .

(a)  $2\cos^2\theta - 1 = 0$

(b)  $\tan\theta + 1 = 0$

(c)  $4(1 + \sin\theta) = \cos^2\theta$

3. 10 pts. each Establish the identity.

(a)  $1 - \frac{\sin^2\theta}{1 - \cos\theta} = -\cos\theta$

(b)  $\sec\theta - \cos\theta = \sin\theta \tan\theta$

4. 10 pts. Find the exact value using a sum or difference formula:

$$\cos\frac{5\pi}{12}\cos\frac{7\pi}{12} - \sin\frac{5\pi}{12}\sin\frac{7\pi}{12}$$

5. 10 pts. Find the exact value of  $\tan 15^\circ$  using a double-angle or half-angle formula.

6. 10 pts. Establish the identity  $\cos^4\theta - \sin^4\theta = \cos(2\theta)$ .

7. 10 pts. A security camera in a neighborhood bank is mounted on a wall 9 feet above the floor. What angle of depression should be used if the camera is to be directed to a spot 6 feet above the floor and 16 feet from the wall?

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.

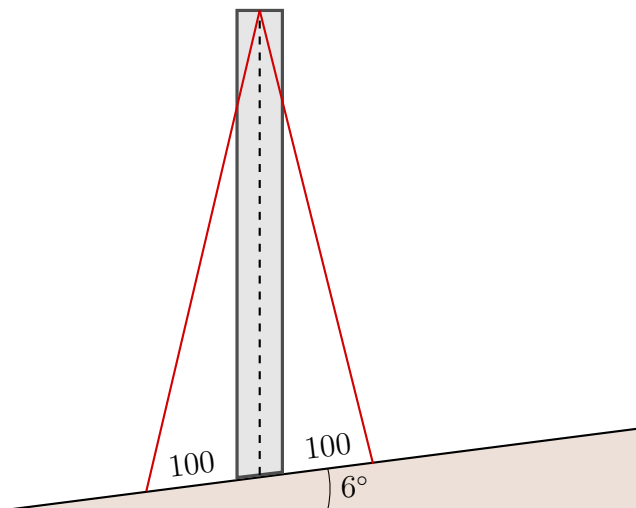
9. 10 pts. each Solve the triangle, rounding to the tenths place.

(a)  $A = 50^\circ$ ,  $C = 20^\circ$ ,  $a = 3$ .

(b)  $b = 3$ ,  $c = 5$ ,  $B = 40^\circ$ .

(c)  $a = 5$ ,  $b = 8$ ,  $c = 12$ .

10. 10 pts. A radio tower 500 feet high is located on the side of a hill with an inclination to the horizontal of  $6^\circ$ , as shown in the figure below. (The dashed line in the figure can be assumed to be 500 feet high and is taken to be the *exact* location of the tower.) How long should two guy wires be if they are to connect to the top of the tower and be secured by two points 100 feet downhill and directly uphill from the base of the tower?



### TRIGONOMETRIC IDENTITIES

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

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

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

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

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

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

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

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

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