

1. 10 pts. Given that $\csc \theta = 3$ and $\cot \theta < 0$, find the value of all trigonometric functions of θ .
2. 10 pts. each Find the exact value of each expression, or state that it is undefined.

 - (a) $\cos^{-1}\left(\cos \frac{3\pi}{10}\right)$
 - (b) $\sin^{-1}\left(\sin \frac{6\pi}{7}\right)$
 - (c) $\csc\left(\tan^{-1} \frac{1}{2}\right)$
 - (d) $\sec^{-1}\left(\sin \frac{7\pi}{6}\right)$
3. 15 pts. Find the inverse function f^{-1} for $f(x) = -2\cos(3x)$, $0 \leq x \leq \pi/3$. Using interval notation, find the range of f and the domain and range of f^{-1} .
4. 10 pts. each Solve each trigonometric equation on the interval $0 \leq \theta < 2\pi$.

 - (a) $3 \tan^3 \theta = \tan \theta$
 - (b) $\sec^2 \theta - 2 = 0$
 - (c) $4(1 + \sin \theta) = \cos^2 \theta$
5. 10 pts. each Establish the identity.

 - (a) $\frac{\csc u - \cot u}{\sec u - 1} = \cot u$
 - (b) $\frac{1}{1 - \sin \theta} = \sec^2 \theta + \tan \theta \sec \theta$
6. 10 pts. A laser beam is to be aimed toward the center of the moon, but the beam strays 0.4° from its intended path. Given that the moon is 384,400 km from Earth, by how much will the beam miss its target? Round to the nearest hundred kilometers.
7. 10 pts. From the top of a 70-meter-tall lighthouse, the angle of depression to a ship in the ocean is 21° . How far is the ship from the base of the lighthouse? Round to the nearest meter.
8. 10 pts. each Solve the triangle using the Law of Sines, rounding sides to the hundredths place and angles to the tenths place when necessary. If no triangle results from the given information, then explain why.

 - (a) $A = 50^\circ$, $C = 20^\circ$, $a = 3$.
 - (b) $a = 2$, $c = 1$, $C = 100^\circ$.

9. 15 pts. Two runners in a marathon determine that the angles of elevation of a news helicopter covering the race are 38° and 45° . If the helicopter is 600 meters directly above the finish line, how far apart are the runners?

TRIGONOMETRIC IDENTITIES

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

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

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

$$\sin 2u = 2 \sin u \cos u$$

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

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

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

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

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