

Problem Set 13

1. A 12-sided polygon is inscribed in a circle whose radius is 10 cm. Find the area of the polygon.
2. What is the largest value that the expression $\sin x + \cos x$ takes?
3. There is a 10 mile pathway toward the ocean, perpendicular to the beach. Two runners agree to race on this path. The first runner runs the path with perfect accuracy. The second runner misses the perpendicular path by 1° to the right. How far apart are the endpoints of the runners' paths?
4. Suppose that $\sin \alpha = \frac{8}{17}$ and α is not in the first quadrant; and $\cos \beta = \frac{4}{5}$ and β is in the first quadrant. Find the exact value for each of the following.

- (a) $\tan 2\alpha$
- (b) $\tan 3\beta$
- (c) $\cos(\alpha + \beta)$
- (d) $\sin(\alpha + \beta)$

5. Simplify the following expressions. Use exact values.

- (a) $\cos(90^\circ - x) =$
- (b) $\sin\left(\alpha - \frac{\pi}{6}\right) =$

6. Find the exact value for each of the following expression.

- (a) $\frac{\tan 72^\circ + \tan 78^\circ}{1 - \tan 72^\circ \tan 78^\circ} =$
- (b) $\sin 15^\circ =$
- (c) $\csc^2\left(-\frac{3\pi}{4}\right) - \cot^2\left(-\frac{3\pi}{4}\right) + \sec^2\left(-\frac{3\pi}{4}\right) - \tan^2\left(-\frac{3\pi}{4}\right) =$
- (d) $\cos 165^\circ =$

7. Solve each of the following equations.

- (a) $\cos 2x = 2 \sin^2 x - 2$
- (b) $2 \cos 4x + 1 = 0$
- (c) $\cos^2 x + 4 \cos x + 3 = 0$

8. Prove each of the following identities.

- (a) $\frac{\cos^3 x + \sin^3 x}{\cos x + \sin x} = 1 - \sin x \cos x$
- (b) $\cos 2x + \sin 2x + 2 \sin^2 x = (\sin x + \cos x)^2$
- (c) $\cot(x + y) = \frac{\cot x \cot y - 1}{\cot x + \cot y}$

9. An object is held by two ropes as shown on the picture. Find the forces in the rope if the object weighs 200 N.

