

Problem Set 12

1. A particle is traveling around a circle with radius 0.5 m. It completes 9 cycles in a second.
 - (a) Find the angle in radians that the particle travels through in a second.
 - (b) Find the coordinates of the point after 0.8 seconds if it starts at the point $P(0.5, 0)$.
 - (c) Find the linear speed of the particle.
2. The angle of elevation to the top of a tower increases from 7° to 10° as the observer travels 200 m toward the tower. How tall is the tower?
3. Find the exact value for each of the following expressions.

(a) $\cos \frac{5\pi}{6} + \cot \frac{7\pi}{4} - \sin \frac{3\pi}{2} \cos 3\pi =$

(b) $\cos \frac{13\pi}{6} \tan \frac{-7\pi}{3} + \sin^2 \frac{5\pi}{4} =$

4. Find the exact value for $\cos \alpha$ if $\sin \alpha = \frac{4}{5}$ and α is not in the first quadrant.
5. Find the exact value of all solutions of each of the following equations. Present your answer in radians.

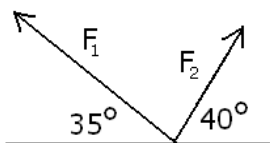
(a) $\sin 2x = -\frac{1}{\sqrt{2}}$

(b) $\cos 3x = \frac{\sqrt{3}}{2}$

(c) $\frac{3}{2} \sin x + \sin^2 x = 1$

(d) $\sin^2 x + 3 \cos x = -3$

6. Find the resultant force based on the picture below. $F_1 = 300$ N and $F_2 = 220$ N.



- (a) Present your answer by rectangular coordinates, i.e. find F_x and F_y .
 - (b) Present your answer in polar coordinates.
7. Prove each of the following identities.
 - (a) $(\sin x - \cos x)^2 + (\sin x + \cos x)^2 = 2$
 - (b) $\frac{\sin^2 x + 4 \sin x + 3}{\cos^2 x} = \frac{3 + \sin x}{1 - \sin x}$
 - (c) $\frac{\cos x}{1 - \sin x} - \tan x = \sec x$
8. Use the identity $\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$ to find the formula for $\sin(\alpha - \beta)$.

9. Use the identities for $\sin 2\alpha$ and $\cos 2\alpha$ to derive the formula for $\tan 2\alpha$.
10. Find the exact value for $\cos 75^\circ$.
11. Suppose that $\cos \alpha = \frac{3}{5}$ and α is not in the first quadrant; $\sin \beta = -\frac{12}{13}$ and β is not in the fourth quadrant. Find the exact values for each of the following.
- (a) $\sin 2\alpha$
 - (b) $\cos (\alpha - \beta)$
 - (c) $\tan 2\beta$
 - (d) $\tan (\alpha + \beta)$