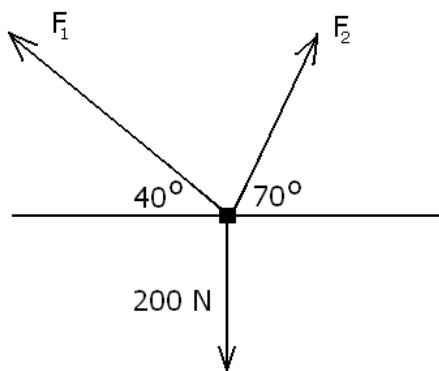


Problem Set 15

1. Convert $(21, 225^\circ)$ to rectangular coordinates.
2. Convert $(-2, 5)$ to polar coordinates.
3. A clock's minute hand is 8 cm long. How far does a point on its tip travel in 18 minutes?
4. Find the exact value of each of the following expressions.
 - (a) $\sin 22.5^\circ =$
 - (b) $2 \cos \frac{10\pi}{3} \cos \frac{-13\pi}{4} - \tan \frac{5\pi}{4} \sin \frac{7\pi}{3} =$
 - (c) $\frac{\tan 18^\circ - \tan 48^\circ}{1 + \tan 18^\circ \tan 48^\circ} =$
5. Solve each of the following equations.
 - (a) $2 \cos^2 x + \sin x - 1 = 0$
 - (b) $\cos 2x + 3 \sin x = 2$
 - (c) $\sin x + \cos x = 0$
6. Find $\sin \alpha$ if $\cos 2\alpha = \frac{7}{9}$ and α is in the first quadrant.
7. Find $\cos \alpha$ if $\cos 2\alpha = -\frac{119}{169}$ and α is in the second quadrant.
8. Prove each of the following identities.
 - (a) $\sin 3x = 3 \sin x - 4 \sin^3 x$
 - (b) $\tan x - \tan y = \frac{\sin(x - y)}{\cos x \cos y}$
 - (c) $\cos 4t = 8 \cos^4 t - 8 \cos^2 t + 1$
9. Assume that the moon's orbit is circular, of radius 243000 mi, and that it takes 28 days for the moon to travel around the earth. Find the linear speed of the moon in miles per hours. Round your answer to the nearest integer.
10. Let m be the straight line determined by the equation $2x - 3y = 8$ and k the line determined by $y = 6x - 15$. Find the exact value of the tangent of the angle formed by these lines.

11. An object is held by ropes as shown on the picture below. Find the forces in the ropes if the object weighs 200 N.



12. How far is Chicago from the equator? (Chicago's latitude is 41.5° . The radius of the earth is 3960 miles.)