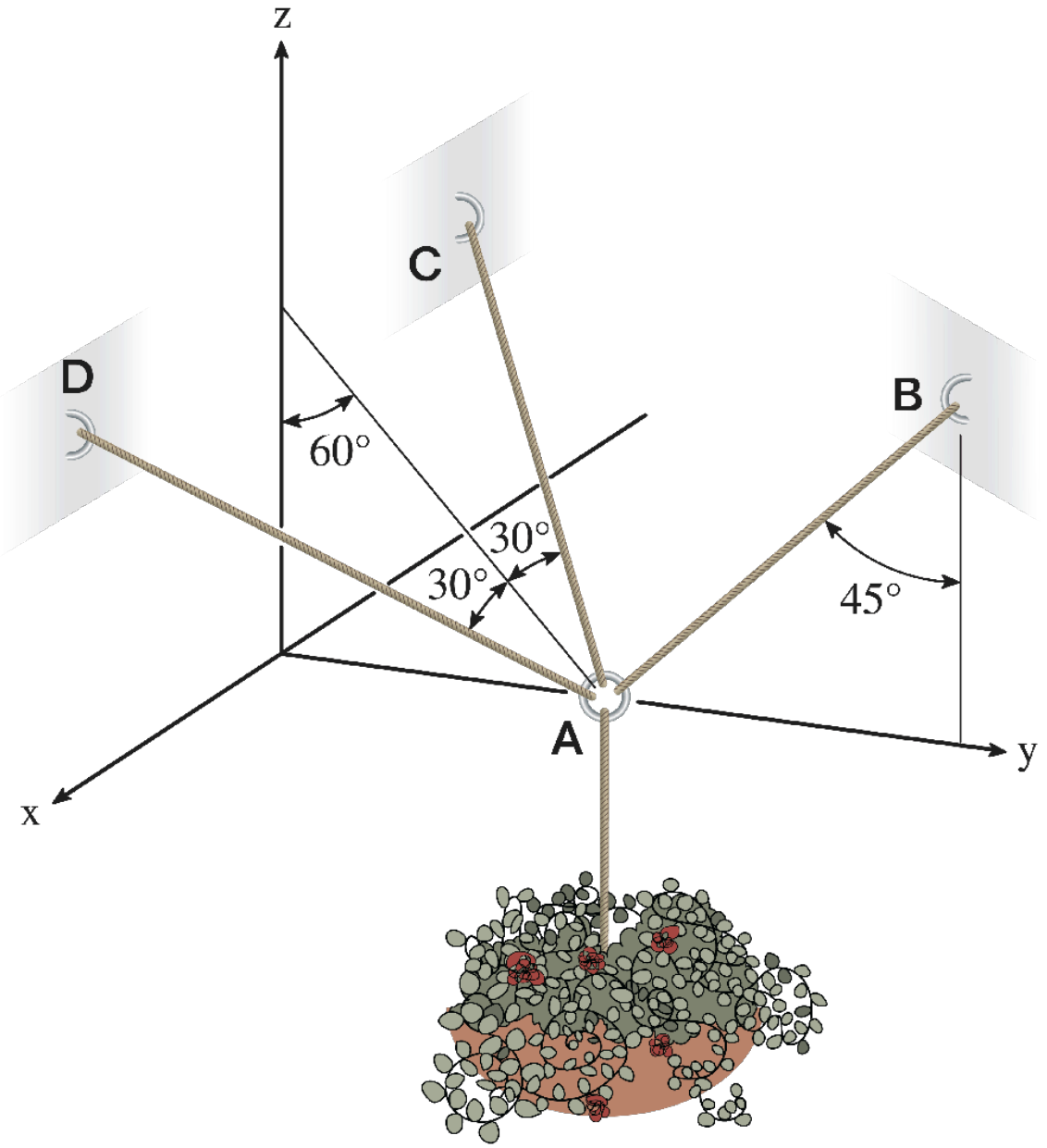

A flowerpot hangs on a ring attached to 3 ropes in equilibrium as shown above. If the flowerpot has a mass of m, find the tensions in each rope.

Find the unit vectors of all forces in the 3D equilibrium system.

$\hat{F}_A = < 0, 0, -1 >$

$$\hat{F_{AB}} = < 0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} >$$

$$\hat{F_{AC}} = < -\sin(30°), -\cos(30°)\sin(60°), \cos(30°)\cos(60°) > = < -\frac{1}{2}, -\frac{3}{4}, \frac{\sqrt{3}}{4} >$$

$$\hat{F_{AD}} = < \frac{1}{2}, -\frac{3}{4}, \frac{\sqrt{3}}{4} >$$

Find the magnitudes of the forces exerted by each rope.

$$\Sigma F_x = 0 \rightarrow \frac{1}{2}F_{AD} - \frac{1}{2}F_{AC} = 0 \rightarrow F_{AC} = F_{AD}$$

$$\Sigma F_y = 0 \rightarrow \frac{1}{\sqrt{2}}F_{AB} - \frac{3}{4}F_{AC} - \frac{3}{4}F_{AD} = 0 \rightarrow \frac{1}{\sqrt{2}}F_{AB} = \frac{3}{2}F_{AC}$$

$$\rightarrow F_{AC} = F_{AD} = \frac{\sqrt{2}}{3}F_{AB}$$

$$\Sigma F_z = 0 \rightarrow \frac{1}{\sqrt{2}}F_{AB} + \frac{\sqrt{3}}{4}F_{AC} + \frac{\sqrt{3}}{4}F_{AD} - mg = 0$$

$$\rightarrow \frac{1}{\sqrt{2}}F_{AB} + \frac{\sqrt{3}}{2}F_{AC} = mg$$

$$\rightarrow \frac{1}{\sqrt{2}}F_{AB} + \frac{\sqrt{3}}{2}\frac{\sqrt{2}}{3}F_{AB} = mg$$

$$\rightarrow F_{AB} = \frac{\sqrt{6}\,mg}{1+\sqrt{3}}$$

$$F_{AC} = F_{AD} = \frac{2mg}{\sqrt{3}+3}$$

$$F_A = mg$$