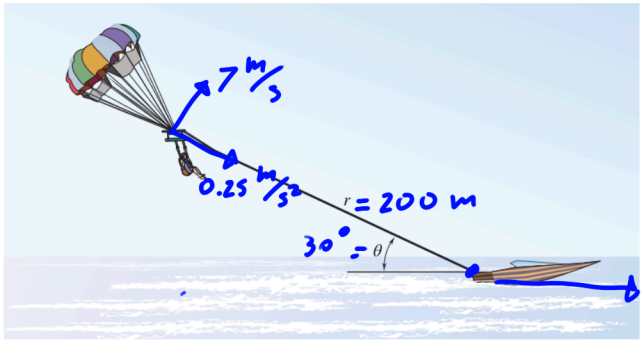
During a parasailing ride, the boat is traveling at a constant 30 km/hr with a 200-m long tow line. At the instant shown, the angle between the line and the water is 30° and is increasing at a constant rate of 2°/s. Determine the velocity and acceleration of the parasailer at this instant.



$r = 200\ m \qquad \frac{dr}{dt} = 0 \qquad \frac{d^2r}{dt^2} = 0$

$\theta = 30°\left(\frac{\pi\ rad}{180°}\right) = 0.52\ rad \qquad \frac{d\theta}{dt} = 2°/s\left(\frac{\pi\ rad}{180°}\right) = 0.035\ rad/s \qquad \frac{d^2\theta}{dt^2} = 0$

$\vec{V} = \frac{dr}{dt}\vec{e}_r + r\frac{d\theta}{dt}\vec{e}_\theta$

$= 0\vec{e}_r + 200\,m\ 0.035\ rad/s\ \vec{e}_\theta = 7\ m/s\ \vec{e}_\theta$

$\vec{a} = \left(\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2\right)\vec{e}_r + \left(r\frac{d^2\theta}{dt^2} + 2\frac{dr}{dt}\frac{d\theta}{dt}\right)\vec{e}_\theta$

$= 200\,m\,(0.035\ rad/s)^2\,\vec{e}_r + (200\,m\ 0 + 2 \cdot 0 \cdot 0.035\ rad/s\,\vec{e}_\theta$

$\boxed{= 0.25\ m/s^2\ \vec{e}_r}$

$30\ \frac{km}{h}\left(\frac{1000\,m}{1\,km}\right)\left(\frac{1\,h}{3600\,s}\right) = 8.33\ m/s$

$\vec{V}_B = 8.33\ m/s\ i$

$\vec{V}_P = 7\ m/s\ \vec{e}_\theta \qquad \vec{e}_\theta = \sin 30\ i + \cos 30\ j$

$= 7\ m/s\,(0.5i + 0.87j) \qquad = 0.5i + 0.87j$

$= 3.5i + 6.1j\ m/s$

$\vec{V} = \vec{V}_B + \vec{V}_P$

$= 8.33i + 3.5i + 6.1j\ m/s$

$= \boxed{11.8i + 6.1j\ m/s}$