4.28. **Model:** The earth is a particle orbiting around the sun.
Solve: **(a)** The magnitude of the earth's velocity is displacement divided by time:

$$v = \frac{2\pi r}{T} = \frac{2\pi(1.5\times10^{11}\text{ m})}{365\text{ days}\times\dfrac{24\text{ h}}{1\text{ day}}\times\dfrac{3600\text{ s}}{1\text{ h}}} = 3.0\times10^{4}\text{ m/s}$$

(b) Since $v = r\omega,$ the angular acceleration is

$$\omega = \frac{v}{r} = \frac{3.0\times10^{4}\text{ m/s}}{1.5\times10^{11}\text{ m}} = 2.0\times10^{-7}\text{ rad/s}$$

(c) The centripetal acceleration is

$$a_r = \frac{v^2}{r} = \frac{(3.0\times10^{4}\text{ m/s})^2}{1.5\times10^{11}\text{ m}} = 6.0\times10^{-3}\text{ m/s}^2$$

Assess: A tangential velocity of 3.0×10^{4} m/s or 30 km/s is large, but needed for the earth to go through a displacement of $2\pi(1.5\times10^{11}\text{ m}) \approx 9.4\times10^{8}$ km in 1 year.