Flipping Physics Lecture Notes:

Introductory Centripetal Acceleration Problem:
Cylindrical Space Station

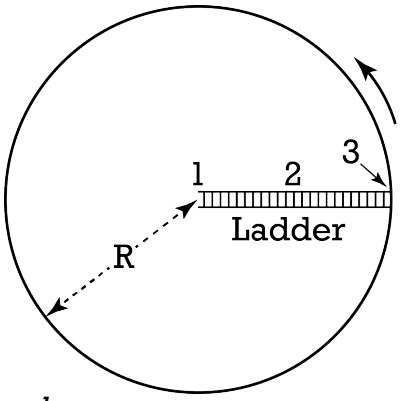
Example: A cylindrical space station with a radius of 115 m is rotating at 0.292 rad/s. A ladder goes from the rim to the center. What is the magnitude of the centripetal acceleration at (1) the top of the ladder, (2) the middle of the ladder, and (3) the base of the ladder?

$$\omega = 0.292\frac{rad}{s};\ r_1 = 0m;\ r_2 = \frac{115m}{2} = 57.5m;\ r_3 = 115m;\ a_c = ?\ \left(each\right)$$

(1) $a_c = \frac{v_t^{\ 2}}{r} = r\omega^2 \Rightarrow a_{c1} = r_1\omega^2 = \left(0\right)\omega^2 = 0$

(2) $a_{2c} = r_2\omega^2 = \left(57.5\right)\left(0.292\right)^2 = 4.90268\frac{m\cdot rad^2}{s^2} \approx 4.90\frac{m}{s^2}$

(3) $a_{3c} = r_3\omega^2 = \left(115\right)\left(0.292\right)^2 = 9.80536 \approx 9.81\frac{m}{s^2}$



Rim tangential velocity calculation:

$$v_{t3} = r_3\omega = \left(115\right)\left(0.292\right) = 33.58\frac{m}{s}\left(\frac{3600s}{1hr}\right)\left(\frac{1km}{1000m}\right) = 120.888\frac{km}{hr}$$

$$\Rightarrow v_{t3} = 120.888\frac{km}{hr}\left(\frac{1mile}{1.609km}\right) = 75.13238 \approx 75\frac{mi}{hr}$$