1. One end of a uniform 7.0 m long rod of weight \( w \) is supported by a cable. The other end rests against the wall, where it is held by friction. The coefficient of static friction between the wall and the rod is \( \mu_s = 0.50 \). Determine the minimum distance, \( x \), from point A at which an additional weight \( w \) (the same as the weight of the rod) can be hung without causing the rod to slip at point A.

Let \( T \) be the tension in the cable and \( N \) the normal force at the wall, with friction given by \( F_R \leq \mu_s N \). Then:

\[
F_x : \quad N - T \cos(\theta) = 0 \\
F_y : \quad T \sin(\theta) + F_R - 2 \times w = 0, \quad \text{and} \\
\tau : \quad T \times L \sin(\theta) - w \times \frac{L}{2} - w \times x = 0,
\]

where torque has been calculated around point A. From the first two equations we have:

\[
2 \times w = T \sin(\theta) + F_R \leq T \sin(\theta) + \mu_s \times T \cos(\theta) \implies T \sin(\theta) \geq \frac{2 \times w}{1 + \mu_s \times \cot(\theta)},
\]

while from the third equation we find

\[
T \sin(\theta) = w \times \left( \frac{1}{2} + \frac{x}{L} \right).
\]

Putting these together we have

\[
x \geq L \left( \frac{2}{1 + \mu_s \times \cot(\theta)} - \frac{1}{2} \right) = 7.0 \times \left( \frac{2}{1 + 0.50 \times 1.327} - \frac{1}{2} \right) = 4.9 \text{ m}.
\]

2. A planet of radius \( 8.00 \times 10^3 \) km spins with an angular velocity of \( 20.0 \times 10^{-5} \) rad/s about an axis through the North Pole. What is the ratio of the normal force experienced by a person at the equator to that experienced by a person at the North Pole? Assume a constant gravitational acceleration of 1.60 m/s\(^2\) and that both people are stationary relative to the planet and are at sea level.

At the North Pole we have \( N_{NP} - mg = 0 \implies N_{NP} = mg \), while at the equator we have \( N_{eq} - mg = -m\omega^2 R \implies N_{eq} = mg - m\omega^2 R \). Thus the ratio \( N_{eq}/N_{NP} \) is given by:

\[
\frac{N_{eq}}{N_{NP}} = 1 - \frac{\omega^2 R}{g} = 1 - \frac{(2.00 \times 10^{-4})^2 \times 8.00 \times 10^6}{1.60} = 1.000 - 0.200 = 0.800.
\]