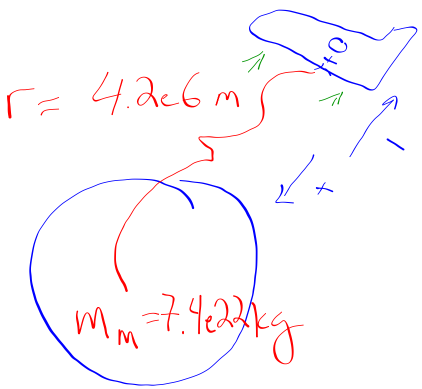
43. What is the apparent weight (include an indication of direction) of a 65-kg astronaut 4200 km from the center of the earth's moon in a space vehicle

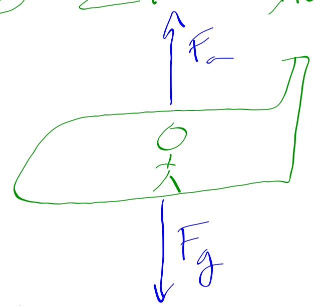
a) moving at constant velocity (imagine $v=0$)

b) accelerating toward the moon at 3.6 m/s^2.

constant v



(a) $\Sigma F = \cancel{m}a = 0$



$$\Sigma F = 0$$

$$-F_a + F_g = $$

$$F_a = F_g = \frac{G M_m m}{r^2} = \frac{(6.67e^{-11})(7.4e22)(65)}{(4.2e6)^2}$$

$$F_a = 18.2\ N \text{ (away)}$$

(b) $\Sigma F = ma$

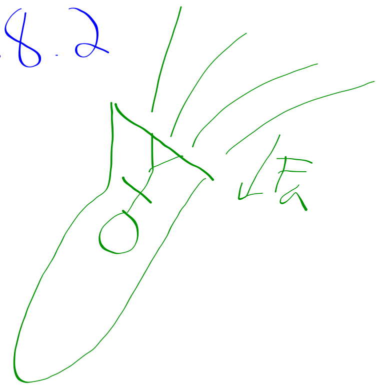
$$F_a + F_g = ma$$

$$F_a = ma - F_g$$

$$= (65)(3.6) - 18.2$$

$$F_a = 215.8\ N$$

(toward)



$$\alpha = \frac{\Sigma\tau}{I} \qquad \Sigma\tau = -T_1 r_1 + T_2 r_2$$

$$\alpha = \frac{a_1}{r_1} = \frac{a_2}{r_2} \qquad T_1 = m_1 g + m_1 a_1$$

$$T_2 = m_2 g - m_2 a_2$$

$$a_1 = \alpha r_1 \qquad a_2 = \alpha r_2$$

$$\alpha = \frac{-(m_1 g + m_1 a_1) r_1 + (m_2 g - m_2 a_2) r_2}{I}$$

$$\alpha = \frac{-(m_1 g + m_1 \alpha r_1) r_1 + (m_2 g - m_2 \alpha r_2) r_2}{I}$$

$$I\alpha = -m_1 g r_1 - m_1 \alpha r_1^2 + m_2 g r_2 - m_2 \alpha r_2^2$$

$$I\alpha + m_1 \alpha r_1^2 + m_2 \alpha r_2^2 = -m_1 g r_1 + m_2 g r_2$$

$$\alpha (I + m_1 r_1^2 + m_2 r_2^2) = \ldots$$

$$\alpha = \frac{-m_1 g r_1 + m_2 g r_2}{I + m_1 r_1^2 + m_2 r_2^2}$$

~~The Atwood Equation~~ TM

- both masses clockwise?
- three masses?
- someone pulling on a string?
- Atwood machine on it's back?