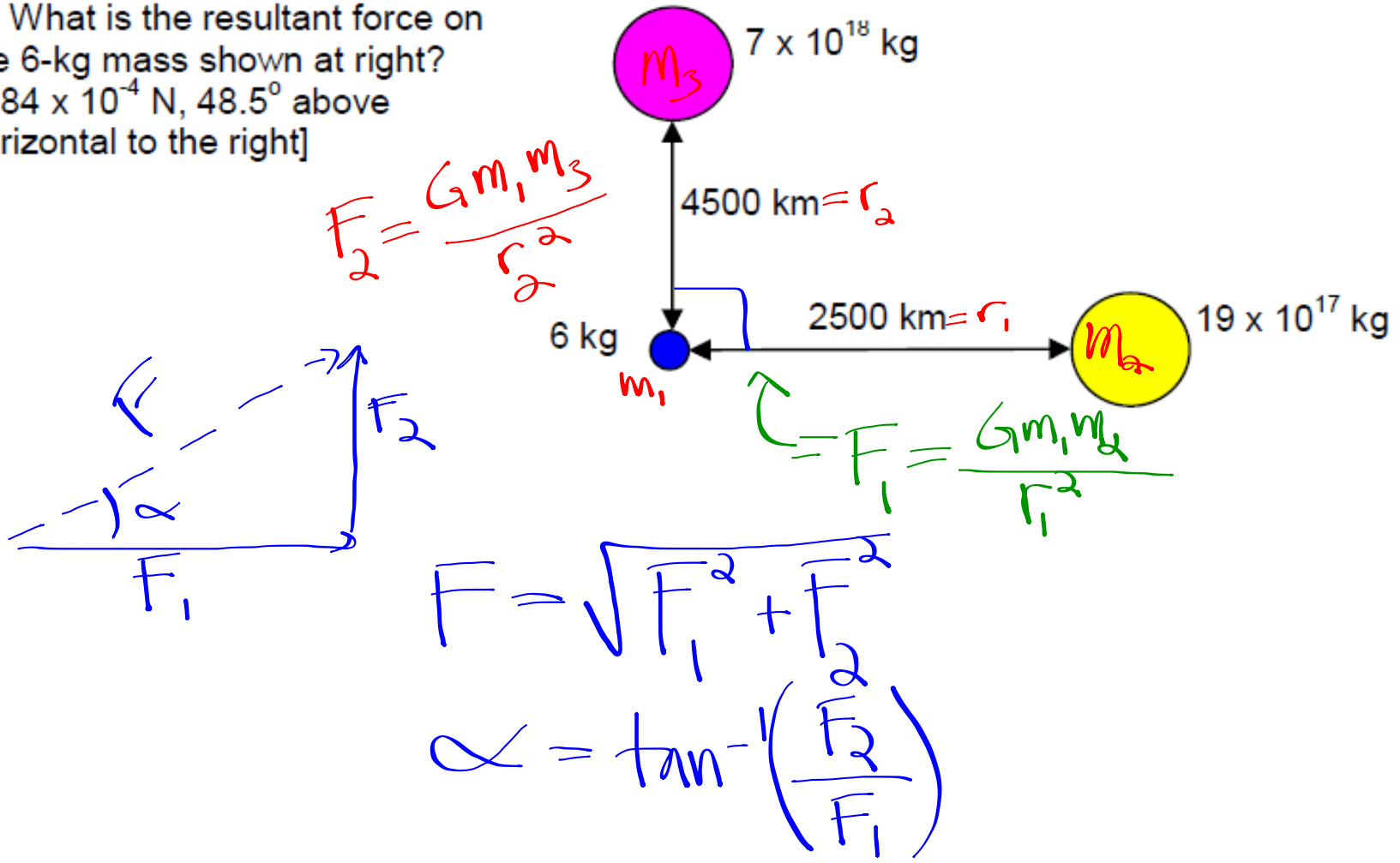
1. What is the resultant force on the 6-kg mass shown at right? [1.84 x 10^{-4} N, 48.5° above horizontal to the right]



10. An astronaut, standing on a new planet, finds that a 35-kg dog weighs 1400 N. She further notes that the period of a satellite just skimming the surface of the planet (having an orbit equal to the radius of the planet) is 150 minutes. What is the radius of the planet? [8.21×10^7 m]

period = 150 min.

↓

T sec.

$v = \frac{2\pi r}{T}$

weight = mass × a_g

$\frac{1400N}{35kg} = a_g = a_c$

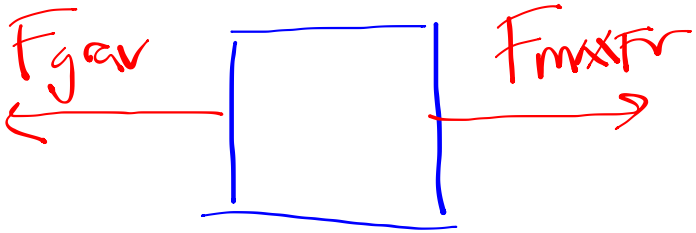
$a_c = \frac{v^2}{r}$

11. Two masses are on a frictional, horizontal surface. If the 8-kg mass is brought close to a 4.3-kg mass on a surface with a coefficient of friction of .2, at what distance will the 4.3-kg mass begin to slide toward the 8-kg mass? [1.65×10^{-5} m]

$\mu_s = 0.2$

$F_{maxFr} = \mu_s F_N$

$F_{grav} = \frac{G m_1 m_2}{r^2}$



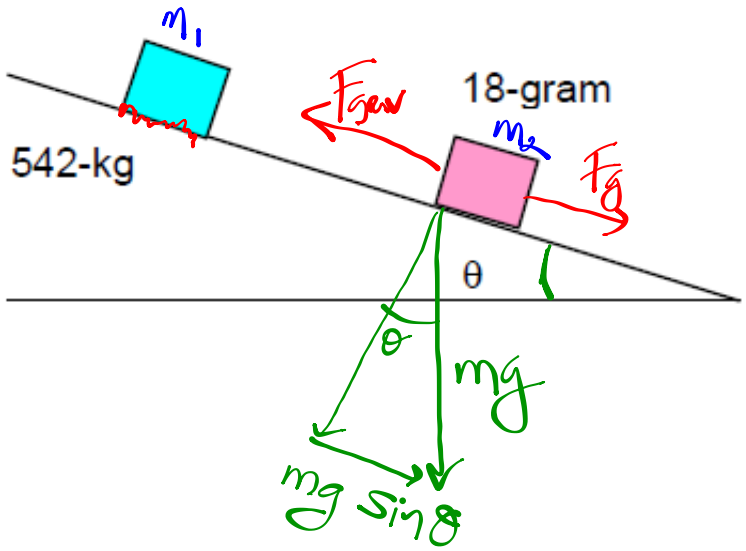
$F_{grav} > F_{maxFr}$

$F_{maxFr} = \frac{G m_1 m_2}{r^2}$

$F_{maxFr} = \mu_s m g$

$= (0.2)(4.3)(9.8)$

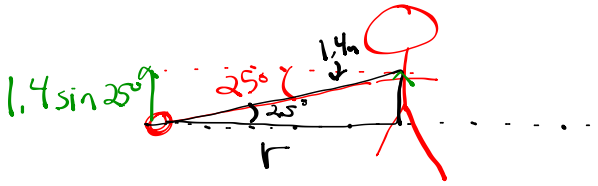
12. At what angle will the attraction of the fixed mass (the 542-kg mass) just keep the 18-gram mass from sliding down the incline? The surface is frictionless and the masses are originally separated by 13 cm. [1.25 x 10^{-5} degrees]

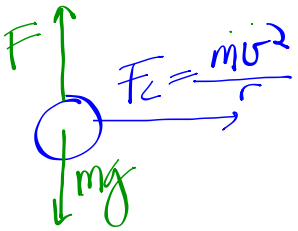


$$F_{grav} = F_g$$

$$\frac{G m_1 m_2}{r^2} = m_2 g \sin\theta$$

18. A boy swings a rock on a 1.4 meter string in a horizontal circle. If he swings it so that the string makes a 25° angle with the horizontal, how fast must it be moving? (Hint: the radius of the rock's orbit is NOT 1.4 meters). [5.16 m/sec]

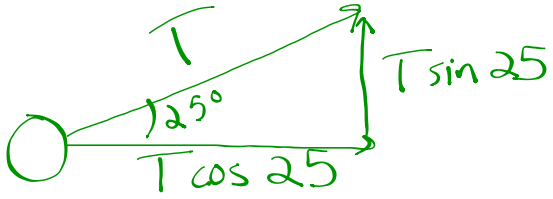


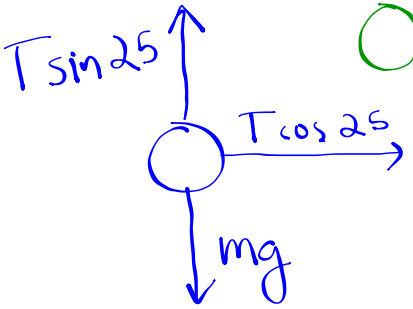


$r = 1.4 \cos 25°$

$\Sigma F_y = 0$

$F - mg = 0 \; ; \; F = mg$





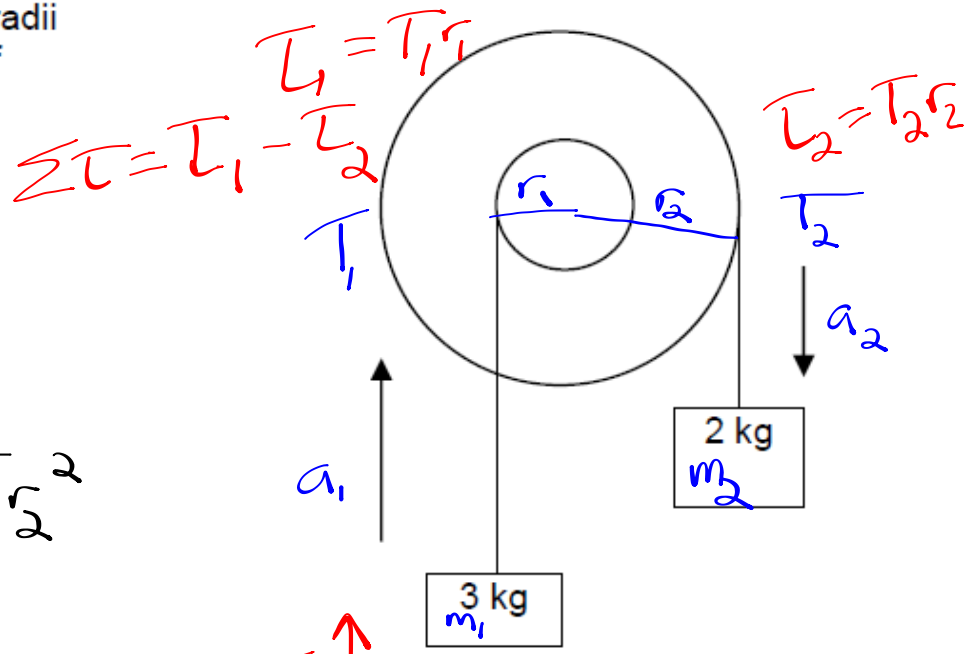
$\Sigma F_y = 0$

$T \sin 25 - mg = 0$

$\Sigma F_x = ma = F_c = \frac{mv^2}{r}$

$T \cos 25 = \frac{mv^2}{r}$

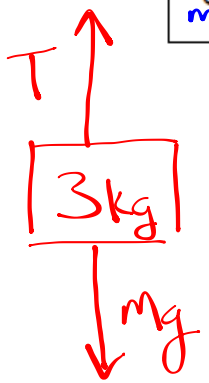
26. A two-disk Atwood machine with radii of 15-cm and 38-cm, has a moment of inertia of 4 kg·m^2. What is the acceleration of the mass on the right? [.265 m/sec^2]



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

$$a_1 = \alpha r_1$$

$$a_2 = \alpha r_2$$



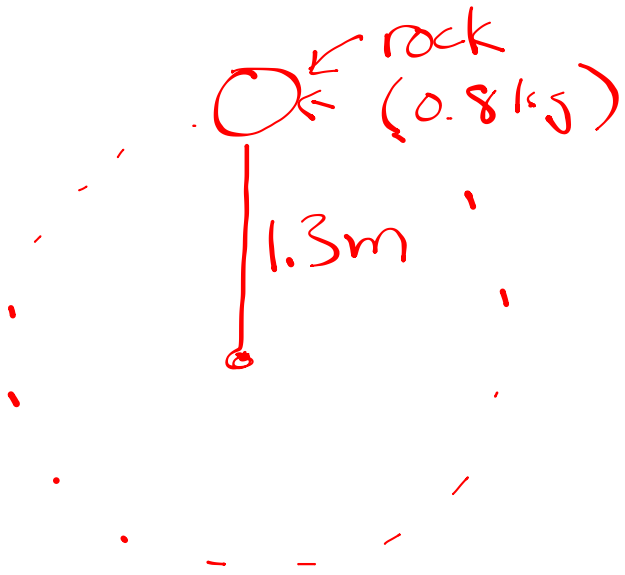
$\Sigma F = ma$

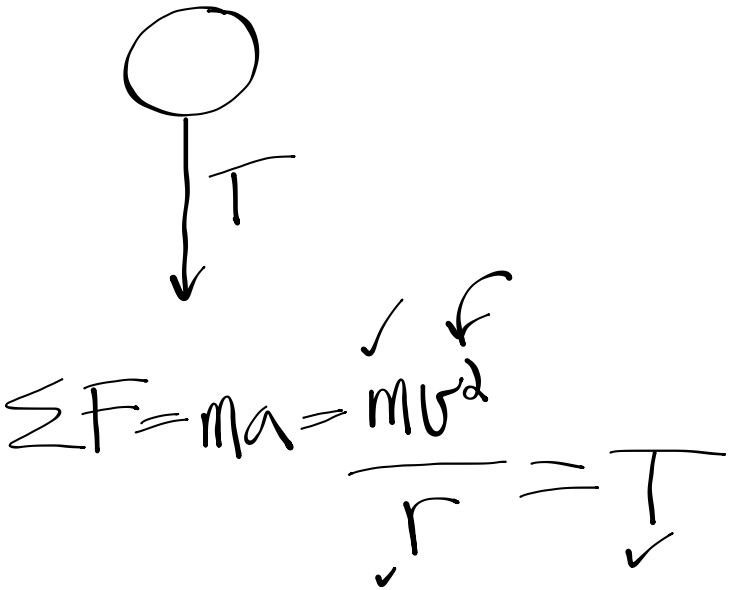
$T - mg = ma$

$T = ma + mg$

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

14. A 0.8 kg rock is spun in a circle on a 1.3 meter string. If the string breaks at 12 N tension, how fast must the rock be moving? (Neglect the effects of gravity). [4.42 m/sec]





units of I: $kg \cdot m^2$

or

$slug \cdot ft^2$