AP Forces
Lecture Problems

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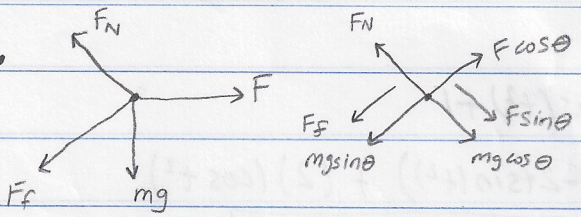
1.

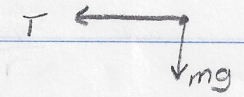


$F_N = F\sin\theta + mg\cos\theta$

$F\cos\theta - mg\sin\theta - F_f = ma$ $\boxed{F_f = F\cos\theta - mg\sin\theta - ma}$ $= \mu F_N$

$$\boxed{\mu = \frac{F\cos\theta - mg\sin\theta - ma}{F\sin\theta + mg\cos\theta}}$$

2.

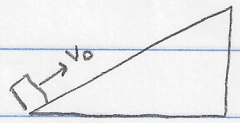


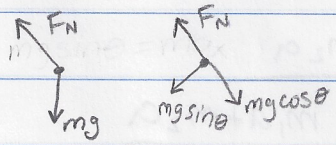
$mg = ma_y \quad a_y = g$

$T = \frac{mv^2}{R} = ma_x \quad a_x = \frac{T}{m} = \frac{v^2}{R}$

$$\boxed{|a_{TOTAL}| = \sqrt{g^2 + \frac{v^4}{R^2}}}$$

3.





$-mg\sin\theta = ma_x$

$a_x = -g\sin\theta$

now we use Kinematics

$v_f^2 - v_0^2 = 2aS$

$0^2 - v_0^2 = 2(-g\sin\theta)S \qquad S = \frac{v_0^2}{2g\sin\theta}$ THIS IS DISTANCE ALONG SLANT

$$h = S\sin\theta = \boxed{\frac{v_0^2}{2g}}$$

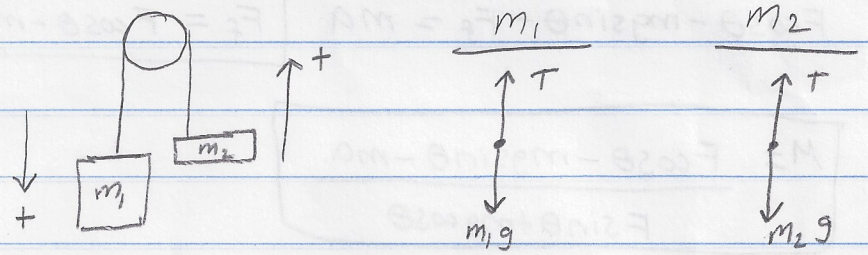
4. $x(t) = \sin(t^2) + t$

$x'(t) = v(t) = 2t\cos(t^2) + 1$

$v'(t) = a(t) = (2t)(-2t\sin(t^2)) + (2)(\cos t^2)$

$= \boxed{2\cos(t^2) - 4t^2\sin(t^2)}$

5.



same acceleration of two blocks since they are along same string

$m_1 g - T = m_1 a$

$T - m_2 g = m_2 a$

$m_1 g - m_2 g = m_1 a + m_2 a$

$$\boxed{a = g\left(\frac{m_1 - m_2}{m_1 + m_2}\right)}$$