Solution #1

$$\vec{A} = 2\hat{i} + 3\hat{j} + \sqrt{3}\,\hat{k}$$

$$\vec{B} = 2\hat{i} - 3\hat{j} - \sqrt{3}\,\hat{k}$$

$$A \equiv |\vec{A}| = \sqrt{2^2 + 3^2 + (\sqrt{3})^2} = 4$$

$$B \equiv |\vec{B}| = \sqrt{2^2 + (-3)^2 + (-\sqrt{3})^2} = 4$$

$$\vec{A} \bullet \vec{B} = 2 \cdot 2 + 3 \cdot (-3) + \sqrt{3} \cdot (-\sqrt{3}) = -8$$

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & \sqrt{3} \\ 2 & -3 & -\sqrt{3} \end{vmatrix} = 4\sqrt{3}\,\hat{j} - 12\,\hat{k}$$

$$|\vec{A} \times \vec{B}| = \sqrt{(4\sqrt{3})^2 + (-12)^2} = 8\sqrt{3}$$

a) $$\cos\theta = \frac{\vec{A} \bullet \vec{B}}{AB} = \frac{-8}{4 \cdot 4} = -\frac{1}{2}$$

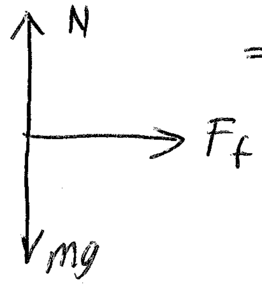
$$\Rightarrow \boxed{\theta = 120^\circ}$$

b) $$\hat{n} = \frac{\vec{A} \times \vec{B}}{|\vec{A} \times \vec{B}|} = \frac{4\sqrt{3}\,\hat{j} - 12\hat{k}}{8\sqrt{3}}$$, or

$$\boxed{\hat{n} = \frac{1}{2}\hat{j} - \frac{\sqrt{3}}{2}\hat{k}}$$

Sln #3

a.



$\Rightarrow a$

b. a: wrt to O_2

$F_f = ma = \mu_k mg$

$a = \mu_k g \Rightarrow$ wrt to O_2

$$O_1 \begin{cases} \vec{a} = \vec{a}' + \vec{A} \\ \mu_k g = a' + A \\ \mu_k g - A = a' \Rightarrow \\ \Leftarrow \\ A - \mu_k g \end{cases}$$

or //

c. $$\left.\begin{aligned} X_m &= L + \tfrac{1}{2}\mu_k g t^2 \\ X_{END} &= \tfrac{1}{2}At^2 \end{aligned}\right\}$$ both equal to D at t: $D = L + \frac{1}{2}\mu_k g t^2$

$D = \frac{1}{2}At^2$

$\frac{D-L}{D} = \frac{\mu_k g}{A}$

$1 - \frac{\mu_k g}{A} = \frac{L}{D}$ //

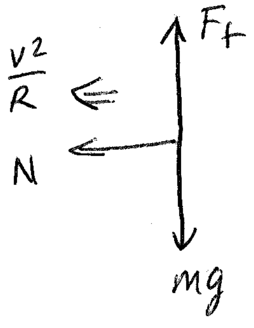
or

$L = \frac{1}{2}(A - \mu_k g)t^2$

$D = \frac{1}{2}At^2$

$\frac{L}{D} = \frac{A - \mu_k g}{A}$

#2



$N = \frac{mv^2}{R}$

$F_f = mg$

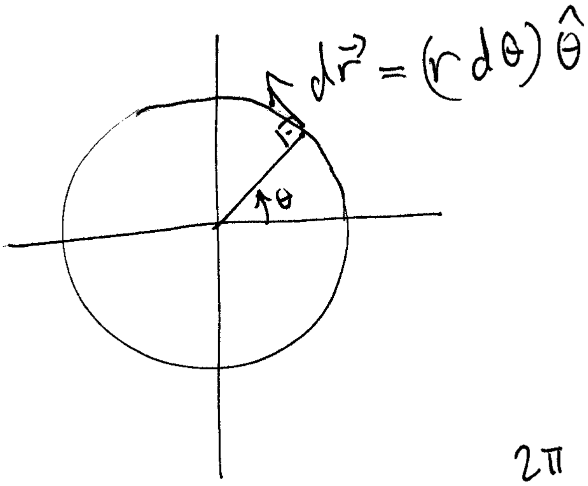
$F_f \leq \mu_s N$

$\cancel{m}g \leq \mu_s \frac{\cancel{m}v^2}{R}$

$\frac{Rg}{\mu_s} \leq v^2$

$V_{min} = \sqrt{Rg/\mu_s}$

Solution # 4



a) $$W_a = \int \vec{F} \cdot d\vec{r} = \int_{\pi}^{2\pi} \left(\cancel{\frac{1}{r^2}\hat{r}} - \hat{\theta} \right) \cdot \left(r\,d\theta\,\hat{\theta} \right) = -r \int_{\pi}^{2\pi} d\theta = \boxed{-\pi r}$$

b) $$W_b = \int \vec{F} \cdot d\vec{r} = \int_{0}^{\pi} \left(\frac{1}{r^2}\hat{r} - \hat{\theta} \right) \cdot \left(r\,d\theta\,\hat{\theta} \right) = -r \int_{0}^{\pi} d\theta = \boxed{-\pi r}$$

c) $W_a + W_b = -2\pi r \neq 0$ for a closed path

$\Rightarrow$ non conservative force.