Problem 1: (1-07-48)

$$M_1 = 5.0\,kg \qquad M_2 = 8.0\,kg$$

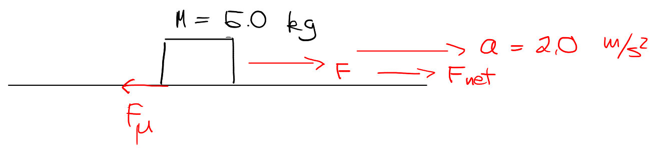
$$(E_{kin})_1 = 3\,(E_{kin})_2$$

$$\rightarrow \tfrac{1}{2} M_1 v_1^2 = \tfrac{3}{2} M_2 v_2^2$$

$$\rightarrow \left(\frac{v_1^2}{v_2^2}\right) = 3\,\frac{M_2}{M_1}$$

$$\rightarrow \frac{v_1}{v_2} = \sqrt{3\,\frac{M_2}{M_1}} = \sqrt{\frac{3 \cdot 8.0}{5.0}} \approx 2.2$$

Problem 2: (1-07-54)



Translation $\Delta x = 0.10\,m$

Use the general eq. $W_{AB} = \int_{C_{AB}} \vec{F} \cdot d\vec{r}$

$F_{net} = F - f_\mu$ (1D --> use a sign to indicate the direction of a vector)

b) $F_{net} = Ma \rightarrow F - f_\mu = F - \mu_k N = Ma$

$$\rightarrow F - \mu_k Mg = Ma$$

Work f_μ

$$W^{f_\mu} = \int_{\Delta x} \vec{f_\mu} \cdot d\vec{r} = -f_\mu \cdot \Delta x = -\mu_k Mg \cdot \Delta x$$

--> f dissipates energy from M

c) Work of F_{net}

$$W^{F_{net}} = Ma \cdot \Delta x$$

a) Work of F

$$W^F = F \cdot \Delta x = \{ Ma + \mu_k Mg \} \Delta x$$

$$\rightarrow W^F = W^{F_{net}} - W^{f_\mu}$$

d) ΔE_{kin} ? $\qquad \Delta E_{pot} = 0$

$$\rightarrow \Delta E_{kin} = W^{F_{net}} = Ma \cdot \Delta x$$

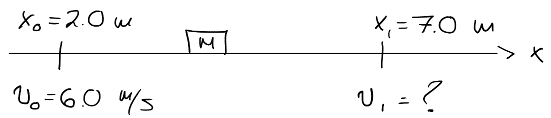
$$= 5.0\,kg \cdot 2.0\,m/s^2 \cdot 0.1\,m$$

$$= 1.0\,J$$

Problem 3: (1-08-28)

1D motion in force field $F(x) = \left(\frac{3}{\sqrt{x}}\right) N$

which in reality means that "3" has dimension...



$M = 2.0\,kg$

No friction, no dissipation, 1D conservative force $\rightarrow \Delta E_{total} = 0$

$$F(x) = -\frac{dU(x)}{dx} = \left(\frac{3}{\sqrt{x}}\right) N$$

$$\rightarrow U(x) = -6\sqrt{x} + \underbrace{U_0}_{\text{constant}}$$

$$U(x) - U_0 = \left(-6\sqrt{x}\right) N$$

$$\left.\begin{array}{l} U(7) = -6\sqrt{7} + U_0 \\ U(2) = -6\sqrt{2} + U_0 \end{array}\right\} \rightarrow \Delta\left[U(7) - U(2)\right] = -6\left[\sqrt{7} - \sqrt{2}\right]$$

$$\Delta E_{kin} = \frac{M}{2}\left\{ v_1^2 - v_0^2 \right\}$$

and

$$\Delta E_{kin} + \Delta U = 0$$

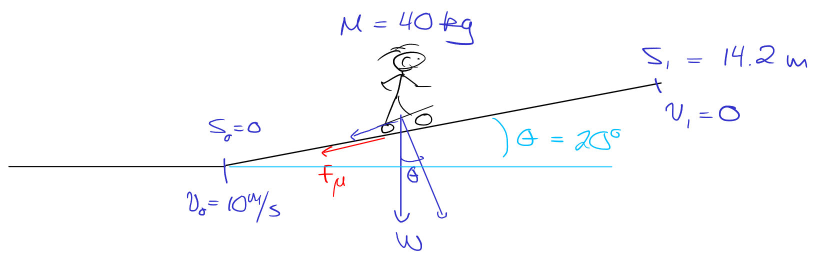
$$\to \frac{M}{2}\left\{ v_1^2 - v_0^2 \right\} - 6\left\{ \sqrt{7} - \sqrt{2} \right\} = 0$$

$$\to v_1^2 = v_0^2 + \frac{12}{M}\left\{ \sqrt{7} - \sqrt{2} \right\}$$

$$v_1 = \sqrt{v_0^2 + \frac{12}{M}\left\{ \sqrt{7} - \sqrt{2} \right\}} \simeq \underline{6.59\ m/s}$$

I consider the system to be the mass and the force field, thus there is no external force working on the mass. If the force field is considered to be an external one, then I have to calculate how the external force changes the kinetic energy of the mass by doing work on it

Problem 4: (1-08-40)



Find F_μ

component of gravity pulling the girl down the slope $\quad -Mg\sin\theta$

the total force against her motion $\quad -F_\mu - Mg\sin\theta$

$$\to a = -\frac{F_\mu}{M} - g\sin\theta \; , \quad \text{use} \quad \begin{aligned} v^2 &= v_0^2 + 2aS \\ 0 &= v_0^2 + 2aS \end{aligned}$$

$$\to 0 = v_0^2 - 2S\frac{F_\mu}{M} - 2Sg\sin\theta$$

$$\to -F_\mu = \frac{Mv_0^2}{2S} - Mg\sin\theta$$