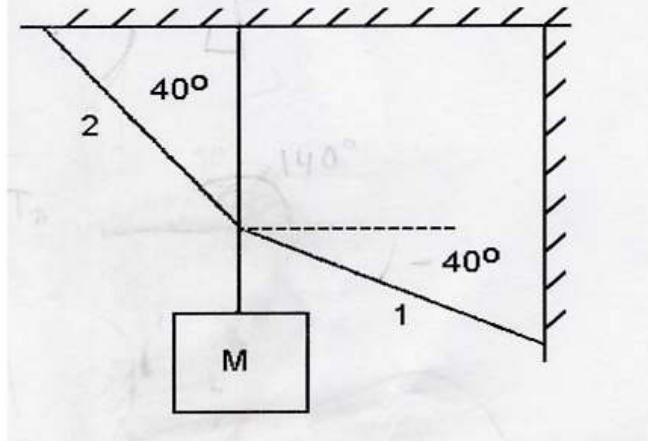


Show all work used to obtain your solution.  
Take extra care in setting up the problem - use drawings.  
Always put arrows above vectors and keep track of units.  
Good luck - you should not need any!

1. A boy on top of a tall building 20 m high throws a stone horizontally outwards with a speed of 15 m/s. It strikes the ground at what horizontal distance from the foot of the building?

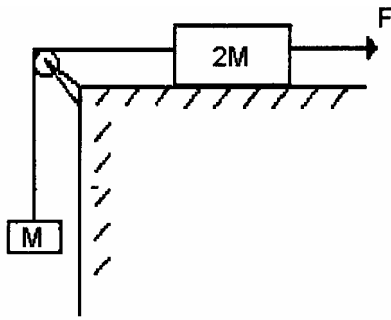
2. At a stop light, a truck traveling at 15 m/s passes a car as it starts from rest. The truck travels at constant velocity and the car accelerates at  $3 \text{ m/s}^2$ . How many seconds will it take for the car to catch up to the truck?

3. If  $M = 1.1 \text{ kg}$ , what is the **tension in string 1** shown?



4. A spring with spring constant of  $20\text{-N/m}$  is compressed by a force of  $10 \text{ N}$ . **What is the potential energy** stored in the spring?

5. If  $F=40\text{N}$  and  $M = 1.5\text{ kg}$ , what is the tension in the string connecting the two blocks? Assume that all surfaces are frictionless?



6. An  $8.0\text{-kg}$  object moving  $4.0\text{ m/s}$  in the positive  $x$  direction has a one-dimensional collision with a  $2.0\text{-kg}$  object moving  $4.0\text{ m/s}$  in the opposite direction. The final velocity of the  $8.0\text{-kg}$  object is  $2.0\text{ m/s}$  in the positive  $x$  direction. What is the change in the kinetic energy of the system?

All the equations you need (and a few more you may not):

$$d(ax^n)/dt = anx^{n-1}$$

$$\vec{a} \cdot \vec{b} = a \cdot b \cdot \cos \theta$$

$$\vec{v} = \frac{d\vec{r}}{dt}$$

$$\checkmark x = x_0 + v_0 t + \frac{1}{2}at^2$$

$$\checkmark W = mg$$

$$\checkmark F_{sp} = -kx$$

$$dW = \vec{F} \cdot d\vec{r}$$

$$P = \frac{dW}{dt}$$

$$U_g = mgy$$

$$\Delta E = W_{NC}$$

$$M \vec{r}_{CM} = \sum m_i \vec{r}_i$$

$$de^{ax}/dx = ae^{ax}$$

$$\vec{a} \times \vec{b} = a \cdot b \cdot \sin \theta \hat{n}$$

$$\vec{a} = \frac{d\vec{v}}{dt}$$

$$\checkmark v = v_0 + at$$

$$f = \mu N$$

$$g = 9.8 \text{ m/s}^2 = 32.2 \text{ ft/s}^2$$

$$W = \int F dx$$

$$P = \vec{F} \cdot \vec{v}$$

$$W = \Delta K$$

$$\vec{P} = m\vec{v}$$

$$\text{If } \sum \vec{F}_{ext} = 0, \text{ then } \Delta \vec{P} = 0$$

$$d[\sin(ax)]/dx = a \cos(ax)$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$1 \text{ mile} = 1609.3 \text{ m}$$

$$\sum \vec{F} = m\vec{a}$$

$$a = v^2/r$$

$$K = \frac{1}{2}mv^2$$

$$\Delta E = \Delta K + \Delta U = 0$$

$$\checkmark U_{sp} = \frac{1}{2}kx^2$$

$$F(x) = -dU(x)/dx$$

$$I_p = I_{CM} + ML^2$$

$$\Delta K = 0 (\text{elastic})$$