THIRD MIDTERM

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) How much work is done by a person moving a 5.00 kg box up a frictionless hill with $s = 10.0$ m and $h = 3.00$ m?

$$\Delta W = mgh = 5 \times 9.8 \times 3 = 14.7 \text{ J}$$

(b) Convert 105 horsepower into watts.

$$105 \times 550 \text{ ft \cdot lbs/s} \times \frac{1 \text{ in}}{5280 \text{ ft}} \times \frac{1 \text{ lb \cdot ft}}{32.2 \text{ ft \cdot lbs}} = 7.83 \times 10^4 \text{ Watts}$$

(c) How much work is done by gravity when a 10.0 kg object is lifted 5.00 m?

$$F \cdot \Delta x = (-mg) \Delta x = -10 \times 9.8 \times 5 = -490 \text{ J}$$

(d) A Hooke's Law spring with $k = 37.5$ N/m is compressed 20.0 cm. Find the work that must be done on the spring to achieve this.

$$E = \frac{1}{2} k (\Delta x)^2 = \frac{1}{2} \times 37.5 \times (0.2)^2 = 0.75 \text{ J}$$

(e) A car rounds a curve at 65.0 mph. The curve has a radius of 700 ft. A weight is suspended on a string inside the car. What is the angle of the string with respect to the vertical?

$$\frac{mg \tan \theta}{v^2} = \frac{v^2}{gR} = \frac{(65 \times 5280 \text{ ft/s})^2}{32.2 \times 700} = 0.403$$

$$\theta = 21.6^\circ \text{ or } 0.383 \text{ radians}$$