

Instructions:

1. Do all of your work on this sheet.
2. **Show all of your steps** in problems for full credit.
3. **Be clear and neat** in your work. Any illegible work, or scribbling in the margins, will not be graded.
4. Place your **answers in a box**.
5. If you need more space, you may use the back of the page and write **On back** in the problem space.

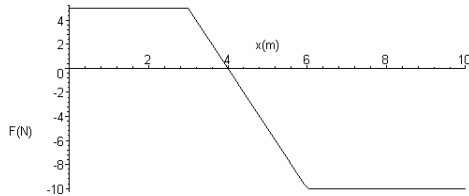
1. **Multiple Guess (3 pts)** Find the answer which best fits the question and *write it in the space provided*.

- a. Moving an object to a height of 5 ft takes _____ work along a steep (frictionless) ramp as opposed to one with a gentle slope.
 - a) more b) less c) the same amount of. _____
- b. The work done by friction is an example of what type of energy?
 - a) Non-conservative b) Conservative c) Kinetic d) Potential _____
- c. Compared to yesterday, you did three times as much work in one third the time. To do so, your power output must have been
 - a) the same as yesterday's power output.
 - b) one third of yesterday's power output.
 - c) 3 times yesterday's power output.
 - d) 9 times yesterday's power output.

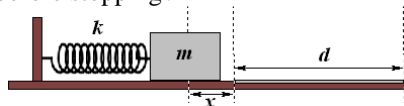
2. **Definition/Principle (3 pts)**

a. Give the exact expression for the elastic potential energy, U_s , for an ideal spring.

b. Below is the graph force vs position. From the graph, find the work done by the force on a particle displaced from $x = 1.0$ m to $x = 8.0$ m.



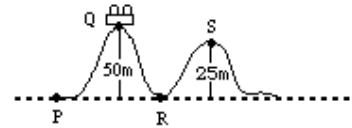
Bonus: A 500 g mass compresses a spring with $k = 50.0$ N/m by $x = 10.0$ cm. When it is released, the mass leaves the spring and slides over a surface with $\mu_k = 0.5$. How far, d , does it go before stopping?



3. **Problems (14 pts)**

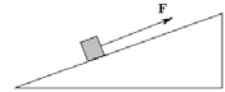
a. Determine the work done by the force $F(x) = 2x^3$ acting on a mass as it is displaced from $x = 2.0$ m to $x = -1.0$ m.

b. Consider the 1000 kg roller coaster in the figure. If the roller coaster leaves point Q from rest, what is its speed at point S?



c. A constant force of 15.0 N pulls a 2.00 kg block 1.50 m up a 30° incline.

i. What is the work done by \mathbf{F} ?



ii. What work is done by the normal force?

iii. What work is done by gravity?

iv. If the block is initially at rest, how fast will it be moving 1.50 m up the incline?

d. A 40.0 kg kid coasts down the water slide from rest as shown below and then leaves the slide horizontally landing in the water below. If the friction between the kid and the slide does 200.0 J of work, then how fast is the kid moving just before hitting the water?

