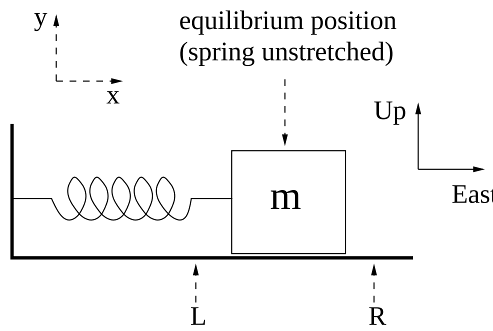
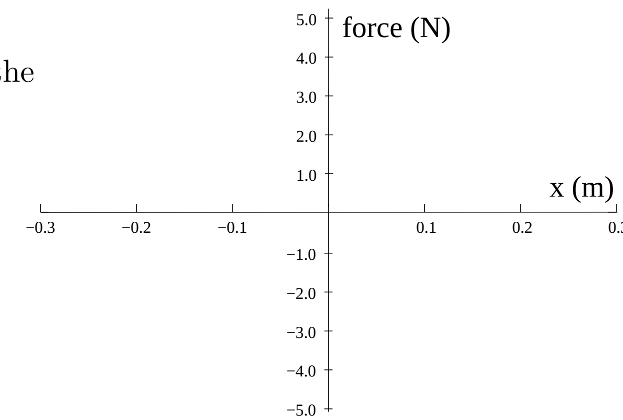
1. A 100-gram block on a frictionless table is connected to a massless spring, with spring constant 20 N/m. The drawing shows the spring in its unstretched position.



a. A student uses her hand to displace the block to the left of point L, where she holds it at rest. Make an extended free-body diagram of the block while being held at rest by the student. Repeat for the spring.

b. Assume that the student is holiding the block at the location $x = -20$ cm, with $x_{eq} = 0$. She plans to release the block from this location so that it will oscillate back at forth between ± 20 cm. Graph the force on the block by spring (x component) for all possible block positions between ± 20 cm. What is the equation for this graph, *i.e.* the equation for the x-component of the force on the block by the spring? ______________________



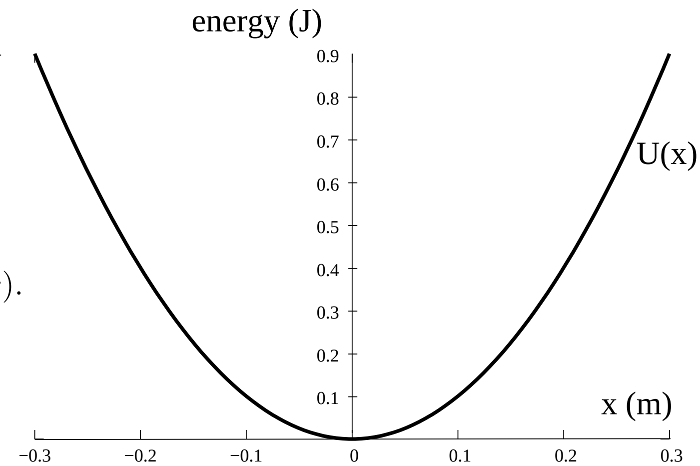
c. Use the graph in (b) to determine the change in kinetic energy for the 100-g mass as it moves from the release point to the equilibrium position. Explain why a selected area under this curve can produce the relevant change in kinetic energy.

d. Make an extended FBD for the block when it is passing the point R for the first time after being released. Repeat for the spring at the same instant of time.

e. Is the net work on the block from release to point R positive, negative, or zero? ______

f. Assume that point R is at $x = +10$ cm. Write the integral for the work done on the block by the spring while the block has moved from the point of release to point R, and compute the value of the integral.

2. The figure shows the potential energy graph $U(x)$ for the block-spring-Earth system described on the previous page.



a. Draw the mechanical energy graph $E(x)$ for the case of release from rest at -20 cm.

b. Draw the relevant kinetic energy graph $K(x)$.

c. What is the equation which describes the potential energy graph? __________

d. What turning points would be required (instead of ± 20 cm) to double $E(x)$?

e. Use the graph to find the change in system potential energy as the block moves from the release point to point R. How is this related to the work done by the spring during the same displacement?

f. Write a strategy for finding the power of the spring at the instant of time when the block is passing point R for the first time. Will this power be positive or negative?