

SECTION 2

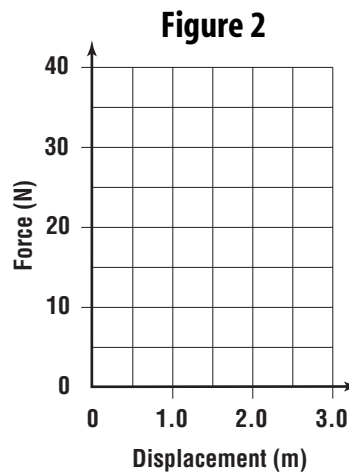
Enrichment

Plotting Force and Displacement

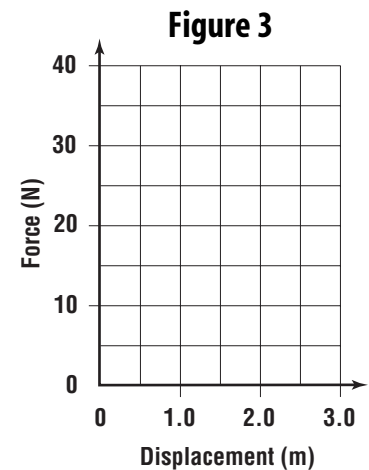
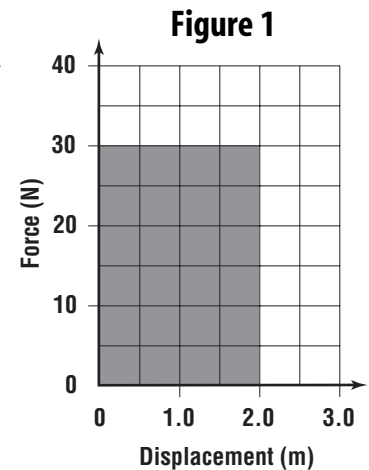
Another way of analyzing the work done by a force is to do a force-displacement graph. The graph to the right is a plot of force vs. displacement for a 30 N box being lifted 2.0 m. The shaded area under the graph (Figure 1) equals the work input. ($W_{in} = F_e \times d_e = 30\text{N} \times 2.0\text{ m} = 60\text{ J}$) Since no machine was used to lift the box, the graph of work output would be the same. ($W_{out} = F_r \times d_r = 30\text{N} \times 2.0\text{ m} = 60\text{ J}$)

Directions: Solve the following problems using force-displacement graphs.

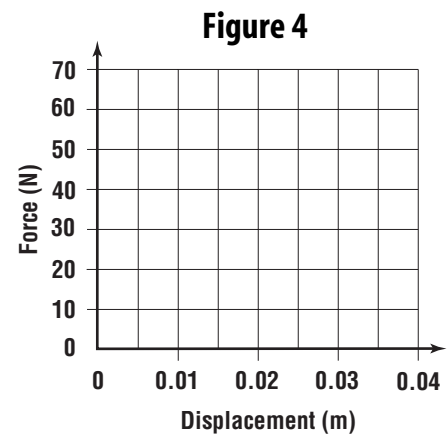
1. Draw a force-displacement graph in Figure 2 showing the work input and the work output when a box of books that needs a force of 40 N is lifted 1.5 m.



2. Draw a force-displacement graph in Figure 3 showing the work input and the work output for the same box if the books are lifted by a pulley system with an IMA of 2.



3. A force of 70 N is required to remove a bottle cap without using an opener. Draw a force-displacement graph in Figure 4 for the work output when the bottle cap is moved 1 cm.



4. Draw a force-displacement graph in Figure 4 for work input on the same bottle cap being removed by an opener resulting in an IMA of 3.5.