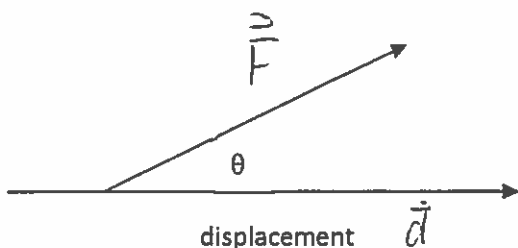
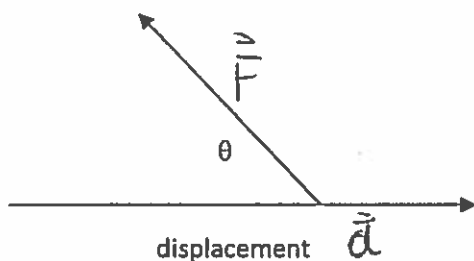
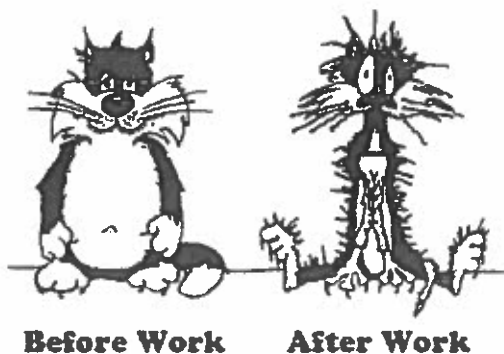


# WORK



The work done by a force  $\vec{F}$  that is acting on an object that undergoes displacement  $\vec{d}$  is given by a dot product of the two vectors:

$$W = \vec{F} \cdot \vec{d}, \text{ when force is parallel with displacement}$$

Work is done only by the component of the force that is parallel with displacement

$$W = (F \cos \theta)d$$

- scalar quantity
- symbol W
- unit JOULE [J] or [N·m]

Negative Work = work done by force whose direction is opposite to the direction of the displacement vector.

Zero Work = 1. \_\_\_\_\_

2. \_\_\_\_\_

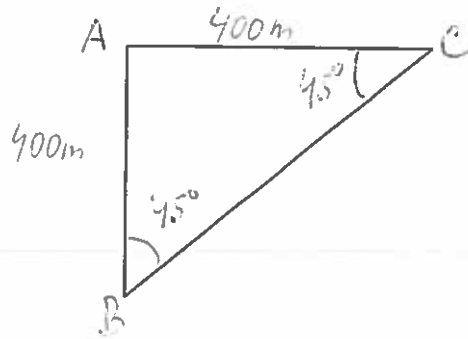
3. \_\_\_\_\_

Example: Find work done by the force of gravity on a 900 kg object displaced as follows:

a)  $A \rightarrow B$

b)  $A \rightarrow C$

c)  $C \rightarrow B$



Practice:

1. Find work done by force 5000 N that moves an object over 3.00 km. What assumptions do you make?

2. a) Find work done by a 750 N force pulling a 20.0-kg object strictly horizontally left over 30.0m.

b) Does the mass of the object affect the amount of the work done? Explain.

3. A 50.0-kg object was dragged on the ground for 15.0 m left and work done was 2000 J. Find the magnitude and direction of the smallest possible force needed to do this work.

4. Consider an object with mass 40.0 kg that is pushed across a horizontal floor by a force of 150N [right]. Find the force of friction (magnitude and direction) that acts on the object provided that the coefficient of kinetic friction is 0.34.

5. Where, relative to its initial position, was an object dragged to if force needed was 600 N [left] and work done 750 J?

6. Consider a box pushed left on a strictly horizontal floor and moves 50.0m. What work was done if the pushing force of 35 N was applied at an angle of  $25^\circ$  at the top right edge of the box?

7. How much force at an angle of  $30^\circ$  does one need to apply in order to do work of 5000 J and move an object by 2.5 m?