Name: _____

Period: _____

Simple Machines Made Simple

If you **remember this saying** you can understand and solve almost every simple machine problem:

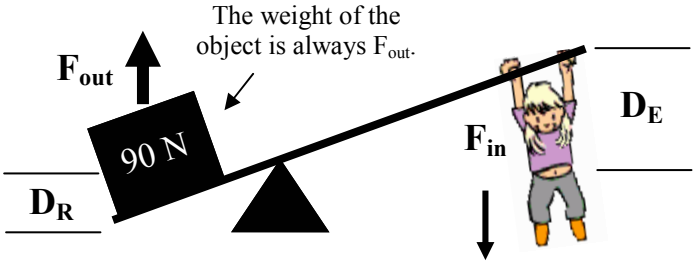
"You put ***effort in***; you get ***resistance out.*** The ***object*** is the ***output***."

But what does this saying mean? …

"You put effort in;" -
means the De (distance of effort) goes with the F_{in} (force in).

"you get resistance out" -
means the D_r (distance of resistance) goes with the F_{out} (force out).

"The object is the output." -
means that whatever object you are lifting or moving is the F_{out} (force out).

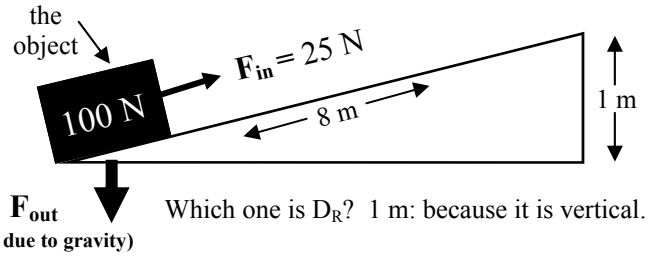


The F_{out} always goes with the D_R and the F_{in} always goes with the D_E: **Always**.

Distance of Resistance

What resists? Gravity. And gravity is always vertical.

How do you decide which distance is the distance of resistance? If you remember that gravity is resisting and gravity always pulls down, then the vertical direction the object is lifted or would have to be lifted without the simple machine is the distance of resistance.



Which one is D_R? 1 m: because it is vertical.

Find the Object First

The object is what you are lifting, moving, pushing or pulling.

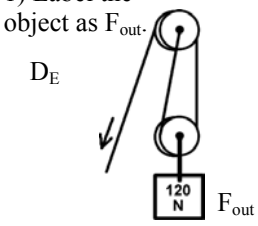
When working on Simple Machine Problems Follow These Steps:

1) Label the weight of the object that is moved or lifted as F_{out}.
2) Label the distance the object moves vertically as D_R.
3) Label the other distance as D_E OR
4) Label the other force as F_{in}.

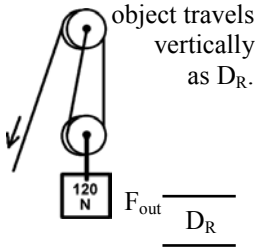
If you follow these four steps it will then be easy to find work or efficiency

Example 1

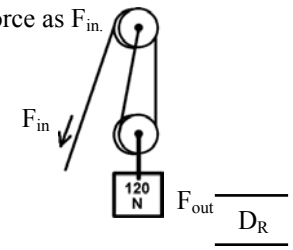
1) Label the object as F_{out}.



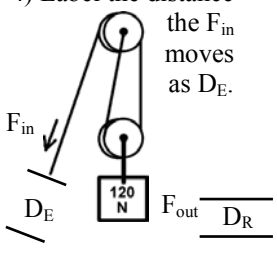
2) Label the distance the object travels vertically as D_R.



3) Label the other force as F_{in}.



4) Label the distance the F_{in} moves as D_E.



Example 2

It takes 60 N to drag a 200 N rock up a 10 m long ramp to get it to the top of a 2 m table. Find the efficiency of the incline plane.

1) The 200 N rock is the object being moved. So, $F_{out} = 200$ N
2) The vertical distance the rock moves is 2 m. So, $D_R = 2$ m.
3) The other distance is D_E. $D_E = 10$ m.
4) Your effort is F_{in}. $F_{in} = 60$ N.

We now know this:
$F_{out} = 200$ N
$D_R = 2$ m
$F_{in} = 60$ N
$D_E = 10$ m

$$Eff = \frac{W_{out}}{W_{in}} x100$$

and $W = Fd$

$$W_{out} = F_{out} D_R = 200N(2m)$$

$$W_{out} = 400J$$

$$W_{in} = F_{in} D_E = 60N(10m)$$

$$W_{in} = 600J$$

$$Eff = \frac{W_{out}}{W_{in}} x100 = \frac{400J}{600J} x100$$

$$Eff = 67\%$$

(33% was lost as friction)