

BASIC

How to Compute Work...

In elementary physics, the work W done by a constant force F in moving an object from point A to point B is defined as:

$$W = \|F\| \|AB\| \cos \theta$$

magnitude of the force

distance (length) over which the force is applied "from A to B"

θ here, is the angle BETWEEN the force and the direction of motion.

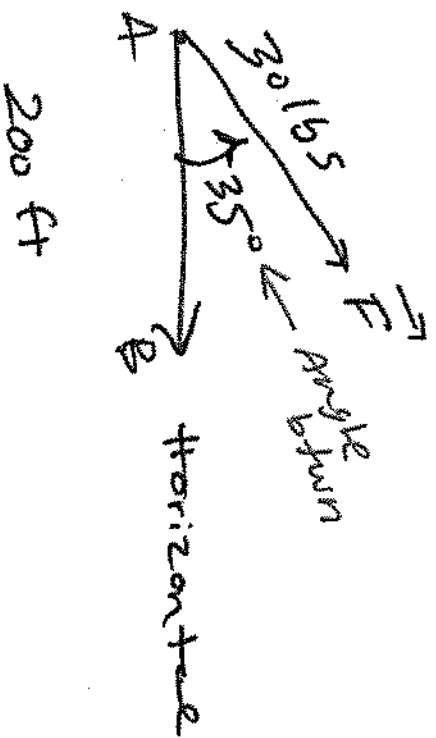
$$W = F \cdot d \cdot \cos \theta$$

Note: work is often measured in foot-pounds or newton-meters.

"joules"

Pound to the tenths.

Ex.1) A child pulls a sled on level ground by exerting a force of 30 pounds on a rope that makes an angle of 35° with the horizontal. How much work is done pulling the sled 200 ft?



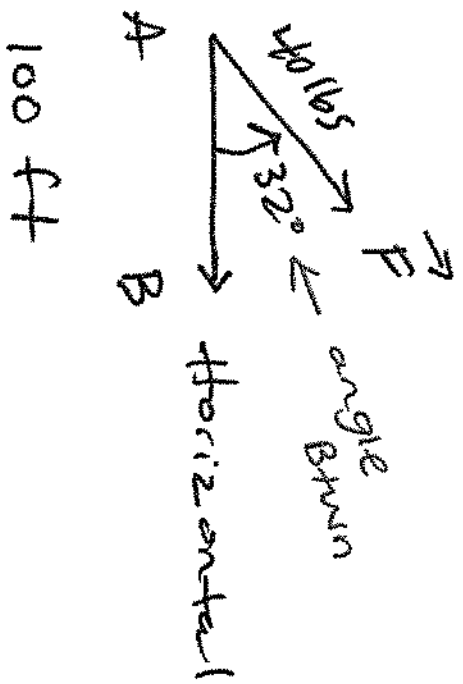
$$W = F \cdot d \cdot \cos \theta$$

$$W = (30)(200) \cos 35^\circ$$

$$W \approx 4914.9 \text{ foot-pounds}$$

ft - lbs

Ex.2) A wagon is pulled along level ground by exerting a force of 40 pounds on a handle that makes an angle of 32° with the horizontal. How much work is done pulling the wagon 100 ft?

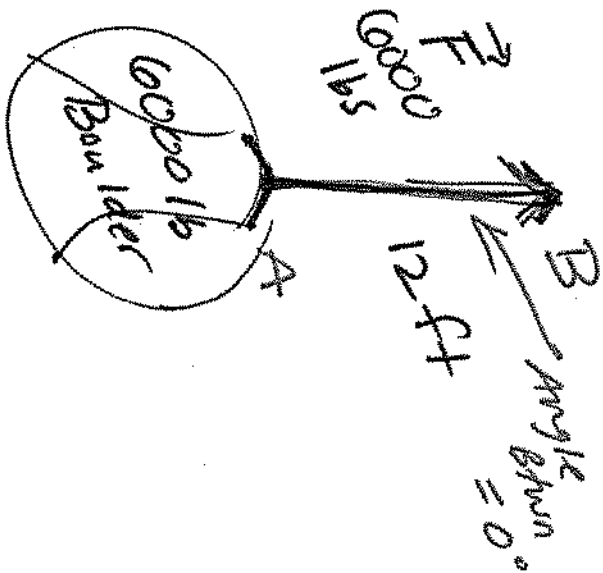


$$W = F \cdot d \cdot \cos \theta$$

$$W = (40)(100) \cos 32^\circ$$

$$W \approx 3392.2 \text{ ft-lbs}$$

Ex.3) Find the work done when a crane lifts a 6000-pound boulder through a vertical distance of 12 feet.



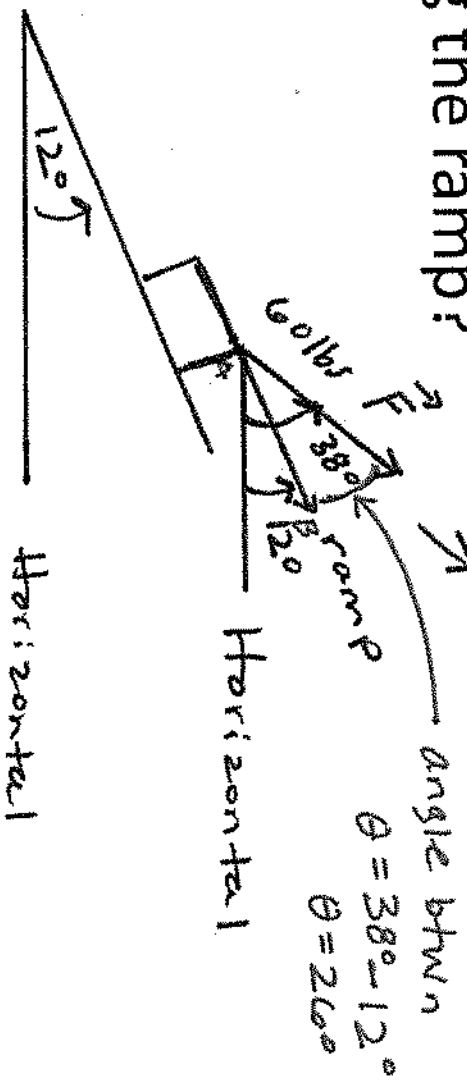
$$W = F \cdot d \cdot \cos \theta$$

Angle
Btwn

$$W = (6000)(12) \cos 0^\circ$$

$$W \approx 72,000 \text{ ft} \cdot \text{lbs}$$

Ex.4) A force of 60 pounds on a rope is used to pull a box up a ramp inclined at 12° from the horizontal. The rope attached to the box forms an angle of 38° with the horizontal. How much work is done pulling the box 20 feet along the ramp?



$$W = F \cdot d \cdot \cos \theta$$

$$W = (60)(20) \cos \theta$$

\leftarrow angle between

$$W = (60)(20) \cos 26^\circ$$

$$W \approx 1078.6 \text{ ft} \cdot \text{lb}$$