

Work & Power

Mr. Skirbst

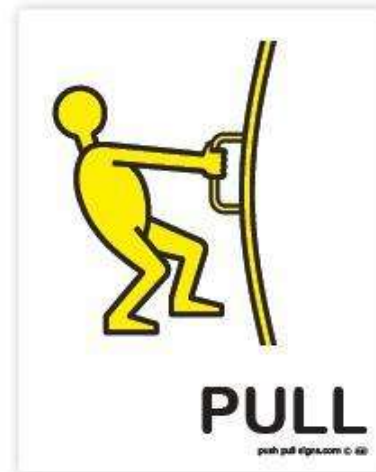
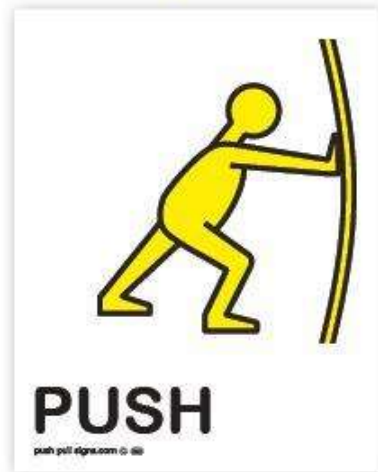
What is work?



Work

Work is a force
acting through a distance

pushes and pulls - forces and motion



Equation for Work

$$W = (F)(d)$$

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Work = force x distance

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(Joules) = (Newtons) (meters)

Example:

A student who weighs 500 N climbs a flight of stairs 5 m high. How much work is done?

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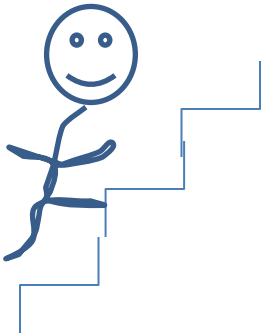
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Picture

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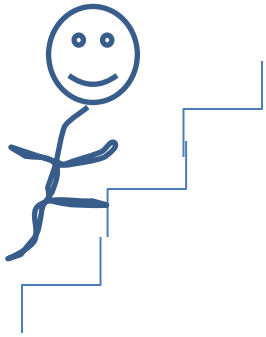
Picture



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Picture

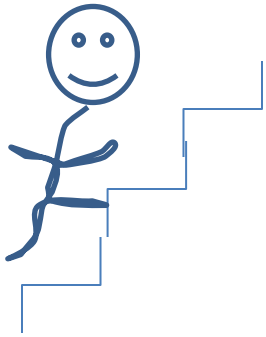


ToV

Example:

A student who weighs 500 N climbs a flight of stairs 5 m high. How much work is done?

Picture



ToV

$$F = 500\text{N}$$

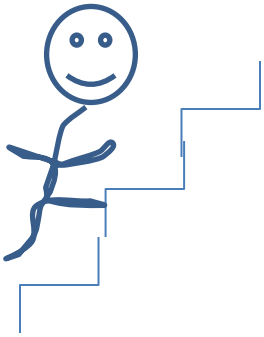
$$d = 5\text{m}$$

$$W = ?$$

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ToV

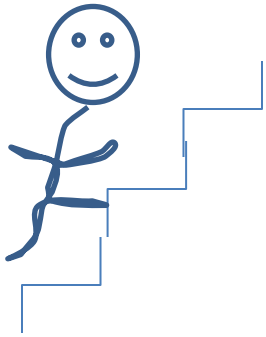
$$F = 500\text{N}$$
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Equation

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ToV

$F = 500\text{N}$
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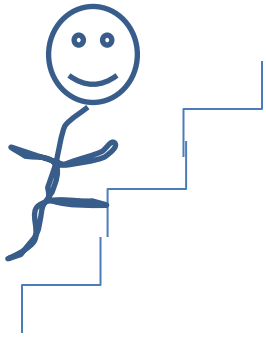
Equation

$$W = Fd$$

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Equation

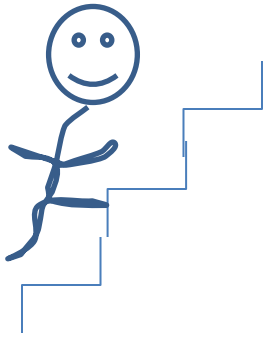
$$W = Fd$$

Plug-In

Example:

A student who weighs 500 N climbs a flight of stairs 5 m high. How much work is done?

Picture



ToV

$$F = 500\text{N}$$
$$d = 5\text{m}$$
$$W = ?$$

Equation

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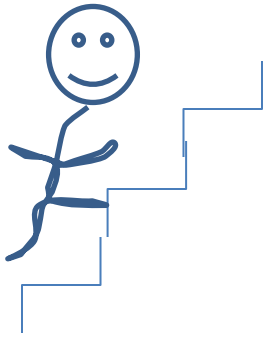
Plug-In

$$W = (500)(5)$$

Example:

A student who weighs 500 N climbs a flight of stairs 5 m high. How much work is done?

Picture



ToV

$$F = 500\text{N}$$
$$d = 5\text{m}$$
$$W = ?$$

Equation

$$W = Fd$$

Plug-In

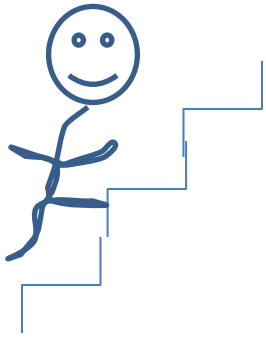
$$W = (500)(5)$$

Solution

Example:

A student who weighs 500 N climbs a flight of stairs 5 m high. How much work is done?

Picture



ToV

$$F = 500\text{N}$$
$$d = 5\text{m}$$
$$W = ?$$

Equation

$$W = Fd$$

Plug-In

$$W = (500)(5)$$

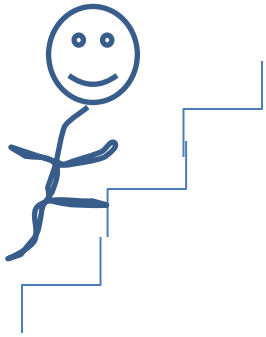
Solution

$$W = 2500 \text{ Nm}$$

Example:

A student who weighs 500 N climbs a flight of stairs 5 m high. How much work is done?

Picture



ToV

$$F = 500\text{N}$$
$$d = 5\text{m}$$
$$W = ?$$

Equation

$$W = Fd$$

Plug-In

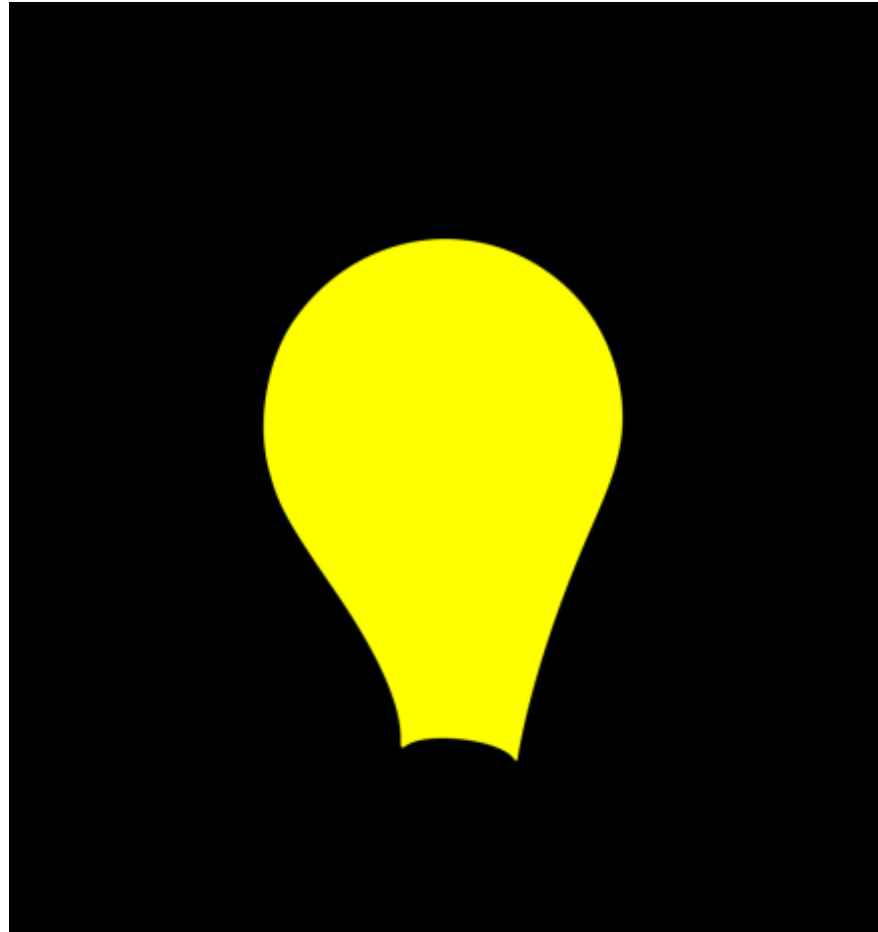
$$W = (500)(5)$$

Solution

$$W = 2500$$

Joules

What is power?



What is power?

Power is the rate
at which work is done



Equation for Power

$$P = W / t$$

Equation for Power

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Power = work / time

Equation for Power

$$P = W / t$$

Power = work / time

(Watts) = (Joules) / (seconds)

Example:

A student rolls a 60 Newton bowling ball a distance of 10 meters in 2 seconds. How much work was done? How powerful was the student?

Example:

A student who weighs 500 N climbs a flight of stairs 5 m high. How much work is done? If she does this in 10 seconds, how powerful is she?

Example:

An 800 N teacher falls 2 meters off a table in 2 sec.

How much power is produced by this fall?

Example:

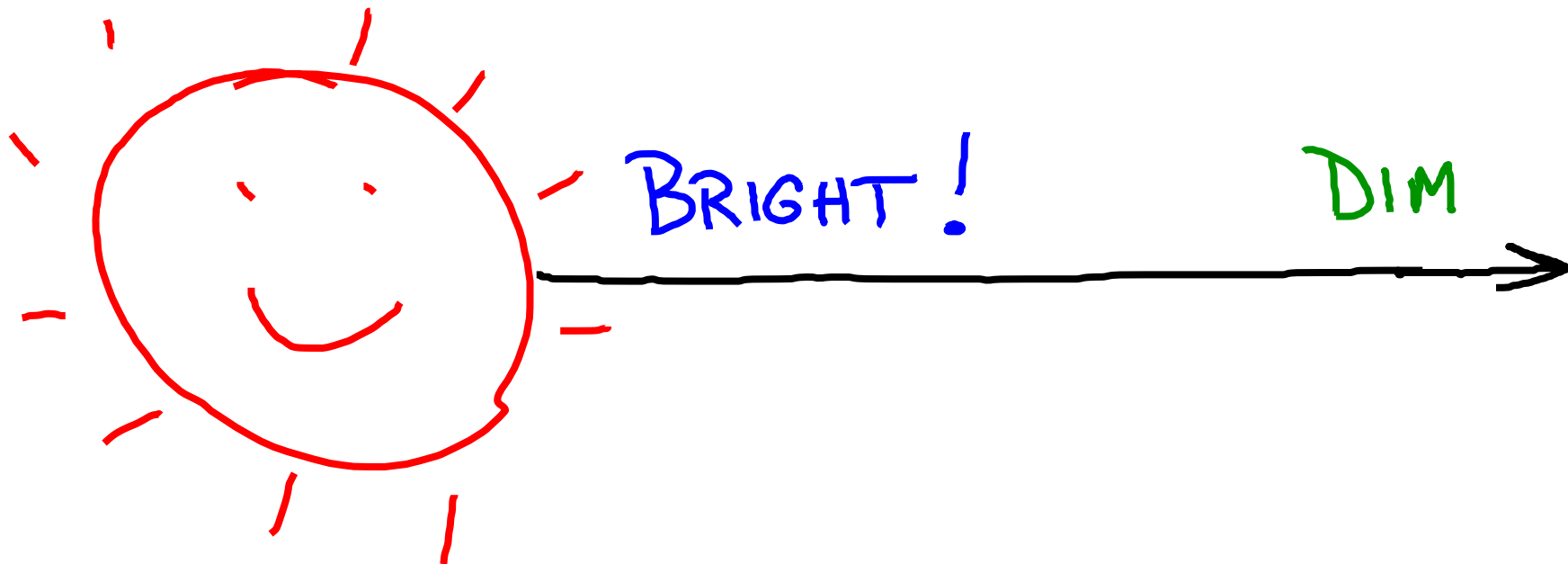
If a 600N student runs 1km in 5 minutes, how powerful is she?

Lab Activity

Convert your weight (force) from
pounds to Newtons:

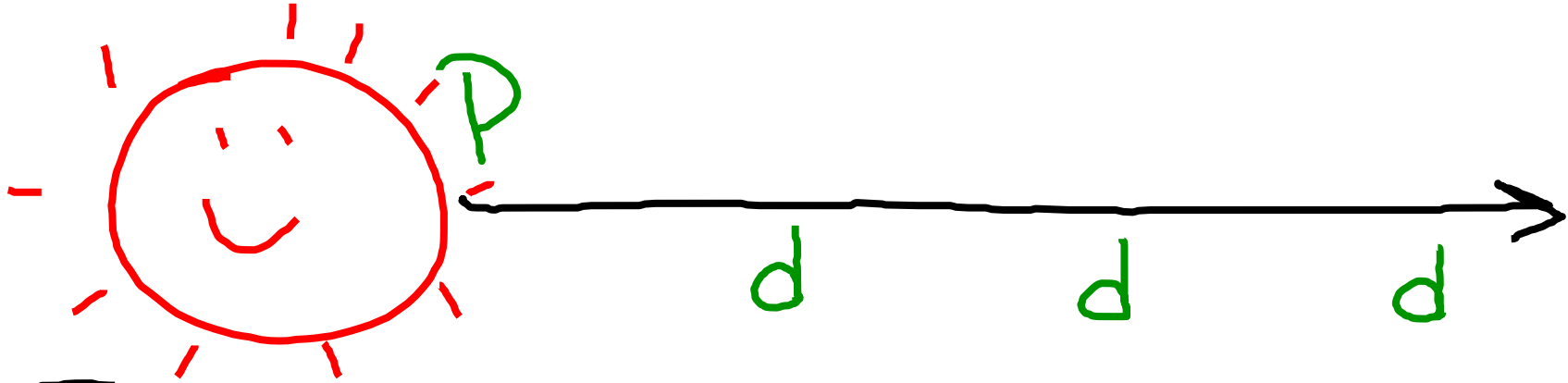
$$(\# \text{ pounds}) \times 4.5 = \# \text{ Newtons}$$

(Ex. 100 lbs x 4.5 = 450 Newtons)

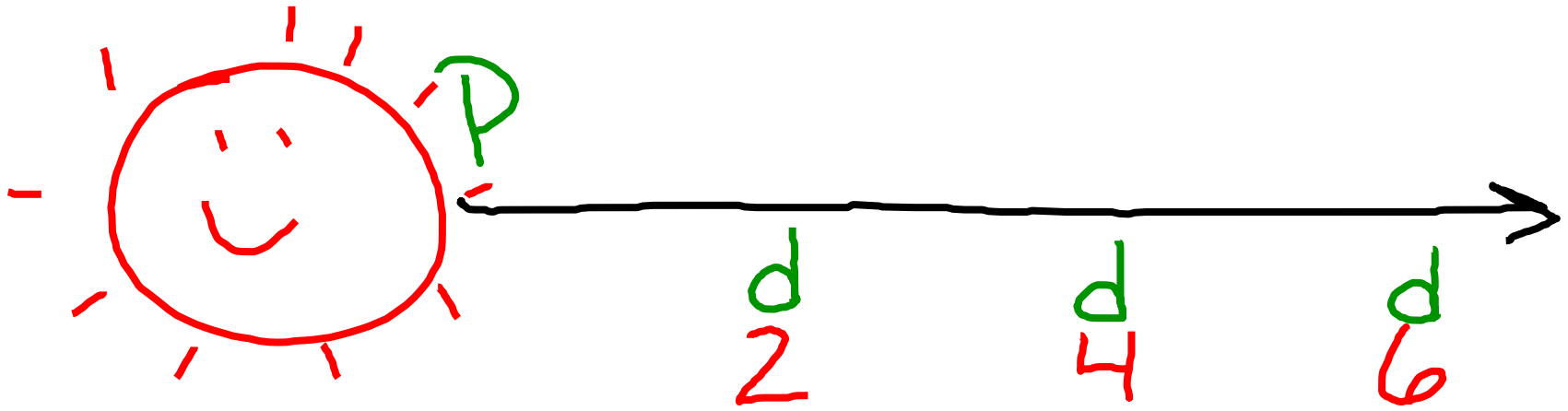


BRIGHT!

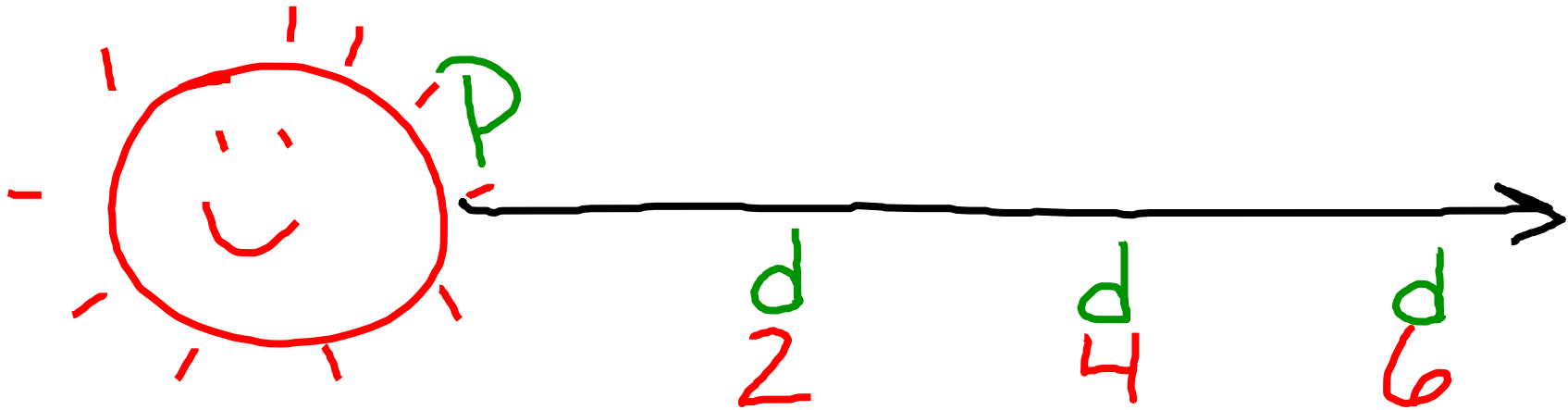
DIM



$$P = \frac{1}{d^2}$$



$$P = \frac{1}{d^2}$$

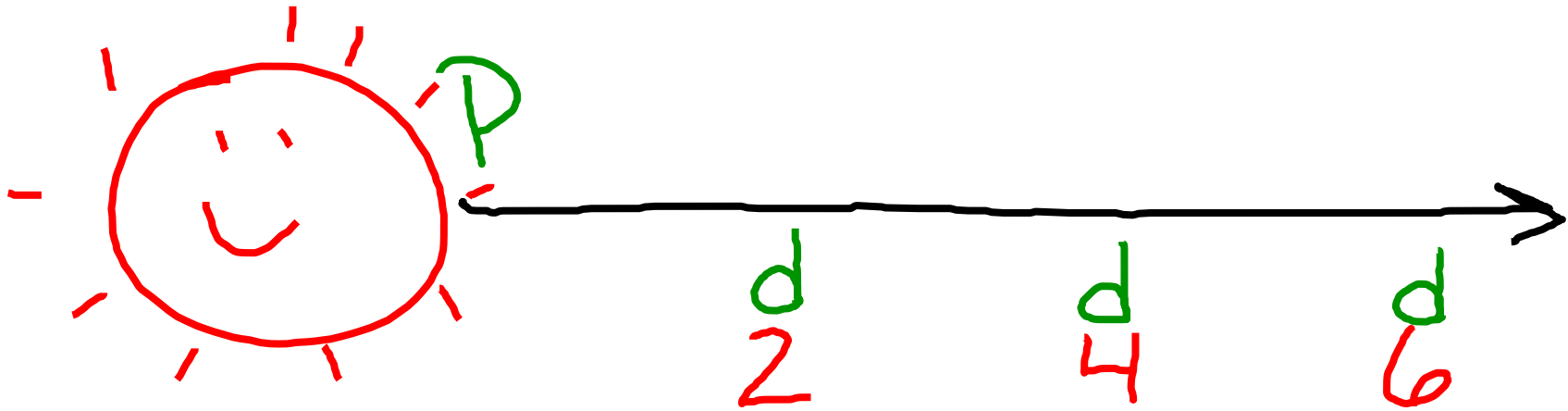


$$P = \frac{1}{d^2}$$

$$\frac{1}{2^2}$$

$$\frac{1}{4^2}$$

$$\frac{1}{6^2}$$



$$P = \frac{1}{d^2}$$

$$\frac{1}{2^2}$$

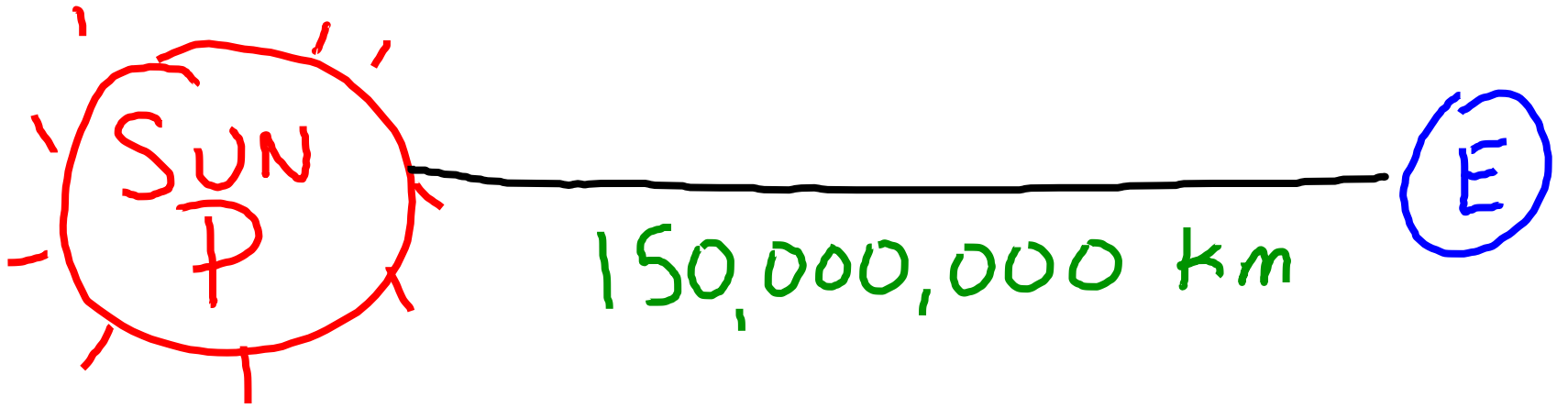
$$\frac{1}{4^2}$$

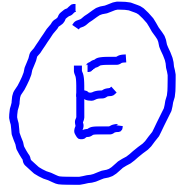
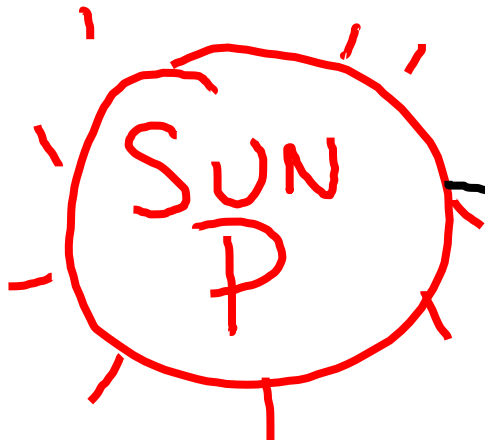
$$\frac{1}{6^2}$$

$$P = \frac{1}{4}$$

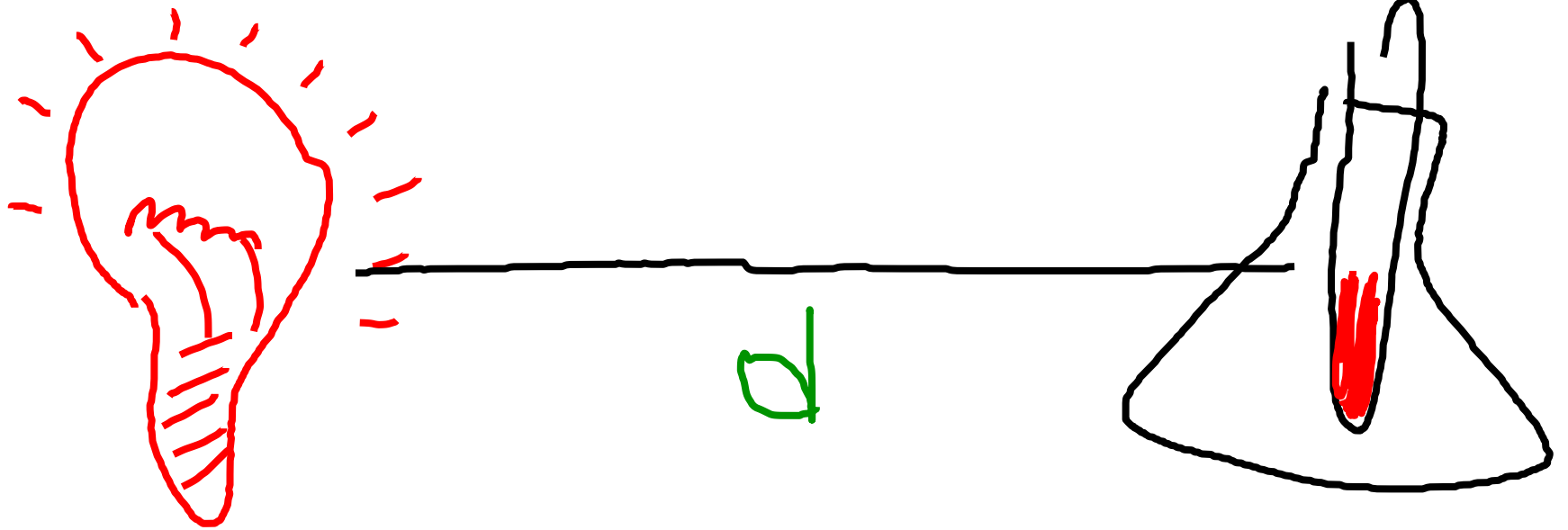
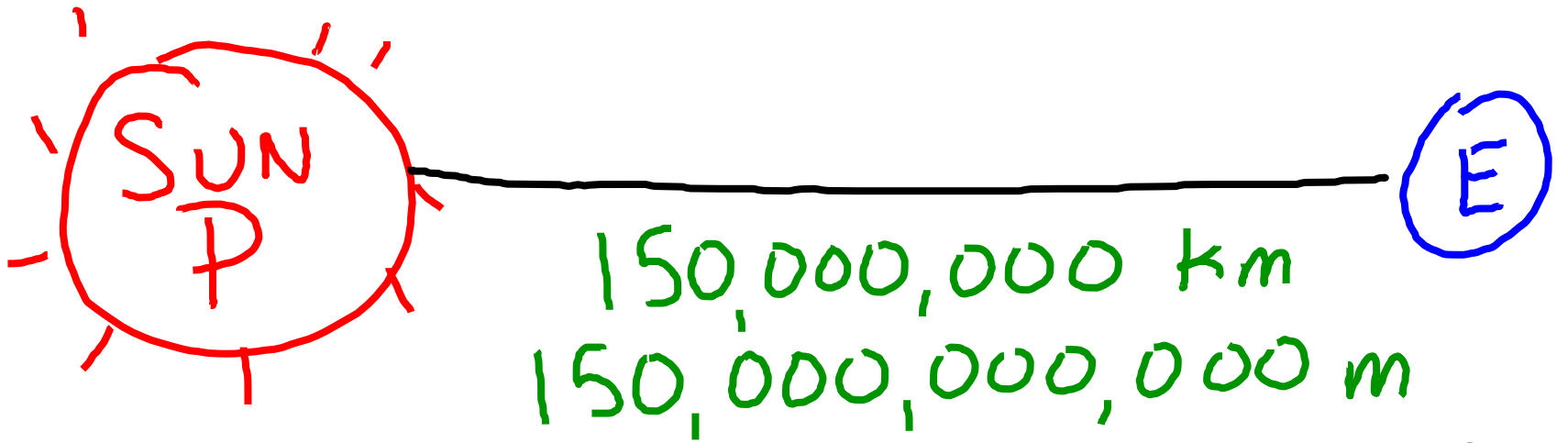
$$\frac{1}{16}$$

$$\frac{1}{36}$$





150,000,000 km
150,000,000,000 m



$$\frac{P_{\text{SUN}}}{d^2} = \frac{P_{\text{BULB}}}{d^2}$$

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$$(P_{\text{SUN}})(d^2) = (P_{\text{BULB}})(d^2)$$

$$\frac{P_{\text{SUN}}}{d^2} = \frac{P_{\text{BULB}}}{d^2}$$

$$\frac{(P_{\text{SUN}}) (d^2)}{d_B^2} = \frac{(P_{\text{BULB}}) (d^2)}{d_B^2}$$

$$\frac{P_{\text{SUN}}}{d^2} = \frac{P_{\text{BULB}}}{d^2}$$

$$\frac{(P_{\text{SUN}})(d^2)}{d^2} = \frac{(P_{\text{BULB}})(d^2)}{d^2}$$

$$P_{\text{SUN}} = \frac{(P_{\text{BULB}})(d_{\text{BULB}}^2)}{d_{\text{SUN}}^2}$$

$$P_{\text{SUN}} = \frac{(100)(2.25 \times 10^{22})}{(d_{\text{BULB}})^2}$$