

25.1: Inclined Plane

An inclined plane (previously encountered in Chapter 14) is a flat surface tilted at some angle θ from the horizontal. For example, if you're ever rented a moving van, the van will have an inclined plane (a "ramp") at the back of the truck. Instead of lifting heavy items directly into the back of the truck, one may push or roll them up the ramp. This requires less force (effort), at the expense of having to move it farther. (Figure 25.1.1

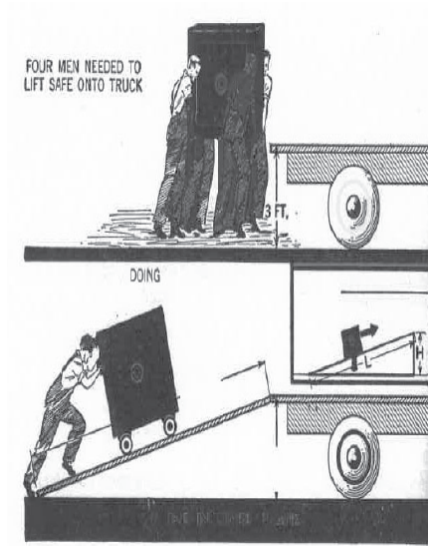


Figure 25.1.1: The inclined plane. In this example, $L = 12\text{ft}$, $H = 3\text{ft}$, so the mechanical advantage is $M.A. = L/H = 4$. Rolling the safe up the incline requires only $1/4$ the force of lifting it directly. (Ref. [17])

In the case of an inclined plane whose inclined length is L and whose high end is at height H , the mechanical advantage is found from $W_i = W_o$, or

$$F_E L = F_R H \quad (25.1.1)$$

so the mechanical advantage $M.A. = F_R/F_E$ is

$$M.A. = \frac{L}{H} = \csc \theta \quad (25.1.2)$$

Note that as $\theta \rightarrow 90^\circ$, the inclined plane approaches a vertical ramp, and the mechanical advantage approaches 1, as expected. The mechanical advantage of the inclined plane may be made arbitrarily large by increasing the length L of the plane.

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