§5.2 Motion and Newton's Second Law

Newton found that acceleration of an object depends on the force$^{(net)}$ acting on the object and the mass of the object.

Acceleration is directly proportional to the force$^{(net)}$ and is inversely proportional to the mass.

$$a \propto F \quad a \propto \frac{1}{m} \quad \Big\} \quad a \propto F\left(\frac{1}{m}\right)$$

$$a \propto \frac{F}{m}$$

$$F \propto ma$$

$$F = kma$$

$$\vec{F}_{net} = m\vec{a}$$

K is special

$$k = \frac{1\,N}{1\,kg \cdot m/s^2}$$

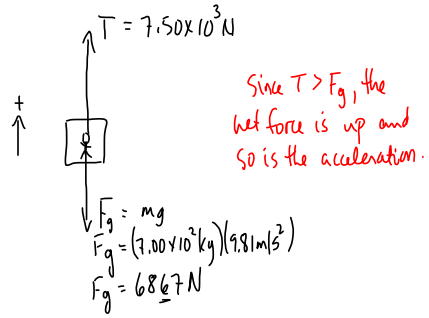
where $\vec{F}_{net}$ is the net force / unbalanced force (N)
m is the mass (kg)
$\vec{a}$ is the acceleration (m/s^2)

MP/162

$m = 7.00 \times 10^2\,kg$

$T = 7.50 \times 10^3\,N$

$\vec{a} = ?$



Since $T > F_g$, the net force is up and so is the acceleration.

$$\vec{F}_{net} = m\vec{a}$$

$$T - F_g = ma$$

$$7.50 \times 10^3\,N - 6867\,N = (7.00 \times 10^2\,kg)\,a$$

$F_{net} \rightarrow 633\,N = (7.00 \times 10^2\,kg)\,a$

$$a = \frac{633\,N}{7.00 \times 10^2\,kg} \qquad \frac{kg \cdot m/s^2}{kg}$$

$$a = +0.90\,m/s^2$$

$$\vec{a} = 0.90\,m/s^2\,[up]$$

upward acceleration could mean:
① speeding up / going up
② slowing down / going down

Recall INV4 !!

TODO: PP/163