Finding Net Force:

If forces going the same direction, ...

\[ \begin{align*}
40 \, \text{N} \\
\text{ oppose} \\
60 \, \text{N} \\
\end{align*} \]

\[ = 100 \, \text{N} \]

If forces are going opposite directions, ...

\[ \begin{align*}
50 \, \text{N} \\
\text{ with} \\
90 \, \text{N} \\
\end{align*} \]

\[ = 40 \, \text{N Left} \]
What force is required to accelerate a 25 kg object at 3.5 m/s/s?

\[ \text{F: ?} \]
\[ m: 25 \text{ kg} \]
\[ a: 3.5 \text{ m/s}^2 \]
\[ F = ma \]
\[ F = 25 \text{ kg} \times 3.5 \text{ m/s}^2 = 87.5 \text{ N} \]
A force of 280 N is applied to a 20 kg object. Find the acceleration of the object.

\[ F = ma \]
\[ \frac{F}{m} = \frac{ma}{m} \]
\[ a = \frac{F}{m} \]
\[ \frac{280}{20} = 14 \text{ m/s}^2 \]
A force of 500 N is applied to a 45 kg object. What is the rate of acceleration of the object?

\[ F = 500 \text{ N} \]
\[ m = 45 \text{ kg} \]
\[ a = ? \]

\[ \frac{F}{M/a} \]
\[ \frac{F}{3} = \frac{3m \cdot a}{3} \]
\[ \frac{500}{45} \]

\[ a = 11.1 \text{ m/s}^2 \]
A car has a mass of 2400 kg. How much does the car weigh?

\[ F_q = ? \]
\[ m = 2400 \text{ kg} \]
\[ g = 9.8 \]

\[ F_q = 2400 \cdot 9.8 \]
\[ F_q = 23520 \text{ N} \]
Determine the mass of a 3000 N boulder.

\[ F_g = \frac{m}{g} \]

\[ F_g = 3000 \text{ N} \]

\[ g = 9.80 \text{ m/s}^2 \]

\[ m = \frac{3000}{9.80} \text{ kg} \]

\[ m = 306.2 \text{ kg} \]
Find the unknown:

\[ F = 26 \text{ N} \]
\[ m = 13 \text{ kg} \]
\[ a = ? \]

\[ a = \frac{F}{m} = \frac{26}{13} \]
\[ a = 2 \text{ m/s}^2 \]
\[ t = 2 \text{ s} \rightarrow \]
Find the unknown:

\[ F = 30 \text{ N} \]
\[ m = 5 \text{ kg} \]
\[ a = \text{?} \]

\[ F = ma \]
\[ a = \frac{F}{m} \]
\[ a = \frac{30}{5} = 6 \text{ m/s}^2 \text{ left} \]
Find the unknown:

\[
75 \text{ N} \quad \boxed{\quad} \quad 40 \text{ N}
\]

\[ m = ? \]

\[ a = 5 \text{ m/s/s} \text{ Left} \]

\[
\begin{align*}
35 \\
\underline{m = ?} \\
a &= 5 \cdot \frac{35}{5} \\
F &= ma \\
\frac{F}{a} &= 7 \text{ m/s}^2 \\
\text{kg}
\end{align*}
\]
Find the unknown:

\[ F = MA \]

\[ m = 20 \text{ kg} \]

\[ a = 3 \text{ m/s/s right} \]

\[ 100 \text{ N} \quad F = ? \quad 160 \text{ N} \]
Find the unknown:

\[ \frac{250 \text{ N}}{205 \text{ N}} \]

\[ F = ? \]

\[ F = ma \]

\[ a = \frac{45}{15} = 3 \text{ m/s}^2 \]

\[ m = 15 \text{ kg} \]

\[ a = 3 \text{ m/s}^2 \text{ left} \]

\[ \frac{250 - 95}{205} \]

\[ F = 15(3) = 45 \]
Find the unknown:

\[ \begin{align*}
\frac{70 \text{ N}}{10} & \quad 110 \text{ N} \\
\frac{3 \text{ m}}{5 \text{ s}^2} & \quad L \\
F & \quad 80 \text{ N}
\end{align*} \]

\[ F = ? \]

\[ F = 30 \text{ N} \]

\[ m = 10 \text{ kg} \]

\[ a = 3 \text{ m/s/s left} \]

\[ \frac{80}{110} \]
Find the unknown:

\[ F = ? \]

\[ F = 200 \text{ N} \]

\[ m = 20 \text{ kg} \]
\[ a = 10 \text{ m/s/s left} \]
Find the unknown:

\[ F = 100 \text{ N} \]

\[ F = ma \]

\[ a = \frac{F}{m} = \frac{100 \text{ N}}{20 \text{ kg}} \]

\[ a = 5 \text{ m/s}^2 \]
Find the unknown:

\[ 30 \text{ N left} \]

\[ \Gamma = ma \]

\[ a = \frac{F}{m} = \frac{90}{10} = 9 \text{ m/s}^2 \text{ left} \]

\[ m = 10 \text{ kg} \]
Find the unknown:

\[ F = 120 \text{ N} \]
\[ m = 40 \text{ kg} \]
\[ a = ? \]

\[ F = ma \]
\[ \frac{F}{m} = \frac{120}{40} \]
\[ a = 3 \text{ m/s}^2 \]
Match the following:

- velocity
- acceleration (including gravity)
- distance
- mass
- Force (including weight)
- time
- Newtons (N)
- meters (m)
- seconds (s)
- m/s/s
- kilograms (kg)
- m/s
Match the following:

- Newton's 1st Law
  - Law that relates force, mass and acceleration in the equation $F = ma$

- Newton's 2nd Law
  - Law that states that any 2 objects have a force of attraction between them!!

- Newton's 3rd Law
  - Law that states that an object at rest will remain at rest and an object in motion will remain in motion unless acted on by some unbalanced force!

- Newton's Law of Universal Gravitation
  - Law that states for every action, there is an equal but opposite reaction!!
This man is twirling a rubber stopper at a constant speed in a horizontal path around his head. Is the velocity constant? Is the object accelerating? What happens when he lets go?