Physics 11 – Dynamics - Newton's 2nd Law

Ex: A 1500 kg ice cream truck accelerates from rest to a top speed of 45 km/h in 8.0 s. What was the net force acting on the truck?

$45\,km/h \div 3.6 = 12.5\,m/s$

$F_{net} = ma$

$= (1500\,kg)(1.5625\,m/s^2)$

$= 2343.75\,N$

$= \boxed{2300\,N}$

Find a:

$V_f = 12.5\,m/s$, $V_i = 0\,m/s$, $a = ?$, $d = —$, $t = 8.0\,s$

$V_f = V_i + at$

$a = \frac{V_f - V_i}{t}$

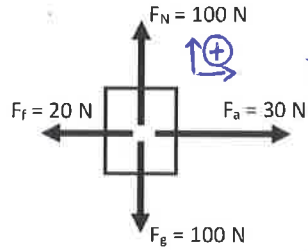
$= \frac{12.5\,m/s - 0\,m/s}{8.0\,s}$

$= 1.5625\,m/s^2$

To find F_{net} when many forces act on an object:

1. Find F_{net} in each dimension by adding the forces.
2. Choose positive direction for your free body diagram.
3. Plug in your values based on the direction of the force vectors.

Ex: Determine the magnitude and direction of the net force



$\vec{F}_{net\,y} = \vec{F}_N + \vec{F}_g$

$= (100N) + (-100N)$

$\vec{F}_{net\,y} = 0N$

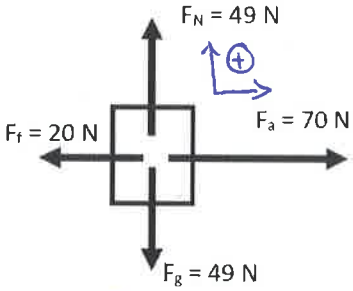
$\vec{F}_{net\,x} = \vec{F}_a + \vec{F}_f$

$= (30N) + (-20N)$

$\vec{F}_{net\,x} = 10N$

$\boxed{F_{NET} = 10N}$

Ex: Use the information given for each diagram to fill in all missing blanks.



$F_g = mg$

$\therefore m = \frac{F_g}{g}$

$= \frac{49\,N}{9.80\,m/s^2}$

$= 0.50\,kg$

m = 0.50 kg

a = 10 m/s²

$m\vec{a} = \vec{F}_a + \vec{F}_f$

$\vec{a} = \frac{\vec{F}_a + \vec{F}_f}{m}$

$= \frac{(70N) + (-20N)}{0.50kg}$

$= 10\,m/s^2$

$F_N = F_g$

$\vec{F}_{net} = \vec{F}_a + \vec{F}_f$

Ex. Stan and Kyle are pushing a 75 kg sled along a frictionless ice rink. Stan pushes with 55 N and Kyle pushes with 45 N. Find the sled's acceleration.

$F_{net} = \boxed{F_{stan} + F_{kyle} = m\vec{a}}$

$\vec{a} = \frac{F_{stan} + F_{kyle}}{m}$

$= \frac{55N - 45N}{75kg}$

$= \boxed{1.3\,m/s^2}$

Ex: The Batmobile exerts a force of 8.50×10^3 N east, while friction pulls back on it with a force of 1500 N. If it has a mass of 1250 kg, what is its acceleration?

$F_{net} = \boxed{F_{Bat} - F_f = m\vec{a}}$

$\vec{a} = \frac{F_{Bat} - F_f}{m}$

$= \frac{8500N - 1500N}{1250kg}$

$= \boxed{5.6\,m/s^2\ East}$