In this problem, we're given all the accelerations in terms of x & y coordinates.

The object that the forces are acting on is a 20 kg box.

We want to find the x and y components of the total acceleration.

We're given forces and can deduce the acceleration by dividing the force by the mass of the object.

Since \( \vec{F} = m \vec{a} \Rightarrow \vec{a} = \frac{\vec{F}}{m} \)

Sum forces in x direction
\[
\sum F_x = -2.0\text{N} + 4.0\text{N} = 2.0\text{N}
\]

Sum forces in the y direction
\[
\sum F_y = -3.0\text{N} + 3.0\text{N} = 0 \text{N}
\]

There's only a force component in the x direction.

Thus,
\[
\alpha_y = \frac{F_y}{m} = \frac{0}{2.0\text{kg}} = 0 \quad \alpha_x = \frac{F_x}{m} = \frac{2.0\text{N}}{2.0\text{kg}} = 1 \text{m/s}^2
\]
B) 

- Find $a_x$ & $a_y$ given that these forces act on a 2.0 kg box.

- Sum all forces in each direction then use $F = ma$ to find $a_x$ & $a_y$.

**Sum forces in x-direction.**

\[ \sum F_x = 4.0N - 2.0N = 2.0N \]

**Sum forces in y-direction.**

\[ \sum F_y = 3.0N - 1.0N - 2.0N = 0N \]

Again, there's isn't a total force component in the y-direction. Thus,

\[ a_y = \frac{F_y}{m} = 0 \]

\[ a_x = \frac{F_x}{m} = \frac{2.0N}{2.0\text{ kg}} = 1.0 \text{ m/s}^2 \]
#6A Write a question for the given free body diagram.

- I imagine this configuration represents a truck with some initial velocity going up a hill while trying to slow down. (A truck using a runaway truck ramp on the freeway.)

**Question:**
How far up the ramp will the truck travel with an initial velocity of 50 m/s?

**Find components of the 15000N force in x & y directions.**

\[ F_y = 15000 \text{ N} \]

In the y-direction

\[ F_{iy} = F_i \cos \theta = (15000 \text{ N}) \cos(15^\circ) \approx 14500 \text{ N} \]

In the x-direction

\[ F_{ix} = F_i \sin \theta = (15000 \text{ N}) \sin(15^\circ) \approx 4000 \text{ N} \]

**The total force in the x & y direction**

\[ \Sigma F_x = -12000 \text{ N} - 4000 \text{ N} = -16000 \text{ N} \]

\[ \Sigma F_y = 14500 - 14500 = 0 \text{ N} \]

**Total acceleration in x & y direction**

\[ \theta a_y = \frac{F_y}{m} = 0 \]

\[ a_x = \frac{F_x}{m} \]
The mass force is the force due to gravity.

\[ F_g = mg \implies m = \frac{F_g}{g} = \frac{16000 \text{ N}}{9.8} = 1530 \text{ kg} \]

Now,

\[ a_x = \frac{F_x}{m} = \frac{-18000 \text{ N}}{1630 \text{ kg}} = -11.76 \text{ m/s}^2 \]

With the acceleration we can find the distance up the ramp the truck will travel before it stops.

\[ V_f^2 = V_i^2 + 2a(\Delta x) \]

\[ V_f^2 - V_i^2 = 2a \]

\[
\frac{(-150 \text{ m/s})^2}{2(-11.76 \text{ m/s}^2)} = \frac{2500 \text{ m}^2/\text{s}^2}{2(11.76 \text{ m/s}^2)} = 106.3 \text{ m}
\]