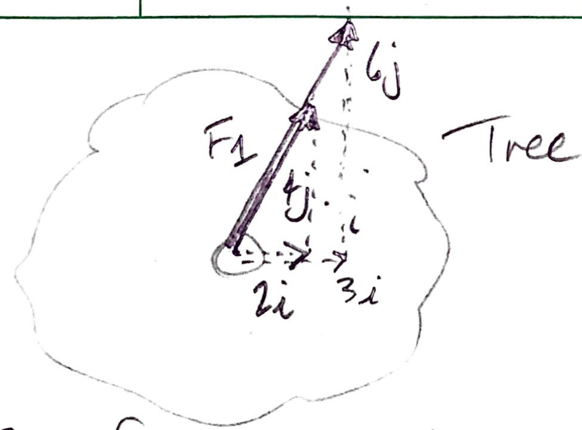
5.19



These forces are in the same direction!

a) $\vec{F}_{net} = \vec{F}_1 + \vec{F}_2$

$= (2i + 4j) + (3i + 6j)$

$= (5i + 10j)\,N$

b) Magnitude & direction?

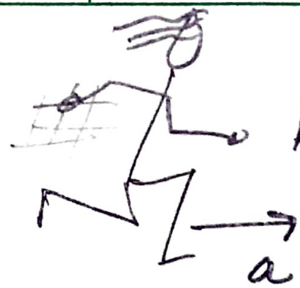
Mag $F = \sqrt{F_x^2 + F_y^2}$

$= \sqrt{5^2 + 10^2}$

$= \boxed{11.2\,N}$

Direction $= \tan^{-1}\left(\frac{10}{5}\right) = \boxed{63.4^\circ}$

5.24



Andra, $m = 63.0\,kg$

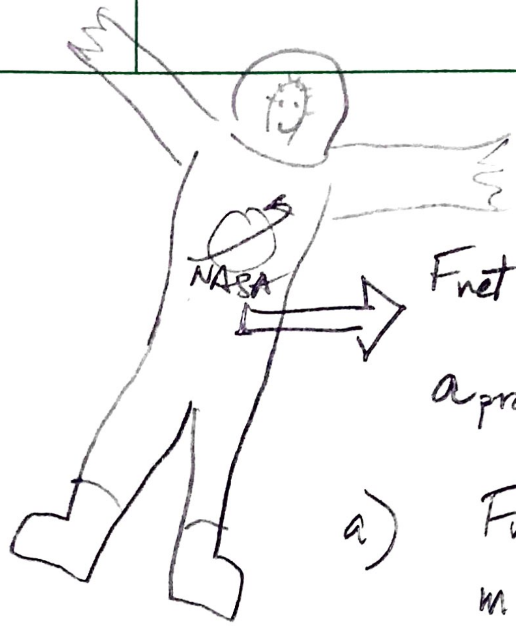
$a = 4.200\,m/s^2$

$F_{net} = ma$

$= (63.0)(4.200)$

$= \boxed{266\,N}$ to the right

5.27



$F_{net} = 50.0\,N$

$a_{produced} = 0.893\ m/s^2$

a) $F_{net} = ma$, so

$$m = \frac{F_{net}}{a} = \frac{50.0}{0.893} = \boxed{56.0\,kg}$$

b) So astronaut pushes on vehicle, & vehicle pushes on astronaut. $a_{system} = ?$

$$a_{system} = a_{astronaut} + a_{vehicle}$$

$F_{net} = ma$, so $a = \frac{F_{net}}{m}$

$$a_{system} = \frac{F_{net\,a}}{m_{astronaut}} + \frac{F_{net\,v}}{m_{vehicle}}$$

$$a_{system} = \left(F_{net_a} + F_{net_v}\right)\left(\frac{m_v + m_a}{2 m_v m_a}\right)$$

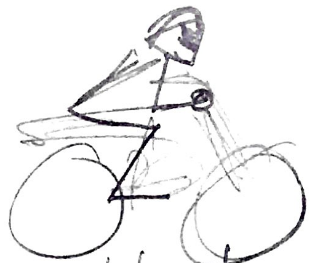
$+ \quad -$

$$0\left(\text{—}\right) = \boxed{0\ m/s^2}$$

These forces cancel, so no net Force on system.

c) Difficult to measure $a_{astronaut}$ if reference frame (ship) is accelerating in the opposite direction. Would need to find a way to accelerate astronaut without ship supplying the force.

5.33



Motorcycle

$a = 3.50\ m/s^2$

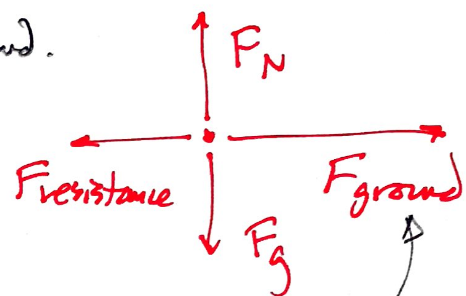
$v = 90 \frac{km}{h} \times \frac{1\ h}{3600\ s} \times \frac{1000}{1\ km}$

$= 25\ m/s$

$F_{resistance} = 400N$.

Find $F_{motorcycle\ on\ ground}$.

Free-body diagram:



$F_{ground\ on\ motorcycle} = -F_{motorcycle\ back\ on\ ground}$. (Newton's 3rd Law)

In x-direction:

$F_{net} = ma$

$F_{ground} - F_{resistance} = ma$

$F_{ground} = ma + F_r$

$= (245\ kg)(3.50\ m/s^2) + 400N$

$= \boxed{1258\ N}$

So Force on ground is also **1258N, in opposite direction (←)**