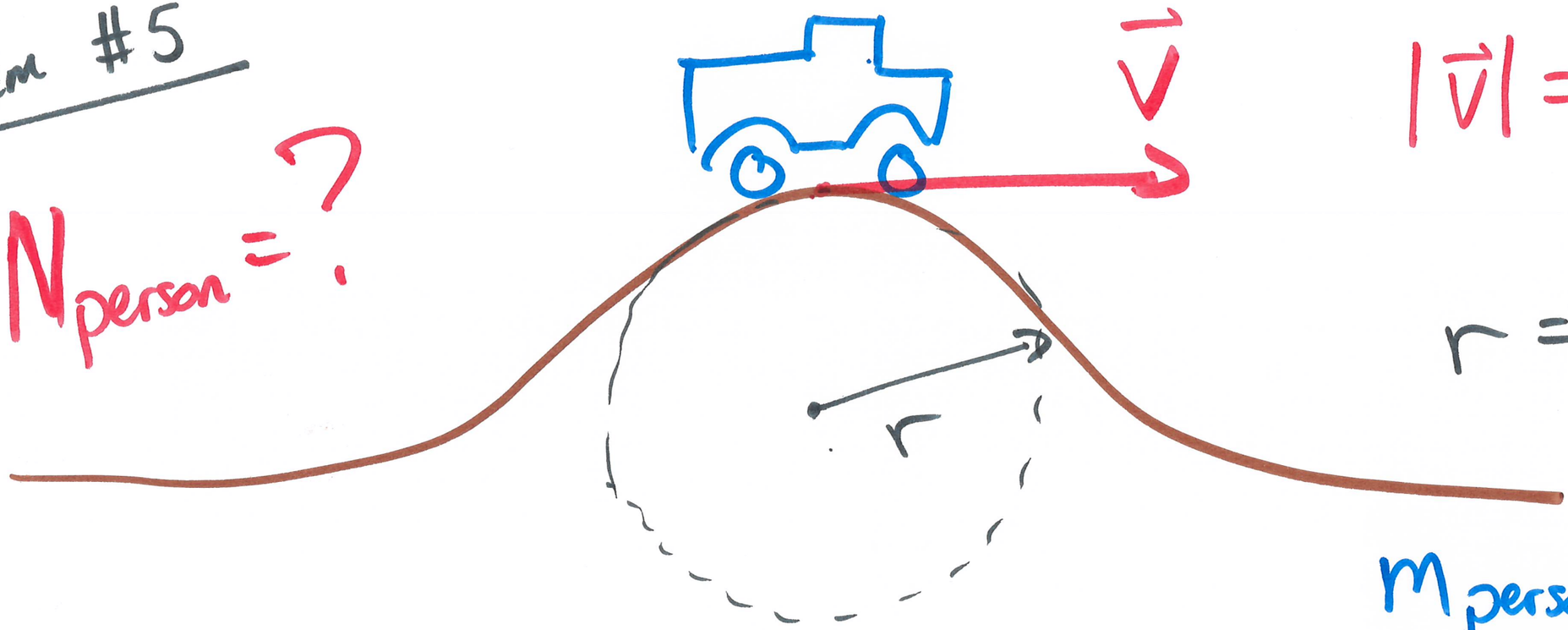
Problem #5

$N_{person} = ?$



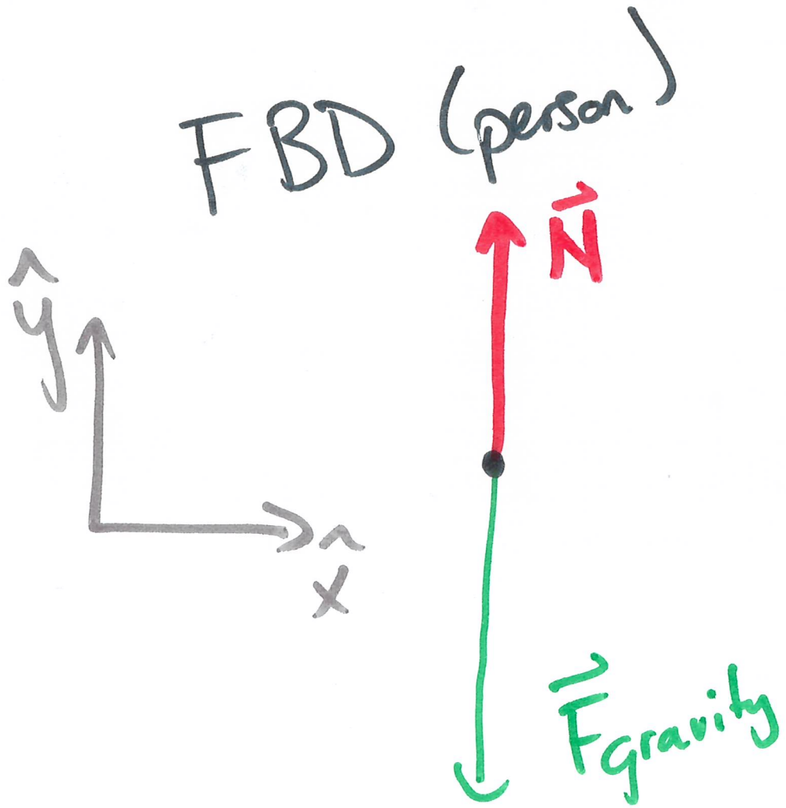
$|\vec{v}| = 33$ mph (15 m/s)

$r = 30$ m

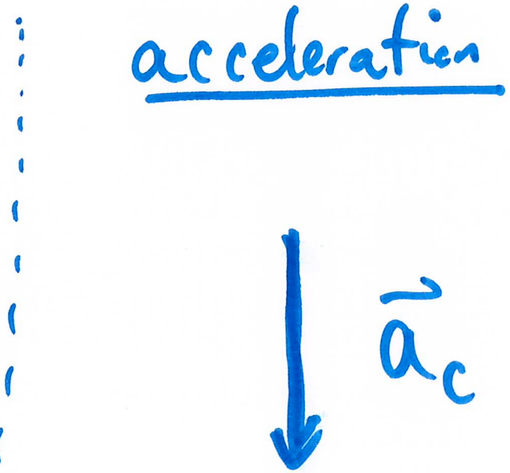
$m_{person} = 80$ kg

$m_{car} = 1000$ kg

FBD (person)



acceleration



$\vec{N} = N(+\hat{y})$

$\vec{F}_{gravity} = mg(-\hat{y})$

$\vec{a}_c = \frac{v^2}{r}(-\hat{y})$

Newton's 2nd Law: $m\vec{a} = \underbrace{\vec{N} + \vec{F}_{gravity}}_{\vec{F}_{NET}}$

$\hat{y}$-component: $m a_y = N_y + F_{gravity,y}$

$$m\left(-\frac{v^2}{r}\right) = N + (-mg)$$

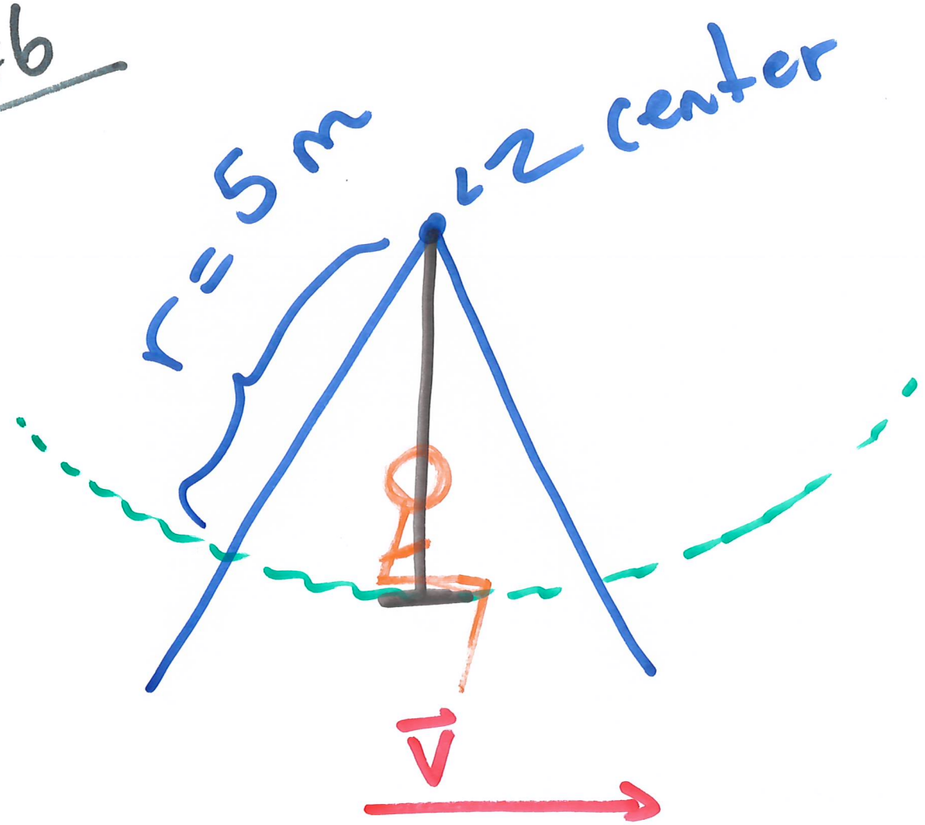
$$N = mg - m\frac{v^2}{r} = m\left(g - \frac{v^2}{r}\right)$$

$$= (80\ kg)\left(9.8\ m/s^2 - \frac{(15\ m/s)^2}{30\ m}\right)$$

experienced weight

$N = 184\ N$ << $W = mg = 784\ N$

Problem #6

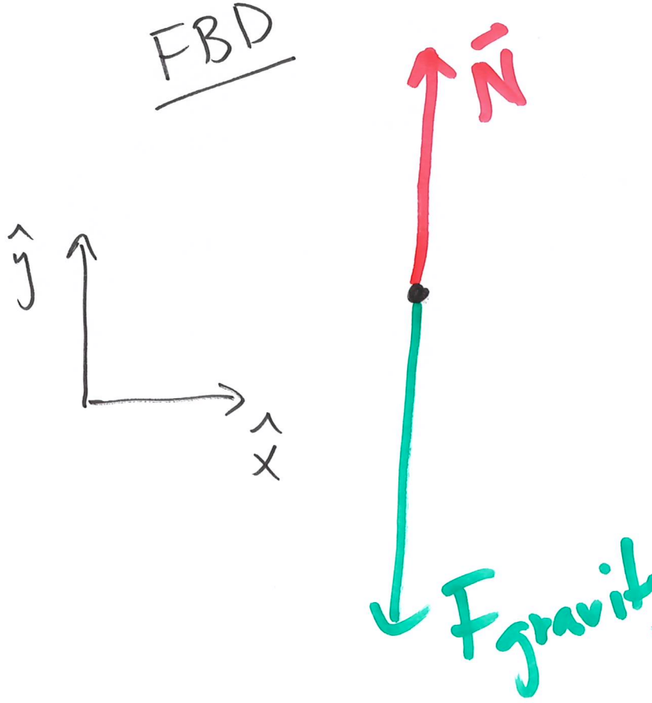


Fed twice as heavy

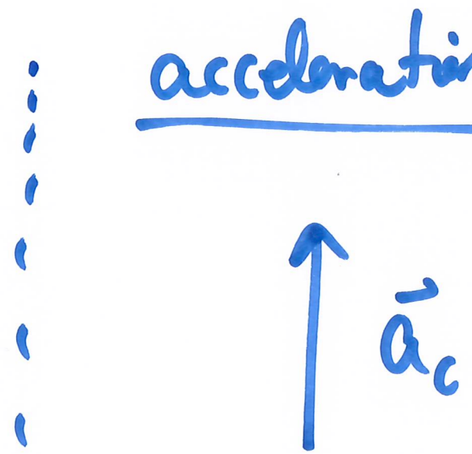
$\Rightarrow N = 2w$

$= 2mg$

FBD



acceleration



$\vec{N} = N(+\hat{y})$

$\vec{F}_{gravity} = mg(-\hat{y})$

$\vec{a}_c = \frac{v^2}{r}(+\hat{y})$

Newton's 2nd Law: $m\vec{a} = \vec{N} + \vec{F}_{gravity}$

$\hat{y}$-component: $ma_y = N_y + F_{gravity,y}$

$$m\left(+\frac{v^2}{r}\right) = N + (-mg)$$

$2mg$

$$m\frac{v^2}{r} = mg$$

$$v = \pm\sqrt{gr} = \pm\sqrt{(9.8\ m/s^2)(5\ m)}$$

$$\boxed{v = \pm 7.0\ m/s}$$