4.59 **While Driving North...**

S = ground $\vec{v}$ = velocity of rain relative to ground.

S'_N = car $\vec{v}'_N$ = velocity of rain relative to car

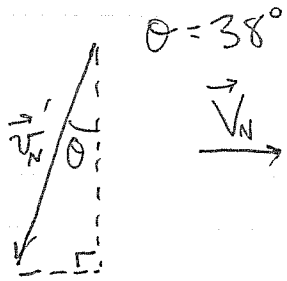
$\vec{V}_N = 25$ m/s, North.

Set ↑ +y = up

→ +x = North −x = South, −y = down.

$\vec{v}'_N = \vec{v} - \vec{V}_N$

$\Rightarrow \boxed{\vec{v} = \vec{v}'_N + \vec{V}_N}$ (*)

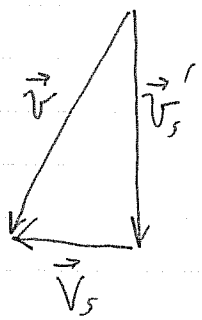


While Driving South. S, $\vec{v}$ the same.

S'_S = car $\vec{v}'_S$ = straight down.

$\vec{V}_S = 25$ m/s, South.

$\vec{v} = \vec{v}'_S + \vec{V}_S$



components:

	x	y
$\vec{v}'_S$	0	$-v'_S$
$\vec{V}_S$	−25	0
$\vec{v}$	−25	$-v'_S$

$\Rightarrow \boxed{v_x = -25 \text{ m/s}}$ (1)

From (*) in components: $v_x = v'_{Nx} + V_{Nx}$, $v_y = v'_{Ny} + V_{Ny}$

but $V_{Nx} = +25$ m/s, $V_{Ny} = 0$.

4.59 continued

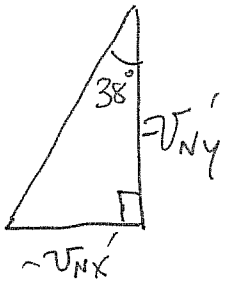
$v_x = v_{Nx}' + 25$ → Recall $v_x = -25$ m/s

$\Rightarrow -25 \text{ m/s} = v_{Nx}' + 25$

$\Rightarrow v_{Nx}' = -50 \text{ m/s}$

$v_y = v_{Ny}'$

Recall:



$$\tan 38^\circ = \frac{-v_{Nx}'}{-v_{Ny}'}$$

$$\Rightarrow -v_{Ny}' = \frac{-v_{Nx}'}{\tan 38^\circ} = \frac{50}{\tan 38^\circ}$$

$$v_y = \frac{-50}{\tan 38^\circ} \quad (2)$$

① & ② give the x & y components of $\vec{v}$, the velocity of the rain relative to the ground. → from components you can get magnitude & direction.