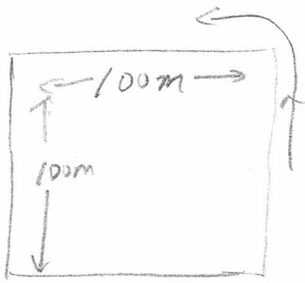
RELATIVE VELOCITY SIN ①
PROBLEMS

93.4



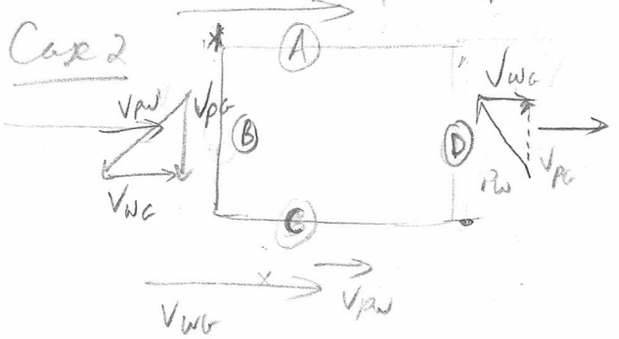
Calm day
$\Delta t_1 = 13\text{ min } 20\text{ s} = 800\text{ s}$.

Speed of Popeye to water

$V_{PW} = \frac{\Delta d}{\Delta t} = \frac{4 \times 100\text{m}}{800\text{s}} = 0.5\text{ m/s}$

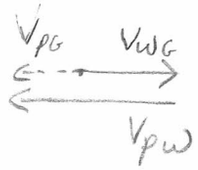
$V_{WG} = 0.2\text{ m/s}$ - speed of water to ground.

Case 2



* Popeye adjusts his angle along sides (A) + (B) so that he travels parallel to the platform

(A)



$V_{PG} = V_{PW} + V_{WG}$
$= 0.5\text{m/s} - 0.2\text{m/s}$
$= 0.3\text{m/s}$

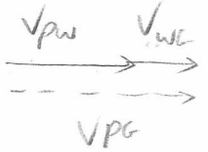
$\Delta t_{(A)} = \frac{100\text{m}}{0.3\text{m/s}} = 333.3\text{s}$

(B)

$V_{PG} = \sqrt{V_{PW}^2 + V_{WG}^2}$
$= \sqrt{(0.5\text{m/s})^2 + (0.2\text{m/s})^2}$
$= 0.458\text{ m/s}$

$\Delta t_B = \frac{100\text{m}}{0.458\text{m/s}} = 218.2\text{s}$

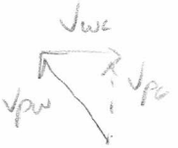
(C)



$V_{PG} = V_{PW} + V_{WG}$
$= 0.5\text{m/s} + 0.2\text{m/s}$
$= 0.7\text{m/s}$

$\Delta t_C = \frac{100\text{m}}{0.7\text{m/s}} = 142.9\text{s}$

(D)



$V_{PG} = \sqrt{V_{PW}^2 + V_{WG}^2}$
$= 0.458\text{m/s}$

$\Delta t_D = \Delta t_B = 218.3\text{s}$

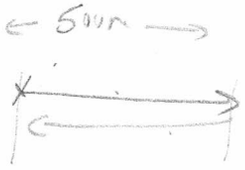
$\Delta t_{TOTAL} = 333.3 + 218.3 + 142.9\text{s} + 218.3\text{s}$
$= 912.8\text{ s}$
OR 15 min 1.3s

ANSWER (D)

84-10 $V_{SW} = 2.5\,m/s$ S-sheep W-water G-ground

$V_{WG} = 1.5\,m/s$

Sheep A



① V_{SW} V_{WG}

$V_{SG} = 2.5\,m/s + 1.5\,m/s$

$= 4.0\,m/s$

$\Delta t_1 = \frac{500m}{4.0\,m/s}$

$= 125s$

② return trip V_{SW} V_{WG} V_{SG}

$V_{SG} = 2.5\,m/s + (-1.5\,m/s)$

$= 1.0\,m/s$

$\Delta t_2 = \frac{500m}{1.0\,m/s}$

$= 500s$

$\Delta t_A = 125s + 500s$

$= 625s$

Sheep B

① V_{WG} V_{SW} V_{SG} $\Delta x = ?$

② Return V_{WG} V_{SG} V_{SW}

$V_{SG} = \sqrt{V_{SW}^2 - V_{WG}^2}$

$= \sqrt{(2.5\,m/s)^2 - (1.5\,m/s)^2}$

$= 2.0\,m/s$

$V_{SG} = 2.0\,m/s$

$\Delta t_B = \Delta t_A = 625s$ to cross both ways

$\Delta t_{\text{one crossing}} = \frac{625s}{2} = 312.5s$

$\Delta x = V_{SG} \cdot \Delta t$

$= (2.0\,m/s)(312.5s)$

$= 625m$

$\approx 630m$

ANSWER is (C)

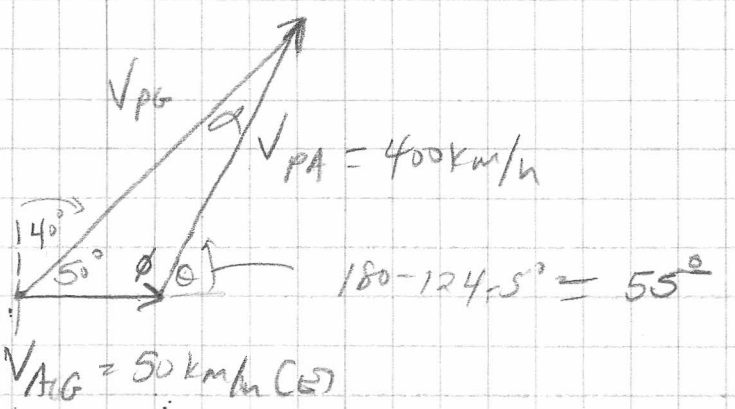
$\Delta \vec{d}_{PG} = 500\,km\ [40^\circ E\ of\ N]$

$\vec{V}_{PG} = ?\ [40^\circ E\ of\ N]$

$\vec{V}_{AG} = 50\,km/h\ [E]$

$\vec{V}_{PA} = 400\,km/h\ [?]$

$\vec{V}_{PG} = \vec{V}_{PA} + \vec{V}_{AG}$



(1) $\frac{\sin\alpha}{50} = \frac{\sin 50}{400} \Rightarrow \alpha = \sin^{-1}\left(\frac{50\sin 50}{400}\right) = 5.495^\circ$

$\phi = 180^\circ - (50^\circ + 5.495^\circ) = 124.5^\circ$

(2) V_{PG} ? $\quad \frac{V_{PG}}{\sin 124.5} = \frac{V_{PA}}{\sin 50^\circ}$

$V_{PG} = V_{PA}\left(\frac{\sin 124.5}{\sin 50^\circ}\right) = 430.3\,km/h$

$\vec{V}_{PA} = 400\,km/h\ [55^\circ N\ of\ E]$

$\vec{V}_{PG} = 430\,km/h\ [40^\circ N\ of\ E]$