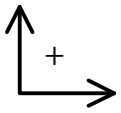
P12 - 2.11 - River Boat Current



Nick swims N across a 30 m river. Nick swims at $4\frac{m}{s}$ in still water. The river flows W at $3\frac{m}{s}$.

What is Nick's Resultant Velocity?

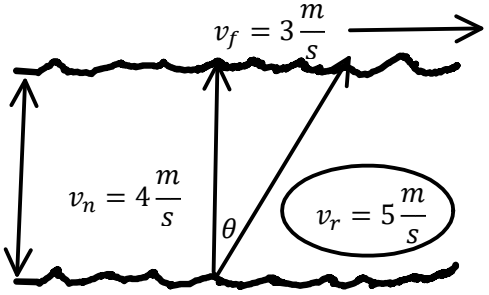
$$v_{r^2} = v_n^2 + v_f^2$$
$$v_r = \sqrt{4^2 + 3^2}$$
$$v_r = \sqrt{25}$$

$v_r = 5\ \frac{m}{2}$

$$tan\theta = \frac{o}{a}$$
$$tan\theta = \frac{3}{4}$$
$$\theta = \tan^{-1}\left(\frac{3}{4}\right)$$

$\theta = 36.9^o\ [EoN]$

$d_y = 30\ m$



How long does it take to cross?

$$v_y = \frac{d_y}{t}$$
$$t = \frac{d_y}{v_y}$$
$$t = \frac{30}{4}$$

$t = 7.5\ s$

How far down river does Nick land?

$$v_x = \frac{d_x}{t}$$
$$d_x = v_x t$$
$$d_x = 3(7.5)$$

$d_x = 22.5\ m$

What is Nick's Displacement?

$$d_r{}^2 = d_x^2 + d_y^2$$
$$d_r = \sqrt{22.5^2 + 30^2}$$

$d_r = 37.5\ m$

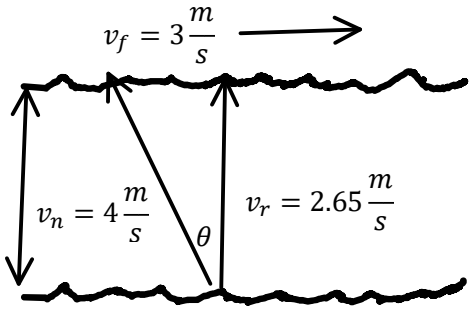
At what heading should Nick head to arrive directly across the river?

$$sin\theta = \frac{o}{h}$$
$$sin\theta = 3/4$$
$$\theta = \sin^{-1}\left(\frac{3}{4}\right)$$

$\theta = 48.59^o$

$48.59^o\ [WoN]$

$d_y = 30\ m$



What is Nick's Resultant Velocity?

$$v_{r^2} = v_n^2 + v_f^2$$
$$v_r = \sqrt{4^2 - 3^2}$$
$$v_r = \sqrt{7}$$

$v_r = 2.65\frac{m}{s}$

At this heading how long will it take to cross?

$$v_y = \frac{d_y}{t}$$
$$t = \frac{d_y}{v_y}$$
$$t = \frac{30}{2.65}$$

$t = 11.32\ s$

What is Nick's Displacement?

$30\ m!$

Less than 3 would be too slow!