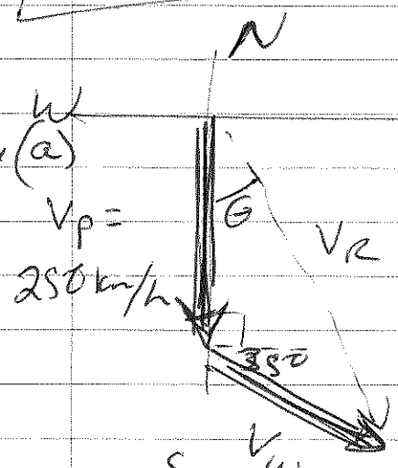
Phys 12 Vector Kinematics WS KEY

1. (a)



	x	y
V_P	0	−250
V_W	$85\cos 35^\circ$	$-85\sin 35^\circ$
R		

$$\tan\theta = \frac{x}{y}$$

$$\theta = \tan^{-1}\left[\frac{85\cos 35^\circ}{250 + 85\sin 35^\circ}\right]$$

$$\theta = 13.119^\circ$$

$$\therefore \boxed{\theta = 13^\circ \text{ E of S}}$$

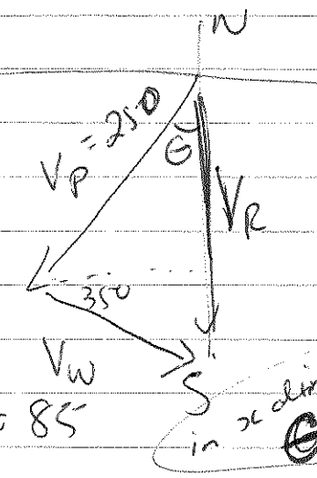
(b) $$V_R^2 = V_P^2 + V_W^2 - 2V_P V_W \cos 125^\circ$$

$$\therefore V_R = \sqrt{(250)^2 + (85)^2 - (2)(250)(85)\cos 125^\circ}$$

$$V_R = 306.76 \text{ km/h}$$

$$\therefore \boxed{V_R = 3.1 \times 10^2 \text{ km/h}}$$

(c)



	x	y
V_P	$-250\sin\theta$	$-250\cos\theta$
V_W	$85\cos 35^\circ$	$-85\sin 35^\circ$
V_R	0	V_R

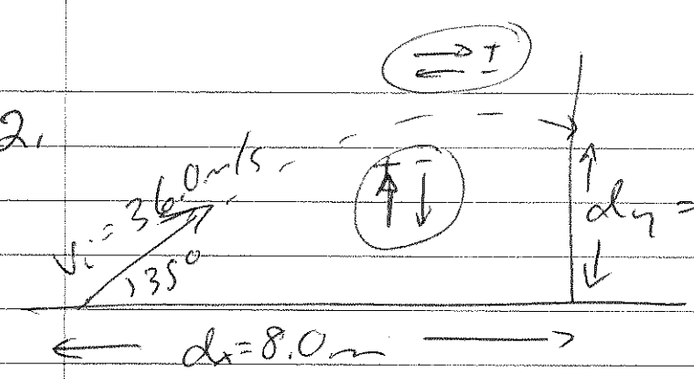
in x direction θ is only unknown

$$\therefore \Sigma V_x = 0 = 85\cos 35^\circ - 250\sin\theta$$

$$\therefore \theta = \sin^{-1}\left[\frac{85\cos 35^\circ}{250}\right] = 16.17^\circ$$

$\therefore \theta = 16^\circ$ W of S

2.



x	y
$d_x = 8.0$ m	$v_{iy} = 36\sin 35^\circ$ m/s
$v_x = 36\cos 35^\circ$ m/s	$a_y = -9.8$ m/s^2
$t = ?$	$d_y = ?$
	$t = ?$

$v_x = \frac{d_x}{t}$

$\therefore t = \frac{d_x}{v_x} = \left(\frac{8}{36\cos 35^\circ}\right)$

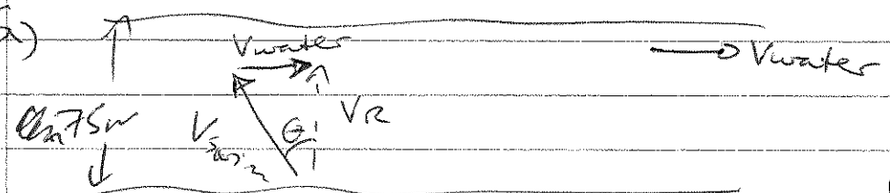
$d_y = \frac{1}{2} a_y t^2 + v_{iy} t$

$d_y = \frac{1}{2}(-9.8)\left(\frac{8}{36\cos 35^\circ}\right)^2 + (36\sin 35^\circ)\left(\frac{8}{36\cos 35^\circ}\right)$

$d_y = 5.2410$

$\boxed{d_y = 5.2\text{ m}}$

3. (a)



$\sin\theta = \frac{v_{water}}{v_{swimmer}}$ $\therefore \theta = \sin^{-1}\left[\frac{0.45}{0.60}\right]$

$\therefore \boxed{\theta = 49^\circ \text{ toward upstream (as per diagram)}}$

(b) $v_R = \sqrt{0.60^2 - 0.45^2} = 0.39686$ m/s

$t = \frac{d_y}{v_y} = \frac{75\text{m}}{0.39686\text{ m/s}} = \boxed{1.9 \times 10^2 \text{ s}} = \boxed{3.1\text{ min}}$

(c) directly across the river perpendicular to shore