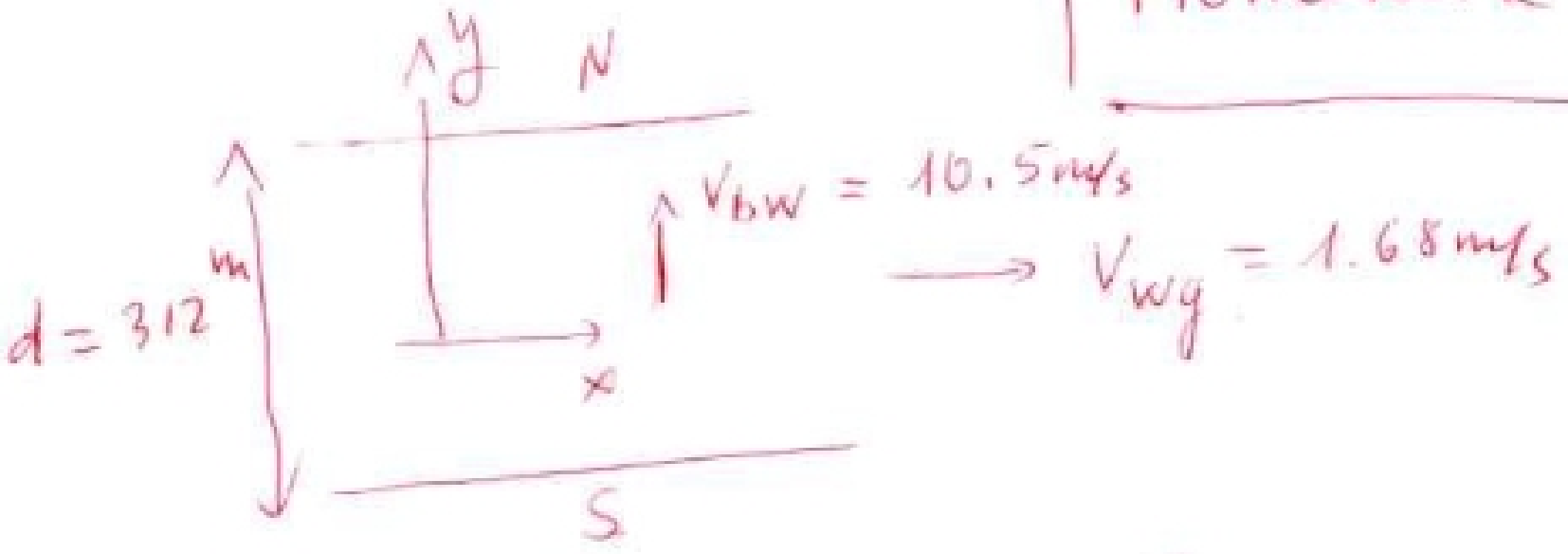
Homework solution #3

①



(a) $\vec{V}_{bw} = 0\hat{x} + 10.5 m/s\,\hat{y}$

$\vec{V}_{wg} = 1.68 m/s\,\hat{x} + 0\,\hat{y}$

$\vec{V}_{bg} = \vec{V}_{bw} + \vec{V}_{wg} = 1.68 m/s\,\hat{x} + 10.5 m/s\,\hat{y}$

$V_{bg} = \sqrt{(1.68 m/s)^2 + (10.5 m/s)^2} = 10.6 m/s$

(b) Time for the boat cross the river.

$t = \frac{d}{V_{bw}} = \frac{312 m}{10.5 m/s} = 29.7 s$

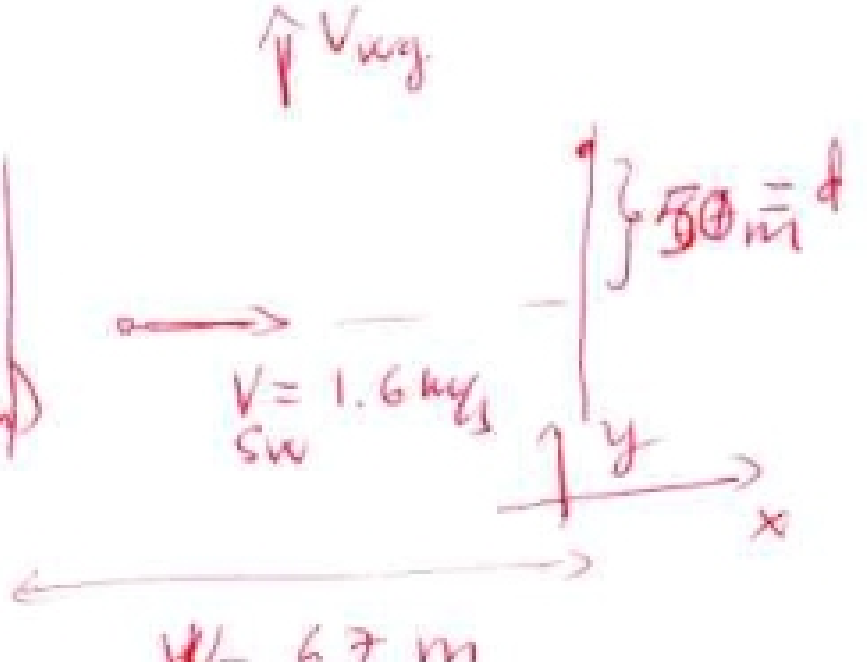
Travel downstream:

$x = V_{wg} t = (1.68 m/s)(29.7 s)$

$= 49.9 m$

(2)

$V_{sw} = 1.6\ m/s$



(a) Time crossing the river (x direction)

$$t = \frac{d}{v_{sw}} = \frac{67\ m}{1.6\ m/s} = 41.9\ s$$

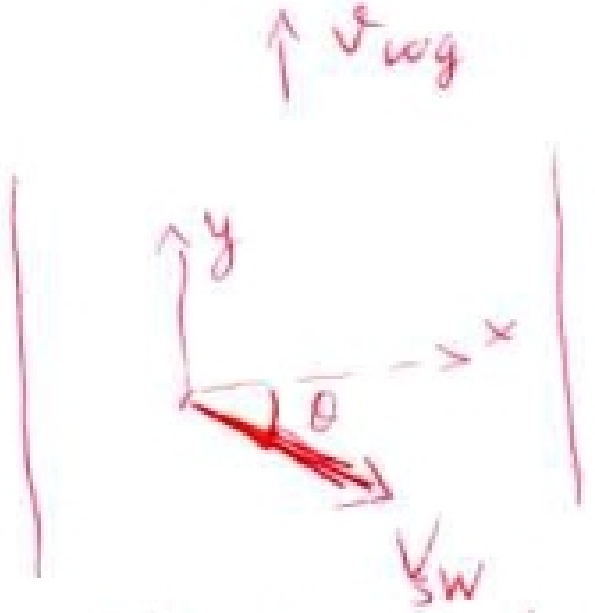
Speed of the river. (y direction)

$$v_{wg} = \frac{d}{t} = \frac{50\ m}{41.9\ s} = 1.19\ m/s$$

(b) $\vec{V}_{sg} = \vec{V}_{sw} + \vec{v}_{wg} = 1.6\ m/s\ \hat{x} + 1.19\ m/s\ \hat{y}$

$$v_{sg} = \sqrt{(1.6\ m/s)^2 + (1.19\ m/s)^2} = 2.00\ m/s$$

(c)



$\vec{V}_{sw} = 1.6\cos\theta\ \hat{x} - 1.6\sin\theta\ \hat{y}$

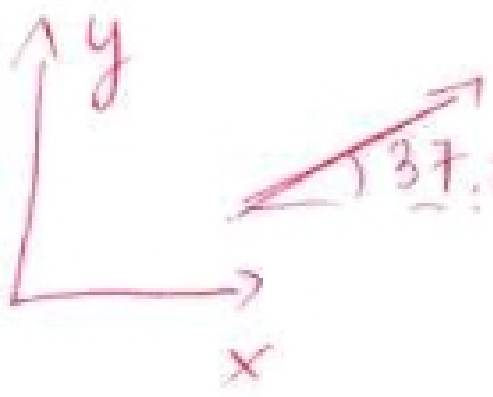
$\vec{V}_{sg} = 1.6\ m/s\cos\theta\ \hat{x} + (-1.6\ m/s\sin\theta + 1.19\ m/s)\hat{y}$

To reach the opposite point $V_{sg,y} = 0$

$-1.6\ m/s\sin\theta + 1.19\ m/s = 0$

$\theta = 48.1°$

(3)



$V_0 = 5.27 m/s = V_i$

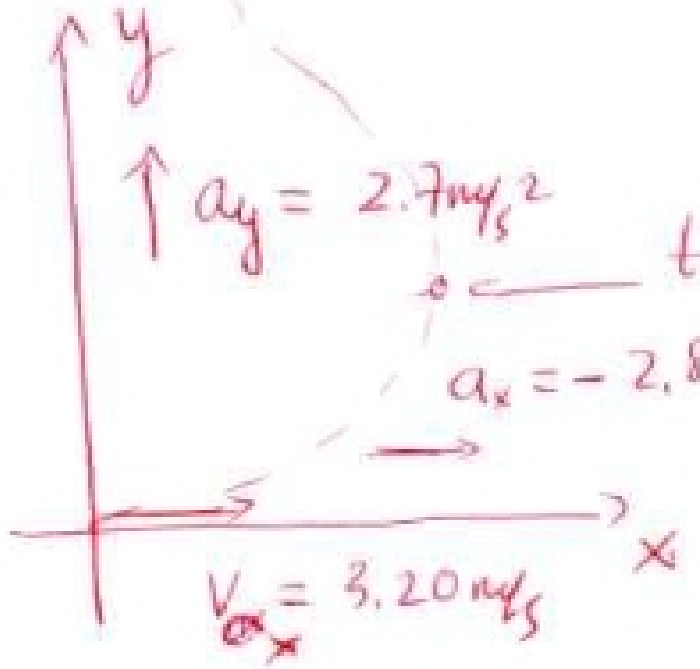
54.5°

$V = 6.22 m/s = V_f$

$$\vec{a} = \frac{\vec{V}_f - \vec{V}_i}{\Delta t} = \frac{(-5.27 \cos 37.2^\circ + 6.22 \cos 54.5^\circ)\hat{x} + (\quad + \quad)\hat{y}}{2s}$$

$$= -0.293 \, m/s^2 \, \hat{x} + 4.12 \, m/s^2 \, \hat{y}$$

(4)



a) At turning point $V_x = 0$

$$0 = V_x = V_{0x} - at \rightarrow t = 1.14 s$$

Travel distance in x axis $x - x_0 = V_{0x}t + \frac{1}{2}a_x t^2$

$= 1.83 m$