

The four basic types of river problems

- Orthogonal
 - Find a component
 - Find the resultant
- Non-orthogonal
 - Find a component
 - Find the resultant

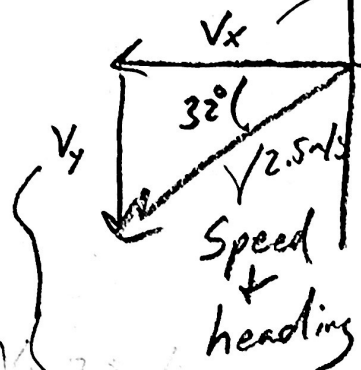
See if you can identify (match to the list above) and solve the types of problems below.

1. An explorer is walking across an iceberg near Antarctica. The explorer walks across the iceberg at a speed of 2.5m/s while following a compass heading 32 degrees South of West. At the same time, the entire iceberg is floating along in an ocean current at a rate of 4.6m/s in a direction 73 degrees North of East. What is the actual velocity (magnitude and direction) of the explorer?
2. One day back in “old west” times, a horse swam due south across a river that was flowing due east. The river’s current flowed at a rate of 3m/s, and the horse’s southern velocity was 2m/s. Find the horse’s heading and speed in still water.
3. A tiny, sentient, and very slow slug has a tiny compass which it uses to head directly south at a rate of 4cm per year. The continent beneath the slug moves westward at a rate of 2cm per year. What is the actual velocity (both magnitude and direction) of the glacier?
4. A small aircraft travels in a direction 20 degrees East of North at a speed of 100mph. The aircraft’s air speed and heading are 200mph and 10 degrees North of East. Find the speed and direction of the wind.

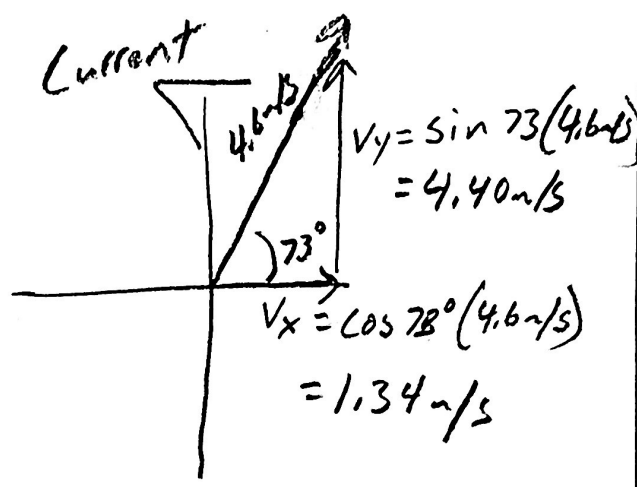
Non-orthogonal, finding resultant

1.

$$V_x = -2.5 \text{ m/s} (\cos 32^\circ) = -2.12 \text{ m/s}$$



$$V_y = -2.5 \text{ m/s} (\sin 32^\circ) = -1.32 \text{ m/s}$$

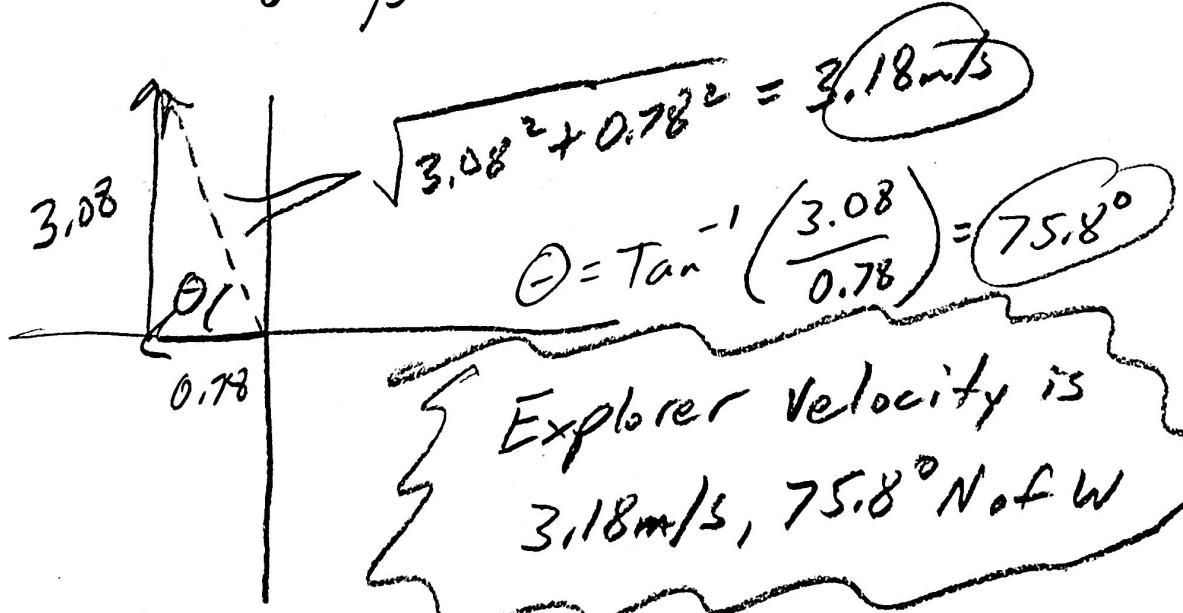


$$V_y = \sin 73^\circ (4.6 \text{ m/s}) = 4.40 \text{ m/s}$$

$$V_x = \cos 78^\circ (4.6 \text{ m/s}) = 1.34 \text{ m/s}$$

Components

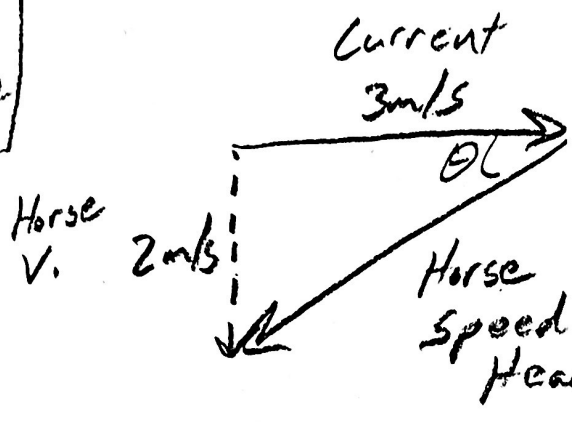
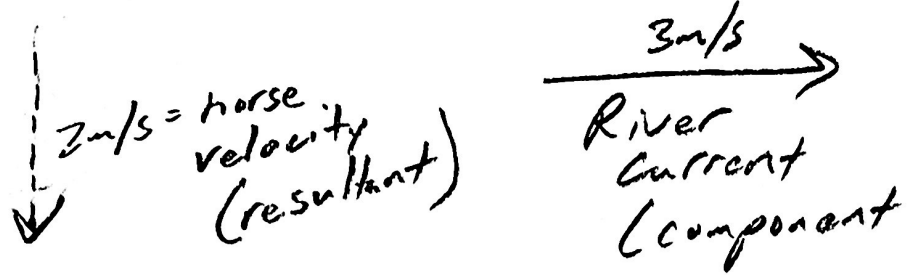
	X	Y
Speed & heading	-2.12	-1.32
Current	1.34	4.4
Explorer Velocity	-0.78 m/s	3.06 m/s
Resultant		



Explorer Velocity is 3.18 m/s, 75.8° N of W

2.

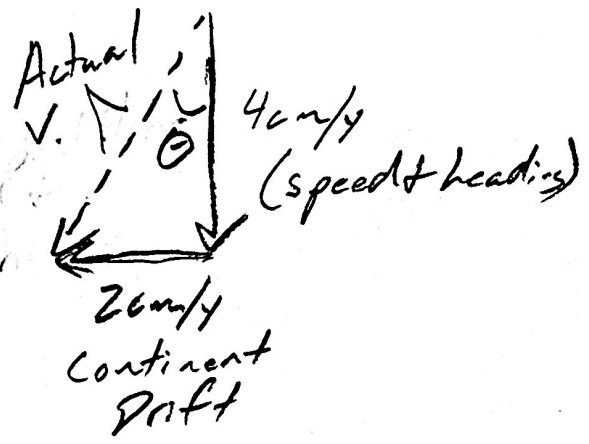
Orthogonal,
finding
Component



$$= \sqrt{2^2 + 3^2} = 3.6 \text{ m/s}$$

$$\theta = \text{Tan}^{-1}\left(\frac{2}{3}\right) = 33.7^\circ \text{ S of W}$$

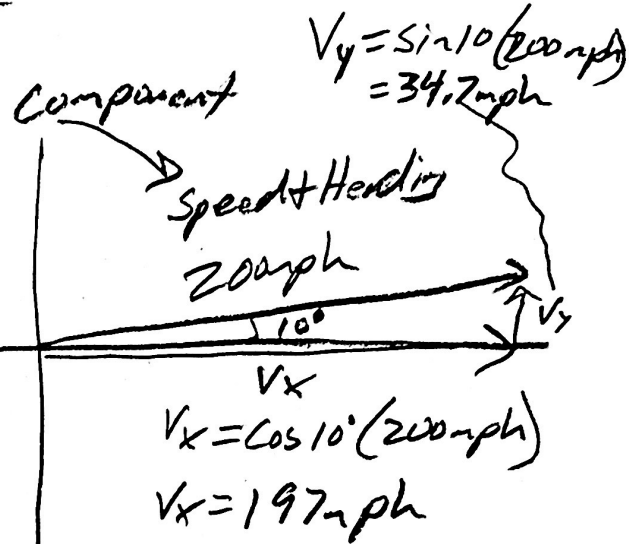
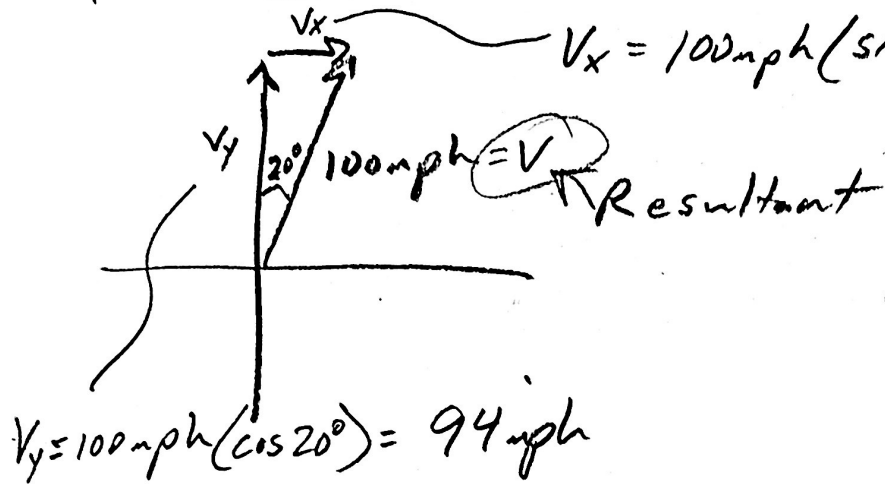
3 (Orthogonal, finding resultant)



$$\text{Actual } V = \sqrt{2^2 + 4^2} = 4.47 \text{ cm/s}$$

$$\theta = \text{Tan}^{-1}\left(\frac{2}{4}\right) = 26.6^\circ \text{ E of S}$$

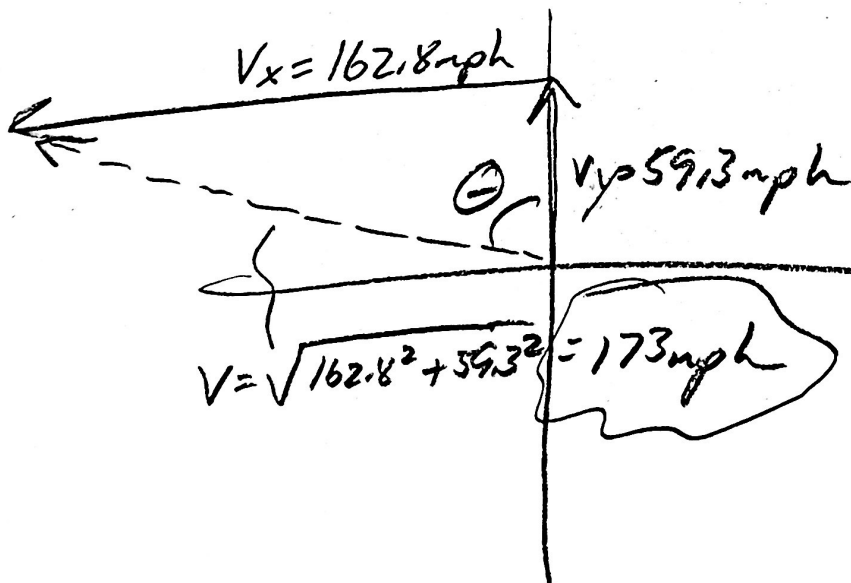
4. Non-orthogonal, finding component



	X	Y
Speed & Heading	197	34.7
Wind Velocity		
Velocity	34.2	94

$V_y = 59.3 \text{ mph}$

$V_x = -162.8 \text{ mph}$



$\Theta = \tan^{-1} \left(\frac{162.8}{59.3} \right)$

$= 70^\circ \text{ W of N}$