Worksheet: Vectors

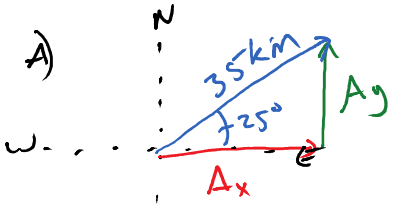
February 1, 2016 8:55 PM

Use the following vectors in all the following problems.

A = 35 km at 25° N of E **B** = 15 km at 10° E of N

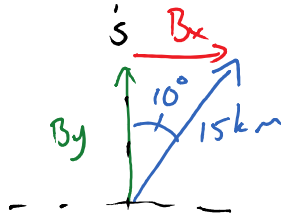
C = 20 km at 43° S of E **D** = 40 km at 28° S of W

1. Break all the vectors above into their North/South and East/West coordinates.



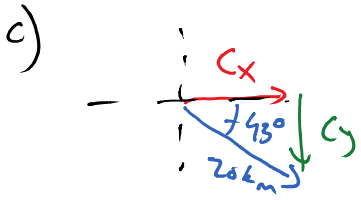
$A_y = 35\sin 25 = 15\text{km}$

$A_x = 35\cos 25 = 32\text{km}$



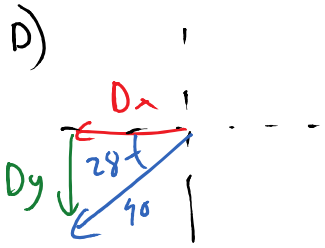
$B_y = 15\cos 10 = 15\text{km}$

$B_x = 15\sin 10 = 2.6\text{km}$



$C_y = 20\sin 43 = -14\text{km}$

$C_x = 20\cos 43 = 15\text{km}$

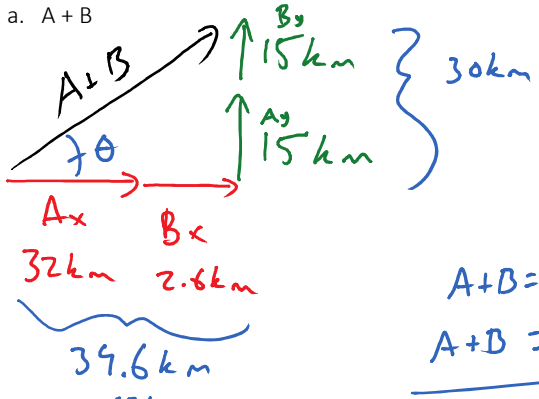


$D_y = 40\sin 28 = -19\text{km}$

$D_x = 40\cos 28 = -35\text{km}$

2. Sketch and Find the resultant Vectors (Magnitude and Direction)

a. A + B



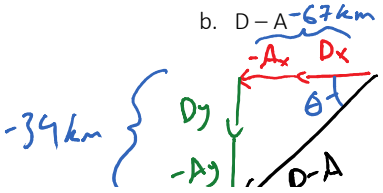
$\theta = \tan^{-1}\left[\frac{30}{34.6}\right]$

$\theta = 41°$

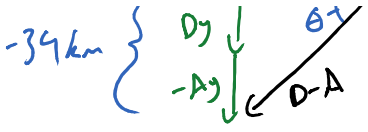
$A+B = \sqrt{30^2+34.6^2}$

$A+B = 46\text{km} \text{ @ } 41° \text{ N of E}$

b. D − A



$\theta = \tan^{-1}\left[\frac{34}{67}\right]$



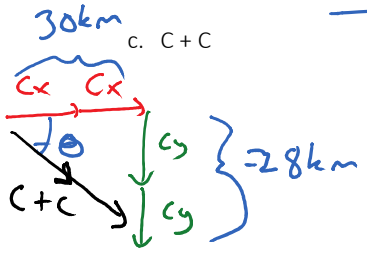
$\theta = \tan^{-1}\left[\frac{27}{67}\right]$

$= 27°$

$D\text{-}A = \sqrt{67^2 + 34^2}$

$D\text{-}A = 75\text{ km}$ @ 27° S of W

c. C + C



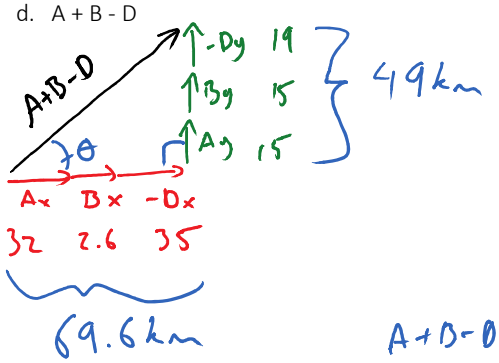
$\theta = 43°$

$C+C = \sqrt{30^2 + 28^2}$

$2C = 41\text{ km}$ @ 43° S of E

Rounding error ; it should be 40km

d. A + B - D



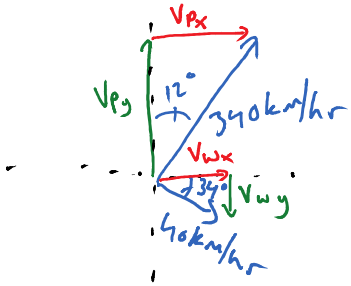
$\theta = \tan^{-1}\left[\frac{49}{69.6}\right]$

$= 35°$

$A+B-D = \sqrt{49^2 + 69.6^2}$

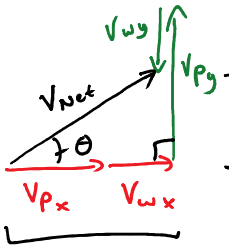
$= 85\text{ km}$ @ 35° N of E

3. An airplane is flying 340 km/hr at 12° East of North. The wind is blowing 40 km/hr at 34° South of East. What is the plane's actual **velocity**?



$V_{px} = 340 \sin 12 = 70.7\text{ km/hr}$

$V_{py} = 340 \cos 12 = 333\text{ km/hr}$



$V_{py} - V_{wy} = 333 - 22.4$

$= 310.6\text{ km/hr}$

$V_{px} + V_{wx} = 70.7 + 33.2$

$= 103.9\text{ km/hr}$

$V_{px} = 340 \sin 12 = 70.7 \text{ km/hr}$

$V_{py} = 340 \cos 12 = 333 \text{ km/hr}$

$V_{wx} = 40 \cos 34 = 33.2 \text{ km/hr}$

$V_{wy} = 40 \sin 34 = -22.4 \text{ km/hr}$

$V_{px} + V_{wx} = 70.7 + 33.2$

$= 103.9 \text{ km/hr}$

$\theta = \tan^{-1}\left[\frac{310.6}{103.9}\right]$

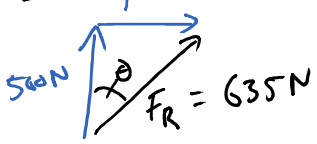
$= 72°$

$V_{Net} = \sqrt{310.6^2 + 103.9^2}$

$= 330 \text{ km/hr} \text{ @ } 72° \text{ N of E}$

4. You push on a box with a **force** of 500 Newtons directly north. Another person pushes the box with a **force** directly east. The **resultant** force has a magnitude of 635N. What direction is the box accelerating in if these are the only forces acting on it?

Adding



$\cos\theta = \frac{500}{635}$

$\theta = \cos^{-1}\left[\frac{500}{635}\right]$

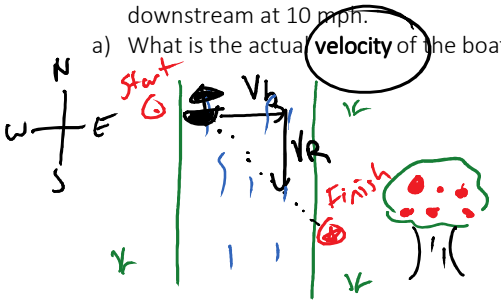
$\theta = 38° \text{ E of N}$

or

$52° \text{ N of E}$

5. A boat is heading across a river at a **velocity** of 25 mph. The river is flowing downstream at 10 mph.

a) What is the actual **velocity** of the boat?



$V_b = 25 \text{ mph}$

$V_R = 10 \text{ mph}$

V_{Net}

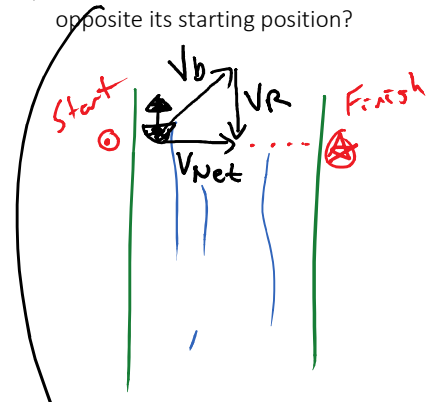
$\theta = \tan^{-1}\left[\frac{10}{25}\right]$

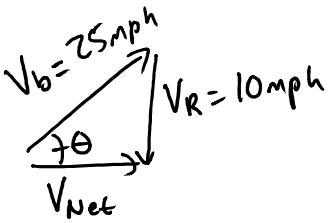
$\theta = 22°$

$V_{Net} = \sqrt{10^2 + 25^2}$

$V_{Net} = 27 \text{ mph} \text{ @ } 22° \text{ S of E}$

b) What direction would the boat have to head in order to land on the other side directly opposite its starting position?





$$\sin\theta = \frac{10}{25}$$

$$\theta = \sin^{-1}\left[\frac{10}{25}\right]$$

$$\theta = 24^\circ$$

$$25^2 = 10^2 + V_{Net}^2$$

$$V_{Net} = \sqrt{25^2 - 10^2}$$

$$V_{Net} = 23\ mph\ East$$

Answer would be 24° N of E

Pg. 70 #1–18 There is some good Vector Questions here

$$45\ km/hr = 45\ \frac{1000\ m}{3600\ s} = \frac{45}{3.6} = m/s$$

$$= 12.5\ m/s$$

$$80\ m/s = 80 \times 3.6\ km/hr = 288\ km/hr$$

$1\ m/s = 3.6\ km/hr$

Vector Test Friday