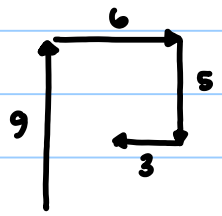
Vectors Review - Key

Note Title 6/4/2015

1. a) # (value)

   b) compass bearing

2. 

3. 

end

$R = \sqrt{4^2 + 3^2} = 5$ blocks

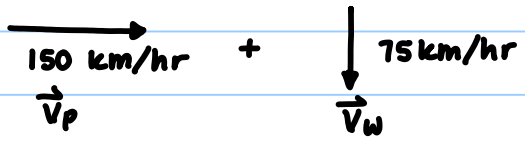
$\theta = \tan^{-1}(3/4) = 37°$

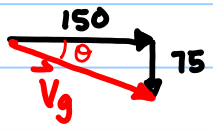
R = 5 blocks @ 37° E of N

or = 5 blocks @ 53° N of E

4. distance = 9 + 6 + 5 + 3 = 23 blocks

5. $\vec{V}_g = \vec{V}_p + \vec{V}_w$





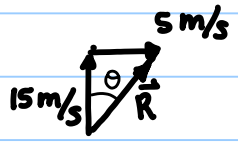
$V_g = \sqrt{150^2 + 75^2}$

$= 167.71$ km/hr

$\theta = \tan^{-1}(75/150) = 27°$

$\vec{V}_g$ = 168 km/hr @ 27° S of E

or 63° E of S

6. 

$R = \sqrt{15^2 + 5^2} = 15.8$ m/s

$\theta = \tan^{-1}(5/15) = 18°$

$\vec{R}$ = 16 m/s @ 18° E of N

or 72° N of E

* assumed directions for $\vec{V}_B$ & $\vec{V}_C$

7. $t = ?$

$d = 40.0$ m (width of river) $\quad V = \frac{d}{t} \Rightarrow t = \frac{d}{V}$

$t = \frac{40.0}{15} = 2.7$ sec

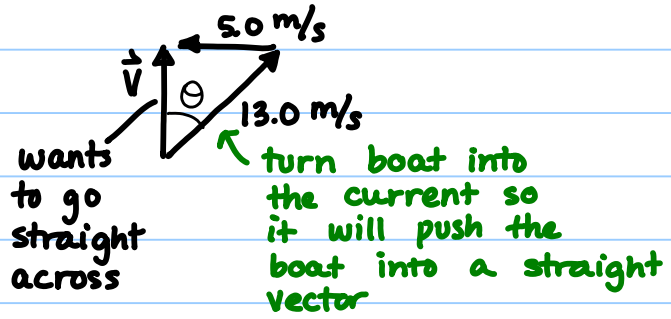
these values are in same orientation

8. $d = ?$ $\quad d = V \cdot t$ (values must be in same orientation)

$d = (5)(2.7)$

$= 13.5$ m

9.



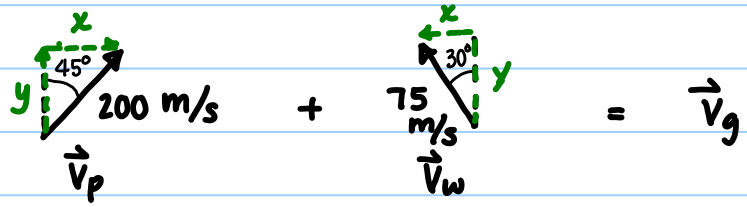
$\theta = \sin^{-1}(5.0/13.0)$

$= 22.6°$

$\theta = 23°$

$V = \sqrt{13.0^2 - 5.0^2} = 12$ m/s

10.

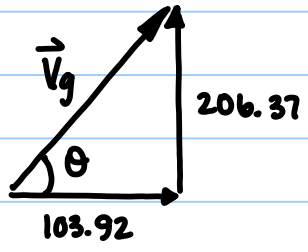


$x: 200 \sin 45° = 141.42$ $\quad x: -75 \sin 30° = -37.5$

$y: 200 \cos 45° = 141.42$ $\quad y: 75 \cos 30° = 64.95$

$x_{TOT}: 141.42 + (-37.5) = 103.92$

$y_{TOT}: 141.42 + 64.95 = 206.37$

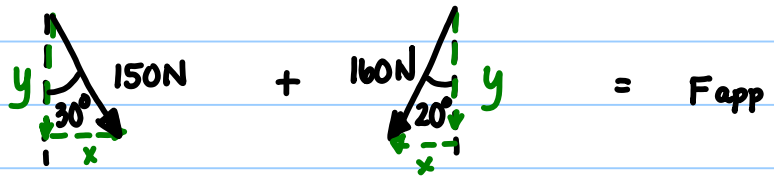


$$V_g = \sqrt{(103.92)^2 + (206.37)^2} = 231.1 \text{ m/s}$$

$$\theta = \tan^{-1}\left(\frac{206.37}{103.92}\right) = 63.3°$$

$\vec{V}_g = 230$ m/s @ 63° N of E
or 27° E of N

11.

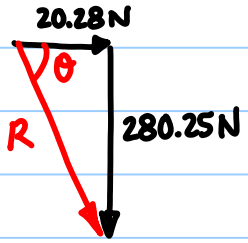


x : $150 \sin 30° = 75$ N x : $160 \sin 20° = -54.72$ N

y : $150 \cos 30° = -129.90$ N y : $160 \cos 20° = -150.35$ N

x TOT : $75 + (-54.72) = 20.28$ N (→)

y TOT : $-129.90 + (-150.35) = -280.25$ N (↓)



R = Fapp

$$R = \sqrt{(20.28)^2 + (280.25)^2}$$

$$= 280.98 \text{ N}$$

$$= 281 \text{ N}$$

$$\theta = \tan^{-1}\left(\frac{280.25}{20.28}\right) = 86°$$

$\vec{R} = \vec{F}_{app} = 281$ N @ 86° S of E
or 4° E of S

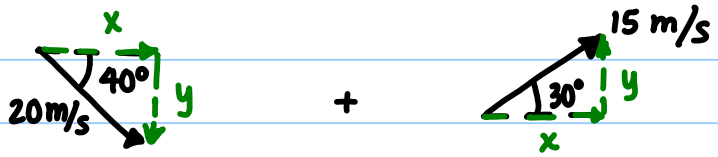
12. $F_{app} = F_f$

$\vec{F}_f = 281$ N @ 86° N of W
or 4° W of N

$F_{net} = F_{app} - F_f$ (0, Ff) (a = 0)

$0 = F_{app} - F_f$

13. a)

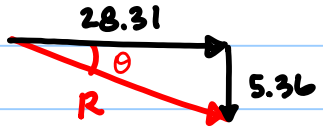


$x: 20\cos 40^\circ = 15.32$ $\quad$ $x: 15\cos 30^\circ = 12.99$

$y: 20\sin 40^\circ = -12.86$ $\quad$ $y: 15\sin 30^\circ = 7.5$

$x_{TOT}: 15.32 + 12.99 = 28.31 \text{ m/s } (\rightarrow)$

$y_{TOT}: -12.86 + 7.5 = -5.36 \text{ m/s } (\downarrow)$



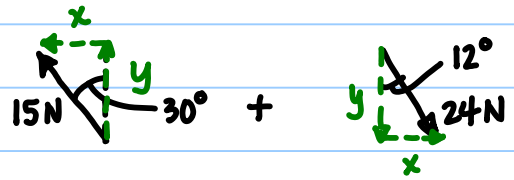
$R = \sqrt{(28.31)^2 + (5.36)^2}$

$= 28.81 \text{ m/s}$

$\theta = \tan^{-1}\left(5.36/28.31\right) = 10.7^\circ$

$\vec{R} = 29 \text{ m/s } @ 11^\circ \text{ S of E}$ or 79° E of S

b)

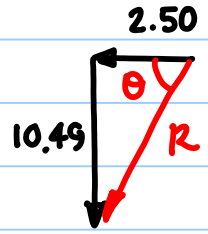


$x: 15\sin 30 = -7.5$ $\quad$ $x: 24\sin 12 = 5.00$

$y: 15\cos 30 = 12.99$ $\quad$ $y: 24\cos 12 = -23.48$

$x_{TOT}: -7.5 + 5.00 = -2.50 \quad (\leftarrow)$

$y_{TOT}: 12.99 + (-23.48) = -10.49 \quad (\downarrow)$



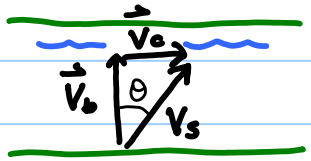
$R = \sqrt{(-2.50)^2 + (-10.49)^2}$

$= 10.78$

$\theta = \tan^{-1}\left(10.49/2.50\right) = 76.6^\circ$

$\vec{R} = 10.8 \text{ N } @ 77^\circ \text{ S of W}$ or 13° W of S

14.



$\vec{V}_c = 5.0 \text{ m/s}$

$\vec{V}_b = 8.0 \text{ m/s}$

$V_s = \sqrt{5^2+8^2} = 9.4\ m/s$

$\theta = \tan^{-1}(5/8) = 32°$

$\vec{V}_s = 9.4\ m/s$ @ $32°$ E of N

How far downstream ? • Must find $\underline{t}$ first.

$$V = \frac{d}{t} \Rightarrow t = \frac{d}{v} = \frac{100}{8} = 12.5s$$

$$d = Vt = (5)(12.5) = 62.5m$$

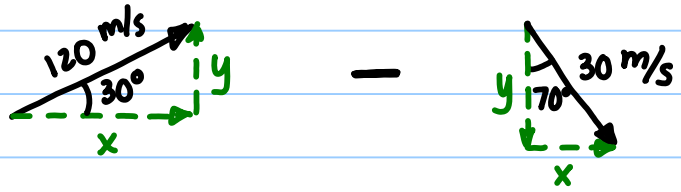
15. $\vec{V}_G = 120\ m/s$ @ $30°$ N of E

$\vec{V}_W = 30\ m/s$ @ $70°$ E of S

$\vec{V}_p = ?$

$\vec{V}_G = \vec{V}_W + \vec{V}_p$

$\vec{V}_p = \vec{V}_G - \vec{V}_W$ vector subtraction



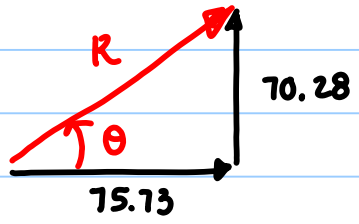
$x: 120\cos 30° = 103.92$ $\quad x: 30\sin 70° = 28.19$

$y: 120\sin 30° = 60$ $\quad y: 30\cos 70° = -10.28$

"add the opposite" for vector subtraction

$x_{TOT}: 103.92 + (-28.19) = 75.73\ m/s \rightarrow$

$y_{TOT}: 60 + (+10.28) = 70.28\ m/s \uparrow$



$V_p = R = \sqrt{(70.28)^2+(75.73)^2}$

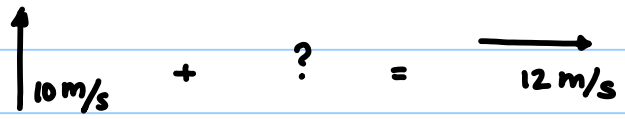
$= 103.3\ m/s$

$\theta = \tan^{-1}(70.28/75.73) = 43°$

$\vec{V}_p = 103\ m/s$ @ $43°$ N of E

or $47°$ E of N

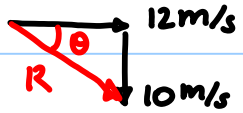
16.



? = → 12 m/s − ↑ 10 m/s

x TOT : 12 m/s

y TOT : − 10 m/s (add the opposite)



$R = \sqrt{12^2 + 10^2}$

$= 15.6$ m/s

$\theta = \tan^{-1}(10/12) = 40°$

$\vec{R}$ = 15.6 m/s @ 40° S of E

or 50° E of S