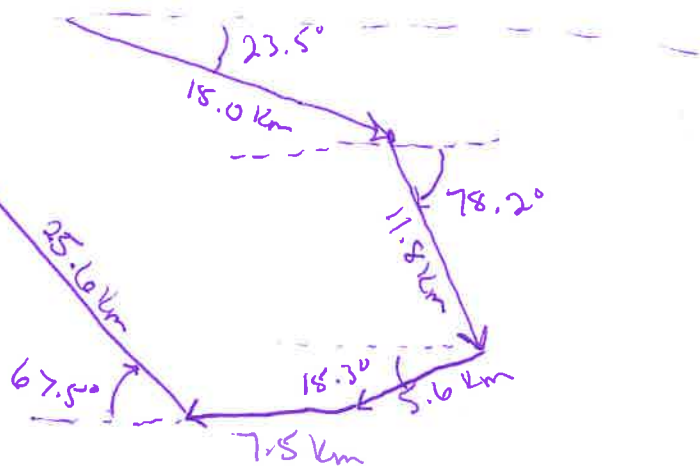


Vector Practice Problems Power Point - Answers/Solutions

- ①
- 15.0 km 23.5° SE
 - 11.8 km, 78.2° SE
 - 5.6 km 15.3° SW
 - 7.5 km W
 - 25.6 km, 67.5° NW



$$X_1 = 15.0 \cos 23.5^\circ = 13.76$$

$$Y_1 = -15.0 \sin 23.5^\circ = -5.98$$

$$X_2 = 11.8 \cos 78.2^\circ = 2.41$$

$$Y_2 = -11.8 \sin 78.2^\circ = -11.55$$

$$X_3 = -5.6 \cos 15.3^\circ = -5.40$$

$$Y_3 = -5.6 \sin 15.3^\circ = -1.48$$

$$X_4 = -7.5$$

$$Y_4 = \emptyset$$

$$X_5 = -25.6 \cos 67.5^\circ = -9.80$$

$$Y_5 = 25.6 \sin 67.5^\circ = 23.65$$

$$\Sigma X = 13.76 + 2.41 - 5.40 - 7.5 - 9.80$$

$$= -6.5 \text{ km}$$

$$\Sigma Y = -5.98 - 11.55 - 1.48 + 23.65$$

$$= 4.64 \text{ km}$$

$$\vec{S} = \sqrt{6.5^2 + 4.64^2}$$

$$= \sqrt{63.78}$$

$$= 7.99 \text{ km}$$

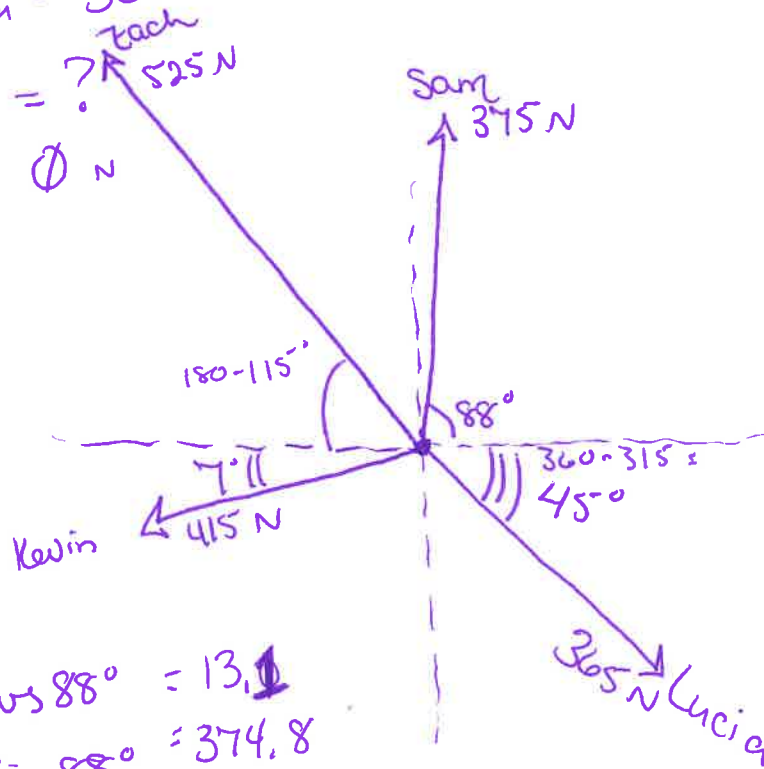
$$\theta = \tan^{-1}\left(\frac{Y}{X}\right) = \tan^{-1}\left(\frac{4.64}{6.5}\right)$$

$$= 35.5^\circ$$

$$\vec{S} = 7.99 \text{ km}, 35.5^\circ \text{ NW}$$

To Return home: 7.99 km, 35.5° SE

- ① Sam: 375 N, 88° ccw from +X
 Zach: 525 N, 115° ccw from +X
 Kevin: 415 N, 187° ccw from +X
 Lucia: 365 N, 315° ccw from +X
 Richa = ?
 $\Sigma F = 0$ N



$$X_s = 375 \cdot \cos 88^\circ = 13.1$$

$$Y_s = 375 \cdot \sin 88^\circ = 374.8$$

$$X_z = -525 \cos 65^\circ = -221.9$$

$$Y_z = 525 \sin 65^\circ = 475.8$$

$$X_k = -415 \cos 7^\circ = -411.9$$

$$Y_k = -415 \sin 7^\circ = -50.6$$

$$X_L = 365 \cos 45^\circ = 258.1$$

$$Y_L = -365 \sin 45^\circ = -258.1$$

$$X_R = ?$$

$$Y_R = ?$$

$$X_s + X_z + X_k + X_L + X_R = 0$$

$$13.1 + (-221.9) + (-411.9) + 258.1 + X_R = 0$$

$$-362.6 = -X_R$$

$$362.6 = X_R$$

$$Y_s + Y_z + Y_k + Y_L + Y_R = 0$$

$$374.8 + 475.8 + (-50.6) + (-258.1) + Y_R = 0$$

$$541.9 + Y_R = 0$$

$$Y_R = -541.9 \text{ km}$$

$$F_R = \sqrt{X_R^2 + Y_R^2} = \sqrt{(362.6)^2 + (541.9)^2}$$

$$F_R = 652 \text{ N}$$

$$\theta = \tan^{-1}\left(\frac{Y}{X}\right) = \tan^{-1}\left(\frac{541.9}{362.6}\right) = 56^\circ \text{ Clockwise from +X axis}$$

3) Stone A: momentum (p) = $72.0 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1}$, 15.0° ~~left~~ ^{right} of center

Stone B: $12.0 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1}$ 23.0° left of center

$$\vec{p}_A + \vec{p}_B = \vec{P}$$



$$A_x = 72.0 \sin 15^\circ = 18.6$$
$$A_y = 72.0 \cos 15^\circ = 69.5$$

$$B_x = -12.0 \sin 23.0^\circ = -4.7$$
$$B_y = 12.0 \cos 23.0^\circ = 11.0$$

$$P_x = A_x + B_x = 18.6 - 4.7 = 13.9$$
$$P_y = A_y + B_y = 69.5 + 11.0 = 80.5$$

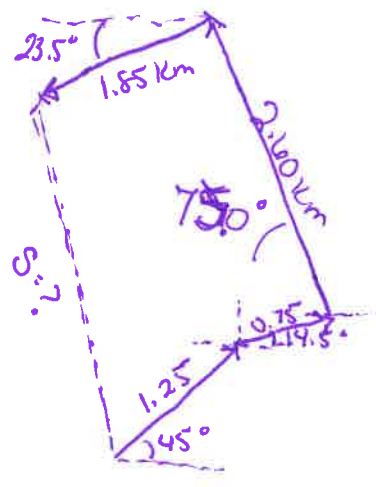
$$P = \sqrt{P_x^2 + P_y^2} = \sqrt{13.9^2 + 80.5^2} = 81.7 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1}$$

Measured from horizontal $\rightarrow \theta = \tan^{-1}\left(\frac{y}{x}\right) = \tan^{-1}\left(\frac{80.5}{13.9}\right) = 80.2^\circ$

$\theta = 9.8^\circ$ To the Right of the center line

4

- a 1: 1.25 km NE
- 2: 0.75 km, 14.5° NE
- 3: 2.60 km, 75.0° NW
- 4: 1.85 km, 23.5° SW
- $\vec{S} = ?$



$$x_1 = 1.25 \cos 45^\circ = 0.884$$

$$y_1 = 1.25 \sin 45^\circ = 0.884$$

$$x_2 = 0.75 \cos 14.5^\circ = 0.73$$

$$y_2 = 0.75 \sin 14.5^\circ = 0.19$$

$$x_3 = -2.60 \cos 75^\circ = -0.673$$

$$y_3 = 2.60 \sin 75^\circ = 2.51$$

$$x_4 = -1.85 \cos 23.5^\circ = -1.70$$

$$y_4 = -1.85 \sin 23.5^\circ = -0.738$$

$$\sum x = 0.884 + 0.73 + (-0.673) - 1.70$$

$$= -0.76 \text{ km}$$

$$\sum y = 0.884 + 0.19 + 2.51 - 0.738$$

$$= 2.85 \text{ km}$$

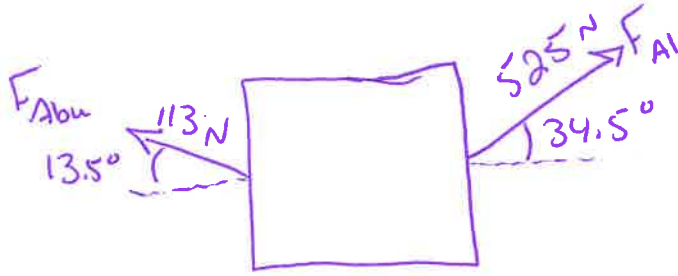
$$S = \sqrt{x^2 + y^2} = \sqrt{(-0.76)^2 + (2.85)^2}$$

$$S = 2.95 \text{ km}$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right) = \tan^{-1}\left(\frac{2.85}{-0.76}\right) = 75.1^\circ$$

$S = 2.95 \text{ km}, 75.1^\circ \text{ NW}$

5



$$X_1 = 525 \cdot \cos 34.5^\circ = 433 \text{ N}$$

$$Y_1 = 525 \sin 34.5^\circ = 297 \text{ N}$$

$$X_2 = -113 \cos 13.5^\circ = -110 \text{ N}$$

$$Y_2 = 113 \sin 13.5^\circ = 26 \text{ N}$$

$$X_3 = ?$$

$$Y_3 = ?$$

$$\sum X = 0$$

$$\sum Y = 0$$

$$X_1 + X_2 + X_3 = 0$$

$$433 - 110 + X_3 = 0$$

$$X_3 = -323 \text{ N}$$

$$Y_1 + Y_2 + Y_3 = 0$$

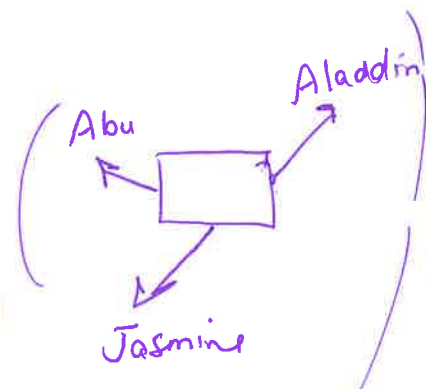
$$297 + 26 + Y_3 = 0$$

$$Y_3 = -323 \text{ N}$$

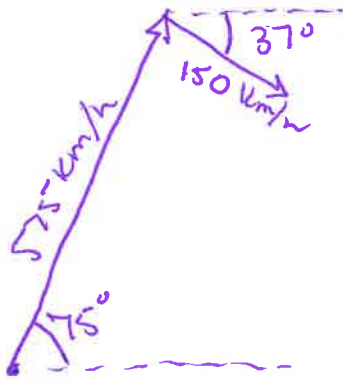
$$F_{\text{Jasmine}} = \sqrt{X^2 + Y^2} = \sqrt{323^2 + 323^2}$$

$$\theta = 45^\circ$$

$$F = 457 \text{ N}, 45^\circ \text{ Down \& left}$$



6



$$\vec{V} = \vec{V}_a + \vec{V}_w$$

$$A_x = 575 \cos 75^\circ = 149 \text{ km/h}$$

$$A_y = 575 \sin 75^\circ = 555 \text{ km/h}$$

$$W_x = 150 \cos 37^\circ = 120 \text{ km/h}$$

$$W_y = -150 \sin 37^\circ = -90$$

$$\Sigma x = 149 + 120 = 269 \text{ km/h}$$

$$\Sigma y = 555 - 90 = 465 \text{ km/h}$$

$$\begin{aligned} V &= \sqrt{x^2 + y^2} \\ &= \sqrt{269^2 + 465^2} \\ &= 537 \text{ km/h} \end{aligned}$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right) = \tan^{-1}\left(\frac{465}{269}\right) = 60^\circ$$

Final (net) Velocity = 537 km/h, 60° NE