

Today's Learning Goal(s):

By the end of the class, I will be able to:

- a) understand the ways vectors were used in this unit to solve problems.

5.10.2 Student Presentations

Group Members:

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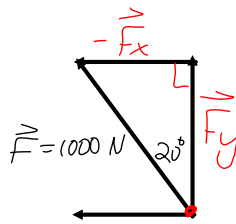
Kurtis

5.12.1 Reviewing Vectors

Date: NOV. 28/19

1. For each of the following make a diagram and then calculate the magnitude of the horizontal and vertical components. For the purpose of this assignment N is the unit of force called a Newton.

- a) 650 N at 35° to the horizontal
- b) 45 N at 130° to the horizontal
- c) 1000 N at 20° to the **vertical** (or bearing 340°)



$$\sin 20^\circ = \frac{-F_x}{1000}$$

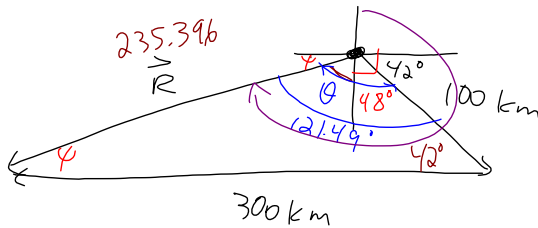
$$\begin{aligned} F_x &= -1000 \sin 20^\circ \\ &= -342.0201 \\ &= -342.020 \text{ N} \end{aligned}$$

$$\cos 20^\circ = \frac{F_y}{1000}$$

$$\begin{aligned} F_y &= 1000 \cos 20^\circ \\ &= 939.6926 \\ &= 939.693 \text{ N} \end{aligned}$$

2. Find the resultant force of the forces: $\vec{F}_1 = 200 \text{ N [N } 30^\circ \text{ E]}$ and $\vec{F}_2 = 100 \text{ N [E } 15^\circ \text{ S]}$.

3. A pigeon flies 100 km [E 42° S] and then 300 km [W]. What is the total displacement of this pigeon from its starting point?



$$\begin{aligned} \psi &= 180^\circ - \theta - 42^\circ \\ &= 180^\circ - 121.49^\circ - 42^\circ \\ &= 16.51^\circ \end{aligned}$$

} bearing =
270° - 16.51° = 253.49°

$$\frac{\sin \theta}{300} = \frac{\sin 42^\circ}{235.396}$$

$$\begin{aligned} |\vec{R}| &= \sqrt{300^2 + 100^2 - 2(300)(100)\cos 42^\circ} \\ &= 235.3960 \\ &= 235.396 \end{aligned}$$

$$\begin{aligned} \theta &= \sin^{-1}\left(\frac{300 \times \sin 42^\circ}{235.396}\right) \\ &= 58.514 \\ &= 58.51^\circ \end{aligned}$$

$$\cos \theta = \frac{235.396^2 + 100^2 - 300^2}{2(235.396)(100)}$$

$$\theta = \cos^{-1}\left(\frac{-24588.72318}{47079.2}\right)$$

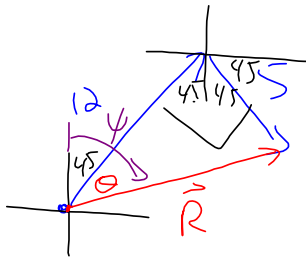
$$\begin{aligned} &= 121.485 \\ &= 121.49 \end{aligned}$$

∴ the pigeon's displacement is 235.396 bearing 253.49°

or [W 16.59° S]

or [S 73.41° W]

4. A school bus travelled 12 km [N 45° E] and then 5 km [S 45° E]. Calculate total displacement for this trip.



$$|\vec{R}| = \sqrt{12^2 + 5^2}$$

$$= 13$$

$$\tan \theta = \frac{5}{12}$$

$$\theta = \tan^{-1}\left(\frac{5}{12}\right)$$

$$\approx 22.619^\circ$$

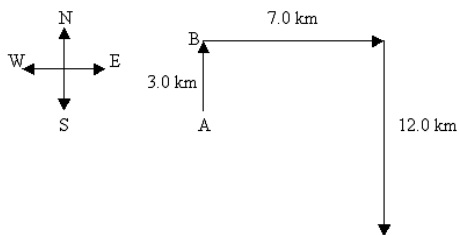
$$\approx 22.62^\circ$$

$$\psi = 45^\circ + 22.62^\circ$$

$$= 67.62^\circ$$

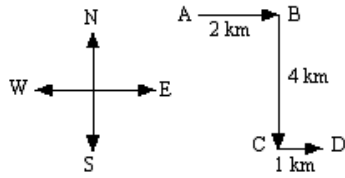
\therefore resultant is 13 km [N 67.62° E].

5. A group of hikers sets out from point A, proceeds to B, then to C, and finally to D. The entire trip takes 5.0 h.



- What is the hikers' total distance relative to their initial position?
- What is the hikers' final displacement relative to their initial position?

6. The diagram below shows the first three legs of a trip: A to B, B to C, and C to D. If a person returns from point D to point A, what is the displacement for this fourth and final leg?



7. Consider the following points: A(2, 5), B(7, 12), C(-3, 6), D(8, -2). Determine the component vectors:

a) \overline{AB} b) \overline{BC} c) \overline{BD} d) \overline{BA} e) \overline{CD} f) \overline{CB} g) \overline{DA}

$$= [7-2, 12-5] = [-10, -6]$$

$$= [5, 7]$$

$$= [2-7, 5-12] = [-5, -7]$$

$$= [2-8, 5-(-2)] = [-6, 7]$$

$$= [-6, 7]$$

and the magnitudes (to 3 decimal places): h) $|\overline{BC}|$ i) $|\overline{DA}|$

$$|\overline{BC}| = \sqrt{(-10)^2 + (-6)^2}$$

$$= \sqrt{136}$$

$$\doteq 11.6619$$

$$\doteq 11.662$$



$$= \sqrt{100 + 36} = \sqrt{136}$$

$$|\overline{DA}| = \sqrt{(-6)^2 + 7^2} = \sqrt{36 + 49}$$

$$= \sqrt{85}$$

$$\doteq 9.2195$$

$$\doteq 9.220$$

Thinking

8. Imagine that you are planning to build a railway line between four remote towns. The town of Addington is located 60 km [E] of Bracketon. The town of Cosville is located 40 km [S] of the town of Addington and Degreesville is located 40 km [N 60° E] of the town of Cosville. Draw a diagram to show the locations of each town and use this information to determine the minimum length of track that will link the towns (to 3 decimal places).

