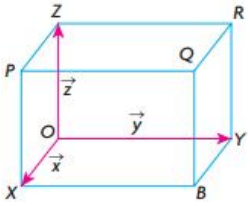
6.2 Vector Addition (and Subtraction)

Problems taken from the Nelson Text: Pg 290 – 292

1. The vectors $\vec{x}$ and $\vec{y}$ are drawn as shown below. Draw a vector equivalent to each of the following.

a. $\vec{x} + \vec{y}$ b. $\vec{x} - \vec{y}$ c. $\vec{y} - \vec{x}$ d. $(-\vec{y}) + (-\vec{x})$

7. The rectangular box shown is labelled with $\overrightarrow{OX} = \vec{x}$, $\overrightarrow{OY} = \vec{y}$, and $\overrightarrow{OZ} = \vec{z}$.



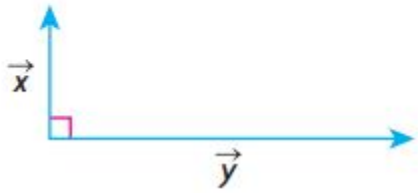
Express each of the following vectors in terms of $\vec{x}$, $\vec{y}$, and $\vec{z}$.

a. $\overrightarrow{BY}$ b. $\overrightarrow{XB}$ c. $\overrightarrow{OB}$ d. $\overrightarrow{XY}$ e. $\overrightarrow{OQ}$ f. $\overrightarrow{QZ}$ g. $\overrightarrow{XR}$ h. $\overrightarrow{PO}$

9. In still water, Maria can paddle at the rate of 7 km/h. The current in which she paddles has a speed of 4 km/h.
   a. At what velocity does she travel downstream?
   b. Using vectors, draw a diagram that illustrates her velocity going downstream.
   c. If Maria changes her direction and heads upstream instead, what is her speed? Using vectors, draw a diagram that illustrates her velocity going upstream.

11. A small airplane is flying due north at 150 km/h when it encounters a wind of 80 km/h from the east. What is the resultant ground velocity of the airplane?

12. $|\vec{x}| = 7$ and $|\vec{y}| = 24$. If the angle between these vectors is 90°, determine $|\vec{x} + \vec{y}|$ and calculate the angle between $\vec{x}$ and $\vec{x} + \vec{y}$.



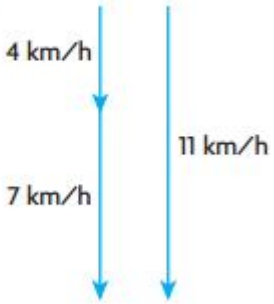
13. $\overrightarrow{AB}$ and $\overrightarrow{AC}$ are two unit vectors (vectors with magnitude 1) with an angle of 150° between them. Calculate $|\overrightarrow{AB} + \overrightarrow{AC}|$.

14. $ABCD$ is a parallelogram whose diagonals BD and AC meet at the point E. Prove that $\overrightarrow{EA} + \overrightarrow{EB} + \overrightarrow{EC} + \overrightarrow{ED} = \vec{0}$.

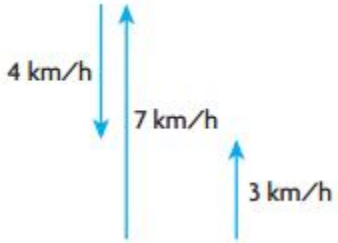
Answers to Selected Problems

7. **a.** $-\vec{x}$
b. $\vec{y}$
c. $\vec{x} + \vec{y}$
d. $-\vec{x} + \vec{y}$
e. $\vec{x} + \vec{y} + \vec{z}$
f. $-\vec{x} - \vec{y}$
g. $-\vec{x} + \vec{y} + \vec{z}$
h. $-\vec{x} - \vec{z}$

9. **a.** 11 km/h
b.



c. 3 km/h



11. 170 km/h, N28.1°W
12. $|\vec{x} + \vec{y}| = 25$, $\theta \doteq 73.7°$
13. 0.52
14. The diagonals of a parallelogram bisect each other. So, $\overrightarrow{EA} = -\overrightarrow{EC}$ and $\overrightarrow{ED} = -\overrightarrow{EB}$.
Therefore, $\overrightarrow{EA} + \overrightarrow{EB} + \overrightarrow{EC} + \overrightarrow{ED} = \vec{0}$.