

## Lesson 8.1 – A More Formal Intro to Vectors

- I. Using your Trigonometry:** An airplane in calm conditions is flying at 800 km/hr due east. A cold wind suddenly blows from the south at 35 km/hr pushing the airplane slightly off course. Draw a picture of the scenario, and using trigonometry, find the resulting speed and direction on the plane

**What are vectors?****II. Representing Vectors in the Coordinate Plane**

1. Write each of the following vectors in unit vector form.

a.  $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$

b.  $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

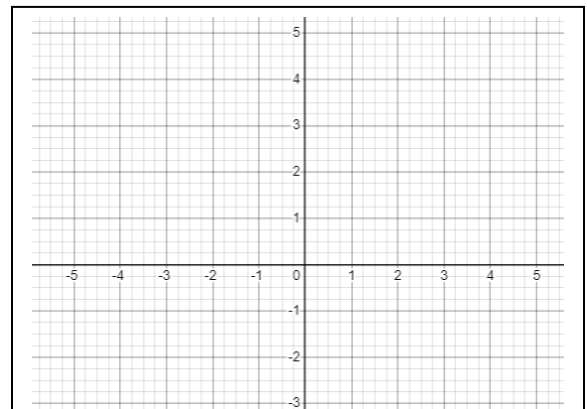
c.  $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$

d.  $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$

2. Find the unknowns if

a.  $\begin{pmatrix} a + 1 \\ 2b - 8 \end{pmatrix} = \begin{pmatrix} 9 - a \\ a \end{pmatrix}$

b.  $\begin{pmatrix} 2x + 3y \\ x - 2 \end{pmatrix} = \begin{pmatrix} 11 \\ 2y \end{pmatrix}$



- Plot the point (2,5).
- Plot the vector  $\langle 2, 5 \rangle$  or  $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$

**Rewriting in terms of unit vectors:**

Let  $\mathbf{i} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$  and  $\mathbf{j} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

### III. The Magnitude & Direction of a Vector

3. Given the following information, find the component form & unit vector form of each vector, as well as the magnitude and direction angle for each vector.

a.  $\overrightarrow{RS}$  where  $R = (7, 2)$ ;  $S = (-1, -10)$

b.  $\overrightarrow{PQ}$  where  $P = (-4, -10)$ ;  $Q = (-5, -2)$

c.  $\overrightarrow{RS}$  where  $R = (10, 7)$ ;  $S = (-5, -3)$

d.  $\overrightarrow{RS}$  where  $R = (-6, -4)$ ;  $S = (-8, -7)$

Consider our previous vector:  $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$

Which can be written in base unit vector form as  $2\mathbf{i} + 5\mathbf{j}$ .

The **length** or **magnitude** of the vector is the distance of the vector from the standard position in the origin (This is just the Pythagorean Theorem).

The **direction** of a vector is the measure of the angle it makes with a horizontal line. Using trigonometry,

4. Given the magnitude and direction, find the horizontal and vertical components for the following vectors.

a.  $|\mathbf{a}|, \theta = 45, 298^\circ$

b.  $|\mathbf{m}|, \theta = 17, 41^\circ$

c.  $|\mathbf{a}|, \theta = 11, 99^\circ$

d.  $|\mathbf{t}|, \theta = 17, 41^\circ$