

Before we begin, are there any questions from last day's work?

Today's Learning Goal(s):

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

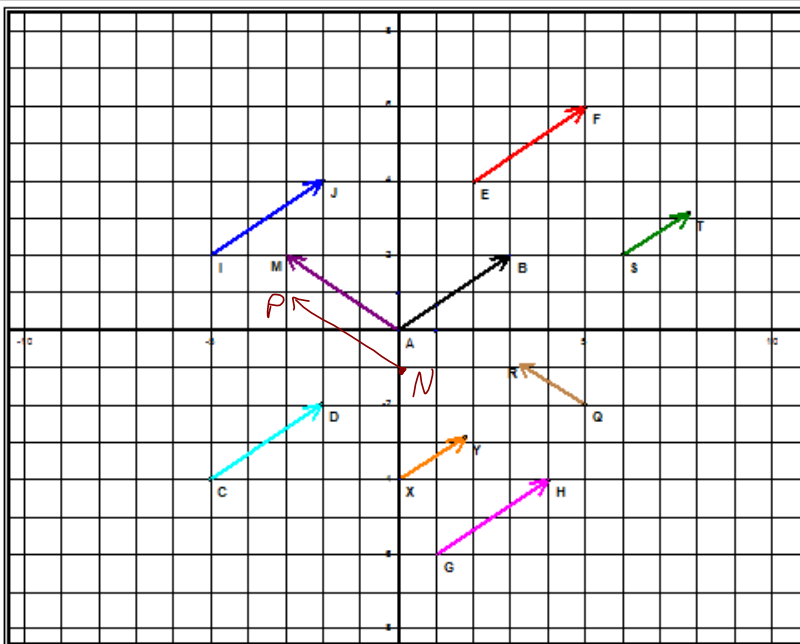
- a) represent a vector as a directed line segment, with directions expressed in different ways.
- b) resolve a vector into horizontal and vertical components.

5.7.1: All Vectors are not Created Equal

Date: Nov. 22/18

- Complete the following statement: **magnitude** and **direction**.
A vector is a quantity which has _____ and _____.
- Examine the vectors in the diagram. Classify the vectors in the table below using appropriate vector notation (e.g. \vec{AB})

Same Magnitude Only	Same Direction Only	Same Magnitude And Direction	No Similarities
0 $\vec{AB}, \vec{CD}, \vec{EF}, \vec{GH}, \vec{IJ}$ 1 \vec{AM} 2 \vec{ST}, \vec{XY} 3 \vec{QR}	$\vec{AB},$ \vec{XY}, \vec{ST} <hr/> \vec{AM}, \vec{QR}	$\vec{AB} = \vec{CD} = \vec{EF} = \vec{GH} = \vec{IJ}$ $\vec{ST} = \vec{XY}$	\vec{AM}, \vec{ST} \vec{AB}, \vec{QR}



- On the grid, construct a vector with the same magnitude and direction as \vec{AM}
- Without measuring, how would you determine that \vec{AB} and \vec{EF} have equal magnitudes?
Both are 2 units up and 3 units over from tail to tip. (using grid lines and PT.)
- \vec{AB} and \vec{EF} are an example of equal vectors. What conditions are necessary for equal vectors?
The vectors must have equal magnitude and same direction.

5.7.2: Vector Components

1. Sketch the vector \overline{JK} with tail at $J(1, 2)$ and head at $K(5, 4)$.

The directed line segment \overline{JK} represents a displacement of some magnitude in the direction indicated by the arrow.

We can describe \overline{JK} by giving its horizontal and vertical components.

2. Create a right triangle with the rise and run of the line segment that represents the vector.
- 3a) Determine the horizontal component of \overline{JK} by subtracting the x -coordinates of the endpoints of the vector.
- b) Determine the vertical component of \overline{JK} by subtracting the y -coordinates of the endpoints of the vector.

$$\begin{aligned}x &= x_K - x_J \\ &= 5 - 1 \\ &= 4\end{aligned}$$

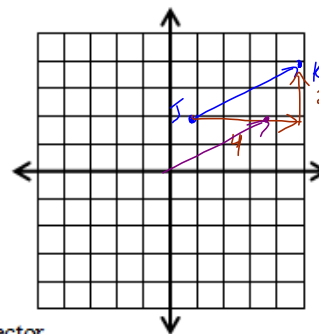
$$\begin{aligned}y &= y_K - y_J \\ &= 4 - 2 \\ &= 2\end{aligned}$$

4. We can also define a vector by stating its components as an ordered pair of numbers.

In this example, $\overline{JK} = [\text{horizontal component}, \text{vertical component}]$.

State the components of vector \overline{JK} , and sketch it on the grid above.

$$\overline{JK} = [4, 2]$$



Note: **Square brackets** are used to avoid confusion between the coordinates of a point, and the components of a vector.

5. Use the above information and your knowledge of the Pythagorean theorem to determine the magnitude of vector \overline{JK} .

$$\begin{aligned}|\overline{JK}| &= \sqrt{4^2 + 2^2} \\ &= \sqrt{16 + 4} \\ &= \sqrt{20} \text{ units} \\ &= 2\sqrt{5} \text{ units}\end{aligned}$$

$$\begin{aligned}\text{Recall: } \sqrt{20} &= \sqrt{4 \cdot 5} \\ &= 2\sqrt{5}\end{aligned}$$

Further Practice Questions

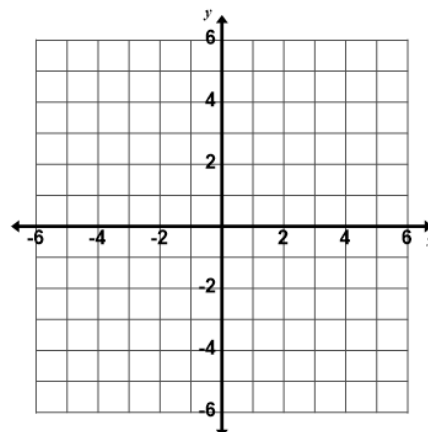
6. Given the points $L(1, 2)$, $M(5, 11)$, $P(2, -3)$, and $R(5, -2)$, state the components of vectors \overline{LM} and \overline{PR} .

$$\begin{aligned}\overline{LM} &= [5 - 1, 11 - 2] \\ &= [4, 9]\end{aligned}$$



7. Sketch a diagram AND determine the magnitude of the following vectors given their components.

a) $\overline{AB} = [2, 5]$ b) $\overline{CD} = [-2, 5]$ c) $\overline{EF} = [3, 2]$ d) $\overline{GH} = [-2, 3]$



8. Consider the following statement:

"If $\overline{AB} = [2, 5]$ and $\overline{ST} = [2, 5]$, then \overline{AB} and \overline{ST} are equal."

Is this: always true sometimes true never true?

Justify your choice.

5.7.3: Seeking Direction

Scaled vector diagrams are used in navigation to represent the motion of ships and aircraft. The direction is often stated as a bearing.

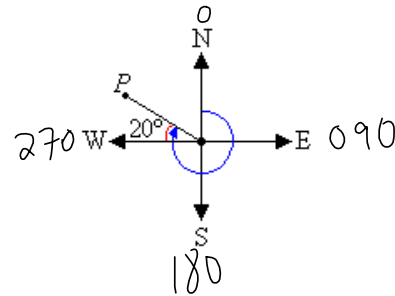
A **true bearing** to a point is the angle between due north and the line of travel of an object measured in degrees in a clockwise direction. We will refer to this as **bearing**.

A **conventional bearing** of a point is stated as the number of degrees east or west of the north-south line. We will refer to this as **direction**.

In the diagram below, the bearing of point P is 290° .

The direction method can be stated in two ways:

- $W20^\circ N$ (point P is 20° north of west)
 - $N70^\circ W$ (point P is 70° west of north)
- } heading*



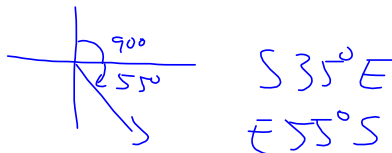
1. Complete the following table with reference to point P.

Diagram	Bearing	Direction	Diagram	Bearing	Direction
	048	$N48^\circ E$ $E42^\circ N$			
			Provide a sketch here.	235°	

2. Describe each of the following bearings as directions in two different ways.

a) 073°

b) 145°



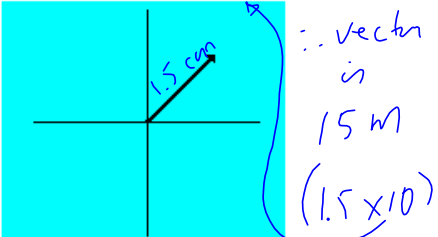
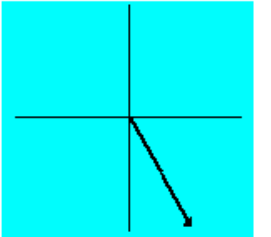
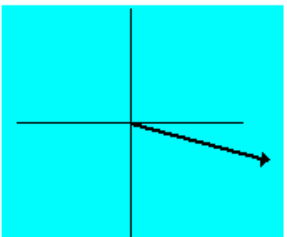
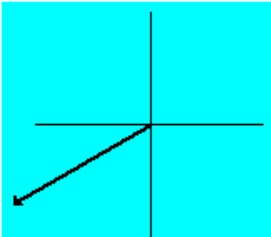
c) 219°

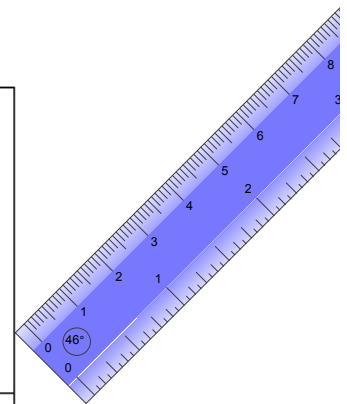
d) 305°

5.7.4: "Scalars" NOT Scalars

We know that a vector requires both magnitude and direction.
Scale diagrams are useful in presenting geometric vectors.

1. Given the scale, determine the **magnitude** of each vector.

<p>a) SCALE: 1 cm = 10 m</p> 	<p>b) SCALE: 1 cm = 50 km</p> 
<p>c) SCALE: 1 cm = 10 m/s</p> 	<p>d) SCALE: 1 cm = 50 km/hr</p> 



2. Use an accurately-drawn scaled vector diagram to represent the magnitude and direction for the following vectors.

a) Given the SCALE: 1 cm = 10 m, represent the vector 50 m, with a bearing of 60° by a scaled vector diagram.

b) Given the SCALE: 1 cm = 10 m, represent the vector 60 m, $W30^\circ N$ by a scaled vector diagram.
∴ use 5 cm line

c) Given the SCALE: 1 cm = 15 m/s, represent the vector 120 m/s, $S30^\circ W$ by a scaled vector diagram.

d) Given the SCALE: 1 cm = 20 m/s, represent the vector 140 m/s, $N30^\circ E$ by a scaled vector diagram

