<name>
Class: Honors Geometry
Date: <date>
Topic: Lesson 9-4 (Vectors)

Vector

Quantity with direction and magnitude (distance, speed, etc)

Tail of vector

Initial/starting point of vector

Head of vector

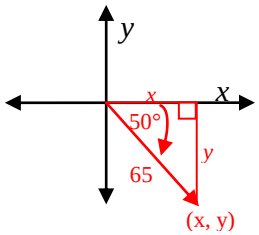
End/terminal point of vector

Describe w/coords

$\langle x, y \rangle$ tail at origin, head at (x, y)

Use dist formula to determine magnitude.

Use tangent to determine direction angle



Given direction and magnitude use cosine (x) and sine (y).

Describe w/compass directions

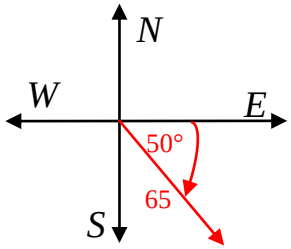
Compass rose:

y-axis: up is North, down is South

x-axis: left is West, right is East

65 *mi* 50° south of east.

Or complement: 65 *mi* 40° east of south.



Vector addition

Move tail to head.

Add coords: *if* $\vec{u} = \langle x_1, y_1 \rangle$ *and* $\vec{v} = \langle x_2, y_2 \rangle$ *then* $\vec{u} + \vec{v} = \langle x_1 + x_2, y_1 + y_2 \rangle$

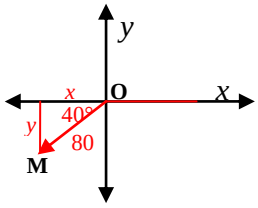
Examples

1. Describe $\overline{OM}$ as an ordered pair. Give coords to nearest 10th.

   $\cos 40 = \frac{x}{80}$; $x = 80 \cos 40 = 61.28 \approx 61.3$ (in the negative *x* dir)

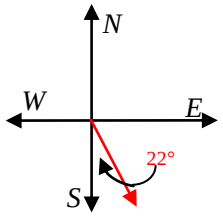
   $\sin 40 = \frac{y}{80}$; $y = 80 \sin 40 = 51.42 \approx 51.4$ (in the negative *y* dir)

   $\overline{OM} = \langle -61.3, -51.4 \rangle$



2. Use compass directions to describe the direction of the vector.

   22° east of south. (preferable)
   or 68° south of east.



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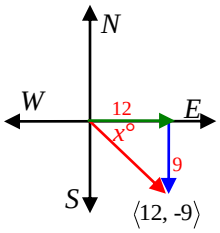
3. A boat sailed 12 mi E & 9 mi S. The trip can be described by the vector $\langle 12,-9\rangle$. Use dist & dir to describe it in a 2nd way.



Direction:

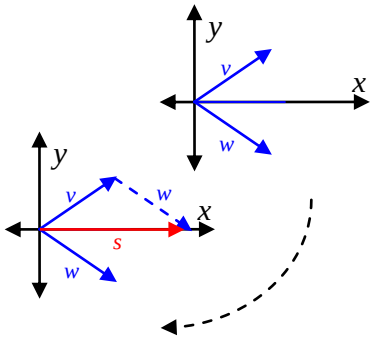
$$x = \tan^{-1}\left(\frac{9}{12}\right) = 36.87 \approx 37°$$

Now the distance sailed: use the Pythagorean Theorem.

$$\sqrt{9^2 + 12^2} = 15$$

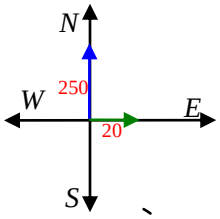
The boat sailed 15 miles at about 37° south of east.

4. Vectors $\vec{v}\langle 4,3\rangle$ and $\vec{w}\langle 4,-3\rangle$ are shown. Write $\vec{s}$, their sum, as an ordered pair.



$$\vec{s} = \vec{v} + \vec{w} = \langle 4+4, 3+{}^{-}3\rangle = \langle 8,0\rangle$$

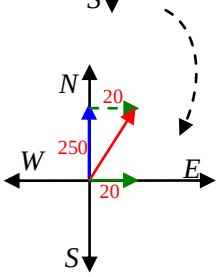
5. An airplane's speed is 250 *mph* in still air. The wind is blowing due east at 20 *mph*. If the airplane heads due north, what is its resultant speed and bearing (direction)? Round to the nearest unit. Diagram is not to scale.



The airplane's vector is $\langle 0,250\rangle$

The wind's vector is $\langle 20,0\rangle$

The resultant vector is $\langle 20,250\rangle$



The resultant's speed (magnitude) is:

$$\sqrt{20^2 + 250^2} = 250.799 \approx 251 mi$$

The resultant's bearing is:

$$x° = \tan^{-1}\left(\frac{20}{250}\right) = 4.57 \approx 5°$$

251 *mi* at about 5° east of north