Vector Components, Vector Resolution and Vector Addition

Read from **Lesson 1** of the **Vectors and Motion in Two-Dimensions chapter** at **The Physics Classroom**:

http://www.physicsclassroom.com/Class/vectors/u3l1b.html
http://www.physicsclassroom.com/Class/vectors/u3l1c.html
http://www.physicsclassroom.com/Class/vectors/u3l1eb.cfm

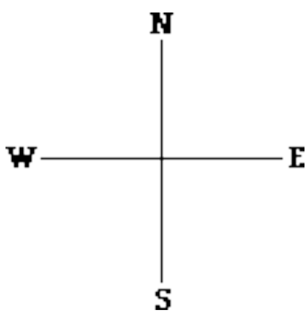
MOP Connection: Vectors and Projectiles: sublevels 3 and 5

Review: The direction of a vector is often expressed as a counterclockwise (CCW) angle of rotation of that vector from due east (i.e., the horizontal). In such a convention, East is 0°, North is 90°, West is 180° and South is 270°.

About Vector Components:
A vector directed at 120° CCW has a direction which is a little west and a little more north. Such a vector is said to have a northward and a westward component. A **component** is simply the effect of the vector in a given direction. A hiker with a 120° displacement vector is displaced both northward and westward; there are two separate effects of such a displacement upon the hiker.

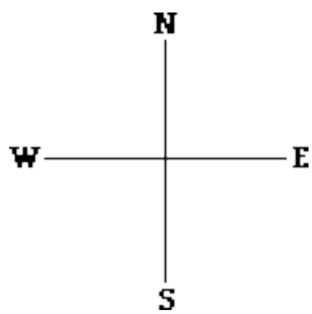
1. Sketch the given vectors; determine the direction of the two components by circling two directions (N, S, E or W). Finally indicate which component (or effect) is greatest in magnitude.

45 km, 300°



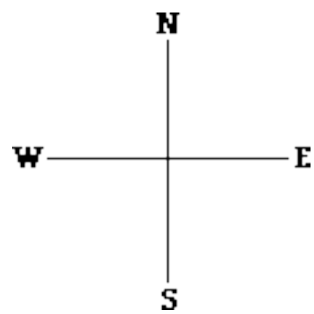
Components: **E W N S**
Greatest magnitude? ______

10 km, 265°



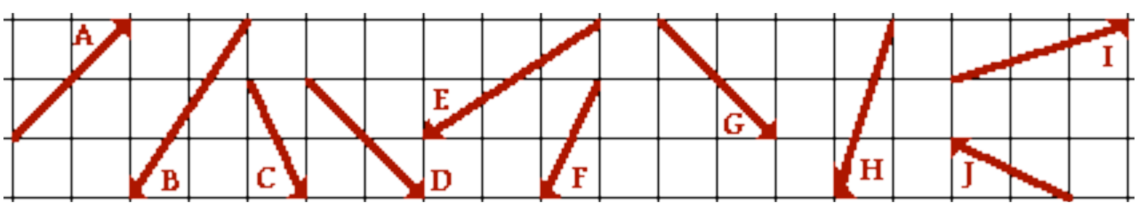
Components: **E W N S**
Greatest magnitude? ______

200 mi, 150°



Components: **E W N S**
Greatest magnitude? ______

2. Consider the various vectors below. Given that each square is 10 km along its edge, determine the magnitude and direction of the components of these vectors.



Vector	E-W Component mag. & dir'n)	N-S Component mag. & dir'n)
A		
C		
E		
G		
I		

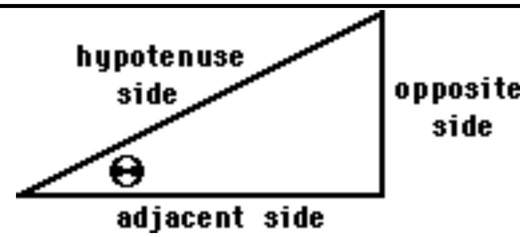
Vector	E-W Component mag. & dir'n)	N-S Component (mag. & dir'n)
B		
D		
F		
H		
J		

The magnitude of a vector component can be determined using trigonometric functions.

TIP
Trigonometry Review

Trigonometric functions are mathematical functions that relate the length of the sides of a right triangle to the angles of the triangle. The meaning of the functions can be easily remembered by the mnemonic

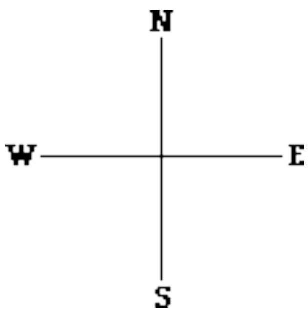
SOH CAH TOA



SOH --> Sin $\Theta = \frac{\text{Opposite}}{\text{Hypoteneuse}}$ **CAH** --> Cos $\Theta = \frac{\text{Adjacent}}{\text{Hypoteneuse}}$ **TOA** --> Tan $\Theta = \frac{\text{Opposite}}{\text{Adjacent}}$

3. Sketch the given vectors; project the vector onto the coordinate axes and sketch the components. Then determine the magnitude of the components using SOH CAH TOA.

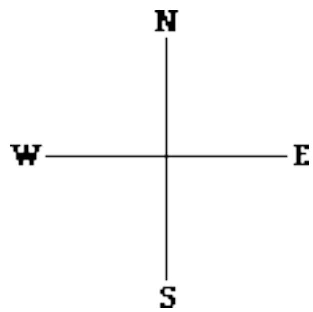
45 km, 300°



E-W Component:

N-S Component:

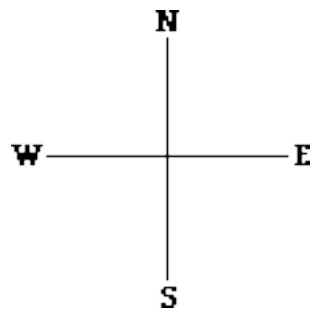
10 km, 265°



E-W Component:

N-S Component:

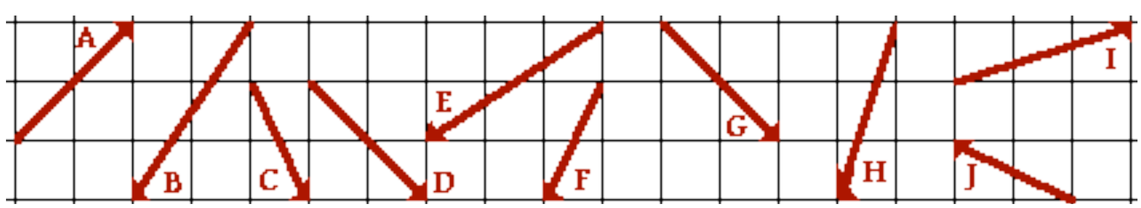
200 mi, 150°



E-W Component:

N-S Component:

4. Consider the diagram below (again); each square is 10 km along its edge. Use components and vector addition to determine the resultant displacement (magnitude only) of the following:



A + B + C ➔ Σ E-W: ___________ Σ N-S: ___________ Overall Displacement: _____________

D + E + F ➔ Σ E-W: ___________ Σ N-S: ___________ Overall Displacement: _____________

G + H + I ➔ Σ E-W: ___________ Σ N-S: ___________ Overall Displacement: _____________

A + J + G ➔ Σ E-W: ___________ Σ N-S: ___________ Overall Displacement: _____________