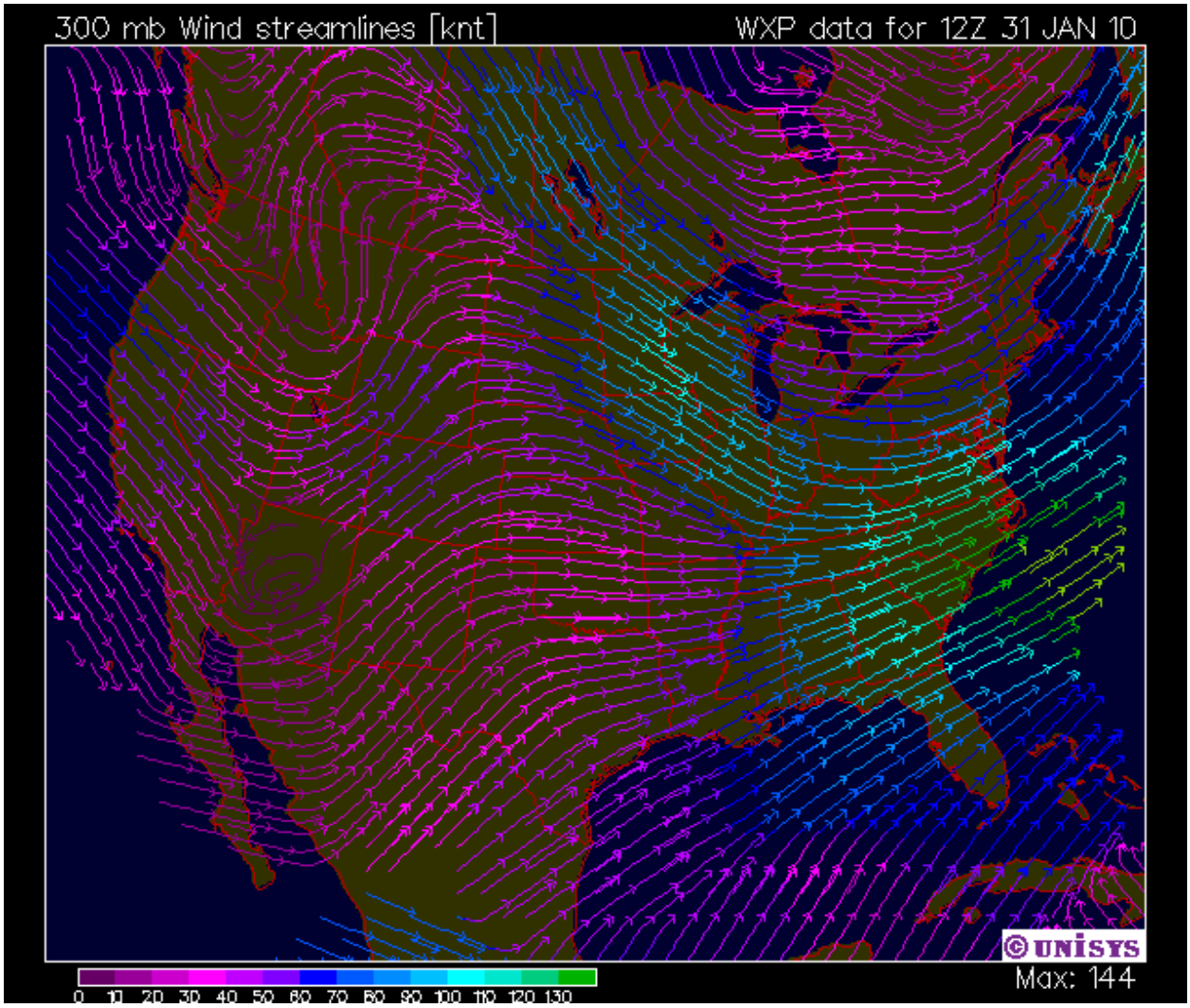
Vectors & Scalars

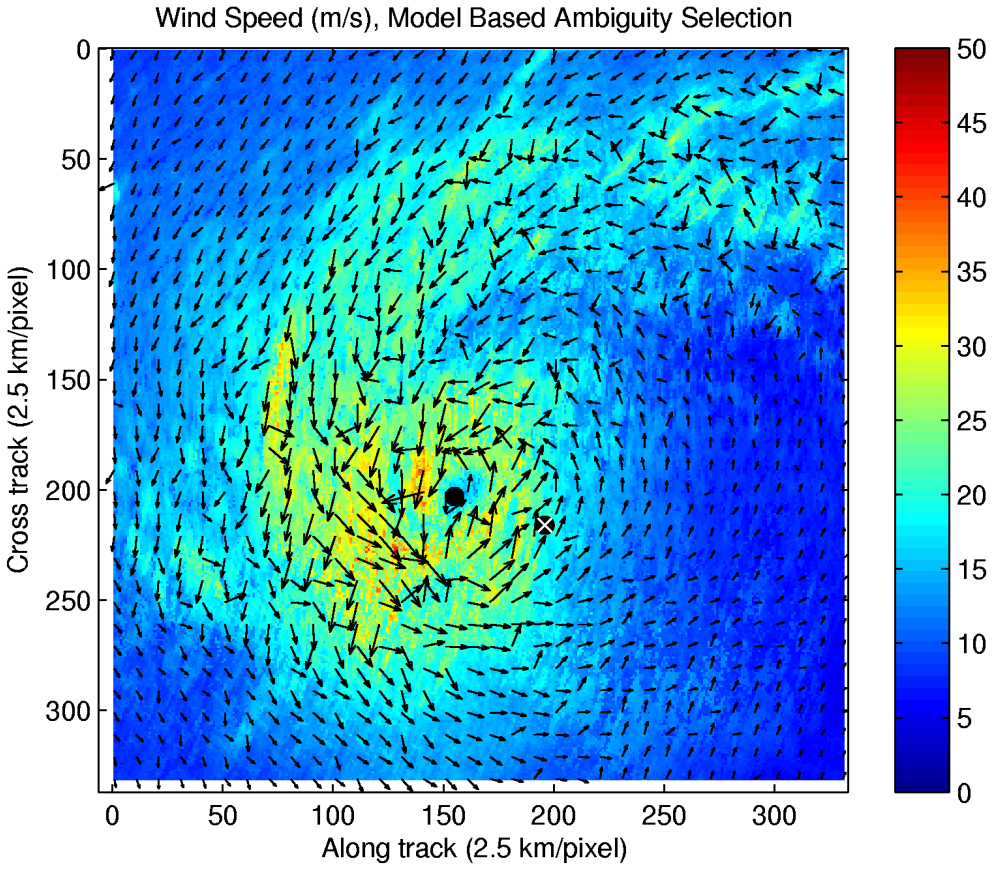
Scalars: these quantities have only magnitude.
Ex. 2.0kg, 5.0m/s
Ex. mass, speed, distance, time

Vectors: these quantities have magnitude and direction.
Ex. position, displacement, velocity, acceleration.
Ex. 15km[E], 30m/s[E30^{0}N]

March 24, 2014



March 24, 2014

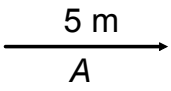


Graphical Representation of Vectors

Vectors are represented by ***arrows***.

- The ***length*** of the arrow corresponds to the magnitude of the vector.
- The ***direction in which the arrow points*** represents the direction of the vector.

Vector ***A*** or $\vec{A}$ has a magnitude of 5 m and is directed to the right:

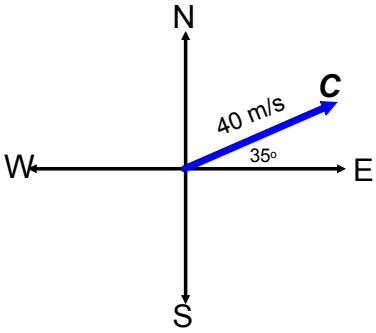


Vector ***B*** or $\vec{B}$ has a magnitude of 3 m/s² and is directed downward:

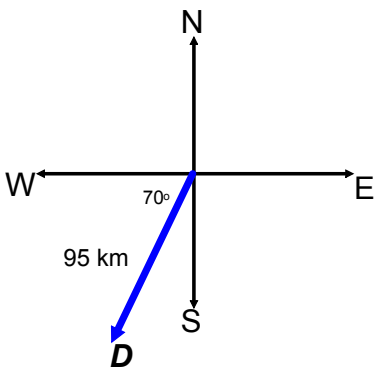
Vector ***C*** or $\vec{C}$ represents a vector of 40 m/s E35°N or 35° NofE

reference

reference

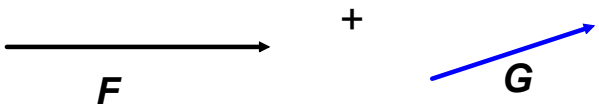


Vector ***D***, or $\vec{D}$ represents a vector of 95 km, W70°S:

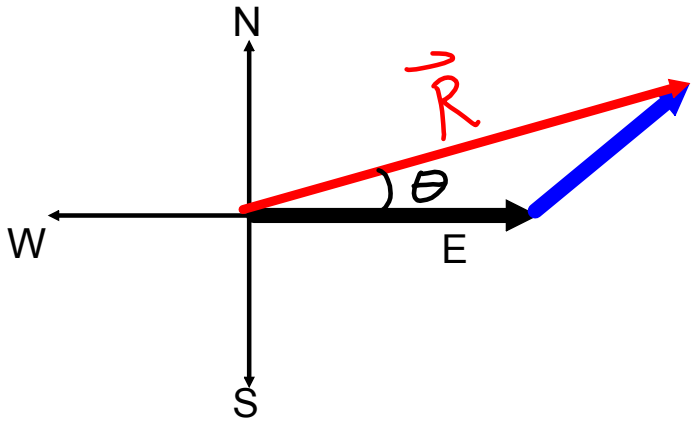


Adding Vectors Graphically

Method #1: Tip-To-Tail Method



To add vectors graphically, they must first be ***lined up tip-to-tail.***



The vector sum of ***F*** and ***G*** is the vector, ***R***. It connects the tail of the first arrow to the tip of the last arrow.

Why is the letter ***R*** used for the vector sum?

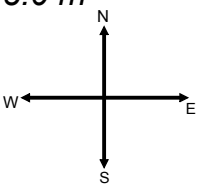
Physicists call the vector sum the ***resultant vector*** *or the* ***resultant****.*

Why is the graphical method not considered the best method to use when adding vectors?

If the vectors are not drawn precisely, your final answer will not be accurate.

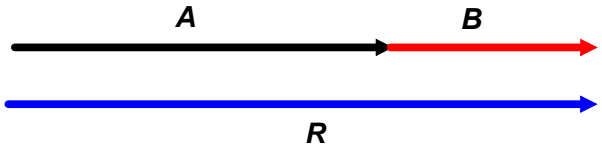
Examples - Graphing Analysis of Vectors

*Let the magnitudes of vector **A** and vector **B** be 8.0 m and 6.0 m, respectively.*



☆ Choose a scale. Let 1.0 cm = 1.0 m

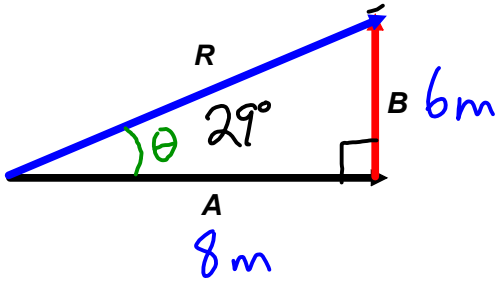
a) If vector ***A*** and vector ***B*** are both directed East, what is the angle between the vectors? What is the magnitude and direction of their resultant?

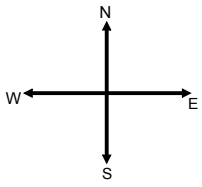


Angle between vectors: 0°

R = 14 m, East
= 14 m, right
= + 14 m

b) If vector ***A*** is directed East and vector ***B*** is directed North, what is the angle between the vectors? What is the magnitude and direction of their resultant?

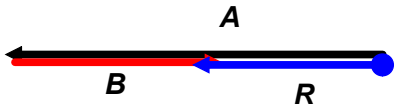




Angle between the vectors: 90°

R = 10. m, [E29°N]
= 10. m, 29°N of E
= 10. m, 29° above the +x axis

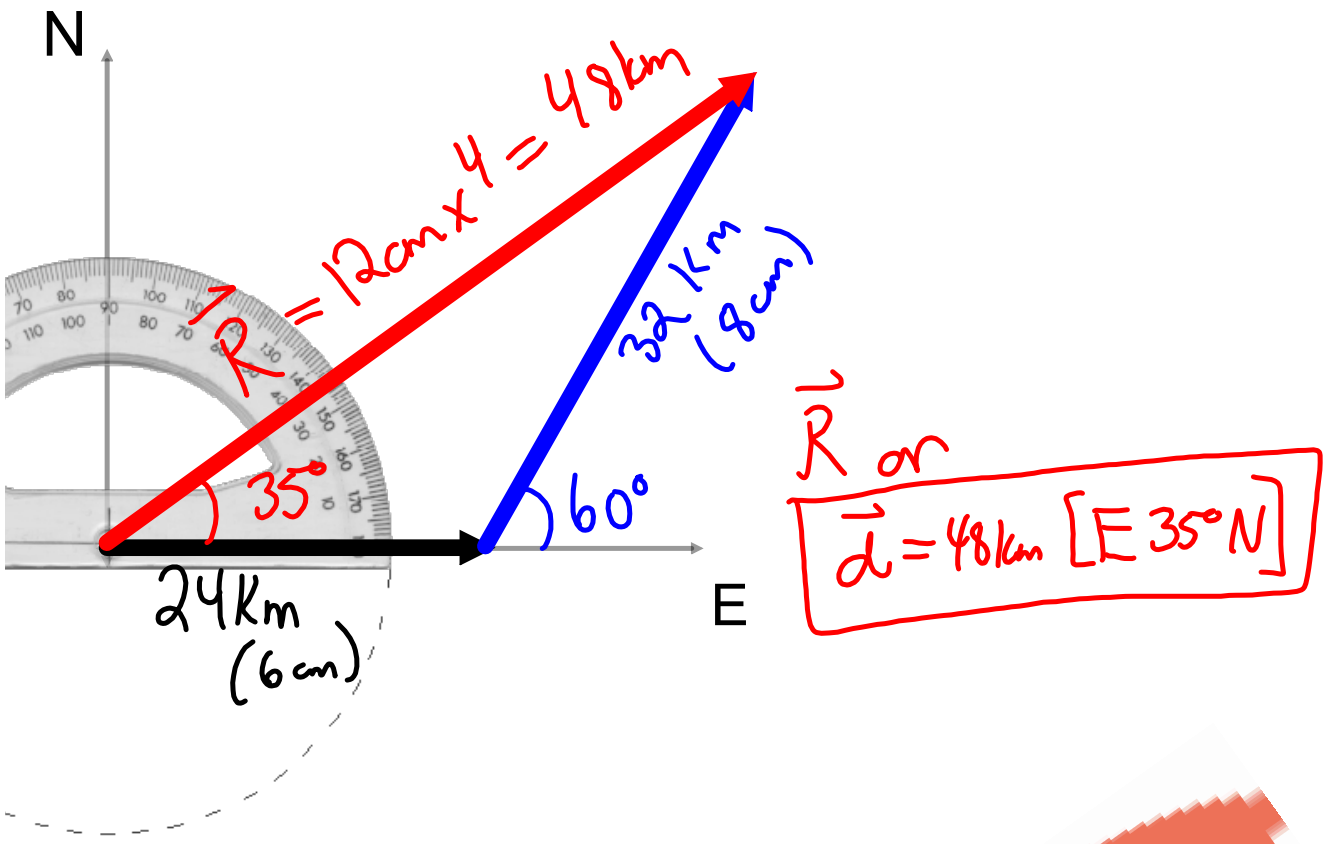
c) If Vector ***A*** is directed West and vector ***B*** is directed East, what is the magnitude and direction of their resultant?



R = 2.0 m, West
= -2.0 m, East

Example 1: Find the resultant displacement if vector ***A*** = 24 km [E] and vector ***B*** = 32 km [E60°N].

Scale: Let 1.0 cm = 4.0 km



Class Work: Resultant Vectors Worksheet - Part 1

Resultant Vectors Worksheet - Solutions

#1) 1:4, 29 km [E58S]

#2) 1:1, 5.4 m/s [E50N]

#3) 1:5, 42.5 m [W30N]

#4) 1:2, 20.4 m [W70N]

#5) 1:10, 127 km [E42N]

#6) 1:300, 2800 km [W45S]