

INTRODUCTION TO VECTORS I

VECTORS

A property with a direction

Displacement

Velocity

Acceleration

Force

Weight

SCALARS

Distance

Speed

Time

Mass

VECTORS:

Represented by arrows: \rightarrow

Length = amount or magnitude of vector

Direction:

In one dimensional motion:

Back and forth, positive and negative, backwards, forwards

In two dimensional motion:

Direction of arrow

Compass points: North, South, East, West, etc...

Angle (relative to some line)

How to add vectors:

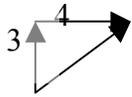
One dimension: If I go 3 m/s N, with a wind at 4 m/s S?

$$\begin{aligned}V_{pg} &= V_{pa} + V_{ag} \\ &= 3\text{m/s} + -4\text{ m/s} \\ &= -1\text{ m/s or } 1\text{ m/s South}\end{aligned}$$

But in two dimensions:

If I go 3 m/s N with a wind at 4 m/s E?

$$V_{pg} = V_{pa} + V_{pg}$$



Graphically, with a ruler and protractor on graph paper

: V_{pg} is the resultant of the two vectors drawn head to tail, $V_{pg} = 5\text{ m/s}$, or use Algebraic Method: Pythagorean Theorem ($C^2 = A^2 + B^2$).

$V_{pg} = \text{square root } (3^2 + 4^2) = 5\text{ m/s}$

Direction?... use protractor or TRIG: angle = inverse tangent $(4/3) = 53\text{ degrees}$

Order doesn't matter for adding!

READ SEC. 3-1, DO SEC REVIEW pg 87

SECTION REVIEW 3-1 pg 87

1. Which of the following properties are scalars and which are vectors?
 - a) the acceleration of a plane as it takes off
 - b) the number of passengers on the plane
 - c) the duration of the flight
 - d) the displacement of the flight
 - e) the amount of fuel required for the flight

2. A roller coaster moves 85 m horizontally, then travels 45 m at an angle of 30° above the horizontal. What is its displacement from its starting point. Use graphical techniques (with ruler, protractor and graph paper)

3. A novice pilot sets a plane's controls, thinking that the plane will fly 250 km/hr to the north. If the wind blows at 75 km/hr to the south east (135°), what is the plane's resultant velocity? Use graphical techniques (with ruler, protractor and graph paper)

4. While flying over the Grand Canyon, the pilot slows the planes engines down to one-half the velocity in item 3 (125 km/hr to the north). If the wind's velocity is still 75 km/hr to the southeast (135°), what will the planes new resultant velocity be? Use graphical techniques (with ruler, protractor and graph paper)

5. The water used in many fountains is recycled (ugh!). For instance, a single water particle in a fountain travels through an 85 m system and then returns to the same point. What is the displacement of a water particle during one cycle?