What is a vector quantity?
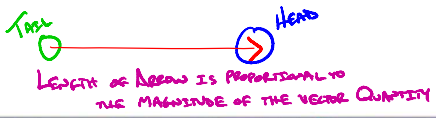
- A quantity that has both magnitude and direction
- Vectors (or arrows) are used to symbolize the quantity's size and direction

Tail ○———→ Head

Length of Arrow is Proportional to the Magnitude of the Vector Quantity

How Are Vectors Used?

- Vectors are used to represent size and direction graphically.
- Common vector quantities are:

Displacement
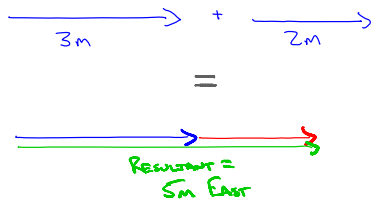Velocity
Acceleration
Force
Momentum

How Are Vectors Added?

- **Vectors are added head to tail.**
  - Draw the first vector the appropriate length and direction.
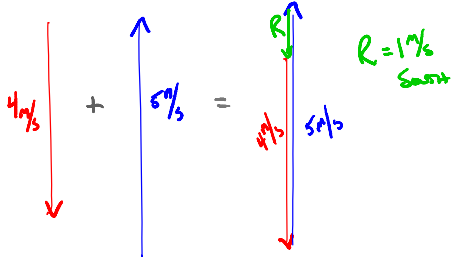 - Draw the second vector starting at the head (point) of the vector it is being added to.

Drawing the resultant

- **Draw the vector sum from the tail end of the first vector to the head (point) end of the last vector.**
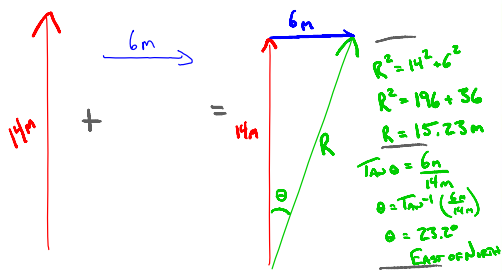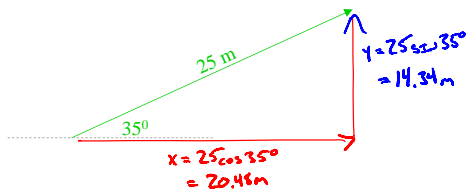
Adding Parallel Vectors

Adding Parallel Vectors

$R = 1\text{m/s}$
South

4m/s + 5m/s = R

Adding Perpendicular Vectors

6m

14m + 6m =

$R^2 = 14^2 + 6^2$
$R^2 = 196 + 36$
$R = 15.23\,m$
$\tan\theta = \dfrac{6m}{14m}$
$\theta = \tan^{-1}\left(\dfrac{6m}{14m}\right)$
$\theta = 23.2°$
East of North

Components

- All vectors can be broken into horizontal and vertical components

25 m
35°

$y = 25\sin 35°$
$= 14.34\,m$

$x = 25\cos 35°$
$= 20.48\,m$

3

Adding Non-Perpendicular Vectors

6 m/s

$X = 6$ m/s East

40^0

$Y = 8 \cos 40^0 = 6.13$ m/s South

8 m/s

Totals
$X = .86$ m/s East
$Y = 6.13$ m/s South

$X = 8 \sin 40^0 = 5.14$ m/s West

Adding Non-Perpendicular Vectors (cont.)

New Triangle

.86 m/s

6 m/s

$R^2 = .86^2 + 6^2$
$R^2 = 36.74$
$R = 6.06$ m/s
$\tan \theta = \frac{6}{.86}$
$\theta = \tan^{-1}\left(\frac{6}{.86}\right)$
$\theta = 81.8^\circ$ South of East
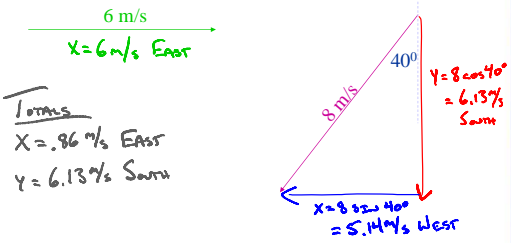
6.06 m/s, 81.8° South of East
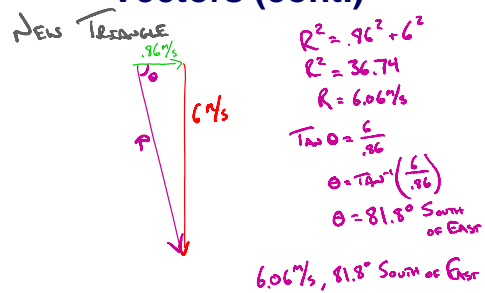
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