Chapter 3, no 1 –

Scalar vs. Vector – we did this already (See chapter 1 notes)

In writing a vector, put an arrow above the number or variable.

We use arrows to represent vectors. Longer arrows represent larger numbers.

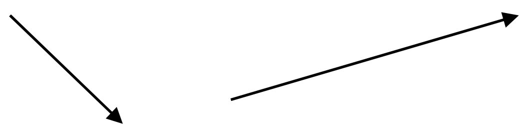
To add vectors, they must be of the same quantity (same units). You can't add acceleration (m/s^2) with distance (m).

Also can't add vectors of same dimensions and different units: can't add meters to feet.
One must be converted.

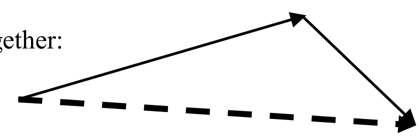
Vectors can be added together.

Easy if only two dimensional: you walk 100 m to the right, then 25 meters to the left. Your displacement is: +100 m – 25 m = 75 m to the right. MUST HAVE A DIRECTION IF THEY ARE VECTORS.

If 3 dimensional you have to use trigonometry.
Graphically you could use arrows: put them tail to arrowhead:

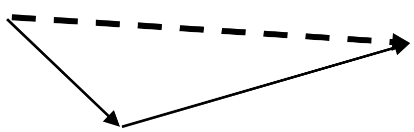


Adding them together:



The dotted line is the resultant (the sum of the two vectors)

If you add them together in the opposite order:



The resultant vector is the same.

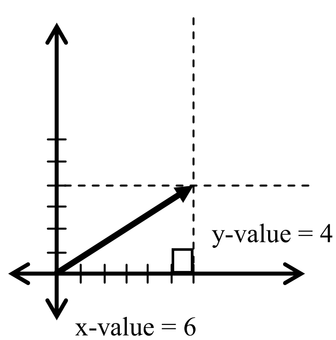
You could use a protractor to find the angle between the resultant and the first vector.

Subtracting Vectors: to subtract a vector, just add the negative:

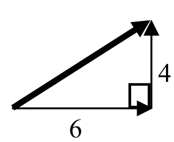
50 m/s minus a 100 m/s vector = 50 m/s—100 m/s = -50 m/s

Components:

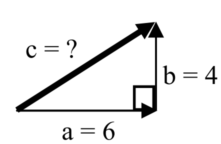
A point on a graph can be described by its x and y components. When we say an object is at (6,4) we mean it is 6 in the x direction and 4 in the y direction.



This vector could be represented by a right-triangle with a horizontal leg of 6 and a vertical leg of 4.



The length of the vector can be found using the Pythagorean theorem: $\mathbf{a^2 + b^2 = c^2}$



$\mathbf{a^2 + b^2 = c^2}$
$\mathbf{6^2 + 4^2 = c^2}$
$\mathbf{36 + 16 = c^2}$
$\mathbf{52 = c^2}$
$\mathbf{c = 7.2}$

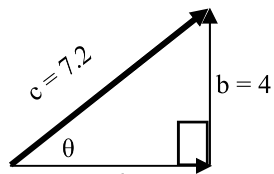
Finding the angle? Use trigonometry

tan θ = opposite/ adjacent

$\tan \theta = 4/6 = 2/3 = .667$

$\theta = \tan^{-1}(.667)$

$\theta = 34^o$



Other trig functions:

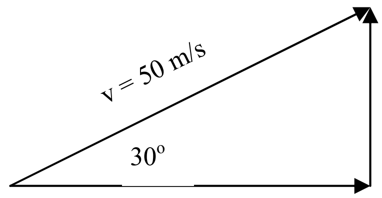
sin θ = opposite/hypotenuse

cos θ = adjacent/hypotenuse

Solving for components:

adjacent = (cos θ)hypotenuse

opposite = (sin θ)hypotenuse



PROBLEM: Find the component of a 50 m/s velocity moving 30° to horizontal.

Finding the x-component: the adjacent leg.

adjacent = (cos θ)hypotenuse
= $(\cos 30^o)50$ m/s
= (0.866)50 m/s
= 43.3 m/s in the x direction

Finding the y-component: the opposite leg.

opposite = (sin θ)hypotenuse
= $(\sin 30^o)50$ m/s
= (0.5)50 m/s
= 25 m/s in the y direction

Checking using the Pythagorean theorem:

$$a^2 + b^2 = c^2$$
$$25^2 + 43.3^2 = 50^2$$
$$625 + 1874.89 = 2500$$
$$2499.89 = 2500$$

(Difference due to rounding)