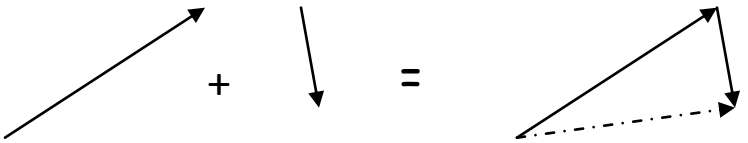
# Vectors in 2 dimensions [2.1]

Vector addition → add 'tail-to-tip'. The resultant 'starts at the start and ends at the end'. Dashed line = resultant

ie:



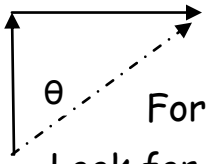
In grade 12, you are expected to solve this mathematically, not with scale drawings. You will see 3 types.

A: Collinear – lines in 1D – establish the +ve direction and add.

ie: 5m [N] + 2 m [S] = +5 + (-2) = +3 m [N]

B: Non-collinear – **easy** - lines in 2D – but perpendicular

ie: Go 3m [N] and then 4 m [E]. What is $\Delta d$ ?




Use Pythagorean & trigonometry.

For the length of resultant, use Pythagorean

Look for 3,4,5 pattern. So $\Delta d$ = 5 m

For the direction, use trigonometry. $\text{Tan}^{-1}\,\theta = 4/3 = 53°$

So… $\overrightarrow{\Delta d}$ = 5 m [N 53° E]

C: Non-collinear – **hard** – lines not perpendicular. Solve these with vector components – tedious but always works! Works with 2+ vectors too.

ie: Sailboat goes 20 km [E 25° N] and then tacks to [N 40° W] and continues along this line for 45 km. What is final displacement?

Basically, these are the steps: ***key is organization!***

1) Draw a relatively accurate sketch, including the resultant.

2) Lightly draw in the NSEW coordinates.

3) Break each vector in x and y components. (usually north & east = +ve directions)

4) Solve resultant x component ($r_x$) and solve resultant y component ($r_y$).

5) Add $r_x$ and $r_y$ – it will make a triangle.

6) solve using method #2 above!

** Full solution will be worked up on the board during class. If you miss, please see a classmate's notes. It's too difficult to 'draw' for computer.

**Subtracting Vectors** – pg. 68 – Simply add the opposite!

**Acceleration** - Interestingly, example 3 – pg. 68 – if your speed remains constant, but your direction changes, you have accelerated! You can use this method to determine the acceleration! (a = v2-v1/t). You will need to 'add the opposite' with vectors, determine $\Delta v$ and then divide by time.