Drawing & Adding Vectors

Motion - involves a change in the position of an object over time.

Motion can be described in **scalar** or **vector** terms. **'Scalar'** means there is no reference to direction (distance, speed & acceleration). **'Vector'** means one takes note of direction (displacement, velocity & acceleration). Physicists prefer vectors. In symbol form, how do you know a variable is a vector?

put vector arrow on top

Working with NESW reference coordinates

Quite often we use north/south/east/west reference coordinates but the object is moving or is positioned obliquely (ie: NOT due north,south,east or west). So we might say the position is 25 km [E 35° S]. To translate this, start pointing east, then drop 35° towards south. This is the direction! There are other ways to describe direction, but I prefer this way since you follow the directions in order!

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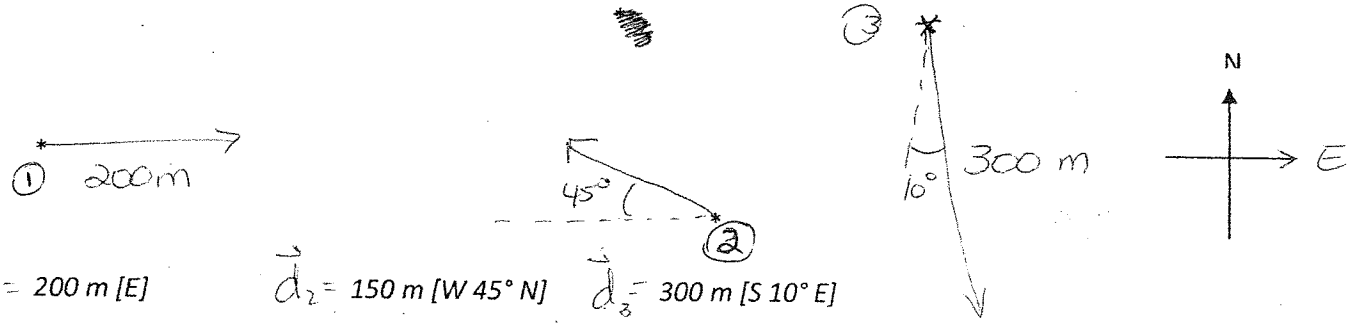
Vectors are represented by a line with an arrowhead at the end in the direction of travel. The tail is the origin (start) and the tip is the end or arrowhead.

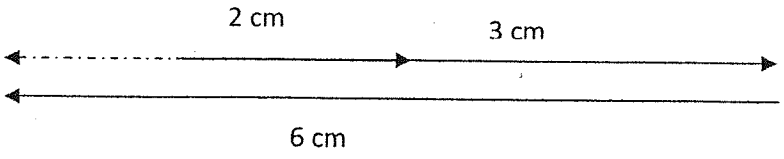
~~Use a scale of 1 cm = 100 m~~ and draw the following accurately. * is the reference point.



$\vec{d}_1$ = 200 m [E] $\vec{d}_2$ = 150 m [W 45° N] $\vec{d}_3$ = 300 m [S 10° E]

Adding ***Collinear*** *vectors* – these are vectors that are drawn in 1 plane. In other words, in 1 dimension (1D) or in a straight line. (north and south vectors, up and down vectors). Simply draw (add) them tail-to-tip style. The resultant vector (the sum, the answer) is draw from the tail of the first vector to the tip of final vector. It is dotted ----------→

ie: 2 cm [right] + 3 cm [right] + 6 cm [left] would look like this:



←---------- = the resultant. You could measure, but logic tells you it's 1 cm [left].

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You can also use scale drawings (OK) or math (preferable). Math results would use integers in 1 dimension. Ie: set [right] = +ve. Therefore, you would have:

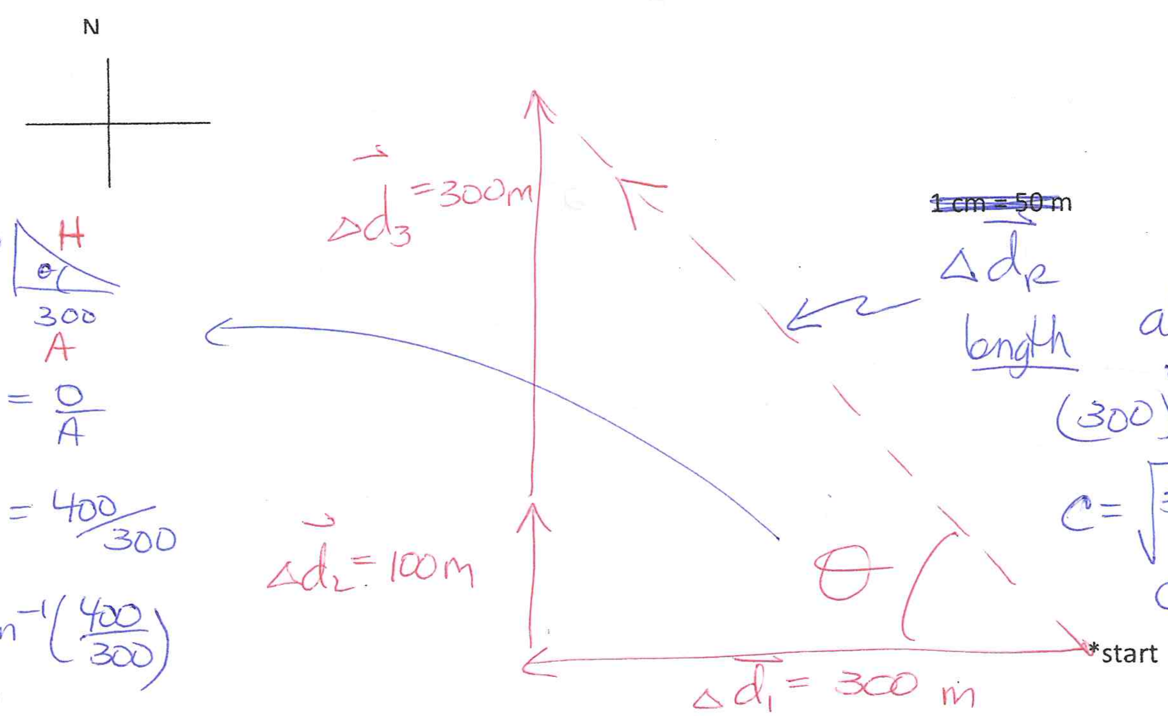
(+2 cm) + (+3 cm) + (-6 cm) = -1 cm [right].

* you always set the final [direction] as the one you set +ve. You can reverse the direction.
So… -1 cm [right] = +1 cm [left] Notice: I switch the sign AND the direction!

(*) *Adding* ***Non-Collinear*** *vectors* – these are vectors that are drawn in 2 planes. In other words, in 2 dimensions (2D) or **not** in a straight line. (north and east vectors, up and left vectors). Simply draw (add) them tail-to-tip style. The resultant vector (the sum, the answer) is draw from the tail of the first vector to the tip of final vector. (tail-to-tip) It is dotted. –·–·–·–·–·–·▸

Try this one: I start at reference point A and travel 300 m [W], then 100 m [N] and then 300 m [N] at which point I stop. This is point B. Label these points.
What is the distance travelled? Δd = Add the distances 300 + 100 + 300 = 700 m
How do I calculate the displacement? Δd = DRAW + use pythagorean & trig.

Remember it is the *straight line* change in position. You will need to do a tip-to-tail scale drawing.
Hint: look at Fig. 1.8 on page 10 of your text. Tail-to-tip connect 'A' to 'B'. Try!



θ (triangle: O = 400, A = 300, H)

$\tan\theta = \frac{O}{A}$

$\tan\theta = \frac{400}{300}$

$\theta = \tan^{-1}\left(\frac{400}{300}\right)$

$\theta = 53^\circ$

Δd_R length

$a^2 + b^2 = c^2$

$(300)^2 + (300+100)^2 = c^2$

$c = \sqrt{300^2 + 400^2}$

$c = 500$ m

Remember: include scale and reference coordinates! Accuracy counts!
Mathematic solutions are preferred. Do you know how to do this? **Stay tuned……tomorrow in class!**

so… my final displacement $\vec{\Delta d_R}$ = 500 m [W 53° N]