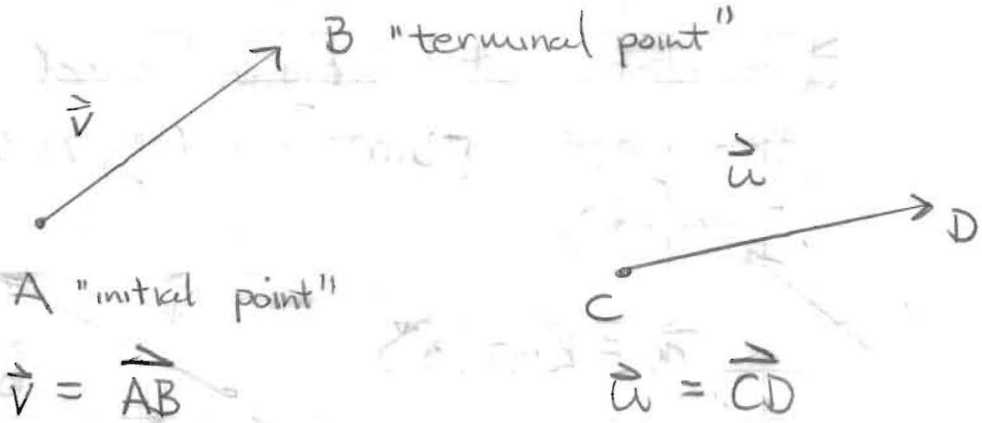
Section 12.2 - Vectors (DAY 1)

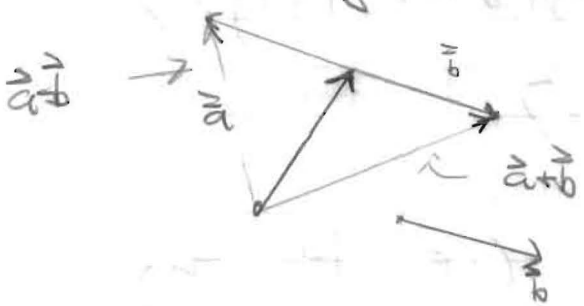
(I) Definition: "vector" - used by scientists to indicate a quantity that has both magnitude and direction



$\vec{v} = \overrightarrow{AB}$ $\quad\quad$ $\vec{u} = \overrightarrow{CD}$

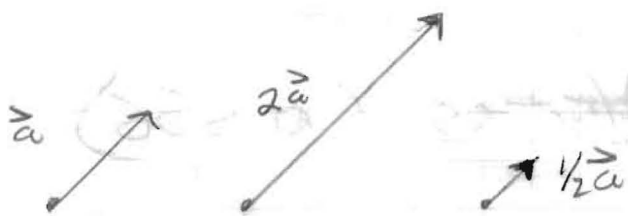
ⓐ "zero vector" - no length or directions

(II) Adding / Subtracting Vectors



note: $\vec{a}-\vec{b} = \vec{a}+(-\vec{b})$

(III) Scaler Multiplication



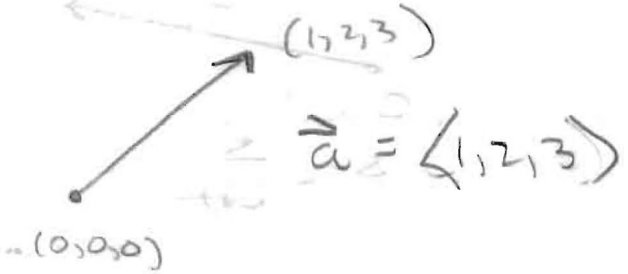
Section 12.2 - Vectors (Day 2)

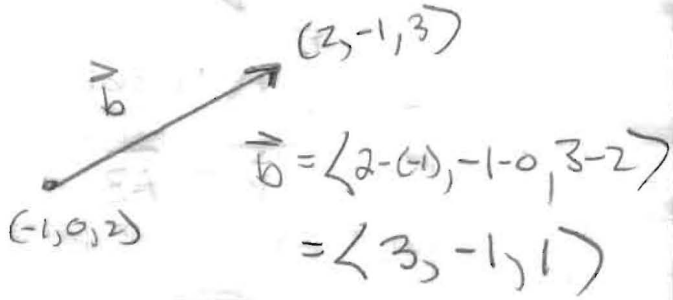
⇒ Treating vectors algebraically

I Components

$\vec{a} = \langle a_1, a_2, a_3 \rangle$ in 3-D.

i.e. If $\vec{a}$ starts at origin and has terminal point $(1, 2, 3)$





(II) Vector Algebra

(a) $\vec{a} + \vec{b} = \langle 1, 2, 3 \rangle + \langle 3, -1, 1 \rangle = \langle 4, 1, 2 \rangle$

(b) $2\vec{a} = 2\langle 1, 2, 3 \rangle = \langle 2, 4, 6 \rangle$

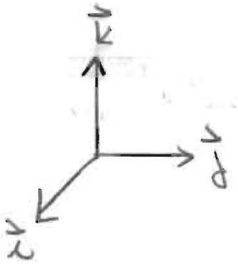
(III) Magnitude of Vector (i.e. length)

$\vec{a} = \langle a_1, a_2, a_3 \rangle \quad |\vec{a}| = (a_1^2 + a_2^2 + a_3^2)^{1/2}$

(IV) Properties of Vectors (p 656)

(V) Standard Basis Vectors

$\vec{i} = \langle 1,0,0 \rangle \quad \vec{j} = \langle 0,1,0 \rangle \quad \vec{k} = \langle 0,0,1 \rangle$



$\Rightarrow$ If $\vec{a} = \langle a_1, a_2, a_3 \rangle$

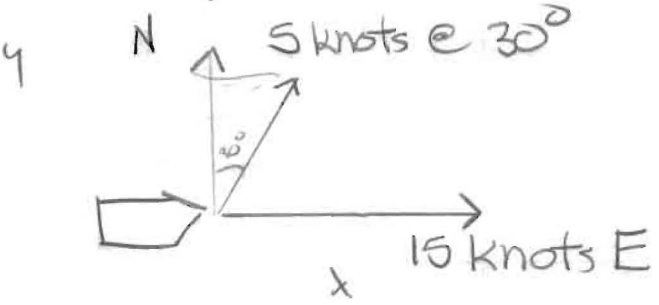
$= a_1\vec{i} + a_2\vec{j} + a_3\vec{k}$

(VI) Unit Vector - "Vector w/ Length of One"

$\vec{a} = \langle a_1, a_2, a_3 \rangle$

$\Rightarrow \vec{u} = \dfrac{\vec{a}}{|\vec{a}|}$

(VII) Example



Speed $= \vec{s} = \langle 15, 0 \rangle$

current $= \vec{c} = \langle 5\sin 30, 5\cos 30 \rangle$

$= \langle 2.5, 2.5\sqrt{3} \rangle$

$\therefore \vec{v} = \vec{s} + \vec{c} = \langle 17.5, 2.5\sqrt{3} \rangle$

$|\vec{v}| = \left[17.5^2 + (2.5\sqrt{3})^2\right]^{1/2} = 18.03$ knots, $\theta = \tan^{-1}\left[\dfrac{2.5\sqrt{3}}{17.5}\right] = 14.97^\circ$

$\alpha = 90 - 14.97^\circ \approx 75^\circ$