

Math Lab TEC 142

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Lecture Notes, Videos

Coursepack

D2L or

www.leahhoward.com/251CP.pdf

COURSE OVERVIEW : Geometry and Algebra

Geometry : distances and angles in  
2D and 3D

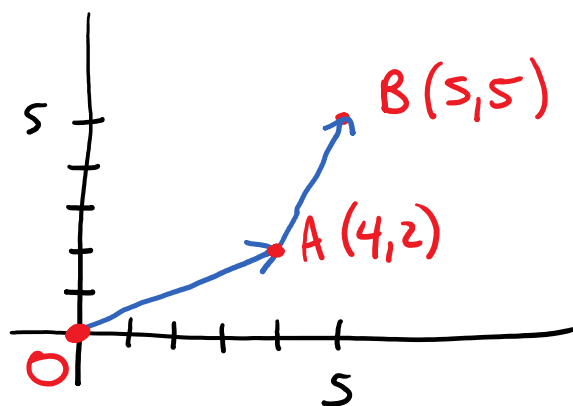
Algebra : formulas, calculations  
in higher dimensions

e.g. tracking an object's  
location and temperature  
requires 4 dimensions

1.1 Geometry and Algebra of Vectors

Vector : line segment with direction  
Used for forces, velocity etc.

Ex:



$$\vec{OA} = [4, 2]$$

$$\vec{AB} = [1, 3] \quad \text{Think } B-A$$

↑ ↑  
"Components" of  $\vec{AB}$

Could write  $\vec{OA} = \begin{bmatrix} 4 \\ 2 \end{bmatrix}$

$$\vec{AB} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$$

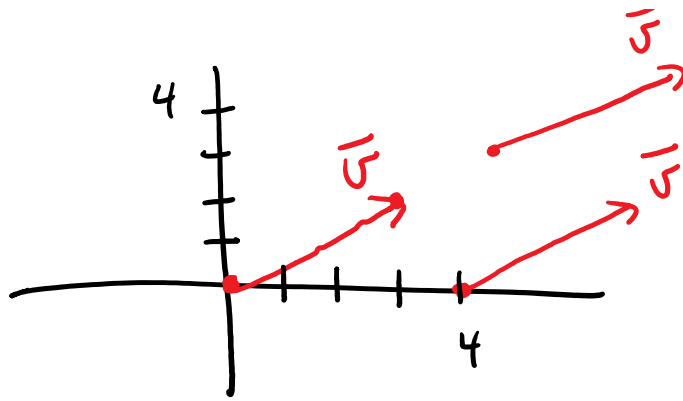
Ex: Points  $C = (-1, -3)$   $D = (2, -1)$

Find  $\vec{v} = \vec{CD}$  and draw it.

$$\vec{v} = [2 - (-1), -1 - (-3)] \quad \text{Think } D-C \\ = [3, 2]$$

4 1





A given vector can be drawn from any initial position.

Rephrased: Same length and same direction  
 $\Rightarrow$  same vector.

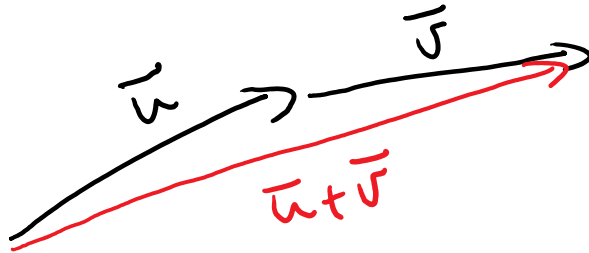
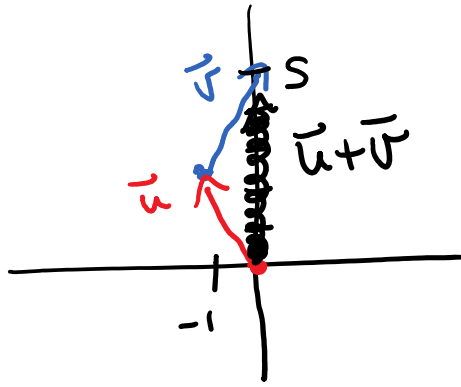
A vector is in standard position if it starts at the origin.

Notation:  $[1, 3]$  is a vector  
 $(1, 3)$  is a point

Ex: Vector addition

$$\vec{u} = [-1, 2] \quad \vec{v} = [1, 3]$$

$$\vec{u} + \vec{v} = [0, 5]$$

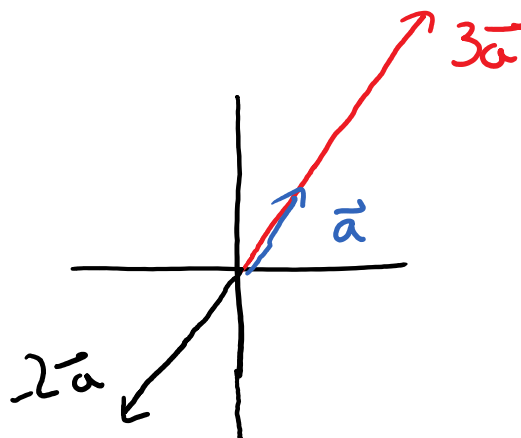


Ex: Scalar Multiplication

$$\vec{a} = [2, 3]$$

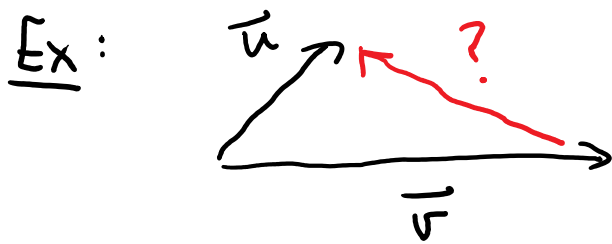
$$3\vec{a} = [6, 9]$$

$$-2\vec{a} = [-4, -6]$$



$\vec{a}$ ,  $3\vec{a}$ ,  $-2\vec{a}$  are all parallel

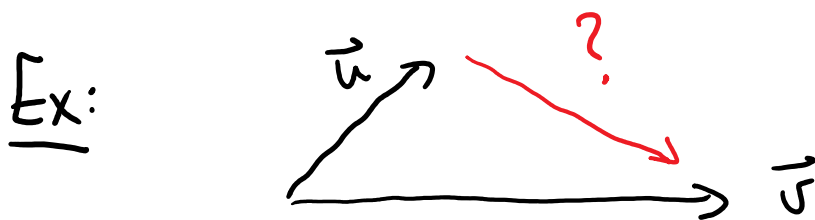
$$\underline{\text{Ex:}} \quad [2, 6] - [3, 4] = [2, 6] + [-3, -4] \\ = [-1, 2]$$



? = backwards along  $\vec{v}$ ,  
then along  $\vec{u}$

$$= -\vec{v} + \vec{u}$$

$$\text{or } \vec{u} - \vec{v}$$



? =  $\vec{v} - \vec{u}$  (negative of above vector)

