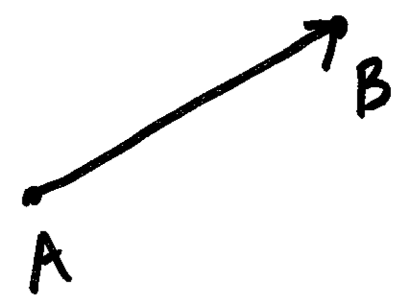
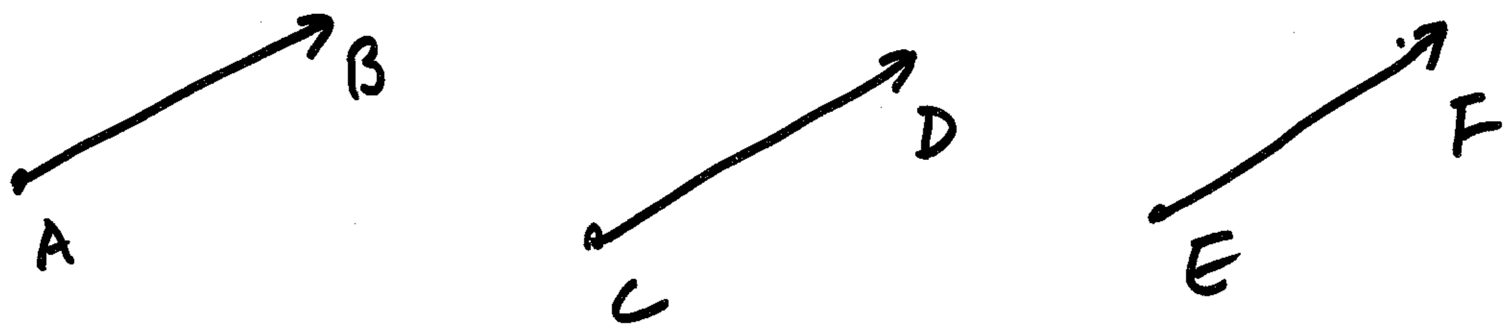
Lesson 2 Section 12.2

Vectors.

(i) Oriented Segment:



(ii) Identify all oriented segments that have the same orientation and Same length length



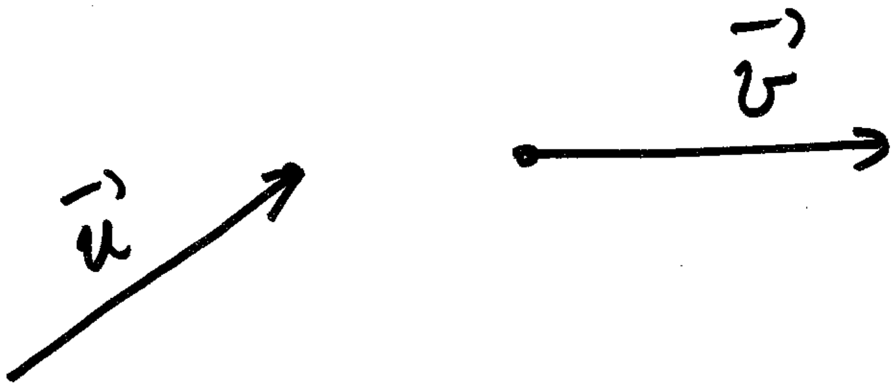
iii) The vector ~~a~~ ~~the~~ associated with $\vec{AB}$. is the family of oriented segments given or represented by $\vec{AB}$.

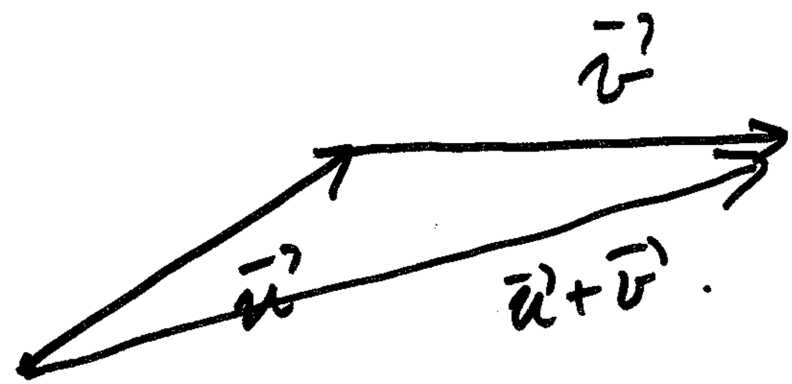
The zero vector.

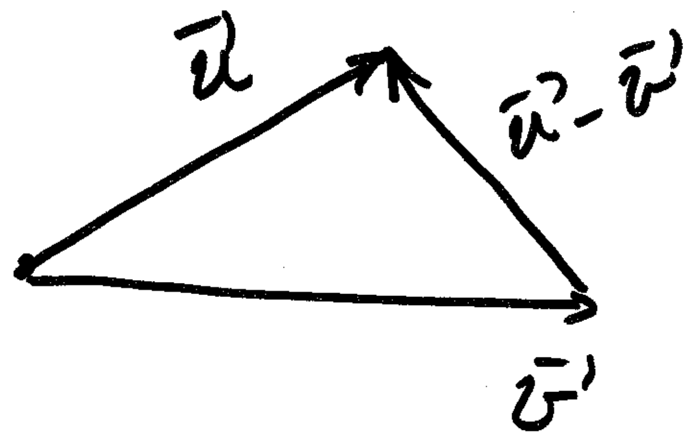
$\vec{0}$ = Vector of length zero

No given orientation

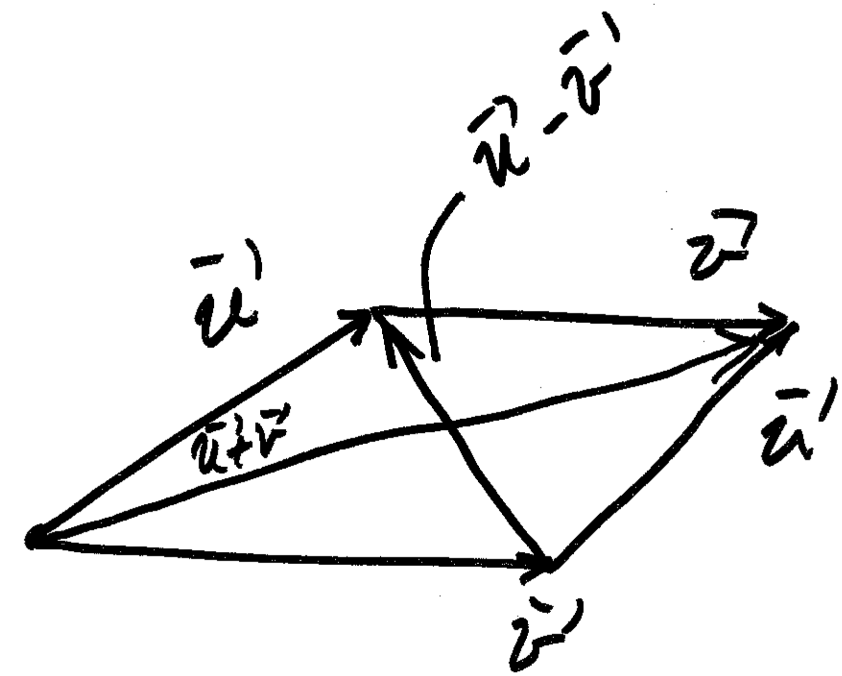
Addition: Geometric Definition.





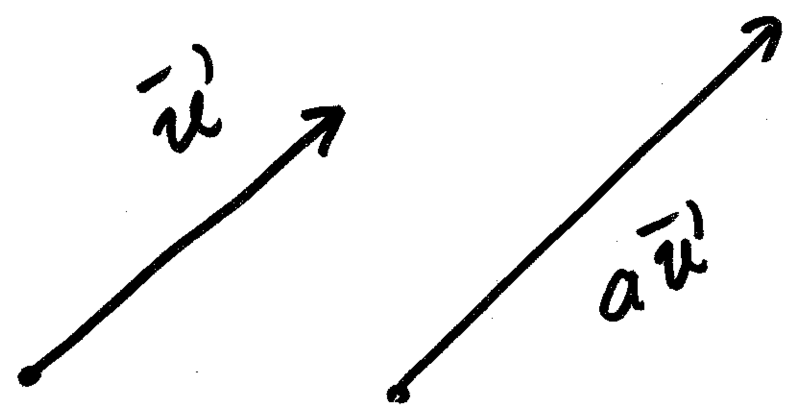


$\vec{v}+(\vec{u}-\vec{v})=\vec{u}$



Multiplication by Numbers (or Scalars)

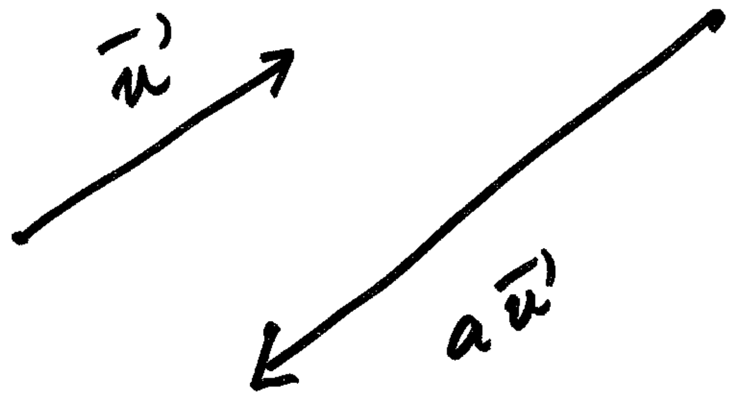
<u>$a > 0$</u>



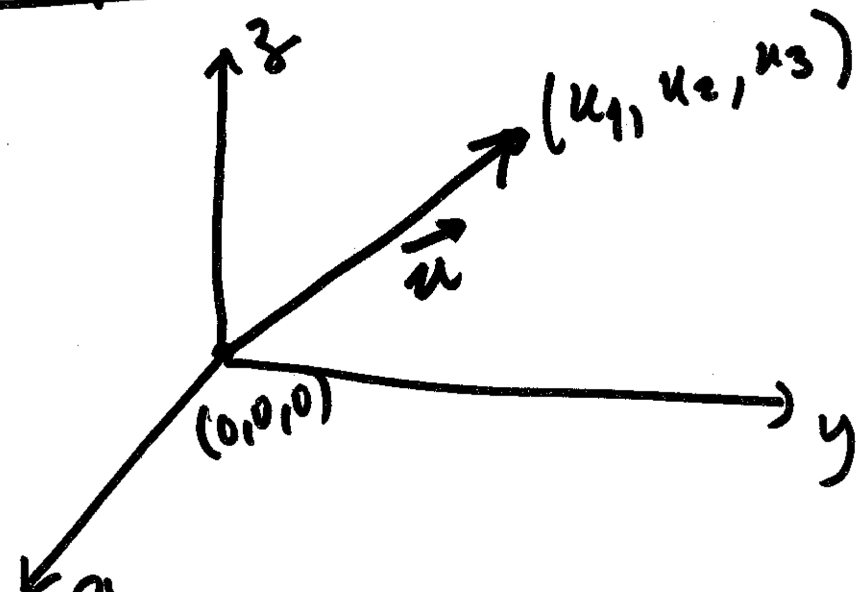
the length of $a\vec{u}$

$= |a| \cdot$ length of u

If $a < 0$



The use of Coordinates



$$\vec{u} = \langle u_1, u_2, u_3 \rangle$$

Vector.

<u>Addition:</u>

$$\vec{u} = \langle u_1, u_2, u_3 \rangle$$

$$\vec{v} = \langle v_1, v_2, v_3 \rangle$$

$$\vec{u} + \vec{v} = \langle u_1 + v_1, u_2 + v_2, u_3 + v_3 \rangle$$

<u>Multiplication:</u>

$$a\,\vec{u} = \langle a u_1, a u_2, a u_3 \rangle.$$

Example: $\vec{u} = \langle 1, 5, 6 \rangle$, $\vec{v} = \langle -2, 3, 4 \rangle$

Compute $\vec{u} + 3\vec{v}$.

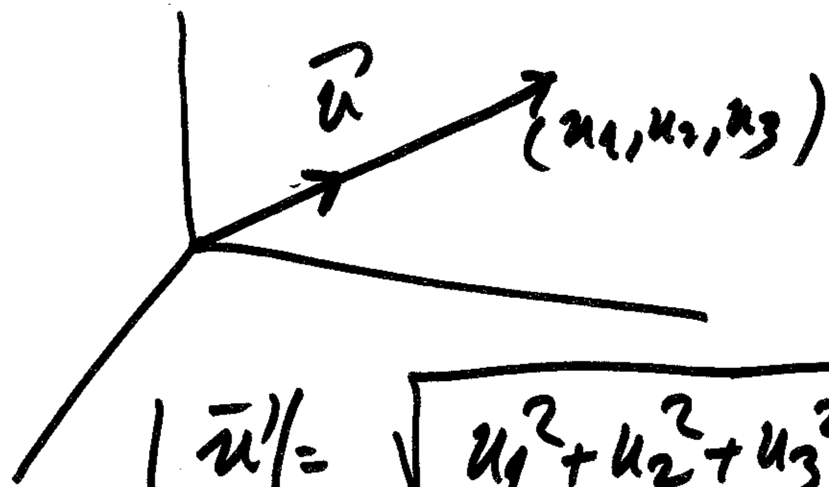
$$\vec{u} + 3\vec{v} = \langle 1, 5, 6 \rangle + 3\langle -2, 3, 4 \rangle$$

$$= \langle 1, 5, 6 \rangle + \langle -6, 9, 12 \rangle$$

$$= \langle -5, 14, 18 \rangle.$$

Unit vectors: The length of a vector

$$\vec{u} = \langle u_1, u_2, u_3 \rangle$$



$$|\vec{u}| = \sqrt{u_1^2 + u_2^2 + u_3^2}.$$

<u>Example:</u> $\vec{u} = \langle 0, 1, 3 \rangle$,

$$|\vec{u}| = \sqrt{0^2 + 1^2 + 3^2} = \sqrt{10}.$$

A unit vector is a vector of length 1.

The vector $\vec{w} = \dfrac{\vec{u}}{|\vec{u}|}$

$$|\vec{w}| = 1.$$

In the example: $\vec{w} = \dfrac{1}{\sqrt{10}} \langle 0, 1, 3 \rangle$

has length 1 and points in the direction of $\vec{u}$.

If we write

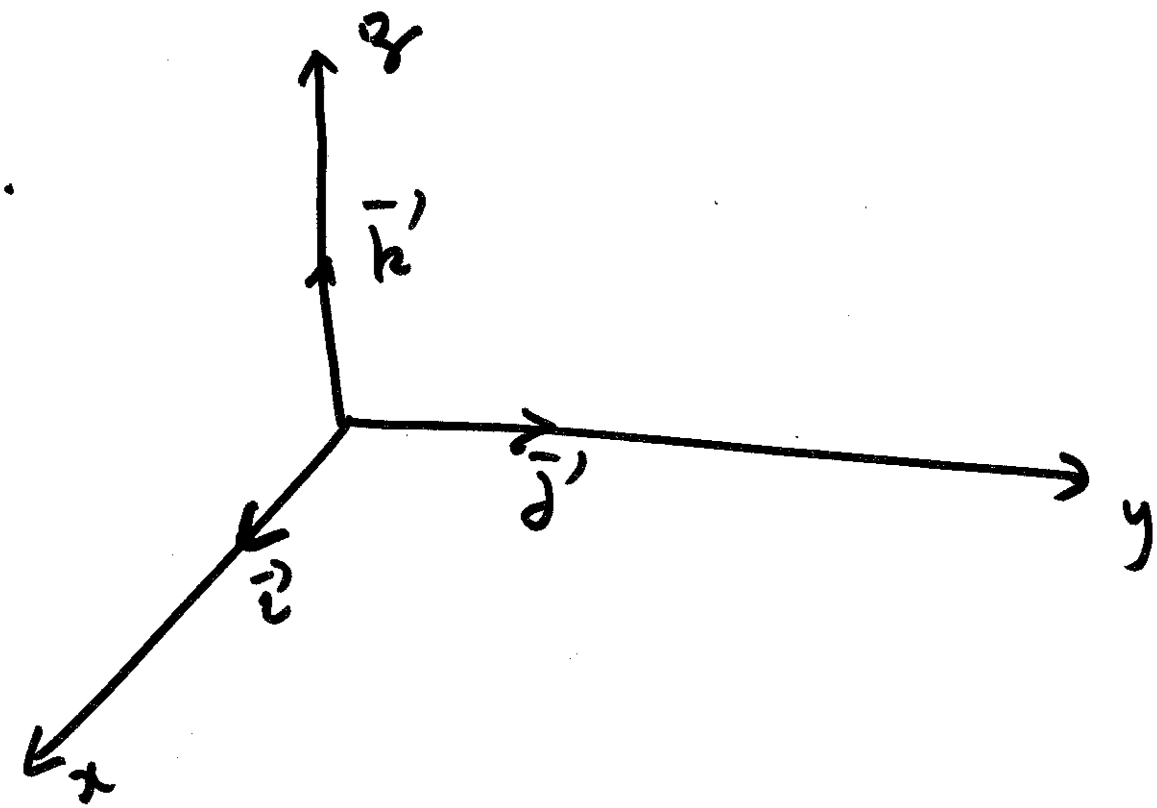
$$\vec{u} = \langle u_1, u_2, u_3 \rangle =$$

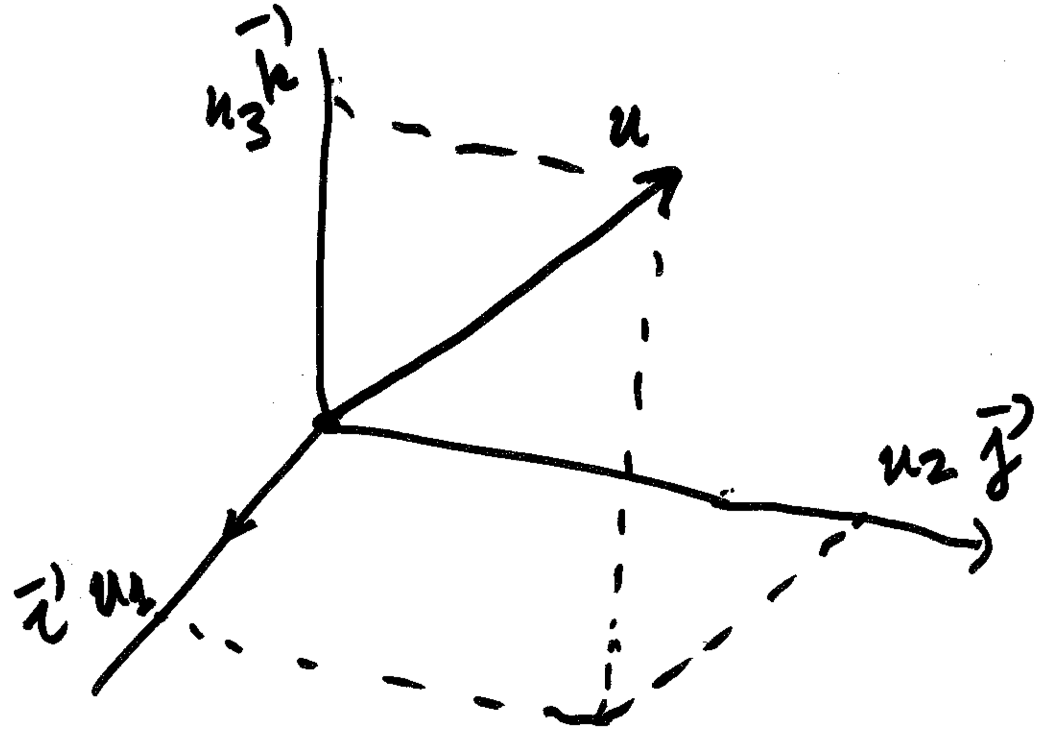
$$= u_1 \langle 1, 0, 0 \rangle + u_2 \langle 0, 1, 0 \rangle + u_3 \langle 0, 0, 1 \rangle$$

$$\langle 1, 0, 0 \rangle = \vec{i}.$$

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

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





$$\vec{u} = u_1\vec{i} + u_2\vec{j} + \vec{u}_3\vec{k} = \langle u_1, u_2, u_3 \rangle$$