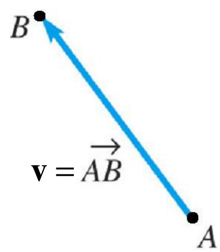
Section 12.2 Vectors

Quantities such as area, volume, mass, and time can be characterized by a ______________________

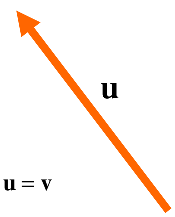
Other quantities such as displacement, velocity, and force involve both _________ and _____________.

To represent these quantities we use a _________ represented by a directed line segment (arrow)



The __________ of a vector is represented by $|\mathbf{v}|$ or $\|\mathbf{v}\|$.

Any other vector **u** that has the same magnitude and direction as **v** is called an equivalent or equal vector $\Rightarrow \mathbf{u} = \mathbf{v}$

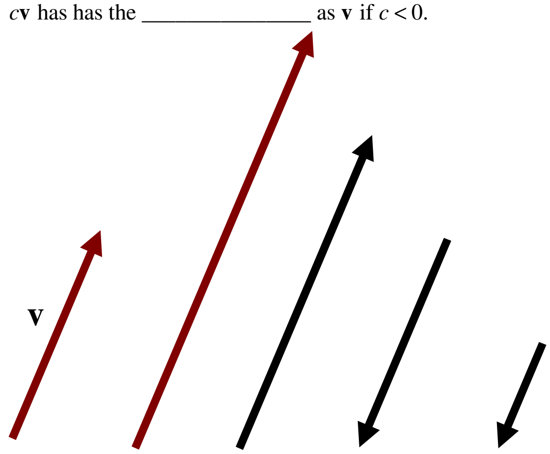


We can multiply a vector by a real number c.
This is called _____________________.

$c\mathbf{v}$ has a magnitude that is ____ times the magnitude of $\mathbf{v}$.

$c\mathbf{v}$ has has the _____________ as $\mathbf{v}$ if $c > 0$.

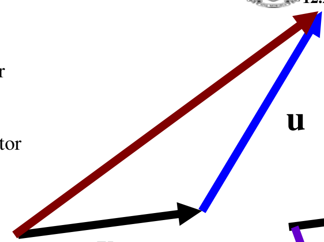
$c\mathbf{v}$ has has the ________________ as $\mathbf{v}$ if $c < 0$.

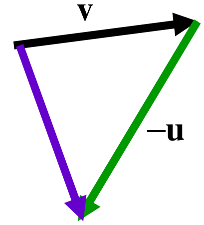


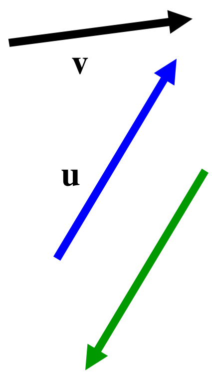
We can add a vector **v** to another vector **u**.
This is called __________________, $\mathbf{v}+\mathbf{u}$

Connect the ________ point of the first vector
to the ________ point of the second vector

When connected this way, the sum is the vector
from the ______ point of the first vector
to the _________ point of the second vector

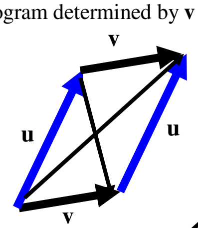


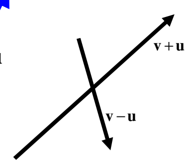




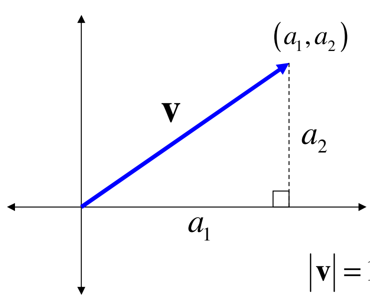
Vector subtraction $\mathbf{v}-\mathbf{u}$ is just vector addition in disguise $\mathbf{v}+(-\mathbf{u})$

This can all be summed up using the parallelogram determined by **v** and **u**.





So far we have studied vectors ____________.
We now want to look at vectors ___________.



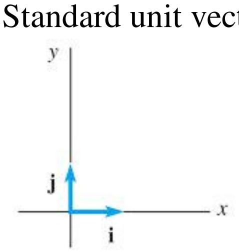
$\mathbf{v} = \langle \qquad \rangle$

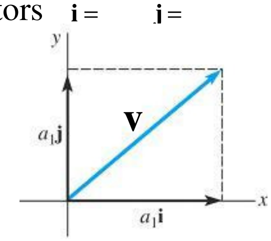
The magnitude of **v** is found by:

$|\mathbf{v}| =$

$|\mathbf{v}| = 1 \Rightarrow$ the vector is called a _____________

Standard unit vectors $\mathbf{i} =$ $\mathbf{j} =$





Now **v** can be written as :

$\mathbf{v} =$

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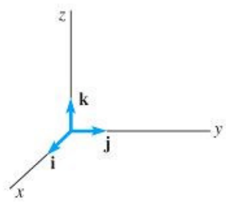
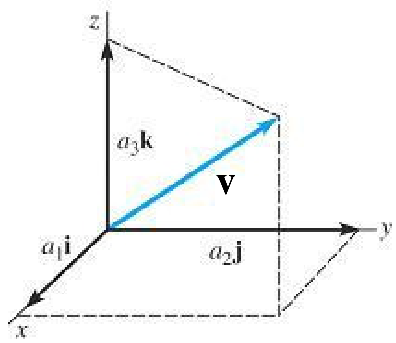
Now for 3 dimensions we have:



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

$$\mathbf{v} = a_1\mathbf{i} + a_2\mathbf{j} + a_3\mathbf{k}$$
$$\mathbf{v} = \langle a_1, a_2, a_3 \rangle$$



$a_1, a_2,$ and a_3 are called the ___________ of **v**

More specifically,

$a_1 =$

$a_2 =$

$a_3 =$

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Scalar Multiplication:

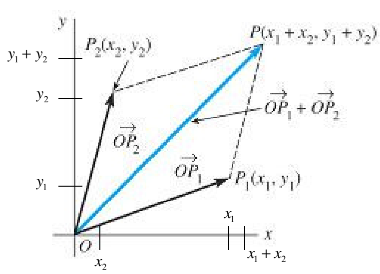
$\mathbf{v} = \langle a_1, a_2, a_3 \rangle$ scaled by a factor c

$c\mathbf{v} =$

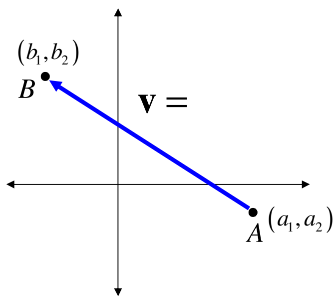
Vector Addition:

$\mathbf{v} = \langle a_1, a_2, a_3 \rangle$ added to $\mathbf{u} = \langle b_1, b_2, b_3 \rangle$

$\mathbf{v} + \mathbf{u} =$



Vector from a point A to another point B:

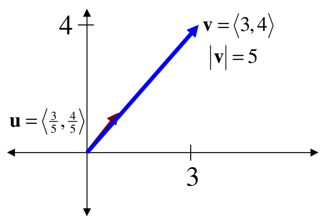


$\mathbf{v} =$

In 3-dimensions

$\mathbf{v} =$

A unit vector $\mathbf{u}$ in the same direction as another vector $\mathbf{v}$:



Scale the vector $\mathbf{v}$ by the recirocal of $|\mathbf{v}|$

$\mathbf{u} =$

$\mathbf{u} =$

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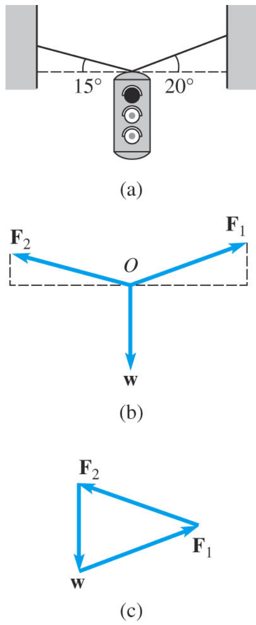
⊙ Find the component form and magnitude of the vector $\mathbf{v}$ with the initial point $(3, 2, 0)$ and terminal point $(4, 1, 5)$.

⊙ Find $3\mathbf{v}$.

⊙ Find a unit vector in the direction of $\mathbf{v}$.



A 200 lb. traffic light supported by two cables hangs in equilibrium.
As shown in figure (b), let the weight of the light be represented by **w** and the forces in the two cables by $\mathbf{F}_1$ and $\mathbf{F}_2$.

As shown in figure (c), the forces can be arranged to form a triangle.
Equilibrium implies that the sum of the forces is **0**.
Find $\mathbf{F}_1$ and $\mathbf{F}_2$, and Find the magnitudes of $\mathbf{F}_1$ and $\mathbf{F}_2$.