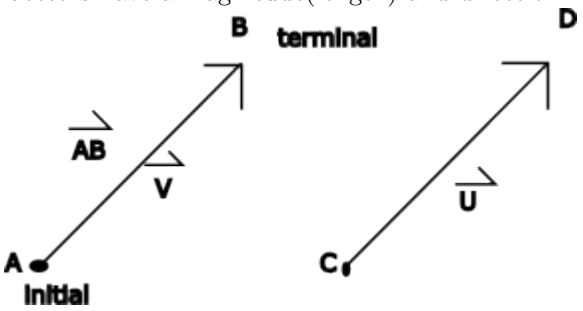
1 Vectors

Vectors have a magnitude(length) and direction.

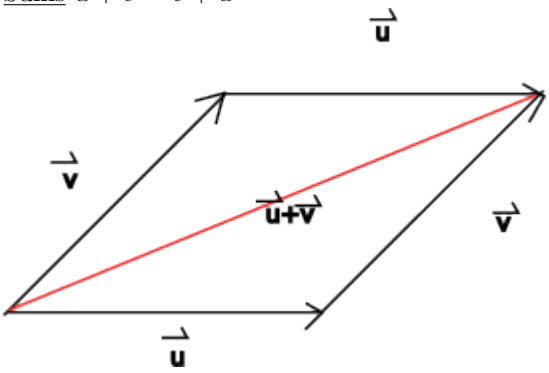


$\vec{u}$ & $\vec{v}$ have the same direction and magnitude, $\therefore$ they are equivalent.

Zero Vector $\vec{O}$ has length zero.

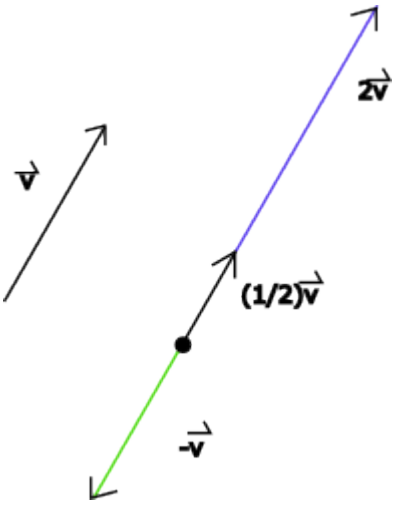
Vectors appear in forces, position, velocity, acceleration, torque, displacement, images.

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

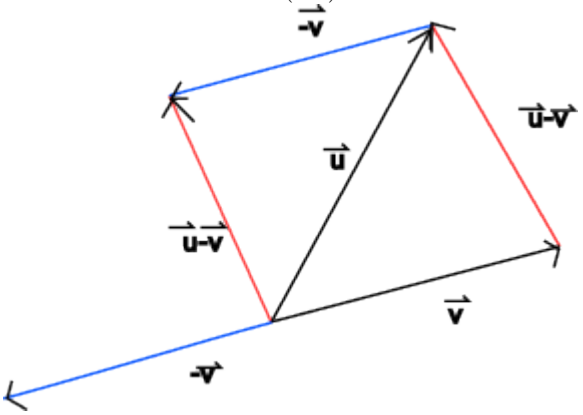


Scalar Multiplication

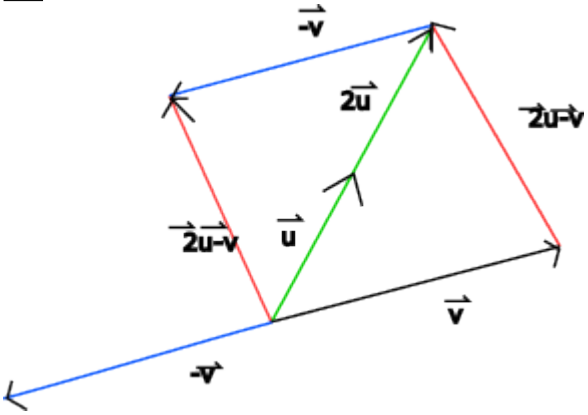
- If $c \in \mathbb{R}$, then vector $c\vec{v}$ has length —c— times the length of $\vec{v}$ and
  - the same direction as $\vec{v}$ if $c > 0$
  - opposite direction as $\vec{v}$ if $c < 0$
- If $c = 0$ or $\vec{v} = \vec{o}$, then $c\vec{v} = 0$



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

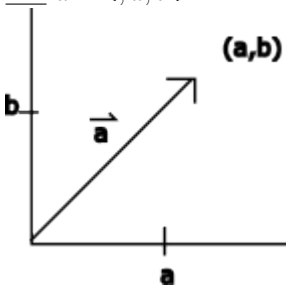


Ex: Consider $\vec{u}$ *and* $\vec{v}$. Sketch $2\vec{u} - \vec{v}$

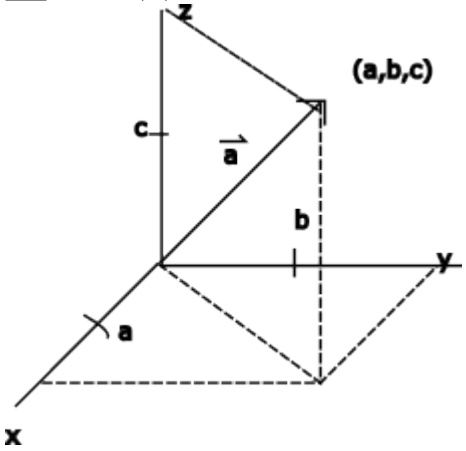


Components

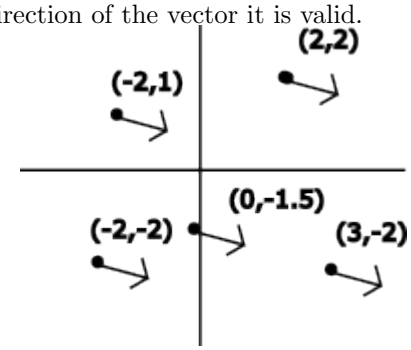
2D: $\vec{a} =< a, b >$



3D: $\vec{a} =< a, b, c >$



Sketch vectors equivalent to $\vec{a} =< 2, -1 >$
Choose any initial position in the graph. So long as it obeys the magnitude and direction of the vector it is valid.



Unmarked in the graph is the point $o\vec{P}$ which is the position vector for point P, otherwise known as the origin.

Find components of the vector $\vec{a}$ that has the following:
Initial Point: $(3, 1)$
Terminal Point: $(-2, 5)$

Vector $\vec{a}$ has point $(-2 - 3, 5 - 1) = (-5, 4)$

Find components of the vector $\vec{b}$ that has the following:
Initial Point: $(1, 2, 3)$
Terminal Point: $(-2, 5, -7)$

Vector $\vec{a}$ has point $(-2-1, 5-2, -7-3) = (-3, 3, -10)$

To sum up, In general $\vec{AB}$ has components $B(x_2, y_2),\ A(x_1, y_1)$ and is the result of $\vec{AB} =< x_2 - x_1, y_2 - y_1 >$

Vector $\vec{ABC}$ has components $B(x_2, y_2, z_2),\ A(x_1, y_1, z_1)$.
It is the result of $\vec{ABC} =< x_2 - x_1, y_2 - y_1, z_2 - z_1 >$