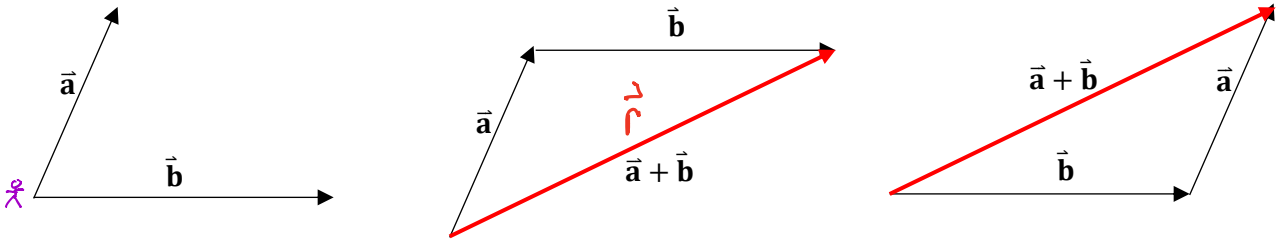
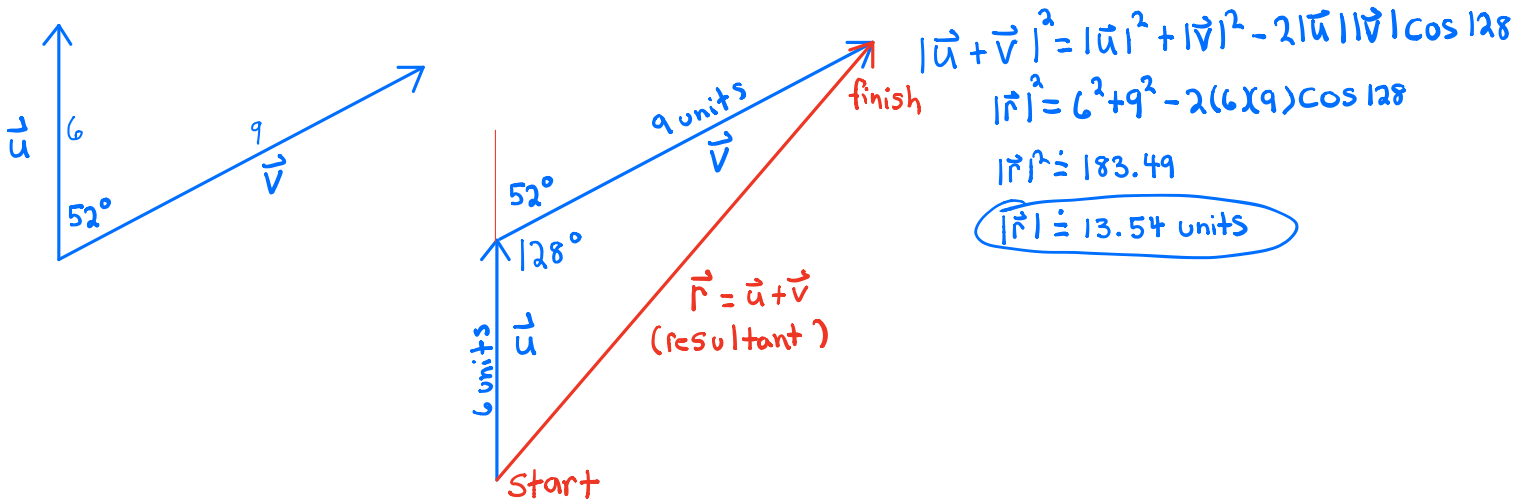
# VECTOR ADDITION

## *The Triangle Law for Adding Two Vectors*

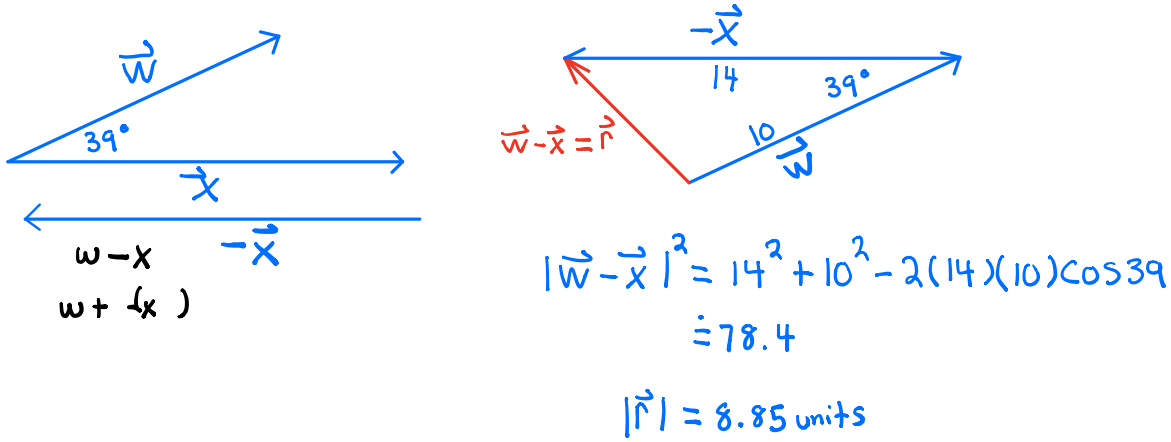
- When adding two vectors the tail of one vector (e.g. $\vec{a}$ ) is attached to the tip of the other vector (e.g. $\vec{b}$ )
- The "**resultant**" vector (e.g. $\vec{a}+\vec{b}$ ) is constructed from the tail of one vector to the tip of the other vector




Ex. 1
Given vectors $\vec{u}$ and $\vec{v}$ such that the angle between them is 52°, $|\vec{u}| = 6$ and $|\vec{v}| = 9$, determine $|\vec{u}+\vec{v}|$. Include a diagram.



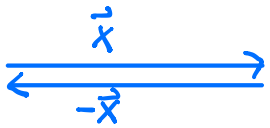

Ex. 2
Given vectors $\vec{w}$ and $\vec{x}$ such that the angle between them is 39°, $|\vec{w}| = 10$ and $|\vec{x}| = 14$, determine $|\vec{w}-\vec{x}|$. Include a diagram.




## *The Zero Vector*

- When two vectors are added that are equal in magnitude and opposite in direction, the resultant is the zero vector.
- The zero vector has a magnitude of 0 and no defined direction.

$\vec{x}-\vec{x}=\vec{0}$

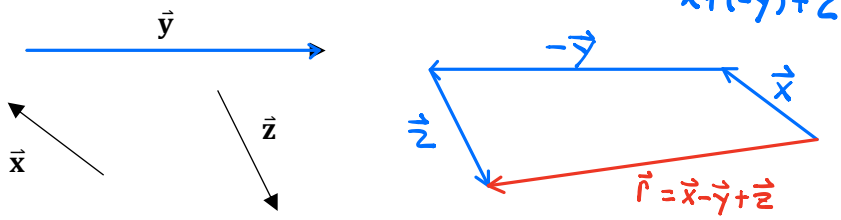


Ex. 3

Given vectors shown, construct one vector equivalent to $\vec{x} - \vec{y} + \vec{z}$.

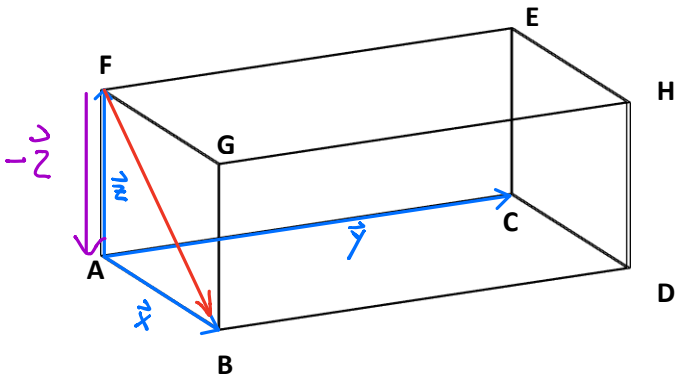
$\vec{z} + \vec{x} - \vec{y}$

$\vec{x} + (-\vec{y}) + \vec{z}$




Ex 4.

Express each of the following in terms of $\vec{x}, \vec{y}$ and $\vec{z}$ , where $\vec{x} = \overrightarrow{AB}$, $\vec{y} = \overrightarrow{AC}$, and $\vec{z} = \overrightarrow{AF}$




a) $\overrightarrow{BD} = \vec{y}$ b) $\overrightarrow{EC} = -\vec{z}$

c) $\overrightarrow{FB} = -\vec{z} + \vec{x}$ d) $\overrightarrow{DA} = -\vec{x} - \vec{y}$

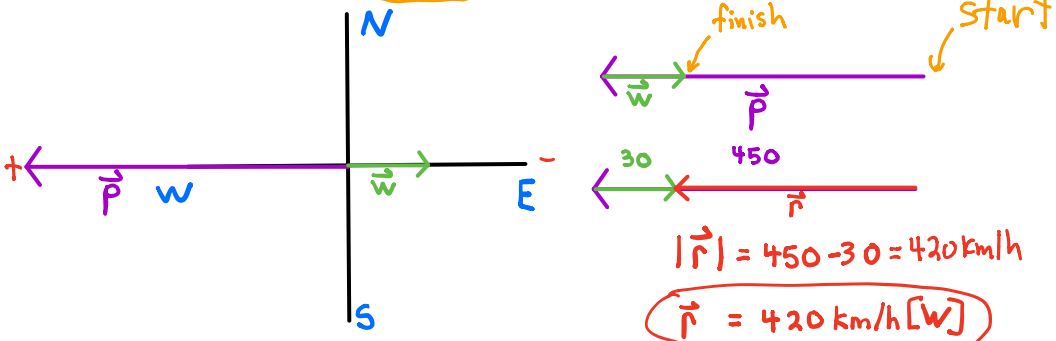
$= \vec{x} - \vec{z}$

e) $\overrightarrow{BE} = -\vec{x} + \vec{y} + \vec{z}$

Ex 5.

A plane is travelling due west at 450 km/h. The velocity of the plane is affected by the direction and speed of the wind. Determine the resultant ground velocity for each case.

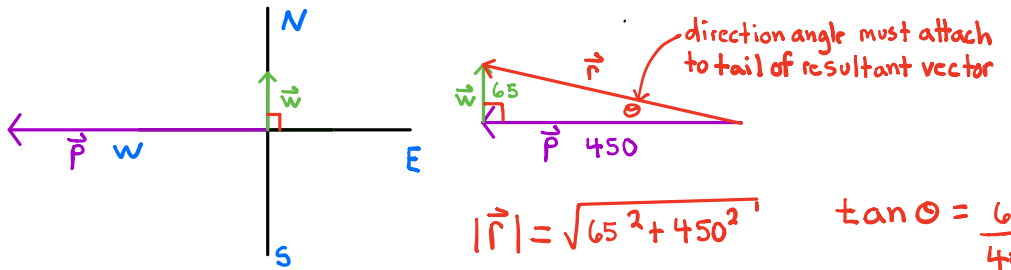
a) The wind is from the west (pointed east) at 30 km/h.




$|\vec{r}| = 450 - 30 = 420$ km/h

$\vec{r} = 420$ km/h [W]

b) The wind is from the south at 65 km/h




$|\vec{r}| = \sqrt{65^2 + 450^2}$

$\doteq 455$ km/h

$\tan\theta = \frac{65}{450}$

$\theta \doteq 8°$

$\vec{r} = 455$ km/h [W 8° N]

[N 82° W]