Vector Subtraction

Wednesday, October 5, 2016 1:59 PM

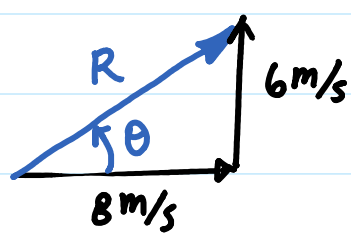
Never subtract vectors from each other.
Instead, we will add the opposite vector.

Example: Subtract the following vectors

a) $8\ m/s \rightarrow \ - \ 6\ m/s \downarrow$

★ Rewrite this as an addition statement

$$\underbrace{8\ m/s \rightarrow}_{\text{1st vector remains the same}} \ + \ \underbrace{6\ m/s \uparrow}_{\text{only 2nd vector changes}}$$



$$R^2 = 8^2 + 6^2$$
$$\sqrt{R^2} = \sqrt{100}$$
$$R = 10\ m/s$$

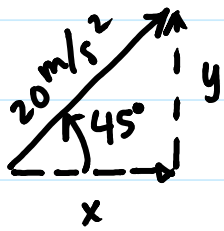
$$\tan\theta = \frac{6}{8}$$
$$\theta = \tan^{-1}\left(\frac{6}{8}\right) = 37°$$

$$\vec{R} = 10\ m/s \text{ at } 37° \text{ N of E}$$

$\vec{R}$ = 10 m/s at 37° N of E

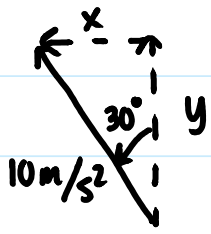
b) 20 m/s² at 45° N of E − 10 m/s² at 30° W of N

To solve, first find the x & y components of each vector.



$x = 20 \cdot \cos 45° = 14.14\ m/s^2 \rightarrow$

$y = 14.14\ m/s^2 \uparrow$



$x = 10 \cdot \sin 30° = 5\ m/s^2 \leftarrow$

$y = 10 \cdot \cos 30° = 8.66\ m/s^2 \uparrow$

change direction

Now, we write addition statements for the x and y components. Change the direction for the second vector's components.

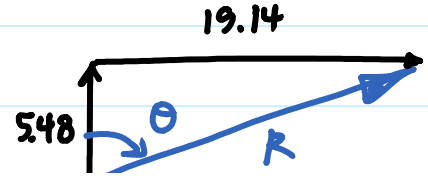
now positive (East)

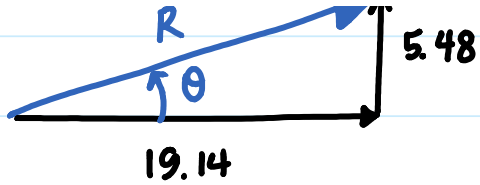
x-comp : $14.14 + 5 = 19.14\ m/s^2 \rightarrow$

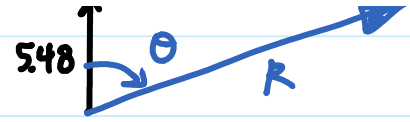
y-comp : $14.14 + (-8.66) = 5.48\ m/s^2 \uparrow$

now negative (South)

or







$$R^2 = (19.14)^2 + (5.48)^2$$

$$\sqrt{R^2} = \sqrt{396.37}$$

$$R = 19.9 \ m/s^2$$ (same magnitude no matter which Δ you drew)

$$\theta = \tan^{-1}\left(\frac{5.48}{19.14}\right)$$

$$\theta = 16°$$

or

$$\theta = \tan^{-1}\left(\frac{19.14}{5.48}\right)$$

$$\theta = 74°$$

$\vec{R} = 19.9 \ m/s^2$ at 16° N of E

$\vec{R} = 19.9 \ m/s^2$ at 74° E of N