Non Right Triangle Vector Addition

Adding Vectors

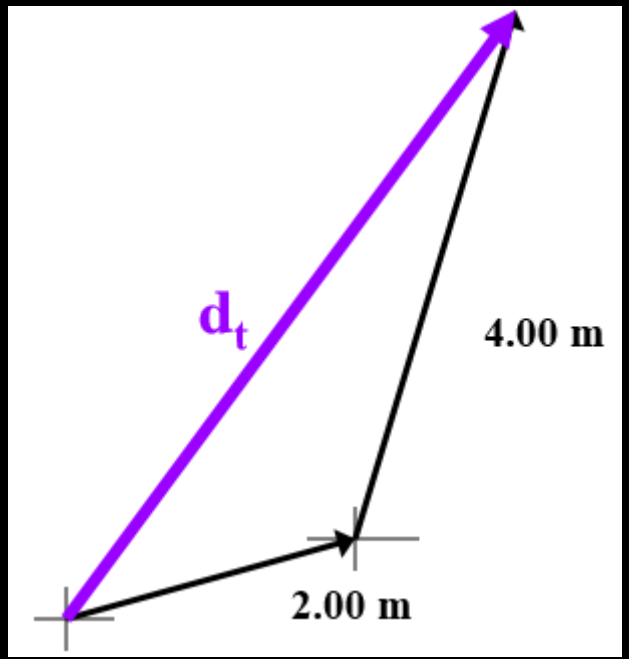
$\vec{a} = (3, -1)$ $\vec{b} = (2, 3)$

$\vec{a} + \vec{b} = (3+2, -1+3) = (5, 2)$

$\vec{a} - \vec{b} = (3-2, -1-3) = (1, -4)$

CONSIDER THE FOLLOWING...

- Cameron walks 2.00 m 25° N of E , then turns and walks 4.00 m 20° E of N.
- The total displacement of Cameron?
- …can not be found using right-triangle math because
- WE DON'T HAVE A RIGHT TRIANGLE!

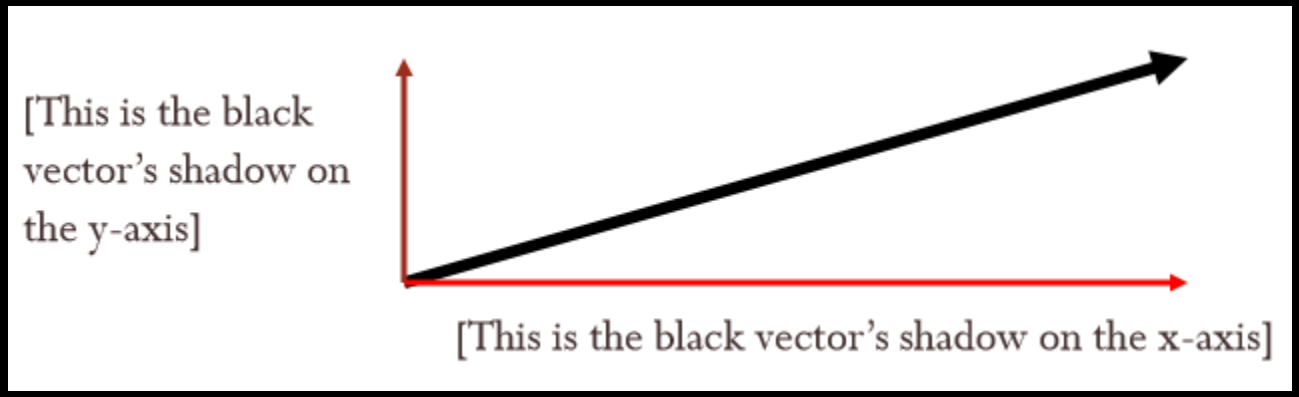


However…..

- We can add the two individual displacement vectors together by first separating them into pieces, called x- & y-components

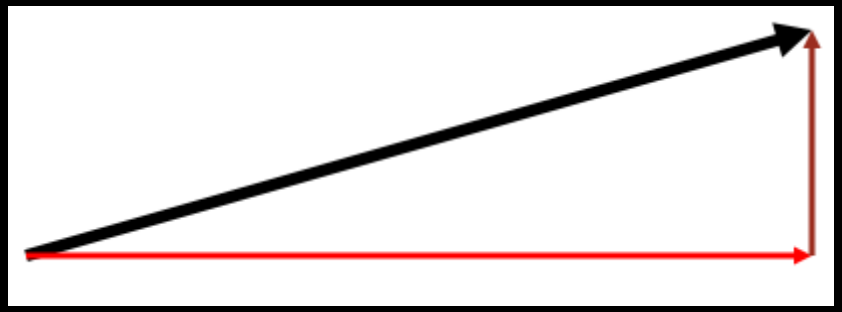
Into WHAT??????????

- Every vector can be thought of as pointing somewhat horizontally…



- …and somewhat vertically. They're kind of like the vector's shadows.

- If we add the x- and y-components together…



- they create the original vector…
- …and it makes a right triangle!

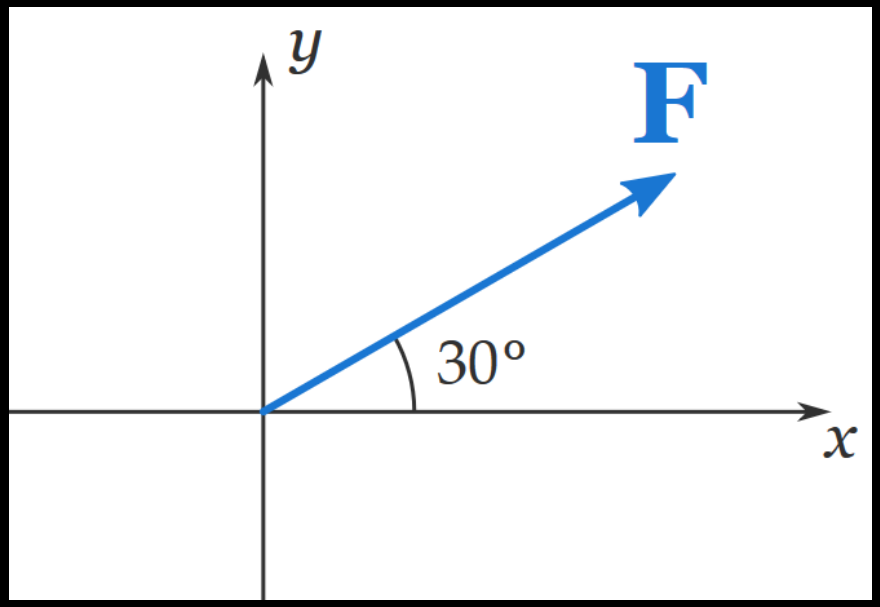
Just a few things to keep in mind...

Since X-component vectors can point either EAST or WEST…

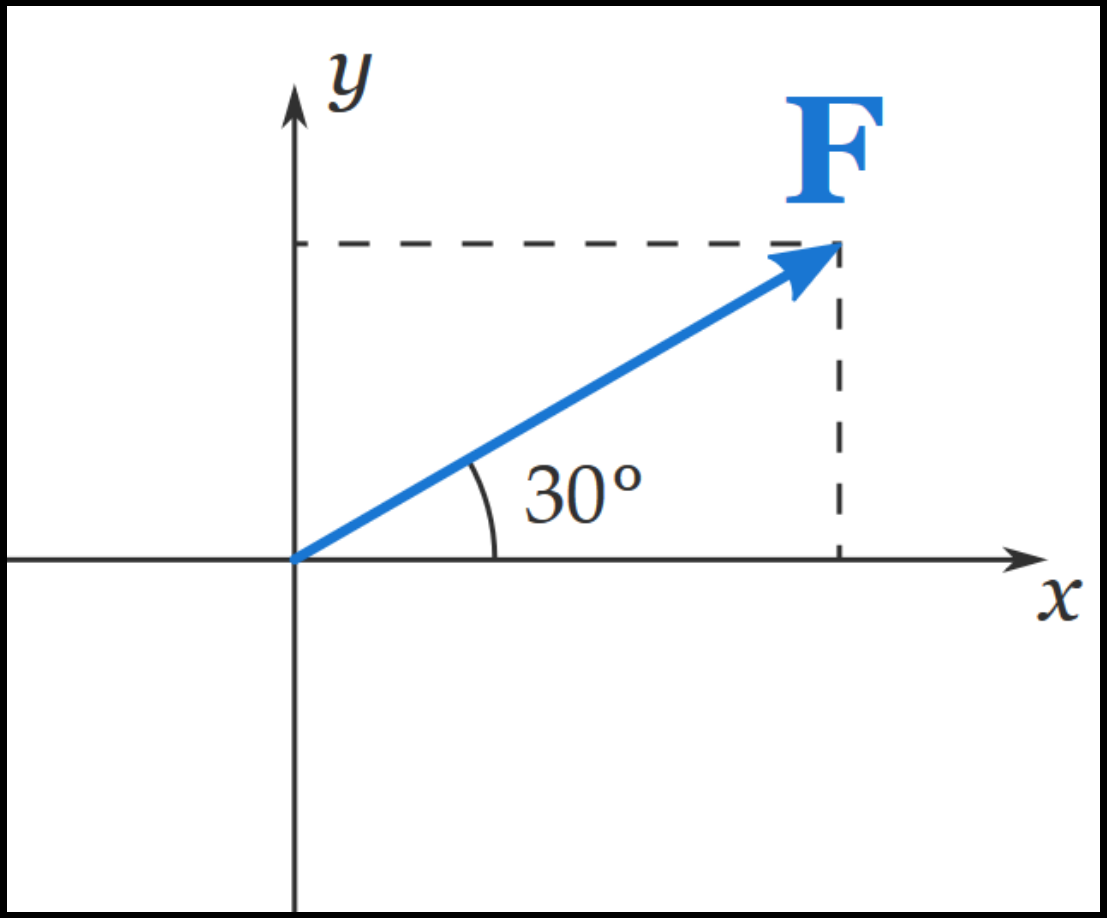
EAST is considered positive.

WEST is considered negative.

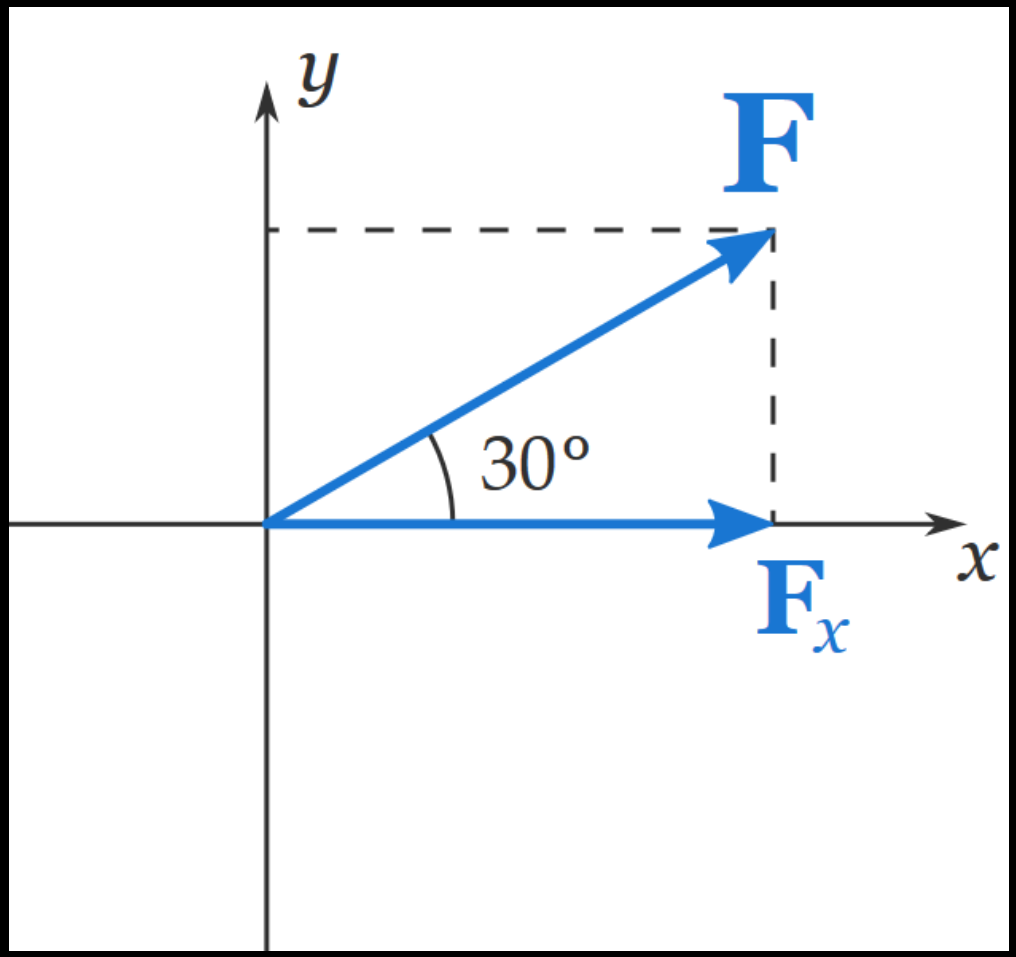
- Suppose we have a force F that makes an angle of 30° with the *positive* x axis, as shown below:



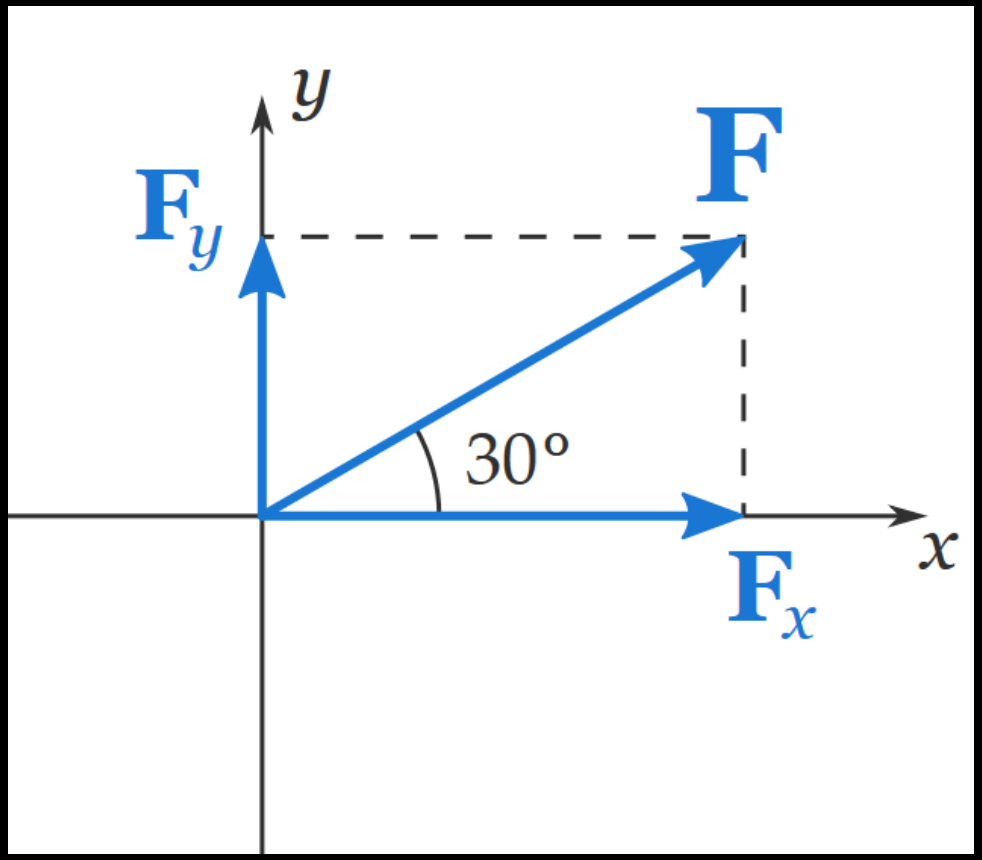
- Decompose F into x and y components.
- Represent the two components on the **xy-plane**.
- Drop two perpendiculars from the head of F: one to the x axis, the other to the y axis.



- Join the **origin** of the xy-plane with the **x-intercept** to represent the x component of F:



- Join the **origin** with the **y-intercept** to represent the y component of F:

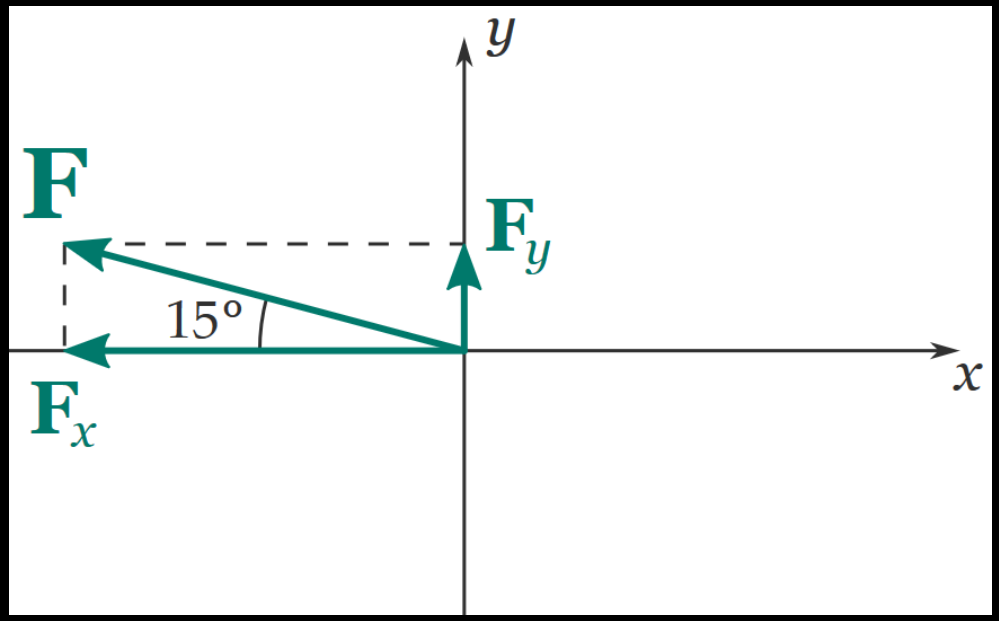


Some Points

- F_x and F_y are two vectors, i.e. they both have *a magnitude and a direction*.
- However, since F_x and F_y are in the directions of the x and y axes, they are commonly expressed by the *magnitude alone*, preceded by a positive or negative sign:
- positive when they point in the positive directions, and negative when they point in the negative directions of the x and y axes.

- The positive values of F_x and F_y can be found using trigonometry:
- $F_x = F \cos 30°$
- $F_y = F \sin 30°$
- To keep it simple, just remember that **if a component is *adjacent* to the angle, then it is cos, otherwise it is sin.**
- Often F_x will be the component adjacent to the angle, so it will be cos, and F_y will be sin.

- Let's now consider a force that has one of its components negative:



- In this case F_x is negative because it points in the negative direction of the x axis.
- Therefore:
- $F_x = -F \cos 15°$
- $F_y = F \sin 15°$
- Notice the minus sign before F cos 15° which we have added to make F_x negative.