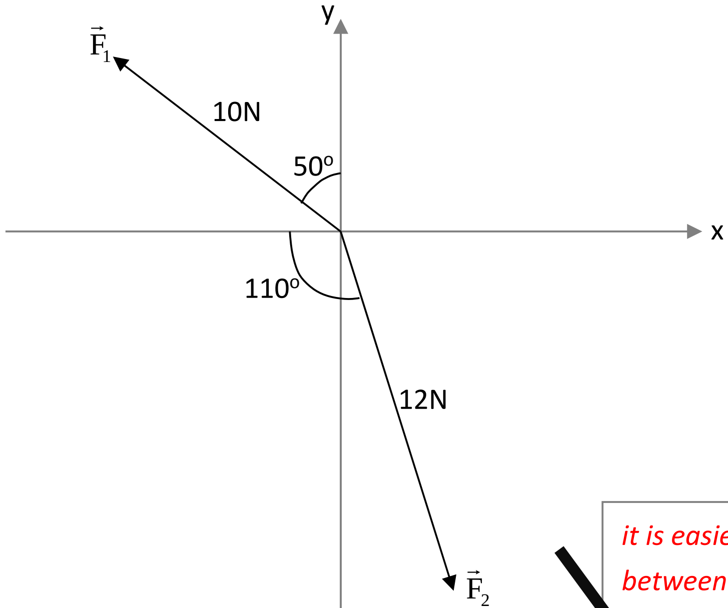
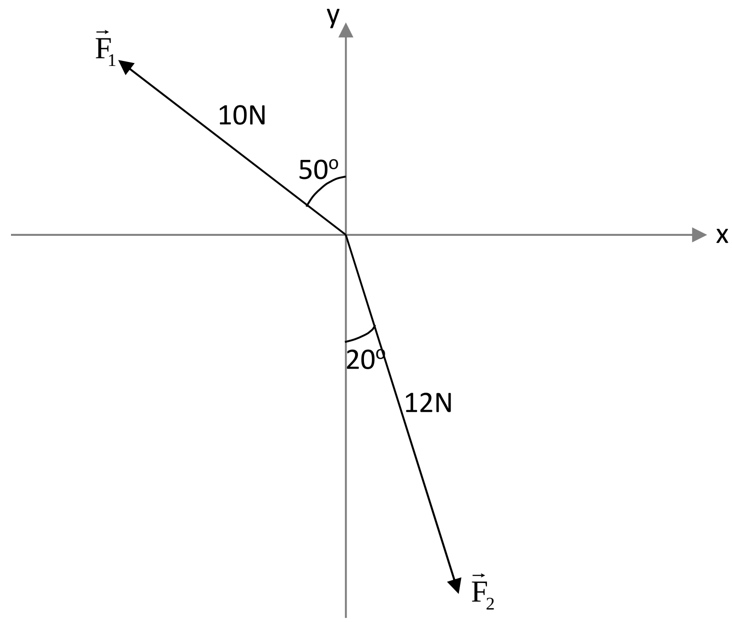
General advice:

In dealing with vectors, *it is easier to keep all angles between 0° and 90°* so that all trigonometric functions are positive in value. Of course, you have to add in the sign according to what quadrant the vector is pointing at. The reason is we often use a right angled triangle to define trigonometric functions, and both angles in a right angled triangle must be less than 90°.

Also note that in using a calculator to calculate the inverse trigonometric functions it will give only angle in the range of -90° to 90°. This may not be the angle we want at the end (if the vector is pointing at the second and third quadrants). Following above advice, I will make all values I want to calculate the inverse trigonometric values positive (i.e. take absolute value), then the calculator will always give me an angle between 0° and 90°. From the right angled triangle I use to define the functions I can then interpret the meaning of that angle.



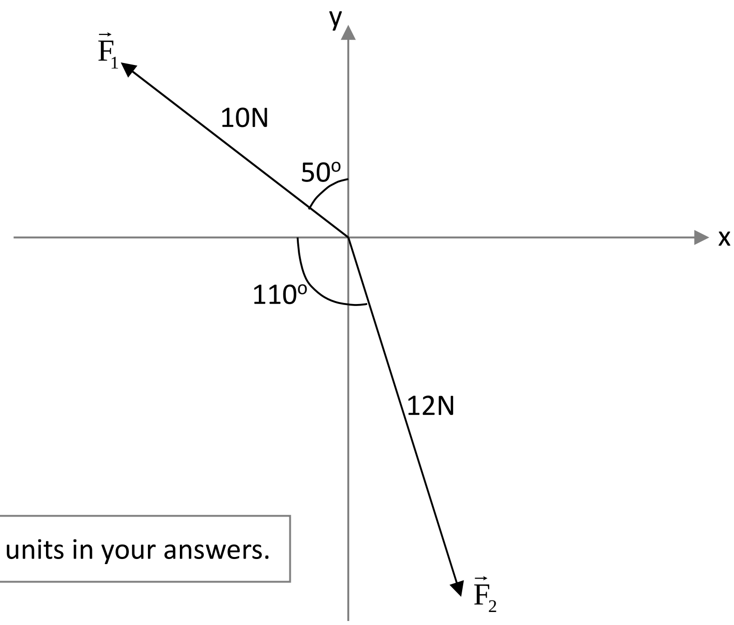
it is easier to keep all angles between 0° and 90°



From this point onward we will work on this figure instead of the given on.

PHY 232 Fall 2017 Supplementary Work (will not be collected)

Class 1. Circular motion and gravitational law



Pay attention to units in your answers.

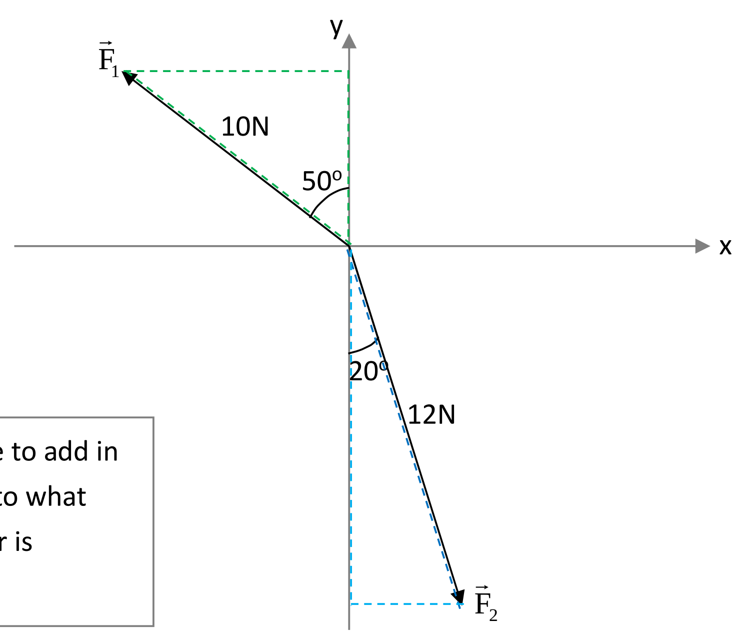
(a) Calculate the x- and y- components of $\vec{F}_1$ and $\vec{F}_2$.

Work on the green triangle:

$$F_{1x} = -10\sin 50^\circ = -7.660\ \text{N}$$
$$F_{1y} = +10\cos 50^\circ = +6.428\ \text{N}$$

Work on the blue triangle:

$$F_{2x} = +12\sin 20^\circ = +4.104\ \text{N}$$
$$F_{2y} = -12\cos 20^\circ = -11.276\ \text{N}$$



Of course, you have to add in the sign according to what quadrant the vector is pointing at.

Calculate $\vec{F}_1 + \vec{F}_2$ in terms of unit vectors $\hat{i}$ and $\hat{j}$.

Add x-components together:

$$F_{1x} + F_{2x} = -7.660\ \text{N} + 4.104\ \text{N} = -3.556\ \text{N}$$

Add y-components together:

$$F_{1y} + F_{2y} = +6.428\ \text{N} - 11.276\ \text{N} = -4.848\ \text{N}$$

In $\hat{i}, \hat{j}$ form:

$$\vec{F}_1 + \vec{F}_2 = -3.556\ \text{N}\,\hat{i} - 4.848\ \text{N}\hat{j}$$

(b) Calculate the magnitude and describe the direction of $\vec{F}_1 + \vec{F}_2$.

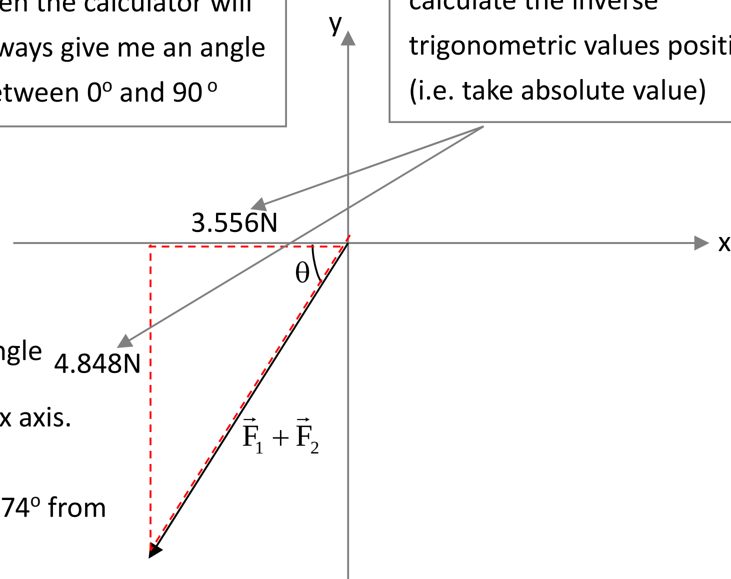
Since both the x-and y- components of $\vec{F}_1 + \vec{F}_2$ are negative, we know $\vec{F}_1 + \vec{F}_2$ is pointing at the third quadrant. Make a sketch:

I will make all values I want to calculate the inverse trigonometric values positive (i.e. take absolute value)

With respect to the figure,

$$\theta = \tan^{-1}\left(\frac{4.848}{3.556}\right) = 53.74^{\circ}$$

then the calculator will always give me an angle between 0° and 90°



So $\vec{F}_1 + \vec{F}_2$ is pointing at an angle of 53.74° below the –x axis.

We can also say $\vec{F}_1 + \vec{F}_2$ is at an angle of 180°+53.74°=233.74° from the +x axis.

Or we can say it is 90°+53.74°=143.74° from The + y axis.

From the right angled triangle I use to define the functions I can then interpret the meaning of that angle.

For magnitude:

$$|\vec{F}_1 + \vec{F}_2| = \sqrt{3.556^2 + 4.848^2}$$
$$= 6.012\text{N}$$