Answer on Question #49890, Physics, Other

In an x-y plane a graph is given. P vector that has magnitude of 50 is in 1st quadrant and makes an angle of 60 degree with x axis and Q vector that has magnitude of 30 is in 4TH quadrant and makes an angle of 30 degree with x axis. What is the area of P vector minus Q vector? Like the answer might be in which quadrant lies P vector minus Q vector?

Solution:

In our task we need firstly to represent the graph of the vectors based on the given condition. We have P vector that has magnitude of 50 and placed in the first quadrant makes an angle of $60°$ with x axis. Also we know that Q vector that has magnitude of 30 is in fourth quadrant and makes an angle of 30 degree with x axis. Now our goal is to determine the difference between vectors $\vec{P}$ and $\vec{Q}$.

The vector difference works the same as vector addition except that we multiply the vector we are subtracting by -1. It is much like subtracting two numbers:

$$\vec{P} - \vec{Q} = \vec{P} + (-\vec{Q})$$

To do this we have to convert from polar to Cartesian:

Firstly we find the coordinate for vector $\vec{P}$.

$$x = r \cdot \cos(60°) = |P| \cdot \cos(60°) = 50 \cdot 0.5 = 25$$

$$y = r \cdot \sin(60°) = |P| \cdot \sin(60°) = 50 \cdot 0.8660 = 43.301$$

Now we calculate the coordinate for the vector $\vec{Q}$.

$$x = r \cdot \cos(30°) = |Q| \cdot \cos(30°) = 30 \cdot 0.8660 = 25.981$$

$$y = r \cdot \sin(30°) = |Q| \cdot \sin(30°) = -30 \cdot 0.5 = -15$$

Now we can to find the difference. For, example the resulting vector will be $\vec{F}$. Then we can write the following.

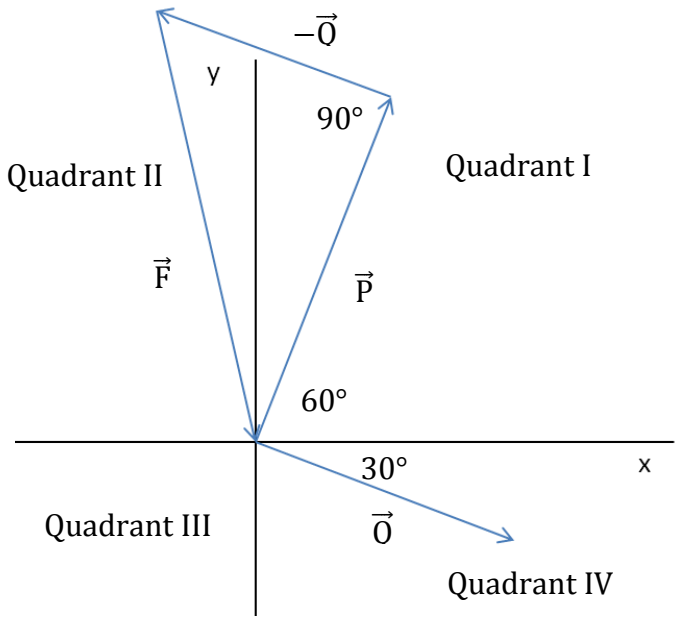
$$\vec{F} = \vec{P} - \vec{Q} = (25,43.301) + (25.981, -15) = (50.981,28.301)$$

Then we can convert that to polar:

$$r = \sqrt{x^2 + y^2} = \sqrt{(50.981)^2 + (28.301)^2} = \sqrt{3400.0089} = 58.3096$$

This mean that combine magnitude is equal to 58.3096.

The graph of the vectors we represent on the Figure below. From the graph we can see that the obtained figure is triangle.



In terms of vectors the area of the triangle below is:

$$S_{\Delta} = \frac{1}{2}|\vec{P}||\vec{Q}|$$

We apply the formula noted above and find the value of Area of the determined triangle. Thus we got the following value.

$$S_{\Delta} = 750.006$$

Also we can note that the resulting vector obtained as difference between vectors $\vec{P}$ and $\vec{Q}$ placed on the second quadrant.