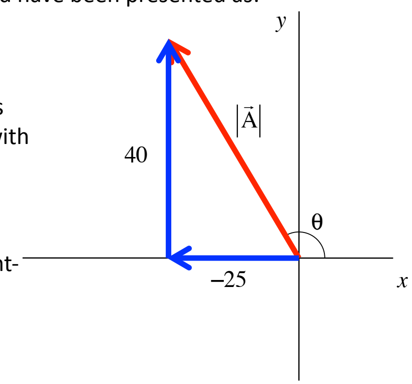
Problem 3.15

We are given the components, which could have been presented as:

$$\vec{A} = -25.0\hat{i} + 40.0\hat{j}$$



A graphical representation of this vector is shown to the right (though not to scale) with the unknown magnitude and angular position additionally shown.

To get the magnitude of the contrived right-triangle, trig yields:

$$\begin{aligned} |\vec{A}| &= \left(A_x^2 + A_y^2\right)^{1/2} \\ &= \left((-25.0)^2 + (40.0)^2\right)^{1/2} \\ &= 47.2 \end{aligned}$$

The standard way to do this is to use, with appropriate substitutions:

$$\begin{aligned} \phi &= \tan^{-1}\left(\frac{A_y}{A_x}\right)^{1/2} \\ &= \tan^{-1}\left(\frac{40.0}{-25.0}\right)^{1/2} \\ &= -58.0^\circ \end{aligned}$$

Because this is a fourth quadrant vector, and ours is a second quadrant vector, we need to add 180°. Doing so yields:

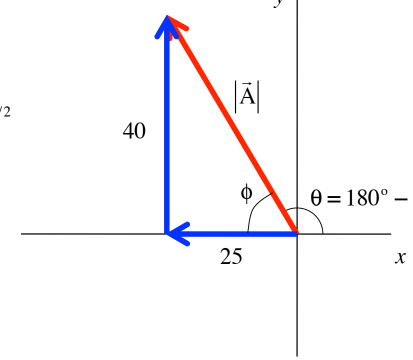
In *polar notation*, our resultant is:

$$\vec{A} = 47.2\measuredangle 122^\circ$$

Note that this would put the vector about 30° to the left of the +y axis, which seems about right.

An alternative way to do this, if you prefer to work with first-quadrant right triangles (that is, triangles with angles in them that are less than or equal to 90°), I'm going to determine ϕ, then with that information θ. That operation looks like:

$$\begin{aligned} \phi &= \tan^{-1}\left(\frac{A_y}{A_x}\right)^{1/2} \\ &= \tan^{-1}\left(\frac{40.0}{25.0}\right)^{1/2} \\ &= 58.0^\circ \end{aligned}$$



This means: $\theta = 180^\circ - \phi$

$$= 122^\circ$$

In *polar notation*, our resultant is:

$$\vec{A} = 47.2\measuredangle 122^\circ$$