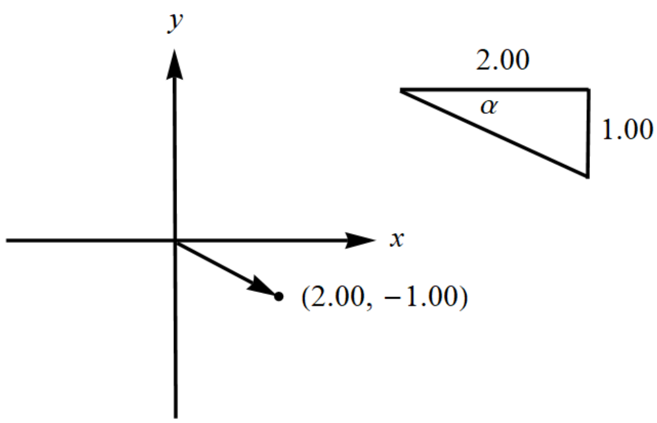
Exercise 1.30

Let the angle θ be the angle that the vector $\overrightarrow{\boldsymbol{A}}$ makes with the $+x$-axis, measured counterclockwise from that axis. Find the angle θ for a vector that has the following components: (a) $A_x = 2.00$ m, $A_y = -1.00$ m; (b) $A_x = 2.00$ m, $A_y = 1.00$ m; (c) $A_x = -2.00$ m, $A_y = 1.00$ m; (d) $A_x = -2.00$ m, $A_y = -1.00$ m.

Solution

Part (a)

Plot the given vector, $\overrightarrow{\boldsymbol{A}} = \langle A_x, A_y \rangle = \langle 2.00, -1.00 \rangle$ m.



Determine α, the angle that $\overrightarrow{\boldsymbol{A}}$ is under the x-axis.

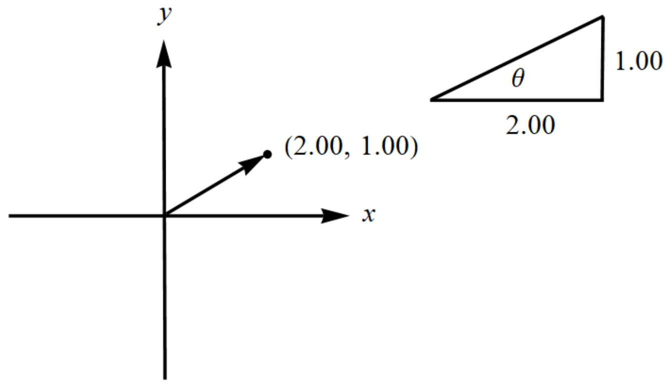
$$\tan\alpha = \frac{1.00}{2.00} \quad \rightarrow \quad \alpha = \tan^{-1}\left(\frac{1}{2}\right) \approx 26.6°$$

The desired angle θ is 360° minus this angle.

$$\theta = 360 - \alpha \approx 333°$$

Part (b)

Plot the given vector, $\vec{A} = \langle A_x, A_y \rangle = \langle 2.00, 1.00 \rangle$ m.

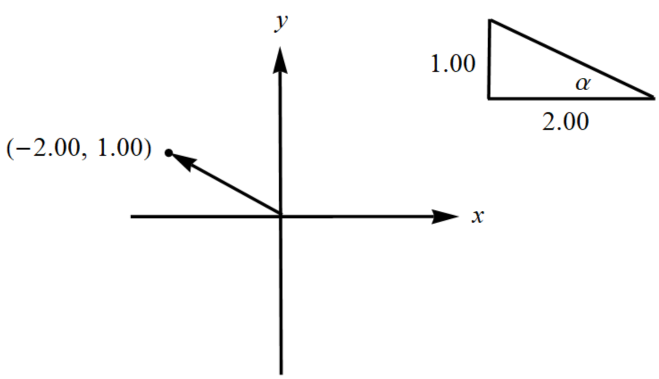


Determine θ, the desired angle.

$$\tan\theta = \frac{1.00}{2.00} \quad \rightarrow \quad \theta = \tan^{-1}\left(\frac{1}{2}\right) \approx 26.6^\circ$$

Part (c)

Plot the given vector, $\vec{A} = \langle A_x, A_y \rangle = \langle -2.00, 1.00 \rangle$ m.



Determine α, the angle that $\vec{A}$ is over the $-x$-axis.

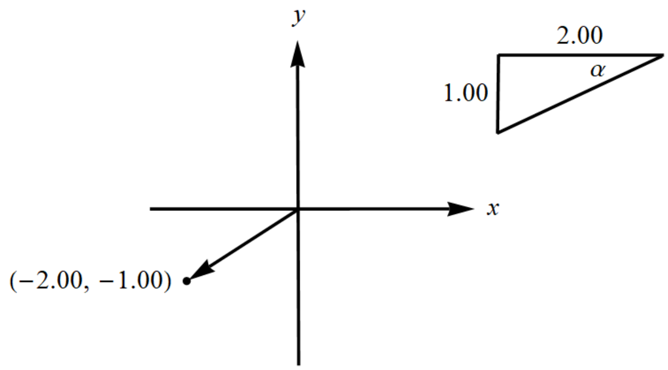
$$\tan\alpha = \frac{1.00}{2.00} \quad \rightarrow \quad \alpha = \tan^{-1}\left(\frac{1}{2}\right) \approx 26.6^\circ$$

The desired angle θ is 180° minus this angle.

$$\theta = 180 - \alpha \approx 153^\circ$$

Part (d)

Plot the given vector, $\overrightarrow{\boldsymbol{A}} = \langle A_x, A_y \rangle = \langle -2.00, -1.00 \rangle$ m.



Determine α, the angle that $\overrightarrow{\boldsymbol{A}}$ is under the $-x$-axis.

$$\tan\alpha = \frac{1.00}{2.00} \quad \rightarrow \quad \alpha = \tan^{-1}\left(\frac{1}{2}\right) \approx 26.6°$$

The desired angle θ is 180° plus this angle.

$$\theta = 180 + \alpha \approx 207°$$