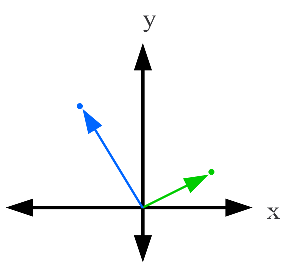
Chapter 2 Problem 43 [†]



Solution

Find the distance between the two points in Cartesian coordinates.

The first point (green) is located at $(2.500\ m, \pi/6)$. The x-component of this point is

$$x_1 = (2.500\ m)\cos(\pi/6) = 2.165\ m$$

The y-component is

$$y_1 = (2.500\ m)\sin(\pi/6) = 1.250\ m$$

In unit vector notation, this is

$$\vec{v_1} = \{2.165\ \hat{i} + 1.250\ \hat{j}\}\ m$$

In Cartesian coordinates, it is expressed as $P_1(2.165\ m, 1.250\ m)$.

The second point (blue) is located at $(3.800\ m, 2\pi/3)$. The x-component of this point is

$$x_2 = (3.800\ m)\cos(2\pi/3) = -1.900\ m$$

The y-component is

$$y_2 = (3.800\ m)\sin(2\pi/3) = 3.291\ m$$

In unit vector notation, this is

$$\vec{v_2} = \{-1.900\ \hat{i} + 3.291\ \hat{j}\}\ m$$

In Cartesian coordinates, we have $P_2(-1.900\ m, 3.291\ m)$.

The displacement between these two points is the difference between the position vectors.

$$\vec{v_{12}} = \vec{v_2} - \vec{v_1} = \{-1.900\ \hat{i} + 3.291\ \hat{j}\} - \{2.165\ \hat{i} + 1.250\ \hat{j}\}$$

$$\vec{v_{12}} = (-1.900 - 2.165)\ \hat{i} + (3.291 - 1.250)\ \hat{j} = \{-4.065\ \hat{i} + 2.041\ \hat{j}\}\ m$$

The magnitude of this vector is.

$$v_{12} = \sqrt{(-4.065)^2 + (2.041)^2} = 4.549\ m$$

Reporting this value to the closest centimeter gives $4.55\ m$.

[†] Problem from University Physics by Ling, Sanny and Moebs (OpenStax)