Answer on question 64128

The three displacement vectors in the drawing have magnitudes of A = 4.84 m with angle of 20d.\, B = 5.35 m with angle of 60d, and C = 3.81 m with angle of 0d. Find the resultant ((a) magnitude and (b) directional angle) of the three vectors by means of the component method. Express the directional angle as an angle above the positive or negative x axis.

Solution

Let's write these vectors in the Cartesian system of coordinates:

$$\boldsymbol{A} = A(\cos 20\,, \sin 20) \approx 4.84(0.94{,}0.34) \approx (4.55\,, 1.66)$$

$$\boldsymbol{B} = B(\cos 60\,, \sin 60) \approx 5.35(0.5{,}0.87) \approx (2.68{,}4.65)$$

$$\boldsymbol{C} = C(\cos 0\,, \sin 0) = 3.81(1{,}0) = (3.81{,}0)$$

So we can find the resultant adding them

$$\boldsymbol{R} = \boldsymbol{A} + \boldsymbol{B} + \boldsymbol{C} = (4.55\,, 1.66) + (2.68{,}4.65) + (3.81{,}0) = (4.55 + 2.68 + 3.81{,}1.66 + 4.65)$$
$$= (11.04{,}6.31)$$

(a) Magnitude is:

$$\sqrt{11.04^2 + 6.31^2} = \sqrt{121.88 + 39.82} = \mathbf{12.72}$$

(b) We know the magnitude, so we can rewrite the resultant as

$$\boldsymbol{R} = 12.72\left(\frac{11.04}{12.72}, \frac{6.31}{12.72}\right) \approx 12.72(0.868{,}0.496)$$

We have $\cos\theta = 0.868 \rightarrow \theta = \arccos(0.868) \approx 29{,}77^{\circ}$

Answer

(a) 12.72
(b) $29{,}77^{\circ}$