Question

The resultant of vector A and B has a magnitude of 20 units. A has a magnitude of 8 units, and the angle between A and B is 40. Calculate the magnitude of B.

Solution

$$\vec{|C|} = 20, \qquad \vec{|A|} = 8, \qquad \alpha = 40^0 , \qquad \beta = \pi - 40^0. \ \vec{|B|} - ?$$

$$\cos (\beta) = - \cos (\alpha)$$

Law of cosines:

$$\vec{|C|}^2 = \vec{|A|}^2 + \vec{|B|}^2 - 2 * \vec{|A|} * \vec{|B|} * \cos(\beta)$$

$$\vec{|B|}^2 + 2 * \vec{|A|} * \vec{|B|} * \cos(\alpha) + \vec{|A|}^2 - \vec{|C|}^2 = 0;$$

$$D = 4 * \vec{|A|}^2 * cos^2(\alpha) + 4 * (\vec{|C|}^2 - \vec{|A|}^2)$$

$$\vec{|B|} = -\vec{|A|} * \cos(\alpha) + \sqrt{\vec{|A|}^2 * cos^2(\alpha) + (\vec{|C|}^2 - \vec{|A|}^2)}$$

$$\vec{|B|} \approx 13.2$$

Answer

$$\vec{|B|} \approx 13.2$$

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