

3) Given three points in Cartesian co-ordinate System as  $A(3, -2, 1)$   $B(-3, -3, 5)$   $C(2, 6, -4)$   
Find i) The unit vector from A to C

ii) The unit vector from B to A

iii) The distance from B to C

iv) The vector from A to the Mid point of the straight line joining B to C

Soln The position vector's are

$$\vec{A} = 3\vec{a}_x - 2\vec{a}_y + \vec{a}_z$$

$$\vec{B} = -3\vec{a}_x - 3\vec{a}_y + 5\vec{a}_z$$

$$\vec{C} = 2\vec{a}_x + 6\vec{a}_y - 4\vec{a}_z$$

i) To find Unit Vector from A to C

$$\vec{AC} = \vec{C} - \vec{A} = (2-3)\vec{a}_x + [6-(-2)]\vec{a}_y + [-4-1]\vec{a}_z$$

$$\vec{AC} = -\vec{a}_x + 8\vec{a}_y - 5\vec{a}_z$$

$$\vec{a}_{AC} = \frac{\vec{AC}}{|\vec{AC}|}$$

$$|\vec{AC}| = \sqrt{(-1)^2 + (8)^2 + (-5)^2}$$
$$= \sqrt{90} = 9.487$$

$$\bar{a}_{AC} = \frac{-\bar{a}_x + 8\bar{a}_y - 5\bar{a}_z}{9.487}$$

$$\bar{a}_{AC} = -0.1054\hat{a}_x + 0.8433\hat{a}_y - 0.5270\hat{a}_z$$

ii) To find the Unit Vector from B to A

$$\bar{BA} = \bar{A} - \bar{B} = [3 - (-3)]\bar{a}_x + [(-2) - (-3)]\bar{a}_y + [1 - 5]\bar{a}_z$$

$$\bar{BA} = 6\bar{a}_x + \bar{a}_y - 4\bar{a}_z$$

$$|\bar{BA}| = \sqrt{(6)^2 + (1)^2 + (-4)^2} = 7.2801$$

$$\bar{a}_{BA} = \frac{\bar{BA}}{|\bar{BA}|} = \frac{6\bar{a}_x + \bar{a}_y - 4\bar{a}_z}{7.2801} = 0.8242\bar{a}_x + 0.1374\bar{a}_y - 0.5494\bar{a}_z$$

iii) To find the distance from B to C

$$\bar{BC} = \bar{C} - \bar{B}$$

$$= [2 - (-3)]\bar{a}_x + [6 - (-3)]\bar{a}_y + [(-4) - 5]\bar{a}_z$$

$$= 5\bar{a}_x + 9\bar{a}_y - 9\bar{a}_z$$

$$|\bar{BC}| = \sqrt{(5)^2 + (9)^2 + (-9)^2}$$

$$|\bar{BC}| = 13.6748$$

iv) To find the vector from A  
to the midpoint of the straight line.

Joining B to C.

To find midpoint of B to C

$$\text{mid point of BC} = \left( \frac{-3+2}{2}, \frac{-3+6}{2}, \frac{5-4}{2} \right)$$

$$= -0.5, 1.5, 0.5$$

$$\bar{D} = -0.5\bar{a}_x + 1.5\bar{a}_y + 0.5\bar{a}_z$$

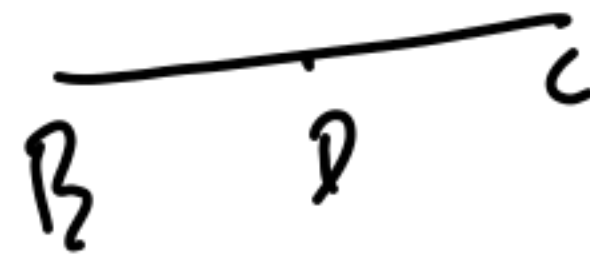
$$\overline{AD} = (-0.5-3)\bar{a}_x + (1.5-(-2))\bar{a}_y + (0.5-1)\bar{a}_z$$

$$\overline{AD} = -3.5\bar{a}_x + 3.5\bar{a}_y - 0.5\bar{a}_z$$

$$B(x_1, y_1, z_1)$$

$$C(x_2, y_2, z_2)$$

$$\text{mid pt} = \left( \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}, \frac{z_1+z_2}{2} \right)$$



$$3, -2, 1$$

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