Electromagnetic field

week (1)

[11] Given: $\vec{r}_A = (6, -2, -4)$, $\vec{a}_{r_B} = \frac{(2, -2, 1)}{3}$, $|\vec{r}_{AB}| = 10$

Req: find B

Sol.

$A(6, -2, -4)$, $B(x_B, y_B, z_B)$, $\vec{r}_{AB} = (x_B - 6, y_B + 2, z_B + 4)$

$\vec{r}_B = k\vec{a}_{r_B} = \frac{k}{3}(2, -2, 1)$ $\therefore x_B = \frac{2}{3}k$, $y_B = \frac{-2}{3}k$, $z_B = \frac{k}{3}$

$\therefore \left(\frac{2}{3}k - 6\right)^2 + \left(\frac{-2}{3}k + 2\right)^2 + \left(\frac{k}{3} + 4\right)^2 = 100$ $\longrightarrow$ $\therefore k = 11,746$ ✓

or

$k = -3,746$ ✗ → magnitude Cannot be negative

$\therefore B(7,83, -7,83, 3,92)$ #

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[4] Given: $\vec{M} = (-10, 4, -8)$, $\vec{N} = (8, 7, -2)$

Req:

Sol

a) $-\vec{M} + 2\vec{N} = (10, -4, 8) + (16, 14, -4) = (26, 10, 4)$ ← $\vec{\alpha}$

$\vec{a}_\alpha = \frac{\vec{\alpha}}{|\alpha|} = \frac{(26, 10, 4)}{\sqrt{26^2 + 10^2 + 4^2}} = (0,924, 0,355, 0,142)$ #a

b) $(5, 0, 0) + (8, 7, -2) + (30, -12, 24) = (43, -5, 22)$

$\therefore$ magnitude $= \sqrt{43^2 + 5^2 + 22^2} = 48,559$ #b

c) $|M| = \sqrt{10^2 + 4^2 + 8^2} = 13,4164$, $|2N| = \sqrt{16^2 + 14^2 + 4^2} = 21,6333$

$(\vec{M} + \vec{N}) = (-2, 11, -10)$ $\longrightarrow$ $\therefore |\vec{M}||\vec{N}|(\vec{M} + \vec{N}) = (-580,4, 3192,6, -2902)$

#c

5 Given: $\vec{OA} = (1, 2, 3)$, $\vec{OB} = (2, 3, -2)$

Req:

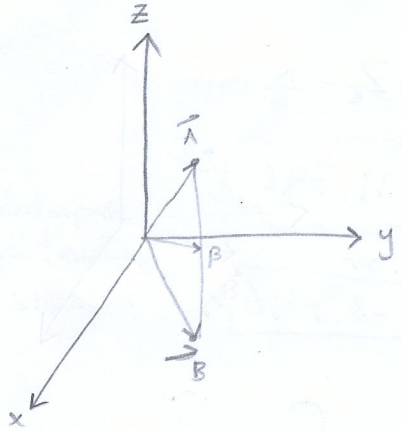
#a

Sol

a) $(\vec{OA} - \vec{OB}) = (-1, -1, 5) \leftarrow \vec{\alpha}$

$\therefore \vec{a}_\alpha = \dfrac{\vec{\alpha}}{|\alpha|} = \dfrac{(-1, -1, 5)}{\sqrt{1+1+25}} = \begin{matrix} -0{,}1924\,\vec{a}_x \\ -0{,}1924\,\vec{a}_y \\ +0{,}9622\,\vec{a}_z \end{matrix}$

b)



$\beta\left(\dfrac{1+2}{2}, \dfrac{2+3}{2}, \dfrac{3-2}{2}\right)$

$\therefore \vec{OB} = (1.5, 2.5, 0.5)$

$\therefore \vec{a}_{OB} = \dfrac{\vec{OB}}{|OB|} = \begin{matrix} 0.507\,\vec{a}_x \\ +0{,}845\,\vec{a}_y \\ +0{,}169\,\vec{a}_z \end{matrix}$

#b