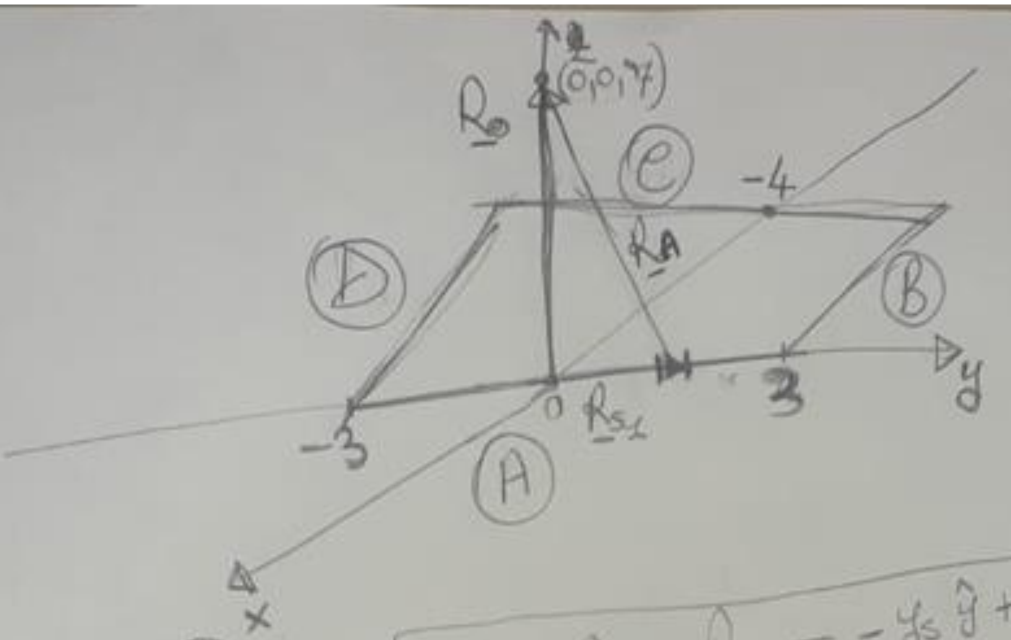
(1)



TRATTO (A)

$\underline{R}_{SA} = y_s \hat{y}$; $\boxed{\underline{R}_A = \underline{R}_0 - \underline{R}_{SA} = -y_s \hat{y} + 7 \hat{z}}$

$\underline{R}_0 = 7 \hat{z}$

$$d\underline{H}_A = \frac{I}{4\pi} \frac{d\underline{l}_A \times \underline{R}_A}{|\underline{R}_A|^3} =$$

$$= \frac{I}{4\pi} \frac{(dy_s \hat{y}) \times [-y_s \hat{y} + 7 \hat{z}]}{\left(\sqrt{y_s^2 + 49}\right)^3}$$

$$= \frac{I}{4\pi} \frac{7 \hat{x} \, dy_s}{\left(\sqrt{y_s^2 + 49}\right)^3}$$

$$\underline{H}_A = \int_{-3}^{3} \frac{7I}{4\pi} \frac{1}{\left(\sqrt{y_s^2+49}\right)^3} \, dy_s \ \hat{x}$$ (2)

$$= \frac{7I}{4\pi} \int_{-3}^{3} \frac{1}{\left[y_s^2+49\right]^{\frac{3}{2}}} \, dy_s \ \hat{x}$$

$$= \frac{7I}{4\pi} \left[\frac{y_s}{49\sqrt{y_s^2+49}} \right]_{-3}^{3} \hat{x}$$

$$= \frac{\cancel{7}I}{4\pi} \frac{1}{\cancel{49}\,7} \left[\frac{3}{\sqrt{9+49}} - \frac{(-3)}{\sqrt{9+49}} \right] \hat{x}$$

$$= \frac{I}{\cancel{28}\pi} \cdot \cancel{2} \cdot \frac{3}{\sqrt{58}} \hat{x} = \frac{3I}{14 \cdot \sqrt{58} \cdot \pi} \hat{x}$$

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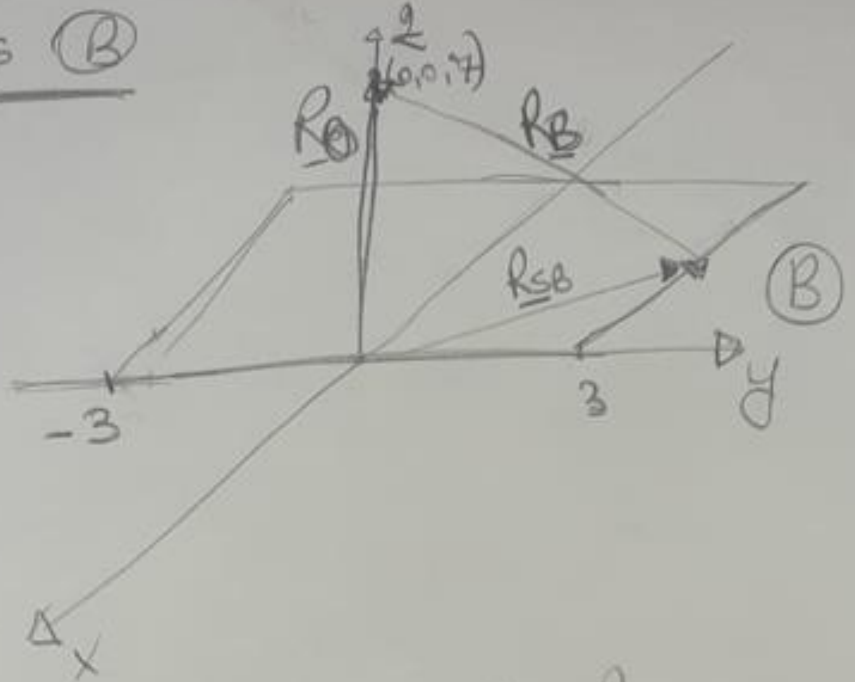
TRATTO (B)



$\underline{R}_{SB} = x_s \hat{x} + 3\hat{y}$; $\underline{R}_B = \underline{R}_0 - \underline{R}_{SB} =$

$= -x_s \hat{x} - 3\hat{y} + 7\hat{z}$

$\underline{R}_0 = 7\hat{z}$

$$d\underline{H}_B = \frac{I}{4\pi} \frac{d\underline{l}_B \times \underline{R}_B}{|\underline{R}_B|^3} =$$

$$= \frac{I}{4\pi} \frac{dx_s(-\hat{x}) \times [-x_s\hat{x} - 3\hat{y} + 7\hat{z}]}{\left(\sqrt{x_s^2 + 9 + 49}\right)^3}$$

$$= \frac{I}{4\pi} \frac{dx_s\,[3\hat{z} + 7\hat{y}]}{\left(\sqrt{x_s^2 + 58}\right)^3}$$

$$\underline{H}_B = \int_{-4}^{0} \frac{I}{4\pi} \frac{7\hat{y} + 3\hat{z}}{\left(\sqrt{x_s^2 + 58}\right)^3} \, dx_s$$

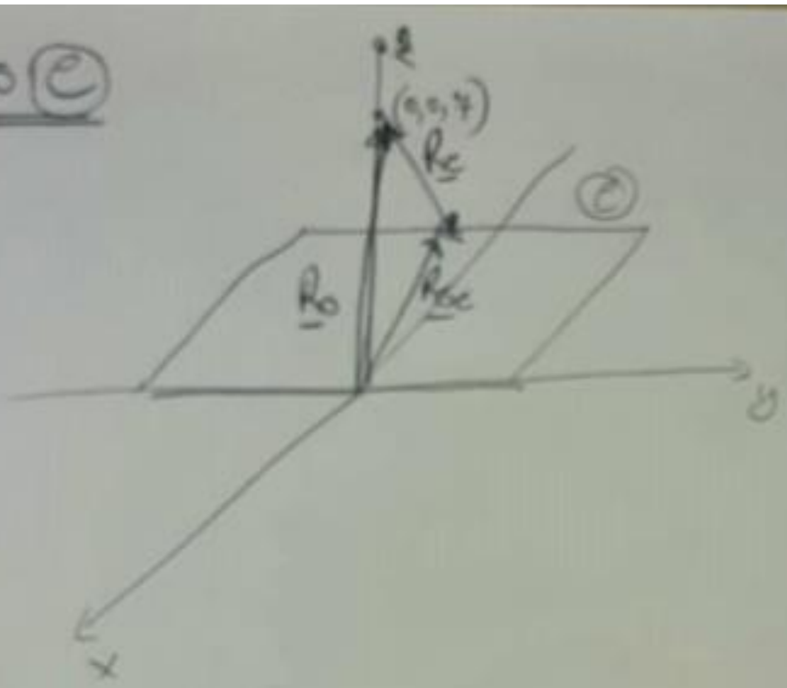
$$= \frac{7I}{4\pi} \int_{-4}^{0} \frac{1}{\left(\sqrt{x_s^2 + 58}\right)^3} \, dx_s \; \hat{y} \; +$$

$$\frac{3I}{4\pi} \int_{-4}^{0} \frac{1}{\left[x_s^2 + 58\right]^{\frac{3}{2}}} \, dx_s \; \hat{z}$$

$$= \frac{I}{4\pi} \cdot \left[7\hat{y} + 3\hat{z}\right] \cdot \left[\frac{x_s}{58\sqrt{x_s^2 + 58}}\right]\Bigg|_{-4}^{0}$$

$$= \frac{I}{4\pi} \left[7\hat{y} + 3\hat{z}\right] \frac{4}{58\sqrt{16 + 58}}$$

TRATTO (c)



$$\underline{R}_{sc} = -4\hat{x} + y_s\hat{y} \Rightarrow \underline{R}_c = \underline{R}_0 - \underline{R}_{sc}$$

$$\underline{R}_0 = 7\hat{z} \qquad = 4\hat{x} - y_s\hat{y} + 7\hat{z}$$

$$d\underline{H}_c = \frac{I}{4\pi} \frac{d\underline{\ell}_c \times \underline{R}_c}{|\underline{R}_c|^3}$$

$$= \frac{I}{4\pi} \frac{dy_s(-\hat{y}) \times \left[4\hat{x} - y_s\hat{y} + 7\hat{z}\right]}{\sqrt{y_s^2 + 16 + 49}}$$

$$= \frac{I}{4\pi} \frac{dy_s\left[4\hat{z} - 7\hat{x}\right]}{\sqrt{y_s^2 + 75}}$$

$$\underline{H}c = \int_{-3}^{3} \frac{I}{4\pi} \frac{(4\hat{z} - 7\hat{x})}{\sqrt{y_s^2 + 75}} \, dy_s$$

$$= \frac{I}{4\pi} \left[-7\hat{x} + 4\hat{z}\right] \int_{-3}^{3} \frac{1}{\left[y_s^2 + 75\right]^{\frac{3}{2}}} \, dy_s$$

$$= \frac{I}{4\pi} \left[-7\hat{x} + 4\hat{z}\right] \left[\frac{y_s}{75\sqrt{y_s^2 + 75}}\right]_{-3}^{3}$$

$$= \frac{I}{4\pi} \left[-7\hat{x} + 4\hat{z}\right] \, 2 \cdot \frac{3}{75\sqrt{9 + 75}}$$

$$= \frac{I}{4\pi} \left[-7\hat{x} + 4\hat{z}\right] \frac{6}{75\sqrt{84}}$$

TRATTO D

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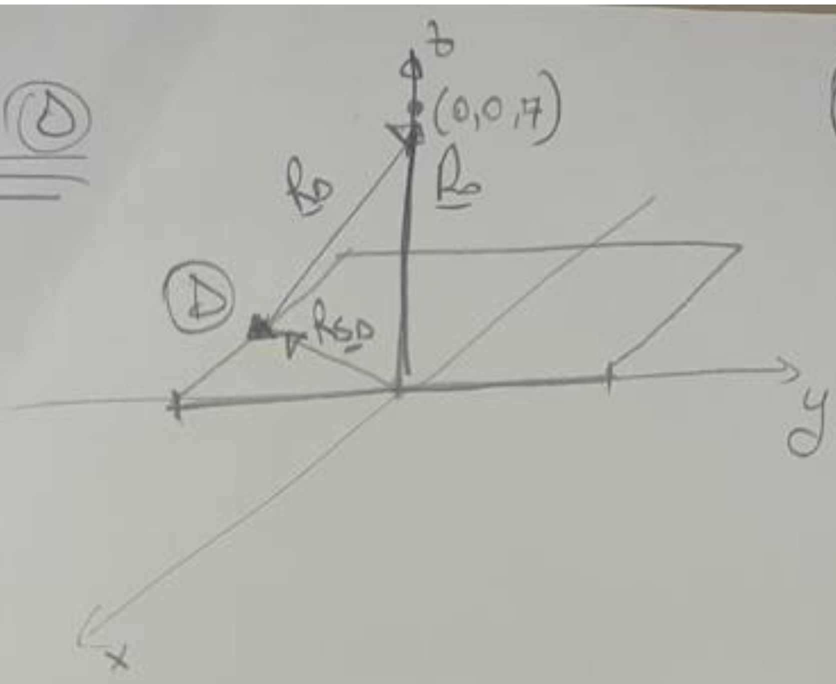

$$\underline{R}_{SD} = x_s \hat{x} - 3\hat{y} \Rightarrow \underline{R}_D = \underline{R}_o - \underline{R}_{SD}$$

$$\underline{R}_o = 7\hat{z} \qquad = -x_s\hat{x} + 3\hat{y} + 7\hat{z}$$

$$d\underline{H}_D = \frac{I}{4\pi} \frac{d\underline{l}_D \times \underline{R}_D}{|\underline{R}_D|^3}$$

$$= \frac{I}{4\pi} \frac{dx_s\,\hat{x} \times \left[-x_s\hat{x} + 3\hat{y} + 7\hat{z}\right]}{\left(\sqrt{x_s^2 + 9 + 49}\right)^3}$$

$$d\underline{H_D} = \frac{I}{4\pi} \frac{dx_s\,[3\hat{z} - 7\hat{y}]}{\left(\sqrt{x_s^2 + 58}\right)^3}$$

$$\underline{H_D} = \int_{-4}^{0} \frac{I}{4\pi} \frac{[-7\hat{y} + 3\hat{z}]}{\left(\sqrt{x_s^2 + 58}\right)^3}\, dx_s$$

$$= \frac{I}{4\pi}[-7\hat{y} + 3\hat{z}] \int_{-4}^{0} \frac{1}{[x_s^2 + 58]^{\frac{3}{2}}}\, dx_s$$

$$= \frac{I}{4\pi}[-7\hat{y} + 3\hat{z}] \left[\frac{x_s}{58\sqrt{x_s^2 + 58}}\right]\Bigg|_{-4}^{0}$$

$$= \frac{I}{4\pi}[-7\hat{y} + 3\hat{z}]\, \frac{4}{58\sqrt{16 + 58}}$$

$$\underline{H}_{TOT}(0,0,7) = \underline{H}_A + \underline{H}_B + \underline{H}_C + \underline{H}_D$$