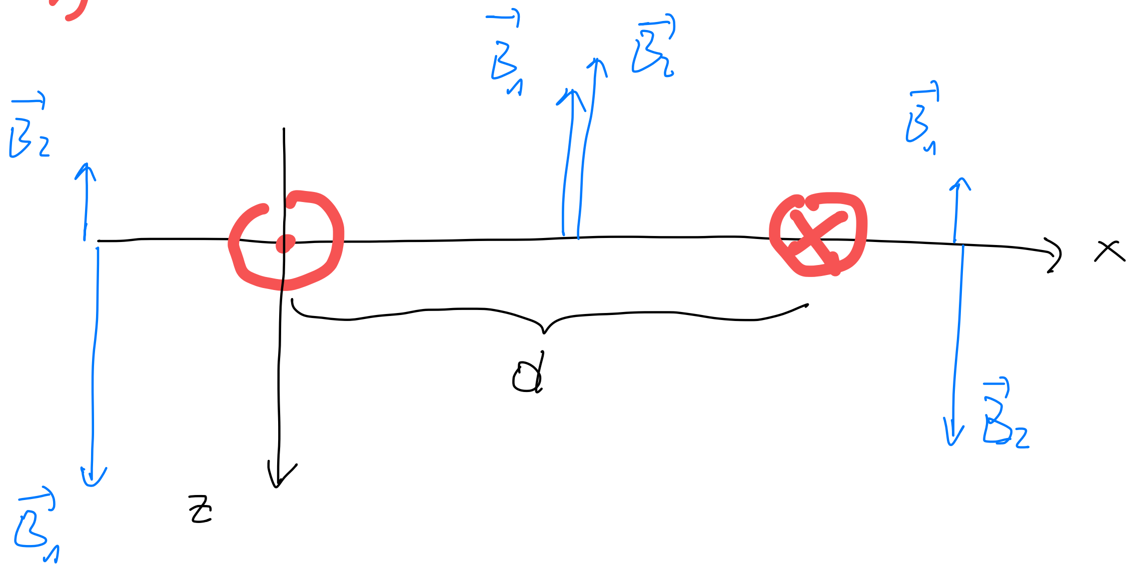
Es. 1)



$|\vec{B}_1| = \dfrac{\mu_0 I_1}{2\pi |x|}$ e B_{1z} ha segno < 0 per $x > 0$

quindi scrivo $\quad B_{1z} = -\dfrac{\mu_0 I_1}{2\pi x}$

$$|\vec{B}_2| = \frac{\mu_0 I_2}{2\pi r_2} = \frac{\mu_0 I_2}{2\pi |d-x|}$$

$B_{2z} > 0$ per $x > d \implies B_{2z} = \dfrac{\mu_0 I_2}{2\pi (x-d)}$

$$B_z = B_{1z} + B_{2z} = \frac{\mu_0}{2\pi}\left(-\frac{I_1}{x} + \frac{I_2}{x-d}\right)$$

B_z si annulla per

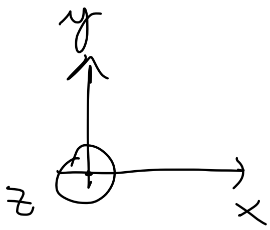
$$-\frac{I_1}{x} + \frac{I_2}{x-d} = 0$$

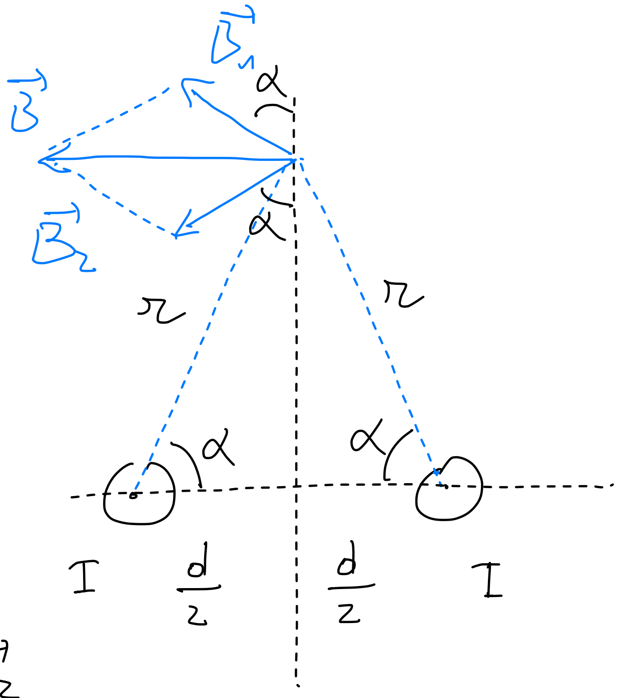
$$\frac{I_1}{x} = \frac{I_2}{x-d}$$

$(x-d) I_1 = x I_2 \qquad\qquad x(I_1 - I_2) = d I_1$

$$\implies x = d\,\frac{I_1}{I_1 - I_2}$$

ES. 2





$$\vec{B} = \vec{B}_1 + \vec{B}_2$$

$$B_y = B_z = 0$$

$$B_x = B_{1x} + B_{2x} = -\left(B_1 \sin\alpha + B_2 \sin\alpha\right)$$

$$= -2\,\frac{\mu_0 I}{2\pi r}\sin\alpha$$

$$\frac{\sin\alpha}{r} = \frac{1}{r}\,\frac{y}{r} = \frac{y}{\left(y^2 + \frac{d^2}{4}\right)}$$

$$\Rightarrow B_x = -\frac{\mu_0 I}{\pi}\,\frac{y}{\left(y^2 + \frac{d^2}{4}\right)}$$

Il modulo è massimo quando $\frac{dB_x}{dy} = 0$

$$\frac{dB_x}{dy} = -\frac{\mu_0 I}{\pi}\left[\frac{1}{\left(y^2 + \frac{d^2}{4}\right)} - \frac{y}{\left(y^2 + \frac{d^2}{4}\right)^2}\,2y\right]$$

$$= 0 \quad \text{per} \quad 1 - \frac{2y^2}{y^2 + \frac{d^2}{4}} = 0 \quad \Rightarrow \quad y = \pm\frac{d}{2}$$