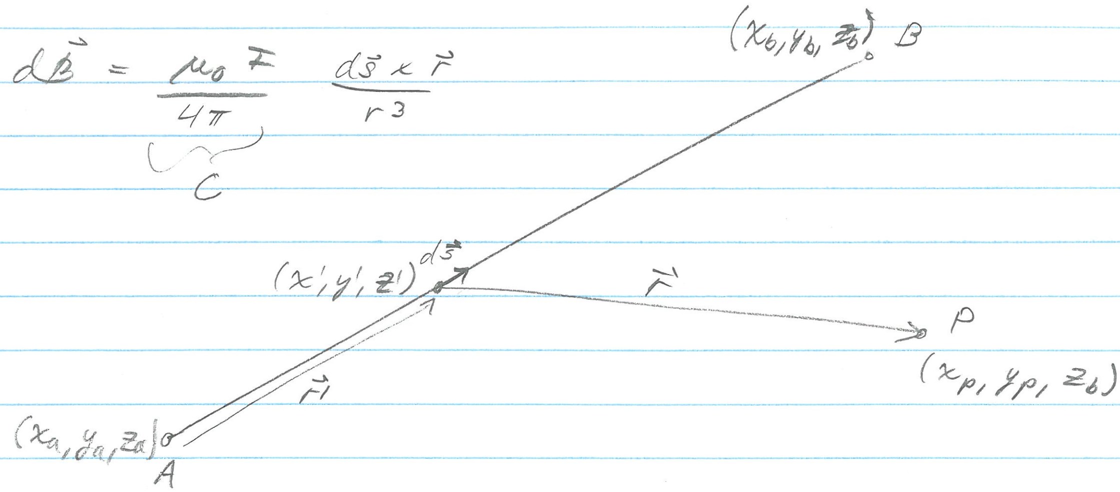
$$d\vec{B} = \underbrace{\frac{\mu_0 I}{4\pi}}_{C} \frac{d\vec{s} \times \vec{r}}{r^3}$$



$\vec{r} = \langle x_p - x', y_p - y', z_p - z' \rangle = \vec{p} - \vec{r}'$

$d\vec{s} = \langle dx', dy', dz' \rangle$

parametrize $\vec{r}'$:

$\vec{r}'(t) = \langle (x_b - x_a)t + x_a, (y_b - y_a)t + y_a, (z_b - z_a)t + z_a \rangle$ for $t \in [0,1]$

$\vec{r}(t) = \langle x_p - (x_b - x_a)t - x_a, y_p - (y_b - y_a)t - y_a, z_p - (z_b - z_a) - z_a \rangle$

$d\vec{s} = d\vec{r}'(t) = \langle (x_b - x_a)dt, (y_b - y_a)dt, (z_b - z_a)dt \rangle$

$\Delta x \equiv x_b - x_a \quad \Delta y \equiv y_b - y_a \quad \Delta z \equiv z_b - z_a$

$\vec{r}(t) = \langle x_p - t\Delta x - x_a, y_p - t\Delta y - y_a, z_p - t\Delta z - z_a \rangle$

$d\vec{s} = \langle \Delta x\, dt, \Delta y\, dt, \Delta z\, dt \rangle$

$$d\vec{s} \times \vec{r}(t) = \det \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \Delta x\, dt & \Delta y\, dt & \Delta z\, dt \\ x_p - t\Delta x - x_a & y_p - t\Delta y - y_a & z_p - t\Delta z - z_a \end{vmatrix}$$

$$d\vec{s} \times \vec{r}(t) = \langle \Delta y\, dt(z_p - t\Delta z - z_a) - \Delta z\, dt(y_p - t\Delta y - y_a),$$

$$\Delta z\, dt(x_p - t\Delta x - x_a) - \Delta x\, dt(z_p - t\Delta z - z_a),$$

$$\Delta x\, dt(y_p - t\Delta y - y_a) - \Delta y\, dt(x_p - t\Delta x - x_a)\rangle$$

$$r^3(t) = \left[(x_p - t\Delta x - x_a)^2 + (y_p - t\Delta y - y_a)^2 + (z_p - t\Delta z - y_a)^2\right]^{3/2}$$

$$d\vec{s} \times \vec{r}(t) = \langle(\Delta y z_p - t\Delta y\Delta z - \Delta y z_a - \Delta z y_p + t\Delta z\Delta y + \Delta z y_a)dt,$$

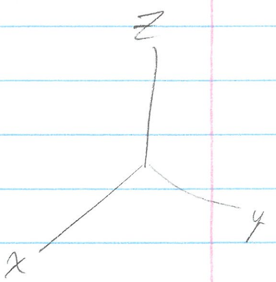
$$(\Delta z x_p - t\Delta z\Delta x - \Delta z x_a - \Delta x z_p + t\cancel{\Delta x\Delta z} + \Delta x z_a)dt,$$

$$(\Delta x y_p - t\Delta x\Delta y - \Delta x y_a - \Delta y x_p + t\Delta y\Delta x + \Delta y x_a)dt\rangle$$

$$= \langle(\Delta y z_p - \Delta y z_a - \Delta z y_p + \Delta z y_a)dt,$$

$$(\Delta z x_p - \Delta z x_a - \Delta x z_p + \Delta x z_a)dt,$$

$$(\Delta x y_p - \Delta x y_a - \Delta y x_p + \Delta y x_a)dt\rangle$$



$$= \langle[\Delta y(z_p - z_a) + \Delta z(y_a - y_p)]dt$$
$$[\Delta z(x_p - x_a) + \Delta x(z_a - z_p)]dt$$
$$[\Delta x(y_p - y_a) + \Delta y(x_a - x_p)]dt\rangle$$

$$B_x = C \int_{t=0}^{1} \frac{\Delta y (z_p - z_a) + \Delta z (y_a - y_p)}{\left[(x_p - t\Delta x - x_a)^2 + (y_p - t\Delta y - y_a)^2 + (z_p - t\Delta z - z_a)^2\right]^{3/2}} \, dt$$

denominator: $\left[(x - t\alpha - a)^2 + (y - t\beta - b)^2 + (z - t\gamma - c)^2\right]^{3/2}$

$: \left[(x - t \cdot a1 - a2)^2 + (y - t \cdot b1 - b2)^2 + (z - t \cdot c1 - c2)^2\right]^{-3/2}$