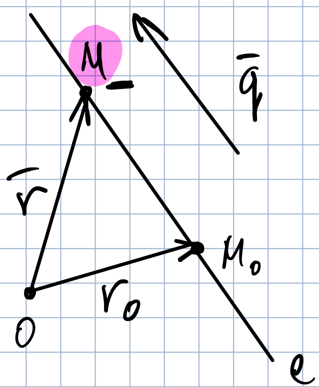


$$\overline{M_0M} = \overline{OM} - \overline{OM_0} = \bar r - \bar r_0$$

$$\bar r - \bar r_0 = t\,\bar q$$

t - parameter

$M(x, y, z) \qquad M_0(x_0, y_0, z_0)$

$r = [x, y, z]^T; \quad \bar r_0 = [x_0, y_0, z_0]^T; \quad \bar q = [q_x, q_y, q_z]^T$

$$\underline{\bar r - \bar r_0 = t\,\bar q}$$

$$\begin{cases} x - x_0 = t \cdot q_x \\ y - y_0 = t\, q_y \\ z - z_0 = t\, q_z \end{cases}$$

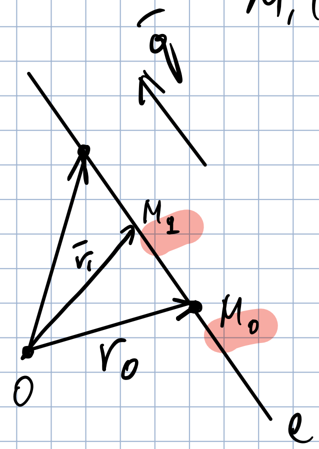
$q_y = 0$

$$t = \boxed{\frac{x - x_0}{q_x} = \frac{y - y_0}{q_y} = \frac{z - z_0}{q_z}}$$

canonical equation

if $q_x = 0$: line is in plane $\parallel$ to yz-plane.

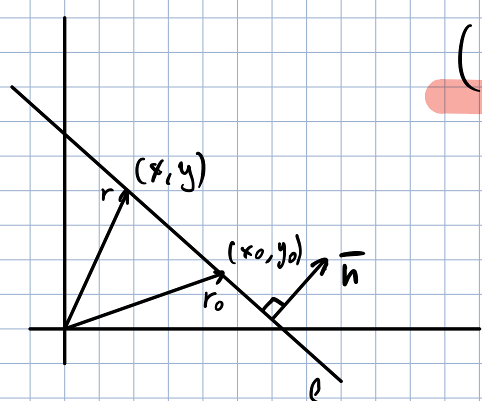
$M_1(x_1, y_1, z_1)$ $M_0(x_0, y_0, z_0)$



$$\bar{q} = [x_1 - x_0, y_1 - y_0, z_1 - z_0]^T$$

$$\frac{x - x_0}{x_1 - x_0} = \frac{y - y_0}{y_1 - y_0} = \frac{z - z_0}{z_1 - z_0}$$

Line in a plane



$$(\bar{r} - \bar{r}_0) \cdot \bar{n} = 0$$

$$\bar{n} = \begin{bmatrix} A \\ B \end{bmatrix}$$

$$r - r_0 = \begin{bmatrix} x - x_0 \\ y - y_0 \end{bmatrix}$$

$$A(x - x_0) + B(y - y_0) = 0$$

$$Ax + By \underbrace{- Ax_0 - By_0}_{C} = 0$$

$$\boxed{Ax + By + C = 0}$$

General equation of a Line

$$M_1(2, 1, 0) \quad x_0 \; y_0 \; z_0$$

$$M_2(1, -2, 3) \quad x_1 \; y_1 \; z_1$$

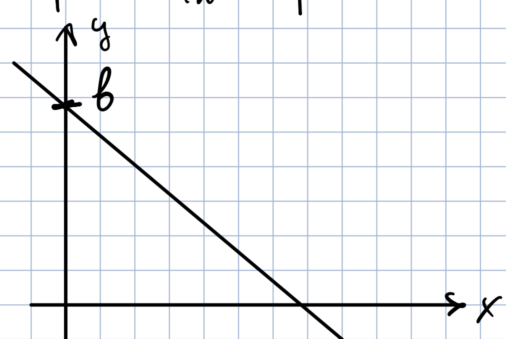
$$\frac{x-2}{1-2} = \frac{y-1}{-2-1} = \frac{z-0}{3-0}$$

$$Ax + By + C = 0$$

General form of eq-n of a Line

$$\underbrace{ax}_{\text{slope}} + \underbrace{b}_{\text{intercept}} = y$$

Slope-intercept form



$$\frac{x-3}{2} = \frac{y-1}{1}$$

$$q_1 = \begin{bmatrix} 4 \\ 1 \\ 2 \end{bmatrix} \checkmark$$

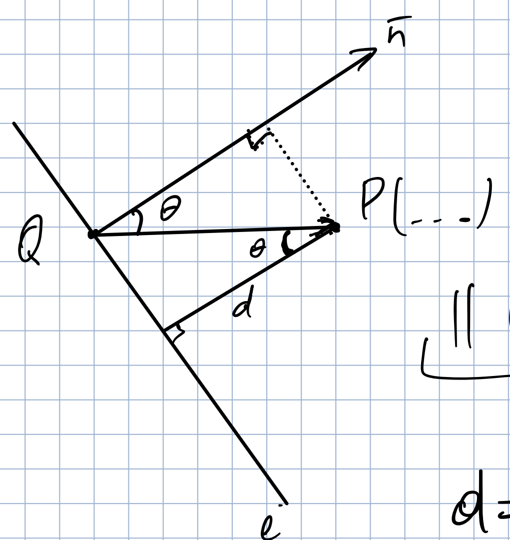
$$\frac{x-5}{\underset{q_x}{2}} = \frac{y-4}{\underset{q_y}{1}}$$

$$q_2 = \begin{bmatrix} 3 \\ 3 \\ 0 \end{bmatrix} \checkmark$$

$Ax + By + \underline{C} = 0 \qquad \bar{n}_1 = \begin{bmatrix} A \\ B \end{bmatrix}$

$A_1 x + B_1 y + \underline{C_1} = 0 \qquad \bar{n}_2 = \begin{bmatrix} A_1 \\ B_1 \end{bmatrix}$

$$\frac{n_1 \cdot n_2}{\|n_1\| \cdot \|n_2\|} = \cos\theta$$



$$\overline{QP} \cdot \bar{n} = \underline{\|\overline{QP}\|} \cdot \|\bar{n}\| \cdot \underline{\cos\theta}$$

$$\underbrace{\|\overline{QP}\| \cdot \cos\theta} = d$$

$$d = \frac{\overline{QP} \cdot \bar{n}}{\|\bar{n}\|}$$

$\overline{QP} \quad (x_1, y_1)$

$\bar{n} = \begin{bmatrix} a \\ b \end{bmatrix} \qquad d = \dfrac{x_1 a + y_1 b}{\sqrt{a^2 + b^2}}$