

Distance from a point to a line

↳ parametric equation

Find the shortest distance from the parametric line $l(t) = \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} t$ and the point $p = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$

សមីការ parametric equation → general form
បំប្លែងជាសមីការទូទៅបាន ៖

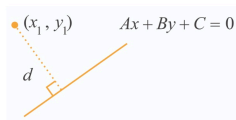
$$l(t) = \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} t$$

$$\begin{cases} x = 1+t \\ y = 1+2t \end{cases} \text{ yield } t$$

$$\begin{aligned} 2x &= 2+2t & \text{--- ①} \\ -y &= -1-2t & \text{--- ②} \end{aligned}$$

$$\begin{aligned} \text{①} + \text{②}; \quad 2x - y &= 1 \\ 2x - y - 1 &= 0 \end{aligned}$$

Formula



$$d = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$$

$$d = \frac{|2(1) - 1(3) - 1|}{\sqrt{2^2 + (-1)^2}}$$

$$= \frac{|-2|}{\sqrt{5}}$$

$$\therefore d = \frac{2}{\sqrt{5}} \quad \#$$

Find the intersection point

$$l(t) = \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} t \rightarrow l_2(s) = \begin{pmatrix} 1 \\ 3 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \end{pmatrix} s$$

the line perpendicular to $l(t)$
passing through $(1,3)$

$$l(t) = l_2(s)$$

$$\begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} t = \begin{pmatrix} 1 \\ 3 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \end{pmatrix} s$$

$$\begin{pmatrix} 1 \\ 2 \end{pmatrix} t - \begin{pmatrix} 2 \\ -1 \end{pmatrix} s = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 1 \\ 2 \end{pmatrix} t + \begin{pmatrix} -2 \\ 1 \end{pmatrix} s = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$$

$$\left[\begin{array}{cc|c} 1 & -2 & 0 \\ 2 & 1 & 2 \end{array} \right] \rightarrow \text{សមីការ} \quad \begin{aligned} t &= \frac{4}{5} \\ s &= \frac{2}{5} \end{aligned} \quad \text{បានចំណុចប្រសព្វ}$$

$$l(t) = \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} t$$

$$l\left(\frac{4}{5}\right) = \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} \left(\frac{4}{5}\right)$$

$$= \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} 4/5 \\ 8/5 \end{pmatrix}$$

$$\text{Intersection point} = \begin{pmatrix} 9/5 \\ 13/5 \end{pmatrix} \quad \#$$

