Distance Examples

1) A point and a line in 2-D

$\therefore$ dist $= |\text{Proj}_{\vec{n}} \overline{PP_0}|$

$P_0 = (-3, 7)$

P_0 = any pt on line

$= (0, -5)$

$\overline{PP_0} = (3, -12)$

$\vec{n} = (2, 1)$

$$= \frac{|\vec{n} \cdot \overline{PP_0}|}{|\vec{n}|}$$

$$= \frac{|(2,1) \cdot (3,-12)|}{\sqrt{5}}$$

$$= \frac{|-6|}{\sqrt{5}}$$

$$= 2.68$$

2) A Point & a line in 3-D

$$dist = \frac{|\overline{PP} \times \vec{d}|}{|\vec{d}|}$$

$P_0 = (1, -1, 2)$

$P = (3, 5, -3)$

$\overline{PP_0} = (2, 6, -5)$

$\vec{d} = (1, 1, -1)$

$$= \frac{|(2,6,-5) \times (1,1,-1)|}{|(1,1,-1)|}$$

$$= \frac{|(-1, -3, -4)|}{\sqrt{3}}$$

$$= \frac{\sqrt{26}}{\sqrt{3}}$$

$$= 2.94$$

3) Two skew (?) lines

$P_1 = (1, -3, 2)$

$P_2 = (3, 1, -4)$

$\overline{P_1P_2} = (2, 4, -6)$

$\bar{d}_1 = (1, -1, 2)$

$\bar{d}_2 = (3, 1, -4)$

$\bar{d}_1 \times \bar{d}_2 = (2, 10, 4)$

$$dist = \left| Proj_{\bar{d}_1 \times \bar{d}_2} \overline{P_1P_2} \right|$$

$$= \frac{\left| (\bar{d}_1 \times \bar{d}_2) \cdot \overline{P_1P_2} \right|}{\left| (\bar{d}_1 \times \bar{d}_2) \right|}$$

$$= \frac{\left| (2, 10, 4) \cdot (2, 4, -6) \right|}{\sqrt{120}}$$

$$= \frac{20}{\sqrt{120}}$$

$$= 1.83$$