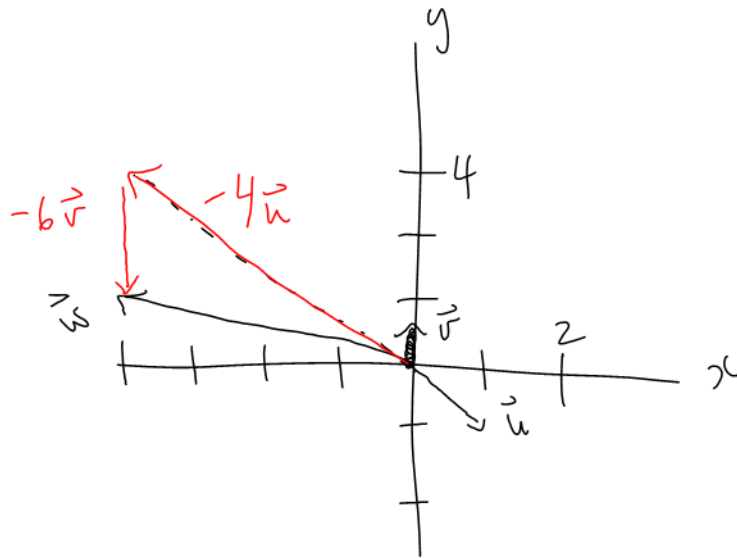
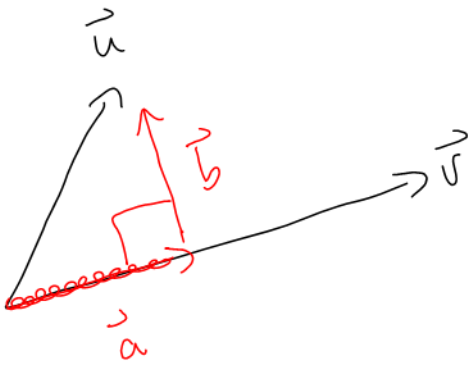


①



$$\vec{w} = -4\vec{u} - 6\vec{v}$$

2



$$\vec{a} = \text{proj}_{\vec{v}} \vec{u}$$

$$= \frac{\vec{u} \cdot \vec{v}}{\|\vec{v}\|^2} \vec{v}$$

$$= \frac{918}{54} [1, -2, 7]$$

$$= 17 [1, -2, 7]$$

$$= [17, -34, 119]$$

$$\vec{a} + \vec{b} = \vec{u}$$

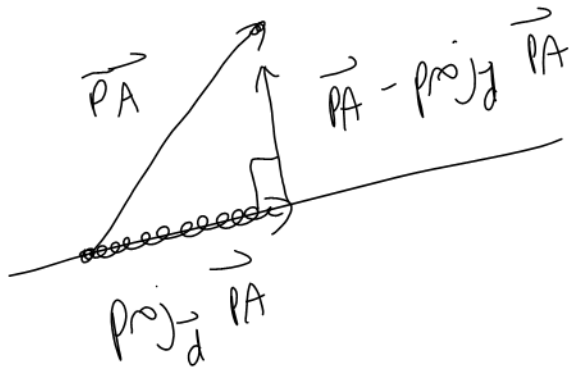
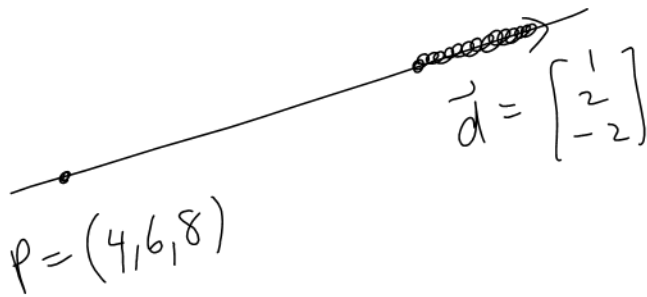
$$\vec{b} = \vec{u} - \vec{a}$$

$$= [-12, -38, 122] - [17, -34, 119]$$

$$= [-29, -4, 3]$$

3

$$A = (11, 13, -2)$$



$$\text{distance} = \|\vec{PA} - \text{proj}_{\vec{d}} \vec{PA}\|$$

$$\vec{PA} = \begin{bmatrix} 7 \\ 7 \\ -10 \end{bmatrix}$$

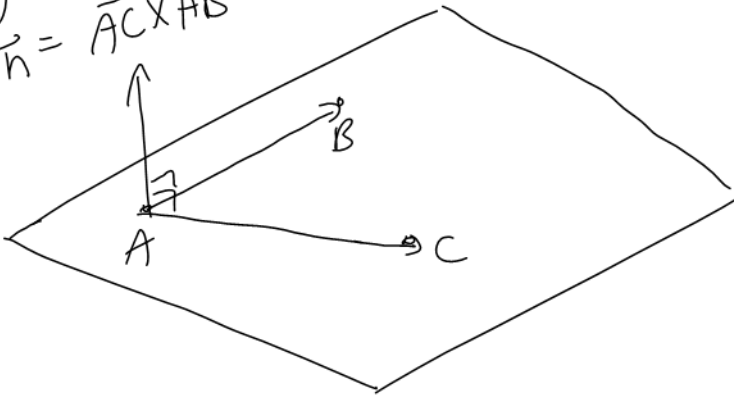
$$\begin{aligned} \text{proj}_{\vec{d}} \vec{PA} &= \frac{\vec{d} \cdot \vec{PA}}{\|\vec{d}\|^2} \vec{d} \\ &= \frac{41}{9} \begin{bmatrix} 1 \\ 2 \\ -2 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} \vec{PA} - \text{proj}_{\vec{d}} \vec{PA} &= \frac{9}{9} \begin{bmatrix} 7 \\ 7 \\ -10 \end{bmatrix} - \frac{41}{9} \begin{bmatrix} 1 \\ 2 \\ -2 \end{bmatrix} \\ &= \frac{1}{9} \begin{bmatrix} 22 \\ -19 \\ -8 \end{bmatrix} \end{aligned}$$

$$\text{distance} = \left\| \frac{1}{9} \begin{bmatrix} 22 \\ -19 \\ -8 \end{bmatrix} \right\| = \frac{1}{9} \left\| \begin{bmatrix} 22 \\ -19 \\ -8 \end{bmatrix} \right\| = \frac{\sqrt{909}}{9} = \frac{\sqrt{101}}{3}$$

④

$$\vec{n} = \vec{AC} \times \vec{AB}$$



$$\vec{AC} = \begin{bmatrix} 3 \\ 1 \\ 0 \end{bmatrix} \quad \vec{AB} = \begin{bmatrix} -3 \\ -3 \\ 3 \end{bmatrix}$$

$$\begin{aligned} \vec{n} &= \vec{AC} \times \vec{AB} \\ &= \begin{bmatrix} 3 \\ -9 \\ -6 \end{bmatrix} \end{aligned}$$

$$\begin{array}{cccccc} 3 & 1 & 0 & 3 & 1 \\ & \times & & \times & \times \\ -3 & -3 & 3 & -3 & -3 \end{array}$$

Normal form  $\vec{n} \cdot \vec{x} = \vec{n} \cdot \vec{p}$  ← any point on the plane

$$\begin{bmatrix} 3 \\ -9 \\ -6 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ -9 \\ -6 \end{bmatrix} \cdot \begin{bmatrix} 6 \\ 5 \\ -3 \end{bmatrix}$$

$$\begin{aligned}
 \textcircled{5} \quad V(\text{parallelepiped}) &= \left| \det \begin{bmatrix} 2 & -3 & 7 \\ -4 & 5 & 4 \\ 1 & -1 & -1 \end{bmatrix} \right| \\
 &= \left| 2 \begin{vmatrix} 5 & 4 \\ -1 & -1 \end{vmatrix} + 3 \begin{vmatrix} -4 & 4 \\ 1 & -1 \end{vmatrix} + 7 \begin{vmatrix} -4 & 5 \\ 1 & -1 \end{vmatrix} \right| \\
 &= \left| 2(-1) + 3(0) + 7(-1) \right| \\
 &= \left| -9 \right| \\
 &= 9
 \end{aligned}$$