(1) [redacted]

$$\begin{matrix} 3 & -6 & 9 \\ \times & \times & \times \\ 4 & 8 & 1 \end{matrix} \qquad \begin{matrix} 3 & -6 \\ \times & \times \\ 4 & 8 \end{matrix}$$

$$\bar{a} \times \bar{b} = [-78, 33, 48]$$

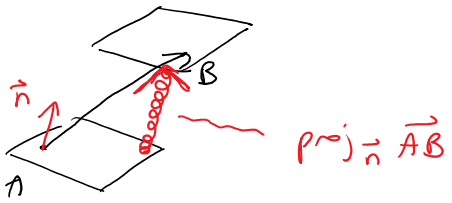
$$\text{area of triangle} = \frac{\|\bar{a} \times \bar{b}\|}{2}$$

$$= \frac{\sqrt{9477}}{2}$$

(2) Choose points A and B on each plane:

$A = (2, 0, 0)$

$B = (0, -3, 0)$



$$\vec{AB} = \begin{bmatrix} -2 \\ -3 \\ 0 \end{bmatrix}$$

$$\vec{n} = \begin{bmatrix} 2 \\ -3 \\ 7 \end{bmatrix}$$

$$\text{proj}_{\bar{n}} \bar{AB} = \frac{\bar{n} \cdot \bar{AB}}{\|\bar{n}\|^2} \bar{n}$$

$$= \frac{5}{62} \begin{bmatrix} 2 \\ -3 \\ 7 \end{bmatrix}$$

$$\text{distance} = \| \text{proj}_{\vec{n}} \vec{AB} \|$$

$$= \frac{5}{\sqrt{62}} \sqrt{62}$$

$$= \frac{5\sqrt{62}}{62}$$

(3) $\vec{u} \cdot \vec{v} = a(a\cos\beta - b\sin\beta) + b(a\sin\beta + b\cos\beta)$

$= a^2\cos\beta - ab\sin\beta + ab\sin\beta + b^2\cos\beta$

$= (a^2 + b^2)\cos\beta$

$\|\vec{u}\| = \sqrt{a^2+b^2}$

$\|\vec{v}\| = \sqrt{(a\cos\beta - b\sin\beta)^2 + (a\sin\beta + b\cos\beta)^2}$

$= \sqrt{a^2\cos^2\beta - 2ab\cos\beta\sin\beta + b^2\sin^2\beta + a^2\sin^2\beta + 2ab\sin\beta\cos\beta + b^2\cos^2\beta}$

$= \sqrt{a^2(\cos^2\beta + \sin^2\beta) + b^2(\sin^2\beta + \cos^2\beta)}$

$= \sqrt{a^2+b^2}$

Now $\theta = \cos^{-1}\left(\frac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\,\|\vec{v}\|}\right)$

$= \cos^{-1}\left[\frac{(a^2+b^2)\cos\beta}{a^2+b^2}\right]$

$= \cos^{-1}(\cos\beta)$

$= \beta$