$$z^2 - z + 8 + 2i(z+1) = 0$$

$$z^2 - z + 8 + 2iz + 2i = 0$$

$$z^2 - z(1-2i) + 8+2i = 0$$

$a = 1, \quad b = -(1-2i) \quad c = 8+2i$

$$z = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$(1-2i)^2$$

$$= 1^2 + 4i^2 - 4i$$

$$= \frac{(1-2i) \pm \sqrt{(-3-4i) - 32 - 8i}}{2}$$

$$= \frac{(1-2i) \pm \sqrt{-35 - 12i}}{2}$$

$$\sqrt{-35-12i} = a + ib$$

$$-35 - 12i = a^2 - b^2 + 2abi$$

$a^2 - b^2 = -35 \qquad 2ab = -12$

$ab = -6$

$a = -1$

$b = 6$

$$\sqrt{-35-12i} = -1 + 6i$$

$$z = \frac{(1-2i) \pm (-1+6i)}{2}$$

$$= \frac{1-2i+(-1+6i)}{2} \quad \text{OR} \quad \frac{(1-2i)-(-1+6i)}{2}$$

$$= \underline{2i} \qquad = \underline{1-4i}$$

$P(4,3,6)$ $\quad Q(-2,0,8)$ $\quad R(1,5,0)$

$\vec{PQ} = \langle -6, -3, 2 \rangle$

$\vec{PR} = \langle -3, 2, -6 \rangle$

$$\vec{PQ} \times \vec{PR} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -6 & -3 & 2 \\ -3 & 2 & -6 \end{vmatrix} = \langle 14, -42, -21 \rangle$$

$$\|\vec{PQ} \times \vec{PR}\| = \sqrt{196 + 1764 + 441}$$

$$= \sqrt{2401} = 49$$

Area of $\Delta PQR = \frac{49}{2} = 24.5$ sq units

Eq of plane

$$14(x-4) - 42(y-3) - 21(z-6) = 0$$

$$14x - 56 - 42y + 126 - 21z + 126 = 0$$

$$14x - 42y - 21z = -196$$

$$2x - 6y - 3z = -28$$

$\vec{w} = \text{proj}_{\vec{v}}\, \vec{u}$

$2\vec{u} \times \vec{v} \perp \vec{u}$ and $\vec{v}$

$\vec{w} \parallel \vec{v}$

$\therefore\ 2\vec{u} \times \vec{v} \perp \vec{w}$

$$\underbrace{\vec{w} \cdot (2\vec{u} \times v)}_{0} - 3\vec{w}\vec{v}$$

$$-3\,\vec{w}\vec{v} = -3\left(\frac{\vec{u}\cdot\vec{v}}{\|\vec{v}\|^2}\right)\vec{v} \cdot \vec{v}$$

$$= -3\left(\frac{\vec{u}\cdot\vec{v}}{\cancel{\|\vec{v}\|^2}}\right)\cancel{\|\vec{v}\|^2}$$

$$= -3\,(\vec{u}\cdot\vec{v})$$

$$= -3 \times 17$$

$$= -51$$

$$\|\vec{u}\| = \|\vec{v}\| = 1$$

$$\theta = \frac{2\pi}{3}$$

$$\|\vec{u}+2\vec{v}\|^2 = (\vec{u}+2\vec{v})\cdot(\vec{u}+2\vec{v})$$

$$= \vec{u}\cdot\vec{u} + 2\vec{u}\vec{v} + 2\vec{u}\vec{v} + 4\vec{v}\cdot\vec{v}$$

$$= \|\vec{u}\|^2 + 4\|\vec{u}\|\,\|\vec{v}\|\cos\frac{2\pi}{3} + 4\|\vec{v}\|^2$$

$$= 1 + 4\cos\frac{2\pi}{3} + 4$$

$$= 5 + 4\left(\frac{-1}{2}\right)$$

$$= 3$$

$$\|u+2v\| = \sqrt{3}$$

$$6-8+5c=0$$

$$5c=2$$

$$c=2/5$$

$n_1 = \langle 4, 4, -2 \rangle$