

HW 2 Solutions

1. $A(2,1,3)$ $B(2,2,4)$ $C(1,1,6)$ $S(1,1,1)$

$$\vec{AB} = \langle 0, 1, 1 \rangle$$

$$\vec{AC} = \langle -1, 0, 3 \rangle$$

$$\vec{AB} \times \vec{AC} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 1 & 1 \\ -1 & 0 & 3 \end{vmatrix} = \langle 3, -1, 1 \rangle = \vec{n}$$

$$d = \frac{|\vec{PS} \cdot \vec{n}|}{|\vec{n}|}$$

$$\vec{PS} = \vec{SA} = \langle 1, 0, 2 \rangle$$

$$d = \frac{|\langle 1, 0, 2 \rangle \cdot \langle 3, -1, 1 \rangle|}{\sqrt{3^2 + 1^2 + 1^2}} = \frac{5}{\sqrt{11}}$$

2. $\vec{r}_1(t) = \langle 3-t, -4+t, 4+2t \rangle$

$$\vec{r}_2(t) = \langle 3+t, -4+t, 4+t \rangle$$

$$\vec{v}_1 \times \vec{v}_2 = \vec{n} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -1 & 1 & 2 \\ 1 & 1 & -1 \end{vmatrix} = \langle -3, 1, -2 \rangle$$

$$-3x + y - 2z = D$$

$$-3(3) + (-4) - 2(4) = D$$

$$D = -21$$

$$\Rightarrow -3x + y - 2z = -21$$

$$\text{x-axis: } y = z = 0$$

$$-3x = -21$$

$$x = 7$$

$$\therefore (7, 0, 0)$$

3. $A(1,3,2)$ $\vec{r}(t) = \langle 1+t, -1-2t, 3+2t \rangle$

$$\vec{v}_1 = \langle 1, -2, 2 \rangle$$

$$\vec{v}_2 = \langle 0, 4, -1 \rangle$$

$$\vec{v}_1 \times \vec{v}_2 = \vec{n} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -2 & 2 \\ 0 & 4 & -1 \end{vmatrix} = \langle -6, 1, 4 \rangle$$

$$-6x + y + 4z = D$$

$$-6(1) + (3) + 4(2) = D$$

$$D = 5$$

$$\therefore -6x + y + 4z = 5$$

- 4. (i) hyperbola
- (ii) ellipse
- (iii) parabola
- (iv) crossing lines
- (v) circle

- 5. (i) elliptical cone
- (ii) elliptical paraboloid
- (iii) hyperbolic paraboloid
- (iv) ellipsoid
- (v) elliptical cone
- (vi) hyperboloid of two sheets
- (vii) hyperboloid of one sheet