MATH 178 Sec. 9.4 – SOLUTIONS

(25) $X = \langle 0, -1, 3 \rangle$ AND $Y = \langle -3, 1, 1 \rangle$

$$\cos\theta = \frac{X \cdot Y}{|X||Y|} = \frac{2}{\sqrt{10}\sqrt{11}} = \frac{2}{\sqrt{110}}, \quad \text{so} \quad \theta = \boxed{\cos^{-1}\frac{2}{\sqrt{110}}}$$

(39) $\vec{n} = \langle 0, -1, 1 \rangle$, SO THE PLANE HAS EQUATION

$\underline{-Y + Z = d}$ WHERE $d = -2 + 3 = 1$: $\boxed{-Y + Z = 1}$

(40) $\vec{n} = \langle 1, -2, -1 \rangle$, SO THE PLANE HAS EQUATION

$\underline{X - 2Y - Z = d}$ WHERE $d = 1 - 2(0) - (-3) = 4$: $\boxed{X - 2Y - Z = 4}$

(59) $P(5, 4, -1)$, $Q(2, 0, 3)$ LET $\vec{a} = \overrightarrow{PQ} = \underline{\langle -3, -4, 4 \rangle}$

USING P AS THE POINT GIVES $\boxed{X = 5 - 3T,\ Y = 4 - 4T,\ Z = -1 + 4T}$, T IN $\mathbb{R}$

REMARK USING Q INSTEAD WOULD GIVE $\boxed{X = 2 - 3T,\ Y = -4T,\ Z = 3 + 4T}$, T IN $\mathbb{R}$

(61) $P(2, -3, 1)$, $Q(-5, 2, 1)$ LET $\vec{a} = \overrightarrow{QP} = \underline{\langle 7, -5, 0 \rangle}$

USING P AS THE POINT GIVES $\boxed{X = 2 + 7T,\ Y = -3 - 5T,\ Z = 1}$, T IN $\mathbb{R}$

REMARK WE COULD ALSO USE $-\vec{a} = \overrightarrow{PQ}$ AS A DIRECTION VECTOR, AND WE COULD USE Q AS THE POINT.

(63) 1) $\vec{n} = \langle 1, 2, 1 \rangle$, SO THE PLANE HAS EQUATION $\underline{X + 2Y + Z = d}$

WHERE $d = 1 + 2(-1) + 2 = 1$, SO $\underline{X + 2Y + Z = 1}$.

2) $P(0, -3, 2)$, $Q(-1, -2, 3)$ LET $\vec{a} = \overrightarrow{PQ} = \underline{\langle -1, 1, 1 \rangle}$, SO

THE LINE IS GIVEN BY $\underline{X = -T,\ Y = -3 + T,\ Z = 2 + T}$, T IN $\mathbb{R}$

3) THE PLANE AND LINE INTERSECT WHERE

$(-T) + 2(-3 + T) + (2 + T) = 1$ SO $-T - 6 + 2T + 2 + T = 1$, $2T = 5$, $\underline{T = 5/2}$

$\boxed{X = -5/2,\ Y = -1/2,\ Z = 9/2}$

(66) $X + 2Y - Z = -1$ HAS NORMAL VECTOR $\vec{n} = \langle 1, 2, -1 \rangle$.

SINCE THE LINE IS PERPENDICULAR TO THE PLANE, $\vec{n}$ IS A DIRECTION VECTOR FOR THE LINE:

$\boxed{X = 5 + T,\ Y = -3 + 2T,\ Z = 4 - T}$, T IN $\mathbb{R}$