Practice Problems for Midterm 1:

1: (a) Find an equation of the line of intersection of the planes:

\[ 3x - y + z = 1, \quad \text{and} \quad x + 2y - z = 0. \]

(b) Find an equation of the plane which intercepts the axis at:

\( \langle 2, 0, 0 \rangle, \quad \langle 0, -3, 0 \rangle, \quad \text{and} \quad \langle 0, 0, 6 \rangle. \)

2: (a) Find parametric equations for the plane curve

\[ x^2 + 4x + y^2 - 2y - 4 = 0. \]

(b) Find an equation of the line tangent to the curve

\[ \mathbf{r}(t) = \langle t^2 + 2, \ t^3, \ 4 - t \rangle, \]

at the point \( P = (3, -1, 5). \)

3: (a) The unit vectors

\[ \mathbf{u} = \begin{bmatrix} 3/5 \\ 0 \\ -4/5 \end{bmatrix}, \quad \text{and} \quad \mathbf{v} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \]

are perpendicular. Find a unit vector \( \mathbf{w} \) which is perpendicular to both \( \mathbf{u} \), and \( \mathbf{v} \).

(b) Suppose we write the vector \( \mathbf{r} = 2\mathbf{i} - 5\mathbf{j} + \mathbf{k} \) in terms of \( \mathbf{u}, \mathbf{v}, \mathbf{w} \) from part (a), as

\[ \mathbf{r} = \alpha \mathbf{u} + \beta \mathbf{v} + \gamma \mathbf{w}, \]

where \( \alpha, \beta, \gamma \) are real numbers. Find \( \alpha \).