Practice Problems for Midterm 1:

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

$$3\,x - y + z = 1, \qquad \text{and} \qquad x + 2\,y - z = 0.$$

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

$$(2, 0, 0), \qquad (0, -3, 0), \qquad \text{and} \qquad (0, 0, 6).$$

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

$$\mathbf{r}(t) = < t^2 + 2, \ t^3, \ 4 - t >,$$

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

3: (a) The **unit** vectors

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

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 α, β, γ are real numbers. Find α.