

Name: \_\_\_\_\_

**Quiz 2 Solutions**

Please write your solutions to the following exercises in the space provided. You should write legibly and fully explain your work.

*Good Luck!*

- (1) Find the parametric equations of the plane in  $\mathbb{R}^3$  passing through the point  $P = (1, 3, 1)$  with direction vectors  $\mathbf{u} = \begin{bmatrix} -1 \\ 0 \\ 4 \end{bmatrix}$  and  $\mathbf{v} = \begin{bmatrix} 0 \\ -1 \\ 3 \end{bmatrix}$ . [6 pts]

*Solution:* The vector equation is

$$\mathbf{x} = \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix} + s \begin{bmatrix} -1 \\ 0 \\ 4 \end{bmatrix} + t \begin{bmatrix} 0 \\ -1 \\ 3 \end{bmatrix}.$$

Thus, the parametric equations are

$$\begin{aligned} x &= 1 - s \\ y &= 3 - t \\ z &= 1 + 4s + 3t \end{aligned}$$

- (2) Are the following equations linear? If not, then explain. [6 pts]

(a)  $7e^x - 4y + z = \sqrt{3}$

*Solution:* This is not a linear equation because the variable  $x$  is the input of the function  $e^x$ .

(b)  $e^7x - 4y + z = \sqrt{3}$

*Solution:* This is a linear equation.

(3) Find the augmented matrix of the linear system

[5 pts]

$$\begin{aligned} -2x_1 + 5x_2 - x_3 &= 7 \\ 2x_1 + x_3 &= -5 \\ x_1 - 3x_2 + 4x_3 &= 0 \end{aligned}$$

*Solution:* 
$$\left[ \begin{array}{ccc|c} -2 & 5 & -1 & 7 \\ 2 & 0 & 1 & -5 \\ 1 & -3 & 4 & 0 \end{array} \right]$$

(4) Let  $\mathbf{v}, \mathbf{v}_1, \dots, \mathbf{v}_k$  be vectors in  $\mathbb{R}^n$ . Define what it means for  $\mathbf{v}$  to be a *linear combination* of  $\mathbf{v}_1, \dots, \mathbf{v}_k$ . [3 pts]

*Solution:*  $\mathbf{v}$  is a *linear combination* of  $\mathbf{v}_1, \dots, \mathbf{v}_k$  if there exist scalars  $c_1, \dots, c_k$  such that

$$\mathbf{v} = c_1\mathbf{v}_1 + c_2\mathbf{v}_2 + \cdots + c_k\mathbf{v}_k.$$