MTH 277, Homework #2, Spring 2025 Name ____

Instructions: Write your work up neatly and attach to this page. Record your final answers (only) directly on this page if they are short; if too long indicate which page of the work the answer is on and mark it clearly. Use exact values unless specifically asked to round.

1. Find an equation of the line with the given properties, in the indicated form.
   a. $A(2,4,-3), B(3,-1,1)$ in parametric form.
   b. $A(-8,2,4), B(3,-2,5)$ in symmetric form.
   c. Parallel to $x+2=\frac{1}{2}y=z-3$ through the point $(1,-1,1)$ in both forms.

2. Find the equation of the plane.
   a. Passes through the point $(5,-3,-4)$ and perpendicular to vector $\langle 2,-1,3\rangle$
   b. Passes through the point $(-6,0,8)$ and perpendicular to line $x=5-2t, y=-4+2t, z=0$.
   c. Passes through $(2,3,-2), (3,4,2)$ *and* $(-1,-1,0)$
   d. Contains the y-axis and makes an angle of π/6 with the positive x-axis.
   e. Contains the lines given by $\frac{x-1}{-2}=y-4=z$ and $\frac{x-2}{-3}=\frac{y-1}{4}=\frac{z-2}{-1}$
   f. Passes through $(2,2,1)$ and $(-1,1,-1)$ and is perpendicular to the plane $2x-3y+z=3$.

3. Find a set of parametric equations for the line of intersection of the planes $3x+2y-z=7, x-4y+2z=0$. At what angle do they intersect?

4. Find the distance between the point and the plane/line using the formulas $D=\frac{\|\overrightarrow{PQ}\times\vec{v}\|}{\|\vec{v}\|}$, and $D=\frac{\|\overrightarrow{PQ}\cdot\vec{n}\|}{\|\vec{n}\|}$ respectively where Q is any point in the plane/line.
   a. P$(2,8,4)$ $2x+y+z=5$
   b. P$(-2,1,3)$ $x=1-t, y=2+t, z=-2t$

5. Find the domain of the vector-valued function. Find $\left\|\overrightarrow{r(t)}\right\|$.
   a. $\overrightarrow{r(t)}=\sqrt{4-t^2}\vec{i}+t^2\vec{j}-6t\vec{k}$
   b. $\overrightarrow{r(t)}=\sqrt[3]{t}\vec{i}+\frac{1}{t+1}\vec{j}+(t+2)\vec{k}$
   c. $\overrightarrow{r(t)}=(\ln t-1)\vec{i}+t\vec{j}$
   d. $\overrightarrow{r(t)}=(1-t)\vec{i}+\sqrt{t}\vec{k}$

6. Convert the plane curve (2-D) into 2 different vector-valued function. There are more than two correct answers.
   a. $y=4-x$
   b. $x^2+y^2=25$

7. Find the domain of the function. Evaluate the function at the given points and simplify.
   a. $f(x,y)=4-x^2-y^2; (0,0), (2,3), (1,y), (x,0), (t,t^2)$
   b. $f(x,y)=\ln(xy-6); (5,e), (e,1), (1,y), (x,0), (t,e^t)$

8. Find the parametric equation for the space curve represented by the intersection of surfaces using the given parameter (if stated), or choose an appropriate one.
   a. $z=x^2+y^2, x+y=0$ $x=t$
   c. $x^2+y^2+z^2=4, x+z=2$ $x=1+\sin t$

b. $z = \sqrt{x^2 + y^2}, z = 1 + y$

d. $z = 4x^2 + y^2, y = x^2$

9. Find two different parametrizations of the following paths.
   a. $x^2 + y^2 = 9$ starting and ending at the point (3,0) counterclockwise.
   b. $\frac{x^2}{16} + \frac{y^2}{9} = 1$ starting at the point (4,0) and ending at the point (0,3), counterclockwise.
   c. Along the line segments connecting (0,0,0), (1,0,0), (1,0,1), (1,1,1).
   d. Along the curve $y = x^2$ from (0,0) to (2,4), then along the line segment (2,4) to (0,4), and then back to the origin.
   e. Along the top half of the hyperbola $\frac{y^2}{16} - \frac{x^2}{4} = 1$, between $(-3, 2\sqrt{13})\ and\ (3, 2\sqrt{13})$.