Math 208: Calculus and Analytic Geometry

This is a set of exercise that will help you prepare for the first in-class test.

Vectors

(1) Let $\mathbf{v} = \langle 3, 2, 1 \rangle$ and $\mathbf{w} = \langle 3, 0, 1 \rangle$. Find $\mathbf{v} \cdot \mathbf{w}$, $\mathbf{v} \times \mathbf{w}$, $||\mathbf{v}||$, $proj_\mathbf{v} \mathbf{w}$, a vector of length 4 in the opposite direction of $\mathbf{v}$.

Planes and lines

(1) Find the plane passing through the points $P(0, 0, 1)$, $Q(1, 2, 3)$ and $R(4, 1, 2)$.
(2) Let $\pi : 3x - 6y + 8z = 0$ be a plane in $\mathbb{R}^3$. Find a line perpendicular to $\pi$ passing through the point $P(8, 1, 0)$.
(3) Let $\pi_1 : 3x - 6y + 8z = 0$ and $\pi_2 : 4x + 2y = 0$ be two planes. Find the intersection of the two planes.
(4) Let $\pi_1 : 3x - 6y + 8z = 0$ and $\pi_2 : 4x + 2y = 0$ be two planes. Find the plane perpendicular to $\pi_1$ and $\pi_2$ passing through the point $P(8, 1, 0)$.
(5) Find the distance between the plane $\pi : 3x - 6y + 8z = 0$ and the line with direction the vector $\langle 2, 1, 0 \rangle$ and passing through the point $P(8, 1, 0)$.
(6) Decide whether the two lines $r$ and $s$ as in number 7 are parallel, skew or intersecting.
(7) Find a plane parallel to the lines

$$s : \begin{cases} x = t + 9 \\ y = 7t \\ z = 8t + 8 \end{cases} \text{ and } r : \begin{cases} x = 5t + 9 \\ y = 4 \\ z = 8t + 8 \end{cases}$$

(8) Sketch

$$s : \begin{cases} x = e^t + 9 \\ y = 7e^t \\ z = 8e^t + 8 \end{cases}$$

Surfaces in $\mathbb{R}^3$

Identify and describe the following surfaces. You may sketch the graph but it is acceptable to just adequately describe it in words.

(1) The surface $z^2 + y^2 = 9$ in $\mathbb{R}^3$.
(2) The surface $x^2 + x + y^2 - y + z^2 = 10$ in $\mathbb{R}^3$.
(3) The surface $y^2 + z^2 = x^2$ in $\mathbb{R}^3$. 

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