**Math 20C - Midterm - 10/23/2019**

Name & Student ID: __________________________________________________________

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1. (a) (2 points) Circle the vectors below which are perpendicular to \((1, 2, 0)\).

\[
\begin{align*}
(0, 0, 4) & \quad (-4, 2, 6) & \quad (2, 2, -1) & \quad (2, -1, 0)
\end{align*}
\]

(b) (2 points) Find the angle between the vectors \((1, 1, \sqrt{2})\) and \((1, 1, 0)\).

(c) (2 points) Write down a vector that is perpendicular both of the vectors \((-2, 4, 5)\) and \((1, 1, 1)\).
2. (a) (3 points) Find a parametric equation for the line through the point \((4, 5)\) in the direction of the vector \((1, 4)\).

(b) (1 point) Let \(P\) be the plane with equation \(z = 2x + 3y - 4\). Let \(L\) be the line parametrized by the equation \(\mathbf{r}(t) = (0, 0, 1) + t(4, 6, -2)\).

Are \(P\) and \(L\) perpendicular? \textbf{Yes} or \textbf{No} (circle one)

(c) (3 points) Find an equation for the plane through the point \((1, 1, 1)\) with normal vector \(\mathbf{n} = (-2, 1, 2)\)
3. (a) (2 points) Which of the following vectors has the largest length? Which has the smallest length?

\[
(3, 4) \quad \quad \quad (\sqrt{2}, -5, 3) \quad \quad \quad (-\sqrt{3}, -2, -3)
\]

(b) (4 points) Let \( P \) be the plane with equation \( x + y + z = 4 \) and let \( \vec{a} \) be the point \((1, 2, 3)\). Find the distance between \( P \) and \( \vec{a} \).
4. (a) (2 points) Let
\[ f : \mathbb{R}^2 \to \mathbb{R} \]
be the function \( f(x, y) = x^2 + e^{xy} \). Compute the partial derivatives \( \frac{\partial f}{\partial x} \) and \( \frac{\partial f}{\partial y} \).

(b) (3 points) Let \( f(x, y) \) be the function from part (a). Find the equation for the tangent plane to the graph \( z = f(x, y) \) at the point \((4, 0, 17)\).
Scratch Paper.