Math 107H Exam 2 **Name** _____.

1. (20 points)

   a. Find a value of the constant c so that the vectors $\vec{u} =< -2, -3, 4 >$ and $\vec{v} =< 6, 9, c >$ are parallel.

   b. Find the angle between the vectors $\vec{a} =< 1, -1, 3 >$ and $\vec{b} =< -1, 2, -2 >$.

   c. Find the work done by the constant force $\vec{F} =< -1, 2, 4 >$ in moving an object from the point $(2, 3, -2)$ to the point $(-1, -2, 3)$.

   d. Find a value of the constant c so that the vectors $\vec{u} =< -2, -3, 4 >$ and $\vec{v} =< 1, 3, c >$ are perpendicular.

2. (14 points)

   a Find an equation of the plane passing through the points $(1, 0, 3)$, $(2, 1, 4)$, and $(-1, -1, 2)$.

   b Find a parametric representation of the line that passes through the point $(2, -1, 7)$ and is parallel to the line

$$\vec{r}(t) =< -2 + 4t, 1 + 3t, 4 - 3t >, \quad -\infty < t < \infty.$$

3. (13 points) Given the vectors $\vec{u} =< 3, -2, 4 >$ and $\vec{v} =< -1, 2, 1 >$, find the component of $\vec{u}$ in the direction of $\vec{v}$. Also find the vector projection of $\vec{u}$ on $\vec{v}$.

4. (25 points)

a Find the area of the triangle with vertices $P = (2, 1, 3)$, $Q = (1, -2, -3)$, $R = (-2, 3, 4)$.

b Find the Taylor polynomial of degree 2 for $f(x) = \tan(2x)$ about $x = \frac{\pi}{8}$.

c Graph the surface $x^2 + (z - 2)^2 = 4$ in R^3.

d Graph the surface $-x^2 - y^2 + z^2 = 1$ in R^3.

e Find the distance from the point $(1, 3, 2)$ to the plane $z = 3x + 4y + 5$.

5. (13 points) Given $\vec{r}(t) =< 2\sin t, -2\cos t, 3t >$, $t \geq 0$ is the position vector of an object at time t. Find the velocity, acceleration, and speed of the object at time $t = \frac{\pi}{3}$.

6. (15 points)

a Find the volume of the tetrahedron with vertices $P = (2, 1, 3)$, $Q = (1, 0, -1)$, $R = (3, 1, 2)$, $S = (4, 1, 2)$.

b Graph the curve

$$C : x(t) = 6 - t^2, \quad y(t) = \frac{t}{2}, \quad -2 \leq t \leq 4.$$

c Find a parametrization of the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$, where you go around the ellipse one time in the clockwise direction.