Quiz 1: Covers 8.1 to 8.3

1. Find a vector of length 3 in the opposite direction of $< 2, -4 >$.
2. Find the measure of the angle between the vectors $< -2, 0, 1 >$ and $< 1, 1, -4 >$.
3. Let $\overrightarrow{a}$ and $\overrightarrow{b}$ be two 3-dimensional vectors that are orthogonal. What is $\mathbf{proj}_{\overrightarrow{b}} \overrightarrow{a}$? (You must justify your answer.)

Quiz 2: Covers 8.4 to 8.5

1. Find symmetric equations of the line through the point $(-5, 7, -2)$ parallel to the line $6x + 12 = 3y - 9 = z - 5$.
2. Find an equation of the plane containing the lines
$$\begin{cases} x = -2 + 2t \\ y = 1 + 4t \\ z = 2 - t \end{cases} \quad \text{and} \quad \begin{cases} x = 2 - 4t \\ y = 3 - 8t \\ z = 1 + 2t \end{cases}.$$
3. Find the area of the triangle whose vertices are at the three points $(1, -2, 3)$, $(2, 0, 2)$, and $(-2, -1, 4)$.

Quiz 3: Covers 8.5 to 8.6, 0.7 and 9.1

1. Sketch the graph of $\begin{cases} x = \sinh t + 2 \\ y = 3\cosh t - 1 \end{cases}$
2. Sketch the graph of $r = 4\sin\theta$
3. Sketch the graph of $2x - 4y + z = 4$
4. Sketch the graph of $x^2 + y^2 - z^2 = -1$
5. Sketch the graph of $\overrightarrow{r}(t) =< t^2\cos t, t, \sin t >$. To receive full credit for this problem, you must draw the graph of $\overrightarrow{r}(t)$ in two ways:
   (a) From the perspective of the positive $y-$axis
   (b) From the usual viewpoint

Quiz 4: Covers 9.2 to 9.5

1. Consider the curve C which is the graph of the vector-valued function $\overrightarrow{r}(t) =< t^2, 2\sqrt{2}\,t, 2\ln t >$ for $t > 0$.
   (a) Find the unit tangent vector to the graph of C at the point $(1, 2\sqrt{2}, 0)$.
   (b) Find the curvature of C when $t = 2$.
   (c) Find the tangential component of the acceleration of $\overrightarrow{r}$ when $t = 2$.
   (d) Find the normal component of acceleration of $\overrightarrow{r}$ when $t = 2$.

2. Let C_1 be the circle in the $xy-$plane centered at the origin with radius 1. Let C_2 be the curve which is the graph of the vector-valued function $< \cos t, \sin t, t >$ (this is a helix lying within the cylinder $x^2 + y^2 = 1$). Without doing any calculations, which curve (C_1 or C_2) would you expect to have greater curvature? Why?

Quiz 5: Covers 9.6, 11.6 and 11.7, 10.1 and 10.2

1. Find a parametrization of the surface
$$\frac{x^2}{16} + \frac{y^2}{16} + z^2 = 1.$$
2. Find the following limits, if they exist. If they do not exist, say so. All answers must be justified.

(a) $\lim_{(x,y)\to(0,0)} \left(\frac{x^2 - y^2}{x^2 + y^2}\right)^2$

(b) $\lim_{(x,y)\to(0,0)} \frac{x}{\sqrt{x^2 + y^2}}$

(c) $\lim_{(x,y)\to(0,0)} \frac{x^3 - y^3}{x - y}$

(d) $\lim_{(x,y)\to(0,0)} \frac{yx^{3/2}}{y^4 + x^2}$

Quiz 6: Covers 10.3 to 10.4

1. Let $f(x, y) = \sin x \cos y$. Find the values of the partial derivatives of $f(x, y)$ at the point $(\frac{\pi}{4}, \frac{\pi}{3})$.
2. Let $f(x, y) = x^3y + 3xy^2$.
   (a) Find the tangent plane to $f(x, y)$ at the point $(2, -2, 8)$.
   (b) Use the tangent plane to find the linear approximation to $f(1.9998, -1.9998)$.
3. Let $f(x, y, z) = e^{2x-y+z}$. Find the following high-order partial derivative:
$$\frac{\partial^{40} f}{\partial x^2 \partial z^3 \partial y^{22} \partial x \partial z^7 \partial y^3 \partial x^2}$$
4. Suppose $f(x, y)$ is a function of 2 variables with
$$f_x(x, y) = 6x^2y^4 + 2xy + 4 \quad \text{and} \quad f_y(x, y) = 8x^3y^3 + x^2 - 2y.$$
Find a formula for $f(x, y)$.

Quiz 7: Covers 10.5 to 10.7

1. Find the critical points of $f(x, y) = x^3 + y^3 - 3x^2 - 3y^2$.

2. Find a unit vector in the direction in which $f(x, y, z) = xe^{yz}$ increases most rapidly at the point $(2, 0, -4)$.
3. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if x, y, and z are related by the equation

$$ye^{-x} = z \sin x + 4x - 3.$$

4. The elevation of a mountain above sea level at (x, y) is $3000e^{\frac{-(x^2+2y^2)}{100}}$ meters. The positive $x-$axis points east and the positive $y-$axis points north. A climber is directly above $(10, 10)$. If the climber moves northwest, will his/her elevation go up or down? Why?