Calculus 3 Name ________________________________

Final Exam Review

#1) Find the parametrization for the line segment from $(1,-2,2)$ to $(4,1,7)$. Be sure to state what values the parameter t must take.

#2) Find the equation of the plane that…

(a) …passes through the points $(0,1,1),(1,0,1),$ and $(1,1,0)$

(b) …passes through the point $(-1,6,-5)$ and is parallel to the plane $x+y+z=-2$

#3) Given the position vector for a particle $\vec{r}(t)=\langle 4-3t,\ 2t,\ 3t-1\rangle$

(a) Where is the particle at t = 0?

(b) What is the speed of the particle at t = 0?

(c) When does the particle go through $(-2,4,5)$?

#4) Given $\vec{r}(t)=\langle 2\sin t,\ 5t,\ 2\cos t\rangle$

(a) Find the unit tangent vector $\vec{T}(t)$

(b) Find the normal vector $\vec{N}(t)$

(c) Find the curvature of $\vec{r}(t)$, κ

#5) For $\vec{r}(t)=\langle 4\sin t, 3\cos t\rangle$

(a) Sketch the plane curve.

(b) On the same graph, add the vectors $\vec{r}\left(\frac{5\pi}{6}\right)$ and $\vec{r}'\left(\frac{5\pi}{6}\right)$

#6) Compute the dot product $\langle y^2z^3, xy, x^2z \rangle \bullet \langle y^3, z^4, xz \rangle$

#7) Compute the cross product $\langle 3, 1, -1 \rangle \, x \, \langle -2, 5, 0 \rangle$

#8) If $z = f(x, y) = xy + ye^x + xe^y$ compute the following partial derivatives:
f_x, f_y, f_{xx}, f_{yy}, f_{xy}

#9) Find the equation of the plane tangent to $z = 4x^2 - y^2 + 2y$ at $(-1, 2, 4)$

#10) Find the gradient of $z = \frac{y}{x^2}$

#11) Find the directional derivative of $f(x, y) = 1 + 2x\sqrt{y}$
from any point (x, y) in the direction of $\langle 4, -3 \rangle$.

#12) Find the maxima, minima, and saddle points of $f(x, y) = x^3 - 12xy + 8y^3$
(The system must be solved by hand showing all steps – no calculator/software solvers allowed)