Name: _____

1. Consider the point $(r, \theta, z) = (1, 3\pi/2, 2)$ in cylindrical coordinates. Find the rectangular coordinates of the point. Put a box around your answer.

6 pts

2. CLASSIFY the surface whose equation is given. Illustrate with a labeled SKETCH.

   (a) $\phi = \pi/3$

8 pts

   (b) $\rho^2(\sin^2\phi - 4\cos^2\phi) = 1$

8 pts

(OVER)

3. Consider the curve $\mathcal{C}$ given by the parametric equations $x = e^{-t}\cos t$, $y = e^{-t}\sin t$, $z = e^{-t}$.

   (a) Sketch the curve $\mathcal{C}$, labeling the axes. Indicate with an arrow the direction in which t increases.

8 pts

   (b) Find parametric equations for the tangent line to the curve $\mathcal{C}$ at the point $(1, 0, 1)$. Put a box around your answer.

16 pts

4. Consider the position of a particle given by $\mathbf{r}(t) = e^t\mathbf{i} + \sqrt{2}t\mathbf{j} + e^{-t}\mathbf{k}$. Find the normal component of the acceleration of the particle. [Recall that the acceleration vector can be written in the form $\mathbf{a} = v'\mathbf{T} + \kappa v^2\mathbf{N}$.] Put a box around your answer.

22 pts

5. Consider the surface $x^2 + \dfrac{y^2}{4} + \dfrac{z^2}{9} = 1$.

10 pts

(a) Draw and label the trace of the surface in the plane $x = k = 0$. Label the axes and intercepts.

(b) Draw and label the trace of the surface in the plane $y = k = 0$. Label the axes and intercepts.

(c) Draw and label the trace of the surface in the plane $z = k = 0$. Label the axes and intercepts.

(d) CLASSIFY the quadric surface, and SKETCH it. Label the axes and intercepts.

6. SET UP an expression for the length of the curve given by $\mathbf{r}(t) = 12t\mathbf{i}+8t^{3/2}\mathbf{j}+3t^2\mathbf{k}$, $0 \leq t \leq 1$. **Do not evaluate the expression.**

10 pts

7. Match the surfaces (A)–(F) on the back of this page with their contour plots (I)–(VI). Write the Roman numeral of the contour plot next to the surface it matches. (Problems 53–58, Section 15.1)

12 pts

(OVER)