Math 251 Exam 1 Name_____
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YOU MUST SHOW ALL WORK!

[30] 1. Consider the following curve:

$$\mathbf{r}(t) = \langle t\sqrt{8} + 3,\ (t-1)^2 + 4,\ 2\ln(t-1) + 8 \rangle$$

Find the

a) velocity

b) acceleration

c) unit tangent vector

d) length of the curve for $3 \leq t \leq 6$

e) equation of tangent line at $(3 + 2\sqrt{8},\ 5, 8)$.

[15] 2. Find the equation of the line of intersection of the two planes

$$x + y - z = 2 \text{ and } 2x - y + 3z = 1$$

.

[10] 3. Find the equation of the plane that contains the line found in 2 and the point $(-1, 2, 1)$.

[10] 4. Determine if the line intersects the plane. If not, what does this say about the line and plane?

$$x + 2y + 3z = 4 \qquad \begin{aligned} x &= 1 + 4t \\ y &= 3 - 2t \\ z &= 1 \end{aligned}$$

[15] 5. a) Sketch the curve represented by the vector-valued functions and give the orientation of the curve.

$$\mathbf{r} = e^{-t}\mathbf{i} - e^{-t}\mathbf{j}$$

b) Draw $\mathbf{r}(0)$ and $\mathbf{r}'(0)$ on the curve.

[20] 6. a) Compute the curvature and radius of curvature for the plane curve $\mathbf{r} = \langle \frac{1}{3}t^3, \frac{1}{2}t^2, t \rangle$.

b) Find $\lim_{t \to \infty} \kappa$.

[10] 7. Match the equation to its graph.

____ 1. $x^2 + y^2 = 4$

____ 2. $\rho = 4$

____ 3. $z^2 + r^2 = 16$

____ 4. $z = r^2$

____ 5. $z^2 = 4 + x^2 + y^2$

____ 6. $z = \sqrt{x^2 + y^2}$

____ 7. $z = r$

____ 8. $z = x^2 + y^2$

____ 9. $\rho \sin\theta = 2$

____ 10. $z^2 = 4 + r^2$