Math 251 Makeup Exam 1 Name_____
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YOU MUST SHOW ALL WORK!

[30] 1. Consider the following curve:

$$\mathbf{r}(t) = \langle \cos t + 2,\ \sin t - 3,\ 7 + \ln \cos t \rangle$$

Find the

a) velocity

b) acceleration

c) unit tangent vector

d) length of the curve for $0 \leq t \leq \dfrac{\pi}{4}$

e) equation of tangent line at $(3,\ -3, 7)$.

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

$$x = 3 + t, \qquad y = 1 - t, \qquad z = 4t.$$

[10] 3. Find the point at which the line $x = 3 - t,\ y = 2 + t,\ z = 5t$ intersects the plane $x - y + 2z = 9$. Does the line intersect the plane perpendicularly?

[10] 4. Which of the following four planes are parallel? Are any of them identical?

$$P_1 : 3x + 6y - 3z = 6 \qquad P_3 : 9y = 1 + 3x + 6z$$
$$P_2 : 4x - 12y + 8z = 5 \qquad P_4 : z = x + 2y - 2$$

[10] 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 $\mathbf{r} = \langle t^2, \ln t, t \ln t \rangle$.

b) Find the radius of curvature at the point (1,0,0).

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

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

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

____ 3. $x^2 + y^2 = 2$

____ 4. $z^2 = 4 - x^2 - y^2$

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

____ 6. $\tan^2 \theta = 1$

____ 7. $\rho = \dfrac{\pi}{4}$

____ 8. $z^2 = 4 - r^2$

____ 9. $r = 4$

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