

MATH 281: Multivariable Calculus

February 10, 2010

Midterm

Name: _____

ID: _____

In order to receive full credit your answer must be **complete**, **legible** and **correct**. Show all of your work, and give adequate explanations.

DO NOT WRITE IN THIS BOX!

| Problem | Points | Score |
|----------------|---------------|--------------|
| 1 | 20 pts | |
| 2 | 10 pts | |
| 3 | 8 pts | |
| 4 | 12 pts | |
| Total | 50 pts | |

1. Let

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

- (a) Find the arclength of the curve between $0 \leq t \leq 3$; compute the unit tangent vector \mathbf{T} .

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(b) Compute the unit normal vector $\mathbf{N}(t)$ and the unit binormal vector $\mathbf{B}(t)$.

2. Consider the point $(2, 3, 1)$ and the plane $2x + y - 3z = 2$.

(a) Find the plane which passes through the given point and parallel to the given plane.

(b) Find the distance between two parallel planes above.

3. (a) For which values of a is the vector $\mathbf{v} = \langle 3, 2, a \rangle$ orthogonal to $\mathbf{w} = \langle 2a, 4, a \rangle$?

(b) Find a unit vector which is orthogonal to both $\langle 0, 1, 2 \rangle$ and $\langle 1, -2, 3 \rangle$.

4. (a) Find the velocity and acceleration of the position function

$$\mathbf{r}(t) = \langle e^t \cos t, e^t \sin t, e^t \rangle.$$

- (b) Find the curvature of the curve given by the position function above.