

Mathematics 2401T Test 1 4 September 2008 VERSION ↑

NAME: _____
TA: _____

Instructions: Work absolutely on your own, without reference to notes or text. Answers should be as specific as possible and it should be evident how they were obtained. Write the answers where indicated. **Your grade will be based on the best 4 of the 6 problems.** You may choose to do only 4, or you may attempt more, and the graders will drop the lowest scores. Each problem is worth 25 points.

This test will end promptly at 5:55. Sign below and await the signal to begin the test.

I am familiar with the Georgia Tech Honor Code and will abide by it. Any stored information about MATH 2401 has been erased from my calculator (or similar storage device)

NAME: _____

1. Calculate the following.

$$\frac{d}{dt}((t^2\mathbf{j}) \times (t\mathbf{i} - e^{-t}\mathbf{j} + t\mathbf{k})) = \underline{\hspace{10em}}.$$

2. Calculate the following.

a)

$$|\hat{\mathbf{T}}'(t)| = \underline{\hspace{10em}},$$

where $\hat{\mathbf{T}}(t) = \left(\frac{\mathbf{v}(t)}{|\mathbf{v}(t)|}\right)$ and $\mathbf{v}(t) = 2t\mathbf{i} - \mathbf{j} + 2t\mathbf{k}$.

b) The angle between $\hat{\mathbf{T}}'(t)$ and $\mathbf{v}(t) = \underline{\hspace{10em}}$.

3. Find the angle at which the curve $\mathbf{r}_1 = (t, t^2, 0)$ and the line $\mathbf{r}_2(u) = (1, u, 3u - 3)$ cross. (It is acceptable to leave answer in form of a specific function of a specific number. Decimal evaluation is optional.)

ANSWER _____

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4. On the graph paper on the final page,
- a) (0 pts) Plot the point $P = (3, 0)$ and mark it with the letter P .
 - b) (2 pts) Sketch the curve $\mathbf{r}(t) = 3e^{-t} \cos \pi t \mathbf{i} - 3e^{-t} \sin \pi t \mathbf{j}$ for $t \in [-\frac{1}{2}, 3]$.
 - c) Draw the unit tangent vector at the point P , oriented consistently with the parametrization of the curve. Label it \mathbf{T} . You do not need to show any calculation.
 - d) Draw the principal unit normal vector at the point P . Label it \mathbf{N} . You do not need to show any calculation.

5. Consider the same curve as in Problem 4. Find the following.
- a) The speed at time t of an object moving along the curve $\mathbf{r}(t)$:

ANSWER _____

- b) A specific integral formula for the length of the curve:

ANSWER _____

- c) The length of the curve (actual value, not the formula):

ANSWER _____

6. Consider the same curve as in Problem 4. Find a formula for the normal line at $\mathbf{r} = (3, 0)$:

ANSWER _____