

Name \_\_\_\_\_

MATH 253

Paper Homework 1

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Section 501,503

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Consider the curve  $\vec{r}(t) = (e^t, \sqrt{2}t, e^{-t})$ . Compute each of the following. Show your work. Simplify where possible.

1. velocity

$$\vec{v}(t) =$$

2. acceleration

$$\vec{a}(t) =$$

3. jerk

$$\vec{j}(t) =$$

4. speed (HINT: The quantity in the square root is a perfect square.)

$$|\vec{v}(t)| =$$

5. arclength between  $(1,0,1)$  and  $(e, \sqrt{2}, \frac{1}{e})$

$$L =$$

6. unit tangent vector

$$\hat{T} =$$

7.  $\vec{v} \times \vec{a}$

$$\vec{v} \times \vec{a} =$$

8.  $|\vec{v} \times \vec{a}|$

$$|\vec{v} \times \vec{a}| =$$

9. unit binormal vector

$$\vec{B} =$$

10. unit normal vector

$$\vec{N} =$$

11. curvature

$$\kappa =$$

12. torsion

$$\tau =$$

13. tangential acceleration (compute in 2 ways)

$$a_T =$$

$$a_T =$$

14. normal acceleration (compute in 2 ways)

$$a_N =$$

$$a_N =$$

15. mass of a wire between  $(1, 0, 1)$  and  $(e, \sqrt{2}, \frac{1}{e})$  with linear density  $\rho = x - z$

$$M =$$

16. work to move a bead along the wire from  $(1, 0, 1)$  to  $(e, \sqrt{2}, \frac{1}{e})$  with the force

$$\vec{F} = (z, y, x)$$

$$\vec{F}(\vec{r}(t)) =$$

$$W =$$