Consider the curve \( \vec{r}(t) = \left( e^t, \sqrt{2} t, e^{-t} \right) \). 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 
   \( \vec{T} = \)

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 \(\vec{F} = (z, y, x)\)
\[ \vec{F}(r(t)) = \]

\[ W = \]