Math 103.02 Quiz Four

I have neither given nor received aid in the completion of this test.
Signature: 

Let
\[ r(t) = \left( \frac{t^2}{2}, \sin t, t \right) \quad \text{for } t \in \mathbb{R}. \]

Compute
\[ v, |v|, T, a, |v'|, N, \kappa \]
at \( t = 0 \).

**Solution.** We have
\[ v(t) = r'(t) = < t, \cos t, 1 > \quad \text{and} \quad a(t) = v'(t) = < 1, -\sin t, 0 >. \]
(No more differentiation is necessary!)

Thus
\[ v(0) = < 0, 1, 1 >, \]
\[ |v|(0) = \sqrt{2}, \]
\[ a(0) = < 1, 0, 0 >, \]
\[ |v'|(0) = a_T = a \bullet T = 0, \]
\[ N(0) = \frac{a - a_T T}{|a - a_T T|}(0) = < 1, 0, 0 >, \]
\[ \kappa(0) = \frac{a \bullet N}{|v|^2}(0) = \frac{1}{2}. \]