

1. (2pts) Compute the following two limits.

(a)  $\lim_{t \rightarrow 1^+} \langle \sqrt{t-1}, te^t \rangle$

(b)  $\lim_{t \rightarrow 1^+} \langle \ln(t-1), \sqrt{t-1}, te^t \rangle$

2. (3pts) Let  $\vec{r}'(t) = \langle 3 \sin(t), 4e^{-2t} \rangle$ . Find  $\vec{r}(t)$  if we know  $\vec{r}(0) = \langle 1, -1 \rangle$

3. (4pts) Let  $\vec{r}(t) = \langle \cos(\pi t), e^{-2t}, t^2 - t \rangle$ .

(1) Compute the tangent vector  $\vec{r}'(t)$ .

(2) Determine if the tangent vector is orthogonal to  $\vec{r}(t)$  when  $t = 0$ .

(3) Find all possible real values of  $t$  at which the tangent vector is parallel to the  $xy$ -plane.

4. (3pts) The curve  $C$  traced out by  $\vec{r}(t)$  is given below.

(1) Sketch the vectors:  $\vec{r}'(t_0)$  and  $\vec{r}'(t_1)$ .

(2) Sketch the vectors:  $\vec{T}(t_0)$  and  $\vec{T}'(t_0)$ .

(3) Determine graphically if  $\kappa(t_0) > \kappa(t_1)$ .