(1) (5 Points) State the Frenet formulas for a $C^2$ regular unit speed curve in $\mathbb{R}^2$ carefully defining all the quantities involved.

(2) (5 Points) Let $\alpha: [a, b]$ be a $C^2$ regular curve in $\mathbb{R}^2$, but we do not assume that $\alpha$ is unit speed. Then, using the Frenet formulas define formulas for the velocity vector $\frac{d\alpha}{dt}$ and the acceleration vector $\frac{d^2\alpha}{dt^2}$ in terms of the speed $v$, curvature $\kappa$, unit tangent $t$ and unit normal $n$ of $\alpha$. 
(3) (10 points)
(a) Parameterize the ellipse \( \frac{x^2}{4} + \frac{y^2}{25} = 1 \).

(b) Set up the integral for the length of this ellipse (do not evaluate this integral.)

(4) (10 points) Find the curvature of the curve \( \alpha(t) = (e^t \cos(t), e^t \sin(t)) \)
(5) (10 points) For the following curves find \( \int_0^L \kappa(s) \, ds \).

\[ \int_0^L \kappa(s) \, ds = \]

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