1. Let $F$ be a continuous function, with $F(y)/y > 0$, for $y \neq 0$. Show that $x'' + F(x') + x = 0$ does not have limit cycles in the phase plane $(x, y = x')$.

2. Consider $x' = t/4 - 1/(1 + x^2)$, $x(0) = 1$ with the approximate solution $\tilde{x} = 1 - t/2$. Estimate the error in the interval $|t| \leq 1/2$.

3. Find $\frac{\partial x}{\partial \mu}|_{\mu=0}$ for

$$x' = x + \mu(t + x^2), \quad x(0) = 1.$$ 

4. Find the first 3 terms in the power series expansion of a solution with respect to $\mu$:

$$x' = 4\mu x - x^2, \quad x(1) = 1.$$ 

5. Compute all terms up to $t^4$ in the power series expansion of a solution of

$$x' = x^2 - t.$$