1. Solve the following initial-value problem

\[ y' + 3y = e^{-t}, \quad y(0) = 0. \]

2. Find approximate values of the solution of the given problem

\[ y' = 0.5 - t^2 + y^2, \quad y(0) = 2 \]

at \( t = 0.1 \) and \( 0.2 \) using the Euler method with \( h = 0.1 \).
3. For the problem: \( \frac{dy}{dt} = y(y - 3)(y - 5), \quad y_0 \geq 0 \), find all the equilibrium solutions and classify each one as asymptotically stable or unstable.

4. Radium-226 has a half-life of 1620 years. Find the time period during which a given mass of this material is reduced by one-quarter.
5. Suppose that a certain population obeys the logistic equation

\[
\frac{dy}{dt} = ry[1 - (y/K)].
\]

If \(y_0 = K/4\), find the time \(\tau\) at which the initial population has doubled. Find the value of \(\tau\) corresponding to \(r = 0.05\) per year. (Hint : For the initial value problem

\[
\frac{dy}{dt} = ry(1 - y/K), \quad y(0) = y_0,
\]

the solution is

\[
y(t) = \frac{y_0K}{y_0 + (K - y_0)e^{-rt}}.
\]
6. Find the general solution of the following differential equation:

\[
\frac{dy}{dx} = \frac{x^2 + xy + y^2}{x^2}.
\]

7. Find the general solution of the following differential equation:

\[
y' = 2x(y^2 - 9).
\]