1. $\boxed{15 \text{ pts.}}$ Solve $(3x^2 + y) + (2x^2y - x)y' = 0$ by finding an integrating factor of the form

$$\mu(x) = \exp\left(\int \frac{M_y - N_x}{N}dx\right) \quad \text{or} \quad \mu(y) = \exp\left(\int \frac{N_x - M_y}{M}dy\right).$$

2. $\boxed{15 \text{ pts.}}$ Solve $(x^3y^2 - 2y^3) + x^4yy' = 0$ by finding an integrating factor of the form x^my^n.

3. $\boxed{10 \text{ pts.}}$ Solve the homogeneous equation $y' = \dfrac{y(\ln y - \ln x + 1)}{x}$.

4. $\boxed{10 \text{ pts.}}$ Solve the Bernoulli equation $y' + y = e^x y^{-2}$.

5. $\boxed{20 \text{ pts.}}$ Blood enters an organ at a rate of 3 cm^3/sec and leaves at the same rate. The organ has a liquid volume of 125 cm^3. If the concentration of a drug in the blood entering the organ is 0.2 g/cm^3, what is the concentration of the drug in the organ at time t if there was no trace of the drug initially? When will the concentration of the drug in the organ reach 0.1 g/cm^3?

6. $\boxed{10 \text{ pts.}}$ Using the definition of linear independence, determine whether the functions $\varphi(t) = te^{2t}$ and $\psi(t) = e^{2t}$ are linearly independent.

7. $\boxed{10 \text{ pts.}}$ Solve the initial value problem $y'' - 4y' - 5y = 0$, $y(-1) = 3$, $y'(-1) = 9$.

8. $\boxed{10 \text{ pts.}}$ Find the general solution to $9y'' - 12y' + 4y = 0$.

9. $\boxed{10 \text{ pts.}}$ Find the general solution to $12y''' - 28y'' - 3y' + 7y = 0$.

10. $\boxed{10 \text{ pts.}}$ Solve the initial value problem $y'' + 9y = 0$, $y(0) = 1$, $y'(0) = 1$.