

King Saud University, Department of Mathematics
Math 204 (1.30H), Alternative Exam S2. 47/48

Question 1 [4,4] a) Find and sketch the largest region in $\mathbb{R}^2$, for which

the following initial value problem admits a unique solution

$$\begin{cases} [\ln \{1 - \ln(1 - 2y)\}]dx - (2x^2 + x - 6)dy = 0 \\ y(0) = 0. \end{cases}$$

b) Solve the initial value problem

$$\begin{cases} \frac{dy}{dx} = 3 - \sqrt{x + y - 1} \\ y(0) = 1. \end{cases}$$

Question 2 [4,4] a) Find the general solution of the differential equation

$$[y^3(1 - 2x \tan^{-1} x) + 1 - x^2]dx + [3(1 + x^2)y^2 \tan^{-1} x]dy = 0.$$

b) Solve the differential equation

$$y'' - y = \sinh x$$

Question 3. [4,5]. a) Obtain the general solution of the differential equation

$$y'' - y' + \frac{y}{4} = e^{\frac{x}{2}} \sqrt{1 - x^2}, \quad |x| \leq 1.$$

b) Solve the system of linear differential equations

$$\begin{cases} y'' + x' + x = 0 \\ y' - y + x = \sin t \end{cases}$$