King Saud University,
College of Sciences
Mathematical Department.

Mid-Term1 /S2/2016
Full Mark:25. Time 1H30mn
21/05/1437

Question 1[4,4]. a) Determine the region in the $xy-$plane for which the following differential equation

$$(1-y^2)\frac{dy}{dx} = xe^x,$$

would have a unique solution through the origin $(0,0)$.

b) Find the solution of the differential equation:

$$\frac{dy}{dx} - 2xy = e^x(1-2x).$$

Question 2[4,4]. a) Verify that the differential equation

$$\cos x dx + (1+\frac{2}{y})\sin x dy = 0, \quad y \neq 0,$$

is not exact. Find a suitable integrating factor to convert it to an exact equation, and then solve it.

b) Solve the initial value problem

$$\begin{cases} \frac{dy}{dx} = \frac{x}{y} + \frac{y}{x} \\ y(1) = 2 \end{cases} \quad x \neq 0, \ \ y \neq 0$$

Question 3[4]. Find the general solution of the differential equation

$$\frac{dy}{dx} + \frac{\tan x}{2}y = \frac{(4x+5)^2}{2\cos x}y^3, \quad -\frac{\pi}{2} < x < \frac{\pi}{2}.$$

Question 5[5]. A thermometer is removed from a room where the air temperature is 70^0F to outside where the temperature is 10^0F. After 1/2 minute the thermometer reads 50^0F. What is reading at $t=1$ minute?. How long will it take for the thermometer to reach 15^0F.