KING SAUD UNIVERSITY
DEPARTMENT OF MATHEMATICS

TIME: 1H30   **FULL MARKS: 40**

___Question 1.___ **a)** Determine whether the initial value problem has a unique solution
$$y' = y + (\sin x)^2, \quad y(\pi) = 1.$$ **[6]**

b) Find m such that y^m will be an integrating factor for the DE: $(y^2 + 2xy)dx = x^2 dy$
and solve the DE.   **[6]**

___Question 2.___   **a)** Solve the initial value problem

$$\frac{dy}{dx} = (x + y + 2)^2, \quad y(-2) = 1.$$ **[6]**

b) Write the differential equation

$$x\frac{dy}{dx} = y^2(1 + 2y^2)$$ **[7]**

 into Bernoulli' s equation form, and then solve it.

___Question 3___   Determine the region of the xy-plane for which the differential equation
$$\sqrt{y+1}\frac{dy}{dx} = \ln(x - 5)$$
Would have a unique solution through a point (x_0, y_0) in the region.   **[7]**

___Question 4.___ A hot bar is moved to a storage room whose temperature is 20° F. 5
minutes later, the temperature of the bar is 119^0 C, and after 15 minutes, it is 31^0 C.
What was the temperature of the bar when it was placed in the storage room?   **[8]**