Question:1. Find the general solutions to the differential equations

(i) $x\dfrac{dy}{dx} = 1 + y^2$

(ii) $x\dfrac{dy}{dx} = 2x^3 + y$ [4+4+4]

(iii) $x^2\dfrac{dy}{dx} = x^2 + xy + y^2$

Question:2. Verify that $\mu(x) = x$ is an integrating factor for differential equation
$(3y^2 - 4x^2 + 2)dx + 3xy\,dy = 0$. hence solve the differential equations.   [10]

Question:3. Write the differential equation in the form of Bernoulli's equation, hence
solve it $y(6y^2 - x - 1)dx + 2x\,dy = 0,\ \ x > 0$ and $y \neq 0$.   [10]

Question:4. Find the orthogonal trajectory of the family of curves
$y = 4x + 1 + c_1 e^x$ passing through point (0,0)   [10]

Question: 5. A thermometer is removed from a room where the air temperature is 80^0 C
and is taken outside , where the temperature is 20^0 C, after 2 minutes the
thermometer reads 60^0 C. What is the reading of the thermometer after three
minutes? How long it will take for the thermometer to reach 25^0 C?
[Formulate the differential equation and then solve].   [8]