



MASENO UNIVERSITY
UNIVERSITY EXAMINATIONS 2016/2017

**THIRD YEAR FIRST SEMESTER EXAMINATIONS FOR THE
DEGREE OF BACHELOR OF SCIENCE, BACHELOR OF
EDUCATION AND BACHELOR OF ARTS WITH
INFORMATION TECHNOLOGY**

MAIN CAMPUS

MMA 301: ORDINARY DIFFERENTIAL EQUATIONS I

Date: 7th December, 2016

Time: 3.30 - 6.30 pm

INSTRUCTIONS:

- Answer question ONE and any other TWO questions.
- Start each question on a fresh page.
- Indicate question numbers clearly at the top of each page.
- Scientific calculators may be used.
- Observe further instructions on the answer booklet.

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Question 1 [30 Marks]

(a) Solve the differential equation below

$$\frac{dy}{dx} = (9x + y + 1)^2$$

[5 Marks]

(b) Evaluate

$$\frac{dy}{dx} = (x + y - 4)^2$$

[5 Marks]

(c) Solve

$$(x^2 + 1) \frac{dy}{dx} + 4xy = x \quad y(0) = 10$$

[5 marks]

(d) In the investigation of a homicide, the time of death is important. The normal body temperature of most healthy people is 98.6°F. Suppose that when a body is found is discovered at noon, its temperature is 82°F. Two hours later, it is 72°F. If the temperature of the surrounding is 65°F. What is the approximate time of death? [5 Marks]

(e) Solve

$$(e^{2y} - y) \cos x \frac{dy}{dx} = e^y \sin 2x, \quad y(0) = 0$$

[5 marks]

(f) Use the method of variation of parameters to solve

$$y'' - 4y' + 3y = e^{-x}$$

[5 Marks]

Question 2 [20 Marks]

(a) Show that

$$(2x \cos y + 3x^2y) + (x^3 - x^2 \sin y - y) \frac{dy}{dx}$$

is an exact differential equation and solve it subject to the initial condition $y(0)=2$

[10 Marks]

(b) Evaluate

$$\frac{dy}{dx} = \frac{x + y + 4}{x - y - 6}$$

[10 Marks]

Question 3 [20 Marks]

(a) Consider the linear second order differential equation

$$y'' + P_1y' + P_2y = f(x)$$

Derive the formula for particular integral used in solving differential equation by variation of parameters

[10 Marks]

(b) Using method of variation of parameters above, solve

$$\frac{d^2y}{dx^2} + y = \tan x$$

[10 Marks]

Question 4 [20 Marks]

(a) Evaluate

$$xy'' + 2(1-x)y' + (x-2)y = 0 \quad y_1 = e^x$$

[5 Marks]

(b) Identify types of differential equations and give examples

[5 Marks]

(c) Solve

$$x \frac{dy}{dx} = y + xe^{\frac{1}{x}}$$

[5 Marks]

(d) Evaluate

$$x^2y'' - 2xy' - 4y = 0$$

[5 Marks]

Question 5 [20 Marks]

(a) Solve

$$y'' - 4y = 8x^2 - 2x$$

[10 Marks]

(b) Evaluate

$$y^2dx + (3xy - 1)dy = 0$$

[5 Marks]

(c) Suppose that a sausage is removed from 350°F oven and placed in a room with a temperature of 75°F. In 15 minutes, the sausage has a temperature of 150°F. Determine the time required to cool the sausage to a temperature of 80°F when one can enjoy eating [5 Marks]