

MTH4102 Differential Equations

10 am, Friday 26th February, 2010

Duration: 40 minutes

You should attempt all questions. Marks awarded are shown next to the question. Calculators are NOT permitted in this examination. The unauthorised use of a calculator constitutes an examination offence.

This is an OPEN BOOK test

permitted: any printed material, e.g. books
any handwritten notes
photocopies of any kind

prohibited: using electronic devices, e.g. calculators or mobile phones
sharing material with other students

YOU ARE NOT PERMITTED TO START READING THIS QUESTION PAPER UNTIL INSTRUCTED TO DO SO BY AN INVIGILATOR.

STUDENT NAME:

STUDENT NUMBER:

Problem 1

Find the general solution of the differential equation

$$\frac{dy}{dx} = xe^{4x^2}$$

by the method of direct integration.

(2 marks)

Problem 2

By using separation of variables, find the particular solution to the following differential equation that satisfies the given initial condition

$$\frac{dy}{dx} = \frac{(y^2 + 1)x}{y}, \quad y(0) = -1.$$

(2 marks)

Problem 3

Find the general solution to the linear inhomogeneous differential equation

$$\frac{dy}{dx} = \frac{2y}{x} + x^3.$$

(2 marks)

Problem 4

Show that the following equation is an exact differential equation and determine the general solution (in implicit form)

$$2xy^3 + 2 + (3x^2y^2 + e^{2y})\frac{dy}{dx} = 0.$$

(2 marks)

Problem 5

Given the initial conditions $y(0) = 1$ and $y'(0) = 2$, find the particular solution to the linear second-order differential equation

$$y'' + y' - 2y = 0.$$

(2 marks)

Maximum number of marks: 10

page 11 of 12
End of Examination

