



The University of Sydney

School of Mathematics and Statistics

**Summer School 2012
SS1003 Assignment 3**

The assignment should be written in ink on one side of the paper only and stapled into a manila folder on the cover of which is written your name and SID.

It is due on Tuesday 7th February and should be handed in at your tutorial on that day. It is intended to provide feedback: it will be marked and returned the following Monday. It will not contribute to the assessment for the subject.

Q1 Find the general solution of

(a) $\ln y \frac{dy}{dx} = xy$ (b) $\frac{dy}{dx} = \frac{\tan y}{\sqrt{x^2 + 9}}$ (c) $\frac{dy}{dx} = \frac{e^{2x}}{\sqrt{1 + e^x}}$ Hint: in (c) make a substitution

2 Evaluate the integrals

(a) $\int \frac{3x-2}{(x+1)(x-2)} dx$ (b) $\int \frac{x^3}{(x+1)(x-2)} dx$ (c) $\int \frac{x^2+1}{(x+1)(x-1)^2} dx$

Q3 The number N of bacteria in a culture grew at a rate proportional to N . The value of N was initially 100 and increased to 332 in one hour. What was the value of N after 1.5 hours?

Q4 The number x in a population satisfies the logistic equation

$$\frac{dx}{dt} = 10x(20 - x) \text{ where } t \text{ is the time in days}$$

(a) What is the equilibrium population?

(b) If the population is initially 40, how long does it take for it to reach 30?

Q5 Determine the particular solution curve $y(x)$ of the differential equation

$$\frac{dy}{dx} = -\frac{3y}{x} - \frac{2}{x^4}$$

which passes through the point (e^2, e^{-6}) .