

## Differential Equations (MAS118)

### Problem Sheet 3

#### Problem 7

Solve each of the following differential equations by separation of variables. Whenever possible write the general solution in explicit form. Fix for each solution the constant of integration according to the given initial condition.

a)  $y' = -x/y$ ,  $y(0) = -2$  (12 points)

b)  $y' = (y^2 + 1)/y$ ,  $y(0) = 1$  (12 points)

c)  $y' = (1 + y^2)e^x$ ,  $y(0) = -1$  (12 points)

d)  $y' = ye^x - 2e^x + y - 2$ ,  $y(0) = 0$  (12 points)

e)  $y' = xy/(x - 1)$ ,  $y(0) = 2$  (12 points)

#### Problem 8

Consider the differential equation

$$y' = -y/x - x/y$$

a) Use the substitution  $y(x) = xz(x)$  to rewrite the differential equation in terms of the new dependent variable  $z$ . (10 points)

b) Solve the differential equation for  $z$  by separation of variables and determine the general solution  $y(x)$  of the original differential equation. (10 points)

#### Problem 9

Find the general solution of the differential equation

$$y' = y/x + e^{-y/x}$$

(20 points)

**Problem C**

Find a solution of the differential equation

$$y' = \sqrt{y - 1}$$

which is bounded (i.e. a solution which does not tend to infinity when  $x$  goes to infinity). (20 bonus points)