

## MATH224. Homework 4.

1. Solve

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^{ax}$$

in the two separate cases (a) when  $a \neq 1$  (b) when  $a = 1$ .

2. Find the general solutions of the following systems of differential equations.

(i)

$$\frac{dx}{dt} = -3x + y, \quad \frac{dy}{dt} = x - 3y.$$

(ii)

$$\frac{dx}{dt} = 2x + y, \quad \frac{dy}{dt} = 3.$$

(iii)

$$\frac{dx}{dt} = x + 4y, \quad \frac{dy}{dt} = -5x + 5y.$$

3. Solve the following systems of first order differential equations with the initial conditions  $x(0) = y(0) = 0$ :

(i)

$$\frac{dx}{dt} = -3x + y, \quad \frac{dy}{dt} = x - 3y + 8t - 2$$

(ii)

$$\frac{dx}{dt} = -2x + y + 2e^{-2t}, \quad \frac{dy}{dt} = x - 2y$$

4. [Short problems.] Do the following indefinite integrals.

(i)  $\int \frac{dy}{y(1+y)}$

(ii)  $\int \frac{t}{t+1} dt$

(iii)  $\int \frac{t}{1+t^2} dt$

(iv)  $\int e^{\cos x} \sin x dx$