MATH6103 Differential & Integral Calculus
MATH6500 Elementary Mathematics for Engineers

Problem Sheet 9

Deadline: **Monday 12 December, 5:00**.
Hand in to **the drop box** in the undergraduate common room (maths department, room 502).

Hand in the questions marked with an asterisk (*).

One mark will be deducted if you do not **staple your work**.

1) Solve the following second order ODEs.

a) $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$

* b) $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = e^x$

* c) $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = e^{2x}$

d) $\frac{d^2y}{dx^2} + 7\frac{dy}{dx} + 10y = e^{-x}$

e) $\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 10y = 3e^{-x}$

* f) $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 18y = 34e^x$

2) Solve the following second order ODEs with boundary conditions.

* a) $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 6e^{3x}, \quad y(0) = 3 \quad y'(0) = 8$

* b) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x, \quad y(0) = 3, \quad y'(0) = 3 \quad y(1) = \frac{7e}{2}$

c) $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 18y = 34e^x \quad y(3) \quad y\left(\frac{\pi}{6}\right) = 2e^{\frac{\pi}{6}}$

* 3a) Use Euler's Method with three steps to approximate $y(1)$ when $y(0) = 3$ and

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

Give your answer as a fraction.

* 3b) Give one way in which the accuracy of the answer to (3a) could be improved.