

**Section 1: Introduction to differential equations****Exercise level 2**

1. Find the solution of the differential equation  $x \frac{dy}{dx} = \frac{1}{\cos y}$  which passes through the point  $(1, \frac{3}{4}\pi)$ .
2. Solve the differential equation  $\frac{dy}{dx} = -xy$ , given that  $y = 1$  when  $x = 0$ . Make  $y$  the subject of your solution.
3. Find the general solution of the differential equation  $x + y \frac{dy}{dx} = 10$ .
4. During a fermentation process, the rate of decomposition of fermenting mass  $m$  kg at time  $t$  hours after the start of the process is given by  $\frac{dm}{dt} = -\frac{m}{(1+t)^2}$ . Show that, if  $m = 10$  when  $t = 0$ , after a very long time there will be about 3.7 kg of the fermenting mass left.
5. Find the general solution of the differential equation  $\frac{dy}{dx} = \frac{2y}{(x^2 - 1)}$ , giving  $y$  in terms of  $x$ .