Further mathematics for economists
Exercise Sheet 3 - Differential Equations

1. Find the general solutions of the following differential equations
   (a) $\frac{2}{t}\frac{dx}{dt} + x^2\sqrt{a - t^2} = 0, a = const.$ and $a > 0$
   (b) $xy^2\frac{dy}{dx} = 1 + y^3$
   (c) $y\cos^2 x\frac{dy}{dx} - \tan x - 2 = 0, -\frac{\pi}{2} < x < \frac{\pi}{2}$
2. Find the solution of the differential equation
$$\frac{dy}{dx} = \frac{5xy}{(x+3)(2x+1)}$$
   that satisfies the condition $y = 3$ when $x = 0$.
3. Solve the following differential equations
   (a) $5\frac{dy}{dt} + 10y = 2$
   (b) $5\frac{dy}{dt} - 10y = 2$
   - Find their general solutions and take their limits for t$\to \infty$. Discuss their similarities and differences
   - Find the solution for the boundary condition $y(0) = 4$
4. Find the solution of the differential equation
$$\frac{dy}{dx} - 3y = 6x - 3$$
that satisfies $y = 1$ when $x = 0$.