Further mathematics for economists

Coursework 1
Integration/Differential Equations/Complex Numbers[1]

1. (15/100) Find the specific solution of the differential equation

$$\frac{dy}{dt} + 2y = (3t+1)e^{-t} + e^{-2t}$$

so that $y = 4$ when $t = 0$.
Hints:

- The particular solution should be of the form $y_p = y_{p1} + y_{p2}$.
- Take $y_{p2} = Cte^{-2t}$(this is an exception to the rule we have seen in class).

2. (20/100) Find the specific solution of the differential equation

$$\frac{dy}{dt} - \frac{4t}{(1+t^2)}y = -2\frac{1+t^2}{t^3}$$

so that $y(1) = 4 - 4\ln[2]$. Hint: Employ the integrating factor

3. (30/100) Find the general solution of the Bernoulli equation

$$\frac{dy}{dt} + \frac{1}{(1-t^2)}y = (1+t^2)y^3$$

4. (15/100) Compute the complex power

$$\left(\frac{1+i\sqrt{3}}{\sqrt{3}-i}\right)^{30} + \left(\frac{1-i}{\sqrt{2}(1+i)} + 1/\sqrt{2}\right)^{100}$$

5. (20/100) Compute $\int xe^{-x}\cos x dx$ by parts. Write the final answer in terms of trigonometric functions.
Hint: use the complex forms of $\cos x, \sin x$.

[1]Material to the course: http://www.staff.city.ac.uk/c.f.m.faria/furthermaths.html