University of Ruhuna
Department of Mathematics

Bachelor of Science (General) Degree (Level II)

Industrial Mathematics

IMT 2b2β: Mathematical Computing

Assignment No: 09 **Semester I, 2012**

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1. Compute the general solutions of the following ordinary differential equations by means of routine **ode2** as well as the corresponding initial value problems with initial values $y(1) = 1$. Determine which methods are used to solve these ODEs.

(i) $y' - k\dfrac{y}{x} = 0$

(ii) $xy' - (1 + y) = 0$

(iii) $y' = xy$

(iv) $y' + e^y = 0$

(v) $y' = y^2$

(vi) $y' = \sqrt{x^3 y}$

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2. Compute the general solutions of the following ordinary differential equations by means of routine **ode2**. Determine which methods are used to solve these ODEs.

(i) $x^2(1 - x^2)\dfrac{\mathrm{d}y}{\mathrm{d}x} = (x - 3x^3 - y)y$

(ii) $y' = x^2 \sin x + \sqrt{1 + x^2}$

(iii) $y' = \dfrac{x^2 y^2}{\sqrt{3 - x^2}}$

(iv) $y' = \dfrac{x^2 e^y}{\sqrt{3 - x^2}}$

(v) $y' = -\dfrac{x^2 - 3y^2}{xy}$

(vi) $y' + 11xy = x^3 y^3$

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3. Compute the general solutions of the following ordinary differential equations by means of routine **ode2** as well as the corresponding initial value problems with the given initial values. Determine which methods are used to solve these ODEs.

(i) $y'' + y' - 2y = 3$ with $y(0) = y'(0) = 1$.

(ii) $y'' - 6y' + 9y = 0$ with $y(0) = 2$ and $y'(0) = 0$.

(iii) $y'' + 2y' + 17y = 0$ with $y(0) = 0$ and $y'(0) = 1$.

(iv) $2y'' + 5y' + 3y = 0$ $y(0) = 3$ and $y'(0) = -4$.

(v) $y'' + 16y = 0$ $y(\pi/4) = -3$ and $y'(\pi/4) = 4$.

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4. Consider two tanks filled with brine connected by pipes. Through the first pipe the brine is coming from the first tank to the second tank at the rate r = 10gal/min. Through the second pipe brine coming from the second tank to the first tank at the same rate r = 10gal/min. Initially volume of brine in the first tank is 50gal and amount of salt is 15lb. The second tank initially contains 25gal of pure water. Find amount of salt in the first and second tanks at moment t.

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5. Solve the following system of ODE equations.

$$\frac{\mathrm{d}^2 f}{\mathrm{d}x^2} = \sin x + \frac{\mathrm{d}g}{\mathrm{d}x}$$
$$\frac{\mathrm{d}f}{\mathrm{d}x} + x^2 - f = 2\frac{\mathrm{d}g^2}{\mathrm{d}x^2}$$

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