FE-II (Old)
AM-II

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3. (a) Solve $\left[1+\log(xy)\right]dx+\left(1+\frac{x}{y}\right)dy=0$ 6

(b) Find by double integration the mass of a thin plate bounded by $y^2 = x$ and $y = x^3$. If the density of any point varies as the square of its distance from the origin. 6

(c) Solve $x^2\frac{d^2y}{dx^2}-4x\frac{dy}{dx}+6y=-x^4\sin x$. 8

4. (a) Solve $\frac{dy}{dx}+y=y^2(\cos x-\sin x)$ 6

(b) Change the order of integration and evaluate 6

$$\int_0^1\int_0^{\sqrt{1-y^2}}\frac{\cos^{-1}x}{\sqrt{1-x^2}\,\sqrt{1-x^2-y^2}}\,dx\,dy$$

(c) Use Euler's method to find an approximate value of y correct to 4 decimal places for $x = 0{\cdot}1$ given $\frac{dy}{dx}=x-y^2$ at $x = 0$, $y = 1$. Take $h = 0{\cdot}02$. 8

5. (a) Find the length of the astroid $x=a\cos^3 t,\ y=a\sin^3 t$. 6

(b) Evaluate $\iiint\frac{dx\,dy\,dz}{x^2+y^2+z^2}$ throughout the volume of the sphere $x^2+y^2+z^2=a^2$. 6

(c) Solve $\frac{dy}{dx}=xy$ with intial conditions $y(1) = 2$ and find y at $x = 1{\cdot}2$, $1{\cdot}4$ by Runge Kutta method of fourth order. 8