Exam I Problems for Ma 221 2004 Fall.

1   Exam IA

In Problems $1 - 3$ solve the equations:

1 [**25 pts.**]

$$y' - y \tan t = \sin t$$
$$y(0) = 2$$

Note: $\int \tan t\, dt = -\ln(\cos t) + C.$

2 [**25 pts.**]

$$\frac{dy}{dx} = -\frac{3x^2 y^2 + 2xy}{2x^3 y + x^2 + y}$$

3 [**25 points**]

$$\frac{dx}{dt} - tx = t^3 x^2$$

Note: $\int t^3 e^{\frac{t^2}{2}}\, dt = t^2 e^{\frac{1}{2}t^2} - 2e^{\frac{1}{2}t^2} + C$

4a [**15 pts.**] The differential equation

$$y'' - 9y = 2e^{3x} \qquad\qquad ((*))$$

has the general solution

$$y(x) = c_1 e^{-3x} + c_2 e^{3x} + \frac{1}{3} x e^{3x}$$

Find the solution or solutions (if they exist) to $(*)$ with the initial conditions $y(0) = -\frac{1}{9}, y'(0) = \frac{1}{3}.$

4b [**10 pts.**] Solve the equation

$$x\frac{dy}{dx} = 2(y-4) \quad y \neq 4$$

2 Exam IB

In Problems $1-3$ solve the equations:

1 [**25 pts.**]

$$
\begin{aligned}
y' + y \cot t &= \cos t \\
y\left(\frac{\pi}{2}\right) &= 3
\end{aligned}
$$

Note: $\int \cot t\, dt = \ln(\sin t) + C$

2 [**25 pts.**]

$$\frac{dy}{dx} = -\frac{4xy^2 + 6xy}{4x^2y + 3x^2 + 2}$$

3 [**25 points**]

$$\frac{dx}{dt} - \frac{1}{t}x = 3t^2 x^3$$

4a [**15 pts.**] The differential equation

$$y'' - 9y = 9x^2 \qquad\qquad ((*))$$

has the general solution

$$y(x) = c_1 e^{-3x} + c_2 e^{3x} - x^2 - \frac{2}{9}$$

Find the solution or solutions (if they exist) to $(*)$ with the initial conditions $y(0) = -\frac{1}{9}, y'(0) = \frac{1}{3}$.

4b [**10 pts.**] Solve the equation

$$x^2\frac{dy}{dx} = 2(y+4) \quad y \neq -4$$