Engineering Math Midterm#2

Class:_____

ID:_____

Name:_____

1. (10%) In Fig. 1, the capacitor is initially discharged. How long after the switch is closed will the capacitor voltage be 60 volts? Determine the current in the resistor at the time.

Ans: t=0.229 Sec, i=016A

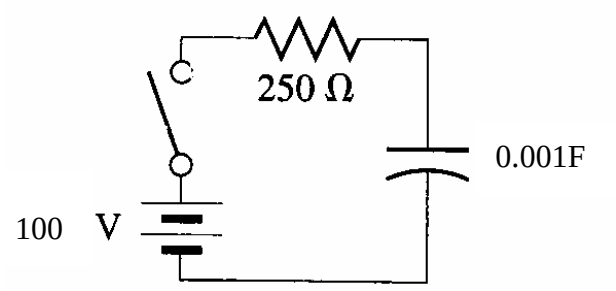

Fig. 1

2. (10%) $x^2(y')^2+\left(2x^3+5xy\right)y'+8x^2y+4y^2=0$.

Ans: $(x^4y-c)(y+\frac{2}{3}x^2-\frac{c}{x})=0$

3. (15%) Let y_1 and y_2 be linear independent solutions of $y''+p(x)y'+q(x)y=0$. Show that every solution of this differential equation is a linear combination of y_1 and y_2. (Hint: $W\left(y_{1,}y_2\right)=y_1(x)y_2'(x)-y_1'y_2(x)=c_1e^{\int -p(x)dx}$).

Ans: omitted

4. (9%) $y''+11y'+24y=x; y(0)=\frac{-11}{576}, y'(0)=\frac{25}{24}$.

Ans: $y=\frac{1}{5}e^{-3x}-\frac{1}{5}e^{-8x}+\frac{1}{24}x-\frac{11}{576}$

5. (7%) $y'''+5y''+3y'-9y=0.$

Ans: $y=c1e^{x}+c2e^{-3x}+c3xe^{-3x}$

6. (12%) $(4x^2+12x+9)y''-(16x+24)y'+16y=16; y(0)=85, y'(0)=218.$

Ans: $y=(2x+3)^4+2x+4$

7. (13%) $x^2y''-2xy'+2y=6(\ln x)^2, x>0.$

Ans: $y=c1x^2+c2x+3(\ln x)^2+9\ln x+\frac{21}{2}$

8. (13%) $4y''+36y=4\csc 3x.$ (Hints: $\int \tan x dx=\ln|\sec x|+c$,

$\int \cot x dx=\ln|\sin x|+c$).

Ans: $y=c1\cos 3x+c2\sin 3x-\frac{1}{3}x\cos 3x+\frac{1}{9}(\ln\sin 3x)\sin 3x$

9. (11%) $(x^2-x)y''-2xy'+2y=0.$

Ans: $y=c1(x^2-2x\ln x-1)+c2x$

10. (10%) $y''-6y'+9y=8\sin 2x+4e^{3x}.$

Ans: $y=c1e^{3x}+c2xe^{3x}+\frac{96}{169}\cos 2x+\frac{40}{169}\sin 2x+2x^2e^{3x}$