出題教師 :劉政湖

建國科技大學 98 學年度 班級: 四技二乙 科目: 工程數學上 (期中考) 考試試題

(每題十分) 班級: 機三乙 學號: 9M4010B3 姓名: 林相宏

100

1.

1. $y''+8y=0$

$\lambda^2+8=0 \quad \lambda^2=-8$

$\lambda=\pm 2\sqrt{2}\,i$

$y=C_1\cos 2\sqrt{2}x+C_2\sin 2\sqrt{2}x$ ※

2. $y'=-y$

2.

$\frac{1}{y}dy=dx$

$\ln y=x+C$

$y=e^{x}C$ ※

3. $y'+2y=y^2$

3.

$u=y^{-1} \quad u'=-y^{-2}y'$

$y'=-y^2u'$

$-y^2u'+2y=y^2$

$u'-2y^{-1}=-1$

$u'-2u=-1$

$u=e^{2x}\left[\int(-1)e^{-2x}dx+C\right]$

$=e^{2x}\left[\frac{e^{-2x}}{2}+C\right]$

$=\frac{1}{2}+e^{2x}C$

$y=\frac{1}{\frac{1}{2}+e^{2x}C}$ ※

4. $y''=0$

4.

$\lambda^2=0$

$\lambda=0,0$

$y=C_1+C_2x$ ※

5. $y'=\sqrt{xy}$

9. $y''+y'+7y=0$

9.

$\lambda^2+\lambda+7=0$

$\lambda=\frac{-1\pm\sqrt{-27}}{2}=-\frac{1}{2}\pm\frac{3\sqrt{3}}{2}i$

$y=e^{-\frac{1}{2}}\left[C_1\cos\frac{3\sqrt{3}}{2}x+C_2\sin\frac{3\sqrt{3}}{2}x\right]$ ※

6. $2xy'-3y=9x^3$

7. $y''+y'+y=0$

7.

$\lambda^2+\lambda+1=0$

$\lambda=\frac{-1\pm\sqrt{-3}}{2}=-\frac{1}{2}\pm\frac{\sqrt{3}}{2}i$

$y=e^{-\frac{1}{2}}\left[C_1\cos\frac{\sqrt{3}}{2}x+C_2\sin\frac{\sqrt{3}}{2}x\right]$ ※

8. $y^2\cos x\,dx+(4+2y\sin x)dy=0$

8.

$\frac{\partial M}{\partial y}=\frac{\partial(y^2\cos x)}{\partial y}=2y\cos x$

$\frac{\partial N}{\partial x}=\frac{\partial(4+2y\sin x)}{\partial x}=2y\cos x$

$\int y^2\cos x\,dx+h(y)$

$=y^2\sin x+h(y)$ 0

$\int 4+2y\sin x\,dy+g(x)$

$=4y+y^2\sin x+g(x)$

$4y+y^2\sin x=C$ ※

10. $y''-y'-2y=3e^{2x}$

10.

$\lambda^2-\lambda-2=0$

$(\lambda-2)(\lambda+1)=0$

$\lambda=2,-1$

$y_c=C_1e^{2x}+C_2e^{-x}$

$y_p=Axe^{2x}+B$

$y_p'=Ae^{2x}+2Axe^{2x}$

$y_p''=2Ae^{2x}+2Ae^{2x}+4Axe^{2x}$

$=4Ae^{2x}+4Axe^{2x}$

$4Ae^{2x}+4Axe^{2x}-Ae^{2x}-2Axe^{2x}-2Axe^{2x}-2B=3e^{2x}$

$3Ae^{2x}-2B=3e^{2x}$

$3A=3$

$A=1 \quad B=0$

$y_p=xe^{2x}$

$y=C_1e^{2x}+C_2e^{-x}+xe^{2x}$ ※

6.

$2xy'-2y=9x^3$

5.

$y'=\sqrt{x}$ 0

$\frac{dy}{dx}=\sqrt{x}\cdot\sqrt{y}$

$\frac{1}{\sqrt{y}}dy=\sqrt{x}\,dx$

$2y^{\frac{1}{2}}=\frac{2}{3}(x)^{\frac{3}{2}}+C$

$y=\left(\frac{\frac{2}{3}(x)^{\frac{3}{2}}}{2}+C\right)^2$ ※

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(每題十分) 班級:机三甲 學號:9840501 姓名:陳孟潍

90

1. $y'' + 8y = 0$

2. $y' = -y$

3. $y' + 2y = y^2$

4. $y'' = 0$

5. $y' = \sqrt{xy}$

6. $2xy' - 3y = 9x^3$

7. $y'' + y' + y = 0$

8. $y^2 \cos x dx + (4 + 2y \sin x) dy = 0$

9. $y'' + y' + 7y = 0$

10. $y'' - y' - 2y = 3e^{2x}$

10. $\lambda^2 - \lambda - 2 = 0$

$(\lambda+1)(\lambda-2) = 0$

$\lambda = -1, 2$

$y_c = c_1 e^{-x} + c_2 e^{2x}$

$y_p = Axe^x + B$

$y_p' = 2Axe^x + Ax^2 e^x$

$y_p'' = 2Ae^x + 2Axe^x + 2Axe^x + Ax^2 e^x$

$2Ae^x + 2Axe^x + 2Axe^x + Ax^2 e^x - 2(Ax^2 e^x + B) = 3e^{2x}$

$2Axe^x + 2Ae^x - 2Ax^2 e^x - 2B = 3e^{2x}$

1. $\lambda^2 + 8 = 0$

$\lambda = \pm\sqrt{8}i$

$y = c_1 2\sqrt{2}\cos x + c_2 2\sqrt{2}\sin x$

2. $y' + y = 0$

$\lambda + 1 = 0$

$\lambda = -1$

$y = c \cdot e^{-x}$

3.

$u = y^{1-2} = y^{-1}$

$y' = -y^2 u'$

$-y^2 u' + 2y = y^2$

$u' + -2y^{-1} = -1$

$u = e^{\int 2dx}\left[\int -1 \cdot e^{\int -2dx} dx + C\right]$

$= e^{2x}\left[\frac{-e^{-2x}}{-2} + C\right]$

$\frac{1}{y} = \frac{1}{2} + C \cdot e^{2x}$

$y = \frac{1}{\frac{1}{2} \cdot Ce^{2x}}$

4. $\lambda^2 = 0$

$\lambda = 0$

$y = C \cdot e^{0 \cdot x} = C$

5.

6. $y' - \frac{3y}{2x} = -\frac{9}{2}x^2$

7. $\lambda^2 + \lambda + 1 = 0$

$\lambda = \frac{-1 \pm \sqrt{3}i}{2} = -\frac{1}{2} \pm \frac{\sqrt{3}}{2}i$

$y = e^{-\frac{1}{2}x}\left[c_1 \frac{\sqrt{3}}{2}\cos x + c_2 \frac{\sqrt{3}}{2}\sin x\right]$

8. $M dx + N dy = 0$

$\frac{\partial M}{\partial y} = 2y\cos x$

$\frac{\partial N}{\partial x} = \frac{\partial(4+2y\sin x)}{\partial x} = 2y\cos x$

$F(x,y) = \int y^2 \cos x dx + g(y)$

$= y^2 \sin x + g(y)$

$F(x,y) = \int (4 + 2y\sin x) dy + h(x)$

$= 4y + y^2 \sin x + h(x)$

$C = y^2 \sin x + 4y$

9. $\lambda^2 + \lambda + 7 = 0$

$\frac{-1 \pm \sqrt{1-28}}{2} = \frac{-1 \pm \sqrt{27}i}{2} = \frac{1}{2} \pm \frac{\sqrt{27}}{2}i$

$y = e^{\frac{1}{2}x}\left[c_1 \frac{\sqrt{27}}{2}\cos x + c_2 \frac{\sqrt{27}}{2}\sin x\right.$

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40

1. $y'' + 8y = 0$

1. $\lambda^2 + 8y = 0$
$\lambda^2 = -8$
$= \pm 2\sqrt{2}i$
$y = C_1 \cos 2\sqrt{2}x + C_2 \sin 2\sqrt{2}x$ #

2. $y' = -y$

2. $y'' + y = 0$
$\lambda + 1 = 0$
$\lambda = -1$
$y = ce^{-x}$ #

3. $y' + 2y = y^2$

3. $y' + y^2 - 2y = 0$

4. $y'' = 0$

5. $y' = \sqrt{xy}$

6. $2xy' - 3y = 9x^3$

7. $y'' + y' + y = 0$

8. $y^2 \cos x dx + (4 + 2y \sin x)dy = 0$

9. $y'' + y' + 7y = 0$

10. $y'' - y' - 2y = 3e^{2x}$

7. $\lambda^2 + \lambda + y = 0$

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40

1. $y'' + 8y = 0$

2. $y' = -y$

3. $y' + 2y = y^2$

4. $y'' = 0$

5. $y' = \sqrt{xy}$

6. $2xy' - 3y = 9x^3$

7. $y'' + y' + y = 0$

8. $y^2 \cos x dx + (4 + 2y \sin x)dy = 0$

9. $y'' + y' + 7y = 0$

10. $y'' - y' - 2y = 3e^{2x}$

1. $y'' + 8y = 0$

$\lambda^2 + 8 = 0$

$\lambda^2 = -8$

$\lambda = \pm\sqrt{8}$

$= \pm 2\sqrt{2}$

Ans: $c_1 \cos \pm 2\sqrt{2} + c_2 \sin \pm 2\sqrt{2}$

2. $y' = -y$

$y' + y = 0$

$\lambda + 1 = 0$

$\lambda = -1$

Ans: Ce^{x}

3. $y' + 2y = y^2$

4. $y'' = 0$

$\lambda^2 = 0$

$\lambda = 0$

Ce^{x}

7. $y'' + y' + y = 0$

9. $y'' + y' + 7y = 0$

$= \frac{-1 \pm \sqrt{-28}}{2}$

$=$

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60

1..$y''+8y=0$ $\lambda^2+8=0$ $\lambda=-8$ $\lambda=\pm 8i=\pm 2\sqrt{2}i$

$C_1\cos 2\sqrt{2}x+C_2\sin 2\sqrt{2}x$

2. $y'=-y$ $\lambda+1=0$ $\lambda=-1$ $y=C_1e^{-x}$

3. $y'+2y=y^2$

$y'+2y=y^2=$

4. $y''=0$ $\lambda^2=0$ $x=0,0$ $y=C_1+C_2e^x$

5.$y'=\sqrt{xy}$

6.$2xy'-3y=9x^3$

9.$y''+y'+7y=0$

$\lambda^2+\lambda+7=0$

$(\lambda+1)^2=0$ $\lambda=7,7$ $y=C_1e^{7x}+C_2e^{7x}$

7.$y''+y'+y=0$

$y^2+y+1=0$ $\lambda^2+\lambda+1=0$ $(\lambda+1)^2=0,0=1$ $y=C_1e^x+C_2e^x$

8.$y^2\cos x dx+(4+2y\sin x)dy=0$

10.$y''-y'-2y=3e^{2x}$

$y''-y'-2y=3e^{2x}$

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65

1. $y''+8y=0$

2. $y'=-y$

3. $y'+2y=y^2$

4. $y''=0$

5. $y'=\sqrt{xy}$

6. $2xy'-3y=9x^3$

7. $y''+y'+y=0$

8. $y^2\cos x dx+(4+2y\sin x)dy=0$

9. $y''+y'+7y=0$

10. $y''-y'-2y=3e^{2x}$

1. $y''+8y=0$

$\lambda^2+8=0$

$\lambda^2=-8$

$\lambda=\pm\sqrt{8}i$

$=\pm 2\sqrt{2}i$

$y=c_1\cos 2\sqrt{2}x+c_2\sin 2\sqrt{2}x$ ※

2. $y'=-y$

$\lambda=-1$

$y=ce^{-x}$ ※

3. $y''=0$

$\lambda^2=0$

$\lambda=0,0$

$y=c_1+c_2x$ ※

4. $y'=\sqrt{xy}$

$\lambda=\sqrt{xy}$

$y=ce^{\sqrt{xy}}$ ※

7. $y''+y'+y=0$

$\lambda^2+\lambda+1=0$

$y'+2y=y^2$

$u=y^{1-2}=y^{-1}$

$u'=-y^{-2}y'$

$y'=-y^2u'$

$y^2u'+2y=y^2$

$u'-2y^{-1}=-1$

$u'-2u=-1$

$u=e^{\int 2dx}\left[\int -1\cdot e^{\int -2dx}dx+c\right]$

$=e^{2x}\left[\int -e^{-x}dx+c\right]$

$=e^{2x}\left[\frac{-e^{2x}}{-2}+c\right]$

$\frac{1}{y}=\frac{1}{2}+c\cdot e^{2x}$

$y=\frac{1}{\frac{1}{2}+c\cdot e^{2x}}$ ※