SS CENTRE FOR MATHS – 7904389447

WORKSHEET 01 – FIRST ORDER ODE

01. The integrability condition for the existence of a solution to the total differential equation $Pdx+Qdy+Rdz=0$

A. $P\left(\frac{\partial Q}{\partial y}-\frac{\partial R}{\partial z}\right)+Q\left(\frac{\partial R}{\partial z}-\frac{\partial P}{\partial x}\right)+R\left(\frac{\partial P}{\partial x}-\frac{\partial Q}{\partial y}\right)=0$

B. $P\left(\frac{\partial Q}{\partial x}-\frac{\partial R}{\partial x}\right)+Q\left(\frac{\partial R}{\partial y}-\frac{\partial P}{\partial y}\right)+R\left(\frac{\partial P}{\partial z}-\frac{\partial Q}{\partial z}\right)=0$

C. $P\left(\frac{\partial Q}{\partial z}-\frac{\partial R}{\partial y}\right)+Q\left(\frac{\partial R}{\partial x}-\frac{\partial P}{\partial z}\right)+R\left(\frac{\partial P}{\partial y}-\frac{\partial Q}{\partial x}\right)=0$

D. $P/\left(\frac{\partial Q}{\partial z}-\frac{\partial R}{\partial y}\right)=Q/\left(\frac{\partial R}{\partial x}-\frac{\partial P}{\partial z}\right)=R/\left(\frac{\partial P}{\partial y}-\frac{\partial Q}{\partial x}\right)$

02. The integrating factor of the differential equation $\left(1+x^2\right)y'+y=e^{\tan^{-1}x}$ is

A. $\tan^{-1}x$

B. $y\tan^{-1}x$

C. $e^{\tan^{-1}x}$

D. $y^{\tan^{-1}x}$

03. The solution of the total differential equation $(ydx+xdy)(2-z)+xydz=0$ is

A. $y=Cx(y-z)$

B. $xy=C(2-z)$

C. $xy=2z+C$

D. $y=2x+C$

04. The solution of $\left(xy^2+x\right)dx+\left(x^2y+y\right)dy=0$ is:

A. $\left(x^2+1\right)\left(y^2+1\right)=c$

B. $(x+1)(y+1)=c$

C. $\left(x^2+1\right)=c\left(y^2+1\right)$

D. $(x+3)=c(y+1)$

05. The integrating factor of the differential equation $\left(1+y^2\right)dx=\left(\tan^{-1}y-x\right)dy$ is:

A. $e^{\tan^{-1}y}$

B. $e^{\tan^{-1}x}$

C. $e^{\tan y}$

D. $e^{\tan x}$

06. The necessary and sufficient condition for a differential equation $M(x,y)dx+N(x,y)dy=0$ to be exact is:

A. $\frac{\partial M}{\partial y}=\frac{\partial N}{\partial x}$

B. $\frac{\partial M}{\partial x}=\frac{\partial N}{\partial y}$

C. (c) $\frac{\partial M}{\partial y}+\frac{\partial N}{\partial x}=0$

D. $\frac{\partial M}{\partial x}+\frac{\partial N}{\partial y}=0$

07. The solution of the total differential equation $2yzdx+zxdy-xy(1+z)dz=0$ is

A. $xy^2=cze^z$

B. $xy=cze^z$

C. $x^2y=cze^z$

D. $x^2yz=ce^z$

08. If $f(y)dx - zxdy - xy\log y dz = 0$ is integrable, then $f(y)$ is:

A. $C\log y$ B. Cy

C. C/y D. Ce^{y}

09. If the equation $Pdx + Qdy + Rdz = 0$ satisfies the integrablity condition and if $Px + Qy + Rz \neq 0,$ then the integrating factor is:

A. $Px + Qy + Rz$ B. $\frac{P}{x} + \frac{Q}{y} + \frac{R}{z}$

C. $\frac{x}{P} + \frac{y}{Q} + \frac{z}{R}$ D. $\frac{1}{Px + Qy + Rz}$

10. The solution of $(y^2 + z^2 - x^2)dx - 2xydy - 2xzdz = 0$ is: (where c is a constant)

A. $x + c = x^2y^2z^2$ B. $xc = x^2 - y^2 - z^2$

C. $x - c = x^2 + y^2 - z^2$ D. $xc = x^2 + y^2 + z^2$

11. If a solution for the homogeneous linear differential equation exists on some interval, then

A. the solution is unique B. there are finitely many solutions

C. the solution is trivial D. there are infinite number of solutions

12. The integral factor of $\frac{dy}{dx} + y\cot x = \sin 2x$ is

A. tanx B. cotx

C. sinx D. cosx

13. The integral factor of $\frac{dy}{dx} + \frac{2y}{x} = \cot x$

A. logsinx B. x^2

C. 2/x D. cotx

14. The integral factor of $\frac{dy}{dx} + \frac{y\log x}{x} = e^{x}x^{-\log x/2}$ is

A. $e^{(\log x)^2/2}$ B. $\log x$

C. $e^{\log x/2}$ D. $x^{(\log x)^2}/2$

15. The integral factor of $\frac{dy}{dx} + \frac{y}{x} = x^2$

A. log x B. x^2

C. 1 / x D. x

16. The integral factor of $\sqrt{1-x^2}\dfrac{dy}{dx}+y=1$ is

A. $e^{\sin^{-1}x}$ B. $ye^{\sin^{-1}x}$

C. $e^{\cos^{-1}x}$ D. $e^{\tan^{-1}x}$

17. The integral factor of $\dfrac{dy}{dx}+\dfrac{2xy}{1+x^2}=\dfrac{1}{1+x^2}$

A. $1-x^2$ B. $e+x^2$

C. $1+x^2$ D. $1/(1+x^2)$

18. The integral factor of $\dfrac{dy}{dx}-\dfrac{xy}{1-x^2}=\dfrac{1}{1-x^2}$

A. $1-x^2$ B. $1-x^3$

C. $\sqrt{1-x^2}$ D. $1/(1+x^2)$

19. If sec x is an integral factor of $\dfrac{dy}{dx}+Py=Q$, then P=

A. cot x B. -cot x

C. tan x D. -tan x

20. If sin x is an integral factor of $\dfrac{dy}{dx}+Py=Q$, then P=

A. cot x B. sin x

C. log sinx D. tan x

21. The integral factor of $\dfrac{dx}{dy}+x\tan y=\cos^3 y$ is

A. cos y B. sin y

C. cosec y D. sec y

22. The integral factor of $2x\dfrac{dy}{dx}+y=2x^3$ is

A. log x B. x^2

C. 1 / x D. $\sqrt{x}$

23. The integral factor of $\dfrac{dx}{dy}+x\cot y=4y\text{cosec}y$ is

A. cos y B. sin y

C. cosec y D. sec y

24. The integral factor of $(y+1)\frac{dx}{dy}+x=\frac{2}{e^y}$

A. log y
B. y^2
C. 1 / y
D. y + 1

25. The integral factor of $x\frac{dy}{dx}+\frac{y}{\log x}=x^2$

A. log x
B. 1 / log x
C. 1 / x
D. x

26. The solution of $\frac{dy}{dx}=e^{2x-y}+x^3e^{-y}$ is

A. $e^y=2e^{2x}+x^4+c$
B. $e^y=e^{2x}+x^4/4+c$
C. $4e^y=2e^{2x}+x^4+c$
D. $e^y=4e^{2x}+2x^4+c$

27. The solution of $x(1+y^2)+y(1+x^2)\frac{dy}{dx}=0$

A. $\log\left(\sqrt{1+x^2}\sqrt{1+y^2}\right)=0$
B. $\left(\sqrt{1+x^2}\sqrt{1+y^2}\right)=c$
C. $(1+x^2)(1+y^2)=xy+c$
D. none

28. The solution of $e^x\tan y dx+(1-e^x)\sec^2 y dy=0$ is

A. $tany=c(1-e^x)$
B. $tany=c(1-e^x)+e^x$
C. $\sec y\tan y=c(1-e^x)$
D. $\sec y=c(1-e^x)$

29. The solution of $\frac{dy}{dx}+\left(\frac{1-y^2}{1-x^2}\right)^{1/2}=0$ is

A. $\cos^{-1} y+\sin^{-1} x=c$
B. $\cos^{-1} x+\sin^{-1} y=c$
C. $\sin^{-1} y+\sin^{-1} x=c$
D. $\sin^{-1} x+\sin^{-1} y=c$

30. The solution of $\frac{dy}{dx}=\frac{y+2}{x-1}$ is

A. $(x-1)(x-2)=c$
B. $\log(y+2)=c$
C. $\log(x-1)=c$
D. $(y+2)=c(x-1)$

31. The solution of $\frac{dy}{dx}=e^{2x+y}$ is

A. $e^{2x}-2e^{-y}=c$
B. $e^{2x}+2e^{-y}=c$
C. $e^{2x}+e^{-y}=c$
D. $e^{2x}-e^{-y}=c$

32. The solution of $\frac{dy}{dx}=e^{x+y}$ is

A. $e^{x+y}=c$
B. $e^x+e^y=c$
C. $e^x+e^{-y}=c$
D. $e^x=e^{-y}+c$

33. The solution of $(1+x^2)dy=(1+y^2)dx$ is

A. $\tan^{-1} y-\tan^{-1} x=\tan^{-1} c$
B. $\tan^{-1} y+\tan^{-1} x=\tan^{-1} c$
C. $\tan^{-1}(xy)=\tan^{-1} c$
D. $\tan^{-1}(y/x)=\tan^{-1} c$

34. Solution of $\sec^2 x\tan y dy + \sec^2 y \tan x dx = 0$ is

A. $\cos 2x - \cos 2y = c$

B. $\cos 2x + \cos 2y = c$

C. $\cos 2x \cdot \cos 2y = c$

D. $\sin 2x - \sin 2y = c$

35. The solution of $\frac{dy}{dx} - \frac{2xy}{1+x^2} = 0$ is

A. $y = c(1+x^2)$

B. $y = (e+x^2)$

C. $\log y = (1+x^2)$

D. $y = c(1+x^2)^2$

36. When y = vx then the equation $\frac{dy}{dx} = \left(\frac{y^3+3yx^2}{x^3+3xy^2}\right)$ is reduces to

A. $\frac{dx}{x} = \frac{2v-2v^3}{1+3v^2}dv$

B. $\frac{dx}{x} = \frac{1+3v^2}{2v-2v^3}dv$

C. $(1+3v^2)dv = (3x^2-x)dx$

D. $(2v-3v^3)dv = (3x^2-x)dx$

37. When $y = vx$ then the equation $x^2dy + y(x+y)dx = 0$ is reduces to

A. $xdv + (2v+v^2)dx = 0$

B. $xdv + (2x+x^2)dx = 0$

C. $vdx + (2x+x^2)dv = 0$

D. $v^2dx - (x+x^2)dv = 0$

38. The solution of $ydy + \frac{(ydx-xdy)}{x^2}$ is

A. $\frac{y^2}{2} + \frac{x}{y} = c$

B. $\frac{y^2}{2} - \frac{x}{y} = c$

C. $\frac{y^2}{2} + \frac{y}{x} = c$

D. $\frac{y^2}{2} - \frac{y}{x} = c$

39. The equation $ydx - (x+x^2)dy = 0$ be comes exact when it is multiply by

A. x

B. $1/x^2$

C. x^2

D. $1/x$

40. If $Mdx + Ndy = 0$ is of the form $yf(xy)dx + xg(xy)dy = 0, f(xy) \neq g(xy)$ then integral factor is

A. $\frac{1}{Mx+Ny}$

B. $\frac{1}{Mx-Ny}$

C. $e^{\int Pdx}$

D. $\frac{1}{f(xy)+g(xy)}$

41. The differential eqution of the family parabolas $y^2 = 4ax$ is

A. $\frac{dy}{dx} = 4\left(\frac{dy}{dx}\right)^2$

B. $y = 2x\frac{dy}{dx}$

C. $\frac{d^2y}{dx^2} = 4$

D. none

42. The differential equation of the family of straight lines is

A. $\frac{dy}{dx} = 4\left(\frac{dy}{dx}\right)^2$

B. $y = 2x\frac{dy}{dx}$

C. $\frac{d^2y}{dx^2} = 0$

D. none

43. The differential equation that represents all parabolas each of which as a rectum 4a & whose axes are parallel to the x -axis

A. $2a\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^3=0$
B. $a\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^3=0$
C. $a\frac{d^2y}{dx^2}+2\left(\frac{dy}{dx}\right)^3=0$
D. $a\frac{d^2y}{dx^2}-2\left(\frac{dy}{dx}\right)^3=0$

44. Differential equation of the family of circles with centre at origin & radius a is

A. $x-y\frac{dy}{dx}=0$
B. $y-x\frac{dy}{dx}=0$
C. $x+y\frac{dy}{dx}=0$
D. $y+x\frac{dy}{dx}=0$

45. Differential equation of the family of circles which passes through the origin & whose centres are on the x-axis is

A. $2xy\frac{dy}{dx}+x^2+y^2=0$
B. $2xy\frac{dy}{dx}+x^2-y^2=0$
C. $2x\frac{dy}{dx}+x^2-y^2=0$
D. $2y\frac{dy}{dx}+x^2-y^2=0$

46. The differential equation of the system of circles touching the x -axis at the origin is

A. $2xy+(x^2+y^2)\frac{dy}{dx}=0$
B. $2xy+(y^2-x^2)\frac{dy}{dx}=0$
C. $2xy-(x^2+y^2)\frac{dy}{dx}=0$
D. $xy+(x^2-y^2)\frac{dy}{dx}=0$

47. The general solution of $yzdx+zxdy+xydz=0$ is

A. $x+y+z=0$
B. $xyz=c$
C. $xy+yz+zx=c$
D. none

48. The general solution of $(y+z)dx+(z+x)dy+(x+y)dz=0$ is

A. $xy+yz+zx=0$
B. $\frac{x^2}{2}+\frac{y^2}{2}+\frac{z^2}{2}=c$
C. $\log xy+\log yz+\log zx=c$
D. $e^{xy}+e^{yz}+e^{zx}=c$

49. The general solution of $(y^2+z^2)dx+xydy+zxdz=0$ is

A. $y^2+z^2+x^2=c$
B. $(y^2+z^2)x^2=c$
C. $y^2+z^2=cx^2$
D. $y^2+z^2=cx$

50. Which of the following equation is integrable

A. $(y+z)dx+(z+x)dy+(x+y)dz=0$
B. $(y-z)dx+(z+x)dy+(x+y)dz=0$
C. $(y+z)dx+(z+x)dy+(x-y)dz=0$
D. $(y+z)dx+(z-x)dy+(x+y)dz=0$

51. The general solution of $(a^2 - z^2)(ydx + xdy) - 2zdz = 0$ is

A. $y^2 + z^2 + x^2 = c$

B. $(y^2 + a^2)x^2 = c$

C. $xy + \log(a^2 - z^2) = c$

D. $y^2 + z^2 = cx$

SOLUTION:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

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WORKSHEET 02 - SECOND AND HIGHER ORDER ODE

01. The general solution of the differential equation $(D^2+10D+25)y=0$ is

A. $e^{5x}(A+Bx)$
B. $e^{-5x}(A+Bx)$
C. $e^{5x}(A\cos x+B\sin x)$
D. $e^{-5x}(A\cos 5x+B\sin 5x)$

02. The particular integral of the differential equation $(D^2-13D+12)y=5e^x$ is

A. $5xe^x/11$
B. $-5xe^x/11$
C. $5e^x/11$
D. $-5x^2e^x/11$

03. Independent solutions of the equation $y''+y'-2y=0$ are

A. e^x, e^{-2x}
B. e^x, e^{2x}
C. $e^x, -e^{-x}$
D. e^x, e^{-x}

04. General solution for $y''-2y'+10y=0$ is

A. $e^x(A\cos 3x+B\sin 3x)$
B. $A\cos 3x+B\sin 3x$
C. Ae^x+Be^{3x}
D. does not exist

05. The particular integral of $y''-5y'+6y=x^2e^{3x}$ is

A. $e^{3x}x^3/3$
B. $e^{3x}(x^3-3x^2+6x)/3$
C. $e^{3x}(x^3+3x^2-6x)/3$
D. $e^{3x}(x^3+x^2-2x)$

06. The characteristic polynomial of an annihilator for the function $x^k e^{ax}$, where a is any non-negative integer is

A. $r-a$
B. $(r-a)^k$
C. $(r-a)^{k+1}$
D. $(r-a)a^k$

07. Solution for $(D^2+5D+6)y=e^x$

A. $y=Ae^{-2x}+Be^{-3x}+e^x/12$
B. $y=Ae^{2x}+Be^{3x}$
C. $y=Ae^{2x}+Be^{3x}+e^{-x}/12$
D. $y=Ae^{2x}+Be^{3x}-e^x$

08. Solution for $(D^2+D+1)y=x^2$ is

A. $\left(A\cos\frac{\sqrt{3}}{2}x+B\sin\frac{\sqrt{3}}{2}x\right)-3x$

B. $e^{-x/2}\left(A\cos\frac{\sqrt{3}}{2}x-B\sin x\right)-x^2$

C. $e^{-x/2}(A\cos x+B\sin x)-x^2+3x$

D. $e^{-x/2}\left(A\cos\frac{\sqrt{3}}{2}x+B\sin\frac{\sqrt{3}}{2}x\right)+x^2-2x$

09. Every solution of the equation $y''+y'-2y=0$ has the form

A. $c_1e^{2x}+c_2e^x$

B. $c_1e^{-2x}+c_2e^x$

C. $c_1e^{2x}+c_2e^{-x}$

D. $c_1e^{-x}+c_2e^{-2x}$

10. If $L(y)=y''+a_1y'+a_2y=0$, then the value of $L(e^{rx})$ is

A. $P(r)e^{-rx}$

B. $P(r)e^{rx}$

C. $P(-r)e^{rx}$

D. $P(-r)e^{-rx}$

11. The particular integral of the differential equation $y''+6y'+9y=2e^{-3x}$ is

A. $e^{-3x}/18$

B. $2xe^{-3x}$

C. $x^2e^{-3x}/2$

D. x^2e^{-3x}

12. If $\varphi(x)$ is a solution of the equation $y''+a_1y'+a_2y=0$, where a_1 and a_2 are constants, then the value of 'k' for which the function $\psi(x)=e^{\frac{a_1}{2}x}\varphi(x)$ is a solution of the equation $y''+ky=0$ is equal to:

A. $a_1^2/4$

B. a_1a_2

C. $\frac{a_1^2+a_2^2}{4}$

D. $a_2-\frac{a_1^2}{4}$

13. For the equation $y^{(100)}+100y=2e^{5x}$, which one of the following is a solution?

A. $2e^{5x}$

B. $e^{5x}/5^{100}$

C. $\frac{2e^{5x}}{5}$

D. $\frac{2e^{5x}}{5^{100}+100}$

14. The general solution of the equation $y^{(n)}-nC_1y^{(n-1)}+nC_2y^{(n-2)}-\cdots-(-1)^n y=e^x$ is

A. $(c_1+c_2x+c_3x^2+\cdots+c_{n-1}x^{n-1})e^x$

B. $(c_1+c_2x+c_3x^2+\cdots+c_{n-1}x^{n-1})e^x+\frac{x^{n-1}}{(n-1)!}e^x$

C. $c_1+c_2x+c_3x^2+\cdots+c_nx^{n-1}+\frac{x^n}{n!}e^x$

D. $(c_1+c_2x+c_3x^2+\cdots+c_nx^{n-1})e^x+\frac{x^n}{n!}e^x$

15. The linear differential equation with constant coefficient is of the form

A. $(x^2+y^2+x)dx-(2x^2+2y^2-y)dy=0$ B. $y''-3y'+2y=\sin 3x$

C. $3x^2y''+xy'+y=x$ D. $x^2y''-3xy'-5y=\sin(\log x)$

16. The solution of $(D^2+4)y=0$ is

A. $y=A\cos 2x+B\sin 2x$ B. $y=A\cos 2x+Bx$

C. $y=e^{2x}(A\cos 2x+B\sin 2x)$ D. $y=e^{-2x}(A\cos 2x+B\sin 2x)$

17. C.F of $(D^2-8D+16)y=e^{4x}$ is

A. $\dfrac{x^2e^{4x}}{2}$ B. $(Ax+B)e^{4x}$

C. $Ae^{4x}+Be^{-4x}$ D. $A\cos 4x+B\sin 4x$

18. C.F of $(D^2+a^2)y=\text{sinax}$ is

A. $A\cos ax+B\text{sinax}$ B. $A\cosh ax+B\text{sinhax}$

C. $A\text{cosax}-B\text{sinhax}$ D. $A\cos 4x+B\sin 4x$

19. The C.F. of $(D^2+2D+3)y=0$ is

A. $y=Ae^{-2x}+Be^{2x}$ B. $y=e^{x}(A\sqrt{2}x+B\sqrt{2}x)$

C. $y=e^{-x}(A\cos\sqrt{2}x+B\sin\sqrt{2}x)$ D. $y=(A\cos\sqrt{2}x+B\sin\sqrt{2}x)$

20. C.F of $(D^2-2D+1)y=x^2+1$ is

A. $e^{2x}(Ax+B)$ B. $(Ax+B)e^{x}$

C. $(Ax+B)e^{-x}$ D. $(Ax+B)e^{-2x}$

21. C.F of $(D^2-4)y=0$ is

A. $e^{2x}(Ax+B)$ B. $(Ax+B)e^{-2x}$

C. $Ae^{-2x}+Be^{2x}$ D. $A\cos 2x+B\sin 2x$

22. Complete solution of $(D^2+1)y=x$ is

A. $e^{x}(Ax+B)+x$ B. $(Ax+B)e^{-x}+2x$

C. $A\cos x+B\sin x+x$ D. $A\cos x+B\sin x+2x$

23. The P.I. of $(D^2+5D+7)y=5$ is

A. $2x^2-x$ B. $\dfrac{5}{7}$

C. $2\dfrac{x}{7}$ D. $\dfrac{5e^3}{3}$

24. The P.I of $(D^2-2D+1)y=2e^{x}$ is

A. x^2e^{x} B. x^2e^{-x}

C. $x^{-2}e^{x}$ D. $x^{-2}e^{-x}$

25. The P.I of $(D^2-3D+2)y=e^{3x}$ is

A. $2e^{3x}$

B. $\frac{e^{3x}}{2}$

C. $e^{3x}\frac{1}{20}$

D. $Ae^{x}+Be^{2x}$

26. The P.I of $(D^2-3D+2)y=e^{x}$ is

A. xe^{x}

B. $e^{x}/8$

C. $-e^{x}/8$

D. $-xe^{x}$

27. The P.I of $(D^2+2D+5)y=xe^{x}$ is

A. $\frac{e^{x}}{8}\left(x+\frac{1}{2}\right)$

B. $\left(x-\frac{1}{2}\right)e^{x}/8$

C. $(x-1)e^{x}/8$

D. $\left(-x+\frac{1}{2}\right)e^{x}/8$

28. The P.I of $(D^2-3D+2)y=e^{-x}$ is

A. $xe^{-x}/6$

B. $e^{-x}/6$

C. $-e^{x}/3$

D. 6

29. The P.I of $(D^2-4)y=e^{-4x}+e^{2x}$ is

A. $\frac{xe^{2x}}{4}+\frac{e^{-4x}}{12}$

B. $e^{x}+e^{-4x}$

C. $e^{x}+e^{-4x}$

D. $e^{-5x}/5$

30. The P.I of $(D^2+9)y=\cos 3x$ is

A. $\frac{\cos x}{2}$

B. $(\sin 3x)$

C. $\frac{x\sin 3x}{6}$

D. $(x^2\sin 3x)/6$

31. The P.I of $(D^2+9)y=4\sin 3x$ is

A. $(2x\sin 3x)/3$

B. $-(2x\sin 3x)/3$

C. $(2x\cos 3x)/3$

D. $(-2x\cos 3x)/3$

32. The P.I of $(D^2+2)y=2\cos^2 x$

A. $2\cos^2 x$

B. $\cos^2 x$

C. $2\sin^2 x$

D. $\sin^2 x$

33. The P.I of $(D^2-1)y=e^{x}+\cos 2x$ is

A. $\left(\frac{xe^{x}}{2}\right)-\frac{\cos 2x}{5}$

B. $\left(\frac{-xe^{x}}{2}\right)-\frac{\cos 2x}{5}$

C. $\left(\frac{xe^{x}}{2}\right)+\frac{\cos 2x}{5}$

D. $\left(-\frac{xe^{x}}{2}\right)+\frac{\cos 2x}{5}$

34. The P.I. of $(D^2 + D + 1)y = x^2$ is

A. $2x^2 - x$

B. $x^2 - 2x$

C. $2x$

D. $x^3/3$

35. The P.I of $(D^2 - 2D + 4)y = e^x \sin x$ is

A. $(e^x \sin x)/2$

B. $(e^x \sin x)/4$

C. $(e^x \cos x)/2$

D. $(e^x \cos x)$

36. The P.I of $(D + 1)^3 y = e^{-x} + x^2$ is

A. $\left(\frac{x^3 e^{-x}}{6}\right) + x^2 + 6x + 12$

B. $\left(\frac{x^3 e^{-x}}{-6}\right) + x^2 + 6x + 12$

C. $\left(\frac{x^3 e^{-x}}{-6}\right) + x^2 - 6x + 12$

D. $\left(\frac{x^3 e^{-x}}{6}\right) + x^2 - 6x + 12$

37. The P.I of $(D^2 - 2D + 2)y = e^x \sin x$ is

A. $(e^x \cos x)/2$

B. $(-xe^x \cos x)/2$

C. $(xe^x \cos x)/2$

D. $(-x\cos x)/2$

38. The general solution to $y''' - y'' + y' - y = 0$ is given by

A. $y = c_1 e^x + c_2 e^{-x} + c_3$

B. $y = c_1 e^{-x} + (c_2 \cos x + c_3 \sin x)$

C. $y = c_1 e^x + (c_2 \cos x + c_3 \sin x)$

D. $y = (c_1 x + c_2)e^{-x} + c_3 e^x$

39. The solution of the differential equation $(D^3 - 12D + 16)y = 0$ is

A. $y(x) = Ae^{-4x} + Be^{2x} + Cxe^{2x}$

B. $y(x) = Ae^{-4x} + (B + Cx)e^{-2x}$

C. $y(x) = (Ax + B)e^{-2x} + Ce^{4x}$

D. None of these

40. The Particular integral of $4y'' - 4y' + 3y = 4$ is

A. 4

B. 0

C. 2

D. 4 / 3

41. The general solution to $y''' + 2y'' - 11y' - 12y = 0$ *is*

A. $y = c_1 e^{-3x} + c_2 e^{-4x} + c_3 e^{-x}$

B. $y = c_1 e^{-3x} + c_2 e^{4x} + c_3 e^x$

C. $y = c_1 e^{3x} + c_2 e^{-4x} + c_3 e^{-x}$

D. $y = c_1 e^{3x} - c_2 e^{-4x} + c_3 e^{-x}$

42. The roots of the auxiliary equation of a differential equation are $1 \pm i, 1 \pm i$. Then the complementary function is given by...

A. $y_c = e^x(c_1 \cos x + c_2 \sin x)$

B. $y_c = e^x[(c_1 x + c_2)\cos x + (c_3 x + c_4)\sin x]$

C. $y_c = e^{-x}[(c_1 x + c_2)\cos x + (c_3 x + c_4)\sin x]$

D. $y_c = c_1 e^{3x} - c_2 e^{-4x} + c_3 e^{-x}$

43. Which is the correct option, if roots of auxiliary equation are $1, -1, -1, 1 \pm 2i$ given by

A. $y = c_1e^x + c_2e^{-x} + c_3e^{-x} + e^x(c_4\cos 2x + c_5\sin 2x)$

B. $y = (c_1x + c_2)e^x + c_3e^{-x} + e^{2x}(c_4\cos x + c_5\sin x)$

C. $y = c_1e^x + (c_2x + c_3)e^{-x} + e^x(c_4\cos 2x + c_5\sin 2x)$

D. $y = c_1e^x + (c_2x + c_3)e^{-x} + e^{-x}(c_4\cos 2x + c_5\sin 2x)$

44. If $y = (Ax + B)e^{2x}$ is the general solution of the differential equation, then its corresponding differential equation is

A. $(D^2 + 4)y = 0$

B. $(D^2 + 4D + 4)y = 0$

C. $(D^2 - 4D + 4)y = 0$

D. None of these

45. The P.I. of $y'' + y' - 12y = e^{6x}$

A. $y_p = \frac{e^{6x}}{20}$

B. $y_p = \frac{e^{6x}}{30}$

C. $y_p = \frac{e^{-6x}}{60}$

D. $y = \frac{e^{6x}}{10}$

46. What is the particular integral of $(D + 1)^2y = x$ is

A. $x + 2$

B. $x - 2$

C. $\frac{1}{2}(x + 2)$

D. $\frac{1}{2}(x - 2)$

47. The P.I. of $(D^2 + 1)y = e^{2x+3}$ is ...

A. $y_p = \frac{e^{2x+3}}{5}$

B. $y_p = \frac{e^{2x+3}}{7}$

C. $y_p = \frac{e^{2x+3}}{9}$

D. $y_p = \frac{e^{2x+3}}{2}$

48. The particular integral of $(D^2 - 4)y = 3^x$ is

A. $\frac{3^x}{(\log 3)^2 - 4}$

B. $\frac{3^x}{(\log 3) - 4}$

C. $\frac{3^x}{(\log 3)^2 + 4}$

D. $-\frac{3^x}{4}$

49. The P.I. of $(D^2 - 5D + 6)y = 2e^{2x}$ is

A. $y_p = xe^{2x}$

B. $y_p = \frac{xe^{2x}}{2}$

C. $y_p = -2xe^{2x}$

D. $y_p = -xe^{2x}$

50. The P.I. of $(D^3 - 1)y = 2e^x$ is

A. $y_p = xe^x$

B. $y_p = \frac{2xe^x}{3}$

C. $y_p = \frac{3xe^x}{4}$

D. $y_p = -xe^{-3x}$

51. The particular integral $(D^2+1)y = -\sin 2x$ is

A. $\frac{\sin 2x}{3}$ B. $\frac{\sin t}{3}$

C. $\frac{\sin 3x}{2}$ D. $\frac{\sin 2t}{3}$

52. The P.I. of $(D^2+6D+5)y = \cosh 2x$ is

A. $y_p = \frac{e^{-2x}}{42} - \frac{e^{2x}}{6}$ B. $y_p = \frac{e^{2x}}{42} + \frac{e^{-2x}}{6}$

C. $y_p = \frac{e^{-2x}}{42} + \frac{e^{+2x}}{6}$ D. $y_p = \frac{e^{2x}}{42} - \frac{e^{-2x}}{6}$

53. The P.I. of $(D^2-2D+5)y = \sinh 3x$ is

A. $y_p = \frac{e^{3x}}{16} - \frac{e^{-3x}}{40}$ B. $y_p = \frac{e^{3x}}{16} + \frac{e^{-3x}}{40}$

C. $y_p = \frac{e^{3x}}{16} + \frac{xe^{-3x}}{40}$ D. $y_p = \frac{xe^{3x}}{16} + \frac{e^{-3x}}{40}$

54. The P.I. of $(D^2-3D+2)y = 7\cos x$ is

A. $y_p = \frac{7}{10}(\cos x - 3\sin x)$ B. $y_p = \frac{7}{10}(\sin x + 3\cos x)$

C. $y_p = \frac{7}{10}(3\cos x + 2\sin x)$ D. $y_p = \frac{7}{10}(3\sin x - 2\cos x)$

55. The P.I. of $(D^2+4)^2 y = \sin 2x$ is

A. $y_p = -\frac{x^2\cos 2x}{32}$ B. $y_p = \frac{x\cos 2x}{32}$

C. $y_p = \frac{x\sin 2x}{32}$ D. $y_p = -\frac{x^2\sin 2x}{32}$

56. The P.I. of $(D^3-1)y = \sin\left(\frac{x}{2}\right)\cos\left(\frac{x}{2}\right)$ is

A. $y_p = \frac{1}{4}[\cos x + \sin x]$ B. $y_p = \frac{1}{2}[\cos x + \sin x]$

C. $y_p = -\frac{1}{4}[\cos x + \sin x]$ D. $y_p = \frac{1}{4}[\cos x - \sin x]$

57. The particular solution of $(D^2+4D+4)y = e^{-2x}\sin x$ is

A. $(A+Bx)e^{2x}$ B. $e^{-2x}\sin x$

C. $e^{-x}\sin x$ D. $-e^{-2x}\sin x$

58. The particular solution of $(D^4-1)y = \cos x$ is

A. $y_p = -\frac{x\cos x}{4}$ B. $y_p = -\frac{x\sin x}{4}$

C. $y_p = \frac{x\cos x}{4}$ D. $y_p = \frac{\sin x}{5}$

59. The P.I of $\frac{e^{2x}\cos 3x}{D^2-4D+13}$ is

A. $y_p = \frac{xe^{2x}\cos 3x}{6}$

B. $y_p = \frac{xe^{2x}\sin 3x}{6}$

C. $y_p = \frac{e^{2x}\sin 3x}{6}$

D. $y_p = -\frac{xe^{2x}\sin 3x}{6}$

60. The P.I of $\frac{e^x x^2}{D^2-2D+1}$ is

A. $y_p = e^x \frac{x^4}{6}$

B. $y_p = e^{-x}\frac{x^3}{12}$

C. $y_p = e^x \frac{x^4}{12}$

D. $y_p = e^{-x}\frac{x^4}{24}$

SOLUTION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

SS CENTRE FOR MATHS – 7904 389 447

WORKSHEET 03 - HIGHER ORDER ODE WITH VARIABLE COEFFICIENTS,INITIAL VALUE PROBLEMS AND WRONSKIAN

01. y_1 and y_2 are two solutions of a second-order linear differential equation. They are linearly independent if the Wronskian $W(y_1, y_2)$ of the solution is

A. zero
B. not equal to zero
C. positive
D. Negative

02. If Wronskian W of functions ϕ_1, ϕ_2 vanishes at some $x_0 \in I$, then in the whole interval I,

A. $W = 0$
B. $W \neq 0$ except at x_0
C. $W = 1$
D. $W > 0$

03. A second order initial value problem has the following two conditions

A. $y(x_0) = k, y'(x_0) = l$
B. $y(x_0) = k_1, y(x_1) = l_1$
C. $y(x_0) = k_2, y(x_n) = l_2$
D. $y(x_0) = y'(x_0), \forall x_0 \in I$

04. If ϕ_1 and ϕ_2 are two linearly independent solutions of a differential equation on an interval I, then their Wronskian is

A. $\neq 0$
B. $= 1$
C. $= 0$ at some point x_0 in I
D. $= 2$ at every point in I

05. The solution for the initial value problem $y'' - 4y' + 4y = 0, y(0) = 3, y'(0) = 1$ is

A. e^{2x}
B. $5xe^{2x}$
C. $(3 - 5x)e^{2x}$
D. $(3 + 5x)e^{2x}$

06. General solution of $x^2 y'' - xy' - 3y = 0$ is

A. $A/x + Bx^3$
B. $Ax + Bx^3$
C. $A/x + B/x^3$
D. $A + Bx^2$

07. The differential equation $y'' + y = \tan x$, $y(0) = 1$ and $y'(1) = 0$ is called

A. an initial value problem
B. a boundary value problem
C. an eigen value problem
D. none of these

08. Two independent solutions $x^2 y'' + xy' + y = 0,\ x \geq 1$ are

A. e^x, e^{2x}
B. $\sin x, \cos x$
C. $\sin(\log x), \cos(\log x)$
D. e^{3x}, e^{5x}

09. $y''+y=0$ has

A. no solution
B. only trivial solution
C. exactly one independent solution
D. many linearly independent solutions

10. The initial value problem $y''+10y=0, y(0)=\pi, y'(0)=\pi^2$ has the solution

A. $\pi\cos\sqrt{10}x+\frac{\pi^2}{\sqrt{10}}\sin\sqrt{10}x$
B. $\pi^2\cos\sqrt{10}x+\pi\sin\sqrt{10}x$
C. $\frac{\pi^2}{\sqrt{10}}\cos\sqrt{10}x+\pi\sin\sqrt{10}x$
D. $\pi\cos\sqrt{10}x-\pi\sin\sqrt{10}x$

11. Two solutions ϕ_1,ϕ_2 of $L(y)=0$ are linearly independent iff $\forall x\in I, w(\phi_1,\phi_2)(x)$ is

A. 1
B. 0
C. $\neq 0$
D. ∞

12. If $y_1(t)=\sin t$ and $y_2(t)=1-t$ are solutions of a second order differential equation, then the Wronskian of y_1 and y_2 is:

A. $(t-1)\cos t+\sin t$
B. $(t+1)\cos t+\sin t$
C. $(t-1)\cos t-\sin t$
D. $(t+1)\cos t-\sin t$

13. The particular integral of $x^2y''-3xy'+y=1/x$ is:

A. $x/6$
B. $1/6x$
C. $6/x$
D. $6x$

14. The function $\phi_1(x)=x$ and $\phi_2(x)=|x|, x\in R$ are

A. Linearly dependent
B. Linearly independent
C. Functionally dependent
D. Functionally independent

15. The Wronskian W of the two linearly independent solutions of $y''+a_1y'+a_2y=0$ satisfies the equation

A. $w''+a_1w=0$
B. $w''-a_1w=0$
C. $w'+a_1w=0$
D. $w'-a_1w=0$

16. For what non-negative values of k, the equation $y''+k^2y=0$ has non-trivial solution ϕ satisfying $\phi(0)=-\phi(\pi)$ and $\phi'(0)=-\phi'(\pi)$

A. $1,2,3,\cdots$
B. $1,3,5,\cdots$
C. $2,4,6,\cdots$
D. $1,4,9,\cdots$

17. The Wronskian of the functions $1, t, t^2, t^3, \cdots, t^n$ is equal to:

A. $n!$ B. 0

C. $\frac{n(n+1)}{2}$ D. $0!1!2!3!\cdots n!$

18. The P.I of $(x^2D^2 + xD + 1)y = x$ is

A. e^x B. e^{-x}

C. $2/x$ D. $x/2$

19. The Solution to the initial value problem $y'' - 4y' - 5y = 0, y(0) = 0, y'(0) = 6$

A. $y = e^{5t} - e^{-t}$ B. $y = 2e^{5t} + e^{-t}$

C. $y = 2e^{-t} - e^{5t}$ D. $y = e^{5t} + e^{-t}$

20. The general solution of the equation $(D^2 + 1)y = 0$ given $y(0) = 0, y'(0) = 1$ is

A. $y = -\sin x$ B. $y = \sin x$

C. $y = \cos x$ D. $y = -\cos x$

21. The Solution to the initial value problem $y'' + 2y' + y = 0, y(0) = 0, y'(0) = 1$ is

A. $y = xe^{-x} + e^{x}$ B. $y = xe^{-x} + e^{-x}$

C. $y = xe^{-x}$ D. $y = 2xe^{-x} + e^{-x}$

22. The Solution to the initial value problem $y'' + 4y = 0, y(0) = 1, y'(0) = 1$ is

A. $y = \cos 2x + \frac{1}{2}\sin 2x$ B. $y = -\cos 2x + \frac{1}{2}\sin 2x$

C. $y = \cos 2x - \frac{1}{2}\sin 2x$ D. $y = \cos 2x + \sin 2x$

23. The Solution to the initial value problem $y'' - 5y' + 6y = 0, y(0) = 1, y'(0) = 0$ is

A. $y = 2e^{2x} - xe^{2x} + e^{3x}$ B. $y = 2e^{2x} - xe^{2x} - e^{3x}$

C. $y = 2e^{2x} + xe^{2x} - e^{3x}$ D. $y = 2e^{2x} + xe^{2x} + e^{3x}$

24. The reduced ordinary differential equation with constant coefficients of $x^3y''' - x^2y'' + xy' - y = 0$ is

A. $(\theta^3 - 4\theta^2 + 4\theta - 1)y = 0$ B. $(\theta^3 - \theta^2 + \theta - 1)y = 0$

C. $(\theta^3 - 1)y = 0$ D. $(\theta^3 + 1)y = 0$

25. C.F of the Differential Equation $x^2y'' + 3xy' + 5y = 0$ is

A. $y = x^{-3/2}\left[A\cos\left(\frac{\sqrt{11}}{2}\log x\right) + B\sin\left(\frac{\sqrt{11}}{2}\log x\right)\right]$

B. $y = x^{3/2}\left[A\cos\left(\frac{\sqrt{11}}{2}\log x\right) + B\sin\left(\frac{\sqrt{11}}{2}\log x\right)\right]$

C. $y = x^{-1}[A\cos(2\log x) + B\sin(2\log x)]$

D. $y = Ax^{-1} + Bx^5$

26. Which of the following is the particular integral of the linear differential equation

$x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}=\log x$

A. $\frac{(\log x)}{6}$ B. $\frac{x^3}{3}$

C. $\frac{(\log x)^3}{6}$ D. $\frac{x^3}{6}$

27. The C.F of the Differential Equation $x^2\frac{d^2y}{dx^2}+4x\frac{dy}{dx}+2y=e^x$

A. $y_c=Ax^{-1}+Bx^2$ B. $y_c=Ax-Bx^{-2}$

C. $y_c=Ax^{-1}+Bx^{-2}$ D. None of the above

28. The particular integral of $x^2y''+xy'=12\log x$ is

A. $y_p=2z^2$ B. $y_p=2z^3$

C. $y_p=3z^3$ D. $y_p=2z^3+3z$

29. The particular integral of $\frac{\cos z}{\theta^2+1}$ is...

A. $y_p=\frac{\cos z}{3}$ B. $y_p=\frac{z^2\sin z}{2}$

C. $y_p=\frac{z\cos z}{3}$ D. $y_p=\frac{z\sin z}{2}$

30. The particular integral of $\frac{e^{4z}}{\theta^2-3\theta-4}$ is...

A. $y_p=\frac{ze^{4z}}{5}$ B. $y_p=\frac{e^{4z}}{5}$

C. $y_p=\frac{ze^{4z}}{2}$ D. $y_p=-\frac{ze^{4z}}{5}$

31. For a given Cauchy Euler differential equation, auxiliary equation is with the roots -1,-2 and particular integral $y_p=\frac{e^z}{36}(6z-5)$. The general solution is

A. $y=\frac{c_1}{x}+\frac{c_2}{x^2}+\frac{x}{36}(6\log x-5)$ B. $y=\frac{c_1}{x}+\frac{c_2}{x^2}+\frac{1}{36}(6\log x-5)$

C. $y=\frac{c_1}{x}+c_2x^2+\frac{x}{36}(6\log x-5)$ D. $y=\frac{c_1}{x}+c_2x^2+\frac{x}{36}(6x-5)$

32. If $c_1e^{-x}+c_2e^{2x}-2x^2+2x-3$ is the general solution of the differential equation $y''-y'-2y=4x^2, y(0)=0, y'(0)=2$, then the value of c_1 and c_2 are respectively

A. -1 and 2 B. 2 and 1

C. 1 and 1 D. -2 and 3

33. The general solution of initial value problem $y''-y'-12y=0, y(0)=3, y'(0)=5$ is

A. $2e^{4x}+e^{-3x}$ B. $e^{4-x}+e^{3x}$

C. $2e^{-4x}+e^{3x}$ D. $e^{-4x}+2e^{-3x}$

34. For independent solutions Wronskian is

A. Non-zero B. zero

C. equal to one D. not equal to one

35. If $y_1(t)=e^{-2t}$ and $y_2(t)=e^{-3t}$ are the solution of the differential equation $y''+5y'+6y=0$, the Wronskian of $y_1(t)$ and $y_2(t)$ is

A. e^{5t} B. e^{4t}

C. $-e^{3t}$ D. $-e^{-5t}$

36. The value of $W(x, x^2, x^3)$ is

A. $2x^4$ B. $2x^2$

C. $2x^3$ D. $2x$

37. If $y_1(t)=\sin t$ and $y_2(t)=\cos t$ are the solution of the differential equation $y''+y=0$, the Wronskian of $y_1(t)$ and $y_2(t)$ is

A. 2 B. 1

C. 0 D. -1

38. How many independent solutions does the nth order homogeneous linear differential equation have?

A. n B. n -1

C. n + 1 D. infinite no. of solutions

39. The Wronskian of the functions x^2 and $x^2 \log x$ is

A. $2x^3$ B. x^3

C. $-x^3$ D. x^2

40. Consider two functions $f_1(x)=x$ and $f_2(x)=|x|$.

(1) Wronskian of f_1 and f_2 is non zero

(2) f_1 and f_2 are linearly independent

A. Only (1) is true B. Only (2) is true

C. Both are true D. Both are false

41. The solution of the initial value problem $y''-4y'+4y=0, y(0)=0, y'(0)=0$ is

A. 1 B. 0

C. 2 D. -2

42. If $y(x)$ is a solution of $a_0y''+a_1y'+a_2y=0, a_0 \neq 0$ satisfying $y(x_0)=y'(x_0)=0$, then the value of $y(x)$ is

A. identically zero
B. non zero
C. one
D. none of these

43. The complementary function of $\left(x^2D^2+xD\right)y=e^x$ is

A. $A+Bx$
B. $A+B\log x$
C. $A+Bx^2$
D. $Ax+Bx^2$

44. The particular integral of $\left(x^2D^2-5xD+9\right)y=x^3\log x$ is

A. $\dfrac{x^3\log x}{6}$
B. $\dfrac{(x\log x)^3}{6}$
C. $\dfrac{x\log x}{6}$
D. $\dfrac{x\log x}{3}$

SOLUTION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45