Normal ODE, Dependent –Independent functions , Homogeneous Linear ODE:

1.) The differential equation $y''+3y'+\sqrt{x}y=\sin x$ an integer is normal on every subinterval of

a) $(-\infty,\infty)$ b) $[0,\infty)$ c) $(0,\infty)$ d) $(-\infty,1),(-1,1),(1,\infty)$

2.) The differential equation $(x^2-1)y''+2xy'+y=x\ln x$ is normal on every subinterval of

a) $(-\infty,\infty)$ b) $(0,\infty)$ c) $(-\infty,2)$ d) $(0,1)$, $(1,\infty)$

3.) Which of the following functions are linearly independent for $x\in(0,\infty)$?

a) $1,x,x^2,1+x$ b) $1,x(1-x),x^2,x$ c) $2x,6x+3,3x+2$ d) $1,x,x^2,x^2(1-x)$

4.) If $y_1(x)\,and\,y_2(x)$ be the linearly independent solutions of the equation $y''+a(x)y'+b(x)y=0$ on an interval I then which of the following is true

a) both $y_1(x)\,and\,y_2(x)$ vanishes for some $x_0\in I$

b) both $y_1(x)\,and\,y_2(x)$ take extreme values for some $x_0\in I$

c) both $y_1(x)\,and\,y_2(x)$ can not vanishes for some $x_0\in I$ d) None of these

5.) The general solution of the differential equation $y''+2\pi y'+\pi^2y=0$ is

a) $(A+Bx)e^{-\pi x}$ b) $(A+Bx)e^{-x}$ c) $(A+B)e^{-\pi x}$ d) $(A+Bx)e^{\pi x}$

6.) The differential equation whose linearly independent solutions are e^{2x},xe^{2x} is ?

a) $y''+4y'+4y=0$ b) $y''+4y'-4y=0$ c) $y''-4y'+4y=0$ d) $y''-4y'-4y=0$

7.) The lowest possible order of homogeneous linear differential equation whose particular solution is $3\cos 2x+5\sinh 3x$ is $= 3\cos 2x + 0\sin 2x + \frac{5}{2}e^{3x} + \frac{5}{2}e^{-3x}$ $\left(\sinh 3x = \frac{e^{3x}-e^{-3x}}{2}\right)$

$\pm 2i, \pm 3$

a) 2 b) 3 c) 5 d) 4

8.) The roots of characteristic equation of differential equation $y^{iv}+8y''-9y=0$

a) $\pm1,\pm3i$ b) $\pm i,\pm3i$ c) $\pm i,\pm3$ d) $\pm1,\pm3$

9.) The general solution of differential equation $y'''-2y''+y'=0$ is

) $Ae^x+(Bx+C)$ b) $A+(Bx+C)e^x$ c) $(Bx+C)e^x$ d) $A+(Bx+C)e^{-x}$

10.) The lowest possible order of homogeneous linear differential equation whose particular solution is $1+x+e^x-3e^{3x}$ is

a) 4 b)3 c) 2 d) 5

$\cosh ax = \frac{1}{2}(e^{ax}+e^{-ax})$ $\sinh ax = \frac{1}{2}(e^{ax}-e^{-ax})$

(Operator method) Exp(ax), cosh(ax) sinh(ax), h(x). exp(ax): : Polynomila , Sin(ax) , cos(ax):

1. The particular integral $\frac{1}{D+3}e^{2x}$ is
   (a) $\frac{1}{5}e^{2x}$ (b) $\frac{1}{5}$ (c) $\frac{1}{3}e^{2x}$ (d) $\frac{1}{2x+3}e^{2x}$
2. The particular integral $\frac{1}{D^2-9}e^{3x}$ is
   (a) $\frac{1}{6}e^{3x}$ (b) $\frac{xe^{3x}}{6}$ (c) $\frac{x}{3}e^{3x}$ (d) doesn't exist
3. The particular integral $\frac{1}{f(D)}e^{ax}g(x)$ is
   (a) $e^{ax}\frac{1}{f(D)}g(x)$ (b) $g(x)\frac{1}{f(D)}e^{ax}$ (c) $e^{ax}\frac{1}{f(D+a)}g(x)$ (d) $\frac{1}{f(a)}e^{ax}g(x)$
4. The particular integral $\frac{1}{f(D^2)}e^{ax}$ is
   (a) $\frac{1}{f(-a^2)}e^{ax}$ (c) $\frac{1}{f(a^2)}e^{ax}$, provided $f(a^2)=0$
   (b) $\frac{1}{f(a^2)}e^{ax}$, provided $f(a^2)\neq 0$ (d) $\frac{1}{f(a)}e^{ax}$, provided $f(a)\neq 0$

   Put D=a then (b) correct
5. The particular integral $\frac{1}{D^3-D^2+4D-4}\sin 3x$ is
   (a) $-\frac{1}{5}\sin 3x$ (c) $\frac{1}{9}x\cos 3x$
   (b) $\frac{1}{50}(\sin 3x + x\cos 3x)$ (d) $\frac{1}{50}(\sin 3x + 3\cos 3x)$
6. The particular integral of the differential equation $y'' + y = 6\sin x$ is
   (a) $6\cos x$ (b) $3x\sin x$ (c) $-3x\cos x$ (d) $6\,x\cos x$
7. The particular integral $\frac{1}{D+5}(2016)^x$ is
   (a) $\frac{1}{2021}(2016)^x$ (b) $x\,(2016)^x$ (c) $\frac{1}{\ln 2016}(2016)^x$ (d) $\frac{1}{(\ln 2016)+5}(2016)^x$
8. The particular integral of $\frac{d^2y}{dx^2}+\frac{dy}{dx}=x^2+2x+4$ is
   (a) $\frac{x^2}{3}+4x$ (b) $\frac{x^3}{3}+4x$ (c) $\frac{x^3}{3}+4$ (d) $\frac{x^2}{3}+4x^2$
9. The particular integral of $\frac{d^4y}{dx^4}-16\frac{d^2y}{dx^2}=(8x+16)$ is
   (a) $-\frac{x^2}{12}-\frac{x}{2}$ (b) $\frac{x^3}{6}+2x$ (c) $\frac{x^3}{3}+4$ (d) $\frac{x^2}{3}+4x$
10. The particular integral $\frac{1}{(D+1)^3}(2x+4)$ is
    (a) $\frac{x^2}{3}+4x$ (b) $2x+4$ (c) $x-2$ (d) $2x-2$
11. The particular integral of the differential equation $y''+4y=\sin x\cos x$ is
    (a) $6\cos x$ (b) $3x\sin x\cos x$ (c) $-3x\cos x$ (d) $-\frac{x}{8}\cos 2x$
12. The particular integral $\frac{1}{D^2}\cos 2x$ is
    (a) $-4\cos 2x$ (b) $-4\sin 2x$ (c) $\frac{1}{2}\sin 2x$ (d) $-\frac{1}{4}\cos 2x$
13. The particular integral $\frac{1}{D-1}\cos 2x$ is
    (a) $-\frac{1}{5}(\cos 2x - 2\sin 2x)$ (b) $\frac{1}{2}\cos 2x$ (c) $-\sin 2x$ (d) $-\frac{1}{5}(\sin 2x + 2\cos 2x)$

Also if Gen soln $y = A(x)y_1 + B(x)y_2$ Then $A(x) = -\int \frac{y_2 r}{W}dx + c_1$

$B(x) = \int \frac{y_1 r}{W}dx + c_2$

Method of Variation of Parameter, Method of Undetermined co-efficient:

1 The value of parameter A(x) for LDE $y''-2y'-3y = e^x$ using method of variation of parameters when $y_1= e^{-x}$ and $y_2= e^{3x}$ is

(a) $-\frac{e^{2x}}{8}+c$ (b) $\frac{3}{2}e^{x}+c$ (c) $\frac{2}{3}e^{3x}+c$ (d) $-\frac{e^{5x}}{18}+c$

2 Solving by variation of parameter for the equation $y'' + y = \sec x$, the value of Wronskian

a. 1 b. 2 c 3 d. 4

3 Solving by variation of parameters for the equation $y'' - 4y' + 3y = e^x$, $x \neq 0$ the value of Wronskian is

(a) $2e^x$ (b) $3e^{4x}$ (c) $2e^{4x}$ (d) $4e^x$

4 If by the method of variation of parameter $y(x) = A(x)\sin x + B(x)\cos x$ is the general solution of $y'' + y = \sec x$ then B(x) is

(A) $\ln|\sin x| + c$, (B) $\ln|\cos x| + c$, (C) $X + c$, (D) $\ln|x| + c$

$m = -3, 3$

5 The choice of particular integral for the equation $y'' - 9y = 13e^{3x}$ is

(a) ce^{3x} (b) cxe^{3x} (c) cx^2e^{3x} (d) none of these

$m^2+4m+4=0$

$m=-2,-2$

6 By the method of undetermined coefficients the choice of particular integral of the ODE $y'' + 4y' + 4y = 12e^{-2x}$ is

(A) ax^2e^{2x}, (B) ax^2e^{-2x}, (C) $12a\,e^{2x}$, (D) $12ax\,e^{-2x}$

7 By the method of undetermined coefficients the trial solution for y_p for the differential equation $y'' + 3y' + 2y = 12x^2$ is of the form

(A) $a + bx + cx^2$ (B) $a + bx$ (C) $ax + bx^2 + cx^3$ (D) None of these

8 By the method of undetermined coefficients the trial solution for y_p for the differential equation $y'' + 2y' + y = 6e^{-x}$ is of the form

$m = -1, -1$ $y_c = c_1e^{-x} + xc_2e^{-x}$ $(m^2+2m+1) = 0$ $(m+1)^2 = 0$

(a) Ae^{-x} (b) Bxe^{-x} (c) Cx^2e^{-x} (d) None of these

here $y_p = ?$

Q19. By the method of variation of parameter if $A(x)\cos x + B(x)\sin x$ be the particular integral of the differential equation $y'' + y = \sec x$ then $A(x)$ is

(a) - log|cos x| (b) log|cos x| (c) log|sin x| (d) - log|sin x|

Q20. By the method of variation of parameter if $A(x)\cos 2x + B(x)\sin 2x$ be the particular integral of the differential equation $y'' + 4y = \sec 2x$ then $B(x)$ is

(a) 3x/2 (b) $x^2/2$ (c) –x/2 (d) x/2

$m^2+9=0$ $m = \pm 3i$

$y_c = c_1\cos 3x + c_2\sin 3x$

Q21. By method of undetermined coefficients the assumed particular integral of the differential equation $y'' + 9y = \cos 3x$ is

(a) a cos 3x + b sin 3x (b) x(a cos 3x + b sin 3x) (c) x^2(A cos 3x + b sin 3x) (d) None of these

$m^2+1=0$

$m = \pm i$

$y_c = (c_1\cos x + c_2\sin x)$

Q22. By method of undetermined coefficients the assumed particular integral of the differential equation $y'' + y = \sin x$ is

(a) a cos x + b sin x (b) x(a cos x) (c) x^2(A cos 3x + b sin 3x) (d) x(a cos x + b sin x)

Q23. By method of undetermined coefficients the assumed particular integral of the differential equation $y'' - 2y' - 3y = 6e^{-x} - 8e^{x}$ is

(a) $a\,e^{-x} + b\,e^{x}$ (b) $a\,xe^{-x} + b\,e^{x}$ (c) $a\,e^{-x} + bx\,e^{x}$ (d) $a\,x^2e^{-x} + b\,e^{x}$

$m^2 - 2m - 3 = 0$ $m = -1, 3$ $y_c = c_1e^{-x} + c_2e^{3x}$

$m^2-1=0$ $m=-1,+1$

Q25. By method of undetermined coefficients the assumed particular integral of the differential equation $y''-y=Sin\,x$ is

(a) a cos x + b sin x (b) x(a sin x) (c) x^2(A cos x + b sin x) (d) x(a cos x + b sin x)

Q26. By method of undetermined coefficients the assumed particular integral of the differential equation $y''-4y'+13y=12e^{2x}\sin 3x$ is

(a) a cos 3 x + b sin 3x (b) x e^{2x}(a sin 3x + b cos 3x)

(c) x^2(A cos 3x + b sin 3x) (d) x^2e^{2x}(a cos x + b sin x)

$m=2\pm i3$

$y_c=e^{2x}[c_1\cos 3x+c_2\sin 3x]$

Euler-Cauchy Equation , Simultaneous ODE

$\frac{1}{\theta^2-\theta+2}16e^{3t}$ $a=3$ $\theta=3$ $\frac{1}{9-3+2}16e^{3t}$ $8e^{3t}=8x^3$

Q28. If $D=\frac{d}{dx}$, then $\frac{1}{x^2D^2+2}16x^3$ is equals to

a) $\frac{1}{2}x^3$ b) $2x^3$ c) $\frac{1}{4}(\log x)^3$ d) $\frac{1}{4}x^3$

$\theta^2-\theta-\theta=0$ $\theta^2-2\theta=0$ $\theta=0,2$ $y_c=c_1+c_2x^2$

Q29. C.F of $(x^2D^2-xD)y=0$ is

a) $a+bx$ b) $ax+bx^2$ c) $a\log x+bx^2$ d) $a+bx^2$

Q30. To convert the Euler Cauchy equation into a linear equation with constant coefficient we assume

a) $x=e^t$ b) $x=t$ c) $x=t^2$ d) None of these

Q31. If the system of equations is $(2D-4)y_1+(3D+5)y_2=3t+2,(D-2)y_1+(D+1)y_2=t$ then y_2 is

a) $ae^{-3t}+\frac{1}{9}(3t+5)$ b) ae^{-3t} c) $ae^{-2t}+\frac{1}{9}(3t+5)$ d) None of these

$\times 1$ $\times 2$ Subtract we get $(D+3)y_2=t+2$

Q27. Which of the following is Euler-Cauchy equation?

a) $x^3y''+x^2y'+y=0$ b) $x^2y''+xy'+y=0$ c) $x^2y''+xy=0$ d) None of these

Q40. Particular integral of $x^2y''-2y=2x+6$ is

a) $-x-3$ b) $x-3$ c) $-x+3$ d) None of these

$(\theta^2-\theta-\theta+1)y=t$ $\theta^2-2\theta+1=0$ $\theta=1,1$

Q38. The complimentary function of the differential equation $x^2y''-xy'+y=\log x$ is given by

a) ae^x+be^{2x} b) ax c) $(a+b\log x)x$ d) $axlog\,x$

$y_c=(c_1+tc_2)e^t$
$=(c_1+\log x\,c_2)x$

Put $y_2=y_1'-2y_1$ from ① in ② then $y_2'=y_1''-2y_1'$

Q36. For the given system of linear differential equation $y_1'=2y_1+y_2$, ① $y_2'=y_1+2y_2$, ② then the second order linear differential equation satisfied by y_1 is

a) $y_1''+4y_1'+3y_1=0$ b) $y_1''-4y_1'+3y_1=0$ c) $y_1''-4y_1'-3y_1=0$ d) None of these

$y_1''-2y_1'=y_1+2(y_1'-2y_1)$
$y_1''-2y_1'=y_1+2y_1'-4y_1$

- Q.5 For the differential equation $(x^3D^3-3xD+3)y=0$ using transformation $x=e^t$ the roots of its operator notation are:

  $\theta^3-3\theta^2+2\theta-3\theta+3=0$ $\theta^3-3\theta^2-\theta+3=0$ $(\theta^2-1)(\theta-3)=0$

  - a) 1,1,3 b) 1, -1 , 3 c) 1, 1, -3 d) 1,2,3

- Q.25 If $y_1(t),y_2(t)$ satisfy the equations $y_1'+5y_2=0$, ① $y_2'+y_1=0$ ② and $y_2''+by_2=0$ is the second order differential equation satisfied by y_1 then what is the value of b

  ② ⇒ $y_1=-y_2'$ ⇒ $y_1'=-y_2''$ Put in ①

  - a) 5 b) −5 c) 3 d)−3

  $-y_2''+5y_2=0$
  $y_2''-5y_2=0$

Same as above

- Q.29 If $D=\frac{d}{dx}$, then $\frac{1}{(x^2D^2+2)}16x^3$ is equal to

  - a) $\frac{1}{2}x^3$ b) $2x^3$ c) $\frac{1}{4}(\log x)^3$ d) $\frac{1}{4}x^3$

Same as 36

- For a given system of linear differential equation $y_1'=2y_1+y_2$, $y_2'=y_1+2y_2$, the second order linear differential satisfiedby the y_1 is

  (A) $y_1''+4y_1'+3y_1=0$ (B) $y_1''-4y_1'+3y_1=0$ (C) $y_1''-4y_1'-3y_1=0$ (D) none

$(\theta^3-3\theta^2+2\theta+5(\theta^2-\theta)+5\theta+1)\,y=e^{2t}$

- The particular integral of differential equation(x > 0) $x^3 y''' + 5x^2y'' + 5xy' + y = x^2$ Using the transformation x =e^t , we get (in operator notation) [θ^3 + $2\theta^2$ + 2θ +1]y = e^{2t} is

$$(A)\ \frac{1}{21}e^{2t}\ (B)\ \frac{1}{31}e^{-2t}\ (C) -\frac{1}{51}e^{2t}\ (D)\ \frac{1}{21}e^{7t}$$

$(\theta^3+2\theta^2+2\theta+1)\,y=e^{2t}$

$\frac{1}{\theta^3+2\theta^2+2\theta+1}e^{2t}$

$a=2$

$\frac{1}{8+8+4+1}e^{2t}$