Practice Questions MTH166

Exact and non-exact

(1) The general solution of the ordinary differential equation

$(p-x)(p-y)=0$, $(p=\frac{dy}{dx}$) is

(a) $(2y+x^2-c)(y-2ce^x)=0$ (b) $(2yx^2-c)(y-ce^x)=0$ (c) $(2y+x^2+c)(ye^x)=0$ (d)$(2y-x^2-c)(y-ce^x)=0$

(2) An integrating factor of $(xy^3+y)dx+2(x^2y^2+x+y^4)dy=0$ is

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

(3) An integrating factor of $(x^3y^2+x)dy+(x^2y^3-y)dx=0$ is

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

(4) An integrating factor of $\frac{dy}{dx}=\frac{x^3+y^3}{xy^2}$ is

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

(5) The solution of $(3x-2y)dx=2xdy\ is$

(a)$3x^2=4xy+c$ (b) $3x^2=2xy+c$ (c) $3x^2=-xy+c$ (d) $3x-2y=2x+c$

(6) The general solution of $xdx+ydy+\frac{xdy-ydx}{x^2+y^2}=0$ is

(a) $x^2+y^2-2tan^{-1}\left(\frac{y}{x}\right)=c$ (b) $x^2+y^2+tan^{-1}\left(\frac{y}{x}\right)=c$ (c) $x^2-y^2+2tan^{-1}\left(\frac{y}{x}\right)=c$ (d) $x^2+y^2+2tan^{-1}\left(\frac{y}{x}\right)=c$

(7) The general solution of the differential equation $p=log(px-y)$ is , ($p=\frac{dy}{dx}$)

(a) $y=px+e^p$ (b) $y=cx-e^c$ (c) $y=px-e^p$ (d) $y=px-e^c$

(8) The differential equation $(x+x^8+ay^2)dx+(y^8-y+bxy)dy=0$ is exact if

(a)b=2a (b) a=b (c) a=3b (d) a=1 , b=3

(9) $\frac{1}{y^2}(-y\,dx+xdy)=$

(a) d(xy) (b) d(y/x) (c) d{ ln(xy) } (d) -d(x/y)

(10) y dx+x dy =

(a) d(xy) (b) d(x/y) (c) d{ ln(xy) } (d) d(x+y)

1st Order Higher degree

1. If the differential equation 16x^2 + 2p^{2}y - p^{3}x = 0 while solving for y takes the form $y = f(x,p)$, then $f(x,p) =$

   (a) $\frac{px}{2} - \frac{8x^2}{p^2}$ (b) $\frac{2x}{p} + \frac{8x^2}{p}$ (c) $\frac{x}{2} + \frac{8x^2}{p^2}$ (d) $\frac{8x}{p^2} - \frac{px}{2}$

2. If the differential equation y = 3px + 6p^{2}y^2 while solving for x takes the form $x = f(y,p)$, then $f(y,p) =$

   (a) $\frac{py}{3} - \frac{8y^2}{p^2}$ (b) $\frac{y}{3p} - 2py^2$ (c) $\frac{px}{2} - 2p^2x^2$ (d) $\frac{y}{p^2} - p^2y$

3. Solution of differential equation $p^2 - 8p + 15 = 0$ is

   (a) $p = 5, p = 3$ (b) $(y - 5x - c)(y - 3x - c) = 0$ (c) $(y + 5x)(y + 3x) = 0$
   (d) $(y + 5x)(y - 3) = 0$

4. Which of the following is solution of $(p - xy)(p - x^2)(p - y^2) = 0$

   (a) $3x - y^3 - c = 0$ (b) $xy + cy + 1 = 0$ (c) $2y + x^2 + c = 0$ (d) None

5. Solution for $px - y = e^p$ is

   (a) $y = cx^2 + e^c$ (b) $y^2 = cx + e^c$ (c) $y = cx - e^c$ (d) $xy + cy = x$

6. Solution for sin y cos px dy − sin px $cos\ y\ dx$ =log p

   (a) $y = \sin^{-1}(logc) + pc$ (b) $y = \log(\log c) + \sin p$ (c) $y = \sin cx + \log c$
   (d) None of these

7. Order of $p^3 + 2xp^2 - y^2p^2 - 2xy^2p = 0$ is

   (a) 2 (b) 1 (c) 3 (d) None of these

8. Degree of $p^3 + 2xp^2 - y^2p^2 - 2xy^2p = 0$ is

   (a) 2 (b) 1 (c) 3 (d) None of these

9. General solution of $3x - y + p = 0$

   (a) $y = 3(x + 1) + ce^x$ (b) $3x + e^y = 0$ (c) $y + 3e^x + cx = 0$ (d) None

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 $y''+2\pi y'+\pi^2 y=0$ 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

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

a) $Ae^{x}+(Bx+C)$ 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

(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 $f(a)\neq 0$
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) $-\frac{1}{5}(\sin 2x + 2\cos 2x)$

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 ≠ 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) $\ln|x| + c$

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

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

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

(A) $a\,x^2e^{2x}$, (B) $a\,x^2e^{-2x}$, (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

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

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

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

(a) acos 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

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}

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)

Euler-Cauchy Equation , Simultaneous ODE

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) $\frac{1}{4}x^3$

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

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

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) $axlog\ x$

Q36. For the given system of linear differential equation $y_1' = 2y_1 + y_2, y_2' = y_1 + 2y_2$, 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

- 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:
  - 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, $y_2' + y_1$=0 and $y_2'' + by_2 = 0$ is the second order differential equation satisfied by y_1 then what is the value of b
  - a) 5 b) -5 c) 3 d) -3
- 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) $\frac{1}{4}x^3$
- 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
- The particular integral of differential equation(x > 0)
  $x^3y''' + 5x^2y'' + 5xy' + y = x^2$ Using the transformation x =e^t , we get (in operator notation) [$\theta^3 + 2\theta^2 + 2\theta + 1$]y = e^{2t} is

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