CLASS XII
GUESS PAPER
MATHS

MATH-MAX

DIFFRENTIAL EQUATIONS

1. Show that $y = ae^{2x} + be^{-x}$ is a solution of the differential equation $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0$.
2. Show that $y = \frac{c-x}{1+cx}$ is a solution of the differential equation $(1+x^2)\frac{dy}{dx} + (1+y^2) = 0$
3. Show that the differential equation representing one parameter family of curves
   $(x^2 - y^2) = c\,(x^2 + y^2)^2$ is $(x^3 - 3xy)^2\,dx = (y^3 - 3x^2)\,dy$
4. Show that the differential equation that represents the family of all parabolas having their axis of symmetry coincident with the axis of x is $yy_2 + y_1^2 = 0$.
5. Verify that $y = ce^{\tan^{-1}x}$ is a solution of the differential equation $(1+x^2)\frac{d^2y}{dx^2} + (2x-1)\frac{dy}{dx} = 0$
6. Verify that y = $y = e^{m\cos^{-1}x}$ satisfies the differential equation $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - m^2y = 0$
7. Verify that $y = \log\,(x + \sqrt{x^2 + a^2})^2$ satisfies the differential equation $(a^2 + x^2)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0$
8. Show that the differential equation of which $y = 2\,(x^2 - 1) + ce^{-x^2}$ is a solution is $\frac{dy}{dx} + 2xy = 4x^3$
9. Obtain the differential equation of all circles of radius r.
10. Find the differential equation if all circles touching the
    (i) x–axis at the origin (ii) y–axis at the origin
11. Form the differential equation of the family of curves represented by
    $y = c\,(x - c)^2$, where c is a parameter.
12. Form the diff. equation corresponding to $y^2 = a\,(b - x)(b + x)$ by eliminating parameters a and b.
13. Find the differential equation of all the circles in the first quadrant which touch the coordinate axes.
14. Form the differential equation of family of parabolas having vertex at the origin and axis along positive y–axis.
15. Form the differential equation of the family of ellipses having foci on y–axis and centre at the origin.
16. Form the differential equation corresponding to $y^2 = m\,(a^2 - x^2)$ by eliminating parameters m and a.

17. Form the differential equation representing the family of ellipses having centre at the origin and foci on x-axis
18. Form the differential equation of the family of hyperbolas having foci on X-axis and centre at the origin.
19. Form the differential equation of the family of circles in the second quadrant and touching the coordinate axes.
20. Find the differential equation of all non-vertical lines in a plane.

GROUP-B (VARIABLE SEPARABLE FORM AND HOMOGENEOUS DIFF. EQN.)

1. Solve: (i) $\frac{dy}{dx} = \frac{x}{x^2+1}$ (ii) $(e^x + e^{-x})\frac{dy}{dx} = (e^x - e^{-x})$
2. Solve the initial value problem $e^{(dy/dx)} = x + 1$; $y(0) = 5$.
3. Solve: (i) $(1+x^2)\frac{dy}{dx} - x = 2\tan^{-1} x$ (ii) $(x^3 + x^2 + x + 1)\frac{dy}{dx} = 2x^2 + x$
4. Solve: (i) $\sec^2 x \tan y\, dx + \sec^2 y \tan x\, dy = 0$ (ii) $e^x\sqrt{1-y^2}\,dx + \frac{y}{x}dy = 0$
5. Solve the differential equation $(1 + e^{2x})\, dy + (1 + y^2)\, e^x\, dx = 0$ given that when $x = 0$, $y = 1$.
6. Solve the differential equation $(1 + y^2)(1 + \log x)\, dx + x\, dy = 0$ given that when $x = 1$, $y = 1$.
7. Solve the differential equation $x(1 + y^2)\, dx - y(1 + x^2)\, dy = 0$, given that $y = 0$ when $x = 1$.
8. Solve: (i) $(x^2 - yx^2)\, dy + (y^2 + x^2y^2)\, dx = 0$ (ii) $3e^x \tan y\, dx + (1 - e^x) \sec^2 y\, dy = 0$
9. Solve (i) $\frac{dy}{dx} = 1 + x + y + xy$ (ii) $y - x\frac{dy}{dx} = a\left(y^2 + \frac{dy}{dx}\right)$
10. Show that general solution of the differential equation $\frac{dy}{dx} + \frac{y^2+y+1}{x^2+x+1} = 0$ is given by

    $x + y + 1 = A(1 - x - y - 2xy)$, where A is a parameter.
11. Find the particular solution of the diff. equation $\log\left(\frac{dy}{dx}\right) = 3x + 4y$ given that $y = 0$ when $x = 0$.
12. Find the equation of the curve passing through the point (1, 1) whose differential equation is

    $x\, dy = (2x^2 + 1)dx$ $(x \neq 0)$.
13. Solve (i) $y\sqrt{1+x^2} + x\sqrt{1+y^2}\frac{dy}{dx} = 0$ (ii) $\sqrt{1+x^2}\,dy + \sqrt{1+y^2}\,dx = 0$

    (iii). $\sqrt{1+x^2+y^2+x^2y^2} + xy\frac{dy}{dx} = 0$ (iv) $(1 + x)(1 + y^2)\, dx + (1 + y)(1 + x^2)\, dy = 0$

    (v) $\tan y \frac{dy}{dx} = \sin(x + y) + \sin(x - y)$ (vi) $\frac{dy}{dx} = e^{x+y} + e^{-x+y}$

(vii) $\frac{dy}{dx}=(\cos^2 x-\sin^2 x)\cos^2 y$ (viii) $(1 + x)(1 + y^2)\,dx + (1 + y)(1 + x^2)\,dy = 0$

(ix) $\frac{dy}{dx}=1+x^2+y^2+x^2y^2,\ y(0)=1$ (x) $\frac{dy}{dx}=\frac{2x(\log x+1)}{\sin y+y\cos y}$; $y(1)=0$

14. For the differential equation $xy\frac{dy}{dx} = (x + 2)(y + 2)$. Find the solution curve passing through the point (1, -1).

15. Solve: (i) $\sin^{-1}\left(\frac{dy}{dx}\right)=x+y$ (ii) $\frac{dy}{dx}=\cos(x+y)$ (iii) $\frac{dy}{dx}=(4x+y+1)^2$

(iv) $\frac{dy}{dx} = \cos(x+y) + \sin(x+y)$ (v) $(x+y+1)^2dy = dx,\ y(-1) = 0$ (vi) $\cos^2(x-2y) = 1-2\frac{dy}{dx}$

(vii) $(x-y)(dx + dy) = dx - dy,\ y(0) = -1$ (viii) $x+y+1=\tan y$ (ix) $x-y=e^{x+y+1}$

(x) $(x + y)(dx - dy) = dx + dy$ (xi) $\frac{dy}{dx}=\frac{(x-y)+3}{2(x-y)+5}$

16. Solve the differential equation $x^2dy + y(x + y)dx = 0$, given that $y = 1$ when $x = 1$.

17. Solve the differential equation $(x + y)dy + (x - y)dx = 0$, given that $y = 1$ when $x = 1$.

18. Solve the differential equation $(x^2 - y^2)dx + 2xy\,dy = 0$; given that $y = 1$ when $x = 1$.

19. Solve : (i) $x^2ydx-(x^3+y^3)dy=0$ (ii) $(x^2+xy)dy=(x^2+y^2)dx$

(iii) $(3xy+y^2)dx+(x^2+xy)dy=0$ (iv) $(x^3-3xy^2)dx=(y^3-3x^2y)dy$

(v) $xdy-ydx=\sqrt{x^2+y^2}dx$ (vi) $x\frac{dy}{dx}=y-x\tan\left(\frac{y}{x}\right)$

(vii) $2ye^{x/y}dx+(y-2xe^{x/y})dy=0$ (viii) $(1+e^{x/y})dx+e^{x/y}\left(1-\frac{x}{y}\right)dy=0$

20. Solve the following initial value problems :

(i) $x\frac{dy}{dx}\sin\left(\frac{y}{x}\right)+x-y\sin\left(\frac{y}{x}\right)=0,\ y(1)=\frac{\pi}{2}$ (ii) $xe^{y/x}-y\sin\left(\frac{y}{x}\right)+x\frac{dy}{dx}\sin\left(\frac{y}{x}\right)=0,\ y(1)=0$

(iii) $\log|x|=\cos\left(\frac{y}{x}\right),\ x\neq 0$ (vi) $e^{-y/x}\left\{\sin\left(\frac{y}{x}\right)+\cos\left(\frac{y}{x}\right)\right\}=1+\log x^2,\ x\neq 0$

(v) $2x^2\frac{dy}{dx}-2xy+y^2=0, y(e)=e$

(vi) $2xy+y^2-2x^2\frac{dy}{dx}=0, y(1)=2$

(vii) $(x^2+y^2)dx+dy=0, y(1)=1$

(viii) $(xe^{y/x}+y)dx=xdy, y(1)=1$

(ix) $(x^2-2y^2)dx+2xydy=0, y(1)=1$

(x) $xe^{y/x}-y\sin\left(\frac{y}{x}\right)+x\frac{dy}{dx}\sin\left(\frac{y}{x}\right)=0, y(1)=0$

(xi) $2x^2\frac{dy}{dx}-2xy+y^2=0, y(e)=e$

(xii) $2xy+y^2-2x^2\frac{dy}{dx}=0, y(1)=2$

GROUP-C (LINEAR DIFFRENTIAL EQUATIONS)

1. Solve (i) $x\log x\frac{dy}{dx}+y=\frac{2}{x}\log x, x>0$

(ii) $(x^2-1)\frac{dy}{dx}+2xy=\frac{1}{x^2-1}$

(iii) $\frac{dy}{dx}+y\sec x=\tan x\left(0\le x<\frac{\pi}{2}\right)$

(iv) $\cos^2 x\frac{dy}{dx}+y=\tan x\left(0\le x<\frac{\pi}{2}\right)$

(v) $(x^2+1)\frac{dy}{dx}+2xy=\sqrt{x^2+4}$

(vi) Solve : $\frac{dy}{dx}-2y=\cos 3x$

(vii) $\frac{dy}{dx}+y=\cos x-\sin x$

(viii) $\frac{dy}{dx}+y\tan x=2x+x^2\tan x$

(ix) $\frac{dy}{dx}+\frac{y}{x}=\cos x+\frac{\sin x}{x}, x>0$

(x) $\frac{dy}{dx}+x\sin 2y=x^3\cos^2 y$

(xi) $\frac{dy}{dx}=-\frac{x+y\cos x}{1+\sin x}$

2. Solve each of the following initial value problems :

(i) $\frac{dy}{dx}-y=e^x, y(0)=1$

(ii) $x\frac{dy}{dx}+y=x\log x, y(1)=\frac{1}{4}$

(iii) $(1+x^2)\frac{dy}{dx}+2xy-4x^2=0$ y(0) = 0.

(iv) $\frac{dy}{dx}+\frac{2x}{x^2+1}y=\frac{1}{(x^2+1)^2}, y(0)=0$

(v) $(x^2+1)y'-2xy=(x^4+2x^2+1)\cos x, y(0)=0$

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3. Solve :(i) $x\frac{dy}{dx}+y-x+xy\cot x=0, x\neq 0$ (ii) $(1+x^2)dy+2xy\,dx=\cot x\,dx, x\neq 0$

(iii) : $ydx-(x+2y^2)dy=0$ (iv) Solve : $ydx+(x-y^3)dy=0$

(v) Solve : $(x+2y^3)dy=ydx$ (vi) Solve : $\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}}-\frac{y}{\sqrt{x}}\right)\frac{dx}{dy}=1$, $x\neq 0$

4. Solve each of the following initial value problem :

(i) $(x - \sin y)\,dy + (\tan y)dx = 0$, $y(0) = 0$ (ii) $(1 + y^2)dx = (\tan^{-1}y - x)dy$, $y(0) = 0$

(iii) $ye^y\,dx = (y^3 + 2x\,e^y)dy$, $y(0) = 1$ (iv) $\sqrt{1-y^2}\,dx = (\sin^{-1} y - x)dy$, $y(0) = 0$

5. Solve : (i) $\frac{dy}{dx}+\frac{4x}{x^2+1}y+\frac{1}{(x^2+1)^2}=0$ (ii) $x\frac{dy}{dx}+y=x\log x$ (iii) $x\frac{dy}{dx}-y=(x-1)e^x$

(iv) $\frac{dy}{dx}=y\tan x-2\sin x$ (v) $(1+x^2)\frac{dy}{dx}+y\tan^{-1}x$ (vi) $\frac{dy}{dx}+y\tan x=\cos x$

(vii) $\frac{dy}{dx}+y\cot x=x^2\cot x+2x$ (viii) $\frac{dy}{dx}+y\tan x=x^2\cos^2 x$ (ix) $(1+x^2)\frac{dy}{dx}+y=e^{\tan^{-1}}x$

(x) $x\,dy = (2y + 2x^4 + x^2)\,dx$ (xi) $(1+y^2)+(x-e^{\tan^{-1}y})\frac{dy}{dx}=0$

(xii) $y^2\frac{dx}{dy}+x-\frac{1}{y}=0$ (xiii) $(2x-10y^3)\frac{dy}{dx}+y=0$ (xiv). $(x + \tan y)\,dy = \sin 2y\,dx$

(xv) $\frac{dy}{dx}=y\tan x-2\sin x$ (xvi) $\frac{dy}{dx}+y\cos x=\sin x\cos x$ (xvii) $(1+x^2)\frac{dy}{dx}-2xy=(x^2+2)(x^2+1)$

(xviii) $(\sin x)\frac{dy}{dx}+y\cos x=2\sin^2 x\cos x$ (xix) $(x^2-1)\frac{dy}{dx}+2(x+2)y=2(x+1)$

(xx). $x\frac{dy}{dx}+2y=x\cos x$ **(xxi)** $\frac{dy}{dx}+2y=xe^{4x}$ (xxii) $x\frac{dy}{dx}-y=(x+1)e^{-x}, y(1)=0$

(xiii) $(1 + y^2)\,dx + (x - e^{-\tan^{-1}y})\,dy = 0, y(0) = 0$ (xxvi) $\frac{dy}{dx}+ y\tan x = 2x + x^2\tan x$, $y(0) = 1$

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(xxv) $x\frac{dy}{dx}+y=x\cos x+\sin x, y\left(\frac{\pi}{2}\right)=1$

(xxvi) $\frac{dy}{dx}+y\cot x=4x\,\mathrm{cosec}\,x, y\left(\frac{\pi}{2}\right)=0$

(xxvii) $\frac{dy}{dx}+2y\tan x=\sin x; y=0 \text{ when } x=\frac{\pi}{3}$

(xxviii) $\frac{dy}{dx}-3y\cot x=\sin 2x; y=2 \text{ whewn } x=\frac{\pi}{2}$

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