Unit – I: Matrices

PART A

MULTIPLE CHOICE QUESTIONS

1. The matrix of the quadratic form $x_1^2+5x_2^2+x_3^2+2x_1x_2+2x_2x_3+6x_3x_1$ is

$$\checkmark(a)\begin{pmatrix}1&1&3\\1&5&1\\3&1&1\end{pmatrix}\quad(b)\begin{pmatrix}1&2&3\\1&5&2\\3&2&1\end{pmatrix}(c)\begin{pmatrix}1&4&4\\4&5&3\\4&3&1\end{pmatrix}(d)\begin{pmatrix}1&4&3\\4&5&4\\3&4&1\end{pmatrix}$$

2. The number of positive terms in the canonical form is called

   (a) Signature ✓(b) Index (c) Quadratic form (d) Positive definite

3. A homogeneous polynomial of second degree in any number of variables is

   (a) Canonical form ✓(b) Quadratic form (c) Orthogonal (d) Diagonal form

4. Find the eigen values of A^2 if $A=\begin{bmatrix}3&2&4\\0&2&6\\0&0&5\end{bmatrix}$

   (a) 6, 4, 10 ✓(b) 9, 4, 25 (c) 9, 2, 5 (d) 3, 2, 5

5. Find the sum and product of the eigen values of $A=\begin{bmatrix}2&1&1\\1&2&1\\0&0&1\end{bmatrix}$

   ✓(a) 5, 3 (b) 3, 5 (c) 2, 1 (d) 0, 1

6. The eigen values of an orthogonal matrix have the absolute value ______

   (a) 0 ✓(b) 1 (c) 2 (d) ±1

7. All the eigen values of a symmetric matrix with real elements are

   (a) Distinct ✓(b) Real (c) Equal (d) Conjugate complex numbers

8. Find the nature of the quadratic form $2x^2+3y^2+2z^2+2xy$

   ✓(a) Positive definite (b) Negative definite (c) Positive semi-definite (d) Indefinite

9. Write the Q.F. defined by the matrix $A=\begin{pmatrix}6 & 1 & -7\\ 1 & 2 & 0\\ -7 & 0 & 1\end{pmatrix}$

✓ (a) $6x_1^2+2x_2^2+x_3^2+2x_1x_2-14x_1x_3$ (b) $6x_1^2+x_2^2+6x_3^2+x_1x_2-7x_1x_3$
(c) $6x_1^2+2x_2^2+x_3^2+2x_1x_2+14x_1x_3$ (d) $6x_1^2+x_2^2+6x_3^2+x_1x_2-14x_1x_3$

10. Find the eigen values of the matrix $\begin{pmatrix}2 & 1\\ 1 & 2\end{pmatrix}$

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

11. Find the eigen values of A^{10} if $A=\begin{pmatrix}1 & 2\\ 0 & 3\end{pmatrix}$

✓ (a) $1,3^{10}$ (b) 3,1 (c) $3^2,1^{10}$ (d) 0, 2

12. If the sum of two eigen values and trace of a 3 x 3 matrix A are equal, find the value of $|A|$

✓ (a) 0 (b) 1 (c) -1 (d) 2

13. Find the characteristic equation of the matrix $A=\begin{bmatrix}1 & 2 & 3\\ 2 & -1 & 4\\ 3 & 1 & -1\end{bmatrix}$

✓ $(a)\ \lambda^3+\lambda^2-18\lambda-40$ $(b)\ \lambda^3-\lambda^2+18\lambda-40$
$(c)\ \lambda^3+\lambda^2+18\lambda+40$ $(d)\ \lambda^3+\lambda^2-18\lambda+40$

14. Find the nature of the quadratic form $x_1^2+2x_2^2+3x_3^2+2x_1x_2+2x_2x_3-2x_3x_1$

✓ (a) Indefinite (b) Positive definite (c) Negative definite (d) Positive semidefinite

15. Find the eigen values of $A=\begin{bmatrix}2 & 2 & 0\\ 2 & 1 & 1\\ -7 & 2 & -3\end{bmatrix}$

✓ $(a)\ 1,3,-4$ $(b)\ 1,-3,-4$ $(c)\ 1,-3,4$ $(d)\ -1,3,-4$

16. The matrix of the quadratic form x^2+xy is

✓ $(a)\begin{pmatrix} 1 & 1/2 \\ 1/2 & 0 \end{pmatrix}$ $(b)\begin{pmatrix} 1 & 2 \\ 2 & 0 \end{pmatrix}$ $(c)\begin{pmatrix} 0 & 1/2 \\ 1/2 & 1 \end{pmatrix}$ $(d)\begin{pmatrix} 1 & 2 \\ 1 & 0 \end{pmatrix}$

17. Two eigen values of the matrix $A = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{pmatrix}$ are 1 and 2. Find the third eigen value.

✓ (a) 3 (b) b (c) 2 (d) 1

18. Two of the eigen values of 3 x 3 matrix A are 2, 1 and |A| = 12. Find the third eigen value

✓(a) 6 (b) 3 (c) 2 (d) 1

19. If A is an orthogonal matrix then

(a) |A| = 0 (b) A is singular (c) $A^2 = I$ ✓(d) $A^T = A^{-1}$

20. Two eigen values of $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$ are equal and they are double the third. Find them.

✓(a) 1, 2, 2 (b) 2, 1, 1 (c) 2, 0, 1 (d) 1, 2, 3

21. Find the inverse of the eigen values of the matrix if $A = \begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$

✓$(a)\ -1, 1/6$ $(b)\ 1, 1/6$ $(c)\ 1, -1/6$ $(d)\ -1, -1/6$

22. Find rank and index of the QF whose canonical form is $3y_2^2 - 3y_3^2$

✓(a) 2, 1 (b) 1, 2 (c) 0, 1 (d) 0, 2

23. Find signature of the QF whose canonical form is $2y_1^2 - y_2^2 - y_3^2$,

(a) 1 ✓(b) -1 (c) 0 (d) 6

24. The eigen vectors corresponding to the distinct eigen values of a real symmetric matrix are

(a) imaginary (b) non-orthogonal (c) real ✓(d) orthogonal

25. Find the characteristic equation of the matrix $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$

(a) $\lambda^2 - 3\lambda - 2 = 0$ ✓ (b) $\lambda^2 + 3\lambda + 2 = 0$ (c) $\lambda^2 - 3\lambda + 3 = 0$ (d) $\lambda^2 - 6\lambda + 3 = 0$

UNIT-II-FUNCTIONS OF SEVERAL VARIABLES

1. If Z= $x^2 + y^2$+3xy then what is $\frac{\partial z}{\partial x}$?

(i) 2y+3x (ii) 3y (iii) 2x+3y (iv) 2x

2. u=$\sin^{-1}\left(\frac{x^2+y^2}{x-y}\right)$ is homogeneous function of degree

(i) 2 (ii) 3 (iii) 1 (iv) 4

3.If u=ax^2+2hxy+by^2 then using Euler's theorem find x$\frac{\partial u}{\partial x}$ + y$\frac{\partial u}{\partial y}$ = ?

(i) u (ii) 2u (iii) 3u (iv) n(n-1)

4. If f(x , y) = e^{xy} then what is $f_{yyy}(1, 1)$?

(i)-e (ii)$\frac{1}{e}$ (iii)e (iv)-$\frac{1}{e}$

5. if z= log (x^2+xy+y^2) then what is x$\frac{\partial z}{\partial x}$ +y$\frac{\partial z}{\partial y}$ =?

(i) 1 (ii) $\frac{2x+y}{x^2+xy+y^2}$ (iii) 2 (iv)$\frac{x+2y}{x^2+xy+y^2}$

6.If f(x,y) is an implicit function then $\frac{dy}{dx}$ =?

(i)$-\frac{(\partial f/\partial x)}{(\partial f/\partial y)}$ (ii) $\frac{(\partial f/\partial x)}{(\partial f/\partial y)}$ (iii)$\frac{(\partial f/\partial y)}{(\partial f/\partial x)}$ (iv)$-\frac{(\partial f/\partial y)}{(\partial f/\partial x)}$

7. If f(x , y) = $e^x\ cosy\ then\ what\ is\ f_{xy}\ (0,0)$?

(i) 1 (ii) -1 (iii) 0 (iv) 2

8. If f (x , y) = cosxcosy then f_{yy} (0, 0)=?

(i) 1 (ii) 0 (iii) -1 (iv)$^1/_2$

9. If f (x , y) = $\tan^{-1}\left({}^y/_x\right)$ then f_x (1 , 1) is

(i) $\frac{\pi}{4}$ (ii) ½ (iii) – ½ (iv) 0

10. If rt - $s^2 < 0$ at (a , b) then the point is

(i) Maximum point (ii) minimum point (iii) saddle point (iv) none of these

11. The stationary points of $x^2 + y^2 + 6x + 12$ are

(i) (-3 , 0) (ii) (0 , 3) (iii) (0 , -3) (iv) (3 , 0)

12. If x=$u^2 - v^2$ and y=2uv then J$\left(\frac{x\ ,y}{u\ ,v}\right)$ is

(i) $u^2 + v^2$ (ii) $2(u^2 + v^2)$ (iii) $4(u^2 + v^2)$ (iv) $4v^2$

13. If x=rcos θ and y=rsin θ Then what is $\frac{\partial(x\ ,y)}{\partial(r\ ,\theta)}$= ?

(i) r^2 (ii) r (iii) 2r (iv) 0

14. If v= $\tan^{-1} x$+$\tan^{-1} y$ then $\frac{\partial v}{\partial x}$ is

(i) 1+y^2 (ii) $\frac{1}{1+y^2}$ (iii) $\frac{1}{1+x^2}$ (iv) 1+x^2

15.u and v are functionally dependent if their jacobian value is

(i)zero (ii)one (iii)non-zero (iv)greater than zero

16.if $J_1 = J\left(\frac{x\ ,y}{u\ ,v}\right)$ and J_2=$J\left(\frac{u\ ,v}{x\ ,y}\right)$ then J_1J_2=?

(i)0 (ii)1 (iii)-1 (iv)2

17.The stationary points of f(x,y)=$sinx + siny + \sin(x+y)$ are

(i)$\left(\frac{\pi}{2},\frac{\pi}{3}\right)$ (ii)$\left(\frac{\pi}{3},\frac{\pi}{3}\right)$ (iii) $\left(\frac{\pi}{3},\frac{\pi}{2}\right)$ (iv) $\left(\frac{\pi}{2},\frac{\pi}{2}\right)$

18.The point (0,0) for f(x, y)=$x^3 + y^3 - 3axy$ is

(i)a maximum point (ii) a minimum point (iii)a saddle point (iv)none of these

19.If f(x, y)=$x^2 + y^2$ where x= rcosθ and y= rsinθ then$\frac{\partial f}{\partial \theta}$ is

(i) r (ii) r^2 (iii) 1 (iv) 0

20.If f(x, y)=x^2y+siny+e^x then $f_x(1,\pi)$ is

(i)2π-e (ii)2π (iii)2π+e (iv) 0

21. $u = \cos^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ is homogeneous function of degree

$(i)\,\frac{1}{2}$ (ii) 1 (iii) 2 (iv) 3

22. If $u = \tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$ then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = ?$

(i) sinu (ii) cosu (iii) sin2u (iv) tanu

23. If $u = \frac{y^2}{x}$, $v = \frac{x^2}{y}$ then $\frac{\partial(x,y)}{\partial(u,v)} =$?

(i) -3 (ii) 3 (iii) - $\frac{1}{3}$ (iv)$\frac{1}{3}$

24. $if\ x = r\cos\theta$, y= r $\sin\theta$, z=z then$\frac{\partial(x,y,z)}{\partial(r,\theta,z)} = ?$

(i)2r (ii)r^2 (iii)$\frac{1}{r}$ (iv)r

25.If u=$x^2 - 2y$ and v=x+y then $\frac{\partial(u,v)}{\partial(x,y)} = ?$

(i)2x (ii) 2x+2 (iii) 2y-2 (iv) 2x - y

ANSWERS

1.(iii) 2x+3y

2. (iii) 1

3. (ii) 2u

4.(iii)e

5. (iii) 2

6.i)$-\frac{(\partial f/\partial x)}{(\partial f/\partial y)}$

7. (iii) 0

8. (iii) – 1

9. (iii) - 1/2

10. (iii) saddle point

11. (i) (-3 , 0)

12. (iii) 4$(u^2 + v^2)$

13. (ii) r

14. (iii) $\frac{1}{1+x^2}$

15. (i)zero

16. (ii)1

17. (ii)$\left(\frac{\pi}{3},\frac{\pi}{3}\right)$

18. (iii) a saddle point

19. (iv) 0

20. (iii)2π+e

21. (i) $\frac{1}{2}$

22. (iii) sin2u

23. (iii) - $\frac{1}{3}$

24. (iv)r

25. (ii) 2x+2

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Unit-III Ordinary Differential Equations

Multiple Choice Questions

1. Which of the following is the general solution to $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - 10y = 0$

   (a) $y = Ae^{2x} + Be^{-5x}$ (b) $y = Ae^{-2x} + Be^{5x}$ (c) $y = Ae^{-2x} + Be^{-5x}$ (d) $y = Ae^{2x} + Be^{5x}$

2. Solution of $(D^2 + 4)y = 0$ is

   (a) $y = A\cos 2x + B\sin 2x$ (b) $y = Ae^{2x} + Be^{-2x}$ (c) $y = A\cos\sqrt{2}x + B\sin\sqrt{2}x$
   (d) $y = (Ax + B)e^{2x}$

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

   (a) $\frac{-x}{4}\cos 2x$ (b) $\frac{x}{4}\cos 2x$ (c) $\frac{x}{2}\cos 2x$ (d) $\frac{-x}{2}\cos 2x$

4. The equation $(a_0x^2D^2 + a_1xD + a_2)\, y = Q(x)$ is called, where $a_0, a_1, a_2 \in C$

   (a) Cauchy's equation (b) Legendre's equation (c) Taylor's equation (d) Clairaut's equation

5. Use the transformation $z = \log x$, convert the D.E $x^2y'' - xy' + y = x^2$ to an equation with constant coefficients

   (a) $(\theta^2 - 2\theta + 1)y = e^{2z}$ (b) $(\theta^2 - 2\theta + 1)y = e^{z}$ (c) $(\theta^2 + 2\theta + 1)y = e^{2z}$
   (d) $(\theta^2 + 2\theta + 1)y = e^{z}$

6. The solution of $(D^2 + 2D + 1)y = 7$ is

   (a) $y = (Ax + B)e^{-x} + 7$ (b) $y = (Ax + B)e^{-x} - 7$ (c) $y = (Ax + B)e^{x} + 7$
   (d) $y = (Ax + B)e^{x} - 7$

7. The P.I of $(D - 1)^2y = e^x \sin x$ is

   (a) $-e^x\cos x$ (b) $e^x\cos x$ (c) $e^x\sin x$ (d) $-e^x\sin x$

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

   (a) $2 - x$ (b) $x + 2$ (c) x^2 (d) $-x^2$

9. If $1 \pm 2i$ are the roots of A.E of a differential equation $f(D)y = 0$ then the general solution is

   (a) $e^{-2x}(A\cos x - B\sin x)$ (b) $Ae^{x} + Be^{-2x}$ (c) $e^{x}(A\cos 2x + B\sin 2x)$ (d) $Ae^{t} + Be^{2x}$

10. Convert the equation $(5 + 2x)^2y'' - 6(5 + 2x)y' + 8y = 0$ to an equation with constant coefficient by using the transformation $z = \log(5 + 2x)$

    (a) $(\theta^2 + 4\theta + 2)y = 0$ (b) $(\theta^2 - 4\theta + 2)y = 0$ (c) $(\theta^2 + 4\theta + 4)y = 0$ (d) $(\theta^2 + 4\theta - 2)y = 0$

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

    (a) $y_p = \frac{\sinh 2x}{8}$ (b) $y_p = \frac{\sinh 2x}{4}$ (c) $y_p = \frac{-\sinh 2x}{8}$ (d) $y_p = \frac{-\sinh 2x}{4}$

12. The P.I of $(D^2+6D+5)y=e^{-x}$ is
    (a) $y_p=\frac{xe^{-x}}{4}$ (b) $y_p=\frac{xe^{-x}}{2}$ (c) $y_p=\frac{e^{-x}}{2}$ (d) $y_p=\frac{e^{-x}}{4}$
13. The solution of $(D^2-2aD+a^2)y=0$ is
    (a) $Ae^{ax}+Be^{bx}$ (b) $Ae^{ax}+Be^{-ax}$ (c) $(Ax+B)e^{ax}$ (d) $(Ax+B)e^{-ax}$
14. The P.I of $(D^2+16)y=\cos 4x$ is
    (a) $\frac{x}{2}\sin 2x$ (b) $\frac{x\sin 4x}{8}$ (c) $\frac{x}{2}\cos 2x$ (d) $\frac{x\cos 4x}{8}$
15. The C.F of $D^2y+y=cosecx$ is
    (a) $Ae^{ax}+Be^{bx}$ (b) $A\cos x+B\sin x$ (c) $(Ax+B)e^{ax}$ (d) $(Ax+B)e^{-ax}$
16. If $y_1=\cos ax, y_2=\sin ax$ then the value of $y_1y_2^{'}-y_2y_1^{'}$ is
    (a) -a (b) 0 (c) 1 (d) a
17. Solve $(D^2+1)\,y=0$ given $y(0)=0,\ y'(0)=1$
    (a) $y=\sin x$ (b) $y=\cos x$ (c) $y=A\cos x+B\sin x$ (d) $y=0$
18. The P.I of $(D-2)^2y=e^{2x}$ is
    (a) $\frac{x^2}{2}\,e^{2x}$ (b) $\frac{x}{4}\,e^{2x}$ (c) $\frac{x^2}{2}\,e^{-2x}$ (d) $\frac{x^2}{2}\,e^{-2x}$
19. The P.I of $(D^2+4)y=\sin(2x+5)$ is
    (a) $-\frac{x}{2}\sin(2x+5)$ (b) $\frac{x}{4}\sin(2x+5)$ (c) $-\frac{x}{4}\cos(2x+5)$ (d) $\frac{x}{2}\cos(2x+5)$
20. Solve $(x^2D^2+xD+1)\,y=0$ is
    (a) $Ae^{az}+Be^{bz}$ (b) $A\cos z+B\sin z$ (c) $(Az+B)e^{az}$ (d) $(Az+B)e^{-az}$
21. The roots of the auxiliary equation $(m^2-4)=0$ are
    (a) ± 2 (b) $\pm 2i$ (c) $\pm\sqrt{2}$ (d) $1\pm 2i$
22. The solution of $(x^2D^2-7xD+12)\,y=0$ is
    (a) $Ae^{-2z}+Be^{6z}$ (b) $Ae^{2z}+Be^{-6z}$ (c) $Ae^{2z}+Be^{6z}$ (d) $Ae^{-2z}+Be^{-6z}$
23. If $y_1=\cos x, y_2=\sin x$ then the value of $y_1y_2^{'}-y_2y_1^{'}$ is
    (a) -1 (b) 0 (c) 1 (d) $\frac{1}{2}$
24. If three roots of the auxiliary equation become equal to the real number a, then the corresponding C.F is
    (a) $(Ax^2+Bx+C)\,e^{ax}$ (b) $Ae^{ax}+Be^{ax}+Ce^{ax}$ (c) $Ae^{ax}+(B\cos ax+C\sin ax)$ (d) a
25. The values of $\frac{e^{ax}}{D-a}$
    (a) xe^{ax} (b) e^{ax} (c) x^2e^{ax} (d) $\frac{x^2}{2}e^{ax}$

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Answers:

1. *a* **2.** *a* **3.** *a* **4.** *a* **5.** *a* **6.** *a* **7.** *d* **8.** *b* **9.** *c* **10.** *b* **11.** *a*
12. *a* **13.** *c* **14.** *b* **15.** *b* **16.** *d* **17.** *a* **18.** *a* **19.** *c* **20.** *b* **21.** a
22. *c* **23.** *c* **24.** *a* **25.** *a*

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Unit-IV Geometrical Applications of Differential Calculus

Multiple Choice Questions

1. If the radius of curvature and curvature of a curve at any point are ρ and κ respectively, then
   (a) $\rho = \frac{-1}{\kappa}$ (b) $\rho = \kappa$ (c) $\rho = -\kappa$ (d) $\rho = \frac{1}{\kappa}$
2. The locus of center of curvature is called
   (a) Involute (b) Evolute (c) Radius of curvature (d) Envelope
3. The envelope of the family of curves $A\alpha^2 + B\alpha + C = 0$ (α is parameter) is
   (a) $B^2 + 4AC = 0$ (b) $B^2 - AC = 0$ (c) $B^2 + AC = 0$ (d) $B^2 - 4AC = 0$
4. The curvature of the straight line is
   (a) 1 (b) 2 (c) -1 (d) 0
5. The radius of curvature of the curve $y = 4\sin x$ at $x = \frac{\pi}{2}$ is
   (a) $\frac{1}{2}$ (b) $\frac{-1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{-1}{4}$
6. The envelope of $ty - x = at^2$, t is the parameter is
   (a) $x^2 = 4ay$ (b) $y^2 = 4ax$ (c) $x^2 + y^2 = 1$ (d) $x^2 - y^2 = 1$
7. The curvature at any point of the circle is equal to $- - -$ of its raduis
   (a) Square (b) Same (c) Reciprocal (d) constant
8. What is the radius of curvature at (4, 3) on the curve $x^2 + y^2 = 25$
   (a) 5 (b) -5 (c) 25 (d) -25
9. What is the curvature of a circle of radius 3
   (a) 3 (b) -3 (c) $\frac{1}{3}$ (d) $\frac{-1}{3}$
10. Find the envelope of the curve $y = mx + \frac{a}{m}$ where m is a parameter
    (a) $y^2 - 4ax = 0$ (b) $y^2 + 4ax = 0$ (c) $x^2 + y^2 = 1$ (d) $xy = c^2$
11. The radius of curvature of $y = e^x$ at $x = 0$ is
    (a) $2\sqrt{2}$ (b) $\frac{2}{\sqrt{2}}$ (c) $\sqrt{2}$ (d) $\frac{1}{\sqrt{2}}$
12. The radius of curvature of the curve $y = log \sec x$ at any point of it is
    (a) $\sec x$ (b) $\tan x$ (c) $\cot x$ (d) $cosecx$
13. In an ellipse the radius of curvature at the end of which axis is equal to the semi latus rectum of the ellipse
    (a) Minor (b) Major (c) Vertical (d) Horizontal
14. The radius of curvature of the curve $x = t^2$, $y = t$ at $t = 1$ is
    (a) $5\frac{\sqrt{5}}{2}$ (b) $\frac{\sqrt{5}}{2}$ (c) $\frac{5}{2}$ (d) $\sqrt{5}$

15. Evolute of a curve is the envelope of $----$ of that curve

(a) Tangent (b) Normal (c) Parallel (d) Locus

16. The evolute of the cycloid $x = a\,(\theta - \sin\theta)\,,\ \ y = a\,(1 - \cos\theta)$ is

(a) Astroid (b) Parabola (c) Cycloid (d) Circle

17. A curve which touches each member of a family of the curves is called $---$ of that family

(a) Evolute (b) Envelope (c) Circle of curvature (d) Radius of curvature

18. The envelope of family of lines $y = mx + am^2$ $(where\,\mathrm{m}\,istheparameter)$ is

(a) $x^2 + 2ay = 0$ (b) $x^2 + 4ay = 0$ (c) $y^2 + 2ax = 0$ (d) $y^2 + 4ax = 0$

19. The envelope of the family of lines $\frac{x}{t} + yt = 2c,$ t being the parameter is

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

20. The radius of curvature at any point on the curve $r = e^{\theta}$ is

(a) $\frac{\sqrt{2}}{r}$ (b) $\frac{r}{\sqrt{2}}$ (c) r (d) $\sqrt{2}r$

21. The radius of curvature in Cartesian coordinates is

(a) $\rho = \dfrac{\left(1 + y_1^2\right)^{3/2}}{y_2}$ (b) $\rho = \dfrac{\left(1 - y_1^2\right)^{3/2}}{y_2}$ (c) $\rho = \dfrac{\left(1 + y_1^2\right)^{2/3}}{y_2}$ (d) $\rho = \dfrac{\left(1 + y_2^2\right)^{3/2}}{y_1}$

22. The radius of curvature in polar coordinates is

(a) $\rho = \dfrac{\left(r^2 + (r')^2\right)^{3/2}}{r^2 - rr' + 2(r')^2}$ (b) $\rho = \dfrac{\left(r^2 - (r')^2\right)^{3/2}}{r^2 - rr' + 2(r')^2}$ (c) $\rho = \dfrac{\left(r^2 - (r'')^2\right)^{3/2}}{r^2 - rr' + 2(r')^2}$

(d) $\rho = \dfrac{\left(r^2 + (r')^2\right)^{3/2}}{r^2 - rr'' + 2(r')^2}$

23. The radius of curvature in parametric coordinates is

(a) $\rho = \dfrac{\left((x')^2 + (y')^2\right)^{3/2}}{x'y'' - y'x''}$ (b) $\rho = \dfrac{\left((x')^2 + (y')^2\right)^{3/2}}{x'y'' + y'x''}$ (c) $\rho = \dfrac{\left((x')^2 - (y')^2\right)^{3/2}}{x'y'' - y'x''}$

(d) $\rho = \dfrac{\left((x')^2 - (y')^2\right)^{3/2}}{x'y'' + y'x''}$

24. The equation of circle of curvature at any point (x, y) with center of curvature $\overline{x}, \overline{y}$ and with radius of curvature ρ is

(a) $(x + \overline{x})^2 + (y + \overline{y})^2 = \rho^2$ (b) $(x - \overline{x})^2 + (y - \overline{y})^2 = \rho^2$ (c) $(x - \overline{x})^2 - (y + \overline{y})^2 = \rho^2$
(d) $(x + \overline{x})^2 + (y + \overline{y})^2 = \rho$

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Answers:

1. *d* **2.** *b* **3.** *d* **4.** *d* **5.** *c* **6.** *b* **7.** *c* **8.** *a* **9.** *c* **10.** *b* **11.** *a* **12.** *a* **13.** *b* **14.** *a* **15.** *b* **16.** *c* **17.** *b* **18.** *b* **19.** *b* **20.** *d* **21.** *a* **22.** *d* **23.** *a* **24.** *b*

SRM INSTITUTE OF SCIENCE & TECHNOLOGY
FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MATHEMATICS

Unit –IV Geometrical Applications of Differential Calculus
(Beta ,Gamma Functions)
Multiple Choice Questions

1. The value of $\beta(4,4)$ is -----------

(a). $\frac{36}{7!}$ (b). $\frac{6!}{7!}$ (c). $\frac{4!4!}{8!}$ (d). $\frac{3!}{7!}$

2. The value of $\beta\left(\frac{5}{2},\frac{3}{2}\right)$ is ----------------

(a). $\frac{\pi}{8}$ (b). $\frac{\sqrt{\pi}}{8}$ (c). $\frac{\pi}{16}$ (d). $\frac{\pi^2}{16}$

3. $\beta(m,n)$ is equal to ------------

(a). $\frac{m!n!}{(m+n)!}$ (b). $\frac{m!n!}{(m-n)!}$ (c). $\frac{\Gamma m\Gamma n}{\Gamma(m+n)}$ (d). $\frac{\Gamma m\Gamma n}{\Gamma(m-n)}$

4. The value of $\Gamma\left(\frac{1}{2}\right)$ is -----------

(a). $\sqrt{\pi}$ (b). π^2 (c). π (d). 2π

5. $\Gamma n\Gamma(1-n)$ is equal to --------

(a). $\int_0^\infty \frac{x^{1-n}}{1+x}dx$ (b). $\Gamma(1)\,\beta(n,1-n)$ (c). $\Gamma(1)\,\beta(1-n,1-n)$ (d). $\Gamma(1)\,\beta(1-n,n)$

6. $\int_0^{\frac{\pi}{2}} \sin^p\theta\cos^q\theta\,d\theta$ is equal to -----------

(a) $.\frac{1}{2}\beta\left(\frac{p+1}{2},\frac{q+1}{2}\right)$ (b). $\frac{1}{2}\beta\left(\frac{p-1}{2},\frac{q-1}{2}\right)$ (c). $\frac{1}{2}\beta\left(\frac{p}{2},\frac{q}{2}\right)$ (d). $\frac{1}{2}\beta\left(\frac{1}{2},\frac{1}{2}\right)$

7. $\int_0^1 x^4[\log(\frac{1}{x})]^3$ is equal to -----------

(a). $\frac{6}{525}$ (b). $\frac{6}{625}$ (c). $\frac{6!}{5!}$ (d). $\frac{5!}{6!}$

8. The value of $\int_0^{\frac{\pi}{2}} \sqrt{\cot\theta}\,d\theta$ is -----------

(a). $\frac{\pi}{2}$ (b). $\frac{\pi}{\sqrt{2}}$ (c). $\frac{\sqrt{\pi}}{2}$ (d). $\sqrt{\frac{\pi}{2}}$

UNIT V
Sequence and Series

1. The series $\sum_{n=1}^{\infty}\frac{1}{n^p}$ is convergent if

   (a)p=1 (b)p=0 (c)p>1 (d)p<1

2. The series $\sum_{n=1}^{\infty}\frac{1}{n^p}$ is divergent if

   (a)p>1 (b)p=0 (c)p≤1 (d)p<1

3. If $\sum u_n$ is a series of positive term such that $\lim_{n\to\infty}(u_n)^{\frac{1}{n}} = l$ where $l>1$, then the series $\sum u_n$ is

   (a) Convergent (b) Divergent (c) Oscillating (d) Monotonic

4. If $\sum u_n$ is a series of positive term such that $\lim_{n\to\infty}(u_n)^{\frac{1}{n}} = l$, then the series $\sum u_n$ is convergent if

   (a) $l<1$ (b) $l=0$ (c) $l>1$ (d) $l=1$

5. The series $\sum_{n=1}^{\infty}\frac{1}{n!}$ is

   (a) Convergent (b) Divergent (c) Oscillating (d) Monotonic

6. The series $1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\text{...........}to\infty$ is

   (a) Convergent (b) Divergent (c) Oscillating (d) Monotonic

7. By D'Alambert's Ratio test $\lim_{n\to\infty}(\frac{u_{n+1}}{u_n}) = l$, the series is convergent when

   (a) $l<1$ (b) $l=0$ (c) $l>1$ (d) $l=1$

8. By Raabe's test $\lim_{n\to\infty}\left[n(\frac{u_{n+1}}{u_n}-1)\right] = l$, the series is divergent when

   (a) $l<1$ (b) $l=0$ (c) $l>1$ (d) $l=1$

9. The series $\sum_{n=1}^{\infty}\frac{2^n}{n!}$ is

   (a) Convergent (b) Divergent (c) Oscillating (d) Monotonic

10. A series $\sum u_n$ is said absolutely convergent if the series

    (a) $\sum|u_n|$ is convergent (c) $\sum u_n$ is divergent

    (c) $\sum u_n$ is convergent (b) $\sum|u_n|$ is divergent

11. A series $\sum u_n$ is saidconditionally convergent if the series

(a) $\sum |u_n|$ is convergent (b) $\sum u_n$ is divergent& $\sum |u_n|$ is convergent

(c) $\sum u_n$ is convergent& $\sum |u_n|$ is divergent (d) $\sum |u_n|$ is divergent

12. The series $1-\frac{1}{2}+\frac{1}{2^2}-\frac{1}{2^3}+..........$ is

(a) Convergent (b) Divergent (c) Conditionally convergent (d) absolutely convergent

13. The series $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+..........$ is

(a) Convergent (b) Divergent (c) Conditionally convergent (d) absolutely convergent

14. The series $\sum \frac{1}{n\log n}$ is

(a) Conditionally convergent (b) absolutely convergent (c) Convergent (d) Divergent

15. An absolutely convergent series is

(a) Conditionally convergent (b) absolutely convergent (c) Convergent (d) Divergent

16. The series $\sum \frac{n^3}{3^n}$ is

(a) Conditionally convergent (b) absolutely convergent (c) Convergent (d) Divergent

17. The series $\sum \frac{1}{(\log n)^n}$ is

(a) Convergent (b) Conditionally convergent (c) absolutely convergent (d) Divergent

ANSWERS

1. d	11. c
2. c	12. d
3. b	13. c
4. a	14. d
5. a	15. c
6. b	16.c
7. a	17.a
8. c	
9. a	
10. a	