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(1) For non-singular matrix A of order $n \times n$, rank r of A is

(A) $r > n$ (B) $r = n$

(C) $r < n$ (D) None of these.

(2) Normal form of matrix $A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ is

(A) $[I_2\ 0]$ (B) $[I_2]$

(C) $[I_3]$ (D) $\begin{bmatrix} I_1 \\ 0 \end{bmatrix}$

(3) Nonhomogeneous system of linear equations $AX = B$ is inconsistent if

(A) rank of A = rank of (A|B)

(B) rank of A ≠ rank of (A|B)

(C) rank of A > number of unknowns

(D) None of these

(4) Given system of linear equations $x - 4y + 5z = 0$, $2x - y + 3z = 0$, $3x + 2y + z = 0$ has

(A) No solution (B) only trivial solution

(C) Infinite solutions (D) None of these

(5) If $Y = AX$ is orthogonal transformation then its inverse transformation is

(A) $X = A^{-1}Y$ (B) $Y = A^{-1}X$

(C) $X = YA^{-1}$ (D) Does not exist.

(6) The matrix of linear transformation,

$y_1 = 2x_1 + x_2 + x_3$ $y_2 = x_1 + x_2 + 2x_3$,

$y_3 = x_1 - 2x_3$

(A) $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 1 & 2 \\ 1 & 0 & -2 \end{bmatrix}$

(B) $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & -2 \end{bmatrix}$

(D) $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 0 & 0 \end{bmatrix}$

(7) For what value of b, the matrix $A = \frac{1}{3}\begin{bmatrix} b & -5 \\ 5 & b \end{bmatrix}$ is an orthogonal ?

(A) ± 5
(B) ± 13
(C) ± 12
(D) ± 16

(8) If $\lambda_1, \lambda_2, \lambda_3$ are non-zero eigen value of A then trace of A^{-1} is

(A) $\frac{1}{\lambda_1} + \frac{1}{\lambda_2} + \frac{1}{\lambda_3}$
(B) $\lambda_1 + \lambda_2 + \lambda_3$
(C) $\lambda_1^2 + \lambda_2^2 + \lambda_3^2$
(D) $\lambda_1 \times \lambda_2 \times \lambda_3$

(9) For the matrix $A = \begin{bmatrix} 1 & -2 & -1 \\ 0 & 3 & 2 \\ 0 & 0 & 5 \end{bmatrix}$ the eigen value of A are

(A) 1, -2, -1
(B) 1, -3, -5
(C) -1, -3, -5
(D) 1, 3, 5

(10) The sum of the eigen value of $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ is

(A) 7
(B) 5
(C) 6
(D) 8

(11) Cayley Hamilton theorem states that

(A) sum of eigen values is equal to trace of matrix

(B) the product of the eigen values of a matrix A is equal to determinant of the matrix

(C) every square matrix satisfies its own characteristic equation

(D) eigen values of a matrix & its transpose is same

(13) The linear transformation $Y = \begin{bmatrix} 4 & -5 & 1 \\ 3 & 1 & -2 \\ 1 & 4 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ is

(A) non-singular (B) composite
(C) singular (D) None of these

(14) For the matrix $A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 4 & 2 \end{bmatrix}$ then eigen values of A^2 are

(A) 1, 4 (B) $-1, -1, 4$
(C) $-1, -1, 2$ (D) None of these

(15) If the characteristic equation of matrix A of order 2×2 is $\lambda^2 - 9\lambda - 1 = 0$ then A^{-1} is

(A) $A - 9I$ (B) $A + 9I$
(C) $-A - 9I$ (D) $A^2 - 9A - I$

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1) If $y = \frac{1}{(x+1)^2}$, then $y_n = ?$

a) $\frac{(-1)^n (n+1)!}{(x+1)^{n+2}}$ b) $\frac{(-1)^n \lfloor n}{2(x+1)^n}$

c) $\frac{(-1)^{n+1} \lfloor n}{(x+1)^{n+2}}$ d) None of the above.

2) If $y = 2^x$ then $y_n = ?$

a) $2^x (\log 2)^n$ b) $x^2 (\log x)^n$

c) $x^2 (\log 2)^n$ d) $2^x (\log x)^n$

3) If $y = \sin(bx+c)$ then $y_n = ?$.

a) $\sin(bx+c+n)$ b) $\sin(bx+c+n\pi/2)$

c) $b^n \sin(bx+c+n\pi/2)$ d) $\cos(bx+c+n\pi/2)$.

4) If $(1+x^2) y_1^2 = 4y$, then which of the following is true ?

a) $(1-x^2) y_{n+2} + (2n+1) y_n = 0$

b) $(1+x^2) y_{n+2} + (2n+1) x y_{n+1} + n^2 y_n = 0$

c) $(2n+1) y_{n+1} = n^2 y_n$

d) None of the above

5) If $y = e^{ax}$ then $y_n = ?$.

a) $a e^{ax}$ b) $a^n e^{ax+1}$

c) $a^n e^{ax}$ d) $a^x e^n$

6) If $u = y^x$ then $\frac{\partial^2 u}{\partial x \partial y} = ?$

a) $y^{x-1}[1 + x \log y]$ b) $x^{y-1}[1 + y \log x]$

c) $y^x \log y$ d) None of the above

7) If $u = \log(x^3 + y^3 - x^2 y - x y^2)$ then $u_y = ?$

a) $\frac{2}{x-y}$ b) $\frac{1}{x+y}$ c) $\frac{-2}{x-y} + \frac{1}{x+y}$

8) If $x = r\cos\theta$, $y = r\sin\theta$. then $\left(\frac{\partial x}{\partial r}\right)_\theta = ?$

a) $x \sin\theta$ b) r c) 1 d) $x\cos\theta$

9) $f(x,y) = \frac{x^2 + y^2}{\sqrt{x} + \sqrt{y}}$ is

a) Non-homogenous
b) Homogenous with degree 1
c) Homogenous with dregree 2
d) Homogenous with dregree 3/2

10) If z is a homogenous function of two variables x, y of degree 'n' then,

a) $x^2 z_{xx} + 2xy z_{xy} + y^2 z_{yy} = n(n-1)z$
b) $z_{xx} + z_{yy} = n(n-1)z$
c) $x^2 z_{yy} + 2xy z_{xy} + y^2 z_{xx} = nz$
d) None of the above

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11) If $u = ax+by$, $v = bx-ay$ then $\left(\frac{\partial v}{\partial y}\right)_u = ?$

a) $-\frac{a^2+b^2}{a}$ b) $\frac{a^2+b^2}{a}$ c) $\frac{a^2+b^2}{b}$ d) 0

12) If $z^3 + xz - y = 4$ then $\frac{\partial z}{\partial x} = ?$

a) $\frac{z}{3z^2-x}$ b) $\frac{z}{3z^2+x}$ c) xy d) 0

13) If $u \to x, y, z \to t$ then total derivative is given by.

a) $\frac{du}{dt} = \frac{\partial u}{\partial x}\cdot\frac{dx}{dt} + \frac{\partial u}{\partial y}\cdot\frac{dy}{dt} + \frac{\partial u}{\partial z}\cdot\frac{dz}{dt}$

b) $\frac{\partial u}{\partial t} = \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} + 0$

c) $\frac{du}{dt} = \frac{du}{dx}\cdot\frac{dx}{dt} + \frac{du}{dy}\cdot\frac{dy}{dt} + \frac{du}{dz}\cdot\frac{dz}{dt}$

14) If $f(x,y)=0$ represents implicit relation then $\frac{dy}{dy} = ?$

a) $\frac{-\partial f/\partial x}{\partial f/\partial y}$ b) $\frac{\partial f/\partial x}{\partial f/\partial y}$ c) $\frac{-\partial f/\partial y}{\partial f/\partial x}$

d) $\frac{\partial f/\partial y}{\partial f/\partial x}$

15) If $y = (2x+3)^3$ then $y_n = ?$

a) 1 b) 0 c) $\frac{(-1)^n(n+1)!}{(2x+3)^{n+3}}$ d) None

Practice MCQs

① Expansion of $\frac{1}{1+x}$ in ascending powers of x is

a) $-1-x-x^2-x^3-\cdots$ b) $1-x+x^2-x^3+\cdots$

c) $1+\frac{x^2}{2!}+\frac{x^4}{4!}+\cdots$ d) $1+x+x^2+x^3+\cdots$

② First two terms in expansion of $e^x \sec x$ by Maclaurin's theorem is

a) $x+x^2+\cdots$ b) $x-x^2+\cdots$

c) $1+x+\cdots$ d) $1-x+\cdots$

③ First two terms in expansion of $(x+2)^5+3(x+2)^4$ by Taylor's theorem in ascending powers of x is

a) $48+98x$ b) $80+176x+\cdots$

c) $80+98x$ d) $48+176x+\cdots$

④ First two terms in expansion of $\tan^{-1}x$ by Taylor's theorem in ascending powers of $(x-1)$ is

a) $\frac{\pi}{4}-\frac{1}{2}(x-1)+\cdots$ b) $\frac{\pi}{4}+\frac{1}{2}(x-1)+\cdots$

c) $1+\frac{1}{2}(x-1)+\cdots$ d) $1-\frac{1}{2}(x-1)$

⑤ If $u=x^2-y$, $v=xy$ then $\frac{\partial(u,v)}{\partial(x,y)}$ is

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

⑥ If $x=1-v$, $y=uv$ then $\frac{\partial(x,y)}{\partial(u,v)}$ is

a) u b) $-u$ c) $-v$ d) v

⑦ If $u=\sin^{-1}x+\sin^{-1}y$, $v=x\sqrt{1-y^2}+y\sqrt{1-x^2}$ are functionally dependent then relation bet^n u & v is

a) $v=\sin u$ b) $u=\sin v$ c) $\sqrt{v}=\sin u$ d) $u+v=\sin u$

8) If $u = \frac{x-y}{x+y}$, $v = \frac{x+y}{x}$ are functionally dependent, then relation bet^n u & v is

a) $uv = 2+v$ b) $u = 2-v$ c) $uv = 2-v^2$ d) $uv = 2-v$

9) Find the percentage error in the area of an ellipse when an error of 4% is made in measuring its major & minor axes. Given area of ellipse $= \pi ab$

a) 4% b) 2% c) 4π% d) 8%

10) In calculating volume of right circular cylinder errors of 3% & 4% are found in measuring height & base radius respectively. Find the percentage error in calculating volume of cylinder. Given volume of right circular cylinder $V = \pi r^2 h$.

a) 7% b) 1% c) 11% d) 4%

11) critical (stationary) point & nature of the function $f(x,y) = x^2 - 2x + 2y^2 + 4y - 2$ at critical point is

a) (1, 1) & maxima b) (1, -1) & maxima

c) (1, 1) & minima d) (1, -1) & minima.

12) Using Lagrange's method of undetermined multiplier Find maximum value of function $f(x,y,z) = xy^2z^3$ on the plane $x+y+z = 3$, given that $x = \frac{1}{\lambda}$, $y = \frac{2}{\lambda}$, $z = \frac{3}{\lambda}$

a) $\frac{27}{16}$ b) $\frac{27}{8}$ c) $\frac{1}{2}$ d) $-\frac{27}{8}$