RAMCO INSTITUTE OF TECHNOLOGY
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+2 Board Examinations Multiple choice Questions with answers

Subject: Mathematics I and II

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TABLE OF CONTENTS

Chapter 1

Applications of Matrices and Determinants

1. Say True or False. The inverse of a matrix exists if and only if it is a non-singular matrix.
   (a) True (b) False
2. Find the $adj(A)$ if $A = \begin{bmatrix} 1 & 2 \\ -1 & 6 \end{bmatrix}$
   (a) $\begin{bmatrix} 1 & -1 \\ 2 & 6 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 \\ -2 & 6 \end{bmatrix}$ (c) $\begin{bmatrix} -6 & 2 \\ -1 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} 6 & -2 \\ 1 & 1 \end{bmatrix}$
3. If $|adj\ A| = |A|^2$, where A is a non-singular square matrix, then the order of A is
   (a) 2 (b) 3 (c) 4 (d) 5
4. A is a non-singular matrix of odd order, then $|adj\ A|$ is
   (a) Positive (b) Negative (c) Zero (d)
5. If A is a non-singular matrix, then which of the following statements are not true
   (i) $(adj\ A)^{-1} = adj(A^{-1})$
   (ii) $adj(AB) = adj(A)adj(B)$
   (iii) $(adj\ A)^T = adj(A^T)$
   (iv) $adj(\lambda A) = \lambda adj(A)$, where λ is a non-zero scalar
   (a) (i) & (iii) (b) (ii) & (iv) (c) (ii) alone (d) (iv) alone
6. Say True or False, whether the null matrices $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ and $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ are equal
   (a) True (b) False
7. If $adj(A) = \begin{bmatrix} 5 & 3 \\ -2 & 4 \end{bmatrix}$ and $adj(B) = \begin{bmatrix} 1 & -1 \\ 0 & 7 \end{bmatrix}$, then find $adj(AB)$
   (a) $\begin{bmatrix} 5 & 16 \\ -2 & 30 \end{bmatrix}$ (b) $\begin{bmatrix} 30 & -16 \\ 2 & 5 \end{bmatrix}$ (c) $\begin{bmatrix} 7 & -1 \\ -14 & 28 \end{bmatrix}$ (d) $\begin{bmatrix} 28 & 1 \\ 14 & 7 \end{bmatrix}$
8. An elementary transformation transforms a given matrix into another matrix which must be equal to the given matrix.
   (a) True (b) False
9. Which of the following matrices are not in row echelon form
   (a) $\begin{bmatrix} 0 & 1 & -1 \\ 0 & 0 & 5 \\ 0 & 0 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 1 & -7 \\ 6 & 0 & 0 \\ 0 & 2 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 1 & -3 \\ 0 & 0 & 2 \\ 0 & 0 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 1 & -1 & 2 \\ 0 & 0 & 3 & -9 \\ 0 & 0 & 0 & 6 \end{bmatrix}$
10. Find the rank of a matrix $\begin{bmatrix} 0 & 1 & 2 & 1 \\ 0 & 2 & 4 & 3 \\ 8 & 1 & 0 & 2 \end{bmatrix}$
    (a) 3 (b) 2 (c) 1 (d)
11. Find the inverse of a matrix $\begin{bmatrix} 5 & 4 \\ 3 & 2 \end{bmatrix}$ by Gauss Jordan method
    (a) $\frac{1}{2}\begin{bmatrix} 2 & -4 \\ -3 & 5 \end{bmatrix}$ (b) $\frac{1}{2}\begin{bmatrix} 2 & 4 \\ 3 & 5 \end{bmatrix}$ (c) $\frac{1}{2}\begin{bmatrix} -2 & 4 \\ 3 & -5 \end{bmatrix}$ (d) $\frac{1}{2}\begin{bmatrix} -2 & -4 \\ -3 & -5 \end{bmatrix}$
12. A system of linear equation having no solution is said to be inconsistent
    (a) True (b) False

13. Cramer's Rule fails if
   (a) Determinant > 0 (b) Determinant < 0
   (c) Determinant = 0 (d) Determinant = non-real

14. Test the given system of equations whether consistent or inconsistent
   $3x + 2y - 5z = 4;\ \ x + y - 2z = 1;\ \ 5x + 3y - 8z = 6$
   (a) Consistent (b) Inconsistent

15. Apply Cramer's rule to solve the system of equation
   $3x + y + 2z = 3;\ \ 2x - 3y - z = -3;\ \ x + 2y + z = 4$
   (a) $x = 2, y = 1, z = -1$ (b) $x = 2, y = -1, z = 1$
   (c) $x = 1, y = -1, z = 2$ (d) $x = 1, y = 2, z = -1$

16. 4 men and 4 women can finish a piece of work jointly in 3 days while 2 men and 5 women can finish the same work jointly in 4 days. Find the time taken by one man alone and that of one woman alone to finish the same work by using matrix inversion method.
   (a) man in 36 days, woman in 18 days (b) man in 18 days, woman in 36 days
   (c) man in 38 days, woman in 16 days (d) man in 16 days, woman in 38 days

17. Investigate for what values of λ, the given system of equation has infinitely many solution $4x + y = 7;\ \ 16x + \lambda y = 28$
   (a) $\lambda = 2$ (b) $\lambda = 3$ (c) $\lambda = 4$ (d) $\lambda = 6$

18. The Homogeneous linear system of equation has a nontrivial solution if and only if the
   (a) Determinant of a coefficient matrix is zero (b) Determinant of a coefficient matrix is non-zero
   (c) Determinant of a coefficient matrix positive (d) Determinant of a coefficient matrix negative

19. Balance the chemical reaction $C_2H_5OH + O_2 \rightarrow CO_2 + H_2O$
   For any parameter $t = 3$, use Gauss elimination method to find all the unknowns
   (a) $x_1 = -1, x_2 = 3, x_3 = -2, x_4 = 3$ (b) $x_1 = 1, x_2 = -3, x_3 = 2, x_4 = -3$
   (c) $x_1 = -1, x_2 = 3, x_3 = 2, x_4 = -3$ (d) $x_1 = 1, x_2 = 3, x_3 = 2, x_4 = 3$

20. By Rouche-Capelli theorem, if there are 3 unknowns in a system of equations and $\rho(A) = \rho[(A|B)] = 2$, then the system has
   (a) Infinitely many solutions and forms a one parameter family (b) Infinitely many solutions and forms a two parameter family
   (c) Consistent and unique solution (d) Inconsistent and no solution

Answers

1) a	2) d	3) b	4) a	5) b
6) b	7) c	8) b	9) b	10) a
11) c	12) a	13) c	14) b	15) d
16) b	17) c	18) a	19) d	20) a

Chapter 2

Complex Numbers

1. Simplify i^{2021}
   (a) 1 (b) -1 (c) i (d) $-i$

2. If $z_1 = 2 + i$ and $z_2 = 1 + 3i$, then the value of $i\, Re(z_1 - z_2)$ is
   (a) i (b) -i (c) $2i$ (d) $-2i$

3. If $z = -5 + 3i$ and $w = -2 + i$, then the value of $(z + w)^2$ is
   (a) $33 + 56i$ (b) $33 - 56i$ (c) $56 + 45i$ (d) $56 - 45i$

4. Which of the following statements are not true
   (a) $Re(z) \leq |z|$ (b) $Im(z) \leq |z|$
   (c) $|z_1 + z_2| \leq |z_1| + |z_2|$ (d) $|z_1 - z_2| \leq |z_1| - |z_2|$

5. If $z_1 = 2 - 3i$ and $z_2 = 1 + i$, then find $\frac{z_1}{z_2}$ in a rectangular form
   (a) $\frac{1}{2} + \frac{5i}{2}$ (b) $\frac{1}{2} - \frac{5i}{2}$ (c) $-\frac{1}{2} + \frac{5i}{2}$ (d) $-\frac{1}{2} - \frac{5i}{2}$

6. Test the given complex number $(2 + i\sqrt{3})^{10}$+$(2 - i\sqrt{3})^{10}$, it is
   (a) Real (b) Purely imaginary
   (c) Complex (d) Zero

7. Which one of the points $i, 2 - i, 3 + i$ is farthest from the origin?
   (a) i (b) $2 - i$ (c) $3 + i$

8. The equation $z^3 = \bar{z}$ has how many solutions
   (a) Two (b) Three (c) Four (d) Five

9. Find the centre and radius of a circle $|z + 3 - i| = 5$
   (a) Centre = $(-3,1)$ and radius 5 units (b) Centre = $(-3,1)$ and radius 25 units
   (c) Centre = $(3,-1)$ and radius 5 units (d) Centre = $(3,-1)$ and radius 25 units

10. If the area of a triangle formed by the vertices z, iz *and* $z + iz$ is 50 square units, find the value of $|z|$
    (a) 20 (b) 25 (c) 10 (d) 15

11. Obtain the Cartesian form of the locus of z in $|2z| = |z - 5i|$
    (a) $3x^2 + 3y^2 - 10y + 25 = 0$ (b) $3x^2 + 3y^2 + 10y + 25 = 0$
    (c) $3x^2 + 3y^2 - 10y - 25 = 0$ (d) $3x^2 + 3y^2 + 10y - 25 = 0$

12. Find the modulus and argument of the complex number $z = -1 - i$
    (a) $|z| = \sqrt{2}$ and $\theta = \frac{\pi}{4}$ (b) $|z| = \sqrt{2}$ and $\theta = \frac{3\pi}{4}$
    (c) $|z| = \sqrt{2}$ and $\theta = \frac{-\pi}{4}$ (d) $|z| = \sqrt{2}$ and $\theta = \frac{-3\pi}{4}$

13. Which of the following statements are not true:
    (a) If $z = r(cos\theta + isin\theta)$ then $\frac{1}{z} = \frac{1}{r}(cos\theta + isin\theta)$
    (b) If $z_1 = r_1(cos\theta_1 + isin\theta_1)$ and $z_2 = r_2(cos\theta_2 + isin\theta_2)$, then $z_1 z_2 = r_1 r_2(\cos(\theta_1 + \theta_2) + isin(\theta_1 + \theta_2))$
    (c) $\arg(z_1 z_2) = \arg(z_1) + \arg(z_2)$
    (d) $\arg\left(\frac{z_1}{z_2}\right) = \arg(z_1) - \arg(z_2)$

14. Find the rectangular form of the complex number
$\left(cos\left(\frac{\pi}{2}\right) + i\ sin\left(\frac{\pi}{2}\right)\right)\left(cos\left(\frac{\pi}{4}\right) + i\ sin\left(\frac{\pi}{4}\right)\right)$

(a) $\frac{-1}{\sqrt{2}} - \frac{i}{\sqrt{2}}$ (b) $\frac{-1}{\sqrt{2}} + \frac{i}{\sqrt{2}}$ (c) $\frac{1}{\sqrt{2}} - \frac{i}{\sqrt{2}}$ (d) $\frac{1}{\sqrt{2}} + \frac{i}{\sqrt{2}}$

15. De Moivre's Theorem states that $(cos\theta + isin\theta)^n = (cosn\theta + isinn\theta)$then $(cos\theta - isin\theta)^{-n}$ is

(a) $(cosn\theta + isinn\theta)$ (b) $(cosn\theta - isinn\theta)$
(c) $(sinn\theta + icosn\theta)$ (d) $(sinn\theta - icosn\theta)$

16. The value of $(1 + i)^{18}$ is
(a) $216i$ (b) $-216i$ (c) $512i$ (d) $-512i$

17. Simplify $\left(sin\left(\frac{\pi}{5}\right) + i\ cos\left(\frac{\pi}{5}\right)\right)^{20}$
(a) i (b) $-i$ (c) 1 (d) -1

18. The product of all the n roots of n^{th} roots of unity is
(a) $(-1)^n$ (b) $(-1)^{n-1}$ (c) $(-i)^n$ (d) $(-i)^{n-1}$

19. The sum of all the n roots of n^{th} roots of unity is
(a) $(-1)^n$ (b) $(-1)^{n-1}$ (c) 0 (d) 1

20. If $z = 2 - 2i$, find the rotation of z by θ radians in the counter clockwise direction about the origin when $\theta = \frac{\pi}{3}$

(a) $2\sqrt{2}\left(cos\left(\frac{\pi}{12}\right) + i\ sin\left(\frac{\pi}{12}\right)\right)$ (b) $2\sqrt{2}\left(cos\left(\frac{\pi}{12}\right) - i\ sin\left(\frac{\pi}{12}\right)\right)$

(c) $-2\sqrt{2}\left(cos\left(\frac{\pi}{12}\right) + i\ sin\left(\frac{\pi}{12}\right)\right)$ (d) $-2\sqrt{2}\left(cos\left(\frac{\pi}{12}\right) - i\ sin\left(\frac{\pi}{12}\right)\right)$

Answers

1) c	2) a	3) b	4) d	5) d
6) a	7) c	8) d	9) a	10) c
11) d	12) d	13) a	14) b	15) a
16) c	17) c	18) b	19) c	20) a

Chapter 3

Theory of Equations

1. The roots of the quadratic equation $ax^2+bx+c=0$ are real and distinct if the discriminant

   $(a) b^2-4ac>0$ (b) $b^2-4ac=0$ (c) $b^2-4ac<0$ (d) none of these

2. The cubic equation with roots α,β,γ is

   $(a) x^3-(\alpha+\beta+\gamma)x^2+(\alpha\beta+\beta\gamma+\gamma\alpha)x-\alpha\beta\gamma=0$ $(b) x^3-(\alpha\beta+\beta\gamma+\gamma\alpha)x^2+(\alpha+\beta+\gamma)x-\alpha\beta\gamma=0$

   $(c) x^3+(\alpha+\beta+\gamma)x^2+(\alpha\beta+\beta\gamma+\gamma\alpha)x-\alpha\beta\gamma=0$ (d) none of these

3. A quadratic equation in standard form with roots -2,-5 is

   $(a) x^2-3x-10=0$ (b) $x^2+7x+10=0$ (c) $x^2-7x+10=0$ (d) $x^2+2x-10=0$

4. What is the value of 'k' in the quadratic equation $x^2+3x+k=0$ if one of the roots is -2?

   $(a) -2$ (b) 2 (c) 4 (d) -4

5. If α and β are the roots of the equation $x^2+9x+33=0$, determine the value of $\frac{1}{\alpha}+\frac{1}{\beta}$

   $(a) \frac{-3}{11}$ (b) $\frac{2}{5}$ (c) $\frac{3}{4}$ (d) none of these

6. Find the sum of the squares of the roots of $2x^4+4x^3+8x^2+10x+12=0$

   (a)7 (b)-4 (c)6 (d)none of these

7. If α and β are the roots of the equation $x^2-12x+19=0$, Find the value of $\alpha(1-\alpha)+\beta(1-\beta)$

   $(a) -94$ (b) 90 (c) 54 (d)none of these

8. If α, β and γ are the roots of the equation $x^3+3x^2+4x+5=0$, Find the value of $\sum\frac{1}{\beta\gamma}$

   $(a) \frac{3}{5}$ (b) $\frac{-2}{5}$ (c) $\frac{4}{7}$ (d) $\frac{2}{9}$

9. Find a polynomial equation with roots 1,-2 and 3

   $(a) x^3-2x^2-5x+6=0$ (b) $x^3+2x^2-5x+6=0$ (c) $x^3+2x^2+5x+6=0$ (d)none of these

10. Find the monic polynomial of minimum degree with real coefficients having $2+i\sqrt{3}$ as a root

    $(a) x^2-4x+7=0$ (b) $2x^2-x+7=0$ (c) $x^2-x+7=0$ (d) $x^2+x+7=0$

11. The nature of the solution for the equation $x^2+2x-63=0$ is

(a)Two roots are real and different (b)Two roots are equal

(c)Two roots are nonreal (d)none of these

12. The polynomial x^3-kx^2+9x has three equal zeros if and only if k satisfies

$(a)|k|\le 6$ (b)k=0 (c)$|k|>6$ (d)$|k|\ge 6$

13. If the roots of the equation $x^3-6x^2-4x+24=0$ are in arithmetic progression then one of the roots is

$(a)2$ (b)4 (c)-4 (d)8

14. A polynomial P(x) of degree 'n' is said to be a reciprocal polynomial of Type-I if

$(a)P(x)=x^nP(x)$ (b)$P(x)=-x^nP(x)$ (c)$P(x)=x^nP\left(\frac{1}{x}\right)$ (d)$P(x)=-x^nP\left(\frac{1}{x}\right)$

15. Can a reciprocal equation have zero as solution?

(a) possible (b) not possible

16. What are solutions of even degree reciprocal equation of Type-II?

$(a)x=0, x=1$ $(b)x=1, x=-1$ $(c)x=1, x=\frac{1}{2}$ $(d)x=2, x=1$

17. One of the factors of the equation $7x^3-43x^2=43x-7$ is

$(a)x+1$ $(b)x-1$ $(c)\frac{1}{x}+1$ $(d)\frac{1}{x}-1$

18. The number of positive zeros of the polynomial $(x-1)^8$ is

$(a)n\le 8$ $(b)n=8$ $(c)n\ge 8$ $(d)n<8$

19. The number of imaginary roots of the polynomial $9x^9+2x^5-x^4-7x^2+2$ is

(a)*atleast*6 (b)*atmost* 6 (c)*exactly* 6 (d)none of these

20. How many negative zeros are possible for the equation $x^4-3x^3-17x^2+39x-21$

(a)3 or 1 (b)3 (c)1 (d)2 or 0

Answers

1(a)	2(a)	3(b)	4(b)	5(a)
6(b)	7(a)	8(a)	9(a)	10(a)
11(a)	12(d)	13(a)	14(c)	15(b)
16(b)	17(a)	18(a)	19(a)	20(c)

Chapter 4

Inverse Trigonometric Functions

1. Find the principal value of $\sin^{-1}\sin\left(\frac{2\pi}{3}\right)$

   (a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{3}$ (c) $\frac{-\pi}{3}$ (d) $\frac{\pi}{6}$

2. The Principal value of $\cos^{-1}\left(\frac{-1}{\sqrt{2}}\right)$ is

   (a) $\frac{-3\pi}{4}$ (b) $\frac{5\pi}{4}$ (c) $\frac{3\pi}{4}$ (d) $\frac{\pi}{6}$

3. Find $\cos^{-1}\left(\cos\left(\frac{\pi}{3}\right)\right)$

   (a) $\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{3\pi}{4}$ (d) $\frac{-\pi}{6}$

4. Find the value of $\tan^{-1}(-1)$

   (a) $\frac{\pi}{4}$ (b) $\frac{-2\pi}{3}$ (c) $\frac{-\pi}{4}$ (d) $\frac{\pi}{3}$

5. If $\sin^{-1}(x) = y$, then

   (a) $0 \le y \le \pi$ (b) $\frac{-\pi}{2} \le y \le \frac{\pi}{2}$ (c) $0 < y < \pi$ (d) $\frac{-\pi}{3} \le y \le \frac{3\pi}{2}$

6. Find the value of $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{1}{3}\right)$

   (a) $\tan^{-1}\left(\frac{7}{11}\right)$ (b) $\tan^{-1}\left(\frac{11}{7}\right)$ (c) $\tan^{-1}(3)$ (d) $\tan^{-1}(7)$

7. If $|x| < 1$, then $\sin(tan^{-1}x)$ is

   (a) $\frac{x}{\sqrt{1+x^2}}$ (b) $\frac{1}{\sqrt{1+x^2}}$ (c) $\sqrt{1+x^2}$ (d) $\frac{x^2}{\sqrt{1+x^2}}$

8. The value of $\sin^{-1}(\cos x)$ is

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

9. The domain of $f(x) = \sin^{-1}(\sqrt{x-1})$ is

   (a)[0,1] (b)[1,2] (c) [-1,1] (d)[-1,0]

10. If $\sin^{-1}x = \frac{\pi}{10}$ for some $x \in R$, then the value of $\cos^{-1}x$ is

(a) $\frac{2\pi}{5}$ (b) $\frac{\pi}{5}$ (c) $\frac{\pi}{4}$ (d) $\frac{2\pi}{3}$

11. The principal domain of *cosecant* function is

(a) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ (b) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] \setminus \{0\}$ (c) $\left[-\frac{\pi}{3}, \frac{\pi}{3}\right]$ (d) $\left[-\frac{\pi}{3}, \frac{\pi}{3}\right] \setminus \{0\}$

12. The principle value of $\operatorname{cosec}^{-1}(-1)$ is

(a) $-\frac{\pi}{2}$ (b) $\frac{\pi}{2}$ (c) $-\frac{\pi}{3}$ (d) $\frac{\pi}{3}$

13. The range of *secant* function is

(a) $(-\infty, 1) \cup (1, \infty)$ (b) $(-\infty, -1) \cup (1, \infty)$ (c) $(-\infty, -1] \cup [1, \infty)$

(d) $(-\infty, -1) \cup (-1, \infty)$

14. The principle value of $sec^{-1}(-2)$ is

(a) $-\frac{2\pi}{3}$ (b) $-\frac{3\pi}{2}$ (c) $\frac{3\pi}{2}$ (d) $\frac{2\pi}{3}$

15. The range of *cotangent* function is

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

16. If $\cot^{-1}\left(\frac{1}{7}\right) = \theta$ then the value of $\cos\theta$ is

(a) $\frac{1}{3\sqrt{2}}$ (b) $-\frac{1}{3\sqrt{2}}$ (c) $\frac{1}{5\sqrt{2}}$ (d) $-\frac{1}{5\sqrt{2}}$

17. The value of $\operatorname{cosec}^{-1}(x) + \sec^{-1}(x)$ for $x \in (-\infty, -1] \cup [1, \infty)$ is

(a) $\frac{\pi}{3}$ (b) $-\frac{\pi}{3}$ (c) $-\frac{\pi}{2}$ (d) $\frac{\pi}{2}$

18. The value of $\sec^{-1}\left(\sec\left(\frac{5\pi}{3}\right)\right)$ is

(a) $\frac{5\pi}{3}$ (b) $\frac{\pi}{3}$ (c) $-\frac{5\pi}{3}$ (d) $-\frac{\pi}{3}$

19. If $\tan^{-1}\left(\frac{2x}{3}\right) + \cot^{-1}\left(\frac{3}{2}\right) = \frac{\pi}{2}$, then the value of x is

(a) $\frac{9}{4}$ (b) $\frac{3}{2}$ (c) $\frac{2}{3}$ (d) 1

20. The value of $\cot^{-1}(-x) + \cot^{-1}(x)$ is

(a) 1 (b) 0 (c) π (d) $\frac{\pi}{2}$

Answers

1) b	2) c	3) a	4) c	5) b
6) a	7) a	8) c	9) b	10) a
11) b	12) a	13) c	14) d	15) a
16) c	17) d	18) b	19) a	20) c

Chapter 5

Two Dimensional Analytical Geometry-II

1. The equation $x^2+y^2+2gx+2fy+c=0$ is a real circle if
   (a) $g^2+f^2-c<0$ (b) $g^2+f^2-c>0$ (c) $g^2+f^2-c=0$
   (d) $g^2+f^2-c\neq 0$
2. The equation of the circle with centre (-3,-4) and radius 3 units is
   (a) $x^2+y^2+6x+8y+16=0$ (b) $x^2+y^2+6x+8y-16=0$
   (c) $x^2+y^2-6x-8y+16=0$ (d) $x^2+y^2-6x-8y-16=0$
3. The equation of the circle whose diameter is the line segment joining the points (-4, -2) and (1, 1) is
   (a) $x^2+y^2+3x+y+6=0$ (b) $x^2+y^2-3x-y+6=0$
   (c) $x^2+y^2+3x+y-6=0$ (d) $x^2+y^2-3x-y-6=0$
4. The position of the point (2, 3) with respect to the circle $x^2+y^2-6x-8y+12=0$ is
   (a) lies outside the circle (b) lies inside the circle
   (c) lies on the circle (d) centre of the circle
5. The equation of the tangent to the circle $x^2+y^2=25$ at P(-3, 4) is
   (a) $3x+4y=25$ (b) $3x-4y=25$ (c) $-3x-4y=25$ (d) $-3x+4y=25$
6. The equation of the tangent to the circle $x^2+y^2-2x-4y+3=0$ at the point (2, 3) is
   (a) $x+y-5=0$ (b) $-x+y-5=0$ (c) $x-y-5=0$ (d) $x+y+5=0$
7. The line $3x+4y-12=0$ meets the coordinate axes at A and B. The equation of the circle drawn AB as diameter is
   (a) $x^2+y^2-2x-4y=0$ (b) $x^2+y^2-4x-3y=0$
   (c) $x^2+y^2+2x+4y=0$ d) $x^2+y^2+4x+3y=0$
8. The set of values of 'a' for which $\frac{x^2}{10-a}+\frac{y^2}{a-11}=1$ represents an ellipse is
   (a) (10, 11) (b) $(-\infty,10)\cup(10,\infty)$ (c) no values of a (d) none of these
9. The length of latus rectum of the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ is
   (a) $\frac{8}{3}$ (b) $\frac{18}{3}$ (c) 9 (d) $\frac{8}{9}$
10. The equation of the ellipse with foci $(\pm 2,0)$, vertices $(\pm 3,0)$ is
    (a) $\frac{x^2}{9}+\frac{y^2}{4}=1$ (b) $\frac{x^2}{9}+\frac{y^2}{5}=1$ (c) $\frac{x^2}{3}+\frac{y^2}{4}=1$ (d) $\frac{x^2}{3}+\frac{y^2}{2}=1$
11. The equation of the parabola whose vertex is (5, -2) and focus (2, -2) is
    (a) $y^2+4y+12x+56=0$ (b) $y^2+4y-12x+56=0$
    (c) $y^2-4y+12x+56=0$ (d) $y^2+4y+12x-56=0$
12. The equation of the parabola with focus $(-\sqrt{2},0)$ and directrix $x=\sqrt{2}$ is
    (a) $y^2=-4\sqrt{2}x$ (b) $x^2=-4\sqrt{2}y$ (c) $y^2=4\sqrt{2}x$ (d) $x^2=4\sqrt{2}y$
13. The equation of the tangent to the parabola $y^2=16x$ at the point (2, 3) is
    (a) $3y=16(x+2)$ (b) $2y=16(x+3)$ (c) $2y=4(x+3)$ (d) $3y=8(x+2)$
14. The type of the conic $4x^2-9y^2-16x+18y-29=0$ is
    (a) Ellipse (b) Circle (c) Hyperbola (d) Parabola

15. The parametric equations of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is

(a) $x=a\cos\theta,\ y=a\sin\theta$ (b) $x=a\sec\theta,\ y=b\tan\theta$

(c) $x=a\cos\theta,\ y=b\sin\theta$ (d) $x=a\sec\theta,\ y=a\tan\theta$

16. The equation of the hyperbola with vertices $(0,\pm4)$ and foci $(0,\pm6)$ is

(a) $\frac{x^2}{20}-\frac{y^2}{16}=1$ (b) $\frac{x^2}{16}-\frac{y^2}{20}=1$ (c) $\frac{y^2}{20}-\frac{x^2}{16}=1$ (d) $\frac{y^2}{16}-\frac{x^2}{20}=1$

17. The vertices of the hyperbola $9x^2-16y^2=144$ are

(a) (-4,0) and (4,0) (b) (-5,0) and (5,0) (c) (4,0) and (3,0)
(d) (16,0) and (9,0)

18. The equation of the normal to the parabola $y^2=4ax$ at the point (x_1,y_1) is

(a) $xy_1+2ay=x_1y+2ay_1$ (b) $xy_1+2ay=x_1y_1+2ay_1$

(c) $xy_1+2ay=x_1y+2ax_1$ (d) $xy_1+2ay_1=x_1y+2ay$

19. The maximum and minimum distances of the Earth from the Sun respectively are 152×10^6 km and 94.5×10^6 km. The Sun is at one focus of the elliptical orbit. Find The distance from the Sun to the other focus

(a) 152×10^6 km (b) 94×10^6 km (c) 246.5×10^6 km (d) 575×10^5 km

20. A search light has a parabolic reflector (has a cross section that forms a 'bowl'). The Parabolic bowl is 40*cm* wide from rim to rim and 30*cm* deep. The bulb is located at the focus . What is the equation of the parabola used for reflector?

(a) $y^2=40x$ (b) $y^2=\frac{20}{3}x$ (c) $y^2=\frac{40}{3}x$ (d) $y^2=\frac{10}{3}x$

Answers

1) b	2) a	3) c	4) b	5) d
6) a	7) b	8) c	9) a	10) b
11) d	12) a	13) d	14) c	15) b
16) d	17) a	18) b	19) d	20) c

Chapter 6

Applications of Vector Algebra

1. A particle acted upon by two constant forces $2\vec{i}+5\vec{j}+6\vec{k}$ and $-\vec{i}-2\vec{j}-\vec{k}$ is displaced from the point $(4,-3,-2)$ and $(6,1,-3)$. What is the total work done by the forces?

(a) 5 Units (b) 9 Units (c) 6 Units (d) 7 Units

2. A particle acted upon by two constant forces $3\vec{i}-2\vec{j}+2\vec{k}$ and $2\vec{i}+\vec{j}-\vec{k}$ is displaced from the point $(1,3,-1)$ and $(4,-1,\lambda)$. If the work done by the forces is 16 units, then what is the value of λ?

(a) 4 (b) 16 (c) – 4 (d) – 16

3. What is the magnitude of the torque about the point $(2,0,-1)$ of the force $2\vec{i}+\vec{j}-\vec{k}$, whose line of action passes through the origin?

(a) $\sqrt{5}$ (b) $\sqrt{6}$ (c) 5 (d) 2

4. The scalar triple product of three non-zero vectors is zero if and only if the three vectors are _______________

(a) Coplanar (b) Collinear
(c) Perpendicular to each other (d) Parallel

5. The volume of the parallelepiped whose coterminous edges are represented by the vectors $2\vec{i}-3\vec{j}+4\vec{k}, \vec{i}+2\vec{j}-\vec{k}$ and $3\vec{i}-\vec{j}+2\vec{k}$ is

(a) 5 cubic units (b) 9 cubic units (c) 6 cubic units (d) 7 cubic units

6. If $2\vec{i}-\vec{j}+3\vec{k}, 3\vec{i}+2\vec{j}+\vec{k}, 3\vec{i}+m\vec{j}+4\vec{k}$ are coplanar, then what is the value of m?

(a) 5 (b) – 4 (c) – 3 (d) 4

7. If $\vec{a},\vec{b},\vec{c}$ are three non-coplanar vectors represented by concurrent edges of a parallelepiped of volume 4 cubic units, then the value of $(\vec{a}+\vec{b}).(\vec{b}\times\vec{c})+(\vec{b}+\vec{c}).(\vec{c}\times\vec{a})+(\vec{c}+\vec{a}).(\vec{a}\times\vec{b})$ is equal to

(a) ±16 (b) ±12 (c) ±20 (d) ±9

8. If $\vec{a}=\vec{i}+\vec{j}+\vec{k}, \vec{b}=\vec{i}+2\vec{j}+2\vec{k}, \vec{c}=\vec{i}+2\vec{j}+3\vec{k}$, then $[\vec{a}\times\vec{b}, \vec{b}\times\vec{c}, \vec{c}\times\vec{a}]$ is equal to

(a) 1 (b) 81 (c) 16 (d) 125

9. If $\vec{a}=-2\vec{i}+3\vec{j}-2\vec{k}, \vec{b}=3\vec{i}-\vec{j}+3\vec{k}, \vec{c}=2\vec{i}-5\vec{j}+\vec{k}$, then $\left(\vec{a}\times\vec{b}\right)\times\vec{c}$ is equal to

(a) $7\vec{i}-7\vec{k}$ (b) $14\vec{i}+3\vec{j}-13\vec{k}$
(c) $-33\vec{i}-54\vec{j}-48\vec{k}$ (d) $-35\vec{i}-21\vec{j}-35\vec{k}$

10. If $\vec{a}, \vec{b}, \vec{c}$ are three-unit vectors such that $\vec{b}$ and $\vec{c}$ are non-parallel and $\vec{a}\times(\vec{b}\times\vec{c}) = \frac{1}{2}\vec{b}$, then the angle between $\vec{a}$ and $\vec{c}$ is

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) π

11. What is the Cartesian equation of the line passing through the point $(-2,3,4)$ and is parallel to the line $\frac{x-2}{-4} = \frac{y+3}{5} = \frac{8-z}{6}$?

(a) $\frac{x-2}{-2} = \frac{y+3}{3} = \frac{8-z}{4}$ (b) $\frac{x-2}{-4} = \frac{y+3}{5} = \frac{8-z}{-6}$

(c) $\frac{x+2}{-4} = \frac{y-3}{5} = \frac{z-4}{-6}$ (d) $\frac{x+2}{-4} = \frac{y-3}{5} = \frac{z-4}{-6}$

12. The Cartesian equations of a straight line passing through the points $(-5,7,-4)$ and $(13,-5,2)$ is

(a) $\frac{x+5}{3} = \frac{y-7}{-2} = \frac{z+4}{1}$ (b) $\frac{x+5}{13} = \frac{y-7}{-5} = \frac{z+4}{2}$

(c) $\frac{x-13}{-5} = \frac{y+5}{7} = \frac{z-2}{-4}$ (d) $\frac{x-13}{10} = \frac{y+5}{-3} = \frac{z-2}{1}$

13. If the straight lines $\frac{x-5}{5m+2} = \frac{2-y}{5} = \frac{1-z}{-1}$ and $x = \frac{2y+1}{4m} = \frac{1-z}{-3}$ are perpendicular to each other, then the value of m is

(a) 4 (b) 5 (c) 1 (d) –1

14. The shortest distance between the straight lines $\vec{r} = \left(2\vec{i}+3\vec{j}+4\vec{k}\right) + t\left(-2\vec{i}+\vec{j}-2\vec{k}\right)$ and $\frac{x-3}{2} = \frac{y}{-1} = \frac{z+2}{2}$ is

(a) $\frac{\sqrt{365}}{3}$ (b) $\frac{\sqrt{365}}{6}$ (c) $\frac{\sqrt{365}}{9}$ (d) $\frac{\sqrt{365}}{12}$

15. The equation of the plane which is a distance of 12 units from the origin and perpendicular to the vector $6\vec{i}+2\vec{j}-3\vec{k}$ is

(a) $6x+2y-3z=12$ (b) $6x+2y-3z=7$

(c) $6x+2y-3z=84$ (d) $6x+2y-3z=5$

16. The equation of the plane passing through the point with position vector $4\vec{i}+2\vec{j}-3\vec{k}$ and normal to vector $2\vec{i}-\vec{j}+\vec{k}$ is

(a) $\vec{r}.\left(4\vec{i}+2\vec{j}-3\vec{k}\right)=3$ (b) $\vec{r}.\left(2\vec{i}-\vec{j}+\vec{k}\right)=8$

(c) $\vec{r}.\left(4\vec{i}+2\vec{j}-3\vec{k}\right)=8$ (d) $\vec{r}.\left(2\vec{i}-\vec{j}+\vec{k}\right)=3$

17. If the two straight lines $\frac{x-1}{2}=\frac{y+1}{\lambda}=\frac{z}{2}$ and $\frac{x+1}{5}=\frac{y+1}{2}=\frac{z}{\lambda}$ are coplanar, then the value of λ is

(a) ± 3 (b) ± 2 (c) ± 4 (d) ± 9

18. The perpendicular distance from the origin to the plane $2x+4y+6z+7=0$ is

(a) $\frac{7}{\sqrt{56}}$ (b) $\frac{7}{\sqrt{12}}$ (c) $\frac{12}{\sqrt{7}}$ (d) $\frac{56}{\sqrt{7}}$

19. The distance between the planes $x+2y-2z+1=0$ and $2x+4y-4z+5=0$ is

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{7}{2}$ (c) $\frac{1}{2}$ (d) $\frac{\sqrt{7}}{2}$

20. The condition for two planes $a_1x+b_1y+c_1z+d_1=0$ and $a_2x+b_2y+c_2z+d_2=0$ to be perpendicular is

(a) $a_1a_2+b_1b_2+c_1c_2=-1$ (b) $a_1a_2+b_1b_2+c_1c_2=0$

(c) $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$ (d) $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}=\frac{d_1}{d_2}$

Answers

1) b	2) c	3) a	4) a	5) d
6) c	7) b	8) a	9) d	10) b
11) c	12) a	13) c	14) a	15) c
16) d	17) b	18) a	19) c	20) b

Chapter 7

Applications of Differential calculus

1. If the given function $f(x)$ is defined on $[1,5]$ then what is the average rate of change?

(a) $\frac{f(5)-f(1)}{4}$ (b) $\frac{f(4)}{4}$ (c) $\frac{f(5)-f(1)}{5}$ (d) $\frac{f(1)-f(5)}{4}$

2. If the given function is $f(x)=5x^2$. Then what is instantaneous rate of change?

(a) $10x^2$ (b) $2x$ (c) $10x$ (d) 6

3. Find the equation of the tangent to the curve $y=x$ at $(1,10)$

(a) $y=x+9$ (b) $y=x-9$ (c) $10y=x$ (d) $x+10y=0$

4. Find the points on the curve $y=x^2$ at which tangent parallel to the line $y=x+5$?

(a) $\left(\frac{1}{2},-\frac{1}{4}\right)$ (b) $\left(-\frac{1}{2},\frac{1}{4}\right)$ (c) $\left(-\frac{1}{2},-\frac{1}{4}\right)$ (d) $\left(\frac{1}{2},\frac{1}{4}\right)$

5. Find the angle between the curves $y=\sqrt{x}$ and $y^2=4x.$

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) 0

6. If $f(x)=(x-3)(x+1)^2, x\in[-1,3].$ then find the value of c which is guaranteed by Rolle's theorem.

(a) -1 (b) 3 (c) $\frac{5}{3}$ (d) $\frac{3}{5}$

7. If $f(x)=(x-3)(x+1), x\in[-1,3].$ then find the value of c which is guaranteed by Mean value theorem

(a) 1 (b) -3 (c) $\frac{5}{3}$ (d) $\frac{3}{5}$

8. True or False? If the graph of a differentiable function has three x – intercepts, then it must have at least two points at which its tangent line is horizontal.

I. True because of Rolle's Theorem.
II. False because Rolle's Theorem only applies if a function is continuous.
III. False because it could be continuous but not differentiable on the interval between Zeros.

(a) I only (b) II only (c) III only (d) II and III only

9. If $f'(x) \geq 20$ and $f(1) = 5$. What is the minimum value of $f(6)$?

(a) 20 (b) 105 (c) 5 (d) 6

10. Pick the wrong statement(s)

i) $-1 \leq \dfrac{\sin x - \sin y}{x - y} \leq 1$

ii) $-1 \leq \dfrac{\cos x - \cos y}{x - y} \leq 1$

(a) i only (b) ii only (c) both i and ii (d) none of the above

11. Write the Maculaurin series expansion of e^x.

(a) $\sum_{n=0}^{\infty} \dfrac{x^n}{n!}$ (b) $\sum_{n=1}^{\infty} \dfrac{x^n}{n!}$ (c) $\sum_{n=0}^{\infty} \dfrac{(-1)^n x^n}{n!}$ (d) $\sum_{n=1}^{\infty} \dfrac{(-1)^n x^n}{n!}$

12. What is the linear approximation of Taylor's series of $\dfrac{1}{x}$ about $x = 2$?

(a) $\dfrac{1}{2} + \dfrac{x-2}{4}$ (b) $\dfrac{1}{2} - \dfrac{x-2}{4}$ (c) $-\dfrac{1}{2} - \dfrac{x-2}{4}$ (d) $-\dfrac{1}{2} - \dfrac{x-2}{4}$

13.Compute $\lim_{x \to 1} \left(\dfrac{x^{100} - 1}{x - 1} \right)$.

(a) 100 (b) 99 (c) 0 (d) ∞

14. Find $\lim_{x \to \infty} (1 + 2x)^{\frac{1}{2 \log x}}$.

(a) e (b) e^2 (c) $\sqrt{e}$ (d) $\dfrac{1}{e}$

15. If $f(x) = x^2$. Then

(a) f is monotonically increasing (b) f is monotonically decreasing

(c) neither increasing nor decreasing (d) none of the above

16. If the given real function is constant. Then Stationary points are

(a) R (b) Z (c) N (d) Q

17. Determine the intervals of concave up of $f(x) = x^2$.

(a) R (b) Z (c) N (d) Q

18. If $f(x) = -x^{100} y$. Then

(a) f is symmetric about x axis (b) f is symmetric about y axis (c) f is symmetric about origin (d) None of the above

19. The vertical asymptote of $\dfrac{1}{x-1}$ is

(a) $x = -1$ (b) $x = 1$ (c) $y = 1$ (d) $y = -1$

20. Find the slant (oblique) asymptote for the function $f(x)=\dfrac{x^2-2x+5}{x+3}$.

(a) $y=x+5$ (b) $x=y$ (c) $y=x^2$ (d) $y=x-5$

Answers

1) a	2) b	3) a	4) d	5) d
6) c	7) a	8) a	9) b	10) d
11) a	12) b	13) a	14) c	15) a
16) a	17) a	18) b	19) a	20) d

Chapter 8

Differentials and Partial Derivatives

1. If $f(x)$ is the linear approximation of $\sin x$ at $x=0$, Then find the value $f\left(\frac{\pi}{2}\right)$.

(a) $-\frac{\pi}{2}$ (b) $\frac{\pi}{2}$ (c) 0 (d) -1

2. What is meant by relative error?

a) $\frac{approximatevalue - actualvalue}{actualvalue}$ b) $\frac{approximatevalue + actualvalue}{actualvalue}$

c) $\frac{actualvalue - approximatevalue}{actualvalue}$ d) $\frac{actualvalue - approximatevalue}{approximatevalue}$

3. Find the approximate value of $\sqrt[3]{26}$ by linear approximation.

(a) 2.963 (b) 1.963 (c) 0.963 (d) 3.963

4. If $f(x) = x + \cos x$. Then find the value of $df = ?$

(a) $1+\sin x$ (b) $x-\cos x$ (c) $(1-\sin x)dx$ (d) $1-\sin x$

5. If the radius of a sphere, with radius 10cm, has increased by 0.1cm, approximately how much will its volume increase?

(a) $40\pi cm^3$ (b) $-40\pi cm^3$ (c) $41\pi cm^3$ (d) $-41\pi cm^3$

6. If $g(x) = e^{f(x)}$. Then $\text{dg} = ?$

(a) $e^{f(x)}dx$ (b) $e^{f(x)} f'(x)dx$ (c) $e^{f^1(x)}dx$ (d) $f'(x)dx$

7. If $f =$ identity function. Then $df = ?$

(a) dx (b) $f(x)dx$ (c) xdx (d) $2dx$

8. The percentage error in $\sqrt[n]{x}$ is approximately equals to.

(a) x times percentage error in the number (b) 2 times percentage error in the number

(c) n times percentage error in the number (d) $\frac{1}{n}$ times percentage error in the number

9. If $f(x) = \log(x^2+1)$ then differential is

(a) e^{x^2} (b) e^{x^2+1} (c) $df = \frac{2x}{x^2+1}dx$ (d) $df = -\frac{2x}{x^2+1}dx$

10. Find Δf for the function $f(x) = x^3 - 2x^2$ for the value $x = 2, \Delta x = 0.5$.

(a) 3.125 (b) 2.125 (c) -3.125 (d) 0.125

11. If $f(x,y) = \sin(xy^2) + e^{x^3+5y}$. Calculate $\frac{\partial f}{\partial x}$.

(a) $\cos(xy^2)y^2 + e^{x^3+5y}3x^2$ (b) $\cos(xy^2)y^2 - e^{x^3+5y}3x^2$
(c) $\sin(xy^2)y^2 + e^{x^3+5y}3x^2$ (d) $\cos(xy^2)y^2 + e^{x^3+5y}$

12. If $f(x,y)$ is harmonic then

(a) $f_{xx} - f_{xy} = 0$ (b) $f_{xx} + f_{yy} = 0$ (c) $f_{xx} + f_{xy} = 0$ (d) $f_{xx} + f_{yy} = 1$

13. If $w(x,y,z) = xyz, x, y, z \in R$, find the differential dw.

(a) $yzdx - xzdy - xydx$ (b) $yzdx + xzdy + xydx$
(c) $yzdx - xzdy + xydx$ (d) $yzdx + xzdy - xydx$

14. If $f(x,y) = \frac{\sqrt{x} + \sqrt{y}}{x+y}$. Then f is a homogenous function of degree

(a) $\frac{1}{2}$ (b) 1 (c) $\sqrt{2}$ (d) 0

15. If $u = \cos^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = ?$

(a) $\cos u$ (b) $\sin u$ (c) $\frac{1}{2}\tan u$ (d) $-\frac{1}{2}\cot u$

16. If $v = \log\left(\frac{x^2+y^2}{x+y}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = ?$

(a) 1 (b) v (c) $\log v$ (d) 0

17. If $v = \log(e^x + e^y)$, then $\frac{\partial v}{\partial x} + \frac{\partial v}{\partial y} = ?$

(a) v (b) 1 (c) $\log v$ (d) 0

18. Evaluate $\underset{\substack{x\to 1 \\ y\to 2}}{Lt} \frac{3x^2 y}{x^2 + y^2 + 5}$.

(a) $\left(\frac{1}{4}\right)^8$ (b) $\frac{3}{5}$ (c) $\left(\frac{3}{4}\right)^2$ (d) $\left(\frac{3}{4}\right)^8$

19. If $f(x,y) = x + y$ and $x = e^t, y = e^{-t}$. Find $\frac{df}{dt}$

(a) $e^t + e^{-t}$ (b) $-e^t - e^{-t}$ (c) $e^t - e^{-t}$ (d) e^t

20. Find the linear approximation of $e^x \cos y$ about $\left(0, \frac{\pi}{2}\right)$.

(a) $1+x+y$ (b) $1+x$ (c) $1-x$ (d) $1+y$

Answers

1) a	2) c	3) a	4) c	5) a
6) b	7) a	8) d	9) c	10) a
11) a	12) b	13) b	14) a	15) d
16) a	17) b	18) b	19) c	20) b

Chapter 9

Applications of Integration

1. Estimate the value $\int_0^{0.5} x^2 dx$ using the Riemann sums corresponding to 5 sub intervals of equal width and applying left end rule.

   (a) 0.03 (b) 0.02 (c) 0.01 (d) 0.05

2. Find an approximate value of $\int_1^{1.5}(2-x)dx$ by applying the mid-point rule with the partition {1.1,1.2,1.3,1.4,1.5} .

   (a) 3.75 (b) 0.375 (c) 37.5 (d) 0.0375

3. Evaluate $\int_0^1 [2x]dx$ where [.] is the greatest integer function.

   (a) 2.5 (b) 1.5 (c) 2 (d) 0.5

4. Evaluate $\int_0^9 \frac{1}{x+\sqrt{x}} dx$

   (a) log 9 (b) log 4 (c) 2 log 4 (d) log 3

5. Equal form of $\int_0^a [f(x)+f(2a-x)]dx$ is

   (a) $\int_0^{2a} f(x)dx$ (b) $\int_0^a f(x)dx$ (c) $2\int_0^a f(x)dx$ (d) 0

6. Find the value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} xcosx\ dx$.

   (a) $\pi/2$ (b) $2\int_0^{\frac{\pi}{2}} xcosx\ dx$ (c) 0 (d) π

7. Evaluate $\int_0^a \frac{f(x)}{f(x)+f(a-x)} dx$

   (a) a (b) $\frac{a}{2}$ (c) 0 (d) 1

8. Evaluate $\int_0^{\frac{\pi}{4}} \log(1+tanx)\ dx$

   (a) $\frac{\pi}{8}$ (b) $\frac{\pi log2}{8}$ (c) $\frac{log2}{8}$ (d) $\pi log2$

9. Evaluate $\int_0^1 e^{2x}(1+x-2x^3)dx$

   (a) $3.5\ e^{-2}$ (b) e^2 (c) e^{-2} (d) $7e^2$

10. Evaluate $\int logx\ dx$

    (a) $logx + c$ (b) $xlogx + c$ (c) $\frac{1}{x} + c$ (d) $x(logx-1)+c$

11. Evaluate $\int_0^{\frac{\pi}{2}} \sin^2 x\ dx$

    (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) $\frac{3\pi}{2}$ (d) π

12. Evaluate $\int_0^{\frac{\pi}{2}} \sin^5 x\ \cos^4 x\ dx$

    (a) $\frac{315}{8}$ (b) $\frac{8}{315}$ (c) $\frac{8\pi}{315}$ (d) $\frac{315\pi}{8}$

13. By using the reduction formula find the value of $\int_0^1 x^m(1-x)^n dx$

(a) $\frac{m!\ n!}{(m+n)!}$ (b) $\frac{(m+n+1)!}{m!\ n!}$ (c) $\frac{(m+n)!}{m!\ n!}$ (d) $\frac{m!\ n!}{(m+n+1)!}$

14. Evaluate the integral $\int_0^\infty e^{-x}x^3 dx$

(a) 0 (b) 3 (c) ∞ (d) 6

15. The area of the region bounded by the line $6x+5y=30$, $x-$ axis and the lines $x=-1$ and $x=3$ is___ .

(a) 96 (b) 19 (c) 19.2 (d) 30

16. The area of the region bounded between the parabola $y^2=4ax$ and its latus rectum is ___ .

(a) $\frac{3a^2}{8}$ (b) $\frac{8a^2}{3}$ (c) $\frac{\pi a^2}{3}$ (d) $\frac{4\pi a^2}{3}$

17. Which one of the following is the formula to find the area of the region bounded between the parabolas $y^2=4x$ and $x^2=4y$.

(a) $\int_0^4 \left(2\sqrt{x}-\frac{x^2}{4}\right)dx$ (b) $\int_0^2 \left(2\sqrt{x}-\frac{x^2}{4}\right)dx$

(c) $\int_0^4 \left(\frac{x^2}{4}-\sqrt{x}\right)dx$ (d) $\int_0^4 \left(2\sqrt{x}+\frac{x^2}{4}\right)dx$

18. The area bounded between the parabola $x^2=y$ and the curve $y=|x|$.

(a) $\frac{1}{3}$ (b) $\frac{1}{6}$ (c) $\frac{2}{3}$ (d) $\frac{4}{3}$

19. Which one of the following is the formula to find the volume of the sphere of radius a.

(a) $\int_{-a}^{a}(a^2-x^2)dx$ (b) $\int_0^a \pi(a^2-x^2)dx$

(c) $\int_{-a}^{a}\pi(a^2-x^2)dx$ (d) $\int_0^a (a^2-x^2)dx$

20. The volume of the solid generated by revolving about $y-$axis the region bounded by the curve $y=logx$, $y=0, x=0$ and $y=2$.

(a) $\frac{\pi(e-1)}{2}$ (b) $\frac{\pi(e^4-1)}{4}$ (c) $\frac{\pi(e^2-1)}{2}$ (d) $\frac{\pi(e^4-1)}{2}$

Answers

1) a	2) b	3) d	4) c	5) a
6) c	7) b	8) b	9) a	10) d
11) b	12) b	13) d	14) d	15) c
16) b	17) a	18) a	19) c	20) d

Chapter 10

Ordinary Differential Equations

1. What is the order of the differential equation $\left(\frac{d^3y}{dx^3}\right)^{\frac{2}{3}} - 3\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 4 = 0$.

    (a) 3 (b) 2 (c) 1 (d) 2/3

2. What is the degree of the differential equation $3y^2\left(\frac{dy}{dx}\right)^3 - \frac{d^2y}{dx^2} = \sin x^2$

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

3. What is the degree of the equation $e^{\frac{d^2y}{dx^2}} + \sin x\,\frac{dy}{dx} = 2$.

    (a) 0 (b) 1 (c) 2 (d) Not defined

4. From the following choose the non-linear differential equation

    (a) $y'' + y = \sin x$ (b) $y'' = y\sin x$
    (c) $y\frac{dy}{dx} + \sin x = 0$ (d) $y''' + y' = e^x$

5. From the following choose the linear differential equation

    (a) $y'' + y' + xy = e^x$ (b) $yy' = \cos x$
    (c) $y''' + yy'' = 0$ (d) $y'' + y^2 = \sin x$

6. What is the differential equation of the family of parabolas $y^2 = 4ax$.

    (a) $\frac{dy}{dx} = \frac{2y}{x}$ (b) $\frac{dy}{dx} = \frac{x}{2y}$ (c) $\frac{dy}{dx} = \frac{y}{2x}$ (d) $\frac{dy}{dx} = \frac{y}{x}$

7. Choose the differential equation which corresponds to the equation $y = A\cos x + B\sin x$

    (a) $y'' - y = 0$ (b) $y'' + y = 0$ (c) $2y' + y = 3$ (d) $y'' + y' = y$

8. From the following, which is not a solution of the equation $\frac{dy}{dx} = 2y$

    (a) $y = 8e^{2x}$ (b) $y = e^x + x$ (c) $y = 2e^{2x}$ (d) $y = \sqrt{2}\,e^{2x}$

9. Find the solution of the differential equation $\frac{dy}{dx} = -\frac{x}{y}$

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

10. Choose the solution of the differential equation $(1 + x^2)\frac{dy}{dx} = 1 + y^2$

    (a) $y^2 = x$ (b) $x + y = 1$ (c) $xy = 1$ (d) $y - x = a(1 + xy)$

11. From the following find out which is NOT a solution of $\frac{d^2y}{dx^2} + b^2y = 0$.

    (a) $2\cos bx$ (b) e^{bx} (c) $5\sin bx$ (d) e^{ibx}

12. Find the value of m so that the function $y = e^{mx}$ is a solution of $y' + 2y = 0$.

    (a) 2 (b) -2 (c) 1 (d) -1

13. Choose the solution of the differential equation $y' = \sin^2(x - y + 1)$

(a) $\sin(x - y + 1) = x$ (b) $\sin(x - y + 1) = 0$

(c) $\cos(x - y + 1) = 0$ (d) $\tan(x - y + 1) = x$

14. From the following, find out the homogeneous equation

(a) $f(x, y) = x + y^2$ (b) $f(x, y) = x^2y + xy^2 + y$

(c) $f(x, y) = \cos x + y\, sin\, x$ (d) $f(x, y) = x^2 + 6xy + 8y^2$

15. From the following, find out the non-homogeneous equation

(a) $f(x, y) = x^2 + y^2$ (b) $f(x, y) = x^2 + 6xy + 8y^2$

(c) $f(x, y) = x^2y + xy^2 + y$ (d) $f(x, y) = xy(x + y)$

16. Find the solution of the equation $y^2 + x^2 \frac{dy}{dx} = xy \frac{dy}{dx}$

(a) $y = \cos x$ (b) $y = ke^{y/x}$ (c)$y = Ae^x + Be^y$ (d) $y = Ae^x + Be^{2x}$

17. Which one of the following is the Integrating factor for the differential equation $\frac{dy}{dx} + Py = Q$.

(a) $e^{\int Pdx}$ (b) $\int e^{\int Pdx} Q\, dx$ (c) $e^{\int Qdx}$ (d) PQ

18. What is the integrating factor of the equation $\frac{dy}{dx} + 2y = e^{-x}$.

(a) e^{2x} (b) e^{-x} (c) e^x (d) ye^{2x}

19. What is the integrating factor of the equation $\frac{dx}{dy} + 2yx = e^y$.

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

20. The growth of a population is proportional to the number present. If the population of a colony doubles in 50 years, in how many years will the population become triple?

(a) 50 (b) $50(\log 2)$ (c) $50(\log 3)$ (d) $50\left(\frac{\log 3}{\log 2}\right)$

Answers

1) a	2) b	3) d	4) c	5) a
6) c	7) b	8) b	9) a	10) d
11) b	12) b	13) d	14) d	15) c
16) b	17) a	18) a	19) c	20) d

Chapter 11

Probability Distributions

1. Suppose two coins are tossed once. If X denotes the number of tails. The inverse image of 1, $X^{-1}(1)$ is

(a) $\{TT, HH\}$ (b) $\{TH, HT\}$ (c) $\{TH, HH\}$ (d) $\{TT, HT\}$

2. Suppose a pair of unbiased dice is rolled once. If X denotes the total score of two dice, then the number of elements in the inverse image of 6 is

(a) 3 (b) 4 (c) 5 (d) 6

3. The value of total probability $\sum_k f(x_k)$ is

(a) 0 (b) 1 (c) 2 (d) ∞

4. If the probability mass function $f(x)$ of random variable X is

x	1	2	3	4
$f(x)$	$\frac{1}{12}$	$\frac{5}{12}$	$\frac{5}{12}$	$\frac{1}{12}$

The value of $P(X \leq 3)$ is

(a) $\frac{1}{12}$ (b) $\frac{5}{12}$ (c) $\frac{6}{12}$ (d) $\frac{11}{12}$

5. A six sided die is marked '1' on one face, '2' on two of its faces and '3' on remaining three faces. The die is rolled twice. If X denotes the total score in two throws. The value of $P(3 \leq X < 6)$ is

(a) $\frac{1}{36}$ (b) $\frac{3}{36}$ (c) $\frac{16}{36}$ (d) $\frac{26}{36}$

6. Suppose a discrete random variable can only take the values 0, 1, and 2. The probability mass function is defined by $f(x) = \begin{cases} \frac{x^2+1}{k}, & for\ x = 0, 1, 2 \\ 0, & otherwise \end{cases}$

The value of k is

(a) 8 (b) 10 (c) 12 (d) 15

7. The value of $\int_a^a f(x)\, dx$ is

(a) 0 (b) 1 (c) a (d) $2a$

8. Find the constant C such that the function $f(x) = \begin{cases} Cx^2, & 1 < x < 4 \\ 0, & otherwise \end{cases}$ is a density function.

(a) $\frac{4}{21}$ (b) $\frac{5}{21}$ (c) $\frac{1}{21}$ (d) $\frac{2}{21}$

9. The probability density function of random variable X is given by $f(x) = \begin{cases} k, & 1 \leq x \leq 5 \\ 0, & otherwise \end{cases}$

Find $P(X < 3)$

(a) 0 (b) $\frac{1}{2}$ (c) 1 (d) 3

10. The average of ten numbers $6, 2, 5, 5, 2, 6, 2, -4, 1, 5$ is

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

11. The value of $E(1)$

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

12. Square root of variance is called

(a) mean (b) expectation (c) standard deviation (d) moment

13. The value of V(b), where b is constant.

(a) 0 (b) 1 (c) b (d) b^2

14. Find the mean of a random variable X, whose probability density function is

$f(x) = \begin{cases} \lambda e^{-\lambda x}, & for\ x \geq 0 \\ 0, & otherwise \end{cases}$

(a) 0 (b) 1 (c) λ (d) $\frac{1}{\lambda}$

15. The random variable X has a one point distribution if there exists a point x_0 such that, the probability mass function $f(x)$ is defined as $f(x) = P(X = x_0) = 1$. The mean of one point distribution is

(a) 0 (b) 1 (c) x_0 (d) x

16. If X is a Bernoulli's random variable which follows Bernoulli distribution with parameter p, the variance is

(a) p (b) pq (c) q (d) 1

17. If X is a binomial random variable which follows binomial distribution with parameters p and n, the mean is

(a) p (b) n (c) np (d) npq

18. The mean and variance of a binomial variate X are respectively 2 and 1.5. Find $P(X = 0)$

(a) $\left(\frac{1}{4}\right)^8$ (b) $\left(\frac{1}{4}\right)^2$ (c) $\left(\frac{3}{4}\right)^2$ (d) $\left(\frac{3}{4}\right)^8$

19. If X is a binomial random variable which follows binomial distribution with parameters p and n, the standard deviation is

(a) $\sqrt{np}$ (b) $\sqrt{np(1-p)}$ (c) $\sqrt{p(1-p)}$ (d) $\sqrt{n(1-p)}$

20. If $X \sim B(n, p)$ such that $4P(X = 4) = P(X = 2)$ and $n = 6$, the value of p is

(a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{6}$

Answers

1) b	2) c	3) b	4) d	5) d
6) a	7) a	8) c	9) b	10) d
11) b	12) c	13) a	14) d	15) c
16) b	17) c	18) d	19) b	20) c

Chapter 12

Discrete Mathematics

1. The operation '+' which is binary operation on

(a) $\mathbb{Q}$ (b) $\mathbb{Q} - \{0\}$ (c) $\mathbb{R} - \{0\}$ (d) $\mathbb{C} - \{0\}$

2. The multiplicative identity of $\mathbb{Z}$ is

(a) 0 (b) 1 (c) -1 (d) 2

3. If $a * b = a^b$ on $\mathbb{N}$, then '$*$' is

(a) commutative but not associative (b) associative but not commutative
(c) binary operation (d) associative

4. A Boolean Matrix is a real matrix whose entries are

(a) either 0 or 1 (b) either 2 or 3 (c) either 3 or 4 (d) either 5 or 6

5. Let $A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ be any two boolean matrices of the same type. $A \vee B$ is

(a) $\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$

6. Let $A = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ be any two boolean matrices of the same type. $A \wedge B$ is

(a) $\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$

7. The inverse of 3 in $\mathbb{Z}_5$ for the operation $+_5$ is

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

8. Let $*$ be defined on $\mathbb{R}$ by $a * b = a + b + ab - 7$. The value of $3 * \left(\frac{-7}{15}\right)$ is

(a) 0 (b) 3 (c) $\frac{-7}{15}$ (d) $\frac{-88}{15}$

9. Define an operation$*$ on $\mathbb{Q}$ as follows: $a * b = \left(\frac{a+b}{2}\right)$; $a, b \in \mathbb{Q}$. The identity element is

(a) not exist (b) $\frac{1}{2}$ (c) 1 (d) 0

10. Identify the valid statements from the following sentences.

(a) 3 + 4 = 8 (b) 7 + 5 > 10 (c) 7 + 5 < 10 (d) 3 + 4 > 8

11. How beautiful this flower is! This sentence is

(a) paradox (b) command (c) exclamatory (d) question

12. This is the beginning of the end. This sentence is

(a) paradox (b) command (c) exclamatory (d) question

13. Write the statements in words corresponding to p ∧ q where p is 'It is cold' and q is 'It is raining.'

(a) It is not cold (b) It is cold or raining
(c) It is raining or it is not cold (d) It is cold and raining

14. How many rows are needed for the statement formula $(p \vee \neg t) \wedge (p \vee \neg s)$?

(a) 1 (b) 2 (c) 4 (d) 8

15. If all the entries in the column corresponding to the statement formula will contain T, then it is said to be

(a) contradiction (b) tautology (c) contingency (d) converse

16. If all the entries in the column corresponding to the statement formula will contain F, then it is said to be

(a) contradiction (b) tautology (c) contingency (d) converse

17. Say True or False. The symbol ¬ is not changed while finding the dual.

(a) True (b) False

18. $p \vee p \equiv p$, $p \wedge p \equiv p$ is called

(a) Commutative Laws (b) Idempotent Laws
(c) Associative Laws (d) Distributive Laws

19. $p \vee q \equiv q \vee p$, $p \wedge q \equiv q \wedge p$ is called

(a) Commutative Laws (b) Idempotent Laws
(c) Associative Laws (d) Distributive Laws

20. The compound proposition $(p \wedge q) \wedge \neg(p \vee q)$ is

(a) contradiction (b) tautology (c) contingency (d) converse

Answers

1) a	2) b	3) c	4) a	5) c
6) c	7) c	8) d	9) a	10) b
11) c	12) a	13) d	14) d	15) b
16) a	17) a	18) b	19) a	20) a