LONDON SCHOOL

+1

MATHS

BOOK BACK ONE WORDS

2024-25

Practice Book

Shuffle and Without Answer

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1. SETS, RELATIONS AND FUNCTIONS

1. If two sets A and B have 17 elements in common, then the number of elements common to the set $A \times B$ and $B \times A$ is
(a) 2^{17} (b) 17^2 (c) 34 (d) insufficient data

2. The range of the function $f(x) = |\lfloor x \rfloor - x|, x \in R$ is
(a) $[0,1]$ (b) $[0,\infty)$ (c) $[0,1)$ (d) $(0,1)$

3. If $A = \{(x,y): y = sin\, x, x \in R\}$ and $B = \{(x,y): y = cos\, x, x \in R\}$ then $A \cap B$ contains
(a) no element (b) infinitely many elements
(c) only one element (d) cannot be determined.

4. The number of constant functions from a set containing m elements to a set containing n elements is
(a) mn (b) m (c) n (d) $m + n$

5. Let A and B be subsets of the universal set $\mathbb{N}$, the set of natural numbers. Then $A' \cup [(A \cap B) \cup B']$ is
(a) A (b) A' (c) B (d) $\mathbb{N}$

6. The number of students who take both the subjects Mathematics and Chemistry is 70. This represents 10% of the enrollment in Mathematics and 14% of the enrollment in Chemistry. The number of students take at least one of these two subjects, is
(a) 1120 (b) 1130 (c) 1100 (d) insufficient data

7. The function $f: \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = sin\, x + cos\, x$ is
(a) an odd function (b) neither an odd function nor an even function
(c) an even function (d) both odd function and even function.

8. For non-empty sets A and B, if $A \subset B$ then $(A \times B) \cap (B \times A)$ is equal to
(a) $A \cap B$ (b) $A \times A$ (c) $B \times B$ (d) None of these.

9. The number of relations on a set containing 3 elements is
(a) 9 (b) 81 (c) 512 (d) 1024

10. Let $X = \{1,2,3,4\}$ and $R = \{(1,1),(1,2),(1,3),(2,2),(3,3),(2,1),(3,1),(1,4),(4,1)\}$. Then R is
(a) reflexive (b) symmetric (c) transitive (d) equivalence

11. The range of the function $\frac{1}{1-2sin\, x}$ is
(a) $(-\infty,-1) \cup \left(\frac{1}{3},\infty\right)$ (b) $\left(-1,\frac{1}{3}\right)$
(c) $\left[-1,\frac{1}{3}\right]$ (d) $(-\infty,-1) \cup \left[\frac{1}{3},\infty\right)$

12. The function $f: \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = \frac{(x^2+cos\, x)(1+x^4)}{(x-sin\, x)(2x-x^3)} + e^{-|x|}$ is
(a) an odd function (b) neither an odd function nor an even function
(c) an even function (d) both odd function and even function.

13. The rule $f(x) = x^2$ is a bijection if the domain and the co-domain are given by
$(a)\mathbb{R},\mathbb{R}$ $(b)\mathbb{R},(0,\infty)$ $(c)(0,\infty),\mathbb{R}$ $(d)[0,\infty),[0,\infty)$

14. The function $f:[0,2\pi] \to [-1,1]$ defined by $f(x) = sin\, x$ is
(a) one-to-one (b) onto (c) bijection (d) cannot be defined

15. Let $f:\mathbb{R} \to \mathbb{R}$ be defined by $f(x) = 1 - |x|$. Then the range of f is
$(a)\ \mathbb{R}$ $(b)\ (1,\infty)$ $(c)\ (-1,\infty)$ $(d)\ (-\infty,1]$

16. Let R be the universal relation on a set X with more than one element. Then R is
(a) not reflexive (b) not symmetric (c) transitive (d) none of the above

17. If the function $f:[-3,3] \to S$ defined by $f(x) = x^2$ is onto, then S is
$(a)\ [-9,9]$ $(b)\ \mathbb{R}$ $(c)\ [-3,3]$ $(d)\ [0,9]$

18. If $n(A) = 2$ and $n(B \cup C) = 3$, then $n[(A \times B) \cup (A \times C)]$ is
$(a)\ 2^3$ $(b)\ 3^2$ $(c)\ 6$ $(d)\ 5$

19. Let $X = \{1,2,3,4\}, Y = \{a,b,c,d\}$ and $f = \{(1,a),(4,b),(2,c),(3,d),(2,d)\}$. Then f is
(a) an one-to-one function (b) an onto function
(c) a function which is not one-to-one (d) not a function

20. The relation R defined on a set $A = \{0,-1,1,2\}$ by xRy if $|x^2 + y^2| \leq 2$, then which one of the following is true?
$(a)R = \{(0,0),(0,-1),(0,1),(-1,0),(-1,1),(1,2),(1,0)\}$
$(b)R^{-1} = \{(0,0),(0,-1),(0,1),(-1,0),(1,0)\}$
(c) Domain of R is $\{0,-1,1,2\}$ (d) Range of R is $\{0,-1,1\}$

21. If $A = \{(x,y): y = e^x, x \in R\}$ and $B = \{(x,y): y = e^{-x}, x \in R\}$ then $n(A \cap B)$ is
(a) Infinity $(b)\ 0$ $(c)\ 1$ $(d)\ 2$

22. If $n((A \times B) \cap (A \times C)) = 8$ and $n(B \cap C) = 2$, then $n(A)$ is
$(a)\ 6$ $(b)\ 4$ $(c)\ 8$ $(d)\ 16$

23. Let $\mathbb{R}$ be the set of all real numbers. Consider the following subsets of the plane $\mathbb{R} \times \mathbb{R}$, $S = \{(x,y): y = x + 1 \text{ and } 0 < x < 2\}$ and $T = \{(x,y): x - y \text{ is an integer}\}$. Then which of the following is true?
(a) T is an equivalence relation but S is not an equivalence relation.
(b) Neither S nor T is an equivalence relation
(c) Both S and T are equivalence relation
(d) S is an equivalence relation but T is not an equivalence relation.

24. The inverse of $f(x) = \begin{cases} x & if\ x < 1 \\ x^2 & if\ 1 \leq x \leq 4 \\ 8\sqrt{x} & if\ x > 4 \end{cases}$ is

$(a)\ f^{-1}(x) = \begin{cases} x & if\ x < 1 \\ \sqrt{x} & if\ 1 \leq x \leq 16 \\ \frac{x^2}{64} & if\ x > 16 \end{cases}$ $(b)\ f^{-1}(x) = \begin{cases} -x & if\ x < 1 \\ \sqrt{x} & if\ 1 \leq x \leq 16 \\ \frac{x^2}{64} & if\ x > 16 \end{cases}$

$(c)\ f^{-1}(x) = \begin{cases} x^2 & if\ x < 1 \\ \sqrt{x} & if\ 1 \le x \le 16 \\ \frac{x^2}{64} & if\ x > 16 \end{cases}$ $(d)\ f^{-1}(x) = \begin{cases} 2x & if\ x < 1 \\ \sqrt{x} & if\ 1 \le x \le 16 \\ \frac{x^2}{8} & if\ x > 16 \end{cases}$

25. If $f(x) = |x-2| + |x+2|,\ x \in R$, then

$(a)\ f(x) = \begin{cases} -2x & if\ x \in (-\infty,-2] \\ 4 & if\ x \in (-2,2] \\ 2x & if\ x \in (2,\infty) \end{cases}$ $(b)\ f(x) = \begin{cases} 2x & if\ x \in (-\infty,-2] \\ 4x & if\ x \in (-2,2] \\ -2x & if\ x \in (2,\infty) \end{cases}$ $(c)\ f(x) = \begin{cases} -2x & if\ x \in (-\infty,-2] \\ -4x & if\ x \in (-2,2] \\ 2x & if\ x \in (2,\infty) \end{cases}$ $(d)\ f(x) = \begin{cases} -2x & if\ x \in (-\infty,-2] \\ 2x & if\ x \in (-2,2] \\ 2x & if\ x \in (2,\infty) \end{cases}$

2. BASIC ALGEBRA

1. If $\frac{1-2x}{3+2x-x^2} = \frac{A}{3-x} + \frac{B}{x+1}$, then the value of $A + B$ is

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

2. If $\frac{|x-2|}{x-2} \ge 0$, then x belongs to

$(a)\ [2,\infty)$ $(b)\ (2,\infty)$ $(c)\ (-\infty,2)$ $(d)\ (-2,\infty)$

3. The value of $\log_3 11 . \log_{11} 13 . \log_{13} 15 . \log_{15} 27 . \log_{27} 81$ is

$(a)\ 1$ $(b)\ 2$ $(c)\ 3$ $(d)\ 4$

4. The solution of $5x - 1 < 24$ and $5x + 1 > -24$ is

$(a)\ (4,5)$ $(b)\ (-5,-4)$ $(c)\ (-5,\ 5)$ $(d)\ (-5,4)$

5. If a and b are the real roots of the equation $x^2 - kx + c = 0$, then the distance between the points $(a,0)$ and $(b,0)$ is

$(a)\ \sqrt{k^2-4c}$ $(b)\ \sqrt{4k^2-c}$ $(c)\ \sqrt{4c-k^2}$ $(d)\ \sqrt{k-8c}$

6. The value of $\log_3 \frac{1}{81}$ is

$(a)\ -2$ $(b)\ -8$ $(c)\ -4$ $(d)\ -9$

7. The solution set of the following inequality $|x-1| \ge |x-3|$ is

$(a)\ [0,2]$ $(b)\ [2,\infty)$ $(c)\ (0,2)$ $(d)\ (-\infty,2)$

8. The value of $\log_a b \log_b c \log_c a$ is

$(a)\ 2$ $(b)\ 1$ $(c)\ 3$ $(d)\ 4$

9. If 3 is the logarithm of 343, then the base is

$(a)\ 5$ $(b)\ 7$ $(c)\ 6$ $(d)\ 9$

10. If $\frac{kx}{(x+2)(x-1)} = \frac{2}{x+2} + \frac{1}{x-1}$, then the value of k is

(a) 1 (b) 2 (c) 3 (d) 4

11. Find a so that the sum and product of the roots of the equation $2x^2 + (a-3)x + 3a - 5 = 0$ are equal is

(a) 1 (b) 2 (c) 0 (d) 4

12. Given that x, y and b are real numbers $x < y, b > 0$, then

(a) $xb < yb$ (b) $xb > yb$ (c) $xb \le yb$ (d) $\frac{x}{b} \ge \frac{y}{b}$

13. The equation whose roots are numerically equal but opposite in sign to the roots of $3x^2 - 5x - 7 = 0$ is

$(a) 3x^2 - 5x - 7 = 0$ $(b) 3x^2 + 5x - 7 = 0$

$(c) 3x^2 - 5x + 7 = 0$ $(d) 3x^2 + x - 7$

14. The value of $\log_{\sqrt{2}} 512$ is

(a) 16 (b) 18 (c) 9 (d) 12

15. If 8 and 2 are the roots of $x^2 + ax + c = 0$ and 3,3 are the roots of $x^2 + dx + b = 0$ then the roots of the equation $x^2 + ax + b = 0$ are

$(a) 1, 2$ $(b) -1,1$ $(c) 9, 1$ $(d) -1,2$

16. If $|x + 2| \le 9$, then x belongs to

(a) $(-\infty, -7)$ (b) $[-11, 7]$ (c) $(-\infty, -7) \cup [11, \infty)$ (d) $(-11,7)$

17. The number of roots of $(x+3)^4 + (x+5)^4 = 16$ is

(a) 4 (b) 2 (c) 3 (d) 0

18. The number of solutions of $x^2 + |x - 1| = 1$ is

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

19. If a and b are the roots of the equation $x^2 - kx + 16 = 0$ and satisfy $a^2 + b^2 = 32$, then the value of k is

(a) 10 $(b) -8$ $(c) -8,8$ (d) 6

20. If $\log_{\sqrt{x}} 0.25 = 4$, then the value of x is

(a) 0.5 (b) 2.5 (c) 1.5 (d) 1.25

3. TRIGONOMETRY

1. $\frac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x}$ is equal to

(a) $\cos 2x$ (b) $\cos x$ (c) $\cos 3x$ (d) $2\cos x$

2. In a triangle $ABC, sin^2A + sin^2B + sin^2C = 2$, then the triangle is

(a) equilateral triangle (b) isosceles triangle

(c) right triangle (d) scalene triangle.

3. $\frac{1}{cos\, 80°} - \frac{\sqrt{3}}{sin\, 80°} =$

(a) $\sqrt{2}$ (b) $\sqrt{3}$ (c) 2 (d) 4

4. If $\sin\alpha + \cos\alpha = b$, then $sin\ 2\alpha$ is equal to

$(a)\ b^2 - 1,\ if\ b \leq \sqrt{2}$ $(b) b^2 - 1,\ if\ b > \sqrt{2}$

$(c)\ b^2 - 1,\ if\ b \geq 1$ $(d) b^2 - 1,\ if\ b \geq \sqrt{2}$

5. The maximum value of $4\ sin^2\ x + 3\ cos^2\ x + \sin\frac{x}{2} + \cos\frac{x}{2}$ is

$(a)\ 4 + \sqrt{2}$ $(b)\ 3 + \sqrt{2}$ $(c)\ 9$ $(d)\ 4$

6. $\left(1 + \cos\frac{\pi}{8}\right)\left(1 + \cos\frac{3\pi}{8}\right)\left(1 + \cos\frac{5\pi}{8}\right)\left(1 + \cos\frac{7\pi}{8}\right) =$

$(a)\ \frac{1}{8}$ $(b)\ \frac{1}{2}$ $(c)\ \frac{1}{\sqrt{3}}$ $(d)\ \frac{1}{\sqrt{2}}$

7. Let $f_k(x) = \frac{1}{k}[sin^k x + cos^k x]$ where $x \in R$ and $k \geq 1$. Then $f_4(x) - f_6(x) =$

$(a)\ \frac{1}{4}$ $(b)\ \frac{1}{12}$ $(c)\ \frac{1}{6}$ $(d)\ \frac{1}{3}$

8. In a ΔABC, if $(i)\ \sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} > 0 (ii) \sin A \sin B \sin C > 0$ then

(a) Both (i) and (ii) are true (b) Only (i) is true

(c) Only (ii) is true (d) Neither (i) nor (ii) is true

9. If $f(\theta) = |\sin\theta\ | + |\cos\theta|,\ \theta \in R$, then $f(\theta)$ is in the interval

(a) $[0,2]$ $(b)\ [1,\sqrt{2}]$ $(c)\ [1,2]$ $(d)\ [0,1]$

10. If $cos\ 28° + sin\ 28° = k^3$, then $cos\ 17°$ is equal to

$(a)\ \frac{k^3}{\sqrt{2}}$ $(b) \frac{-k^3}{\sqrt{2}}$ $(c) \pm\frac{k^3}{\sqrt{2}}$ $(d) -\frac{k^3}{\sqrt{3}}$

11. The triangle of maximum area with constant perimeter $12m$ is

(a) an equilateral triangle with side $4m$

(b) an isosceles triangle with sides $2m, 5m, 5m$

(c) a triangle with sides $3m, 4m, 5m$ (d) Does not exist.

12. Which of the following is not true?

$(a) \sin\theta = \frac{-3}{4}$ $(b) \cos\theta = -1$ $(c) \tan\theta = 25$ $(d) \sec\theta = \frac{1}{4}$

13. $\cos 2\theta\ \cos 2\phi + sin^2(\theta - \phi) - sin^2(\theta + \phi)$ is equal to

$(a)\ sin\ 2(\theta + \phi)$ $(b)\ cos\ 2(\theta + \phi)$ $(c)\ sin\ 2(\theta - \phi)$ $(d)\ cos\ 2(\theta - \phi)$

14. $\frac{sin(A-B)}{\cos A \cos B} + \frac{sin(B-C)}{\cos B \cos C} + \frac{sin(C-A)}{\cos C \cos A}$ is

$(a) \sin A + \sin B + \sin C$ $(b)\ 1$ $(c)\ 0$ $(d) \cos A + \cos B + \cos C$

15. If $\tan\alpha$ and $\tan\beta$ are the roots of $x^2 + ax + b = 0$, then $\frac{\sin(\alpha+\beta)}{\sin\alpha\sin\beta}$ is equal to

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

16. If $\pi < 2\theta < \frac{3\pi}{2}$ then $\sqrt{2 + \sqrt{2 + 2\cos 4\theta}}$ is equals to

$(a) - 2\cos\theta$ $(b) - 2\sin\theta$ $(c) 2\cos\theta$ $(d) 2\sin\theta$

17. $cos\ 1° + cos\ 2° + cos\ 3° + \ldots\ldots\ldots + cos\ 179° =$

$(a)\ 0$ $(b)\ 1$ $(c) - 1$ $(d)\ 89$

18. A wheel is spinning at 2 radians/second. How many seconds will it take to make 10 complete rotations?

(a) 10 π seconds (b) 20 π seconds (c) 5 π seconds (d) 15 π seconds

19. If $\cos p\theta + \cos q\theta = 0$ and if $p \neq q$, then θ is equal to (n is any integer)
(a) $\frac{\pi(3n+1)}{p-q}$ (b) $\frac{\pi(2n+1)}{p\pm q}$ (c) $\frac{\pi(n\pm 1)}{p\pm q}$ (d) $\frac{\pi(n+2)}{p+q}$

20. If $\tan 40° = \lambda$ then $\frac{\tan 140° - \tan 130°}{1+\tan 140° \tan 130°}$
(a) $\frac{1-\lambda^2}{\lambda}$ (b) $\frac{1+\lambda^2}{\lambda}$ (c) $\frac{1+\lambda^2}{2\lambda}$ (d) $\frac{1-\lambda^2}{2\lambda}$

4. COMBINATORICS AND MATHEMATICAL INDUCTION

1. In $2nC_3 : nC_3 = 11:1$ then n is
(a) 5 (b) 6 (c)11 (d)7

2. If nC_4, nC_5, nC_6 are in AP the value of n can be
(a) 14 (b) 11 (c)9 (d)5

3. The number of 5 digit numbers all digits of which are odd is
(a) 25 (b) 5^5 (c) 5^6 (d) 625.

4. In 3 fingers, the number of ways four rings can be worn is … … … … ways.
(a) $4^3 - 1$ (b) 3^4 (c) 6^8 (d) 6^4

5. Everybody in a room shakes hands with everybody else. The total number of shake hands is 66. The number of persons in the room is
(a) 11 (b) 12 (c) 10 (d) 6

6. The product of r consecutive positive integers is divisible by
(a) $r!$ (b) $(r-1)!$ (c) $(r+1)!$ (d) r^r

7. The number of five digit telephone numbers having at least one of their digits repeated is
(a) 90000 (b) 10000 (c) 30240 (d) 69760.

8. The sum of the digits at the 10^{th} place of all numbers formed with the help of 2, 4, 5, 7 taken all at a time is
(a) 432 (b) 108 (c) 36 (d) 18

9. There are 10 points in a plane and 4 of them are collinear. The number of straight lines joining any two points is
(a) 45 (b) 40 (c) 39 (d) 38.

10. Number of sides of a polygon having 44 diagonals is … … … …
(a) 4 (b) 4! (c) 11 (d) 22

11. The number of ways in which a host lady invite 8 people for a party of 8 out of 12 people of whom two do not want to attend the party together is
(a) $2 \times 11C_7 + 10\,C_8$ (b) $11C_7 + 10\,C_8$
(c) $12\,C_8 - 10C_6$ (d) $10C_6 + 2!$

12. The number of parallelograms that can be formed from a set of four parallel lines intersecting another set of three parallel lines.

(a) 6 (b) 9 (c) 12 (d) 18

13. $1 + 3 + 5 + 7 + \ldots\ldots\ldots\ldots + 17$ is equal to

(a) 101 (b) 81 (c) 71 (d) 61

14. In an examination there are three multiple choice questions and each question has 5 choices . Number of ways in which a student can fail to get all answer correct is

(a) 125 (b) 124 (c) 64 (d) 63

15. If 10 lines are drawn in a plane such that no two of them are parallel and no three are concurrent, then the total number of points of intersection are

(a) 45 (b) 40 (c) $10!$ (d) 2^{10}

16. In a plane there are 10 points are there out of which 4 points are collinear, then the number of triangles formed is

(a) 110 (b) $10C_3$ (c) 120 (d) 116

17. $(n-1)C_r + (n-1)C_{(r-1)}$ is

(a) $(n+1)C_r$ (b) $(n-1)C_r$ (c) nC_r (d) $nC_{(r-1)}$

18. The number of 10 digit number that can be written by using the digits 2 and 3 is

(a) $10C_2 + 9C_2$ (b) 2^{10} (c) $2^{10} - 2$ (d) $10!$

19. If $(a^2 - a)C_2 = (a^2 - a)C_4$ then the value of a is

(a) 2 (b) 3 (c) 4 (d) 5

20. The product of first n odd natural numbers equals

(a) $2nC_n \times nP_n$ (b) $\left(\frac{1}{2}\right)^n \times 2nC_n \times nP_n$

(c) $\left(\frac{1}{4}\right)^n \times 2nC_n \times 2nP_n$ (d) $nC_n \times nP_n$

21. The number of ways in which the following prize be given to a class of 30 boys first and second in mathematics, first and second in physics, first in chemistry and first in English is

(a) $30^4 \times 29^2$ (b) $30^3 \times 29^3$ (c) $30^2 \times 29^4$ (d) 30×29^5.

22. The number of rectangles that a chessboard has

(a) 81 (b) 9^9 (c) 1296 (d) 6561

23. The number of ways of choosing 5 cards out of a deck of 52 cards which include at least one king is

(a) $52C_5$ (b) $48C_5$ (c) $52C_5 + 48C_5$ (d) $52C_5 - 48C_5$

24. If P_r stands for rP_r then the sum of the series $1 + P_1 + 2P_2 + 3P_3 + \ldots + nP_n$ is

(a) P_{n+1} (b) $P_{n+1} - 1$ (c) $P_{n-1} + 1$ (d) $(n+1)P_{n-1}$

25. If $(n+5)P_{(n+1)} = \frac{11(n-1)}{2}.(n+3)P_n$, then the value of n are

(a) 7 and 11 (b) 6 and 7 (c) 2 and 11 (d) 2 and 6.

5. BINOMIAL THEOREM, SEQUENCES AND SERIES

1. The coefficient of x^5 in the series e^{-2x} is
   $(a)\ \frac{2}{3}$ $(b)\ \frac{3}{2}$ $(c)\ \frac{-4}{15}$ $(d)\ \frac{4}{15}$
2. The coefficient of x^8y^{12} in the expansion of $(2x+3y)^{20}$ is
   $(a)\ 0$ $(b)\ 2^8 3^{12}$ $(c)\ 2^8 3^{12} + 2^{12} 3^8$ $(d)\ 20C_8 2^8 3^{12}$
3. If $nC_{10} > nC_r$ for all possible r, then a value of n is
   $(a)\ 10$ $(b)\ 21$ $(c)\ 19$ $(d)\ 20$
4. The value of $1 - \frac{1}{2}\left(\frac{2}{3}\right) + \frac{1}{3}\left(\frac{2}{3}\right)^2 - \frac{1}{4}\left(\frac{2}{3}\right)^3 + \ldots\ldots\ldots$ is
   $(a)\ \log\left(\frac{5}{3}\right)$ $(b)\ \frac{3}{2}\log\left(\frac{5}{3}\right)$ $(c)\ \frac{5}{3}\log\left(\frac{5}{3}\right)$ $(d)\ \frac{2}{3}\log\left(\frac{2}{3}\right)$
5. The value of $\frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \ldots\ldots\ldots$ is
   $(a)\ \frac{e^2+1}{2e}$ $(b)\ \frac{(e+1)^2}{2e}$ $(c)\ \frac{(e-1)^2}{2e}$ $(d)\ \frac{e^2+1}{2e}$
6. The coefficient of x^6 in $(2+2x)^{10}$ is
   $(a)\ 10C_6$ $(b)\ 2^6$ $(c)\ 10C_6 2^6$ $(d)\ 10C_6\ 2^{10}$
7. The value of the series $\frac{1}{2} + \frac{7}{4} + \frac{13}{8} + \frac{19}{16} + \ldots\ldots\ldots$ is
   $(a)\ 14$ $(b)\ 7$ $(c)\ 4$ $(d)\ 6$
8. The HM of two positive numbers whose AM and GM are 16, 8 respectively is
   $(a)\ 10$ $(b)\ 6$ $(c)\ 5$ $(d)\ 4$
9. The n^{th} term of the sequence 1,2,4,7,11, ……. is
   $(a)\ n^3 + 3n^2 + 2n$ $(b)\ n^3 - 3n^2 + 3n$ $(c)\ \frac{n(n+1)(n+2)}{2}$ $(d)\ \frac{n^2-n+2}{2}$
10. The value of $2 + 4 + 6 + \ldots\ldots\ldots + 2n$ is
   $(a)\ \frac{n(n-1)}{2}$ $(b)\ \frac{n(n+1)}{2}$ $(c)\ \frac{2n(2n+1)}{2}$ $(d)\ n(n+1)$
11. If a is the arithmetic mean and g is the geometric mean of two numbers, then
   $(a)\ a \leq g$ $(b)\ a \geq g$ $(c)\ a = g$ $(d)\ a > g$
12. The sequence $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}+\sqrt{2}}, \frac{1}{\sqrt{3}+2\sqrt{2}}, \ldots\ldots$ form an
   $(a)\ AP$ $(b)\ GP$ $(c)\ HP$ $(d)\ AGP$
13. The sum up to n terms of the series $\frac{1}{\sqrt{1}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{5}} + \frac{1}{\sqrt{5}+\sqrt{7}} + \ldots\ldots\ldots$ is
   $(a)\ \sqrt{2n+1}$ $(b)\ \frac{\sqrt{2n+1}}{2}$ $(c)\sqrt{2n+1} - 1$ $(d)\ \frac{\sqrt{2n+1}-1}{2}$
14. If $(1+x^2)^2(1+x)^n = a_0 + a_1x + a_2x^2 + \ldots\ldots\ldots + x^{n+4}$ and if a_0, a_1, a_2 are in AP, then n is
   $(a)\ 1$ $(b)\ 2$ $(c)\ 3$ $(d)\ 4$

15. The sum up to n terms of the series $\sqrt{2}+\sqrt{8}+\sqrt{18}+\sqrt{32}+\ldots\ldots$ is
(a) $\frac{n(n+1)}{2}$ (b) $2n(n+1)$ (c) $\frac{n(n+1)}{\sqrt{2}}$ (d) 1

16. If $a, 8, b$ are in AP, $a, 4, b$ are in GP, and if a, x, b are in HP then x is
(a) 2 (b) 1 (c) 4 (d) 16

17. The sum of an infinite GP is 18. If the first term is 6, the common ratio is
(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $\frac{3}{4}$

18. The remainder when 38^{15} is divided by 13 is
(a) 12 (b) 1 (c) 11 (d) 5

19. If S_n denotes the sum of n terms of an AP whose common difference is d, the value of $S_n - 2S_{n-1} + S_{n-2}$ is
(a) d (b) $2d$ (c) $4d$ (d) d^2

20. The n^{th} term of the sequence $\frac{1}{2}, \frac{3}{4}, \frac{7}{8}, \frac{15}{16}, \ldots\ldots$ is
(a) $2^n - n - 1$ (b) $1 - 2^{-n}$ (c) $2^{-n} + n - 1$ (d) 2^{n-1}

6. TWO DIMENSIONAL ANALYTICAL GEOMETRY

1. The point on the line $2x - 3y = 5$ is equidistance from $(1,2)$ and $(3,4)$ is
(a) $(7,3)$ (b) $(4,1)$ (c) $(1,1)$ (d) $(-2,3)$
2. If a vertex of a square is at the origin and its one side lies along the line $4x + 3y - 20 = 0$, then the area of the square is
(a) 20 sq. units (b) 16 sq. units (c) 25 sq. units (d) 4 sq.units
3. The intercepts of the perpendicular bisector of the line segment joining $(1,2)$ and $(3,4)$ with coordinate axes are
(a) $5, -5$ (b) $5, 5$ (c) $5, 3$ (d) $5, -4$
4. Which of the following point lie on the locus of $3x^2 + 3y^2 - 8x - 12y + 17 = 0$
(a) $(0,0)$ (b) $(-2,3)$ (c) $(1,2)$ (d) $(0,-1)$
5. The equation of the locus of the point whose distance from y −axis is half the distance from origin is
(a) $x^2 + 3y^2 = 0$ (b) $x^2 - 3y^2 = 0$ (c) $3x^2 + y^2 = 0$ (d) $3x^2 - y^2 = 0$
6. The slope of the line which makes an angle 45° with the line $3x - y = -5$ are
(a) $1, -1$ (b) $\frac{1}{2}, -2$ (c) $1, \frac{1}{2}$ (d) $2, \frac{-1}{2}$
7. Equation of the straight line that forms an isosceles triangle with coordinate axes in the I −quadrant with perimeter $4 + 2\sqrt{2}$ is
(a) $x + y + 2 = 0$ (b) $x + y - 2 = 0$ (c) $x + y - \sqrt{2} = 0$ (d) $x + y + \sqrt{2} = 0$
8. The coordinates of the four vertices of a quadrilateral are $(-2,4), (-1,2), (1,2)$ and $(2,4)$ taken in order. The equation of the line passing through the vertex $(-1,2)$ and dividing the quadrilateral in the equal areas is
(a) $x + 1 = 0$ (b) $x + y = 1$ (c) $x + y + 3 = 0$ (d) $x - y + 3 = 0$

9. Which of the following equation is the locus of $(at^2, 2at)$

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

10. The equation of one the line represented by the equation $x^2 + 2xy\cot\theta - y^2 = 0$ is

(a) $x - y\cot\theta = 0$ (b) $x + y\tan\theta = 0$

(c) $x\cos\theta + y(\sin\theta + 1) = 0$ (d) $x\sin\theta + y(\cos\theta + 1) = 0$

11. The equation of the line with slope 2 and the length of the perpendicular from the origin equal to 5 is

(a) $x + 2y = \sqrt{5}$ (b) $2x + y = \sqrt{5}$ (c) $2x + y = 5$ (d) $x + 2y - 5 = 0$

12. A line perpendicular to the line $5x - y = 0$ forms a triangle with the coordinate axes. If the area of the triangle is 5 sq. units, then its equation is

(a) $x + 5y \pm 5\sqrt{2} = 0$ (b) $x - 5y \pm 5\sqrt{2} = 0$

(c) $5x + y \pm 5\sqrt{2} = 0$ (d) $5x - y \pm 5\sqrt{2} = 0$

13. If the lines represented by the equation $6x^2 + 41xy - 7y^2 = 0$ make angles α and β with $x-$axis, then $\tan\alpha\tan\beta =$

(a) $\frac{-6}{7}$ (b) $\frac{6}{7}$ (c) $\frac{-7}{6}$ (d) $\frac{7}{6}$

14. If the point $(8, -5)$ lies on the locus $\frac{x^2}{16} - \frac{y^2}{25} = k$ then the value of k is

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

15. Equation of the straight line perpendicular to the linex $x - y + 5 = 0$, through the point of intersection the $y-$axis and the given line

(a) $x - y - 5 = 0$ (b) $x + y - 5 = 0$ (c) $x + y + 5 = 0$ (d) $x + y + 10 = 0$

16. If one of the lines given by $6x^2 - xy + 4cy^2 = 0$ is $3x + 4y = 0$, then c equals to

(1) -3 (b) -1 (c) 3 (d) 1

17. If the equation of the base opposite to the vertex $(2, 3)$ of an equilateral triangle is $x + y = 2$, then the length of a side is

(a) $\sqrt{3/2}$ (b) 6 (c) $\sqrt{6}$ (d) $3\sqrt{2}$

18. The line $(p + 2q)x + (p - 3q)y = p - q$ for different values of p and q passes through the point

(a) $\left(\frac{3}{2}, \frac{5}{2}\right)$ (b) $\left(\frac{2}{5}, \frac{2}{5}\right)$ (c) $\left(\frac{3}{5}, \frac{3}{5}\right)$ (d) $\left(\frac{2}{5}, \frac{3}{5}\right)$

19. θ is acute angle between the lines $x^2 - xy - 6y^2 = 0$, then $\frac{2\cos\theta + 3\sin\theta}{4\sin\theta + 5\cos\theta}$ is

(a) 1 (b) $\frac{-1}{9}$ (c) $\frac{5}{9}$ (d) $\frac{1}{9}$

20. The image of the point $(2, 3)$ in the line $y = -x$ is

(a) $(-3, -2)$ (b) $(-3, 2)$ (c) $(-2, -3)$ (d) $(3, 2)$

21. The length of $\perp$ from the origin to the line $\frac{x}{3} - \frac{x}{4} = 1$ is

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

22. The area of the triangle formed by the lines $x^2 - 4y^2 = 0$ and $x = a$ is

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

23. The y −intercept of the straight line passing through (1,3) and perpendicular to $2x - 3y + 1 = 0$ is

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

24. Straight line joining the points $(2, 3)$ and $(-1, 4)$ passes through the point (α, β) if $(a)\ \alpha + 2\beta = 7$ $(b)\ 3\alpha + \beta = 9$ $(c)\ \alpha + 3\beta = 11$ $(d)\ 3\alpha + \beta = 11$

25. If the two straight lines $x + (2k - 7)y + 3 = 0$ and $3kx + 9y - 5 = 0$ are perpendicular then the value of k is

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

7. MATRICES AND DETERMINANTS

1. If $a \neq b, b, c$ satisfy $\begin{vmatrix} a & 2b & 2c \\ 3 & b & c \\ 4 & a & b \end{vmatrix} = 0$, then $abc =$

$(a)\ a + b + c$ $(b)\ 0$ $(c)\ b^3$ $(d)\ ab + bc$

2. If A is a square matrix, then which of the following is not symmetric?

$(a)\ A + A$ $(b)\ AA^T$ $(c)\ A^TA$ $(d)\ A - A^T$

3. What must be the matrix X, if $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$

$(a)\ \begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$ $(b)\ \begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$ $(c)\ \begin{bmatrix} 2 & 6 \\ 4 & -2 \end{bmatrix}$ $(d)\ \begin{bmatrix} 2 & -6 \\ 4 & -2 \end{bmatrix}$

4. If A and B are two matrices such that $A + B$ and AB are both defined, then

(a) A and B are two matrices not necessarily of same order

(b) A and B are square matrices of same order

(c) Number of columns of A is equal to the number of rows of B $(d)\ A = B$.

5. If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in geometric progression with the same common ratio, then the points $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ are

(a) vertices of an equilateral triangle

(b) vertices of a right angled triangle

(c) vertices of a right angled isosceles triangle (d) collinear

6. If $A = \begin{bmatrix} \lambda & 1 \\ -1 & -\lambda \end{bmatrix}$, then for what value of $\lambda, A^2 = 0$?

$(a) 0$ $(b)\ \pm 1$ $(c) -\ 1$ $(d)\ 1$

7. If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}, B = \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2$ then the values of a and b

$(a)\ a = 4, b = 1$ $(b) a = 1, b = 4$ $(c)\ a = 0, b = 4$ $(d)\ a = 2, b = 4$

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8. If $a_{ij} = \frac{1}{2}(3i - 2j)$ and $A = [a_{ij}]_{2\times 2}$ is

(a) $\begin{bmatrix} \frac{1}{2} & 2 \\ \frac{-1}{2} & 1 \end{bmatrix}$ (b) $\begin{bmatrix} \frac{1}{2} & \frac{-1}{2} \\ 2 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 2 & 2 \\ \frac{1}{2} & \frac{-1}{2} \end{bmatrix}$ (d) $\begin{bmatrix} \frac{-1}{2} & \frac{1}{2} \\ 1 & 2 \end{bmatrix}$

9. If $\lfloor . \rfloor$ denotes the greatest integer less than or equal to the real number under consideration and $-1 \le x < 0, 0 \le y < 1, 1 \le z < 2$ then the value of the determinant $\begin{vmatrix} \lfloor x \rfloor + 1 & \lfloor y \rfloor & \lfloor z \rfloor \\ \lfloor x \rfloor & \lfloor y \rfloor + 1 & \lfloor z \rfloor \\ \lfloor x \rfloor & \lfloor y \rfloor & \lfloor z \rfloor + 1 \end{vmatrix}$

(a) $\lfloor z \rfloor$ (b) $\lfloor y \rfloor$ (c) $\lfloor x \rfloor$ (d) $\lfloor x \rfloor + 1$

10. If $\Delta = \begin{vmatrix} a & b & c \\ x & y & z \\ p & q & r \end{vmatrix}$, then $\begin{vmatrix} ka & kb & kc \\ kx & ky & kz \\ kp & kq & kr \end{vmatrix}$ is

(a) Δ (b) $k\Delta$ (c) $3k\Delta$ (d) $k^3\Delta$

11. If A and B are symmetric matrices of order n, where $(A \neq B)$, then

(a) $A + B$ is skew-symmetric (b) $A + B$ is symmetric

(c) $A + B$ is a diagonal matrix (d) $A + B$ is a zero matrix

12. If $A = \begin{bmatrix} a & x \\ y & a \end{bmatrix}$ and if $xy = 1$ then $\det(AA^T)$ is equal

(a) $(a-1)^2$ (b) $(a^2+1)^2$ (c) $a^2 - 1$ (d) $(a^2-1)^2$

13. The value of x, for which the matrix $A = \begin{bmatrix} e^{x-2} & e^{7+x} \\ e^{2+x} & e^{2x+3} \end{bmatrix}$ is singular is

(a) 9 (b) 8 (c) 7 (d) 6

14. The value of the determinant of $A = \begin{bmatrix} 0 & a & -b \\ -a & 0 & c \\ b & -c & 0 \end{bmatrix}$ is

(a) $-2abc$ (b) abc (c) 0 (d) $a^2 + b^2 + c^2$

15. Let A and B be two symmetric matrices of same order. Then which one of the following statement is not true?

(a) $A + B$ is a symmetric matrix (b) AB is a symmetric matrix

(c) $AB = (BA)^T$ (d) $A^TB = AB^T$

16. If A is skew-symmetric of order n and C is a column matrix of order $n \times 1$, then C^TAC is (a) an identity matrix of order n (b) an identity matrix of order 1 (c) a zero matrix of order 1 (d) an identity matrix of order 2

17. If the points are $(x, -2), (5, 2), (8, 8)$ collinear, then x is equal to

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

18. If $A = \begin{vmatrix} 2a & x_1 & y_1 \\ 2b & x_2 & y_2 \\ 2c & x_3 & y_3 \end{vmatrix} = \frac{abc}{2} \neq 0$ then the area of the triangle whose vertices are $\left(\frac{x_1}{a}, \frac{y_1}{a}\right), \left(\frac{x_2}{b}, \frac{y_2}{b}\right), \left(\frac{x_3}{c}, \frac{y_3}{c}\right)$ is

$(a)\ \frac{1}{4}$ $(b)\ \frac{1}{4}abc$ $(c)\ \frac{1}{8}$ $(d)\ \frac{1}{8}abc$

19. If the square of the matrix $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is the unit matrix of order 2, then α, β and γ Should satisfy the relation

$(a)\ 1 + \alpha^2 + \beta\gamma = 0$ $(b)\ 1 - \alpha^2 - \beta\gamma = 0$

$(c)\ 1 - \alpha^2 + \beta\gamma = 0$ $(d)\ 1 + \alpha^2 - \beta\gamma = 0$

20. Which one of the following is not true about the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 5 \end{bmatrix}$?

(a) a scalar matrix (b) a diagonal matrix

(c) an upper triangular matrix (d) a lower triangular matrix

21. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix}$ is a matrix satisfying the equation $AA^T = 9I$, where I is 3×3 identity matrix, then the ordered pair (a, b) is equal to

$(a)\ (2, -1)$ $(b)\ (-2, 1)$ $(c)\ (2, 1)$ $(d)\ (-2, -1)$

22. A root of the equation $\begin{vmatrix} 3-x & -6 & 3 \\ -6 & 3-x & 3 \\ 3 & 3 & -6-x \end{vmatrix} = 0$ is

$(a)\ 6$ $(b)\ 3$ $(c)\ 0$ $(d)\ -6$

23. The matrix A satisfying the equation $\begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix} A = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$ is

$(a)\ \begin{bmatrix} 1 & 4 \\ -1 & 0 \end{bmatrix}$ $(b)\ \begin{bmatrix} 1 & -4 \\ 1 & 0 \end{bmatrix}$ $(c)\ \begin{bmatrix} 1 & 4 \\ 0 & -1 \end{bmatrix}$ $(d)\ \begin{bmatrix} 1 & -4 \\ 1 & 1 \end{bmatrix}$

24. If $A + I = \begin{bmatrix} 3 & -2 \\ 4 & 1 \end{bmatrix}$ then $(A + I)(A - I)$ is equal to

$(a)\ \begin{bmatrix} -5 & -4 \\ 8 & -9 \end{bmatrix}$ $(b)\ \begin{bmatrix} -5 & 4 \\ -8 & 9 \end{bmatrix}$ $(c)\ \begin{bmatrix} 5 & 4 \\ 8 & 9 \end{bmatrix}$ $(d)\ \begin{bmatrix} -5 & -4 \\ -8 & -9 \end{bmatrix}$

25. If $A = \begin{vmatrix} -1 & 2 & 4 \\ 3 & 1 & 0 \\ -2 & 4 & 2 \end{vmatrix}$ and $B = \begin{vmatrix} -2 & 4 & 2 \\ 6 & 2 & 0 \\ -2 & 4 & 8 \end{vmatrix}$ then B is given by

$(a)\ B = 4A$ $(b)\ B = -4A$ $(c)\ B = -A$ $(d) B = 6A$

8. VECTOR ALGEBRA – I

1. If the projection of $5\vec{i}-\vec{j}-3\vec{k}$ on the vector $\vec{i}+3\vec{j}+\lambda\vec{k}$ is same as the projection of $\vec{i}+3\vec{j}+\lambda\vec{k}$ on $5\vec{i}-\vec{j}-3\vec{k}$ then λ is equal to
(a) ± 4 (b) ± 3 (c) ± 5 (d) ± 1
2. Vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle $\theta = 120°$. If $|\vec{a}| = 1, |\vec{b}| = 2$, then $\left[(\vec{a}+3\vec{b})\times(3\vec{a}-\vec{b})\right]^2$ is equal to
(a) 225 (b) 275 (c) 325 (d) 300
3. A vector $\overrightarrow{OP}$ makes $60°$ and $45°$ with the positive direction of the x and y axes respectively. Then the angle between $\overrightarrow{OP}$ and the z −axis is
(a) $45°$ (b) $60°$ (c) $90°$ (d) $30°$
4. A vector makes equal angle with the positive direction of the coordinate axes. Then each angle is equal to
(a) $\cos^{-1}\left(\frac{1}{3}\right)$ (b) $\cos^{-1}\left(\frac{2}{3}\right)$ (c) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (d) $\cos^{-1}\left(\frac{2}{\sqrt{3}}\right)$
5. If $(1,2,4)$ and $(2,-3\lambda\ -3)$ are the initial and terminal points of the vector $\vec{i}+5\vec{j}-7\vec{k}$, then the value of λ is equal to
(a) $\frac{7}{3}$ (b) $\frac{-7}{3}$ (c) $\frac{-5}{3}$ (d) $\frac{5}{3}$
6. If $\vec{a} = \vec{i}+2\vec{j}+2\vec{k}, |\vec{b}| = 5$ and the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{6}$, then the area of the triangle formed by these two vectors as two sides, is
(a) $\frac{7}{4}$ (b) $\frac{15}{4}$ (c) $\frac{3}{4}$ (d) $\frac{17}{4}$
7. The value of $\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{DA}+\overrightarrow{CD}$ is
(a) $\overrightarrow{AD}$ (b) $\overrightarrow{CA}$ (c) $\vec{0}$ (d) $-\overrightarrow{AD}$
8. If $ABCD$ is a parallelogram, then $\overrightarrow{AB}+\overrightarrow{AD}+\overrightarrow{CB}+\overrightarrow{CD}$ is equal to
(a) $2(\overrightarrow{AB}+\overrightarrow{AD})$ (b) $4\,\overrightarrow{AC}$ (c) $4\,\overrightarrow{BD}$ (d) $\vec{0}$
9. The value of $\theta \in \left(0,\frac{\pi}{2}\right)$ for which the vectors $\vec{a} = (\sin\theta)\vec{i}+(\cos\theta)\vec{j}$ and $\vec{b} = \vec{i}-\sqrt{3}\vec{j}+2\vec{k}$ are perpendicular, is equal to
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$
10. One of the diagonals of parallelogram $ABCD$ with $\vec{a}$ and $\vec{b}$ as adjacent sides is $\vec{a}+\vec{b}$. The other diagonal $\overrightarrow{BD}$ is
(a) $\vec{a}-\vec{b}$ (b) $\vec{b}-\vec{a}$ (c) $\vec{a}+\vec{b}$ (d) $\frac{\vec{a}+\vec{b}}{2}$
11. If $\overrightarrow{BA} = 3\vec{i}+2\vec{j}+\vec{k}$ and the position vector of B is $\vec{i}+3\vec{j}-\vec{k}$, then the position vector A is
(a) $4\vec{i}+2\vec{j}+\vec{k}$ (b) $4\vec{i}+5\vec{j}$ (c) $4\vec{i}$ (d) $-4\vec{i}$

12. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of three collinear points, then which of the following is true?
$(a)\ \vec{a} = \vec{b} + \vec{c}$ $(b)\ 2\vec{a} = \vec{b} + \vec{c}$ $(c)\ \vec{b} = \vec{c} + \vec{a}$ $(d)\ 4\vec{a} + \vec{b} + \vec{c} = 0$

13. If $\vec{r} = \frac{9\vec{a}+7\vec{b}}{16}$ then the point P whose position vector $\vec{r}$ divides the line joining the points with position vectors $\vec{a}$ and $\vec{b}$ in the ratio
(a) 7: 9 internally (b) 9: 7 internally (c) 9: 7 externally (d) 7: 9 externally

14. If $\lambda\vec{\imath} + 2\lambda\vec{\jmath} + 2\lambda\vec{k}$ is a unit vector, then the value of λ is
$(a)\ \frac{1}{3}$ $(b)\ \frac{1}{4}$ $(c)\ \frac{1}{9}$ $(d)\ \frac{1}{2}$

15. Two vertices of a triangle have position vectors $3\vec{\imath} + 4\vec{\jmath} - 4\vec{k}$ and $2\vec{\imath} + 3\vec{\jmath} + 4\vec{k}$ If the position vector of the centroid is $\vec{\imath} + 2\vec{\jmath} + 3\vec{k}$ then the position vector of the third vertex is
$(a) - 2\vec{\imath} - \vec{\jmath} + 9\vec{k}$ $(b) - 2\vec{\imath} - \vec{\jmath} - 6\vec{k}$ $(c)\ 2\vec{\imath} - \vec{\jmath} + 6\vec{k}$ $(d) - 2\vec{\imath} + \vec{\jmath} + 6\vec{k}$

16. If $|\vec{a} + \vec{b}| = 60, |\vec{a} - \vec{b}| = 40$ and $|\vec{b}| = 46$, then $|\vec{a}|$ is
(a) 42 (b) 12 (c) 22 (d) 32

17. If $\vec{a}$ and $\vec{b}$ having same magnitude and angle between them is 60° and their scalar product is $\frac{1}{2}$ then $|\vec{a}|$ is
(a) 2 (b) 3 (c) 7 (d) 1

18. If $\vec{a} = \vec{\imath} + \vec{\jmath} + \vec{k}, \vec{b} = 2\vec{\imath} + x\vec{\jmath} + \vec{k},\ \vec{c} = \vec{\imath} - \vec{\jmath} + 4\vec{k}$ and $\vec{a}.(\vec{b} \times \vec{c}) = 70$, then x is equal to
(a) 5 (b) 7 (c) 26 (d) 10

19. If $|\vec{a}| = 13, |\vec{b}| = 5$ and $\vec{a}.\vec{b} = 60°$ then $|\vec{a} \times \vec{b}|$ is
(a) 15 (b) 35 (c) 45 (d) 25

20. If $\vec{a}, \vec{b}$ are the position vectors A and B, then which one of the following points whose position vector lies on AB is
$(a)\ \vec{a} + \vec{b}$ $(b)\ \frac{2\vec{a}-\vec{b}}{2}$ $(c)\ \frac{2\vec{a}+\vec{b}}{3}$ $(d)\ \frac{\vec{a}+\vec{b}}{2}$

21. If $\vec{a}$ and $\vec{b}$ are two vectors of magnitude 2 and inclined at an angle 60°, then the angle between $\vec{a}$ and $\vec{a} + \vec{b}$ is
(a) 30° (b) 60° (c) 45° (d) 90°

22. If the points whose position vectors $10\vec{\imath} + 3\vec{\jmath}, 12\vec{\imath} - 5\vec{\jmath}$ and $a\vec{\imath} + 11\vec{\jmath}$ are collinear then a is equal to
(a) 6 (b) 3 (c) 5 (d) 8

23. The unit vector parallel to the resultant of the vectors $\vec{\imath} + \vec{\jmath} - \vec{k}$ and $\vec{\imath} - 2\vec{\jmath} + \vec{k}$ is

$(a)\ \frac{\vec{\imath}-\vec{\jmath}+\vec{k}}{\sqrt{5}}$ $(b)\ \frac{2\vec{\imath}+\vec{\jmath}}{\sqrt{5}}$ $(c)\ \frac{2\vec{\imath}-\vec{\jmath}+\vec{k}}{\sqrt{5}}$ $(d)\ \frac{2\vec{\imath}-\vec{\jmath}}{\sqrt{5}}$

24. The vectors $\vec{a}-\vec{b}, \vec{b}-\vec{c}, \vec{c}-\vec{a}$ are

(a) parallel to each other (b) unit vectors

(c) mutually perpendicular vectors (d) coplanar vectors.

25. If $\vec{a}+2\vec{b}$ are $3\vec{a}+m\vec{b}$ parallel, then the value of m is

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

9. LIMITS AND CONTINUITY

1. $\lim_{x\to 0}\frac{8^x-4^x-2^x+1^x}{x^2}$

(1)$2\log 2$ $(b)\ 2(\log 2)^2$ $(c)\log 2$ $(d) 3\log 2$

2. $\lim_{x\to 0}\frac{xe^x-\sin x}{x}$ is

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

3. $\lim_{x\to 0}\frac{e^{\sin x}-1}{x}=$

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

4. $\lim_{x\to 0}\frac{\sqrt{1-\cos 2x}}{x}$

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

5. $\lim_{x\to 0}\frac{e^{\tan x}-e^x}{\tan x-x}=$

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

6. $\lim_{\theta\to 0}\frac{\sin\sqrt{\theta}}{\sqrt{\sin\theta}}$

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

7. $\lim_{n\to\infty}\left(\frac{1}{n^2}+\frac{2}{n^2}+\frac{3}{n^2}+\ldots\ldots\ldots+\frac{n}{n^2}\right)$ is

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

8. $\lim_{x\to\infty}\left(\frac{x^2+5x+6}{x^2+x-6}\right)$ is

$(a)\ e^4$ $(b)\ e^2$ $(c)\ e^3$ $(d)\ 1$

9. $\lim_{x\to\infty}\frac{\sqrt{x^2-1}}{2x+1}$ is

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

10. $\lim_{x\to\infty}\frac{a^x-b^x}{x}$ is

$(a)\log ab$ $(b)\log\left(\frac{a}{b}\right)$ $(c)\log\left(\frac{b}{a}\right)$ $(d)\ \frac{a}{b}$

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11. $\lim_{x\to\infty}\frac{\sin x}{x}$

(a) 1 (b) 0 (c) ∞ (d) $-\infty$

12. $\lim_{\alpha\to\frac{\pi}{4}}\frac{\sin\alpha-\cos\alpha}{\alpha-\frac{\pi}{4}}$ is

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

13. $\lim_{x\to\frac{\pi}{2}}\frac{2x-\pi}{\cos x}$

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

14. $\lim_{x\to3}\lfloor x\rfloor =$

(a) 2 (b) 3 (c) does not exist (d) 0

15. The value of $\lim_{x\to0}\frac{\sin x}{\sqrt{x^2}}$ is

(a) 1 (b) -1 (c) 0 (d) ∞

16. If $f(x) = x(-1)^{\left\lfloor\frac{1}{x}\right\rfloor}, x \le 0$, then the value of $\lim_{x\to0} f(x)$ is equal to

(a) -1 (b) 0 (c) 2 (d) 4

17. The value of $\lim_{x\to k^-} x - \lfloor x\rfloor$, where k is an integer is

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

18. Let the function f be defined by $f(x) = \begin{cases} 3x, & 0 \le x \le 1 \\ -3x+5, & 1 < x \le 2 \end{cases}$, then

(a) $\lim_{x\to1} f(x) = 1$ (b) $\lim_{x\to1} f(x) = 3$

(c) $\lim_{x\to1} f(x) = 2$ (d) $\lim_{x\to1} f(x)$ does not exist

19. If $\lim_{x\to0}\frac{\sin px}{\tan 3x} = 4$, then the value of p is

(a) 6 (b) 9 (c) 12 (d) 4

20. If $f:\mathbb{R}\to\mathbb{R}$ is defined by $f(x) = \lfloor x-3\rfloor + \lfloor x-4\rfloor$ for $x\in\mathbb{R}$ then $\lim_{x\to3^-} f(x)$ is equal to

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

21. At $x = \frac{3}{2}$ the function $f(x) = \frac{|2x-3|}{2x-3}$ is

(a) continuous (b) discontinuous

(c) differentiable (d) non-zero

22. Let f be a continuous function on $[2, 5]$. If f takes only rational values for all x and $f(3) = 12$, then $f(4.5)$ is equal to

(a) $\frac{f(3)+f(4.5)}{7.5}$ (b) 12 (c) 17.5 (d) $\frac{f(4.5)-f(3)}{1.5}$

23. The function $f(x) = \begin{cases} \frac{x^2-1}{x^3+1}, & x \ne -1 \\ p, & x = -1 \end{cases}$, is not defined for $x = -1$. The value of $f(-1)$ so that the function extended by this value is continuous is

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

24. Let $f:\mathbb{R}\to\mathbb{R}$ be defined by $f(x)=\begin{cases} x, & x \text{ is irrational} \\ 1-x, & x \text{ is rational}\end{cases}$, then f is

(a) discontinuous at $x=\frac{1}{2}$ (b) continuous at $x=\frac{1}{2}$
(c) continuous everywhere (d) discontinuous everywhere

25. Let a function f be defined by $f(x)=\frac{x-|x|}{x}$ for $x\neq 0$ and $f(0)=2$. Then f is

(a) continuous nowhere (b) continuous everywhere
(c) continuous for all x except $x=1$ (d) continuous for all x except $x=0$

10. DIFFERENTIABILITY AND METHODS OF DIFFERENTIATION

1. The derivative of $f(x)=x|x|$ at $x=-3$ is
   (a) 6 (b) -6 (c) does not exist (d) 0
2. $x=\frac{1-t^2}{1+t^2}, y=\frac{2t}{1+t^2}$ then $\frac{dy}{dx}$ is
   (a) $\frac{-y}{x}$ (b) $\frac{y}{x}$ (c) $\frac{-x}{y}$ (d) $\frac{x}{y}$
3. If $y=f(x^2+2)$ and $f'(3)=5$ then $\frac{dy}{dx}$ at $x=1$ is
   (a) 5 (b) 25 (c) 15 (d) 10
4. $\frac{d}{dx}\left(e^{x+5\log x}\right)$ is
   (a) $e^x.x^4(x+5)$ (b) $e^x.x(x+5)$ (c) $e^x+\frac{x}{5}$ (d) $e^x-\frac{5}{x}$
5. If $f(x)=x\tan^{-1}x$ then $f'(1)$ is
   (a) $1+\frac{\pi}{4}$ (b) $\frac{1}{2}+\frac{\pi}{4}$ (c) $\frac{1}{2}-\frac{\pi}{4}$ (d) 2
6. $\frac{d}{dx}\left(\frac{2}{\pi}\sin x^\circ\right)$
   (a) $\frac{\pi}{180}\cos x^\circ$ (b) $\frac{1}{90}\cos x^\circ$ (c) $\frac{\pi}{90}\cos x^\circ$ (d) $\frac{2}{\pi}\cos x^\circ$
7. If $y=\frac{1}{a-z}$ then $\frac{dz}{dy}$ is
   (a) $(a-z)^2$ (b) $-(z-a)^2$ (c) $(z+a)^2$ (d) $-(z+a)^2$
8. If $y=\frac{1}{4}u^4, u=\frac{2}{3}x^3+5$ then $\frac{dy}{dx}$ is
   (a) $\frac{1}{27}x^2(2x^3+15)^3$ (b) $\frac{2}{27}x(2x^3+5)^3$
   (c) $\frac{2}{27}x^2(2x^3+15)^3$ (d) $\frac{-2}{27}x(2x^3+5)^3$
9. If $y=mx+c$ and $f(0)=f'(0)=1$ then $f(2)$ is
   (a) 1 (b) 2 (c) 3 (d) -3

10. If the derivative of $(ax-5)e^{3x}$ at $x=0$ is -13 then the value of a is

(a) 8 (b) -2 (c) 5 (d) 2

11. If $x=a\sin\theta$ and $y=b\cos\theta$ then $\frac{d^2y}{dx^2}$ is

(a) $\frac{a}{b^2}\sec^2\theta$ (b) $\frac{-b}{a}\sec^2\theta$ (c) $\frac{-b}{a^2}\sec^3\theta$ (d) $\frac{-b^2}{a^2}\sec^3\theta$

12. If $y=\cos(\sin x^2)$ then $\frac{dy}{dx}$ at $x=\sqrt{\frac{\pi}{2}}$ is

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

13. The differential coefficient of $\log_{10}x$ with respect to $\log_x 10$ is

(a) 1 (b) $-(\log_{10}x)^2$ (c) $(\log_x 10)^2$ (d) $\frac{x^2}{100}$

14. The number of points in $\mathbb{R}$ in which the function $f(x)=|x-1|+|x-3|+\sin x$ is not differentiable, is

(a) 3 (b) 2 (c) 1 (d) 4

15. If $f(x)=x+2$ then $f'(f(x))$ at $x=4$ is

(a) 8 (b) 1 (c) 4 (d) 5

16. If $y=\frac{(1-x)^2}{x^2}$ then $\frac{dy}{dx}$ is

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

17. If $pv=81$ then $\frac{dp}{dv}$ at $v=9$ is

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

18. It is given that $f'(a)$ exists, then $\lim_{x\to a}\frac{xf(a)-af(x)}{x-a}$ is

(a) $f(a)-af'(a)$ (b) $f'(a)$ (c) $-f'(a)$ (d) $f(a)+af'(a)$

19. If $g(x)=(x^2+2x+3)f(x)$ and $f(0)=5$ and $\lim_{x\to 0}\frac{f(x)-5}{x}=4$ then $g'(0)$ is

(a) 20 (b) 14 (c) 18 (d) 12

20. If $f(x)=x^2-3x$ then the points at which $f(x)=f'(x)$ are

(a) both positive integers (b) both negative integers

(c) both irrational (d) one rational and another irrational

21. If $f(x)=\begin{cases}2a-x & for\ -a<x<a\\ 3x-2a & for\qquad x\geq a\end{cases}$ then which one of the following is true?

(a) $f(x)$ is not differentiable at $x=a$ (b) $f(x)$ is discontinuous at $x=a$

(c) $f(x)$ is continuous for all x in $\mathbb{R}$ (d) $f(x)$ is differentiable for all $x\geq a$

22. If $f(x)=\begin{cases}x+1 & when\ x<2\\ 2x-1 & when\ x\geq 2\end{cases}$ then $f'(2)$ is

(a) 0 (b) 1 (c) 2 (d) does not exist

23. If $f(x) = \begin{cases} x-5 & if\ \ x \le 1 \\ 4x^2-9 & if\ 1 < x < 2 \\ 3x+4 & if\ x \ge 2 \end{cases}$ then the right hand derivative of $f(x)$ at $x = 2$ is

(a) 0 (b) 2 (c) 3 (d) 4

24. If $f(x) = \begin{cases} x+2 & if\ \ -1 < x < 3 \\ 5 & if\ \ \ \ x = 3 \\ 8-x & if\ \ \ \ x > 3 \end{cases}$ then at $x = 3, f'(x)$ is

(a) 1 $(b)\ -1$ (c) 0 (d) does not exist

25. If $f(x) = \begin{cases} ax^2 - b & for -1 < x < 1 \\ \frac{1}{|x|} & for\ \ elsewhere \end{cases}$ is differentiable at $x = 1$, then

$(a)\ a = \frac{1}{2}, b = \frac{-3}{2}$ $(b)\ a = \frac{-1}{2}, b = \frac{3}{2}$ $(c)\ a = \frac{-1}{2}, b = \frac{-3}{2}$ $(d)\ a = \frac{1}{2}, b = \frac{3}{2}$

11. INTEGRAL CALCULUS

1. $\int \frac{e^x(1+x)}{\cos^2(xe^x)} dx$ is

$(a)\ \cot(xe^x) + c$ $(b)\ \sec(xe^x) + c$ $(c)\ \tan(xe^x) + c$ $(d)\ \cos(xe^x) + c$

2. $\int \frac{e^{6\log x} - e^{5\log x}}{e^{4\log x} - e^{3\log x}} dx$ is

$(a)\ x + c$ $(b)\ \frac{x^3}{3} + c$ $(c)\ \frac{3}{x^3} + c$ $(d)\ \frac{1}{x^2} + c$

3. $\int \frac{e^x(x^2\tan^{-1}x + \tan^{-1}x + 1)}{x^2+1} dx$ is

$(a)\ e^x \tan^{-1}(x+1) + c$ $(b)\ \tan^{-1}(e^x) + c$

$(c)\ \frac{e^x(\tan^{-1}x)^2}{2} + c$ $(d)\ e^x \tan^{-1}x + c$

4. $\int \sqrt{\frac{1-x}{1+x}} dx$ is

$(a)\ \sqrt{1-x^2} + \sin^{-1}x + c$ $(b)\ \sin^{-1}x - \sqrt{1-x^2} + c$

$(c)\ \log\left|x + \sqrt{1-x^2}\right| - \sqrt{1-x^2} + c$ $(d)\sqrt{1-x^2} + \log\left|x + \sqrt{1-x^2}\right| + c$

5. $\int e^{\sqrt{x}} dx$ is

$(a)\ 2\sqrt{x}(1 - e^{\sqrt{x}}) + c$ $(b)\ 2\sqrt{x}(e^{\sqrt{x}} - 1) + c$

$(c)\ 2e^{\sqrt{x}}(1 - \sqrt{x}) + c$ $(d)\ 2e^{\sqrt{x}}(\sqrt{x} - 1) + c$

6. $\int \frac{x+2}{\sqrt{x^2-1}} dx$ is

$(a)\ \sqrt{x^2-1} - 2\log\left|x + \sqrt{x^2-1}\right| + c$ $(b)\ \sin^{-1}x - 2\log\left|x + \sqrt{x^2-1}\right| + c$

$(c)\ 2\log\left|x + \sqrt{x^2-1}\right| - \sin^{-1}x + c$ $(d)\ \sqrt{x^2-1} + 2\log\left|x + \sqrt{x^2-1}\right| + c$

7. $\int \sin\sqrt{x}\,dx$ is

$(a)\ 2(-\sqrt{x}\cos\sqrt{x} + \sin\sqrt{x}) + c$ $(b)\ 2(-\sqrt{x}\cos\sqrt{x} - \sin\sqrt{x}) + c$

$(c)\ 2(-\sqrt{x}\sin\sqrt{x} - \cos\sqrt{x}) + c$ $(d)\ 2(-\sqrt{x}\sin\sqrt{x} + \cos\sqrt{x}) + c$

8. If $\int f(x)dx = g(x) + c$ then $\int f(x)g'(x)dx$ is

$(a)\ \int (f(x))^2 dx$ $(b)\ \int f(x)g(x)dx$ $(c)\ \int f'(x)g(x)dx$ $(d)\ \int (g(x))^2 dx$

9. If $\int \frac{3^{\frac{1}{x}}}{x^2}dx = k\left(3^{\frac{1}{x}}\right) + c$ then the value of k is

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

10. If $\int f'(x)e^{x^2}dx = (x-1)e^{x^2} + c$ then $f(x)$ is

$(a)\ 2x^3 - \frac{x^2}{2} + x + c$ $(b)\ \frac{x^3}{2} + 3x^2 + 4x + c$

$(c)\ x^3 + 4x^2 + 6x + c$ $(d)\ \frac{2x^3}{3} - x^2 + x + c$

11. $\int \frac{\sec^2 x}{\tan^2 x - 1}dx$

$(a)\ 2\log\left|\frac{1-\tan x}{1+\tan x}\right| + c$ $(b)\ \log\left|\frac{1+\tan x}{1-\tan x}\right| + c$

$(c)\ \frac{1}{2}\log\left|\frac{\tan x + 1}{\tan x - 1}\right| + c$ $(d)\ \frac{1}{2}\log\left|\frac{\tan x - 1}{\tan x + 1}\right| + c$

12. $\int \frac{dx}{e^x - 1}$ is

$(a)\ \log|e^x| - \log|e^x - 1| + c$ $(b)\ \log|e^x| + \log|e^x - 1| + c$

$(c)\ \log|e^x - 1| - \log|e^x| + c$ $(d)\ \log|e^x + 1| - \log|e^x| + c$

13. $\int \frac{\sqrt{\tan x}}{\sin 2x}dx$ is

$(a)\ \sqrt{\tan x} + c$ $(b)\ 2\sqrt{\tan x} + c$ $(c)\ \frac{1}{2}\sqrt{\tan x} + c$ $(d)\ \frac{1}{4}\sqrt{\tan x} + c$

14. $\int sin^3 x\ dx$ is

$(a)\ \frac{-3}{4}\cos x - \frac{\cos 3x}{12} + c$ $(b)\ \frac{3}{4}\cos x + \frac{\cos 3x}{12} + c$

$(c)\ \frac{-3}{4}\cos x + \frac{\cos 3x}{12} + c$ $(d)\ \frac{-3}{4}\sin x - \frac{\sin 3x}{12} + c$

15. $\int \frac{\sec x}{\sqrt{\cos 2x}}dx$is

$(a)\ \tan^{-1}(\sin x) + c$ $(b)\ 2\sin^{-1}(\tan x) + c$

$(c)\ \tan^{-1}(\cos x) + c$ $(d)\ \sin^{-1}(\tan x) + c$

16. $\int 2^{3x+5}dx$ is

$(a)\ \frac{3(2^{3x+5})}{\log 2} + c$ $(b)\ \frac{2^{3x+5}}{2\log(3x+5)} + c$ $(c)\ \frac{2^{3x+5}}{2\log 3} + c$ $(d)\ \frac{2^{3x+5}}{3\log 2} + c$

17. $\int \frac{\sin^8 x - \cos^8 x}{1 - 2\sin^2 x\cos^2 x}dx$ is

$(a)\ \frac{1}{2}\sin 2x + c$ $(b)\ \frac{-1}{2}\sin 2x + c$ $(c)\ \frac{1}{2}\cos 2x + c$ $(d)\ \frac{-1}{2}\cos 2x + c$

18. $\int \frac{x^2+\cos^2 x}{x^2+1} cosec^2 x\, dx$ is
(a) $\cot x + \sin^{-1} x + c$ (b) $-\cot x + \tan^{-1} x + c$
(c) $-\tan x + \cot^{-1} x + c$ (d) $-\cot x - \tan^{-1} x + c$

19. $\int x^2 \cos x\, dx$ is
(a) $x^2 \sin x + 2x \cos x - 2 \sin x + c$ (b) $x^2 \sin x - 2x \cos x - 2 \sin x + c$
(c) $-x^2 \sin x + 2x \cos x + 2 \sin x + c$ (d) $-x^2 \sin x - 2x \cos x + 2 \sin x + c$

20. $\int \tan^{-1} \sqrt{\frac{1-\cos 2x}{1-\cos 2x}} dx + c$ is
(a) $x^2 + c$ (b) $2x^2 + c$ (c) $\frac{x^2}{2} + c$ (d) $\frac{-x^2}{2} + c$

21. $\int e^{-4x} \cos x\, dx$ is
(a) $\frac{e^{-4x}}{17}(4 \cos x - \sin x) + c$ (b) $\frac{e^{-4x}}{17}(-4 \cos x + \sin x) + c$
(c) $\frac{e^{-4x}}{17}(4 \cos x + \sin x) + c$ (d) $\frac{e^{-4x}}{17}(-4 \cos x - \sin x) + c$

22. $\int e^{-7x} \sin 5x\, dx$ is
(a) $\frac{e^{-7x}}{74}(-7 \sin 5x - 5 \cos 5x) + c$ (b) $\frac{e^{-7x}}{74}(7 \sin 5x + 5 \cos 5x) + c$
(c) $\frac{e^{-7x}}{74}(7 \sin 5x - 5 \cos 5x) + c$ (d) $\frac{e^{-7x}}{74}(-7 \sin 5x + 5 \cos 5x) + c$

23. $\int x^2 e^{\frac{x}{2}} dx$ is
(a) $x^2 e^{\frac{x}{2}} - 4x e^{\frac{x}{2}} - 8 e^{\frac{x}{2}} + c$ (b) $2x^2 e^{\frac{x}{2}} - 8x e^{\frac{x}{2}} - 16 e^{\frac{x}{2}} + c$ (c) $2x^2 e^{\frac{x}{2}} - 8x e^{\frac{x}{2}} + 16 e^{\frac{x}{2}} + c$ (d) $\frac{x^2 e^{\frac{x}{2}}}{2} - \frac{x e^{\frac{x}{2}}}{4} + \frac{e^{\frac{x}{2}}}{8} + c$

24. $\int \frac{1}{x\sqrt{(\log x)^2 - 5}} dx$ is
(a) $\log\left|x + \sqrt{x^2 - 5}\right| + c$ (b) $\log\left|\log x + \sqrt{\log x - 5}\right| + c$
(c) $\log\left|\log x + \sqrt{(\log x)^2 - 5}\right| + c$ (d) $\log\left|\log x - \sqrt{(\log x)^2 - 5}\right| + c$

25. The gradient (slope) of a curve at any point (x, y) is $\frac{x^2-4}{x^2}$. If the curve passes through the point $(2, 7)$, then the equation of the curve is
(a) $y = x + \frac{4}{x} + 3$ (b) $y = x + \frac{4}{x} + 4$
(c) $y = x^2 + 3x + 4$ (d) $y = x^2 - 3x + 6$

12. INTRODUCTION TO PROBABILITY THEORY

1. There are three events A, B and C of which one and only one can happen. If the odds are 7 to 4 against A and 5 to 3 against B, then odds against C is

(a) 23: 65 (b) 65: 23 (c) 23: 88 (d) 88: 23

2. A matrix is chosen at random from a set of all matrices of order 2, with elements 0 or 1 only. The probability that the determinant of the matrix chosen is non zero will be

$(a)\ \frac{3}{16}$ $(b)\ \frac{3}{8}$ $(c)\ \frac{1}{4}$ $(d)\ \frac{5}{8}$

3. If A and B are any two events, then the probability that exactly one of them occur is

$(a)\ P(A\cup\bar{B})+P(\bar{A}\cup B)$ $(b)\ P(A\cap\bar{B})+P(\bar{A}\cap B)$

$(c)\ P(A)+P(B)-P(A\cap B)$ $(d)\ P(A)+P(B)+2P(A\cap B)$

4. If m is a number such that $m\leq 5$, then the probability that quadratic equation $2x^2+2mx+m+1=0$ has real roots is

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

5. Let A and B be two events such that $P(\overline{A\cup B})=\frac{1}{6}, P(A\cap B)=\frac{1}{4}$, and $P(\bar{A})=\frac{1}{4}$. Then the events A and B are

(a) Equally likely but not independent (b) Independent but not equally likely (c) Independent and equally likely (d) Mutually inclusive and dependent

6. Four persons are selected at random from a group of 3 men, 2 women and 4 children. The probability that exactly two of them are children is

$(a)\ \frac{3}{4}$ $(b)\ \frac{10}{23}$ $(c)\ \frac{1}{2}$ $(d)\ \frac{10}{21}$

7. In a certain college 4% of the boys and 1% of the girls are taller than 1.8 meter. Further 60% of the students are girls. If a student is selected at random and is taller than 1.8 meters, then the probability that the student is a girl is

$(a)\ \frac{2}{11}$ $(b)\ \frac{3}{11}$ $(c)\ \frac{5}{11}$ $(d)\ \frac{7}{11}$

8. The probability of two events A and B are 0.3 and 0.6 respectively. The probability that both A and B occur simultaneously is 0.18. The probability that neither A nor B occurs is

(a) 0.1 (b) 0.72 (c) 0.42 (d) 0.28

9. It is given that the events A and B are such that $P(A)=\frac{1}{4}, P(A/B)=\frac{1}{2}$ and $P(B/A)=\frac{2}{3}$ then $P(B)$ is

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

10. A letter is taken at random from the letters of the word '$ASSISTANT$' and another letter is taken at random from the letters of the word '$STATISTICS$'. The probability that the selected letters are the same is

$(a)\ \frac{7}{45}$ $(b)\ \frac{17}{90}$ $(c)\ \frac{29}{90}$ $(d)\ \frac{19}{90}$

11. A, B and C try to hit a target simultaneously but independently. Their respective probabilities of hitting the target are $\frac{3}{4}, \frac{1}{2}, \frac{5}{8}$. The probability that the target is hit by A or B but not by C is

(a) $\frac{21}{64}$ (b) $\frac{7}{32}$ (c) $\frac{9}{64}$ (d) $\frac{7}{8}$

12. If A and B are two events such that $A \subset B$ and $P(B) \neq 0$, then which of the following is correct?

(a) $P(A/B) = \frac{P(A)}{P(B)}$ (b) $P(A/B) < P(A)$

(c) $P(A/B) \geq P(A)$ (d) $P(A/B) > P(B)$

13. A bag contains 6 green, 2 white, and 7 black balls. If two balls are drawn simultaneously, then the probability that both are different colours is

(a) $\frac{68}{105}$ (b) $\frac{71}{105}$ (c) $\frac{64}{105}$ (d) $\frac{73}{105}$

14. A number is selected from the set $\{1,2,3,\ldots,20\}$. The probability that the selected number is divisible by 3 or 4 is

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

15. An urn contains 5 red and 5 black balls. A ball is drawn at random, its colour is noted and is returned to the urn. Moreover, 2 additional balls of the colour drawn are put in the urn and then a ball is drawn at random. The probability that the second ball drawn is red will be

(a) $\frac{5}{12}$ (b) $\frac{1}{2}$ (c) $\frac{7}{12}$ (d) $\frac{1}{4}$

16. A number x is chosen at random from the first 100 natural numbers. Let A be the event of numbers which satisfies $\frac{(x-10)(x-50)}{x-30} \geq 0$, then $P(A)$ is

(a) 0.20 (b) 0.51 (c) 0.71 (d) 0.70

17. If two events A and B are independent such that $P(A) = 0.35$ and $P(A \cup B) = 0.6$, then $P(B)$ is

(a) $\frac{5}{13}$ (b) $\frac{1}{13}$ (c) $\frac{4}{13}$ (d) $\frac{7}{13}$

18. If two events A and B are such that $P(\bar{A}) = \frac{3}{10}$ and $P(A \cap \bar{B}) = \frac{1}{2}$, then $P(A \cap B)$ is

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

19. If A and B are two events such that $P(A) = 0.4, P(B) = 0.8$ and $P(B/A) = 0.6$, then $P(\bar{A} \cap B)$ is

(a) 0.96 (b) 0.24 (c) 0.56 (d) 0.66

20. A bag contains 5 white and 3 black balls. Five balls are drawn successively without replacement. The probability that they are alternately of different colours is

(a) $\frac{3}{14}$ (b) $\frac{5}{14}$ (c) $\frac{1}{14}$ (d) $\frac{9}{14}$

21. If a and b are chosen randomly from the set $\{1,2,3,4\}$ with replacement, then the probability of the real roots of the equation $x^2 + ax + b = 0$ is

(a) $\frac{3}{16}$ (b) $\frac{5}{16}$ (c) $\frac{7}{16}$ (d) $\frac{11}{16}$

22. Ten coins are tossed. The probability of getting at least 8 heads is

(a) $\frac{7}{64}$ (b) $\frac{7}{32}$ (c) $\frac{7}{16}$ (d) $\frac{7}{128}$

23. Two items are chosen from a lot containing twelve items of which four are defective, then the probability that at least one of the item is defective

$(a)\ \frac{19}{33}$ $(b)\ \frac{17}{33}$ $(c)\ \frac{23}{33}$ $(d)\ \frac{13}{33}$

24. A man has 3 fifty rupee notes, 4 hundred rupees notes and 6 five hundred rupees notes in his pocket. If 2 notes are taken at random, what are the odds in favour of both notes being of hundred rupee denomination?

(a) 1: 12 (b) 12: 1 (c) 13: 1 (d) 1: 13

25. If X and Y be two events such that $P(X/Y) = \frac{1}{2}, P(Y/X) = \frac{1}{3}$ and $P(X \cap Y) = \frac{1}{6}$ then $P(X \cup Y)$ is

$(a)\ \frac{1}{3}$ $(b)\ \frac{2}{5}$ $(c)\ \frac{1}{6}$ $(d)\ \frac{2}{3}$