+1 Maths

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VOLUME - 1

CHAPTER 1 SETS, RELATIONS AND FUNCTIONS

2 MARKS

1. Find the number of subsets of A if $A = \{x: x = 4n + 1, 2 \le n \le 5, n \in N\}$. **(EG 1.1)**
2. If $X = \{1,2,3, \dots\dots,10\}$ and $A = \{1,2,3,4,5\}$, find the number of sets $B \subseteq X$ such that $A - B = \{4\}$. **(E.g. 1.4)**
3. If $n(\wp(A)) = 1024$, $n(A \cup B) = 15$ and $n(\wp(B)) = 32$, then find $n(A \cap B)$. **(Ex. 1.1. 6)**
4. If $n(A \cap B) = 3$ and $n(A \cup B) = 10$, then find $n(\wp(A\Delta B))$. **(Ex. 1.1. 7)**
5. Write the following in roster form.(i) $\{x \in \mathbb{N}: x^2 < 121$ and x is a prime$\}$. **(EX 1.1 - 1)**
6. For a set $A, A \times A$ contains 16 elements and two of its elements are $(1,3)$ and $(0,2)$. Find the elements of A. **(Ex. 1.1. 8)**
7. Let A and B be two sets such that $n(A) = 3$ and $n(B) = 2$. If $(x, 1), (y, 2), (z, 1)$ are in $A \times B$, find A and B, where x, y, z are distinct elements. **(Ex. 1.1. 9)**
8. Let $X = \{a, b, c, d\}$ and $R = \{(a, a), (b, b), (a, c)\}$. Write down the minimum number of ordered pairs to be included to R to make it (i) reflexive (ii) symmetric (iii) transitive (iv) equivalence **(Ex. 1.2. 2)**
9. Let $A = \{a, b, c\}$ and $R = \{(a, a), (b, b), (a, c)\}$. Write down the minimum number of ordered pairs to be included to R to make it (i) reflexive (ii) symmetric (iii) transitive (iv) equivalence **(Ex. 1.2. 3)**
10. Check whether the following for one-to-oneness and ontoness.
    (i) $f: \mathbb{R} \to \mathbb{R}$ defined by $f(x) = \frac{1}{x}$. (ii) $f: \mathbb{R} - \{0\} \to \mathbb{R}$ defined by $f(x) = \frac{1}{x}$. **(EG 1.16)**
11. If $f: [-2,2] \to B$ is given by $f(x) = 2x^3$ then find B so that f is onto. **(EG 1.19)**
12. Check whether the following functions are one-to-one and onto. (i) $f: \mathbb{N} \to \mathbb{N}$ defined by $f(n) = n + 2$. (ii) $f: \mathbb{N} \cup \{-1,0\} \to \mathbb{N}$ defined by $f(n) = n + 2$. **(E.g. 1.14)**
13. Check the following functions for one-to-oneness and ontoness. (i) $f: \mathbb{N} \to \mathbb{N}$ defined by $f(n) = n^2$. (ii) $f: \mathbb{R} \to \mathbb{R}$ defined by $f(n) = n^2$. **(E.g. 1.15)**
14. Find the domain of $f(x) = \frac{1}{1-2\cos x}$. **(E.g. 1.22)**
15. Let $f = \{(1,2), (3,4), (2,2)\}$ and $g = \{(2,1), (3,1), (4,2)\}$. Find $g \circ f$ and $f \circ g$. **(EG 1.25)**
16. Let $f = \{(1,4), (2,5), (3,5)\}$ and $g = \{(4,1), (5,2), (6,4)\}$. Find $g \circ f$. Can you find $f \circ g$? **(EG 1.26)**
17. Let f and g be the two functions from $\mathbb{R}$ to $\mathbb{R}$ defined by $f(x) = 3x - 4$ and $g(x) = x^2 + 3$. Find $g \circ f$ and $f \circ g$. **(E.g. 1.27)**
18. Find the domain of $\frac{1}{1-2\sin x}$. **(Ex. 1.3. 6)**
19. Find the largest possible domain of the real valued function $f(x) = \frac{\sqrt{4-x^2}}{\sqrt{x^2-9}}$. **(Ex. 1.3. 7)**

20. Graph the functions $f(x) = x^3$, $g(x) = \sqrt[3]{x}$ on the same coordinate plane. Find $f \circ g$ and graph it on the plane as well. **(Ex. 1.4. 3)**

3 MARKS

1. In a survey of 5000 persons in a town, it was found that 45% of the persons know Language A, 25% know Language B, 10% know Language C, 5% know Languages A and B, 4% know Languages B and C, and 4% know Languages A and C. If 3% of the persons know all the three Languages, find the number of persons who knows only Language A. **(EG 1.2)**
2. Prove that $\left((A \cup B' \cup C) \cap (A \cap B' \cap C')\right) \cup \left((A \cup B \cup C') \cap (B' \cap C')\right) = B' \cap C'$. **(EG 1.3)**
3. P.T. $\left((A \cup B' \cup C) \cap (A \cap B' \cap C')\right) \cup \left((A \cup B \cup C') \cap (B' \cap C')\right) = B' \cap C'$. **(E.g. 1.3)**
4. If A, B are two sets, $n(B - A) = 2n(A - B) = 4n(A \cap B)$ and if $n(A \cup B) = 14$, then find $n(\wp(A))$. **(E.g. 1.5)**
5. Two sets have m and k elements. If the total number of subsets of the first set is 112 more than that of the second set, find the values of m and k. **(EG 1.6)**
6. If $n(A) = 10$ and $n(A \cap B) = 3$, find $n((A \cap B)' \cap A)$. **(E.g. 1.7)**
7. If $A = \{1,2,3,4\}$ and $B = \{3,4,5,6\}$, find $n((A \cup B) \times (A \cap B) \times (A \Delta B))$. **(EG 1.8)**
8. If $A \times A$ has 16 elements, $S = \{(a, b) \in A \times A : a < b\}$, $(-1,2)$ and $(0,1)$ are two elements of S, then find the remaining elements of S. **(Ex. 1.1. 10)**
9. Check the relation $R = \{(1,1), (2,2), (3,3), \ldots\ldots, (n, n)\}$ defined on the set $S = \{1,2,3, \ldots\ldots, n\}$ for the three basic relations. **(E.g. 1.10)**
10. Discuss the following relations for reflexivity, symmetricity and transitivity: (v) On the set of natural numbers the relation R defined by "xRy if $x + 2y = 1$". **(EX 1.2 - 1)**
11. Let P be the set of all triangles in a plane and R be the relation defined on P as aRb if a *is similar to* b. P.T. R is an equivalence relation. **(Ex. 1.2. 4)**
12. On the set of natural numbers let R be the relation defined by aRb if $2a + 3b = 30$. Write down the relation by listing all the pairs. Check
    a. (i) reflexive (ii) symmetric (iii) transitive (iv) equivalence **(Ex. 1.2. 5)**
13. On the set of natural numbers let R be the relation defined by aRb if $a + b \leq 6$. Write down the relation by listing all the pairs. Check (i) reflexive (ii) symmetric (iii) transitive (iv) equivalence **(Ex. 1.2. 7)**
14. Let $A = \{a, b, c\}$. What is the equivalence relation of smallest cardinality on A? What is the equivalence relation of largest cardinality on A? **(Ex. 1.2. 8)**
15. If $f: \mathbb{R} \to \mathbb{R}$ is defined as $f(x) = 2x^2 - 1$, find the pre-images of $17, 4$ and -2. **(E.g. 1.18)**

16. Find the range of the function $f(x) = \frac{1}{1-3\cos x}$. **(E.g. 1.23)**
17. Find the range of the function $\frac{1}{2\cos x-1}$. **(Ex. 1.3. 8)**
18. Show that the relation $xy = -2$ is a function for a suitable domain. Find the domain and the range of the function. **(Ex. 1.3. 9)**
19. Write the steps to obtain the graph of the function $y = 3(x-1)^2 + 5$ from the graph $y = x^2$. **(Ex. 1.4. 4)**

5 MARKS

1. By taking suitable sets A, B, C, verify the results:$(i)\ A \times (B \cap C) = (A \times B) \cap (A \times C)$. $(ii)(B - A) \cap C = (B \cap C) - A = B \cap (C - A)$. **(Ex. 1.1. 4 (i),(v))**
2. In the set $\mathbb{Z}$ of integers, define $mRn\ if\ m - n\ is\ a\ multiple\ of\ 12$. Prove that R is an equivalence relation. **(E.g. 1.13)**
3. In the set Z of integers, define mRn if $m - n\ is\ divisible\ by\ 7$. Prove that R is an equivalence relation. **(Ex. 1.2. 9)**
4. Find the largest possible domain for the real valued function $f(x) = \frac{\sqrt{9-x^2}}{\sqrt{x^2-1}}$. **(E.g. 1.24)**
5. Write the values of f at $-4, 1, -2, 7, 0$ $if\ f(x) = \begin{cases} -x+4 & if -\infty < x \le -3 \\ x+4 & if -3 < x < -2 \\ x^2 - x & if -2 \le x < 1 \\ x - x^2 & if\ 1 \le x < 7 \\ 0 & otherwise \end{cases}$. **(EX 1.3 - 2)**
6. Write the values of f at $-3, 5, 2, -1, 0$ $if\ f(x) = \begin{cases} x^2+x-5 & if\ x \in (-\infty, 0) \\ x^2+3x-2 & if\ x \in (3, \infty) \\ x^2 & if\ x \in (0,2) \\ x^2 - 3 & otherwise \end{cases}$. **(EX 1.3 - 3)**
7. If $f: \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = 2x - 3$ P.T f is a bijection and find its inverse. **(E.g. 1.30)**
8. If $f: \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = 3x - 5$, P.T f is a bijection and find its inverse. **(Ex. 1.3. 12)**
9. The formula for converting from Fahrenheit to Celsius temperatures is $y = \frac{5x}{9} - \frac{160}{9}$. Find the inverse of this function and determine whether the inverse is also a function. **(Ex. 1.3. 19)**
10. A simple cipher takes a number and codes it, using the function $f(x) = 3x - 4$. Find the inverse of this function, determine whether the inverse is also a function and verify the symmetrical property about the line $y = x$. (by drawing the lines). **(EX 1.3 - 20)**
11. Draw the graph of $y = 2\sin(x-1) + 3$. **(Ill. 4)**

12. For the curve $y = x^3$ given in the Figure, draw
13. $(i)\ y = -x^3$ $(ii)\ y = x^3 + 1$ $(iii)\ y = x^3 - 1$ $(iv)\ y = (x+1)^3$ with the same scale. **(EX 1.4 - 1)**
14. From the curve $y = \sin x$, graph the functions $(i)\ y = \sin(-x)$ $(ii)\ y = -\sin(-x)$ $(iii)\ y = \sin\left(\frac{\pi}{2} + x\right)$ which is $\cos x$ $(iv)\ y = \sin\left(\frac{\pi}{2} - x\right)$ which is also $\cos x$. **(Ex. 1.4. 5)**
15. From the curve $y = |x|$, draw $(i)\ y = |x-1| + 1$ $(ii)\ y = |x+1| - 1$ $(iii)\ y = |x+2| - 3$. **(Ex. 1.4. 7)**

CHAPTER 2 BASIC ALGEBRA

2 MARKS

1. Find a positive number smaller than $\frac{1}{2^{1000}}$. Justify. **(EX 2.1 - 5)**
2. Solve $\left|\frac{2}{x-4}\right| > 1, x \neq 4$. **(EG 2.15)**
3. Solve for x: $(iii)\ \left|3 - \frac{3}{4}x\right| \leq \frac{1}{4}$. **(Ex. 2.2. 1(iii))**
4. Solve $\frac{1}{|2x-1|} < 6$. **(Ex. 2.2. 2)**
5. Solve $-3|x| + 5 \leq -2$ and graph the solution set in a number line. **(Ex. 2.2. 3)**
6. Solve the following system of linear inequalities. $3x - 9 \geq 0, 4x - 10 \leq 6$. **(EG 2.8)**
7. A girl A is reading a book having 446 pages and she has already finished reading 271 pages. She wants to finish reading this book within a week. What is the minimum number of pages she should read per day to complete reading the book within a week? **(EG 2.9)**
8. Solve $23x < 100$ when (i) x is a natural number, (ii) x is an integer. **(EX 2.3 - 2)**
9. Solve $-2x \geq 9$ when (i) x is a real number, (ii) x is an integer, (iii) x is a natural number. **(EX 2.3 - 2)**
10. If a and b are the roots of the equation $x^2 - px + q = 0$, find the value of $\frac{1}{a} + \frac{1}{b}$. **(EG 2.10)**
11. Find the complete set of values of a for which the quadratic $x^2 - ax + a + 2 = 0$ has equal roots. **(EG 2.11)**
12. Construct a quadratic equation with roots 7 and -3. **(Ex. 2.4. 1)**
13. Write $f(x) = x^2 + 5x + 4$ in completed square form. **(EX 2.4 - 10)**
14. Solve $-x^2 + 3x - 2 \geq 0$. **(Ex. 2.5. 2)**
15. Find a quadratic polynomial $f(x)$ such that, $f(0) = 1, f(-2) = 0$ and $f(1) = 0$. **(E.g. 2.16)**
16. Solve $x = \sqrt{x + 20}$ for $x \in R$. **(E.g. 2.21)**

17. Rationalize the denominator of $\frac{\sqrt{5}}{\sqrt{6}+\sqrt{2}}$. **(EG 2.32)**
18. Find the square root of $7-4\sqrt{3}$. **(EG 2.33)**
19. Evaluate $\left(\left((256)^{\frac{-1}{2}}\right)^{\frac{-1}{4}}\right)^{3}$. **(Ex. 2.11. 2)**
20. Simplify and hence find the value of n: $\frac{3^{2n}9^{2}3^{-n}}{3^{3n}}=27$. **(Ex. 2.11. 4)**
21. Find the radius of the spherical tank whose volume is $\frac{32\pi}{3}$ units. **(Ex. 2.11. 5)**
22. Find the logarithm of 1728 to the base $2\sqrt{3}$. **(E.g. 2.34)**
23. If the logarithm of 324 to base a is 4, then find a. **(EG 2.35)**
24. Compute $\log_9 27-\log_{27} 9$. **(Ex. 2.12. 2)**
25. Prove $\log_{a^2} a \log_{b^2} b \log_{c^2} c=\frac{1}{8}$. **(Ex. 2.12. 8)**
26. Solve $\log_{5-x}(x^2-6x+65)=2$. **(Ex. 2.12. 12)**

3 MARKS

1. Prove that $\sqrt{3}$ is an irrational number. **(Ex. 2.1. 2)**
2. Find the number of solutions of $x^2+|x-1|=1$. **(EG 2.12)**
3. Solve: $(i)\ \frac{3(x-2)}{5}\le\frac{5(2-x)}{3}$ $(ii)\ \frac{5-x}{3}<\frac{x}{2}-4$. **(Ex. 2.3. 4)**
4. To secure A grade one must obtain an average of 90 marks or more in 5 subjects each of maximum 100 marks. If one scored 84,87,95,91 in first four subjects, what is the minimum mark one scored in the fifth subject to get A grade in the course? **(EX 2.3 - 5)**
5. Find all pairs of consecutive odd natural numbers both of which are larger than 10 and their sum is less than 40. **(Ex. 2.3. 7)**
6. If $x=-2$ is one root of $x^3-x^2-17x=22$, then find the other roots of equation. **(Ex. 2.6. 2)**
7. Find the real roots of $x^4=16$. **(Ex. 2.6. 3)**
8. Construct a cubic polynomial function having zeros at $x=\frac{2}{5}, 1+\sqrt{3}$ such that $f(0)=-8$. **(EG 2.17)**
9. Prove that $ap+q=0$ if $f(x)=x^3-3px+2q$ is divisible by $g(x)=x^2+2ax+a^2$. **(EG 2.18)**
10. The equations $x^2-6x+a=0$ and $x^2-bx+6=0$ have one root in common. The other root of the first and the second equations are integers in the ratio 4: 3. Find the common root. **(E.g. 2.22)**

11. Solve $\frac{x+1}{x+3} < 3$. **(EG 2.24)**
12. Factorize: $x^4 + 1$. (Hint: Try completing the square.) **(EX 2.7 - 1)**
13. Resolve into partial fractions: $\frac{1}{x^2-a^2}$ **(EX 2.9 - 1)**
14. Resolve into partial fractions: $\frac{x}{(x-1)^3}$ **(EX 2.9 - 4)**
15. Resolve into partial fractions: $\frac{1}{x^4-1}$ **(EX 2.9 - 5)**
16. $\left(x^{\frac{1}{2}} + x^{\frac{-1}{2}}\right)^2 = \frac{9}{2}$, then find the value of $\left(x^{\frac{1}{2}} - x^{\frac{-1}{2}}\right)$for $x > 1$. **(EX 2.11 - 3)**
17. Simplify $\frac{1}{3-\sqrt{8}} - \frac{1}{\sqrt{8}-\sqrt{7}} + \frac{1}{\sqrt{7}-\sqrt{6}} - \frac{1}{\sqrt{6}-\sqrt{5}} + \frac{1}{\sqrt{5}-2}$ **(EX 2.11 - 7)**
18. If $x = \sqrt{2} + \sqrt{3}$ find $\frac{x^2+1}{x^2-2}$. **(Ex. 2.11. 8)**
19. Solve $x^{\log_3 x} = 9$. **(EG 2.38)**
20. Compute $\log_3 5 \log_{25} 27$. **(EG 2.39)**
21. Prove $\log\frac{75}{16} - 2\log\frac{5}{9} + \log\frac{32}{243} = \log 2$. **(E.g. 2.36)**
22. If $\log_2 x + \log_4 x + \log_{16} x = \frac{7}{2}$, find the value of x. **(E.g. 2.37)**
23. Solve $\log_8 x + \log_4 x + \log_2 x = 11$. **(EX 2.12 - 3)**
24. Solve $\log_4 2^{8x} = 2^{\log_2 8}$. **(Ex. 2.12. 4)**
25. If $a^2 + b^2 = 7ab$, show that $\log\frac{a+b}{3} = \frac{1}{2}(\log a + \log b)$. **(Ex. 2.12. 5)**
26. Prove that $\log 2 + 16\log\frac{16}{15} + 12\log\frac{25}{24} + 7\log\frac{81}{80} = 1$. **(EX 2.12 - 7)**
27. P.T. $\log a + \log a^2 + \log a^3 + \cdots . + \log a^n = \frac{n(n+1)}{2}\log a$. **(Ex. 2.12. 9)**
28. Solve $\log_2 x - 3\log_{\frac{1}{2}} x = 6$. **(Ex. 2.12. 11)**

5 MARKS

1. A manufacturer has 600 litres of a 12 percent solution of acid. How many litres of a 30 percent acid solution must be added to it so that the acid content in the resulting mixture will be more than 15 percent but less than 18 percent? **(Ex. 2.3. 6)**
2. If one root of $k(x-1)^2 = 5x - 7$ is double the other root, S.T. $k = 2, -25$. **(Ex. 2.4. 4)**
3. If the difference of the roots of the equation $2x^2 - (a+1)x + a - 1 = 0$ is equal to their product, then prove that $a = 2$. **(Ex. 2.4. 5)**
4. Find the condition that one of the roots of $ax^2 + bx + c$ may be (i) negative of the other, (ii) thrice the other, (iii) reciprocal of the other. **(Ex. 2.4. 6)**

5. If the equations $x^2 - ax + b = 0$, $x^2 - ex + f = 0$ have one root in common and if the second equation has equal roots, then prove that $ae = 2(b + f)$. **(Ex. 2.4. 7)**
6. Use the method of undetermined coefficients to find the sum of $1 + 2 + 3 + \ldots. + (n-1) + n, n \in N$ **(E.g. 2.19)**
7. Find all values of x that satisfies the inequality $\frac{2x-3}{(x-2)(x-4)} < 0$. **(Ex. 2.8. 2)**
8. Solve $\frac{x^2-4}{x^2-2x-15} \leq 0$. **(Ex. 2.4. 3)**
9. Resolve into partial fractions: $\frac{x}{(x^2+1)(x-1)(x+2)}$. **(Ex. 2.9. 3)**
10. Resolve into partial fractions: $\frac{1}{x^4-1}$. **(Ex. 2.9. 5)**
11. Resolve into partial fractions: $\frac{6x^2-x+1}{x^3+x^2+x+1}$ **(EX 2.9 - 10)**
12. Resolve into partial fractions: $\frac{2x^2+5x-11}{x^2+2x-3}$ **(EX 2.9 - 11)**
13. Resolve into partial fractions: $\frac{7+x}{(1+x)(1+x^2)}$ **(EX 2.9 - 12)**
14. Solve the linear inequalities and exhibit the solution set graphically: $2x + y \geq 8, x + 2y \geq 8, x + y \leq 6$. **(Ex. 2.10. 7)**

CHAPTER 3 TRIGONOMETRY

2 MARKS

1. Find a coterminal angle with measure of θ such that $0° \leq \theta < 360°$ (i) $525°$ $(ii) -270°$ $(ii) -450°$. **(EX 3.1. 2)**
2. What must be the radius of a circular running path, around which an athlete must run 5 times in order to describe 1 km? **(EX 3.2. 3)**
3. Find the degree measure of the angle subtended at the centre of circle of radius 100 cm by an arc of length 22 cm. **(EX 3.2. 5)**
4. What is the length of the arc intercepted by a central angle of measure $41°$ in a circle of radius 10 ft? **(EX 3.2. 6)**
5. An airplane propeller rotates 1000 times per minute. Find the number of degrees that a point on the edge of the propeller will rotate in 1 second.
6. **(EX 3.2. 9)**
7. If $\cos\theta = \frac{1}{2}\left(a + \frac{1}{a}\right)$, show that $\cos 3\theta = \frac{1}{2}\left(a^3 + \frac{1}{a^3}\right)$. **(EX 3.5. 3)**
8. P.T. $32(\sqrt{3})\ \sin\frac{\pi}{48}\cos\frac{\pi}{48}\cos\frac{\pi}{24}\cos\frac{\pi}{12}\cos\frac{\pi}{6} = 3$. **(EX 3.5. 11)**

9. Express each of the following as a sum or difference
   (i) $\sin 4x \cos 2x$ (ii) $\sin 5\theta \sin 4\theta$. **(EX 3.6. 1)**
10. Show that $\sin 12° \sin 48° \sin 54° = \frac{1}{8}$. **(EX 3.6. 3)**
11. Prove that $\frac{\sin 4x+\sin 2x}{\cos 4x+\cos 2x} = \tan 3x$. **(EX 3.6. 8)**
12. Find the general solution of $\sin \theta = \frac{-\sqrt{3}}{2}$. **(E.g. 3.43)**
13. Solve the following equations for which solutions lies in the interval $0° \leq \theta < 360°, 2\cos^2 x + 1 = -3\cos x$. **(EX 3.8. 2(ii))**
14. In a ΔABC, if $a = 2\sqrt{2}, b = 2\sqrt{3}$ and $C = 75°$, find the other side and the angles. **(E.g. 3.66)**
15. Find the area of the triangle whose sides are $13\ cm, 14\ cm, 15\ cm$. **(E.g. 3.67)**
16. If the sides of a ΔABC, are $a = 4, b = 6$ and $c = 8$, then show that $4\cos B + 3\cos C = 2$. **(EX 3.10. 2)**

3 MARKS

17. If $a\cos\theta - b\sin\theta = c$ S.T. $a\sin\theta + b\cos\theta = \pm\sqrt{a^2 + b^2 - c^2}$. **(EX 3.1. 3)**
18. If $\sec\theta + \tan\theta = p$, obtain the values of $\sec\theta$, $\tan\theta$ and $\sin\theta$ in terms of p. **(EX 3.1. 9)**
19. Eliminate θ from the equations $a\sec\theta - c\tan\theta = b$ and
    $b\sec\theta + d\tan\theta = c$. **(EX 3.1. 12)**
20. In a circle of diameter $40\ cm$, a chord is of length $20\ cm$. Find the length of the minor arc of the chord. **(EX 3.2. 4)**
21. If in two circles, arcs of the same length subtend angles $60°$ and $75°$ at the centre, find the ratio of their radii. **(EX 3.2. 7)**
22. A circular metallic plate of radius $8\ cm$ and thickness $6\ mm$ is melted and molded into a pie (a sector of the circle with thickness) of radius $16\ cm$ and thickness $4\ mm$. Find the angle of the sector. **(EX 3.2. 11)**
23. Show that $\sin^2\frac{\pi}{18} + \sin^2\frac{\pi}{9} + \sin^2\frac{7\pi}{18} + \sin^2\frac{4\pi}{9} = 2$. **(EX 3.3. 6)**
24. Find $\cos(x - y)$, given that $\cos x = \frac{-4}{5}$ with $\pi < x < \frac{3\pi}{2}$ and $\sin y = \frac{-24}{25}$ with $\pi < y < \frac{3\pi}{2}$. **(EX 3.4. 3)**
25. Find a quadratic equation whose roots are $\sin 15°$ and $\cos 15°$. **(EX 3.4. 7)**
26. S.T. $\cos^2 A + \cos^2 B - 2\cos A\cos B\cos(A + B) = \sin^2(A + B)$. **(EX 3.4. 18)**
27. If $\cos(\alpha - \beta) + \cos(\beta - \gamma) + \cos(\gamma - \alpha) = \frac{-3}{2}$, then prove that $\cos\alpha + \cos\beta + \cos\gamma = \sin\alpha + \sin\beta + \sin\gamma = 0$. **(EX 3.4. 19)**

28. If $\theta+\phi=\alpha, \tan\theta = k\tan\phi$, then P.T. $\sin(\theta-\phi)=\frac{k-1}{k+1}\sin\alpha$. **(EX 3.4. 25)**

29. If $A+B+C=2s$, then prove that $\sin(s-A)\sin(s-B)+\sin s\sin(s-C)=\sin A\sin B$. **(EX 3.7. 2)**

30. If ΔABC is a right triangle and if $\angle A=\frac{\pi}{2}$, then prove that (i) $\sin^2 B+\sin^2 C=1$
$(ii)\cos B-\cos C=-1+2\sqrt{2}\cos\frac{B}{2}\sin\frac{C}{2}$. **(EX 3.7. 5)**

31. In ΔABC, we have $\cos A=\frac{b^2+c^2-a^2}{2bc}$. **(Th. 3.3)**

32. The Government plans to have a circular zoological park of diameter 8 km. A separate area in the form of a segment formed by a chord of length 4 km is to be allotted exclusively for a veterinary hospital in the park. Find the area of the segment to be allotted for the veterinary hospital. **(Eg. 3.56)**

5 MARKS

33. If $x=\sum_{n=0}^{\infty}cos^{2n}\theta, y=\sum_{n=0}^{\infty}sin^{2n}\theta$ and $z=\sum_{n=0}^{\infty}sin^{2n}\theta cos^{2n}\theta, 0<\theta<\frac{\pi}{2}$ then show that $xyz=x+y+z$. **(EX 3.1. 7)**

34. If $\tan^2\theta=1-k^2$ show that $\sec\theta+\tan^3\theta\operatorname{cosec}\theta=(2-k^2)^{\frac{3}{2}}$. Also, find the values of k for which this result holds. **(EX 3.1. 8)**

35. Prove that $(1+\tan 1°)(1+\tan 2°)(1+\tan 3°)\ldots\ldots(1+\tan 44°)$ is a multiple of 4. **(EX 3.1. 5)**

36. Show that $\cos\frac{\pi}{15}\cos\frac{2\pi}{15}\cos\frac{3\pi}{15}\cos\frac{4\pi}{15}\cos\frac{5\pi}{15}\cos\frac{6\pi}{15}\cos\frac{7\pi}{15}=\frac{1}{128}$. **(EX 3.6. 4)**

37. If $A+B+C=180°$, prove that, $\tan\frac{A}{2}\tan\frac{B}{2}+\tan\frac{B}{2}\tan\frac{C}{2}+\tan\frac{C}{2}\tan\frac{A}{2}=1$. **(EX 3.7. 1(v))**

38. If $A+B+C=180°$, prove that, $\sin A+\sin B+\sin C=4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$. **(EX 3.7. 1(vi))**

39. If $x+y+z=xyz$, then prove that $\frac{2x}{1-x^2}+\frac{2y}{1-y^2}+\frac{2z}{1-z^2}=\frac{2x}{1-x^2}\frac{2y}{1-y^2}\frac{2z}{1-z^2}$. **(EX 3.7. 3)**

40. If $A+B+C=\frac{\pi}{2}$, prove that, $\sin 2A+\sin 2B+\sin 2C=4\cos A\cos B\cos C$ **(EX 3.7. 4(i))**

41. In any triangle, the lengths of the sides are proportional to the sines of the opposite angles. That is, in ΔABC, $\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}=2R$ where R is the circumradius of the triangle. **(Th. 3.1)**

42. In ΔABC, we have (i) $\tan\frac{A-B}{2}=\frac{a-b}{a+b}\cot\frac{C}{2}$ (ii) $\tan\frac{B-C}{2}=\frac{b-c}{b+c}\cot\frac{A}{2}$ $(iii)\tan\frac{C-A}{2}=\frac{c-a}{c+a}\cot\frac{B}{2}$. **(Th. 3.2)**

CHAPTER 4 COMBINATORICS AND MATHEMATICAL INDUCTION

2 MARKS

1. How many licence plates may be made using either two distinct letters followed by four digits or two digits followed by 4 distinct letters where all digits or letters are distinct? **(E.g. 4.10)**
2. Find the total number of outcomes when 5 coins are tossed once. **(E.g. 4.13)**
3. How many numbers are there between 100 and 500 with the digits 0, 1, 2, 3, 4, 5 ? if (i) repetition of digits allowed (ii) the repetition of digits is not allowed. **(EX 4.1. 6)**
4. Count the numbers between 999 and 10000 subject to the condition that there are (i) no restriction. (ii) no digit is repeated. (iii) at least one of the digits is repeated. **(EX 4.1. 8)**
5. If the letters of the word $\boldsymbol{GARDEN}$ are permuted in all possible ways and the strings thus formed are arranged in dictionary order, then find the ranks of the words $(\boldsymbol{i})$ $\boldsymbol{GARDEN}$ $(\boldsymbol{ii})$ $\boldsymbol{DANGER}$. **(EX 4.2. 16)**
6. Find the number of strings that can be made using all letters of the word $\boldsymbol{THING}$. If these words are written as in a dictionary, what will be the 85th string? **(EX 4.2. 17)**
7. If the letters of the word $\boldsymbol{FUNNY}$ are permuted in all possible ways and the strings thus formed are arranged in the dictionary order, find the rank of the word $\boldsymbol{FUNNY}$. **(EX 4.2. 18)**
8. If ${}^{n}P_r = 11880$ and ${}^{n}C_r = 495$, Find n and r. **(E.g. 4.47)**
9. Prove that ${}^{24}C_4 + \sum_{r=0}^{4} {}^{28-r}C_3 = {}^{29}C_4$. **(E.g. 4.48)**
10. Prove that ${}^{2n}C_n = \frac{2^n \times 1 \times 3 \times \dots\dots(2n-1)}{n!}$. **(EX 4.3. 7)**
11. Prove that $n \times {}^{n-1}C_{r-1} = (n-r+1) \times {}^{n}C_{r-1}$. **(EX 4.3. 8)**
12. Prove that the sum of first n positive odd numbers is n^2. **(E.g. 4.62)**

3 MARKS

13. How many strings of length 6 can be formed using letters of the word $\boldsymbol{FLOWER}$ if (i) either starts with F or ends with R? (ii) neither starts with F nor ends with R? **(E.g. 4.9)**
14. How many $4-$digit even numbers can be formed using the digits 0,1,2,3 and 4, if repetition of digits are not permitted? **(E.g. 4.12)**
15. Prove that $\frac{(2n)!}{n!} = 2^n\big(1.3.5 \dots \dots (2n-1)\big)$. **(E.g. 4.24)**
16. How many numbers are there between 1 and 1000 (both inclusive) which are divisible neither by 2 nor by 5? **(EX 4.1. 11)**
17. In how many ways 5 boys and 4 girls can be seated in a row so that no two girls are together. **(E.g. 4.32)**

18. 4 boys and 4 girls form a line with the boys and girls alternating. Find the number of ways of making this line. **(E.g. 4.33)**
19. If the letters of the word $\boldsymbol{TABLE}$ are permuted in all possible ways and the words thus formed are arranged in the dictionary order, find the ranks of the words $(\boldsymbol{i})$ $\boldsymbol{TABLE}$, $(\boldsymbol{ii})\boldsymbol{BLEAT}$. **(E.g. 4.35)**
20. If ${}^{n-1}P_3 : {}^{n}P_4 = 1:10$ find n. **(EX 4.2. 1)**
21. If ${}^{10}P_{r-1} = 2 \times {}^{6}P_r$ find r. **(EX 4.2. 2)**
22. Prove: ${}^{n}C_r + {}^{n}C_{r-1} = {}^{n+1}C_r$. **(Pr. 4)**
23. If ${}^{n+2}C_7 : {}^{n-1}P_4 = 13:24$ find n. **(E.g. 4.50)**
24. If ${}^{n+1}C_8 : {}^{n-3}P_4 = 57:16$, find the value of n. **(EX 4.3. 6)**
25. A polygon has 90 diagonals. Find the number of its sides? **(EX 4.3. 25)**
26. Using the induction, S.T. for any integer, $n \geq 2, 3^n > n^2$. **(E.g. 4.68)**

5 MARKS

27. Find the sum of all 4 −digit numbers that can be formed using the digits 1, 2, 4, 6, 8. **(E.g. 4.43)**
28. How many strings are there using the letters of the word $\boldsymbol{INTERMEDIATE}$, if (i) The vowels and consonants are alternative (ii) All the vowels are together (iii) Vowels are never together (iv) No two vowels are together. **(EX 4.3. 14)**
29. Find the sum of all 4 −digit numbers that can be formed using digits 1, 2, 3, 4, and 5 repetitions not allowed? **(EX 4.3. 19)**
30. Find the number of strings of 5 letters that can be formed with the letters of the word $\boldsymbol{PROPOSITION}$. **(E.g. 4.58)**
31. By the principle of mathematical induction, prove that, for all integers $n \geq 1, 1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$. **(E.g. 4.65)**
32. Prove that $3^{2n+2} - 8n - 9$ is divisible by 8 for all $n > 1$. **(E.g. 4.66)**
33. Prove that the sum of the first n non-zero even numbers is $n^2 + n$. **(EX 4.4. 3)**
34. Using the Mathematical induction, show that for any natural number $n \geq 2$, $\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)\ldots\ldots\left(1-\frac{1}{n^2}\right) = \frac{n+1}{2n}$. **(EX 4.4. 5)**
35. Using the Mathematical induction, show that for any natural number n, $\frac{1}{1.2.3} + \frac{1}{2.3.4} + \frac{1}{3.4.5} + \ldots\ldots + \frac{1}{n.(n+1).(n+2)} = \frac{n(n+3)}{4(n+1)(n+2)}$. **(EX 4.4. 7)**
36. Using the Mathematical induction, show that for any natural number $n, x^{2n} - y^{2n}$ is divisible by $x + y$. **(EX 4.4. 10)**

37. By the principle of mathematical induction, prove that, for $n \geq 1, 1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 > \frac{n^3}{3}$. **(EX 4.4. 11)**
38. Use induction to prove that $5^{n+1} + 4 \times 6^n$ when divided by 20 leaves a remainder 9, for all natural numbers n. **(EX 4.4. 13)**
39. Use induction to prove that $10^n + 3 \times 4^{n+2} + 5$ is divisible by 9, for all natural numbers n. **(EX 4.4. 14)**

CHAPTER 5 BINOMIAL THEOREM, SEQUENCES AND SERIES

2 MARKS

1. Evaluate 98^4. **(E.g. 5.2)**
2. Find the middle term in the expansion of $(x + y)^6$. **(E.g. 5.3)**
3. Find the middle terms in the expansion of $(x + y)^7$. **(E.g. 5.4)**
4. Find the last two digits of the number 7^{400}. **(E.g. 5.11)**
5. If n is a positive integer, show that, $9^{n+1} - 8n - 9$ is always divisible by 64. **(EX 5.1. 9)**
6. In the binomial expansion of $(a + b)^n$, the coefficients of the 4^{th} and 13^{th} terms are equal to each other, find n. **(EX 5.1. 13)**
7. Show that the sum of $(m + n)^{th}$ and $(m - n)^{th}$ term of an AP. is equal to twice the m^{th} term. **(EX 5.3. 7)**
8. Expand $(1 + x)^{\frac{2}{3}}$ up to four terms for $|x| < 1$. **(E.g. 5.21)**
9. Expand $\frac{1}{(1+3x)^2}$ in powers of x. Find a condition on x for which the expansion is valid. **(E.g. 5.22)**
10. Write the first 6 terms of the exponential series $(i)\ e^{5x}$ $(ii)\ e^{-2x}$ $(iii)\ e^{\frac{x}{2}}$. **(EX 5.4. 5)**
11. Write the first 4 terms of the logarithmic series $(i) \log(1 + 4x)$ $(ii) \log\left(\frac{1-2x}{1+2x}\right)$. **(EX 5.4. 6)**
12. Find the coefficient of x^4 in the expansion of $\frac{3-4x+x^2}{e^{2x}}$. **(EX 5.4. 9)**

3 MARKS

13. Using Binomial theorem, prove that $6^n - 5n$ always leaves remainder 1 when divided by 25 for all positive integer n. **(E.g. 5.10)**
14. Expand: (i) $\left(2x^2 - 3\sqrt{1 - x^2}\right)^4 + \left(2x^2 + 3\sqrt{1 - x^2}\right)^4$. **(EX 5.1. 1(ii))**
15. Find the constant term of $\left(2x^3 - \frac{1}{3x^2}\right)^5$. **(EX 5.1. 7)**

16. If a and b are distinct integers, prove that $a-b$ is a factor of a^n-b^n whenever n is a positive integer. **(EX 5.1. 12)**
17. Prove that $c_0^2+c_1^2+c_2^2+\ldots\ldots\ldots\ldots+c_n^2=\frac{(2n)!}{(n!)^2}$. **(EX 5.1. 16)**
18. Find the sum up to n terms of the series: $1+\frac{6}{7}+\frac{11}{49}+\frac{16}{343}+\ldots\ldots\ldots$ **(E.g. 5.16)**
19. Find the sum up to the 17^{th} term of the series $\frac{1^3}{1}+\frac{1^3+2^3}{1+3}+\frac{1^3+2^3+3^3}{1+3+5}+\ldots\ldots\ldots\ldots$ **(EX 5.2. 2)**
20. Compute the sum of first n terms of $1+(1+4)+(1+4+4^2)+(1+4+4^2+4^3)+\ldots\ldots$ **(EX 5.2. 4)**
21. Find the value of n, if the sum to n terms of the series $\sqrt{3}+\sqrt{75}+\sqrt{243}+\ldots\ldots\ldots\ldots$ is $435\sqrt{3}$. **(EX 5.2. 6)**
22. Expand $\frac{1}{(3+2x)^2}$ in powers of x. Find a condition on x for which the expansion is valid. **(E.g. 5.23)**
23. Find $\sqrt[3]{65}$. **(E.g. 5.24)**
24. Find $\sqrt[3]{1001}$ approximately. **(EX 5.4. 2)**

5 MARKS

25. The 2^{nd}, 3^{rd} and 4^{th} terms in the binomial expansion of $(x+a)^n$ are $240, 720$ and 1080 for a suitable value of x. Find x, a and n. **(E.g. 5.7)**
26. If the coefficients of three consecutive terms in the expansion of $(a+x)^n$ are in the ratio $1:7:42$, then find n. **(EX 5.1. 14)**
27. In the binomial coefficients of $(1+x)^n$, the coefficients of the 5^{th}, 6^{th} and 7^{th} terms are in AP Find all values of n. **(EX 5.1. 15)**
28. If AM and GM denote the arithmetic mean and the geometric mean of two nonnegative numbers, then $AM \geq GM$. The equality holds if and only if the two numbers are equal. **(Th. 5.2)**
29. If GM and HM denote the geometric mean and the harmonic mean of two nonnegative numbers, then $GM \geq HM$. The equality holds if and only if the two numbers are equal. **(Th. 5.3)**
30. The AM of two numbers exceeds their GM by 10 and HM by 16. Find the numbers. **(EX 5.2. 8)**
31. If the roots of the equation $(q-r)x^2+(r-p)x+p-q=0$ are equal, then show that p, q and r are in AP. **(EX 5.2. 9)**

32. If a, b, c are respectively the p^{th}, q^{th} and r^{th} terms of a GP, S.T. $(q-r)\log a+(r-p)\log b+(p-q)\log c=0$. **(EX 5.2. 10)**

33. Find the general term and sum to n terms of the sequence $1, \frac{4}{3}, \frac{7}{9}, \frac{10}{27}, \ldots \ldots \ldots ..$ **(EX 5.3. 5)**

34. Prove that $\sqrt[3]{x^3+7}-\sqrt[3]{x^3+4}$ is approximately equal to $\frac{1}{x^2}$ when x is large. **(E.g. 5.25)**

35. Prove that $\sqrt[3]{x^3+6}-\sqrt[3]{x^3+3}$ is approximately equal to $\frac{1}{x^2}$ when x is sufficiently large. **(EX 5.4. 3)**

36. Prove that $\sqrt{\frac{1-x}{1+x}}$ is approximately equal to $1-x+\frac{x^2}{2}$ when x is very small. **(EX 5.4. 4)**

37. If $p-q$ is small compared to either $p\ or\ q$, then show that $\sqrt[n]{\frac{p}{q}} \simeq \frac{(n+1)p+(n-1)q}{(n-1)p+(n+1)q}$. Hence find $\sqrt[8]{\frac{15}{16}}$. **(EX 5.4. 8)**

38. Find the value of $\sum_{n=1}^{\infty}\frac{1}{2n-1}\left(\frac{1}{9^{n-1}}+\frac{1}{9^{2n-1}}\right)$. **(EX 5.4. 10)**

CHAPTER 6 TWO DIMENSIONAL ANALYTICAL GEOMETRY

2 MARKS

1. Find the locus of a point P moves such that its distances from two fixed points $A(1,0)$ and $B(5,0)$ are always equal. **(E.g. 6.3)**
2. If θ is a parameter, find the equation of the locus of a moving point, whose coordinates are $(a\sec\theta, b\tan\theta)$. **(E.g. 6.4)**
3. Find the equation of the straight line passing through $(-1,1)$ and cutting off equal intercepts, but opposite in signs with the two coordinate axes. **(E.g. 6.14)**
4. The length of the perpendicular drawn from the origin to a line is 12 and makes an angle $150°$ with positive direction of the x −axis. Find the equation of the line. **(E.g. 6.16)**
5. Find the nearest point on the line $2x+y=5$ from the origin. **(E.g. 6.24)**
6. Find the equation of the bisector of the acute angle between the lines $3x+4y+2=0$ and $5x+12y-5=0$. **(E.g. 6.25)**
7. Find the points on the line $x+y=5$, that lie at a distance 2 units from the line $4x+3y-12=0$. **(E.g. 6.26)**
8. Find the equation of the straight line parallel to $5x-4y+3=0$ and having x −intercept 3. **(EX 6.3. 2)**

9. Find the length of the perpendicular and the co-ordinates of the foot of the perpendicular from $(-10,-2)$ to the line $x+y-2=0$. **(EX 6.3. 10)**
10. Show that the straight lines $x^2-4xy+y^2=0$ and $x+y=3$ form an equilateral triangle. **(E.g. 6.36)**
11. Find the combined equation of the straight lines whose separate equations are $x-2y-3=0$ and $x+y+5=0$. **(EX 6.4. 1)**
12. Show that $4x^2+4xy+y^2-6x-3y-4=0$ represents a pair of parallel lines. **(EX 6.4. 2)**
13. Show that $2x^2+3xy-2y^2+3x+y+1=0$ represents a pair of perpendicular lines. **(EX 6.4. 3)**

3 MARKS

14. A straight rod of the length 6 units, slides with its ends A and B always on the x and y axes respectively. If O is the origin, then find the locus of the centroid of ΔOAB. **(E.g. 6.5)**
15. If θ is a parameter, find the equation of the locus of a moving point, whose coordinates are $(a(\theta-\sin\theta), a(1-\cos\theta))$. **(E.g. 6.6)**
16. Find the value of k and b, if the points $P(-3,1)$ and $Q(2,b)$ lie on the locus of $x^2-5x+ky=0$. **(EX 6.1. 4)**
17. Find the equation of the locus of a point such that the sum of the squares of the distance from the points $(3,5),(1,-1)$ is equal to 20. **(EX 6.1. 6)**
18. Express the equation $\sqrt{3}x-y+4=0$ in the following equivalent form: (i) Slope and Intercept form (ii) Intercept form (iii) Normal form **(E.g. 6.19)**
19. If $P(r,c)$ is midpoint of a line segment between the axes, then show that $\frac{x}{r}+\frac{y}{c}=2$. **(EX 6.2. 2)**
20. If p is length of perpendicular from origin to the line whose intercepts on the axes are a,b then S.T. $\frac{1}{p^2}=\frac{1}{a^2}+\frac{1}{b^2}$. **(EX 6.2. 4)**
21. Find the equations of two straight lines which are parallel to the line $12x+5y+2=0$ and at a unit distance from the point $(1,-1)$. **(EX 6.3. 7)**
22. Find the equation of a straight line parallel to $2x+3y=10$ and which is such that the sum of its intercepts on the axes is 15. **(EX 6.3. 9)**
23. A line is drawn perpendicular to $5x=y+7$. Find the equation of the line if the area of the triangle formed by this line with co-ordinate axes is 10 sq. units. **(EX 6.3. 16)**
24. Find the equation of the pair of lines through the origin and perpendicular to the pair of lines $ax^2+2hxy+by^2=0$. **(E.g. 6.35)**

25. If the pair of lines represented by $x^2 - 2cxy - y^2 = 0$ and $x^2 - 2dxy - y^2 = 0$ be such that each pair bisects the angle between the other pair, prove that $cd = -1$. **(E.g. 6.37)**
26. Show that the straight lines joining the origin to the points of intersection of $3x - 2y + 2 = 0$ and $3x^2 + 5xy - 2y^2 + 4x + 5y = 0$ are at right angles. **(E.g. 6.41)**
27. Find the equation of the pair of straight lines passing through the point $(1, 3)$ and perpendicular to the lines $2x - 3y + 1 = 0$ and $5x + y - 3 = 0$. **(EX 6.4. 6)**
28. Find the separate equation of the following pair of straight lines $2x^2 - xy - 3y^2 - 6x + 19y - 20 = 0$ **(EX 6.4. 7)**

5 MARKS

29. If the points $P(6,2)$ and $Q(-2, 1)$ and R are the vertices of a ΔPQR and R is the point on the locus $y = x^2 - 3x + 4$, then find the equation of the locus of centroid of ΔPQR. **(EX 6.1. 12)**
30. If Q is a point on the locus of $x^2 + y^2 + 4x - 3y + 7 = 0$, then find the equation of locus of P which divides segment OQ externally in the ratio $3: 4$,where O is origin. **(EX 6.1. 13)**
31. The sum of the distance of a moving point from the points $(4,0)$ and $(-4,0)$ is always 10 units. Find the equation of the locus of the moving point. **(EX 6.1. 15)**
32. The normal boiling point of water is $100°C$ or $212°F$ and the freezing point of water is $0°C$ or $32°F$. (i) Find the linear relationship between C and F Find (ii) the value of C for $98.6°F$ and (iii) the value of F for $38°C$ **(EX 6.2. 5)**
33. An object was launched from a place P in constant speed to hit a target. At the 15^{th} second it was $1400m$ away from the target and at the 18^{th} second $800m$ away. Find (i) the distance between the place and the target (ii) the distance covered by it in 15 seconds. (iii) time taken to hit the target. **(EX 6.2. 6)**
34. Find the equation of the lines passing through the point of intersection lines $4x - y + 3 = 0$ and $5x + 2y + 7 = 0$, and (i) through the point $(-1,2)$ (ii) Parallel to $x - y + 5 = 0$ (iii) Perpendicular to $x - 2y + 1 = 0$ **(EX 6.3. 6)**
35. If p_1 and p_2 are the lengths of the perpendiculars from the origin to the straight lines $x \sec\theta + y\,cosec\,\theta = 2a$ and $x\cos\theta - y\sin\theta = a\cos 2\theta$, then prove that ${p_1}^2 + {p_2}^2 = a^2$. **(EX 6.3. 11)**
36. Find the image of the point $(-2,3)$ about the line $x + 2y - 9 = 0$. **(EX 6.3. 17)**
37. Find all the equations of the straight lines in the family of the lines $y = mx - 3$, for which m and the x –coordinate of the point of intersection of the lines with $x - y = 6$ are integers. **(EX 6.3. 20)**

38. If the equation $\lambda x^2 - 10xy + 12y^2 + 5x - 16y - 3 = 0$ represents a pair of straight lines, find (i) the value of λ and the separate equations of the lines (ii) point of intersection of the lines (iii) angle between the lines **(E.g. 6.38)**

39. Show that the straight lines $x^2 - 4xy + y^2 = 0$ and $x + y = 3$ form an equilateral triangle. **(E.g. 6.36)**

40. Prove that the equation to the straight lines through the origin, each of which makes an angle α with the straight line $y = x$ is $x^2 - 2xy \sec 2\alpha + y^2 = 0$. **(EX 6.4. 5)**

41. A ΔOPQ is formed by the pair of straight lines $x^2 - 4xy + y^2 = 0$ and the line PQ. The equation of PQ is $x + y - 2 = 0$. Find the equation of the median of the triangle ΔOPQ drawn from the origin O. **(EX 6.4. 10)**

42. Find p and q, if the following equation represents a pair of perpendicular lines $6x^2 + 5xy - py^2 + 7x + qy - 5 = 0$. **(EX 6.4. 11)**

43. Show that the equation $9x^2 - 24xy + 16y^2 - 12x + 16y - 12 = 0$ represents a pair of parallel lines. Find the distance between them. **(EX 6.4. 14)**

One Words Question with Answer

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 $\frac{1}{1-2\sin x}$ 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 $|x^2+y^2|\le 2$, 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 $f(x) = \begin{cases} x & if\ x < 1 \\ x^2 & if\ 1 \le x \le 4 \\ 8\sqrt{x} & if\ x > 4 \end{cases}$ is

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

(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 $|x-1| \geq |x-3|$ 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) $xb \leq yb$ (d) $\frac{x}{b} \geq \frac{y}{b}$

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 $|x+2| \leq 9$, 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) $b^2 - 1,\ if\ b \le \sqrt{2}$ (b) $b^2 - 1,\ if\ b > \sqrt{2}$

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

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 $f_k(x) = \frac{1}{k}[sin^kx + cos^kx]$ where $x \in R$ and $k \ge 1$. 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) $\frac{\pi(n\pm1)}{p\pm q}$ (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 $1 + P_1 + 2P_2 + 3P_3 + .. + nP_n$ 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) $a \le g$ (b) $a \ge g$ (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 $(1+x^2)^2(1+x)^n = a_0 + a_1x + a_2x^2 + \ldots\ldots + x^{n+4}$ 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

    $(a)\ x+5y\pm5\sqrt{2}=0$ $(b)\ x-5y\pm5\sqrt{2}=0$

    $(c)\ 5x+y\pm5\sqrt{2}=0$ $(d)\ 5x-y\pm5\sqrt{2}=0$

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

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

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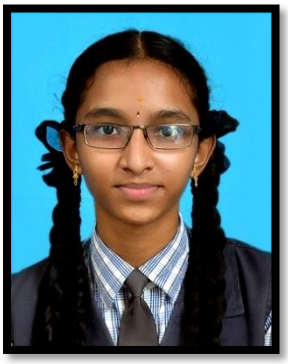

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