Math Bank - 6

Q.1) Suppose A represents the symbol 1, B represents the symbol 0, C represents the symbol 1, D represents the symbol 0 and so on. If we divide INDIA by AGRA, then which one of the following is the remainder in Binary Representation?

(a) $(1101)_2$ (b) $(101)_2$
(c) $(11)_2$ (d) $(110)_2$

Q.2) How many number of digits are there in 2_{98}? (Given that $\log_{10}2 = 0.30103$)

(a) 98 (b) 99
(c) 30 (d) 29

Q.3) What is the area of the triangle on the Argand diagram formed by the complex number z, $-iz$, $z - iz$?

(a) $|z|^2$ (b) $2|z|^2$
(c) $\frac{|z|^2}{2}$ (d) $\frac{|z|^2}{4}$

Q.4) In a quadratic equation, with leading coefficient 1. Sheela reads the coefficient 16 of x wrongly as 19 and obtains the roots as -15 and -4. Which of the following are the correct roots of the equation?

(a) 8, 8 (b) 6, 10
(c) -6, -10 (d) 12, 5

Q.5) Out of 40 children 30 can swim, 27 can play chess and only 5 can do neither. How many children can swim only?

(a) 30 (b) 22
(c) 12 (d) 8

Q.6) Both the roots of a quadratic equation $x^2 - mx + 121 = 0$ are greater than 10. What is the minimum value of m?

(a) 21 (b) 22
(c) 23 (d) Cannot be determined

Q.7) What is the simplified representation of $\left(A' \cap B' \cap C\right) \cup \left(B \cap C\right)\left(A \cap C\right)$ where A, B, C are subsets of set X?

(a) A (b) B
(c) C (d) $X \cap \left(A \cup B \cup C\right)$

Q.8) Which one of the following is the domain of the relation R defined on the set N of natural numbers as

$R = \left\{\left(m, n\right) : 2m + 3n = 30; m, n \in N\right\}$?

(a) {2, 4, 6, 8} (b) {3, 7, 11, 15}
(c) {3, 6, 9, 12} (d) {3, 6, 9, 12, 15}

Q.9) How many terms are there in the expansion of $\left(x + y + z\right)^{10}$?

(a) 11 (b) 33
(c) 66 (d) 3^{10}

Q.10) Which one of the following is correct?

(a) The relation R_0 defined on the set of Real number as $R_0 = \{(a, b$ such that $a_2 + b_2 = 1$ for all $a, b \in R\}$ is an equivalence relation.

(b) The relation R_0 defined on the set of Real numbers as $R_0 = \{(a, b)$ such that $|a-b|\} \leq \frac{1}{3}$ for all $a, b \in R\}$ is an equivalence relation.

(c) The relation I_0 defined on the set of integers as $I_1 I_0 I_2 : I_1^2 - 3I_1 I_2 + 2I_2^2 = 0$ for all $I_1, I_2 \in I$ is an equivalence relation.

(d) We defined AE_C B by the open sentence: A is cardinally equivalent to B on the family of sets. Then the relation E_C on family of sets is an equivalence relation.

Q.11) How many arrangements can be made out of the letters of the word “MOTHER” taken four at a time so that each arrangement contains the letter ‘M’?

(a) 240 (b) 120
(c) 60 (d) 360

Q.12) What are the value of k if the term independent of x in the expansion of $\left(\sqrt{x} + \frac{k}{x^2}\right)^{10}$ is 405?

(a) ± 3 (b) ± 6
(c) ± 5 (d) ± 4

Q.13) If the equation (1) $x^2 - px + q = 0$ and (2) $x^2 - rx + x = 0$ have a root in common and the second equation has equal roots then $q + s$ is equal to which one of the following?

(a) $\frac{pr}{2}$ (b) $2pr$
(c) pr (d) p^2r

Q.14) If the p^{th}, q^{th} and r^{th} terms of a G.P. are again in G.P., then which one of the following is correct?

(a) p, q, r are in A.P. (b) p, q, r are in G.P.
(c) p, q, r are in H.P. (d) p, q, r are neither in A.P. nor in G.P. nor in H.P.

Q.15) In how many ways can 10 lions and 6 tigers be arranged in a row so that no two tigers are together?

(a) $10! \times {}^{11}P_6$ (b) $10! \times {}^{10}P_6$
(c) $6! \times {}^{10}P_7$ (d) $6! \times {}^{10}P_6$

Q.16) The Geometric Mean of two numbers is 6. Their Arithmetic Mean A and Harmonic Mean H satisfy the equation $90A + 5H = 918$.
Which one of the following is correct?

(a) $A = 10$ (b) $A = 1/5, A = 10$
(c) $A = 5, A = 10$ (d) $A = 1/5, A = 5$

Q.17) Eighteen football teams take part in the national championship and every team meets the same opponent twice. How many matches are played during the championship?

(a) 306 (b) 300
(c) 72 (d) 153

Q.18) If x, y, z are distinct positive numbers different from 1 such that $\left(\log_y x.\log_z x - \log_x x\right) + \left(\log_x y.\log_z y - \log_y y\right) + \left(\log_x z.\log_y z - \log_z z\right) = 0$, which is the value of xyz?

(a) 2 (b) 1

(c) -1 (d) 0

Q.19) Which one of the following is the union of the closed sets $\left(2+\frac{1}{n}, 10-\frac{1}{n}\right), n=1,2,\ldots$?

(a) [2, 10] (b) (2, 10)
(c) [2, 10) (d) (2, 10]

Q.20) Indicate which one of the points given below is not a part of the solution of the inequation $3x + 4y \geq 12: x \geq 0, y \geq 0$?
(a) (4, 2) (b) (1, 3)
(c) (2, 1) (d) $\left(\frac{2}{3}, \frac{11}{4}\right)$

Q.21) If A is a square matrix of order $m \times n$ and k is a scalar, then *adj* (kA) is equal to which one of the following?
(a) k *adj A* (b) k^2 *adj A*
(c) k^{n-1} *adj A* (d) k^n *adj A*

Q.22) For what value of k, the system of linear equations $x+y+z=2, 2x+y-z=3, 3x+2y+kz=4$ has a unique solution?
(a) k is any real number other than zero
(b) k is any real number
(c) k is any integer
(d) $k = 0$

Q.23) If the determinant of a non-singular matrix $\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}$ is denoted by Δ, what is the determinant of the matrix $\begin{bmatrix} a_1+2b_1-4c_1 & b_1 & 4c_1 \\ a_2+3b_2-4c_2 & b_2 & 4c_2 \\ a_3+3b_3-4c_3 & b_3 & 4c_3 \end{bmatrix}$?
(a) Δ (b) - Δ
(c) 7 Δ (d) 4 Δ

Q.24) What is the value of the determinant $\begin{vmatrix} 1 & a & a^2-bc \\ 1 & b & b^2-ca \\ 1 & c & c^2-ab \end{vmatrix}$?
(a) abc (b) $ab + bc + ca$
(c) 0 (d) $(a-b)(b-c)(c-a)$

Q.25) If A is non-singular matrix of order $n \times m$, then which one of the following is equal to $|adj\ A|$?
(a) $|A|^{n+1}$ (b) $|A|^n$
(c) $|A|^{n-1}$ (d) $|A|$

Q.26) If $M = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ and G = [3, 4, 5] are two matrices, then which one of the following is correct?
(a) In the product matrix MG = $[h_{ij}]$, the element h_{32} is $5y$.
(b) In the product matrix MG = $[h_{ij}]$, the element h_{32} is $3x + 4y + 5z$.
(c) In the product matrix MG = $[h_{ij}]$, the element h_{32} is $4z$.

(d) In the product matrix MG = $[h_{ij}]$, the element h_{32} does not exist.

Q.27) If $A=\begin{bmatrix}0 & 1\\ 0 & 0\end{bmatrix}$, then which one of the following is equal to $(aI+bA)^n$?

(a) $A^n I + na^{n-1}bA$ (b) $a^n + na^{n-1}bA$

(c) $a^n I + a^{n-1}bA$ (d) $a^n I + b^n A^n$

Q.28) If A is a non-singular matrix such that $A^{-1}=A^T$, then which one of the following represents A? (Here A' denotes the transpose of A).

(a) $\frac{1}{3}\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & -1\\ -2 & 2 & -1\end{bmatrix}$ (b) $\frac{1}{3}\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & -2\\ -2 & 2 & -1\end{bmatrix}$

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

Q.29) The matrix X satisfies the following equation

$\begin{bmatrix}1 & 3\\ 0 & 1\end{bmatrix}X=\begin{bmatrix}1 & 1\\ 0 & -1\end{bmatrix}$

Which one of the following represents X?

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

Q.30) The matrix $M=\begin{bmatrix}0 & 1 & 2\\ 1 & 2 & 3\\ 3 & 1 & 1\end{bmatrix}$ and its inverse $N=\left[n_{ij}\right]$. What is the element n_{23} of the matrix N?

(a) 2 (b) -2

(c) 1 (d) -1

Q.31) If $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\frac{3\pi}{2}$, then what is the value of $x + y + z$?

(a) -3 (b) 3

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

Q.32) If 11Y = 90^0, then what is the value of the expression

$\tan Y \tan 2Y \tan 3Y \tan 4Y \tan 5Y \tan 6Y \tan 7Y \tan 8Y \tan 9Y \tan 10Y$?

(a) 0 (b) -1

(c) 1 (d) 2

Q.33) If sin A = p and sin B = q where | p | and | q | are both less than 1, then what are the total number of possible (and distinct) values of sin (A + B)?

(a) 1 (b) 2

(c) 3 (d) 4

Q.34) If $x\sin^3\theta+y\cos^3\theta=\sin\theta\cos\theta$ and $x\sin\theta=y\cos\theta$, then which one of the following is correct?

(a) $x^2 + y^2 = 0$ (b) $x^2 + y^2 = 1$
(c) $x^2 - y^2 = 0$ (d) $x^2 - y^2 = 1$

Q.35) If sin C and cos C are two roots of a quadratic equation $2x^2 - px + 1 = 0$ where $0 < C < \frac{\pi}{2}$, then how many possible values can p have?
(a) 1 (b) 2
(c) 3 (d) 4

Q.36) Let n be the natural number such that $n > 4$ and $U_n = \sin^n X + \cos^n X$. Which one of the following is correct?
(a) $U_n = U_{n-2} - U_{n-4} \sin^2 X \cos^2 X$ (b) $U_n = U_{n-2} + U_{n-3} \sin X \cos X$
(c) $U_n = U_{n-4} - U_{n-2} \sin^2 X \cos^2 X$ (d) $U_n = -U_{n-2} + 2U_{n-4} \sin^2 X \cos X$

Q.37) The three angles A, B and C of a triangle ABC are in A.P. and $c^2 = a^2 + b^2$. If c = 50 metres, then what is the area of the triangle in square metres?
(a) $\frac{625}{2}$ (b) $\frac{625\sqrt{2}}{2}$
(c) $\frac{625\sqrt{3}}{2}$ (d) 625

Q.38) If $x - y = (4n+1)\frac{\pi}{4}$ (where n is an integer) and $x + y$ is not an odd multiple of $\frac{\pi}{2}$, then what is the value of the following expression:
$$\frac{\sin 2x - \sin 2y}{\cos 2x + \cos 2y}$$
(a) -1 (b) 0
(c) $\frac{1}{2}$ (d) 1

Q.39) From the top of a tower 60 metres high, the angle of depression of two objects which are on the horizontal plane and in a line with the foot of the tower are α and β with β > α. What is the distance between the two objects in metres?
(a) $60 \sin(\beta - \alpha) \ \mathrm{cosec}\alpha \ \mathrm{cosec}\beta$ (b) $60 \cos(\beta - \alpha) \sec\alpha \sec\beta$
(c) $60(\cot\alpha - \cot\beta)$ (d) $60(\tan\beta - \tan\alpha)$

Q.40) The points (3, 4) and (2, -6) lie on opposite sides of which one of the following lines?
(a) $10x - y = 26$ (b) $5x + 3y = -9$
(c) $3x - 4y = 8$ (d) $x - y = 10$

Q.41) Two equal parabolas have the same vertex and their axes are at right angles. What is the angle between the tangents drawn to them at their point of intersection (other than vertex)?
(a) $\frac{\pi}{4}$ (b) $\tan^{-1}2$
(c) $\frac{\pi}{3}$ (d) $\tan^{-1}\left(\frac{3}{4}\right)$

Q.42) Which one of the following is the nearest point on the line $3x - 4y = 25$ from the origin?
(a) (-1, -7) (b) (3, -4)

(c) (-5, -8) (d) (3, 4)

Q.43) Which one of the following is the reflection of the point (4, 3) on the line $x + y = 0$?
(a) (-4, 3) (b) (-3, -4)
(c) (-3, 4) (d) (4, -3)

Q.44) Which one of the following is the orthocenter of the triangle whose sides are $x = 0$, $y = 1$ and $x + y - 2 = 0$?
(a) (1, 1) (b) (0, 1)
(c) (-1, 0) (d) (0, -1)

Q.45) What is the length of the focal distance from the point "t" of the parabola $y^2 = 4ax$?
(a) at^2 (b) $a(1 + t^2)$
(c) $a\left(t+\frac{1}{t}\right)^2$ (d) at^{-2}

Q.46) Which of the following are the equations of circles which touch the x-axis at a distance 3 from the origin and intercept a distance 6 on the y-axis?
(a) $x^2+y^2-6x\pm 6\sqrt{2}y+9=0$ (b) $x^2+y^2+6x\pm 6\sqrt{2}y+9=0$
(c) $x^2+y^2\pm 6x+6\sqrt{2}y+9=0$ (d) $x^2+y^2\pm 6\sqrt{2}x-6y+9=0$

Q.47) Under what condition the lines $x = ay + b$, $z = cy + d$ and $x = a'y + b'$, $z = c'y + d'$ are perpendicular to each other?
(a) $a/a' + c/c' = 0$ (b) $aa' + cc' = -1$
(c) $a/a' + c/c' = 1$ (d) $aa' + cc' = 1$

Q.48) What is the range of the function $f(x)=(3-\cos 2x)^{-1}$?
(a) $\left[\frac{1}{4},1\right]$ (b) $\left(\frac{1}{4},\frac{1}{2}\right)$
(c) $\left[-\frac{1}{4},-\frac{1}{2}\right]$ (d) $\left[\frac{1}{4},\frac{1}{2}\right]$

Q.49) Let $f: R \rightarrow \mathrm{R}$ be defined as $f(x) = x\,|\,x\,|$. Which one of the following is correct?
(a) f is only onto (b) f is only one-one
(c) f is neither onto nor one-one (d) f is one-one and onto

Q.50) What is the value of $\lim_{x\to\infty}\left(\frac{x+3}{x-1}\right)^{x+3}$?
(a) e^2 (b) e^3
(c) e^4 (d) e^{-4}

Q.51) If $\lim_{x\to\infty} x\sin\left(\frac{1}{x}\right) = A$ and $\lim_{x\to\infty} x\sin\left(\frac{1}{x}\right) = B$, then which one of the following is correct?
(a) $A = 1$ and $B = 0$ (b) $A = 0$ and $B = 1$
(c) $A = 0$ and $B = 0$ (d) $A = 1$ and $B = 1$

Q.52) What is the value of $\lim_{x\to\infty}\frac{10^x-2^x-5^x+1}{x\sin x}$?
(a) (In 2) (In 5) (b) (In 3) (In 5)
(c) (In 10) (In 5) (d) 0

Q.53) Let $f(x) = [x]$, where $[x]$ denotes the greatest integer contained in x. Consider the following statements:

1. $f(x)$ is not onto
2. $f(x)$ is continuous at $x = 0$
3. $f(x)$ is discontinuous for all positive integral values of x.

Which of the statements given above are correct?

(a) 1 and 2 (b) 1 and 3

(c) 2 and 3 (d) 1, 2 and 3

Q.54) If $(x+y)^{m+n} = x^m y^n$ then what is the value of $\frac{dy}{dx}$?

(a) $\frac{x}{y}$ (b) xy

(c) $\frac{y}{x}$ (d) 1

Q.55) For what values of 'p' the function $f(x) = \begin{cases} px^2 + 1 & if\ x \le 1 \\ x + p & if\ x > 1 \end{cases}$ is derivable at $x = 1$?

(a) $\frac{1}{2}$ (b) 2

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

Q.56) What is the derivative of $\log_{x^2} x$?

(a) $\frac{1}{x}$ (b) zero

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

Q.57) A function $f : R \to R$ satisfies $f(x + y) = f(x)\, f(y)$ for all $x, y \in R$ and $f(x) \neq 0$ for all $x \in R$. If $f(x)$ is differentiable at $x = 0$ and $f(0) = 2$ then $f'(x)$ is equal to which one of the following?

(a) $f(x)$ (b) $-f(x)$

(c) $2f(x)$ (d) $\frac{f(x)}{2}$

Q.58) Let $f(x)$ be a differentiable even function. Consider the following statements:

1. $f'(x)$ is an even function.
2. $f'(x)$ is an odd function.
3. $f'(x)$ may be even or odd.

Which of the above statement is/are correct?

(a) 1 only (b) 2 only

(c) 1 and 3 (d) 2 and 3

Q.59) What is the derivative of $|x – 1| + |x – 4$ at $x = 3$?

(a) -3 (b) 3

(c) 0 (d) 2

Q.60) Let $g(x)$ be the inverse of an invertible function $f(x)$ which is differentiable at $x = c$. Which one of the following is equal to $g'[f(c)]$?

(a) $f'(c)$ (b) $\frac{1}{f'(c)}$

(c) $f(c)$ (d) $\frac{1}{f(c)}$

ANSWER KEYS

1.	(d)	13.	(a)	25.	(c)	37.	(c)	49.	(d)
2.	(c)	14.	(a)	26.	(c)	38.	(d)	50.	(c)
3.	(c)	15.	(a)	27.	(a)	39.	(c)	51.	(a)
4.	(c)	16.	(b)	28.	(b)	40.	(c)	52.	(a)
5.	(d)	17.	(a)	29.	(c)	41.	(d)	53.	(b)
6.	(c)	18.	(b)	30.	(d)	42.	(b)	54.	(c)
7.	(c)	19.	(a)	31.	(b)	43.	(b)	55.	(a)
8.	(a)	20.	(c)	32.	(c)	44.	(b)	56.	(b)
9.	(c)	21.	(c)	33.	(d)	45.	(b)	57.	(c)
10.	(d)	22.	(a)	34.	(b)	46.	(a)	58.	(b)
11.	(a)	23.	(d)	35.	(a)	47.	(b)	59.	(c)
12.	(a)	24.	(c)	36.	(a)	48.	(d)	60.	(b)