Mathematics

1. ABC is a triangle, right angled at A. The resultant of the forces acting along $\overrightarrow{AB}, \overrightarrow{AC}$ with magnitudes $\frac{1}{AB}$ and $\frac{1}{AC}$ respectively is the force along $\overrightarrow{AD}$, where D is the foot of the perpendicular from A onto BC. The magnitude of the resultant is:
$(a)\dfrac{AB^2+AC^2}{(AB)^2(AB)^2}$ $(b)\dfrac{(AB)(AC)}{AB+AC}$ $(c)\dfrac{1}{AB}+\dfrac{1}{AD}$ $(d)\dfrac{1}{AD}$
2. The value of the integral, $\int_3^6 \frac{\sqrt{x}}{\sqrt{9-x}+\sqrt{x}}dx$
(a)½ (b)3/2 (c)2 (d)1
3. The number of values of x in the interval [0, 3π] satisfying the equation $2sin^2x+5sinx-3=0$ is
(a)4 (b)6 (c)1 (d)2
4. If $(\vec{a}\times\vec{b})\times\vec{c}=\vec{a}\times(\vec{b}\times\vec{c})$, where $\vec{a}$, $\vec{b}$ and $\vec{c}$ are any three vectors such that $\vec{a}.\vec{b}\neq 0, \vec{b}.\vec{c}\neq 0$, then $\vec{a}$ and $\vec{b}$ are:
(a)Inclined at an angle of $\frac{\pi}{3}$ between them
(b)Inclined at an angle of $\frac{\pi}{6}$ between them
(c)Perpendicular
(d)parallel
5. If A and B are square matrices of size n × n such that $A^2-B^2=(A-B)(A+B), then$ which of the following will be always true?
(a)A = B
(b)AB = BA
(c)Either of A or B is a zero matrix
(d)Either of A or B is an identity matrix
6. The value of $\sum_{k=1}^{10}\left(sin\frac{2k\pi}{11}+icos\frac{2k\pi}{11}\right)$ is :
(a)i (b)1 (c)-1 (d)-i
7. At a telephone enquiry system the number of phone calls regarding relevant enquiry follows Poisson distribution with an average of 5 phone calls during 10-minute time intervals. The probability that there is at the most one phone call during a 10-minute time period is:
$(a)6/5^e$ (b) 5/6 (c)6/55 $(d)6/e^5$
8. $\int_0^\pi xf(sinx)dx$ is equal to:
$(a)\pi\int_0^\pi f(cosx)dx$ $(b)\pi\int_0^\pi f(sinx)dx$
$(c)\frac{\pi}{2}\int_0^{\pi/2} f(sinx)dx$ $(d)\pi\int_0^\pi f(cosx)dx$
9. The values of a, for which the points A, B, C with position vectors $2\hat{\imath}-\hat{\jmath}+\hat{k}, \hat{\imath}-3\hat{\jmath}-5\hat{k}$ and $a\hat{\imath}-3\hat{\jmath}+\hat{k}$ respectively are the vertices of a right-angled triangle with C = $\frac{\pi}{2}$ are
(a)2 and 1 (b)-2 and -1
(c)-2 and 1 (d)2 and -1
10. If x is real, the maximum value of $\frac{3x^2+9x+17}{3x^2+9x+7}$ is
(a)¼ (b)41 (c)1 (d)17/7
11. Let A = $\begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix}$ and B = $\begin{pmatrix}a & 0\\ 0 & b\end{pmatrix}$ a, b ∈ N. Then
(a)there cannot exist any B such that AB = BA
(b)there exist more than one but finite number of B's such that AB = BA
(c)there exists exactly one B such that AB = BA
(d)there exist infinitely many B's such that AB = BA
12. The function f(x) = $\frac{x}{2}+\frac{2}{x}$ has a local minimum at
(a)x = 2 (b)x = -2 (c)x = 0 (d)x = 1
13. Let a_1, a_2, a_3, ...be terms of an A.P. If $\frac{a_1+a_2+\cdots+a_p}{a_1+a_2+\cdots+a_q}=\frac{p^2}{q^2}, p\neq 1$ then $\frac{a_6}{a_{21}}$ equals
(a)41/11 (b)7/2 (c)2/7 (d)11/41
14. The set of points, where f(x) = $\frac{x}{1+|x|}$ is differentiable, is:
$(a)(-\infty,0)\cup(0,\infty)$ (b) $(-\infty,-1)\cup(-1,\infty)$
$(c)(-\infty,\infty)$ (d) $(0,\infty)$
15. At an election, a vector may vote for any number of candidates, not greater than the number to be elected. There are 10 candidates and 4 are of be elected. If a voter votes for at least one candidate, then the number of ways in which he can vote is
(a)5040 (b)6210 (c)385 (d)1110
16. The value of $\int_1^a [x]f'(x)dx, a>1$, where [x] denotes the greatest integer not exceeding x is
$(a)af(a)-\{f(1)+f(2)+\ldots.f([a])\}$
$(b)[a]f(a)-\{f(1)+f(2)+\ldots.f([a])\}$
$(c)[a]f([a])-\{f(1)+f(2)+\ldots.f([a])\}$
$(d)af([a])-\{f(1)+f(2)+\ldots.f([a])\}$
17. If $z^2+z+1=0$ where z is a complex number, then the value of $\left(z+\frac{1}{z}\right)^2+\left(z^2+\frac{1}{z^2}\right)^2+\left(z^3+\frac{1}{z^3}\right)^2+\cdots+\left(z^6+\frac{1}{z^6}\right)^2$ is
(a)18 (b)54 (c)6 (d)12
18. If $a_1, a_2, \ldots\ldots, a_n$ are in HP, then the expressions $a_1a_2+a_2a_3+\cdots+a_{n-1}a_n$ is equal to:
(a)n (a_1-a_n) $(b)(n-1)(a_1-a_n)$
(c)na_1a_n $(d)(n-1)a_1a_n$
19. If $a_1, a_2, \ldots\ldots, a_n$ are in GP, then the value of the determinant
$\begin{vmatrix}loga_n & loga_{n+1} & loga_{n+2}\\ loga_{n+3} & loga_{n+4} & loga_{n+5}\\ loga_{n+6} & loga_{n+7} & loga_{n+8}\end{vmatrix}$ is
$(a)0$ $(b)1$ (c) 2 $(d)-2$
20. If $u=\sqrt{a^2cos^2\theta+b^2sin^2\theta}+\sqrt{a^2sin^2\theta+a^2cos^2\theta}$ then the difference between the maximum and minimum values of is given by
$(a)2(a^2+a^2)$ $(b)2\sqrt{a^2+b^2}$ $(c)(a+b)^2$ $(d)(a-b)^2$
21. Domain of the function $^{16-x}C_{2x-1}+{}^{20-3x}C_{4x-5}$ is
(a)\{2, 3\} (b)\{2, 3, 4\} (c)\{1, 2, 3, 4\} (d)\{1, 2, 3, 4, 5\}
22. If $\lim_{n\to\infty}\left(1+\frac{a}{x}+\frac{1}{x^2}\right)^{2x}=e^2$ then the values of a and b are:
$(a)a\in R, b\in R$ $(b)a\in 1, b\in R$

$(c) a \in R, b \in 2$ $(d)\ a \in 1, b \in 2$

23. Inverse function of $\frac{1-x}{1+x}$ is :

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

24. The normal to the curve x = a(1 + cos θ), $y = asin\theta$ at θ always passes through the fixed point

(a)(a, 0) (b)(0, a)

(c)(0, 0)(d)(a, a)

25. A particle is acted upon by constant forces $4\hat{\imath} + \hat{\jmath} - 3\hat{k}$ and $3\hat{\imath} + \hat{\jmath} - \hat{k}$ which displace it from a point $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ to the point $5\hat{\imath} + 4\hat{\jmath} + \hat{k}$. The work done in standard units by the forces is given by

(a)40 (b)30 (c)25 (d)15

26. The probability that A speaks truth is 4/5 while this probability for B is ¾. The probability that they contradict each other when asked to speak on a fact is

(a)3/20 (b)1/5 (c)7/20 (d)4/5

27. A random variable X has the probability distribution

X	1	2	3	4	5	6	7	8
P(X)	0.15	0.23	0.12	0.10	0.20	0.08	0.07	0.05

For the events E ={X is a prime number} and F = {X<4}, the probability P (E ∪ F) is

(a)0.87 (b)0.77 (c)0.35 (d)0.50

28. A particle moves towards east from a point a to a point b at the rate of 4 km/h and then towards north from B to C at rate of 5 km/h. If AB = 12 km and BC = 5 km, then its average speed for its journey from A to C and resultant average velocity direct from A to C are respectively

(a)17/4 km/h and 13/4 km/h

(b)13/4 km/h and 17/4 km/h

(c)17/9 km/h and 13/9 km/h

(d)13/9 km/h and 17/9 km/h

29. If t_1 and t_2 are the times of fight of two particles having the same initial velocity u and range R on the horizontal, then $t_1^2 + t_2^2$ is equal to:

$(a)\frac{u^2}{g}$ $(b)\frac{4\,u^2}{g^2}$ $(c)\frac{u^2}{2g}$ $(d)1$

30. Consider the two curves

$$C_1: y^2 = 4x$$

$C_2: x^2 + y^2 - 6x + 1 = 40$, then

$(a) C_1$ and C_2 touch each other only at one point

$(b) C_1$ and C_2 touch each other exactly at two points

$(c) C_1$ and C_2 intersect (but do not touch) at exactly two points

$(d) C_1$ and C_2 neither intersect nor touch each other

31. If 0 < x < 1, then

$$\sqrt{1+x^2}[\{xcos(cot^{-1}x) + \sin(cot^{-1}x)^2 - 1]^{1/2}$$

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

32. Consider three planes

$$P_1: x - y + z = 1$$
$$P_2: x + y - z = -1$$
$$P_3: x - 3y + 3z = 2$$

Let L_1, L_2, L_3 be the lines of intersection of the planes P_2 and P_3, P_3 and P_1, and P_1 and P_2 respectively.

Statement-1: At least two of the lines L_1, L_2 and L_3 are non-parallel.

Statement-2 : The three planes do not have a common point.

Which of the following is correct?

(a)Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(b)Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1

(c)Statement-1 is True, Statement-2 is False

(d)Statement-1 is False, statement-2 is True

33. Consider the system of equations

ax + by = 0, cx + dy = 0

Where a, b, c, d ∈ (0,1).

Statement-1: The probability that the system of equations has a unique solution is 3/8.

Statement-2: The probability that the system of equations has a solutions is 1,

Which of the following is correct?

(a)Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(b)Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1

(c)Statement-1 is True, Statement-2 is False

(d)Statement-1 is False, statement-2 is True

34. A circle of C of radius 1 is inscribed in an equilateral triangle PQR. The points of contact of C with the sides PQ, QR, RP are D, E, F respectively. The line PQ is given by the equation $\sqrt{3}x + y - 6 = 0$ and the point D is $\left(\frac{3\sqrt{3}}{2}, \frac{3}{2}\right)$. Further, it is given that the origin and the centre of C are on the same side of the line PQ. Equations of the sides QR, RP are

(a)y = $\frac{2}{\sqrt{3}}x + 1, y = -\frac{2}{\sqrt{3}}x - 1$

(b)y = $\frac{1}{\sqrt{3}}x, y = 0$ (c)y = $\frac{\sqrt{3}}{2}x + 1, y = -\frac{\sqrt{3}}{2}x - 1$

(d)y = $\sqrt{3}x, y = 0$

35. Consider the functions defined implicitly by the equation $y^3 - 3y + x = 0$ on various intervals in the real line. If $x \in (-\infty, -2) \cup (2, \infty)$, the equation implicitly defines a unique real valued differentiable function y = f(x). If $x \in (-2, 2)$, the equation implicitly defines a unique real valued differentiable function y = g(x) satisfying g(0) = 0. If f(-10$\sqrt{2}$)= 2$\sqrt{2}$, then $f''(-10\sqrt{2})$ =

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

36. Let A, B, C be three sets of complex numbers as defined below

$$A = \{z: Imz \geq 1\}$$
$$B = \{z: |z - 2 - i| = 3\}$$
$$C = \{z: Re((1 - i)z) = \sqrt{2}\}$$

The number or elements in the set A ∩ B ∩ C is

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

37. Let A, B, C be three sets of complex numbers as defined below

$$A = \{z: Imz \geq 1\}$$
$$B = \{z: |z-2-i| = 3\}$$
$$C = \{z: Re((1-i)z) = \sqrt{2}\}$$

Let z be any point in A∩B∩C. Then, $|z+1-i|^2 + |z-15-i|^2$ lies between
(a)25 and 29 (b)30 and 34
(c)35 and 39 (d)40 and 44

38. Let $z = cos\theta + i\ sin\theta$. Then the value of

$$\sum_{m=1}^{16} Im(z^{2m-1})$$

$at\ \theta = 2^0$is :

$(a)\frac{1}{sin2^0}$ $(b)\frac{1}{3sin2^0}$ $(c)\frac{1}{2sin2^0}$ $(d)\frac{1}{4sin2^0}$

39. If the sum of first n terms of an AP is cm^2, then the sum of squares of these n terms is
$(a)\frac{n(4n^2-1)c^2}{6}$ $(b)\frac{n(4n^2+1)c^2}{3}$
$(c)\frac{n(4n^2-1)c^2}{3}$ $(d)\frac{n(4n^2+1)c^2}{6}$

40. A problem in mathematics is given to three students A, B, C and their respective probability of solving the problem is ½, 1/3 and ¼. Probability that the problem is solved is
(a)¾ (b)½ (c)2/3 (d)1/3

41. The domain of $sin^{-1}\left[log_3\left(\frac{x}{3}\right)\right]$is:
(a)[1, 9] (b)[-1, 9] (c)[-9, 1](d)[-9, -1]

42. The value of $2^{\frac{1}{4}}.4^{\frac{1}{8}}.8^{\frac{1}{6}} + \cdots\infty$ is :
$(a)1$ $(b)2$ $(c)3/2$ $(d)4$

43. $1^3 - 2^3 + 3^3 - 4^3 + \ldots\ldots + 9^3 =$
(a)425 (b)-425 (c)475 (d)-475

44. A and B are events such that

$$P(A \cup B) = \frac{3}{4}, (A \cap B) = \frac{1}{4}, P(\bar{A}) = \frac{2}{3}$$

$then\ P(\bar{A} \cap B)$is :
(a)5/12 (b)3/8 (c)4/5 (d)5/4

45. A die is tossed 5 times. Getting an odd number is considered a success. Then the variance of distribution of success is :
(a)8/3 (b)3/8 (c)4/5 (d)5/4

46. Area of the greatest rectangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is
(a)2ab (b)ab $(c)\sqrt{ab}$$(d)a/b$

47. $\lim_{n\to\infty}\left[\frac{1}{n^2}sec^2\frac{1}{n^2} + \frac{2}{n^2}sec^2\frac{4}{n^2} + \cdots + \frac{1}{n^2}sec^2 1\right] =$
$(a)\frac{1}{2}sec1$ $(b)\frac{1}{2}cosec1$
$(c)\ tan1$ $(d)\frac{1}{2}tan1$

48. If in a frequency distribution, the mean and median are 21 and 22 respectively, then its mode is approximately
(a)22.0(b)20.5
(c)25.5 (d)24.0

49. The system of equations $\alpha x + y + z = \alpha - 1, x + \alpha y + z = \alpha - 1, x + y + \alpha z = \alpha - 1$hasno solution, if $\alpha\ is$
(a)-2(b)either -2 or 1(c)not -2 (d)1

50. If $z_1$and $z_2$are two non-zero complex numbers such that$|z_1 + z_2| = |z_1| + |z_2|$ then arg$z_1 - argz_2$ is equal to :
$(a)\frac{\pi}{2}$ $(b) -\pi$ (c) 0 $(d) -(\frac{\pi}{2})$

51. The normal to the curve x= $a(cos\theta + \theta sin\theta)$, y= $a(sin\theta - \theta cos\theta)$ at any point θ is such that
(a)It passes through the origin
(b)It makes angle $\frac{\pi}{2} + \theta$ with x-axis
(c)It passes through $\left(a\frac{\pi}{2}, -a\right)$
(d)It is a constant distance from the origin

52. Let α and β be the distinct roots of $ax^2 + bx + c = 0$, then $\lim_{x\to\alpha}\frac{1-\cos(ax^2+bx+c)}{(x-\alpha)^2}$is equal to:
$(a)\frac{a^2}{2}(\alpha-\beta)^2$ $(b)0$ $(c) -\frac{a^2}{2}(\alpha-\beta)^2$ $(d)\frac{1}{2}(\alpha-\beta)^2$

53. If f is a real-valued differentiable function satisfying $|f(x) - f(y)| \leq (x-y)^2, x, y \in R$ and f(0) = 0, then f(1) equals
(a)-1 (b)0 (c)2 (d)1

54. If $x\frac{dy}{dx} = y(logy - log + 1)$ then the solution of the equation is :
$(a)ylog\left(\frac{x}{y}\right) = cx$ $(b)xlog\left(\frac{y}{x}\right) = cy$
$(c)log\left(\frac{y}{x}\right) = cx$ $(d)log\left(\frac{x}{y}\right) = cy$

55. The locus of a point P(α, β) moving under the condition that the line$y = ax + \beta$ is tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is:
(a)an ellipse (b)a circle (c)a parabola (d)a hyperbola

56. The distance between the line $\vec{r} = 2\hat{\imath} - 2\hat{\jmath} + 3\hat{k} + \lambda(\hat{\imath} - \hat{\jmath} + 4\hat{k})$ and the plane $\vec{r}.(\hat{\imath} + 5\hat{\jmath} + \hat{k}) = 5$ is:
(a)10/9(b)10/3$\sqrt{3}$$(c)$3/10 (d)10/3

57. For any vector $\vec{a}$, the value of $(\vec{a}\times\hat{\imath})^2 + (\vec{a}\times\hat{\jmath}) + (\vec{a}\times\hat{k})^2$is equal to:
$(a)3\vec{a}^2$$(b)\vec{a}^2$$(c)2\vec{a}^2$$(d)4\vec{a}^2$

58. 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 $P(\bar{A}) = \frac{1}{4}$where $\bar{A}$stands for complement of event a. Then events A and B are
(a)Equally likely and mutually exclusive

(b)Equally likely but not independent
(c)Independent but not equally likely
(d)Mutually exclusive and independent

59. A lizard, at an initial distance of 21 cm behind an insect, moves from rest with an acceleration of $2cm/s^2$and pursues the insect which is crawling uniformly along a straight line at a speed of 20 cm/s. Then the lizard will catch the insect after
(a)20s (b)1s (c)2s (d)24s
60. The resultant R of two forces acting on a particle is at right angles to one of them and its magnitude is one-third of the other force. The ratio of larger force to smaller one is
(a)2:1 (b)3:$\sqrt{2}$
(c)3:2 (d)3:2$\sqrt{2}$
61. A body weighing 13 kg is suspended by two strings 5 m and 12 m long, their other ends being fastened to the extremities of a rod 13 m long. If the rod be so held that the body hangs immediately below the middle point. The tensions in the strings are
(a)12 kg and 13 kg (b)5 kg and 5 kg
(c)5 kg and 12 kg (d)5 kg and 13 kg
62. A pair of fair dice is thrown independently three times. The probability of getting a score of exactly 9 twice is:
(a)1/729 (b)8/9
(c)8/729 $(d)(d)$8/243
63. If $|z+4| \leq 3,$ then the maximum value of $|z+1|$is
(a)4 (b)10 (c)6 (d)0
64. For the hyperbola$\frac{x^2}{cos^2\alpha} - \frac{y^2}{sin^2\alpha} = 1,$ which of the following remains constant when varies?
(a)Eccentricity (b)Directrix
(c)Abscissae of vertices (d)Abscissae of foci
65. A value of c for which the conclusion of mean value theorem holds for the function f(x) = $log_e x$ of the interval [1, 3] is
$(a) 2log_3 e$ $(b) \frac{1}{2} log_e 3$ $(c) log_3 e$ $(d) log_e 3$
66. The function $f(x) = tan^{-1}(sinx + cosx)$ is an increasing function in
$$(a)\left(\frac{\pi}{4},\frac{\pi}{2}\right) (b)\left(-\frac{\pi}{2},\frac{\pi}{4}\right)$$
$$(c)\left(0,\frac{\pi}{2}\right) (d)\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$$
67. The average marks of boys in a class is 52 and that of girls is 42. The average marks of boys and girls combined is 50. The percentage of boys in the class is:
(a)40 (b)20 (c)80 (d)60
68. Let $F(x) = f(x) + f\left(\frac{1}{x}\right)$ where $f(x) = \int_1^x \frac{logt}{1+t} dt$. Then F(e) equals:
(a)½ (b)0 (c)1 (d)2
69. The area enclosed between the curves $y^2 = x$ and $y = |x|\ is$:
(a)2/3 (b)1 (c)1/6 (d)1/3
70. If the difference between the roots of the equation $x^2 + ax + 1 = 0$ is less than $\sqrt{5}$, then the set of possible values of a is:
$$(a)(-3,3)(b)(-3,\infty)$$
$$(c)(3,\infty)(d)(-\infty,-3)$$
71. A dies is thrown. Let A be the event that the number obtained is greater than 3. Let B the event that the number obtained is less than 5. Then P(A∪B) is:
(a)3/5 (b)0 (c)1 (d)2/5
72. The conjugate of a complex number is $\frac{1}{i-1}$. Then, that complex number is:
$$(a) -\frac{1}{i-1} (b)\frac{1}{i+1} (c) -\frac{1}{i+1} (d)\frac{1}{i-1}$$
73. The value of $\sqrt{2}\int \frac{sinxdx}{sin\left(x-\frac{\pi}{4}\right)}$is
$$(a) x + log\left|cos\left(x-\frac{\pi}{4}\right)\right| c (b) x - log\left|sin\left(x-\frac{\pi}{4}\right)\right| c$$
$$(c) x + log\left|sin\left(x-\frac{\pi}{4}\right)\right| c \quad (d)\ x - log\left|cos\left(x-\frac{\pi}{4}\right)\right| c$$
74. Let A be a square matrix all of whose entries are integers. Then, which one of the following is true?
(a)If $\det(A) = \pm 1, then\ A^{-1}$ exists but all its entries are not necessarily integers
(b)If $\det(A) \neq \pm 1, then\ A^{-1}$ exists and all its entries are non-integers
(c)If $\det(A) = \pm 1, then\ A^{-1}$ exists and all its entries are integers
(d)If $\det(A) = \pm 1, then\ A^{-1}$ need not exists
75. If A, B and C are three sets such that $A \cap B = A \cap C,$ and A∪B= A∪C, then
(a)A = B (b)A = C(c)B = C (d)A∩B = ϕ
76. If $f(x) = \cos([\pi]x) + \cos[\pi x]$ then $f\left(\frac{\pi}{2}\right)$ is
(a)0 (b)cos 3(c)cos 4 (d)1 + cos 4
77. For real x, let $f(x) = x^2 + 5x + 1,$ then
(a)f in one-one but not onto R
(b)f is onto R but not one-one
(c)f is one-one and onto R
(d)f is neither one-one not onto R
78. In a binomial distribution $B\left(n, p = \frac{1}{4}\right)$if the probability of at least one success is greater than or equal to 9/10, then n is greater than
$$(a)\frac{1}{log_{10}4 + log_{10}3} \quad (b)\frac{1}{log_{10}4 + log_{10}3}$$
$$(c)\frac{9}{log_{10}4 - log_{10}3} \quad (d)\frac{4}{log_{10}4 - log_{10}3}$$
79. If $\left|z - \frac{4}{z}\right| = 2,$ then the maximum value of $|z|$is equal to:
$(a)\sqrt{3}+1$ $(b)\sqrt{5}+1$ $(c)2$ $(d)(2+\sqrt{2})$
80. The ellipse $x^2 + 4y^2 = 4$ is inscribed in a rectangle aligned with the coordinate axes, which in turn is inscribed in another ellipse that passes through the point (4, 0), then the equation of the ellipse is
$(a) x^2 + 16y^2 = 16$ $(b)\ x^2 + 12y^2 = 16$
$(c) 4x^2 + 48y^2 = 48$ $(d) 4x^2 + 64y^2 = 48$

81. One ticket is selected at random from 50 tickets numbered 00, 01, 02, ..., 49. Then the probability that the sum of the digits on the selected ticket is 8, given that the product of these digits is zero, equals:
(a)1/14 (b)1/7 (c)5/14 (d)1/50

82. Let $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}, \vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$ and $\vec{c} = \hat{\imath} - \hat{\jmath} - \hat{k}$ be three vectors. A vector $\vec{v}$ in the plane of $\vec{a}$ and $\vec{b}$, whose projection on $\vec{c}$ is $\frac{1}{\sqrt{3}}$, is given by
$(a)\hat{\imath} - 3\hat{\jmath} + 3\hat{k}$ $(b) - 3\hat{\imath} - 3\hat{\jmath} - \hat{k}$ $(c)3\hat{\imath} - \hat{\jmath} + 3\hat{k}$ $(d)\ \hat{\imath} + 3\hat{\jmath} - 3\hat{k}$

83. Let the straight line x = b divide the area enclosed by $y = (1-x)^2, y = 0$ and $x = 0$ into two parts $R_1(0 \le x \le b)$ and $R_2(b \le x \le 1)$ such that $R_1 - R_2 = \frac{1}{4}$. then b equals:
(a)¾ (b)½ (c)1/3 (d)¼

84. Let $P = \{\theta : sin\theta - cos\theta = \sqrt{2}\, cos\theta\}$ and $Q = \{\theta : sin\theta + cos\theta = \sqrt{2}\, sin\theta\}$ be two sets. Then
$(a) P \subset Q and\ Q - P = \phi$ $(b) Q$ is not a subset of P
$(c) P$ is not a subset of Q (d)P = Q

85. Let $\omega \neq 1$ be a cube root of unity and S be the set of all non-singular matrices of the form

$$\begin{bmatrix} 1 & a & b \\ \omega & 1 & c \\ \omega^2 & \omega & 1 \end{bmatrix}$$

Where each of a, b and c is either ω or ω^2. Then the number of distinct matrices in the set S is:
(a)2 (b)6 (c)4 (d)8

86. If $\text{Lim}_{x\to 0}[1 + xln(l + b^2)]^{1/x} = 2b\, sin^2\theta, b > 0$ and $\theta \in (-\pi, \pi)$ then the value of θ is:

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

87. Let f(x) be differentiable on the interval (0, ∞) such that f(1)=1, and $\text{Lim}_{t\to x}\frac{t^2 f(x) - x^2 f(t)}{t-1} = 1$, for each x > 0. Then f(x) is:

$$(a)\frac{1}{3x} + \frac{2x^2}{3} \quad (b)\frac{-1}{3x} + \frac{4x^2}{3} \quad (c)\frac{-1}{x} + \frac{2}{x^2} \quad (d)\ \frac{1}{x}$$

88. One Indian and four American men and their wives are to be seated randomly around a circular table. Then the conditional probability that the Indian man is seated adjacent to his wife given that each American man is seated adjacent to his wife is:
(a)½ (b)1/3 (c)2/5 (d)1/5

89. The number of distinct real values of λ, for which the vectors $-\lambda^2\hat{\imath} + \hat{\jmath} + \hat{k},\ \hat{\imath} - \lambda^2\hat{\jmath} + \hat{k}$ and $\hat{\imath} + \hat{\jmath} - \lambda^2\hat{k}$ are coplanar is
(a)zero (b)one (c)two (d)three

90. The number of solutions of the pair of equations $2sin^2\theta - cos2\theta = 0$, $2cos^2\theta - 3sin\theta = 0$, in the interval [0, 2 π] is:
(a)Zero (b)one (c)two (d)four

91. A beam balance measures…. And a spring balance measures……,
(a)weight, weight (b)weight, mass
(c)mass, weight (d)mass, mass

92. Which of the following is not valid?
(a)Inertia of rest (b)Inertia of motion
(c)Inertia of motion (d)Inertia of kinetic energy

93. A particle of mass m moving with a velocity v strikes a stationary particle of mass 4m and sticks to it. The speed of the system will be:
(a)v/4 (b)v/5 (c)4v (d)5v

94. A particle of mass m has momentum p. What is its kinetic energy ?

$$(a)\frac{p^2}{2m} (b)\frac{p^2}{4m} (c)\frac{2p^2}{m} (d)\frac{4p^2}{m}$$

95. If the momentum of a particle is increased by 50%, then its kinetic energy increases by
(a)25% (b)125% (c)225% (d)625%

96. A shell is fired from a canon and it explodes in the air, then
(a)Neither its momentum nor its kinetic energy increase
(b)Only its momentum increases
(c)Only its kinetic energy increases
(d)Both its momentum and kinetic energy increase

97. A 2000 kg car travels at a constant speed of 2 metres per second around a circular curve of radius 30 m. What is the magnitude of the centripetal acceleration of the car as it goes around the curve?
$(a)2.5ms^{-2}$ $(b)4.8ms^{-2}$ $(c)8.33ms^{-2}$ $(d)\ 9.6ms^{-2}$

98. When a particle moves with constant speed along a circle
(a)Its velocity remains constant
(b)No force act on it
(c)On acceleration is produced on it
(d)No work is done on it

99. If we travel from the north pole to the south pole, the value of g will
(a)Increase (b)decrease
(c)Increase till the equator and then decrease
(d)Decrease till the equator and then increase

100. An object weighs 100 N on earth's surface. How much will it weigh when moved to a point one earth radius above the earth's surface
(a)25 N (b)50 N (c)200 N (d)400 N

Logical Ability

101. The film transistor liquid crystal display is an example of
(a)Input device (b)processor
(c)Memory device (d)output device

102. What is the width of a 15-inch monitor with a 4:3 aspect ratio?
(a)12 inches (b)13 inches
(c)14 inches (d)45 inches

103. Convert decimal 50.75 to binary
(a)110010.01 (b)110010.11
(c)110100.01 (d)110100.11

104. Convert binary 101.101 to decimal
(a)5.125 (b)5.375(c)5.625(d)5.875

105. In hexadecimal arithmetic, FACE-BAD=
(a)EC21 (b)ED21(c)EE21(d)EF21

106. The 'C' programming language can be used to implement
(a)application software only
(b)system software only
(c)both application software and system software
(d)neither application software nor system software

107. A Central Processing Unit (CPU) consists of
(a)input, output unit (b)memory unit
(c)arithmetic and logical unit, central unit
(d)key board, printer

108. Which of the following sets contains an invalid library function?
(a)isalnum, abs, strcat (b) isalpha, fmod, strdup
(c)isdigit, modf, strrev(d)isnum, pow, strupr

109. Fill in the blank:
You visited London last week..... you?
(a)Do (b)Did (c)Don't(d)Didn't

110. Fill in the blank:
I have warned you. Haven't......?
(a)I (b)you (c)warn (d)warned

111. Fill in the blanks:
A......of hounds chased away the ... of elephants.
(a)Herd, pack (b)pack, herd
(c)Group, team (d)team, group

112. Fill in the blank:
I went there .... The midnight.
(a)In (b)during(c)at (d)between

113. Which will you call something that is not logical?
(a)Dislogical (b)Illogical
(c)Nonlogical (d)Unlogical

114. a, b, c, d and e are integers such that $1 \leq a < b < c < d < e$. if a, b, c, d and e are geometric progression and lcm (m, n) is the least common multiple of m and n, then the maximum value of $\frac{1}{lcm(a,b)} + \frac{1}{lcm(b,c)} + \frac{1}{lcm(c,d)} + \frac{1}{lcm(d,e)}$ is:
(a)1 (b)79/81(c)15/16(d)7/8

115. Which number replace the question mark?

(a)7 (b)3 (c)13 (d)9

116. Four digits of number 29138576 are omitted so that the result is as large as possible. The largest omitted digit is:
(a)9 (b)8 (c)6 (d)5

117. If X is the brother of the son of Y's son, how is X related to Y?
(a)Son (b)Brother(c)Cousin (d) Grandson

118. Kunal walks 10 km towards North. From there, he walks 6 km towards South. Then he walks 4 km towards East. How far and in which direction is he with reference to his starting point?
(a)5 km, West (b)5 km, North-East
(c)7 km, East (d)7 km, West

119. Books and More, sells books, music CD's and film DVD's. In December, 2004, they earned 40% profit in music CD's and 25% profit in books. Music CD's contributed 35 % towards their total sales in rupees. At the same time total sales in rupees from books is 50% more than that of music CD's. If Books and More made 50% loss in film DVD's, then overall they made
(a)12.3% profit (b)8.7% profit
(c)0.4% loss (d)6.25%loss

120. ABCD is a parallelogram with $\angle ABC = 60^{\circ}$.If the longer diagonal is of length 7 cm and the area of the parallelogram ABCD is $15\frac{\sqrt{3}}{2}$ sq. cm, then the perimeter of the parallelogram (in cm) is:
(a)16 (b)$15\sqrt{3}$ (c)15 (d)$16\sqrt{3}$

121. A shop stores x kg of rice. The first customer buys half of this amount plus half a kg of rice. The second customer buys half the remaining amount plus half a kg of rice. Then the third customer also buys half the remaining amount plus half a kg of rice. Thereafter, no rice is left in the shop. Which of the following best describes the value of x?
(a)$2 \leq x \leq 6$ (b)$5 \leq x \leq 8$ (c)$9 \leq x \leq 12$ (d)$11 \leq x \leq 14$

122. The integers 1, 2,..... 40 are written on a blackboard. The following operation is then repeated 39 times. In each repetition, any two numbers, say a and b, currently on the blackboard are erased and a new number a + b – 1 is written. What will be the number left on the board at the end?
(a)820 (b)821 (c)781 (d)819

123. The number of common terms in the two sequences 17, 21, 25, ..., 417 and 16, 21, 26, ...,466 is
(a)78 (b)19 (c)20 (d)77

124. The sum of
$\sqrt{1+\frac{1}{1^2}+\frac{1}{2^2}}+\sqrt{1+\frac{1}{2^2}+\frac{1}{3^2}}+\cdots+\sqrt{1+\frac{1}{(2007)^2}+\frac{1}{(2008)^2}}$ is:
(a)$2008-\frac{1}{2008}$ (b)$2007-\frac{1}{2007}$ (c)$2007-\frac{1}{2008}$ (d)$2008-\frac{1}{2007}$

125. Ajay plans to drive from city A to station C, at the speed of 70 km per hour, to catch a train arriving there from B. He must reach C at least 15 minutes before the arrival of the train. The train leaves B, located 500 km South of A, at 8.00 AM and travels at a speed of 50 km per hour. It is known that C is located between west and North-West of B, with BC at 60° to AB. Also, C is located between South and South-West of A with AC at 30° to AB. The latest time by which Ajay must leave A and still catch the train is closest to
(a)6.15 AM (b)6.30 AM (c)6.45 AM (d)7.00 AM

126. Let N be the largest number which divides 1305, 4665 and 6905 to leave the same remainder in each case. Then sum of the digits in N is:
(a)4 (b)5 (c)6 (d)8

127. A and B undertake to do a piece of work for Rs. 600. A alone can do it in 6 days while B alone can do it in 8 days. With the help of C, they finish it in 3 days. Then the share of A is:
(a)Rs. 250 (b)Rs. 75 (c)Rs. 300(d)Rs. 225

128. Identify the wrong number in the series:
69, 55, 26, 13, 5
(a)5 (b)13 (c)26 (d)55

129. Choose the best alternatives:
21 : 3 : : 574 : ?
(a)23 (b)82 (c)97 (d)113

130. In a pile of 10 books, there are 3 of History, 3 of Hindi, 2 of Mathematics and 2 of English. Taking from above, there is an English book between a History and Mathematics book, a History book between Mathematics and English book, a Hindi book between an English and a Mathematics book, a Mathematics book between two Hindi books and two Hindi books between a Mathematics and a History book. Book of which subject is at the sixth position from the top?
(a)English (b)Hindi(c)Mathematics (d)History

131. If the word DISTURBANCE, the first letter is interchanged with the last letter, the second letter is interchanged with the tenth letter and so on, which letter would come after 'T' in the newly formed word?
(a)I (b)N (c)S (d)D

132. A, B, C and D play a game of cards. A says to B, "If I give you 8 cards, you will have as many as C has and I shall have 3 less than what C has. Also, If I take 6 cards from C, I shall have twice as many as D has" If B and D together have 50 cards, how many cards has C got?
(a)35 (b)37 (c)27 (d)40

133. Statements: All bags are cakes. All lamps are cakes.
Conclusion: (I) Some lamps are bags.
(II) No lamp is bag
(a) (I) follows (b)(II) follows
(c)Either I or II follows (d)Neither I nor II follow

Directions (134-137): Each question given below has a set of three statements. Each set of statements is further divided Into three segments. Choose the alternative where the third segment in the statement can be logically deduced using both the preceding two, but not just from one of them.

134. A: All beautiful things are sad. She is beautiful. She is sad.
B: all nice things are flat. TVs are flat. TVs are nice things
C: Potatoes are stems. All stems are fruits. Potatoes are fruits.
(a)A only (b)A and B
(c)C only (d)A and C

135. A : Ravens are black. Ravens are evil. All evils are black.
B: Horses are faster than eagles. All eagles are hawks. Horses are faster than hawks.
C: No priest is a saint. Peter is a priest. Peter is a saint.
(a)A only (b)B only (c)C only (d)None of these

136. A: Many poets are not readers. All strangers are poets. Some singers are not readers.
B: Boys play cricket. Some girls do not play cricket. Some girls are not boys.
C: All Eskimos live in Igloos. Some Penguins live in Igloos. Some Penguins are Eskimos.
(a)A only (b)B only
(c)C only (d)B and C

137. A : Some substances are crystalline. Marble is crystalline. Marble is a substance.
B: All greyhounds are dogs. Some dogs are cows. Some greyhounds are dogs.
C: All locks are keys. Some keys do not open. Some locks do not open.
(a)A only (b)B and C
(c)A and C (d)None of these

138. The milk and water in two vessels A and B are in the ratio 4:3 and 2:3 respectively. In what ratio, the liquids in both the vessels be mixed to obtain a new mixture in vessel C containing half-milk and half-water?
(a)7:5 (b)7:8 (c)5:7 (d)8:7

139. 15 litres of mixture contains 20% alcohol and the rest water. If 3 litres of water is mixed with it, the percentage of alcohol in the new mixture would be
(a)15% $(b)$$16\frac{2}{3}$%
(c)17% $(d)$$18\frac{1}{2}$%

140. A watch which gains uniformly is 2 minutes low at noon on Monday and is 4 minutes 48 seconds fast at 3 p.m on the following Monday. When was it correct?
(a)2 p.m. on Tuesday (b)2 p.m on Wednesday
(c)3 p.m. on Thursday (d)1 p.m. on Friday

141. It was Sunday on January 1, 2006. What was the day of the week on January 1, 2010?
(a)Sunday (b)Saturday
(c)Friday (d)Wednesday

142. A player holds 13 cards of four suits, of which seven are black and six are red. There are twice as many diamonds as spades and twice as many hearts as diamonds. How many clubs does he hold?
(a)4 (b)5 (c)6 (d)7

143. The word CHEERS is codes as EHCSRE. According to the same rule, the word BASKET is coded as
(a)BSATEK (b)KETBAS
(c)SABTEK (d)ASBEKT

144. The UN (United Nations) came into existence in
(a)1946 (b)1945 (c)1947 (d)1950

145. The only religious book ever printed in shorthand script is
(a)The Ramayana (b)The Mahabharata
(c)The Bible (d)Guru Granth sahib

146. Which of the following is the author of song of India?
(a)Firdausi
(b)Sarojini Naidu
(c)Lala Lajpat Rai
(d)Sri AurobindoGhosh

147. What is the shape of the earth's orbit around the Sun?
(a)Circular (b)Hyperbolic
(c)Elliptical (d)Parabolic

148. The Indian Flag is rectangular in shape and the ratio of the length to breadth is
(a)2:1 (b)3:2
(c)3:4 (d)5:3