Q1. If the roots of the equation $x^2 + px + q = 0$ are tan 19° and tan 26°, then which one of the following is correct?

(a) q – p = 1
(b) p – q = 1
(c) p + q = 2
(d) p + q = 3

Q2. What is the fourth term of an AP of n terms whose sum is n(n + 1)?

(a) 6
(b) 8
(c) 12
(d) 20

Q3. What is $(1 + \tan\alpha \tan\beta)^2 + (\tan\alpha - \tan\beta)^2 - \sec^2\alpha \sec^2\beta$ equal to?

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

Q4. If p = cosec θ and q = $(\text{cosec}\,\theta + \cot\theta)^{-1}$, then which one of the following is correct?

(a) pq = 1
(b) p = q
(c) p + q = 1
(d) p + q = 0

Q5. If the angles of a triangle ABC are in the ratio 1 : 2 : 3, then the corresponding sides are in the ratio

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

Q6. Consider the following statements :

1. For an equation of a line, x cos θ + y sin θ = p, in normal form, the length of the perpendicular form the point (α, β) to the line is |α cos θ + β sin θ + p|.
2. The length of the perpendicular from the point (α, β) to the line $\frac{x}{a} + \frac{y}{b} = 1$ is $\left|\frac{a\alpha + b\beta - ab}{\sqrt{a^2+b^2}}\right|$.

Which of the above statements is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Q7. A circle is drawn on the chord of a circle $x^2 + y^2 = a^2$ as diameter. The chord lies on the line x + y = a. What is the equation of the circle?

(a) $x^2 + y^2 - ax - ay + a^2 = 0$

(b) $x^2 + y^2 - ax - ay = 0$

(c) $x^2 + y^2 + ax + ay = 0$

(d) $x^2 + y^2 + ax + ay - 2a^2 = 0$

Q8. The sum of the focal distances of a point on an ellipse is constant and equal to the

(a) length of minor axis

(b) length of major axis

(c) length of latus rectum

(d) sum of the lengths of semi-major and semi-minor axes

Q9. The equation $2x^2 - 3y^2 - 6 = 0$ represents

(a) a circle

(b) a parabola

(c) an ellipse

(d) a hyperbola

Q10. The Two parabolas $y^2 = 4ax$ and $x^2 = 4ay$ intersect

(a) at two points on the line y = x

(b) only at the origin

(c) at three points one of which lies on y + x = 0

(d) only at (4a, 4a)

Q11. The points (1, 3) and (5, 1) are two opposite vertices of a rectangle. The other two vertices lie on the line y = 2x + c. What is the value of c?

(a) 2

(b) – 2

(c) 4

(d) – 4

Q12. If the lines 3y + 4x = 1, y = x + 5 and 5y + bx = 3 are concurrent, then what is the value of b?

(a) 1

(b) 3

(c) 6

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

Q13. What is the equation of the straight line which is perpendicular to y = x and passes through (3, 2) ?

(a) x – y = 5

(b) x + y = 5

(c) x + y = 1

(d) x – y = 1

Q14. The straight lines $x + y - 4 = 0$, $3x + y - 4 = 0$ and $x + 3y - 4 = 0$ form a triangle, which is
(a) isosceles
(b) right-angled
(c) equilateral
(d) scalene

Q15. The circle $x^2 + y^2 + 4x - 7y + 12 = 0$, cuts an intercept on y-axis equal to
(a) 1
(b) 3
(c) 4
(d) 7

Q16. What is the value of $\frac{\sin 34^\circ \cos 236^\circ - \sin 56^\circ \sin 124^\circ}{\cos 28^\circ \cos 88^\circ + \cos 178^\circ \sin 208^\circ}$?
(a) –2
(b) –1
(c) 2
(d) 1

Q17. tan 54° can be expressed as
(a) $\frac{\sin 9^\circ + \cos 9^\circ}{\sin 9^\circ - \cos 9^\circ}$
(b) $\frac{\sin 9^\circ - \cos 9^\circ}{\sin 9^\circ + \cos 9^\circ}$
(c) $\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ}$
(d) $\frac{\sin 36^\circ}{\cos 36^\circ}$

Consider the following for the next 03 (three) items:
If $p = X \cos \theta - Y \sin \theta$, $q = X \sin \theta + Y \cos \theta$ and $p^2 + 4pq + q^2 = AX^2 + BY^2, 0 \leq \theta \leq \frac{\pi}{2}$.

Q18. What is the value of θ ?
(a) $\frac{\pi}{2}$
(b) $\frac{\pi}{3}$
(c) $\frac{\pi}{4}$
(d) $\frac{\pi}{6}$

Q19. What is the value of A?
(a) 4
(b) 3
(c) 2
(d) 1

Q20. What is the value of B ?
(a) –1
(b) 0
(c) 1
(d) 2

Consider the following for the next 02 (two) items :

It is given that $\cos(\theta - \alpha) = a$, $\cos(\theta - \beta) = b$.

Q21. What is $\cos(\alpha - \beta)$ equal to?

(a) $ab + \sqrt{1-a^2}\sqrt{1-b^2}$

(b) $ab - \sqrt{1-a^2}\sqrt{1-b^2}$

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

(d) $a\sqrt{1-b^2} + b\sqrt{1-a^2}$

Q22. What is $\sin^2(\alpha - \beta) + 2ab\cos(\alpha - \beta)$ equal to?

(a) $a^2 + b^2$

(b) $a^2 - b^2$

(c) $b^2 - a^2$

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

Q23. If $\sin\alpha + \cos\alpha = p$, then what is $\cos^2(2\alpha)$ equal to?

(a) p^2

(b) $p^2 - 1$

(c) $p^2(2 - p^2)$

(d) $p^2 + 1$

Q24. What is the value of $\sin^{-1}\frac{4}{5} + \sec^{-1}\frac{5}{4} - \frac{\pi}{2}$?

(a) $\frac{\pi}{4}$

(b) $\frac{\pi}{2}$

(c) π

(d) 0

Q25. If $\sin^{-1}\frac{2p}{1+p^2} - \cos^{-1}\frac{1-q^2}{1+q^2} = \tan^{-1}\frac{2x}{1-x^2}$, then what is x equal to ?

(a) $\frac{p+q}{1+pq}$

(b) $\frac{p-q}{1+pq}$

(c) $\frac{pq}{1+pq}$

(d) $\frac{p+q}{1-pq}$

Q26. If $\tan\theta = \frac{1}{2}$ *and* $\tan\varphi = \frac{1}{3}$, then what is the value of $(\theta + \varphi)$?

(a) 0

(b) $\frac{\pi}{6}$

(c) $\frac{\pi}{4}$

(d) $\frac{\pi}{2}$

Q27. If $\cos A = \frac{3}{4}$, then what is the value of $\sin\left(\frac{A}{2}\right) \sin\left(\frac{3A}{2}\right)$?

(a) $\frac{5}{8}$

(b) $\frac{5}{16}$

(c) $\frac{5}{24}$

(d) $\frac{7}{32}$

Q28. What is the value of $\tan 75° + \cot 75°$?

(a) 2

(b) 4

(c) $2\sqrt{3}$

(d) $4\sqrt{3}$

Q29. What is the value of cos 46° cos 47° cos 48° cos 49° cos 50° .... cos 135° ?

(a) –1

(b) 0

(c) 1

(d) Greater than 1

Q30. If $\sin 2\theta = \cos 3\theta$, where $0 < \theta < \frac{\pi}{2}$, then what is sin θ equal to?

(a) $\frac{\sqrt{5}+1}{4}$

(b) $\frac{\sqrt{5}-1}{4}$

(c) $\frac{\sqrt{5}+1}{16}$

(d) $\frac{\sqrt{5}-1}{16}$

Consider the following for the next 02 (two) items that follow:

In a school, all the students play at least one of three indoor games – chess, carrom and table tennis. 60 play chess, 50 play table tennis, 48 play carrom, 12 play chess and carrom, 15 play carrom and table tennis, 20 play table tennis and chess.

Q31. What can be the minimum number of students in the school?

(a) 123

(b) 111

(c) 95

(d) 63

Q32. What can be the maximum number of students in the school?

(a) 111

(b) 123

(c) 125

(d) 135

Q33. If A is an identity matrix of order 3, then its inverse (A^{-1})
(a) is equal to null matrix
(b) is equal to A
(c) is equal to 3A
(d) does not exist

Q34. A is a square matrix of order 3 such that its determinant is 4. What is the determinant of its transpose?
(a) 64
(b) 36
(c) 32
(d) 4

Q35. From 6 programmers and 4 typists, an office wants to recruit 5 people. What is the number of ways this can be done so as to recruit at least one typist?
(a) 209
(b) 210
(c) 246
(d) 242

Q36. What is the number of terms in the expansion of $[(2x-3y)^2(2x+3y)^2]^2$?
(a) 4
(b) 5
(c) 8
(d) 16

Q37. In the expansion of $(1+ax)^n$, the first three terms are respectively 1, 12x and $64x^2$. What is n equal to?
(a) 6
(b) 9
(c) 10
(d) 12

Q38. The numbers 1, 5 and 25 can be three terms (not necessarily consecutive) of
(a) only one AP
(b) more than one but finite numbers of Aps
(c) infinite number of APs
(d) finite number of GPs

Q39. The sum of $(p+q)^{th}$ and $(p-q)^{th}$ terms of an AP is equal to
(a) $(2p)^{th}$ term
(b) $(2q)^{th}$ term
(c) Twice the p^{th} term
(d) Twice the q^{th} term

Q40. If A is a square matrix of order n > 1, then which one of the following is correct?

(a) det (–A) = det A

(b) det (–A) = $(-1)^n$ det A

(c) det $(-A) = -\det A$

(d) det$(-A) = n \det A$

Q41. What is the least value $25\ cosec^2 x + 36 \sec^2 x$?

(a) 1

(b) 11

(c) 120

(d) 121

Consider the following for the next 02 (two) items:

Let A and B be (3 × 3) matrices with det A = 4 and det B = 3.

Q42. What is det (2AB) equal to?

(a) 96

(b) 72

(c) 48

(d) 36

Q43. What is det $(3AB^{-1})$ equal to?

(a) 12

(b) 18

(c) 36

(d) 48

Consider the following for the next 02 (two) items:

A complex number is given by z = $\frac{1+2i}{1-(1-i)^2}$.

Q44. What is the modulus of z?

(a) 4

(b) 2

(c) 1

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

Q45. What is the principal argument of z?

(a) 0

(b) $\frac{\pi}{4}$

(c) $\frac{\pi}{2}$

(d) π

Q46. What is the n^{th} term of the sequence 25, –125, 625, –3125, ...?
(a) $(-5)^{2n-1}$
(b) $(-1)^{2n}\ 5^{n+1}$
(c) $(-1)^{2n-1}\ 5^{n+1}$
(d) $(-1)^{n-1}\ 5^{n+1}$

Q47. Suppose X = {1, 2, 3, 4} and R is a relation on X. If R = [(1, 1), (2, 2), (3, 3), (1, 2), (2, 1), (2, 3), (3, 2)}, then which one of the following is correct?
(a) R is reflexive and symmetric, but not transitive
(b) R is symmetric and transitive, but not reflexive
(c) R is reflexive and transitive, but not symmetric
(d) R is neither reflexive nor transitive, but symmetric

Q48. A relation R is defined on the set N of natural numbers as xRy $\Rightarrow x^2 - 4xy + 3y^2 = 0$. Then which one of the following is correct?
(a) R is reflexive and symmetric, but not transitive
(b) R is reflexive and transitive, but not symmetric
(c) R is reflexive, symmetric and transitive
(d) R is reflexive, but neither symmetric nor transitive

Q49. If A = $(x \in Z : x^3 - 1 = 0)$ and $B = (x \in Z : x^2 + x + 1 = 0)$, where Z is set of complex numbers, then what is A ∩ B equal to ?
(a) Null set
(b) $\left\{\frac{-1+\sqrt{3}\,i}{2}, \frac{-1-\sqrt{3}\,i}{2}\right\}$
(c) $\left\{\frac{-1+\sqrt{3}\,i}{4}, \frac{-1-\sqrt{3}\,i}{4}\right\}$
(d) $\left\{\frac{1+\sqrt{3}\,i}{2}, \frac{1-\sqrt{3}\,i}{2}\right\}$

Q50. Consider the following statements for the two non-empty sets A and B:
1. $(A \cap B) \cup \left(A \cap \overline{B}\right) \cup \left(\overline{A} \cap B\right) = A \cup B$
2. $\left(A \cup \left(\overline{A} \cap \overline{B}\right)\right) = A \cup B$
Which of the above statements is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Q51. Let X be a non-empty set and let A, B, C be subsets of X. Consider the following statements :
1. $A \subset C \Rightarrow (A \cap B) \subset (C \cap B), (A \cup B) \subset (C \cup B)$
2. $(A \cap B) \subset (C \cap B)$ for all sets B ⇒ A ⊂ C
3. (A ∪ B) ⊂ $(C \cup B)$ for all sets B ⇒ A ⊂ C
Which of the above statements are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Q52. If B = $\begin{bmatrix} 3 & 2 & 0 \\ 2 & 4 & 0 \\ 1 & 1 & 0 \end{bmatrix}$, then what is adjoint of B equal to?

(a) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ -2 & -1 & 8 \end{bmatrix}$

(b) $\begin{bmatrix} 0 & 0 & -2 \\ 0 & 0 & -1 \\ 0 & 0 & 8 \end{bmatrix}$

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

(d) It does not exist

Q53. What are the roots of the equation $|x^2 - x - 6| = x + 2$?

(a) $-2, 1, 4$

(b) $0, 2, 4$

(c) $0, 1, 4$

(d) $-2, 2, 4$

Q54. If A = $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, then the matrix A is a/an

(a) Singular matrix

(b) Involutory matrix

(c) Nilpotent matrix

(d) Idempotent matrix

Q55. If $\begin{bmatrix} x & -3i & 1 \\ y & 1 & i \\ 0 & 2i & -i \end{bmatrix}$ = 6 + 11i, then what are the values of x and y respectively?

(a) –3, 4

(b) 3, 4

(c) 3, –4

(d) –3, –4

Q56. The common roots of the equations $z^3 + 2z^2 + 2z + 1 = 0$ and $z^{2017} + z^{2018} + 1 = 0$ are

(a) $-1, \omega$

(b) $1, \omega^2$

(c) $-1, \omega^2$

(d) ω, ω^2

Q57. If $C(20, n + 2) = C(20, n - 2)$, then what is n equal to?

(a) 8

(b) 10

(c) 12

(d) 16

Q58. There are 10 points in a plane. No three of these points are in a straight line. What is the total number of straight lines which can be formed by joining the points?

(a) 90

(b) 45

(c) 40

(d) 30

Q59. The equation $px^2 + qx + r = 0 (where\ p, q, r,$ all are positive) has distinct real roots a and b. Which one of the following is correct?

(a) $a > 0, b > 0$

(b) $a < 0, b < 0$

(c) $a > 0, b < 0$

(d) $a < 0, b > 0$

Q60. If $A = \{\lambda, (\lambda, \mu)\}$, then the power set of A is

(a) $\{\phi, \{\phi), \{\lambda\}, \{\lambda, \mu\}\}$

(b) $\left\{\phi, \{\lambda\}, \{\{\lambda, \mu\}\}, \left\{\lambda, (\lambda, \mu\}\right\}\right\}$

(c) $\left\{\phi, \{\lambda\}, \{\lambda, \mu\}, \left\{\{\{\lambda, (\lambda, \mu\}\right\}\right\}$

(d) $\{(\lambda\}, \{\lambda, \mu\}, (\lambda, \mu\}\}$

Q61. If A, B, C are three events, then what is the probability that at least two of these events occur together?

(a) $P(A \cap B) + P(B \cap C) + P(C \cap A)$

(b) $P(A \cap B) + P(B \cap C) + P(C \cap A) - P(A \cap B \cap C)$

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

(d) $P(A \cap B) + P(B \cap C) + P(C \cap A) - 3P(A \cap B \cap C)$

Q62. If two variables X and Y are independent, then what is the correlation coefficient between them?

(a) 1

(b) –1

(c) 0

(d) None of the above

Q63. Two independent events A and B are such that $P(A \cup B) = \frac{2}{3}$ and $P(A \cap B) = \frac{1}{6}$. If $P(B) < P(A)$, then what is P(B) equal to?

(a) $\frac{1}{4}$

(b) $\frac{1}{3}$

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

(d) $\frac{1}{6}$

Q64. The mean of 100 observations is 50 and the standard deviation is 10. If 5 is subtracted from each observation and then it is divided by 4, then what will be the new mean and the new standard deviation respectively?
(a) 45, 5
(b) 11.25, 1.25
(c) 11.25, 2.5
(d) 12.5, 2.5

Q65. If two fair dice are rolled then what is the conditional probability that the first dice lands on 6 given that the sum of numbers on the dice is 8?
(a) $\frac{1}{3}$
(b) $\frac{1}{4}$
(c) $\frac{1}{5}$
(d) $\frac{1}{6}$

Q66. Two symmetric dice flipped with each dice having two sides painted red, two painted black, one painted yellow and the other painted white. What is the probability that both land on the same colour?
(a) $\frac{3}{18}$
(b) $\frac{2}{9}$
(c) $\frac{5}{18}$
(d) $\frac{1}{3}$

Q67. There are n socks in a drawer, of which 3 socks are red. If 2 of the socks are chosen randomly and the probability that both selected socks are red is $\frac{1}{2}$, then what is the value of n?
(a) 3
(b) 4
(c) 5
(d) 6

Q68. Two cards are chosen at random from a deck of 52 playing cards. What is the probability that both of them have the same value?
(a) $\frac{1}{17}$
(b) $\frac{3}{17}$
(c) $\frac{5}{17}$
(d) $\frac{7}{17}$

Q69. In eight throws of a die, 5 or 6 is considered a success. The mean and standard deviation of total number of successes is respectively given by
(a) $\frac{8}{3}, \frac{16}{9}$
(b) $\frac{8}{3}, \frac{4}{3}$
(c) $\frac{4}{3}, \frac{4}{3}$
(d) $\frac{4}{3}, \frac{16}{9}$

Q70. A and B are two events such that $\overline{A}$ and $\overline{B}$ are mutually exclusive. If P(A) = 0.5 and P(B) = 0.6, then what is the value of P(A|B)?

(a) $\frac{1}{5}$

(b) $\frac{1}{6}$

(c) $\frac{2}{5}$

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

Q71. Consider the following statements:

1. The algebraic sum of deviations of a set of values from their arithmetic mean is always zero.
2. Arithmetic mean > Median > Mode for a symmetric distribution.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Q72. Let the correlation coefficient between X and Y be 0.6. Random variables Z and W are defined as Z = X + 5 and W = $\frac{Y}{3}$. What is the correlation coefficient between Z and W?

(a) 0.1

(b) 0.2

(c) 0.36

(d) 0.6

Q73. If all the natural numbers between 1 and 20 are multiplied by 3, then what is the variance of the resulting series?

(a) 99.75

(b) 199.75

(c) 299.25

(d) 399.25

Q74. What is the probability that an interior point in a circle is closer to the centre than to the circumference?

(a) $\frac{1}{4}$

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

(c) $\frac{3}{4}$

(d) It cannot be determined

Q75. If A and B are two events, then what is the probability of occurrence of either A or event B ?

(a) P(A) + P(B)

(b) P(A ∪ B)

(c) P(A ∩ B)

(d) P(A) P(B)

Q76. What is the general solution of the differential equation $\frac{dy}{dx}+\frac{x}{y}=0$?

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

Q77. The value of k which makes $f(x)=\begin{cases}\sin x & x\neq 0\\ k & x=0\end{cases}$ $continous\ at\ x=0, is$

(a) 2
(b) 1
(c) –1
(d) 0

Q78. What is the minimum value of a^2x+b^2y where xy = c^2 ?

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

Q79. What is $\int e^{x\ln(a)}\,dx$ equal to ?

(a) $\frac{a^x}{\ln(a)}+c$
(b) $\frac{e^x}{\ln(a)}+c$
(c) $\frac{e^x}{\ln(ae)}+c$
(d) $\frac{ae^x}{\ln(a)}+c$

Q80. What is the area of one of the loops between the curve y = c sin x and x-axis?

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

Q81. If sin θ + cos θ = $\sqrt{2}\,cos\theta$, then what is (cos θ – sin θ) equal to?

(a) $-\sqrt{2}\cos\theta$
(b) $-\sqrt{2}\sin\theta$
(c) $\sqrt{2}\sin\theta$
(d) 2 sin θ

Q82. In a circle of diameter 44 cm, the length of a chord is 22 cm. What is the length of minor arc of the chord?

(a) $\frac{484}{21}\ cm$
(b) $\frac{242}{21}\ cm$
(c) $\frac{121}{21}\ cm$
(d) $\frac{44}{7}\ cm$

Q83. If $\sin\theta = -\frac{1}{2}$ and $\tan\theta = \frac{1}{\sqrt{3}}$, then in which quadrant does θ lie?

(a) First
(b) Second
(c) Third
(d) Fourth

Q84. How many three-digit even numbers can be formed using the digits 1, 2, 3, 4 and 5 when repetition of digits is not allowed?

(a) 36
(b) 30
(c) 24
(d) 12

Q85. The angle of elevation of a tower of height h from a point A due South of it is x and from a point B due East of A is y. If AB = z, then which one of the following is correct?

(a) $h^2(\cot^2 y - \cot^2 x) = z^2$
(b) $z^2(\cot^2 y - \cot^2 x) = h^2$
(c) $h^2(\tan^2 y - \tan^2 x) = z^2$
(d) $z^2(\tan^2 y - \tan^2 x) = h^2$

Q86. From a deck of cards, cards are taken out with replacement. What is the probability that the fourteenth card taken out is an ace?

(a) $\frac{1}{51}$
(b) $\frac{4}{51}$
(c) $\frac{1}{52}$
(d) $\frac{1}{13}$

Q87. If A and B are two events such that P(A) = 0.5, P(B) = 0.6 and P(A ∩ B) = 0.4, then what is $P(\overline{A \cup B})$ equal to?

(a) 0.9
(b) 0.7
(c) 0.5
(d) 0.3

Q88. A problem is given to three students A, B and C whose probabilities of solving the problem are $\frac{1}{2}, \frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved if they all solve the problem independently?

(a) $\frac{29}{32}$
(b) $\frac{27}{32}$
(c) $\frac{25}{32}$
(d) $\frac{23}{32}$

Q89. A pair of fair dice is rolled. What is the probability that the second dice lands on a higher value than does the first?

(a) $\frac{1}{4}$

(b) $\frac{1}{6}$

(c) $\frac{5}{12}$

(d) $\frac{5}{18}$

Q90. A fair coin is tossed and an unbiased dice is rolled together. What is the probability of getting a 2 or 4 or 6 along with head?

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

(b) $\frac{1}{3}$

(c) $\frac{1}{4}$

(d) $\frac{1}{6}$

Q91. For r > 0, f(r) is the ratio of perimeter to area of a circle of radius r. Then $f(1) + f(2)$ is equal to

(a) 1

(b) 2

(c) 3

(d) 4

Q92. If $f(x) = 3^{1+x}$, then $f(x)f(y)f(z)$ is equal to

(a) $f(x + y + z)$

(b) $f(x + y + z + 1)$

(c) $f(x + y + z + 2)$

(d) $f(x + y + z + 3)$

Q93. The number of real roots for the equation $x^2 + 9|x| + 20 = 0$ is

(a) Zero

(b) One

(c) Two

(d) Three

Q94. If $f(x) = \sin(\cos x)$, then $f'(x)$ is equal to

(a) cos (cos x)

(b) sin (–sin x)

(c) (sin x) cos (cos x)

(d) (–sin x) cos (cos x)

Q95. The domain of the function $f(x) = \sqrt{(2 - x)(x - 3)}$ is

(a) $(0, \infty)$

(b) $[0, \infty)$

(c) $[2, 3]$

(d) $(2, 3)$

Q96. The solution of the differential equation $\frac{dy}{dx} = \cos(y - x) + 1$ is

(a) $e^x[\sec(y - x) - \tan(y - x)] = c$

(b) $e^x[\sec(y - x) + \tan(y - x)] = c$

(c) $e^x \sec(y - x) \tan(y - x) = c$

(d) $e^x = c \sec(y - x) \tan(y - x)$

Q97. $\int_0^{\frac{\pi}{2}} |\sin x - \cos x| \, dx$ is equal to

(a) 0

(b) $2(\sqrt{2} - 1)$

(c) $2\sqrt{2}$

(d) $2(\sqrt{2} + 1)$

Q98. If y = a cos 2x + b sin 2x, then

(a) $\frac{d^2y}{dx^2} + y = 0$

(b) $\frac{d^2y}{dx^2} + 2y = 0$

(c) $\frac{d^2y}{dx^2} - 4y = 0$

(d) $\frac{d^2y}{dx^2} + 4y = 0$

Q99. A given quantity of metal is to be cast into a half cylinder (i.e. with a rectangular base and semicircular ends). If the total surface area is to be minimum, then the ratio of the height of the half cylinder to the diameter of the semicircular ends is

(a) $\pi : (\pi + 2)$

(b) $(\pi + 2) : \pi$

(c) 1 : 1

(d) None of the above

Q100. $\int_0^{\frac{\pi}{2}} e^{\sin x} \cos x \, dx$ is equal to

(a) e + 1

(b) e – 1

(c) e + 2

(d) e

Q101. If $f(x) = \frac{x-2}{x+2}, x \neq -2$, then what is $f^{-1}(x)$ equal to?

(a) $\frac{4(x+2)}{x-2}$

(b) $\frac{x+2}{4(x-2)}$

(c) $\frac{x+2}{x-2}$

(d) $\frac{2(1+x)}{1-x}$

Q102. What $\int In(x^2)\,dx$ equal to?

(a) $2x\ln(x) - 2x + c$

(b) $\frac{2}{x} + c$

(c) $2x\ln(x) + c$

(d) $\frac{2\ln(x)}{x} - 2x + c$

Q103. The minimum distance from the point (4, 2) to $y^2 = 8x$ is equal to

(a) $\sqrt{2}$

(b) $2\sqrt{2}$

(c) 2

(d) $3\sqrt{2}$

Q104. The differential equation of the system of circles touching the y-axis at the origin is

(a) $x^2 + y^2 - 2xy\frac{dy}{dx} = 0$

(b) $x^2 + y^2 + 2xy\frac{dy}{dx} = 0$

(c) $x^2 - y^2 + 2xy\frac{dy}{dx} = 0$

(d) $x^2 - y^2 - 2xy\frac{dy}{dx} = 0$

Q105. Consider the following in respect of the differential equation :

$\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^2 + 9y = x$

1. The degree of the differential equation is 1.
2. The order of the differential equation is 2.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Q106. The centroid of the triangle with vertices A(2, –3, 3), B(5, –3, –4) and C(2, –3, –2) is the point

(a) $(-3, 3, -1)$

(b) $(3, -3, -1)$

(c) $(3, 1, -3)$

(d) (–3, –1, –3)

Q107. What is the radius of the sphere $x^2 + y^2 + z^2 - 6x + 8y - 10z + 1 = 0$?

(a) 5

(b) 2

(c) 7

(d) 3

Q108. The equation of the plane passing through the intersection of the planes 2x + y + 2z = 9, 4x –5y –4z = 1 and the point (3, 2, 1) is

(a) $10x - 2y + 2z = 28$
(b) $10x + 2y + 2z = 28$
(c) $10x + 2y - 2z = 28$
(d) $10x - 2y - 2z = 24$

Q109. The distance between the parallel planes $4x - 2y + 4z + 9 = 0$ and 8x – 4y + 8z + 21 = 0 is

(a) $\frac{1}{4}$
(b) $\frac{1}{2}$
(c) $\frac{3}{2}$
(d) $\frac{7}{4}$

Q110. What are the direction cosines of z-axis?

(a) < 1, 1, 1 >
(b) < 1, 0, 0 >
(c) < 0, 1, 0 >
(d) < 0, 0, 1 >

Q111. If $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 5\hat{k}$ and $\vec{b} = 2\,\hat{\imath} + \hat{\jmath} - 3\hat{k}$ then what is $(\vec{b} - \vec{a}).(3\vec{a} + \vec{b})$ equal to?

(a) 106
(b) –106
(c) 53
(d) –53

Q112. If the position vectors of points A and B are $3\hat{\imath} - 2\hat{\jmath} + \hat{k}$ and $2\hat{\imath} + 4\hat{\jmath} - 3\hat{k}$ respectively, then what is the length of $\overrightarrow{AB}$?

(a) $\sqrt{14}$
(b) $\sqrt{29}$
(c) $\sqrt{43}$
(d) $\sqrt{53}$

Q113. If in a right-angled triangle ABC, hypotenuse AC = p, then what is $\overrightarrow{AB}.\overrightarrow{AC} + \overrightarrow{BC}.\overrightarrow{BA} + \overrightarrow{CA}.\overrightarrow{CB}$ equal to ?

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

Q114. The sine of the angle between vectors $\vec{a} = 2\hat{\imath} - 6\hat{\jmath} - 3\hat{k}$ and $\vec{b} = 4\hat{\imath} + 3\hat{\jmath} - \hat{k}$ is

(a) $\frac{1}{\sqrt{26}}$
(b) $\frac{5}{\sqrt{26}}$
(c) $\frac{5}{26}$
(d) $\frac{1}{26}$

Q115. What is the value of λ for which the vectors $3\,\hat{\imath} + 4\,\hat{\jmath} - \hat{k}\ and\ -2\,\hat{\imath} + \lambda\hat{\jmath} + 10\hat{k}$ are perpendicular?

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

Q116. What is the derivative of $\sec^2(\tan^{-1} x)$ with respect to x?

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

Q117. If $f(x) = \log_{10}(1 + x)$, then what is $4f(4) + 5f(1) - \log_{10} 2$ equal to?

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

Q118. A function f defined by $f(x) = \ln\left(\sqrt{x^2 + 1} - x\right)$ is

(a) an even function
(b) an odd function
(c) Both even and odd function
(d) Neither even nor odd function

Q119. The domain of the function f defined by $f(x) = \log_x 10$ is

(a) $x > 10$
(b) $x > 0$ excluding $x = 10$
(c) $x \geq 10$
(d) $x > 0$ excluding $x = 1$

Q120. $\lim_{x\to 0} \frac{1-\cos^3 4x}{x^2}$ is equal to

(a) 0
(b) 12
(c) 24
(d) 36