Mathematics

101. The function $\left(x^2-9\right)\left|x^2-7x+12\right|+\cos(|x|)$ is not differentiable at
(a) 4
(b) 3
(c) -3
(d) 0

Correct: a

102. Which statement is true for the line $\frac{x-4}{8}=\frac{y-2}{2}=\frac{z-3}{3}$ and plane having intercepts -4,2 and 3 of the following
(a) line is orthogonal to the plane
(b) line lies in the plane
(c) line makes an acute angle $(\neq 0^{\circ})$ with the plane
(d) None of the above

Correct: b

103. Let * be a binary operation on the set R of real numbers defined by $a*b=\frac{3ab}{7}$ then the identity element in R for '*' is
(a) 3/7
(b) 3/14
(c) 2/3
(d) None of these

Correct: d

104. For any three sets A, B and C the set $(A\cup B\cup C)\cap(A\cap B'\cap C')'\cap C'$ is equal to
(a) $B\cap C'$
(b) $B'\cap C'$
(c) $B\cap C$
(d) $A\cap B\cap C$

Correct: a

105. Let $f(x)=x^3+x$, then the equation $\frac{2}{y-f(2)}+\frac{3}{y-f(3)}+\frac{4}{y-f(4)}=0$, has
(a) both roots lying in (f(2), f(3))
(b) exactly one root lying in (f(3), f(4))
(c) exactly one root lying in $(-\infty, f(2))$
(d) exactly one root lying in $(f(4), \infty)$

Correct: b

106. If $f(x) = xe^{x(1-x)}$, then f(x) is
(a) increasing on [-½, 1]
(b) decreasing on R
(c) increasing on R
(d) decreasing on [-½, 1]

Correct: a

107. The image of the point (1,-1,1) in the plane
$x - 2y + 3z + 1 = 0$ is
(a) (2, -3,4)
(b) $\left(0, \frac{-1}{2}, \frac{-2}{3}\right)$
(c) $\left(\frac{-1}{6}, \frac{4}{3}, \frac{-5}{2}\right)$
(d) $\left(\frac{-7}{3}, \frac{-5}{6}, \frac{2}{3}\right)$

Correct: a

108. If $\sin(\alpha + \beta) = 1, \sin(\alpha - \beta) = \frac{1}{2}, \alpha, \beta \in \left[0, \frac{\alpha}{2}\right]$ then the value of
$\tan(\alpha + 2\beta)\tan(2\alpha + \beta)$ is
(a) 1/2
(b) 1
(c) 1/3
(d) 2

Correct: b

109. If $g(x) = x^2 + x - 2$ and $\frac{1}{2}(gof)x = 2x^2 - 5x + 2$ then f(x) is equal to
(a) 2x-3
(b) 2x + 3
(c) 3x -2
(d) 2x-2

Correct: a

110. The tangent of the angle between the lines whose intercepts on the axes are respectively
(a) $\pm\frac{2ab}{b^2-a^2}$
(b) $\pm\frac{ab}{2(b^2-a^2)}$
(c) $\pm\frac{b^2+a^2}{2ab}$
(d) $\pm\frac{b^2-a^2}{2ab}$

Correct: d

111. If four whole numbers taken at random are multiplied together, then the probability that the last digit in the product is 1, 3, 7, or 9, is
(a) 81/625
(b) 8/625
(c) 32/625
(d) 16/625

Correct: d

112. A region in the xy-plane is bounded by the curve $y = \sqrt{25 - x^2}$ and the line y = 0. If the point (a, a + 1) lies in the interior of the region, then
(a) $a \in (-4, 3)$
(b) $a \in (-\infty, -1) \cup (3, \infty)$
(c) $a \in (-1, 3)$
(d) None of these

Correct: c

113. If $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & \alpha & 1 \end{pmatrix}, A^{-1} = \begin{pmatrix} \frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \\ -4 & 3 & \beta \\ \frac{5}{2} & -\frac{3}{2} & \frac{1}{2} \end{pmatrix}$ then
(a) $\alpha = 2, \beta = -\frac{1}{2}$
(b) $\alpha = 1, \beta = -1$
(c) $\alpha = -1, \beta = 1$
(d) $\alpha = \frac{1}{2}, \beta = \frac{1}{2}$

Correct: b

114. If the sum of n terms of an AP is $nR + \frac{1}{2}n(n-1)T$, where R and T are constants, then the common difference is
(a) R
(b) T
(c) R - T
(d) T - R

Correct: b

115. A straight line has its extremities on two fixed straight lines and cuts off from them a triangle of constant area C^2.Then the locus of the middle point of the line is
(a) $2xy = C^2$
(b) $xy + C^2 = 0$
(c) $4x^2y^2 = C$
(d) None of these

Correct: a

116. Coefficient of variation of two distributions maximum, when r is equal to are 60 and 70 and their standard deviations are 21 and 16 respectively. Then their AM's are
(a) 35 and 22, 85
(b) 36 and 40
(c) 50 and 30
(d) 22 and 36

Correct: a

117. The equation of the normal to the curve $y = e^x$ at (0,1) is
(a) 2x + y = 1
(b) y - x = 1
(c) x + y = 1
(d) None of these

Correct: c

118. Let A be an event that a family has children of both sexes and B be the event that the family has at most one boy. If the family has 3 children then the events A and B are
(a) dependent
(b) independent
(c) mutually exclusive
(d) None of these

Correct: b

119. A ray of light passing through the point (1, 2) reflects on the X-axis at point A and the reflected ray passes through the point (5, 3). The coordinate of A is
(a) $\left(\frac{5}{13}, 0\right)$
(b) $\left(\frac{13}{5}, 0\right)$
(c) $\left(\frac{-5}{13}, 0\right)$
(d) $\left(\frac{-13}{5}, 0\right)$

Correct: b

120. The area bounded by the curve $y = 2x - x^2$ and then straight line y = - x is given by
(a) 9/2
(b) 43/6
(c) 35/6
(d) 23/5

Correct: a

121. Consider the following relations in the real numbers
$R_1 = \{(x, y) | x^2 + y^2 \leq 25\}$
$R_2 = \left\{(x, y) y \geq \frac{4x^2}{9}\right\}$
then the range of $R_1 \cap R_2$ is
(a) [0,5]
(b) [-3,3]
(c) [-5,5]
(d) [-3,5]

Correct: a

122. The solution of the inequality $\left|x^2 - 4x\right| < 5$ is
(a) (-1,5)
(b) (-4,5)
(c) (-5,4)
(d) (- 1,4)

Correct: a

123. If A and B are two events associated to some experiment E such that P(A) = 0.5, P(B) = 0.4, $P(A \cap B) = 0.3$, then $P\left(\frac{A^c}{B^c}\right)$ is equal to
(a) 1/3
(b) 1/2
(c) 2/3
(d) 3/4

Correct: c

124. The coefficient of x^{53} in the expansion
$\sum_{m=0}^{100} 10^0 C_m (x-3)^{100-m} \cdot 2^m$
(a) ${}^{100}\mathrm{C}_{47}$
(b) ${}^{10}\mathrm{C}_{53}$
(c) $-100\mathrm{C}_{53}$
(d) $-100C_{100}$

Correct: c

125. A fair coin is tossed n times. Let the random variable X denote the number of times the head occurs. If P[X = 1], P[X = 2) and P[X = 3] are in arithmetic progression (AP), then the number n of independent trial is
(a) 7
(b) 10

(c) 12
(d) 14

Correct: a

126. The minimum value of $z = 2x_1 + 3x_2$ subject to the constraints $2x_1 + 7x_2 \geq 22 x_1 + x_2 \geq 6, 5x_1 + x_2 \geq 10$ and $x_1, x_2 \geq 0$ is
(a) 14
(b) 20
(c) 10
(d) 16

Correct: a

127. The most correct statement is
(a) Some optimal solution of a linear programming problem (LPP) is also a feasible solution of LPP
(b) Some optimal solution of a LPP is also a basic feasible solution of LPP
(c) No optimal solution of a LPP is a basic feasible solution of LPP
(d) No basic feasible solution is an optimal solution of LPP

Correct: b

128. The amplitude of the complex number $1 + \sin\alpha - i\cos\alpha$is
(a) π/4
(b) $\alpha - \frac{\pi}{4}$
(c) $\frac{\alpha}{2} - \frac{\pi}{4}$
(d) $\frac{\pi}{4} - \alpha$

Correct: c

129. The points $z_1 = x + iy$ and $z_2 = \frac{1}{-x+iy}$ in the complex plane lie on
(a) a circle with centre origin
(b) a straight line through origin
(c) axis of X
(d) axis of Y

Correct: b

130. The area of the region defined by $||x| - |y|| \leq 1$ and $x^2 + y^2 \leq 1$ in the xy-plane is
(a) a
(b) 1
(c) 2
(d) None of these

Correct: a

131. If the sum of two unit vectors is again a unit vector, then magnitude of their difference is
(a) 0
(b) 1
(c) $\sqrt{3}$
(d) 2

Correct: c

132. If Sand S' are the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{26} = 1$ and P is any point on it then range of values of SP.S'P is
(a) $9 \leq f(\theta) \leq 16$
(b) $9 \leq f(\theta) \leq 25)$
(c) $16 \leq f(\theta) \leq 25$
(d) $1 \leq f(\theta) \leq 16$

Correct: c

133. The length of perpendicular from the point $\hat{i} + 2\hat{j} + 3\hat{k}$ to the line $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$
(a) 6
(b) 7
(c) √17
(d) √14

Correct: b

134. The integrating factor of the D.E.
$(x \log x)\frac{dy}{dx} + y = 2 \log x$
(a) log(log x)
(b) e^x
(c) log x
(d) x

Correct: c

135. Let a, be the rth term of an AP, whose first term is a and common difference is d. If for some positive integers $m, n, m \neq n, \alpha_m = \frac{1}{n}$ and $\alpha_n = \frac{1}{m}$ then a – d equals
(a) $\frac{1}{mn}$
(b) 1
(c) 0
(d) $\frac{1}{m} + \frac{1}{n}$

Correct: c

136. The general solution of differential equation $\frac{dy}{dx} + 2xy = 2e^{-x^2}$ is
(a) $y = 2xe^{-x}$
(b) $y = (2x + C)e^{-x^2}$
(c) $y = 2xe^{x}$
(d) $y = (2x + C)e^{x^2}$

Correct: b

137. If A and B are disjoint sets, then $B \cap A'$ where A' is complement of A is equal to
(a) A
(b) B
(c) A'
(d) B’

Correct: b

138. Which of the following is an incorrect statement?
(a) $n^3 + 3n^2 + 5n + 3$ is divisible by 3 for all $neIN$
(b) $n(n + 1)(2n + 1)$ is divisible by 6 for all $neIN$
(c) $n^2 - n + 41$ is a prime number for all $neIN$
(d) $7^n - 3^n$ is divisible by 4 for all $neIN$ where IN denotes the set of all natural numbers.

Correct: c

139. The total revenue in rupees received from the sale of 'x' units of a product is given by $R(x) = 5x^2 + 20x + 7$. The marginal revenue, when x=8 is
(a) 60
(b) 100
(c) 360
(d) 487

Correct: b

140. The unit vector which is orthogonal to the vector $\hat{i} + \hat{j} + \hat{k}$ and is coplanar with vectors $\hat{i} + 2\hat{j} - \hat{k}$ and $2\hat{i} + \hat{j} + 3\hat{k}$, is
(a) $\frac{i+5\hat{j}-6\hat{k}}{\sqrt{62}}$
(b) $\frac{i+3\hat{j}-\hat{k}}{\sqrt{11}}$
(c) $\frac{i+7i}{\sqrt{50}}$
(d) $\frac{\hat{i}+2\hat{j}+\hat{k}}{\sqrt{6}}$

Correct: a

141. The function $f(x) = \sqrt{|x| - x}$ is continuous for
(a) real numbers
(b) natural numbers
(c) rational numbers
(d) $[0, \infty)$

Correct: a

142. If the system of equations
2x + ay + 6z = 8
x + 2y + bz = 5
x + y + 32 = 4
has a unique solution then
(a) a = 2 or b = 3
(b) $a \neq 2$ or $b \neq 3$
(c) a = 1, b = 5
(d) a = 0, b = 5

Correct: b

143. The area bounded by the curve $y = \begin{cases} x^{1/\ln x} & x \neq 1 \\ e, & x = 1 \end{cases}$ and $y = |x - e|$ is
(a) $e^2/2$
(b) e^2
(c) $2e^2$
(d) 1

Correct: b

144. The distance of point of intersection of the line with the plane
 from the point with position vector is
(a) $\sqrt{14}$
(b) $\sqrt{42}$
(c) $3\sqrt{14}$
(d) $\sqrt{3}$

Correct: d

145. $\sin^{-1}\frac{8}{17} + \sin^{-1}\frac{3}{5}$ is equal to
(a) $\sin^{-1}\left(\frac{77}{85}\right)$
(b) $\tan^{-1}\left(\frac{77}{36}\right)$
(c) $\cos^{-1}\left(\frac{1}{36}\right)$

(d) Both (a) and (b)

Correct: d

146. The equation $||x| + \left|\frac{x}{x-1}\right| = \frac{x^2}{|x-1|}$ will be always true for x, belonging to
(a) $[0, 1)$
(b) $\{0\} \cup (1, \infty)$
(c) $(-1, 1)$
(d) $(-\infty, \infty)$

Correct: b

147. Let $\frac{\sin(\theta-\alpha)}{\sin(\theta-\beta)} = \frac{a}{b}, \frac{\cos(\theta-\alpha)}{\cos(\theta-\beta)} = \frac{c}{d}$ .Then the value of $\cos(\alpha - \beta)$ equals
(a) $\frac{ac-bd}{ad+bc}$
(b) $\frac{ac+bd}{ad+bc}$
(c) $\frac{ac+bd}{ab+cd}$
(d) $\frac{ac-bd}{ab+cd}$

Correct: b

148. If $\cos^{-1}\sqrt{p} + \cos^{-1}\sqrt{1-p} + \cos^{-1}\sqrt{1-q} = \frac{3\pi}{4}$, then the value of q is
(a) $\frac{1}{\sqrt{2}}$
(b) 1
(c) 1/2
(d) 1/3

Correct: c

149. If a,b,c are the integers between 1 and 9 and a51, b41, c31 are three-digit numbers and the value of determinant $D = \begin{vmatrix} \vdots 5 & 4 & 3 \\ a51 & b41 & c31 \\ a & b & i \end{vmatrix}$ is zero, then a,b,c are
(a) in GP
(b) in AP
(c) equal
(d) None of the above

Correct: b

150. If ${}^nP_4 = 20 \times {}^nP_2$. Then, the value of n is
(a) 18

(b) 13
(c) 7
(d) 4

Correct: c