MATHEMATICS (Mock Test-1)

☐ **81.** If $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$, then

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$$ is equal to :

(a) $-abc$ (b) abc
(c) 0 (d) none of these

☐ **82.** The smallest positive integer n for which $\left(\frac{1+i}{1-i}\right)^n=-1$ is :

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

☐ **83.** If $A=\begin{bmatrix} 3 & 6 \\ 2 & 4 \end{bmatrix}$, then A is :

(a) singular (b) non-singular
(c) 1 (d) none of these

☐ **84.** $\int_0^1 \sqrt{\frac{1-x}{1+x}}\,dx$ is equal to :

(a) $\frac{\pi}{2}+1$ (b) $\frac{\pi}{2}$
(c) $\pi+1$ (d) $\frac{\pi}{2}-1$

☐ **85.** $\int \frac{(x+1)\,e^x}{\cos^2(xe^x)}\,dx$ is equal to :

(a) $\tan^{-1}(xe^x)$ (b) $\tan(xe^x)$
(c) $\sqrt{\tan(xe^x)}$ (d) none of these

☐ **86.** The matrix $\begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$ is :

(a) skew symmetric
(b) symmetric
(c) diagonal matrix
(d) scalar matrix

☐ **87.** $\sin^{-1}(\cos x), 0 \le x < 1$, is equal to :

(a) $x-\frac{\pi}{2}$ (b) $\frac{\pi}{2}-x$
(c) $x-\pi$ (d) $\pi-x$

☐ **88.** The distance between the lines $3x+4y=9$ and $6x+8y=15$ is :

(a) 3/10 (b) 3/2
(c) 6 (d) none of these

89. If $f(x) = x^2 + 1$, then the value of fof is equal to :

(a) $x^4 - 2 + 2x^2$ (b) $x^4 + 2 + 2x^2$
(c) $x^4 + x^2 + 1$ (d) none of these

90. $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$, where :

(a) $-1 \le x \le 1$
(b) $-1 < x \le 1$
(c) $-1 < x < 1$
(d) $-1 \le x < 1$

91. If $f(x) = \begin{cases} \frac{\sin [x]}{[x]+1} & \text{for } x > 0 \\ \frac{\cos \pi/2\,[x]}{[x]} & \text{for } x < 0 \\ k & x = 0 \end{cases}$

where $[x]$ denotes the greatest integer less than or equal to x, then in order that f be continuous at $x = 0$, the value of k is :

(a) equal to 1 (b) equal to 0
(c) equal to –1 (d) indeterminate

92. $\lim\limits_{x \to 0} \frac{[x]}{x}$ is equal to :

(a) 0 (b) 1
(c) –1 (d) does not exist

93. If $f(3-x) = f(x)$, then $\int_1^2 xf(x)\,dx$ is equal to :

(a) $\frac{1}{2}\int_1^2 f(x)\,dx$ (b) $\frac{3}{2}\int_1^2 f(2-x)\,dx$
(c) $\frac{3}{2}\int_1^2 f(x)\,dx$ (d) none of these

94. The co-efficient of x^2 in the expansion of $(1 + 4x + x^2)^{1/2}$ is equal to :

(a) –2 (b) –3
(c) 2 (d) none of these

95. If $A = \sin^2\theta + \cos^4\theta$, then for all real values of θ :

(a) $\frac{13}{16} \le A \le 1$ (b) $\frac{3}{4} \le A \le \frac{13}{16}$
(c) $1 \le A \le 2$ (d) $\frac{3}{4} \le A \le 1$

96. Let A and B be subsets of X. Then :
(a) $A - B = A^c \cap B$
(b) $A - B = A \cap B^c$
(c) $A - B = A \cup B$
(d) $A - B = A \cap B$

97. $\lim_{n \to \infty} (4^n + 5^n)^{1/n}$ is equal to :
(a) 5 (b) 4
(c) e (d) none of these

98. The solution of the equation $\left|3 + \frac{1}{x}\right| = 2$ are :
(a) $-1, -\frac{1}{5}$ (b) $0, -1, -\frac{1}{5}$
(c) $2, -1$ (d) none of these

99. The value of determinant $\begin{vmatrix} x & 0 & 0 & 0 \\ 2 & y & 0 & 0 \\ 3 & 5 & z & 0 \\ 1 & 9 & 0 & \omega \end{vmatrix}$ is equal to :
(a) $xyz\omega$ (b) $x + y + z + \omega$
(c) 0 (d) none of these

100. If z is a complex number, then $|3z - 1| = 3|z - 2|$ represents :
(a) a circle (b) y-axis
(c) x-axis
(d) a line parallel to y-axis

101. The probability that a teacher will give an announced test during any class meeting is $\frac{1}{5}$. If a student is absent twice, then the probability that the student will miss at least one test is :
(a) $\frac{9}{25}$ (b) $\frac{7}{75}$
(c) $\frac{2}{5}$ (d) $\frac{4}{5}$

102. Two cards are drawn successively with replacement from a pack of 52 cards. The probability of drawing two aces is :
(a) $\frac{1}{12} \times \frac{4}{51}$ (b) $\frac{1}{52} \times \frac{1}{51}$
(c) $\frac{1}{13} \times \frac{1}{13}$ (d) $\frac{1}{13} \times \frac{1}{17}$

103. $11^3 + 12^3 + 13^3 + \ldots + 20^3$ is :
(a) an odd integer but not a multiple of 5
(b) multiple of 10
(c) an odd integer divisible by 5
(d) an even integer

104. There are n different books and m copies of each in a college library. The number of ways in which a selection of one or more books is :
(a) ${}^{mn}C_n \times {}^nC_n$
(b) $(m+1)^n$
(c) $\frac{mn!}{(m!)^m}$
(d) $(m+1)^n - 1$

105. A G.P. consists of an even number of terms. If the sum of all the terms is 5 times the sum of the terms occupying odd places, then the common ratio will be :
(a) 2
(b) 3
(c) 4
(d) 5

106. The arithmetical fraction that exceeds its square by the the greatest quantity is :
(a) $\frac{1}{2}$
(b) $\frac{1}{4}$
(c) $\frac{3}{4}$
(d) none of these

107. The number of common tangents to the circles $x^2 + y^2 + 2x + 8y - 25 = 0$ and $x^2 + y^2 - 4x - 10y + 19 = 0$ are :
(a) 1
(b) 2
(c) 3
(d) 4

108. The points with position vectors $60\vec{\mathbf{i}} + 3\vec{\mathbf{j}}, 40\vec{\mathbf{i}} - 8\vec{\mathbf{j}}$ and $a\vec{\mathbf{i}} - 52\vec{\mathbf{j}}$ are collinear if :
(a) $a = 40$
(b) $a = -40$
(c) $a = 40$
(d) none of these

109. The number of ways in which a mixed doubles tennis game be arranged between 10 players consisting of 6 men and 4 women :
(a) 90
(b) 48
(c) 12
(d) 180

110. Given that $(\vec{\mathbf{a}} + \vec{\mathbf{b}})$ is perpendicular $\vec{\mathbf{b}}$ and $\vec{\mathbf{a}}$ is perpendicular to $2\vec{\mathbf{b}} + \vec{\mathbf{a}}$. This implies :

(a) $2a = b$ (b) $a = b$
(c) $a = 2b$ (d) $a = \sqrt{2}b$

111. The number of ways in which 6 boys and 6 girls sit alternatively is :

(a) 1036800 (b) 508400
(c) 518400 (d) none of these

112. The position vectors of point A and B are $\hat{\mathbf{i}} - \hat{\mathbf{j}} + 3\hat{\mathbf{k}}$ and $3\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$ respectively. The equation of a plane is $\vec{\mathbf{r}} \cdot (5\hat{\mathbf{i}} + 2\hat{\mathbf{j}} - 7\hat{\mathbf{k}}) + 9 = 0$. The points A and B :

(a) lie on the plane
(b) lie on the same side of the plane
(c) lie on the opposite side of the plane
(d) none of these

113. Equation of the curve passing through and which satisfied the differential equation $\frac{dy}{dx} = x + \frac{1}{x^2}$ is :

(a) $6xy = 3x^3 + 29x - 6$
(b) $6xy = 3x^2 - 6x + 29$
(c) $6xy = 3x^3 - 29x + 6$
(d) none of these

114. The equation of the normal at the point 't' to the curve $x = at^2, y = 2at$ is :

(a) $tx + y = 2at + at^3$ (b) $tx + y = 2at$
(c) $tx + y = at^3$ (d) none of these

115. The equation of the circle which touches the axes of the co-ordinates and the line $\frac{x}{3} + \frac{y}{4} = 1$ and whose centre lies in the first-quadrant is
$x^2 + y^2 - 2cx - 2cy + c^2 = 0$, where c is :

(a) 1, 6 (b) 4, 5
(c) 3, 4 (d) 2, 3

116. If a vector $\vec{\mathbf{r}}$ satisfies the equation $\vec{\mathbf{r}} \times (\vec{\mathbf{i}} + 2\vec{\mathbf{j}} + \vec{\mathbf{k}}) = \vec{\mathbf{i}} - \vec{\mathbf{k}}$, then $\vec{\mathbf{r}}$ is equal to :

(a) $\vec{\mathbf{i}} + (t+3)\vec{\mathbf{j}} + \vec{\mathbf{k}}$ (b) $\vec{\mathbf{j}} + t(\vec{\mathbf{i}} + 2\vec{\mathbf{j}} + \vec{\mathbf{k}})$
(c) $2\vec{\mathbf{i}} + 7\vec{\mathbf{j}} + 3\vec{\mathbf{k}}$ (d) $2\vec{\mathbf{i}} + 3\vec{\mathbf{j}} + \vec{\mathbf{k}}$

117. $g(x) = xf(x)$

where $f(x) = x \sin \frac{1}{x}, x \neq 0, x = 0$, at $x = 0$:

(a) g is differentiable while f is not continuous
(b) g is differentiable but g' is not continuous
(c) g is differentiable but g' is continuous
(d) both f and g are differentiable

118. The magnitude of a radian is :

(a) 180° (b) $58^\circ 59'$
(c) $57^\circ 17' 44.8''$ (d) 60°

119. The vector $\vec{\mathbf{c}}$, directed along the internal bisector of the angle between the vectors $\vec{\mathbf{a}} = 7\vec{\mathbf{i}} - 4\vec{\mathbf{j}} - 4\vec{\mathbf{k}}$ and $\vec{\mathbf{b}} = -2\vec{\mathbf{i}} - \vec{\mathbf{j}} + 2\vec{\mathbf{k}}$ with $|\vec{\mathbf{c}}| = 5\sqrt{6}$, is :

(a) $\frac{5}{3}(5\vec{\mathbf{i}} + 5\vec{\mathbf{j}} + 2\vec{\mathbf{k}})$
(b) $\pm\frac{5}{3}(\vec{\mathbf{i}} - 7\vec{\mathbf{j}} + 2\vec{\mathbf{k}})$
(c) $\frac{5}{23}(-5\vec{\mathbf{i}} + 5\vec{\mathbf{j}} + 2\vec{\mathbf{k}})$
(d) $\frac{5}{3}(\vec{\mathbf{i}} + 7\vec{\mathbf{j}} + 2\vec{\mathbf{k}})$

120. If a, b are odd integers, then the roots of the equation $2ax^2 + (2a + b)x + b = 0$, $a \neq 0$ is :

(a) non-real (b) equal
(c) irrational (d) rational

121. If $a > 0, b > 0, c > 0$ are in G.P., then $\log_a x, \log_b x, \log_c x$ are in :

(a) A.P. (b) G.P.
(c) H.P. (d) none of these

122. In normalized floting point representation $0.8642E02 \div 0.2562E02$ gives :

(a) $3.3731E04$
(b) 0.3373
(c) $3.373E0$
(d) none of these

123. The value of k in order that $f(x) = \sin x - \cos x - kx + b$ decreases for all real values is given by :

(a) $k < \sqrt{2}$ (b) $k \geq \sqrt{2}$
(c) $k \geq 1$ (d) $k < 1$

☐ **124.** The value of the determinant

$$\begin{vmatrix} 1 & \cos(\beta-\alpha) & \cos(\gamma-\alpha) \\ \cos(\alpha-\beta) & 1 & \cos(\gamma-\beta) \\ \cos(\alpha-\gamma) & \cos(\beta-\gamma) & 1 \end{vmatrix} \text{ is :}$$

(a) $2\cos\alpha\cos\beta\cos\gamma$
(b) $4\sin\alpha\sin\beta\sin\gamma$
(c) $4\cos\alpha\cos\beta\cos\gamma$
(d) none of these

☐ **125.** A problem in statistics is given to three students whose chances of solving it are $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$. The probability that the problem is solved is :

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