MATHEMATICS

101. In a town of 10,000 families it was found that 40% families buy newspaper A, 20% families buy newspaper B and 10% families buy newspaper C, 5% families buy A and B, 3% buy B and C and 4% buy A and C. If 2% families buy all the three newspaper, then number of families which buy A only is

a) 3100 **b)** 3300
c) 2900 d) 1400

102. if $F(x) = \left(f\left(\frac{x}{2}\right)\right)^2 + \left(g\left(\frac{x}{2}\right)\right)^2$ where $f''(x) = -f(x)$ and $g(x) = f'(x)$ and given that $F(5) = 5$, then $F(10)$ is equal to

a) 5 b) 10
c) *0* d) *15*

103. Let f(x+y) = f(x) f(y) for all x and y. Suppose f(5) = 2 and f'(0) = 3. Find f'(5).

a) 3 **b)** 6
c) 9 d) 0.6

104. If $|z| = 1$ and $\omega = \frac{z-1}{z+1}$ (where $z \neq -1$), then Re (ω) is

a) 0 b) $\frac{1}{|z+1|^2}$
c) $\left|\frac{z}{z+1}\right| \cdot \frac{1}{|z+1|^2}$ d) $\frac{\sqrt{2}}{|z+1|^2}$

105. Let z_1 ans z_2 be two roots of the equation $z^2+az+b=0$, z being complex. Further, assume that the origin, z_1 and z_2 form an equilateral triangle, then

a) $a^2 = b$ b) $a^2 = 2b$
c) $a^2 = 3b$ d) $a^2 = 4b$

106. For all complex numbers z_1, z_2 satisfying $|z_1| = 12$ and $|z_2 - 3 - 4i| = 5$, the minimum value of $|z_1 - z_2|$ is

a) 0 **b)** 2
c) 7 d) 17

107. *Let* λ and α be real, Find the set of all values of λ for which the system of linear equations

$\lambda x + (\sin\alpha) y + (\cos\alpha) z = 0$
$x + (\cos\alpha) y + (\sin\alpha) z = 0$
$-x + (\sin\alpha) y - (\cos\alpha) z = 0$

has a nontrivial solution. For $\lambda = 1$, find the value of α.

a) $n\pi \pm \pi/8 + \pi/8$ b) $n\pi \pm \pi/4 + \pi/4$
c) $\pm n\pi + \pi/4 + \pi/4$ d) $\pm n\pi + \pi/4 + \pi/8$

108. *If p and q are the roots of $x^2+px+q=0$, then*

a) p = 1, q = -2 b) p = -2, q = 1
c) p = 1, q = 0 d) p = -2, q = 0

109. *If $a_1, a_2, \ldots, a_n, \ldots,$ are in GP then the determinant*

$$\blacktriangle = \begin{vmatrix} \log a_n & \log a_{n+1} & \log a_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log a_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log a_{n+8} \end{vmatrix}$$

is equal to

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

110. *Let* $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ *and* $(10)B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$. If B is *the inverse of marix A, them* α

a) -2 b) 1
c) 2 ***d)*** *5*

111. If the system of equations $x+ay=0$, $az+y=0$ and $ax+z=0$ has infinite solution, then values of a is

a) -1 b) 1

c) 0 *d) no real value*

112. Let M and N be two even order non-singular skew-symmetric matrices such that MN=NM. If P^T denotes the transpose of P, then $M^2 N^2 (M^T N)^{-1} (MN^{-1})^T$ is equal to

a) M^2 b) $-N^2$

c) $-M^2$ d) MN

113. The value of the determination

$$\begin{vmatrix} 1 & a & a^2-bc \\ 1 & b & b^2-ac \\ 1 & c & c^2-ab \end{vmatrix}$$ is...............

a) 1 b) 3

c) 100 **d)** 0

114. Numbers greater than 1000 but not greater than 4000 which can be formed with the digits 0, 1, 2, 3,4 (repetition of digits is allowed), are

a) 350 **b)** 375

c) 450 d) 576

115. How many words can be formed with the letters of the words MATHEMATICS by rearranging them

a) $\frac{11!}{2!\,2!}$ b) $\frac{11!}{2!}$

c) $\frac{11!}{2!\,2!\,2!}$ d) 11!

116. In how many ways can 6 persons be selected from 4 officers and 8 constables, if at least one officer is to be included

a) 224 b) 672

c) 896 d) none of these

117. The product of n positive numbers is unity. Then their sum is

a) a positive integer b) divisible by n

c) equal to n+1/n **d)** never less than n.

118. If x is positive , the first negative term in the expansion of $(1+x)^{27/5}$ is

a) 7th term b) 5th term

c) 8th term d) 6th term

119. Let x be the arithmetic mean and y, z be the two geometric means between any two positive numbers. Then $\frac{y^3+z^3}{xyz}$ =

a) 4 b) 0.2

c) 2 d) 20

120. Sum of the infinite series $1+2+\frac{1}{2!}+\frac{2}{3!}+\frac{1}{4!}+\frac{2}{5!}+$ .... is

a) e^2 b) $e+e^{-1}$

c) $\frac{e-e^{-1}}{2}$ **d)** $\frac{3e-e^{-1}}{2}$

121. The interior angles of a polygon are in A.P. the smallest angle is 120^0 and the common difference is 5^0. Find the number of sides of the polygon.

a) 16 b) 9

c) 4 d) 12

122. If the sum of first n terms of an A.P. is cn^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)** $\frac{n(4n^2+1)c^2}{6}$

123. The domain of $f(x)=\dfrac{\log_2(x+3)}{x^2+3x+2}$ is

a) R-{-1,-2} b) (-2,+ ∞)
c) R-{-1,-2,-3} **d)** (-3,+∞)-{-1,-2}

124. Let $g(x)=1+x-[x]$ and $f(x)=\begin{cases}-1, x<0\\ 0, x=0,\\ 1, x>0\end{cases}$ then for all x, $f(g(x))$ is equal to

a) x **b)** 1
c) $f(x)$ d) $g(x)$

125. For $x>0$, $\lim_{x\to 0}[(\sin x)^{1/x}+(1/x)^{\sin x}]$ is

a) 0 b) -1
c) 1 d) 2

126. $\lim_{x\to\frac{\pi}{4}}\dfrac{\int_2^{\sec^2 x} f(t)dt}{x^2-\frac{\pi^2}{16}}$ equals

a) $\frac{8}{\pi}f(2)$ b) $\frac{2}{\pi}f(2)$

c) $\frac{2}{\pi}f(1/2)$ d) $4f(2)$.

127. If $f(x)=\dfrac{e^x}{1+e^x}$, $I_1=\int_{f(-a)}^{f(a)} xg\{x(1-x)\}\,dx$, and $I_2=\int_{f(-a)}^{f(a)} g\{x(1-x)\}\,dx$, then value of I_2/I_1 is

a) 2 b) -3

c) -1 **d)** 1

128. Let $f(x)$ be a function satisfying $f'(x)=f(x)$ with $f(0)=1$ and $g(x)$ be a function that satisfies $f(x)+g(x)=x^2$. Then the value of the integral $\int_0^1 f(x)\,g(x)=x^2$. Then the value of the integral $\int_0^1 f(x)\,g(x)\,dx$, is

a) $e-\frac{e^2}{2}-\frac{5}{2}$ b) $e+\frac{e^2}{2}-\frac{3}{2}$

c) $e-\frac{e^2}{2}-\frac{3}{2}$ d) $e+\frac{e^2}{2}+\frac{5}{2}$

129. The value of $\int_0^{\pi/2}\dfrac{dx}{1+\tan^3 x}$ is

a) 0 b) 1
c) π/2 **d)** π/4

130. If $\int_0^x f(t)\,dt=x+\int_x^1 tf(t)dt$ then the value of $f(1)$ is

a) 1/2 b) 0
c) 1 d) -1/2

131. The value of $\int_{-2}^{2}|1-x^2|\,dx$ is................

a) 8 b) 14
c) 4 d) 40

132. The general solution of the equation $(e^y+1)\cos x dx+e^y\sin x dy=0$ is

a) $(e^y+1)\cos x=c$ b) $(e^y-1)\sin x=c$
c) $(e^y+1)\sin x=c$ d) None of these

133. If $xdy=y(dx+ydy)$, $y>0$ and $y(1)=1$, then $y(-3)$ is equal to

a) 1 **b)** 3
c) 5 d) -1

134. The integration factor of the differential equation

$\frac{dy}{dx} + \frac{1}{x} y = 3x$ is

a) x b) ln x

c) 0 d) ∞

135. The solution of the differential equation

$x\frac{dy}{dx} = y(\log y - \log x + 1)$ is

a) $y = xe^{cx}$ b) $y + xe^{cx} = 0$

c) $y + e^{x} = 0$ d) None of these

136. The eccentricity of an ellipse with its centre at the origin, is 1/2 if one of the directrices is x = 4, then the equation of the ellipse is

a) $3x^2 + 4y^2 = 1$ b) $3x^2 + 4y^2 = 12$

c) $4x^2 + 3y^2 = 12$ d) $4x^2 + 3y^2 = 1$

137. The greatest distance of the point P (10, 7) from the circle $x^2 + y^2 - 4x - 2y - 20 = 0$ is

a) 10 unit b) 15unit

c) 5 unit d) None of these

138. The parabolas $y^2 = 4x$ and $x^2 = 4y$ divide the square region bounded by the lines x = 4, y = 4 and the coordinate axes. If s_1, s_2 s_3 are respectively the areas of these parts numbered from top to bottom, then $s_1 : s_2 : s_3$ is

a) 1 : 1 : 1 b) 2 : 1 : 2

c) 1 : 2 : 3 d) 1 : 2 : 1

139. The area of the triangle formed by the line $4x^{2;}$- $9xy - 9y^2 = 0$ and x = 2 is

a) 2 b) 3

c) 10/3 d) 20/3

140. The value of k so that $x^2 + y^2 + kx + 4y + 2 = 0$ and $2(x^2+y^2) - 4x - 3y + k = 0$ cut orthogonally is

a) $\frac{10}{3}$ b) $\frac{-8}{3}$

c) $\frac{-10}{3}$ d) $\frac{8}{3}$

141. The equation to the circle with origin as center passing through the vertices of an equilateral triangle whose median is of length 3a is

a) $x^2 + y^2 = 9a^2$ b) $x^2 + y^2 = 16a^2$

c) $x^2 + y^2 = a^2$ d) None of these

142. A square is inscribed in the circle $x^2+y^2-2x+4y-93=0$ with its sides parallel to the coordinate axes. The coordinates of its vertices are

a) (-6, -9), (-6, 5), (8, -9) and (8, 5)

b) (-6, 9), (-6, -5), (8, -9), and (8, 5)

c) (-6, -9), (-6, 5), (8, 9), and (8, 5)

d) (-6, -9), (-6, 5), (8, -9), and (8, -5)

143. The points A(5,-1,1); B(7,-4,7); C(1, -6,10) and D(-1,-3, 4) are vertices of a

a) Square b) Rhombus

c) Rectangle d) None of these

144. Find the equation of the plane passing through (2, 1,0), (4, 1, 1), (5, 0, 1). Find the point *Q* such that its distance from the plane is equal to the distance of point *P* (2, 1, 6) from the plane and the line joining *P* and *Q* is perpendicular to the plane.

a) 9/2 cubic unit b) 9/4 cubic unit

c) 4 cubic unit d) 2/9 cubic unit

145. The points D,E,F divide BC, CA and AB of the triangle ABC in the ratio 1 : 4, 3 : 2 and 3 : 7 respectively and the point K divides AB in the ratio 1:3, then $(\overrightarrow{AD}+\overrightarrow{BE}+\overrightarrow{CF}):\overrightarrow{CK}$ is equal to

a) 1: 1 **b)** 2 : 5

c) 5 : 2 d) None of these

146. If a, b, c are non-coplanar unit vectors such that $a\times(b\times c)=\frac{b+c}{\sqrt{2}}$, then the angle between a and b is

a) Л/4 b) Л/2

c) 3Л/4 d) Л

147. Three numbers are chosen at random without replacement from {1,2 ....10}. The probability that the minimum of the chosen numbers is 3, or their maximum is 7,is ....

a) 13/60 b) 13/30

c) 60/13 d) 60/3

148. Out of 3*n* consecutive natural numbers, 3 natural numbers are chosen at random without replacement. The probability that the sum of the chosen numbers is divisible by 3 is

a) $\frac{n(3n^2-3n+2)}{2}$ b) $\frac{(3n^2-3n+2)}{2(3n-1)(3n-2)}$

c) $\frac{(3n^2-3n+2)}{(3n-1)(3n-2)}$ d) $\frac{n(3n-1)(3n-2)}{3(n-1)}$

149. one bag contains 5 white and 4 black balls. Another bag contains 7 white and 9 black balls. A ball is transferred from the first bag to the second and then a ball is drawn from second. The probability that the ball is white, is

a) 8/17 b) 40/153

c) 5/9 **d)** 4/9

150. If $\alpha+\beta=\pi/2$ and $\beta+\gamma=\alpha$, then $\tan\alpha$ equals

a) $2(\tan\beta+\tan\gamma)$ b) $\tan\beta+\tan\gamma$

c) $\tan\beta+2\tan\gamma$ d) $2\tan\beta+\tan\gamma$