Section 3 – Mathematics

121) If (-4,5) is the image of the point (6,1) with respect to the line L, then L is given by

A) 5x+2y=1
B) 5x-2y=0
C) 6x-2y+1=0
D) 2x-5y+1=0

122) Evaluate integral of $x^3/(x^2 + (9-x)^2)$ with limits from 4 to 5. The result is

A) 1/2
B) 0
C) 1
D) 2

123) The values of x for which $4^x + 4^{1-x} - 5 < 0$, is given by

A) x=1
B) x=0,1
C) x=0
D) 0<x<1

124) Derivative of $\cos^{-1}(2x^2-1)$ with respect to $\sqrt{1-x^2}$ at x=1/2 is

A) 4/3
B) √6/5
C) √6/3
D) - 4√6/3

125) If x is one of the first fifty numbers chosen at random, then the probability that x+3/x is greater than 20 is

A) 11/50
B) 21/50
C) 31/50
D) 41/50

126) Which of the following is TRUE about the function $f(x) = x^4 - 4x^2$?

A) It has two local minima and one local maxima
B) It has two local minima and zero local maxima
C) It has one local minima and one local maxima
D) It has two local minima and two local maxima

127) Which of the following is the range of the function $3(\sin^{-1}x)^2 + 2(\cos^{-1}x)^2 + 7$?

A) $(3\pi^2 + 70)/10$ to $(11\pi^2 + 28)/4$
B) $(3\pi^2 + 70)/10$ to $(7\pi^2 + 28)/4$
C) $(3\pi^2 + 70)/10$ to $(3\pi^2 + 28)/4$
D) $(11\pi^2 + 70)/10$ to $(11\pi^2 + 28)/4$

128) A function f(x) is differentiable for all $x \in [1,2]$ such that $|f'(x)| < 2$. Which of the following options can be true?

A) f(1) = 9 , f(2) = 13
B) f(1) = 4 , f(2) = 6
C) f(1) = -3 , f(2) = -2
D) f(1) = -7 , f(2) = -10

129) Suppose P, Q and R are three sets, each with three elements. The number of subsets of the set P x Q x R, that have at least 2 elements is

A) 134217700
B) 134217701
C) 134217727
D) 134217728

130) z is a complex number such that arg(z) < 0. What will be the value of arg(-z) – arg(z)?

A) π/2
B) π
C) 0
D) π/4

131) There is a set P of ordered pairs in which each pair has a vowel as first element and a consonant as second element. It is given that $R = 2^{42}$. How many elements will be there in power set of P?

A) $16(R^4)$
B) $32(R^4)$
C) $16(R^5)$
D) $32(R^5)$

132) You are given a curve, y = ln (x + e). What will be the area enclosed between this curve and the coordinate axes?

A) 1
B) 0
C) 2e
D) e-1

133) The mapping f: N→N given by $f(n) = n^3+3$, $n \in N$ where N is the set of natural number, is

A) One to one and onto
B) One to one but not onto
C) Onto but not one to one
D) Neither one to one nor onto

134) A cubic equation $x^3 + rx - p = 0$ has roots a, b and c. A square matrix $M = [m_{ij}]$, i,j = 0,1 and 2, of size 3 X 3 is made such that $m_{00} = a$, $m_{11} = b$ and $m_{22} = c$. All other elements of M are 1. What should be the least value of p so that |M| is an odd prime?

A) 0
B) 1
C) -1
D) -2

135) Which term of the sequence (9-8i, 8-6i, 7-4i, ...) is a real number?

A) 4^{th} term
B) 5^{th} term
C) 6^{th} term
D) 7^{th} term

136) If $y = \tan^{-1}\left(\frac{x-a}{1+xa}\right)$ then $\frac{dy}{dx} =$

A) $\frac{1}{\sqrt{1+x^2}}$
B) $\frac{1}{1+x^2}$
C) $\frac{1}{\sqrt{1-x^2}}$
D) $\frac{1}{1-x^2}$

137) A person goes 2 km east, then 3 km north, then 4 km west and then 1 km north, starting from the origin. This point is taken as vector A. The vector B such that 3A + 5B = (9, 32), is

A) (4,3)
B) (-3,4)
C) (-4,3)
D) (3,4)

138) Which of the following functions is inverse of itself?

A) f(t)=(1-t)/(1+t)
B) $f(t)=(1-t^2)/(1+t^2)$
C) $f(t)= 4^{\log t}$
D) $f(t)=2^t$

139) The number of all positive odd divisors of 17500 is

A) 5
B) 8
C) 9
D) 10

140) A is a 3x3 matrix where its first row is (1 0 0), second row is (2 1 0) and third row is (3 2 1). P, Q and R are column matrices such that $AP = (1\ 0\ 0)^T$, $AQ = (2\ 3\ 0)^T$ and $AR = (0\ 0\ 1)^T$. If P, Q and R are three columns of matrix U, then |U| =

A) 0
B) 1
C) 3
D) 9

141) If $\cot(\sin^{-1}x)=\cos(\tan^{-1}\sqrt{3})$, then x=

A) 0
B) $\frac{2}{\sqrt{3}}$
C) 2
D) $\frac{2}{\sqrt{5}}$

142) If n(P)=8, n(Q)=10 and n(R)=5 ('n' denotes cardinality) for three disjoint sets P, Q, R then n(PUQUR)=

A) 23
B) 20
C) 18
D) 15

143) The sum value of the series $\frac{3}{4}+\frac{5}{36}+\frac{7}{144}+\frac{9}{400}+\ldots\ldots\infty$ is

A) 1
B) 2
C) 32
D) 0

144) Which of the following number cannot be in the range of $f(x) = 4\,\text{cosec}^4x - 7 + 3\sec^2x + 11$?

A) 11
B) 96
C) 101.5
D) 43

145) If 60 times the 60^{th} term of an AP with non zero common difference is equal to 40 times the 40^{th} term, then the 100^{th} term of this AP is

A) 0
B) 1
C) -1
D) 2

146) The domain of the function $f(x) = \frac{\log(x+5)}{x^2+4x+3}$ is

A) $(-\infty, -1)$
B) [-3, -1]
C) R- [-3, -1]
D) $(-5, \infty) - \{-3, -1\}$

147) What will be the distance of (1, 0, 2) from the point of intersection of plane x-y+z=16 and the line (x-2)/3 = (y+1)/4 = (z-2)/12?

A) 13 units
B) 17 units
C) 25 units
D) 19 units

148) In a system of linear equations, three equations are given as

5x + 4y + 2z = 13; 4x - y - kz = 6; 2x + 3y + 3z = 16.

What should be the value of k so that the equations have no solution?

A) 3
B) 5
C) -3
D) -5

149) One of the roots of the equation $2x^3 - 9x^2 + kx - 13 = 0$ is 2 + 3i. What will be the real root of the equation?

A) 1
B) 1/4
C) -1/2
D) 1/2

150) The equation of a circle is C: $x^2 + y^2 - 6x - 4y + 11 = 0$. A point P(4,3), that lies on this circle is taken. A diameter with P as an end is drawn. What will be the coordinates of its other end?

A) (2, 1)
B) (4, 3)
C) (5, 4)
D) (1, 3)

151) What should be the positive value of p so that the magnitude of (3 + pi) where $i=\sqrt{(-1)}$ is twice that of (3/4) + pi?

A) 1
B) 0
C) 3/2
D) 3

152) For 'c' is the arbitrary constant, the solution of the differential equation $(x^2+2y^2)\,dx - xy\,dy = 0$ is

A) $x^2+y^2=x^4c^2$
B) $x^2-y^2=x^4c^2$
C) $x+y=x^4c^2$
D) $x^2+y^2=c^2$

153) sin(ix) =

A) i sinhx
B) i sin x
C) sin x
D) sinhx

154) Natural numbers from 51 to 150 are written on 100 cards. A card is drawn randomly from this set of 100 cards. What is the probability that the number written on the card drawn will either be a perfect square or a perfect cube?

A) 1/25
B) 3/50
C) 2/25
D) 1/20

155) Between 1 and 2, how many local maxima the function $f(x) = 6x^5 - 7x^4 + 3x^3 + 2x^2 + 11x - 17$ has?

A) 0
B) 1
C) 2
D) 3

156) It is given that P = Sum of all integral powers of (4/5) from 1 to n. Also, Q = 1 – P. The smallest natural number for which Q>P is

A) 3
B) 7
C) 9
D) Never possible

157) Let P and Q are two matrices such that PQ=Q and QP=P, then P^2+Q^2 =

A) P
B) Q
C) P+Q
D) P-Q

158) The equation xy=0 in 3D space represents

A) a pair of straight lines
B) a plane
C) a pair of planes at right angles
D) a pair of parallel planes

159) In a triangle PQR, A, B and C are the angles opposite to the corresponding sides of lengths a, b and c respectively. If the sides are a=5, b=13 and c=12 then sin B/2 + cos B/2 =

A) 1/2
B) $1/\sqrt{2}$
C) $\sqrt{2}$
D) 1

160) The minimum value of the function $Z=2x - y$ subjected to the constraints, $x+y \leq 5$, $x+2y \geq 8$, $x \geq 0$, $y \geq 0$ is

A) Z = 5
B) Z = 1
C) Z = -4
D) Z = -5

161) If $\alpha+\beta = \pi/2$ & $\beta+\gamma = \alpha$, then sin γ =

A) cos 2β
B) 1
C) sin 2β
D) tan 2β

162) P speaks truth in 70% cases and Q speaks in 80% of the cases. In what percentage of cases are they likely to contradict each other in stating the same fact?

A) 25%
B) 38%
C) 42%
D) 48%

163) If $3^x+3^y=3^{x+y}$, then at x=y=1, dy/dx =

A) 1
B) -1
C) 0
D) 2

164) The co-efficient of x^7 in the expansion of $(1+2x+3x^2+.....)^{3/2}$ is

A) 250
B) 280
C) 300
D) 330

165) It is given that $f(x) = e^x$, when $0 \leq x \leq 1$ and $f(x) = 2 - e^{(x-1)}$, when $1<x\leq 2$. If g(x) = integral of f(x) from 0 to x, then the point where g(x) has local maxima is

A) 0
B) 1
C) 2
D) NOT determinable

166) For 'c' is the arbitrary constant, the solution of the differential equation $\left(x^2 - yx^2\right)\frac{dy}{dx} + \left(y^2 + xy^2\right) = 0$ is

A) log(xy)+ (1/x+1/y)=c
B) log(xy)+ (1/x-1/y)=c
C) log(x/y)- (1/x+1/y)=c
D) log(x/y)+ (1/x-1/y)=c

167) Three points M, N and P are taken on a cartesian plane such that the triangle formed by them lies completely inside the circle $x^2 + y^2 - 4x - 5 = 0$. What could the coordinates of the points M, N and P?

A) M(0,0) , N(0,2) , P(0, -3)
B) M(4,0) , N(0,2) , P(0, -3)
C) M(4,0) , N(0,2) , P(0, 0)
D) M(0, 0) , N(4,0) , P(0, -3)

168) A line through P(3,5) is such that its intercept between the axes bisected at P. Its equation is

A) 5x+3y=30
B) 3x+5y=30
C) x+5y=30
D) 5x+y=30

169) A differential equation $dy/dx = (y + 4x - 4)^2$ is given. At x = 0, y = 4 the solution of this differential equation is given by

A) y + 4x = 2tan (2x)
B) y + 4x - 4 = 2tan (x)
C) y + 4x - 4 = 2tan (2x)
D) y + 4x - 4 = tan (2x)

170) If $\sin^{-1}x\cos^{-1}x = p$,
then the value of $(\sin^{-1}x)^3 + (\cos^{-1}x)^3$ is

A) $(\pi/2)(\pi/4 - 3p)$
B) $(\pi/4)(\pi^2/4 - 3p)$
C) $(\pi/2)(\pi^2/4 - 3p)$
D) $(\pi/4)(\pi^2/2 - 3p)$

171) In which of these cases, the parabola generated by the given pair of directrix and focus will be a degenerate case?

A) Directrix: 2x + 4y -7 = 0, Focus: (3, 5)
B) Directrix: 7x - 3y - 2 =0, Focus: (2, 4)
C) Directrix: 8x - 3y + 21 = 0, Focus: (2, -4)
D) Directrix: x = 3, Focus: (6, 1)

172) Given a function $f(x) = x^4e^x$ where $x \neq 0$. Which of the given options is a correct expression for f ''(x) ?

A) ((12/x) - x)f(x) + 2f'(x)
B) 8f(x) + 2f'(x)
C) ((12/x²) - 1)f(x) + 2f'(x)
D) 8f(x)/x + 3f'(x)

173) If P(A)=1/4, P(B)=1/5 and P(AB)=1/8 then $P(A^C/B^C)$ =

A) 21/32
B) 25/32
C) 27/32
D) 29/32

174) Here, [x] denotes the greatest integer less than or equal to x. Given that f(x) = [x] + x. The value obtained when this function is integrated with respect to x with lower limit as 3/2 and upper limit as 9/2, is

A) 12
B) 10.5
C) 8
D) 16.5

175) Evaluate the integral: $\int dy/[(y+6)(y+5)^{1/2}]$. The result is

A) $2\tan^{-1}(\sqrt{(y+6)})$ + constant
B) $2\tan^{-1}(y+6)$ + constant
C) $2\tan^{-1}(\sqrt{(y+5)})$ + constant
D) $2\tan^{-1}(y+5)$ + constant

176) The mean of three positive numbers is 9. The mean is larger than only one of these numbers. The mean deviation about mean is 2. The smallest number is

A) 5
B) 6
C) 7
D) 7.5

177) If α, β, γ are the angles made by a vector with the co-ordinate axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ =

A) 0
B) 1
C) -1
D) 2

178) A can solve 75% of the problems and B can solve 80% of the problems. If one problem is selected at random, the probability that the problem will be solved is

A) 0.95
B) 0.85
C) 0.72
D) 0.65

179) The value of 'x' for which the points (1,2,1), (0,1,3), (1,0,1) and (2,0,x) are coplanar is

A) x=0
B) x=1
C) x=-1
D) x=2

180) If a and b are unit vectors then the vector (a+b) X (aXb) is parallel to the vector

A) a+b
B) a
C) b
D) a-b

Space for Rough Work:

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