Section 3 - Mathematics

121) Nine non zero integers a, b, c, d, e, f, g, h and i are taken such that they form a geometric progression in the same order as mentioned. The common ratio of the geometric progression is an integer. Which of the following relation will always hold?

A) abce > 0

B) bcef > 0

C) ahbd > 0

D) bdgh > 0

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122) What will be the equation of the standard hyperbola where foci are (0, ±10) and the length of the latus rectum is 30?

A) $3y^2 - x^2 = 75$

B) $y^2 - x^2 = 25$

C) $3y^2 - x^2 = 25$

D) $y^2 - x^2 = 75$

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123) A set P = {7, 21, 28, 42, 14, 0} is given. A relation R holds on elements a and b of set P if either a is a factor of b or b is a factor of a. The relation R on the set P is

A) NOT reflexive

B) NOT symmetric

C) NOT transitive

D) antisymmetric

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124) The square of height of a tower is three times the square of its shadow. What would be the angle of depression of sun at this moment?

A) 30°

B) 45°

C) 60°

D) 75°

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125) Given that a function $f(x) = [x]^2 + x^2$, where [x] is the greatest integer less than or equal to x. If $f(x) > 25$, then the value of x is

A) any real number

B) a member of the set $\{ x \mid x \geq 0 \}$

C) a member of the set $\{ x \mid x \leq -4 \text{ or } x \geq 4 \}$

D) a member of the set $\{ x \mid x \geq 25 \text{ or } x \leq 0 \}$

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126) A 3 X 3 square matrix $M = [a_{ij}]$ is taken, where i = 0, 1, 2 and j = 0, 1, 2. In matrix M, value of each element is determined as $a_{ij} = i \times j$. What will be the value of largest minor of the matrix M?

A) -1

B) 0

C) 1

D) 4

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127) What will be the argument of the complex number z = 1 - cosp + isinp?

A) π – p

B) π/4 - p/2

C) π/2 - p/2

D) π - p/2

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128) What is the number of different values of the products that can be done using two or more of the numbers 3, 4, 5 and 7? (A number can be used at most once)

A) 11

B) 12

C) 15

D) 24

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129) From a deck of cards, all the diamonds are removed. From remaining cards, a card is chosen randomly. What is the probability that it will be a black card?

A) ½

B) 2/3

C) 1/3

D) ¾

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130) A parabola $y^2 = 32x$ is drawn. From its focus, a line of slope 1 is drawn. The equation of the line is

A) y=x+8

B) y=x-4

C) y=x

D) y=x-8

131) What will be the argument of the complex number $z = \frac{i-1}{e^{\frac{i\pi}{3}}}$?

A) π/4
B) π/3
C) 5π/12
D) 3π/8

132) An equilateral triangle is inscribed in the parabola $y^2 = 4ax$, where one vertex of the triangle is at the vertex of the parabola. The length of the side of the triangle is

A) 8a
B) 16a
C) $8a\sqrt{3}$
D) $16a\sqrt{3}$

133) On a biased dice, numbers from 1 to 6 are written on its six faces. The probability that a face will appear on throwing the dice is directly proportional to number written on that face. What is the probability that a face on which a multiple of 3 is written will appear both times when this dice is thrown twice?

A) 5/28
B) 3/14
C) 2/7
D) 9/49

134) The direction ratios of a normal to a plane are (3, 12, 4). Through which of the following points the plane passes if origin is at a distance of 2 units from this plane?

A) (2, 2, 1)
B) (2, 1, 2)
C) (2, 1, 1)
D) (3, -1, 2)

135) The sum of the series:

$\sin p + x\sin(p+q) + \frac{x^2}{2!}\sin(p+2q) + \cdots\infty$ is

A) 0
B) $e^{x\cos q}[\sin(p + x\sin q)]$
C) 1
D) $e^{x\cos q}[\cos(p + x\sin q)]$

136) The first order derivative of f(x) is given by $f'(x) = \sec^4 x + 5$ with $f(0) = 0$. Then f(x) =

A) $\tan x + \frac{1}{3}\tan^3 x + 5x + 2$
B) $\tan x + \frac{1}{3}\tan^3 x + 5x$
C) $\tan x + \frac{1}{3}\tan^3 x$
D) $\frac{1}{3}\tan^3 x + 5x$

137) A function $f(x) = x^2\tan x + e^{2x}$ is given. The value of second order derivative of f(x) at x = 0 is

A) 1
B) 2
C) 4
D) 0

138) What will be the area of the triangle formed by the lines joining the vertex of the parabola $y^2 = 28x$ to the ends of its latus rectum?

A) 64 sq. units
B) 51 sq. units
C) 98 sq. units
D) 72 sq. units

139) A plane is given as 3x+4y-12z+13 = 0. The points (1, 1, k) and (-3, 0, 1) are equidistant from the plane. What will be the quadratic equation that will have roots as values of k?

A) $4x^2 - 15x + 9 = 0$

B) $x^2 - 10x + 25 = 0$

C) $3x^2 - 8x + 4 = 0$

D) $3x^2 - 10x + 7 = 0$

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140) 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 $M = 4^{10}$. How many elements will be there in power set of P?

A) $32(M^5)$

B) $16(M^5)$

C) $32(M^4)$

D) $16(M^4)$

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141) $[(\cos 3t + i\sin 3t)^4(\cos 4t - i\sin 4t)^5(\cos 5t + i\sin 5t)^4] \div (\cos 4t + i\sin 4t)^3 =$

A) 0

B) 1/2

C) 1

D) $8\sqrt{2}$

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142) An eagle is sitting at a distance of 100 metres from base of a building. It can see a sparrow sitting at the top of the building at an angle of elevation of 30 degrees. It moves towards the building and sits at a point such that now it can see the same sparrow at an angle of elevation of 45 degrees. At what distance from the base of building is the eagle sitting now?

A) 57.735 metres

B) 70.711 metres

C) 100 metres

D) 173.205 metres

143) $\int_0^{\frac{\pi}{4}} \tan^2 x \sec^4 x \, dx =$

A) 1/3

B) 4/15

C) 1

D) 8/15

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144) 4 consecutive years are taken such that exactly one of them is a leap year. One of these four years is randomly chosen. What is the probability that it will have 53 Wednesdays?

A) 1/7

B) 3/14

C) ¼

D) 5/28

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145) A system of linear equations in two variables, p and q, is given as $(n + 1)p + (n + 2)q = 8$, $p - (n + 1)q + (n + 2) = 0$, $p + q = 3$. Which of the following would be one of the values of n for which the given system of linear equations is consistent?

A) 0

B) 1

C) 3

D) 7

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146) It is given that $f(x) = \frac{-3x + (-1)^x}{4x - (-1)^x}$. The limit value of the function f(x) as x tends to infinity is

A) 3/4

B) -3/4

C) 1/4

D) -1/4

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147) For 'C' is an arbitrary constant, the solution of the differential equation $3(xy)^2dx + 2x^3ydy = 0$ is given by

A) $x^2y^2 + C = 0$

B) $x^3y^3 + C = 0$

C) $x^3y^2 + C = 0$

D) $x^2y^3 + C = 0$

148) For which of the following values of T, the expression (1 + icos T)/(1 - 2icos T) will give a real number?

A) 0

B) π/2

C) π/3

D) 3π/4

149) The solution of $\frac{dy}{dx} = (y + 4x + 1)^2$ when y(0) = 1, is given by

A) y = 2tan(2x + π/4) – 4x – 1

B) y = 2cot(2x + π/8) – 4x – 1

C) y = 2tan(x + π/4) – 4x – 1

D) y = 2cot(2x + π/4) – 4x – 1

150) In which of the following domains f(x) is continuous, where $f(x) = \frac{|x+2|}{\tan^{-1}(x+2)}$?

(Note: R denotes set of real numbers)

A) R

B) R - {-2, 2}

C) R - {-2}

D) {-2, 2}

151) The sum value of the infinite series $1 + \frac{1}{5} + \frac{1}{25} + \frac{1}{125} + \frac{1}{625} + \cdots \infty$ is

A) $\frac{4}{5}$

B) $\frac{5}{4}$

C) $\frac{3}{2}$

D) indefinite

152) Out of 4 symbols, 5 letters and 3 numbers, how many strings can be formed each containing 3 letters, 2 symbols and beginning with a number?

A) 180

B) 2160

C) 14400

D) 21600

153) If [x] represents greatest integer less than or equal to x, then $\int_2^5 2[x]\,dx$ =

A) 9

B) 12

C) 18

D) 24

154) Which of the following can be the equal expression for cos(3T) + isin(3T) using the De Moivre's theorem and binomial theorem concepts?

A) $\cos^3T + 3i\cos^2T \sin T - 3\cos T \sin^2T + i\sin^3T$

B) $\cos^3T + 3i\cos^2T \sin T + 3\cos T \sin^2T - i\sin^3T$

C) $\cos^3T + 3i\cos^2T \sin T - 3\cos T \sin^2T - i\sin^3T$

D) $\cos^3T + 3i\cos^2T \sin T + 3\cos T \sin^2T + i\sin^3T$

155) For 'C' is an arbitrary constant,

$\int \frac{2x-1}{(x-1)(x+2)(x-3)}\,dx$ =

A) 3x - 2 + C

B) $\frac{1}{6}\log(x-1) - \frac{1}{3}\log(x+2) + \frac{1}{2}\log(x-3) + C$

C) $-\frac{1}{6}\log(x-1) - \frac{1}{3}\log(x+2) + \frac{1}{2}\log(x-3) + C$

D) $\frac{1}{6}\log(x-1) + \frac{1}{3}\log(x+2) + \frac{1}{2}\log(x-3) + C$

156) Two lines in three-dimensional system are given as (x-1)/2 = (y-2)/3 = (z-3)/4 and (x-4)/5 = (y-1)/2 = z. Their point of intersection is

A) (1,1,1)

B) (1,2,3)

C) (-1,-1,-1)

D) (4,1,0)

157) How many digits will be there after decimal point 12th term of the sequence: 32, 16, 8, 4, ...?

A) 5

B) 6

C) 7

D) 8

158) The domain of the function $f(x) = \log(3x^2 - 4x + 7)$ is

A) set of real numbers - {3, 2, 7}

B) set of real numbers

C) set of positive real numbers

D) set of non negative real numbers

159) For 'C' is an arbitrary constant, the solution of the differential equation $\frac{dy}{dx} + 2 = e^{2x+y}$ is given by

A) $(x+C)e^{(x+2y)} + 1 = 0$

B) $(2x+C)e^{(2x+y)} + 1 = 0$

C) $(x+C)e^{(2x+y)} + 1 = 0$

D) $(2x+ y + C)e^{(2x+y)} + 1 = 0$

160) What will be the sum of coefficients of even powers of x in the expansion of $(1 + 3x)^{10}$?

A) 524144

B) 524414

C) 524800

D) 524288

161) A function is given by the equations in parametric form as x = 2cost - cos(2t), y = 2sint - sin(2t). The value of $\frac{dy}{dx}$ at t = 90° is

A) 0

B) -1

C) 1

D) 2

162) To the curve x = sin t + 2t, y = 4t, a normal is drawn at t = 0. Where would this normal intersect with line y = x + 3?

A) (6, 9)

B) (9,12)

C) (0, 3)

D) (4, 7)

163) Suppose A, B and C are three sets, each with three elements. The number of subsets of the set A x B x C that have at least 2 elements is

A) $(2^{27}) - 28$

B) $(2^{27}) - 55$

C) 27

D) $(27^2) - 3$

164) Which of the following functions is neither even nor odd?

A) $f(x) = 5x + \sin(4x)$

B) $f(x) = 4x^3 + 7\tan x$

C) $f(x) = 7x^4 + 8x^2 - 6x$

D) $f(x) = 5x^2 + \cos(6x)$

165) Two matrices, A and B, are both 5 X 5 square matrices such that A = kB, where k is a non zero constant. If |B| = z, then what will be the value of |4(A + B)|?

A) 5z

B) (20k + 20)z

C) 3125z

D) $(4k + 4)^5 z$

166) The mean of a group of data is given as 27. Data is 39, 21, 18, X, Y, 24. What could be the values of X and Y, if both X and Y are prime?

A) X = 23, Y = 29

B) X = 29, Y = 31

C) X = 26, Y = 34

D) X = 12, Y = 48

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167) A set P is taken such that P = {$2/3^p$ | p is a natural number}. What will be the sum of elements of set P?

A) 1

B) 2/3

C) 5/3

D) 2

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168) M = $[m_{ij}]$, is a 4 X 4 square matrix, where i = 1, 2, 3, 4 and j = 1, 2, 3, 4. In M, m_{ij} = sin (i.j)x. What will be the value of the determinant |M| at x = π/3?

A) 0

B) 1

C) -1

D) 1/2

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169) The probability that Madhu will pass in her terminal exam is 1/3. The probability that Meena will fail in same exam is 3/4. What is the probability that exactly one of them passes in this exam?

A) 5/12

B) 1/4

C) 1/6

D) 11/24

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170) What will be the area enclosed by the ellipse given by $\frac{4x^2}{81} + \frac{9y^2}{49} = 1$?

A) 16.49 sq. units

B) 24.72 sq. units

C) 32.97 sq. units

D) 48 sq. units

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171) We are given that p and q are two complex numbers such that |p+q| = |p| + |q|. The value of arg(p) - arg(q) is

A) 0

B) π/2

C) π/3

D) 3π/4

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172) If $-\pi/2 < p < \pi/2$, then the values of 'p' for which $2\sin^2 p - 7\sin p + 3 > 0$, lie in

A) (0, π/2)

B) (-π/2, -π/6)

C) [–π/2, π/6)

D) (-π/2, 0)

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173) Two fair coins are thrown together. Only if heads appear on both coins, a fair dice is thrown on which natural numbers from 1 to 6 are written on the faces. What is the probability that face on which 2 is written will appear on the dice?

A) 1/4

B) 1/6

C) 1/12

D) 1/24

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174) It is given that $z_r = \cos(\pi/2^r) + i\sin(\pi/2^r)$. The value of the product $z_1.z_2.z_3.z_4.....^{\infty}$ is

A) 0

B) 1

C) -1

D) 1 + i

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175) If f(x) = √[(sin 2x + 2)(cos 2x + 2)] for x is a real number, then which of the following values lies in the domain of f(x) but NOT in the range of f(x)?

A) √6

B) √2

C) 1

D) (1/√2) + 2

176) A set T is given as T = {x∈ R | (x - 3) = (x + 4)², x < 2}. Which of these would be TRUE about the set T?

A) T is an empty set

B) T is a singleton set

C) x = 3 is a member of T

D) x = -4 is a member of T

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177) If S $= \sin^2 p - \frac{1}{2}\sin(2p)(\sin^2 p) + \frac{1}{3}\sin(3p)(\sin^3 p) - \frac{1}{4}\sin(4p)((\sin^4 p) + \cdots \infty$

then tan S =

A) $\frac{\cos^2 p}{1 + \cos p . \sin p}$

B) $\frac{\sin^2 p}{1 + \cos p . \sin p}$

C) $\frac{\sin^2 p}{1 + \cos 2p}$

D) 0

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178) A plane passes through the points (2, 1, -1) and (-1, 3, 4). Also, this plane is perpendicular to the plane x - 2y + 4z = 10. The equation of the plane is

A) 7x + 9y + 6z = 23

B) x + y + z = 2

C) 7x + y + z = 0

D) 18x + 17y + 4z = 49

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179) What will be the distance of point (2, 4, -1) from the straight line given by (x+5) = (y+3)/4 = (6-z)/9?

A) 5 units

B) 6 units

C) 7 units

D) 9 units

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180) What will be the coordinates of foot of perpendicular from the point (1, 1.5, 2) to the plane 2x - 2y + 4z + 5 = 0?

A) (1, 1/2, 1)

B) (0, 5/2, 0)

C) (0, 0, -5/4)

D) (6, 1, -15/4)

Space for Rough Work:

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