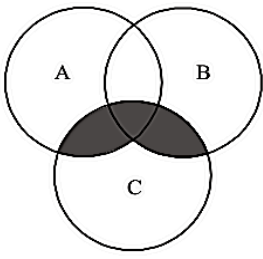


No of Questions: 120

Time: 2 ½ hours

- Universal set,
 $U = \{x/x^5 - 6x^4 + 11x^3 - 6x^2 = 0\}$
 $A = \{x/x^2 - 5x + 6 = 0\}$
 $B = \{x/x^2 - 3x + 2 = 0\}$
 What is $(A \cap B)'$ equal to
 a) $\{1, 3\}$
 b) $\{1, 2, 3\}$
 c) $\{0, 1, 3\}$
 d) $\{0, 1, 2, 3\}$
- Let $P = \{P_1, P_2, P_3, P_4\}$
 $Q = \{Q_1, Q_2, Q_3, Q_4\}$ and
 $R = P = \{R_1, R_2, R_3, R_4\}$
 If $S_{10} = \{(P_i, q_j, r_k) : i + j + k = 10\}$
 How many element does S_{10} have?
 a) 2 b) 4
 c) 6 d) 8
- What is the value of $0.\overline{2} + 0.\overline{23}$?
 a) $0.4\overline{3}$ b) $0.4\overline{5}$
 c) $0.2\overline{23}$ d) $0.2\overline{23}$
- If $(A-B) \cup (B-A) = A$ for subsets A and B of the universal set U, then which one of the following is correct?
 a) B is proper non empty subset of A
 b) A and B are non empty disjoint sets
 c) $B = \phi$
 d) None of the above
- 
 a) $(A \cap B) \cap C$
 b) $(A \cup B) \cap C$
 c) $(A \cup B) - C$
 d) None of these
- What is the number of proper subsets of a given finite set with n elements?
 a) $2n-1$ b) $2n-2$
 c) 2^n-1 d) 2^n-2
- If $x = (1101)_2$ and $y = (110)_2$, then what is the value of $x^2 - y^2$?
 a) $(1000101)_2$
 b) $(10000101)_2$
 c) $(10001101)_2$
 d) $(10010101)_2$
- What is the number of natural numbers less than or equal to 1000 which are neither divisible by 10 nor 15 nor 25?
 a) 860 b) 854
 c) 840 d) 824
- If the cardinality of a set A is 4 and that of a set B is 3, then what is the cardinality of the set $A \Delta B$?
 a) 1 b) 5
 c) 7
 d) Cannot be determined as the sets A and B are not given
- What is the value of $\log_2(\log_3 81)$?
 a) 2 b) 3
 c) 4 d) 9
- Let $P = \{1, 2, 3\}$ and a relation on set P is given by the set $R = \{(1, 2), (1, 3), (2, 1), (1, 1), (2, 2), (3, 3), (2, 3)\}$. Then R is:
 a) Reflexive, transitive but not symmetric
 b) Symmetric, transitive but not reflexive
 c) Symmetric, reflexive but not transitive
 d) None of the above
- If $(\log_3 X)^2 + \log_3 x < 2$, then which one of the following is correct?
 a) $0 < x < 1/9$ b) $1/9 < x < 3$
 c) $3 < x < \infty$ d) $1/9 \leq x \leq 3$
- What is the value of x at the intersection of $y = 8/(x^2 + 4)$ and $x + y = 2$?
 a) 0 b) 1
 c) 2 d) -1
- If x is real and $x^2 - 3x + 2 \leq 0$, then which one of the following is correct?
 a) $-1 \leq x \leq 4$
 b) $2 \leq x \leq 4$
 c) $-1 \leq x \leq 1$
 d) $-1 \leq x < 1$ or $2 < x \leq 4$
- Let α, γ be the roots of $Ax^2 - 4x + 1 = 0$ and β, δ be the roots of the $Bx^2 - 6x + 1 = 0$. If $\alpha\gamma, \beta\delta$ are in the HP, then what is the value of A and B respectively?
 a) 3, 8 b) -3, -8
 c) 3, -8 d) -3, 8
- If α, β are the roots of the quadratic equation $x^2 - x + 1 = 0$ then which one of the following is correct?

- a) $(\alpha^4 - \beta^4)$ is real
 b) $2(\alpha^6 + \beta^5) = (\alpha\beta)^5$
 c) $(\alpha^6 - \beta^6) = 0$
 d) $(\alpha^8 + \beta^8) = (\alpha\beta)^8$
17. One of the roots of the quadratic equation $ax^2 + bx + c = 0, a \neq 0$ is positive and the other root is negative. The condition for this to happen is
 a) $a > 0, b > 0, c > 0$
 b) $a > 0, b > 0, c < 0$
 c) $a > 0, b < 0, c > 0$
 d) $a > 0, b < 0, c < 0$
18. What are the roots of the equation $2(y+2)^2 - 5(y+2) = 12$?
 a) $-7/2, 2$ b) $-3/2, 4$
 c) $-5/3, 3$ d) $3/2, 4$
19. If the roots of the equation $3ax^2 + 2bx + c = 0$ are in the ratio 2 : 3, then which one of the following is correct?
 a) $8ac = 25b$ b) $8ac = 9b^2$
 c) $8b^2 = 9ac$ d) $8b^2 = 25ac$
20. For an AP with first term u and common difference v , the p th term is $15uv$ more than the q th term. Which one of the following is correct?
 a) $p = q + 15v$ b) $p = q + 15u$
 c) $p = q + 14v$ d) $p = q + 14u$
21. If a, b, c, d are in harmonical progression such that $a > d$, then which one of the following is correct?
 a) $a + c = b + d$ b) $a + c > b + d$
 c) $ac = bd$ d) $ab = cd$
22. If the sum of the first two terms and the sum of the first four terms of a geometric progression with positive common ratio are 8 and 80 respectively, then what is the 6th term?
 a) 88 b) 243
 c) 486 d) 1458
23. The sum of an infinite geometric progression is 6, If the sum of the first two terms is $9/2$, then what is the first term?
 a) 1 b) $5/2$
 c) 3 or $3/2$ d) 9 or 3
24. If the arithmetic and geometric means of two numbers are 10, 8 respectively, then one number exceeds the other number by
 a) 8 b) 10
 c) 12 d) 16
25. If the numbers $n - 3, 4n - 2, 5n + 1$ are in AP, what is the value of n ?
 a) 1 b) 2
 c) 3 d) 4
26. A straight line is passing through the points represented by the complex numbers $a + ib$ and $\frac{1}{-a + ib}$, where $(a, b) \neq (0, 0)$. Which one of the following is correct?
 a) It passes through the origin
 b) It is parallel to the x-axis
 c) It is parallel to the y-axis
 d) It passes through $(0, b)$
27. If z is a complex number such that $z + z^{-1} = 1$, then what is the value of $z^{99} + z^{-99}$?
 a) 1 b) -1
 c) 2 d) -2
28. What are the square roots of $-2i$? ($i = \sqrt{-1}$)
 a) $+(1+i)$ b) $\pm(1-i)$
 c) $\pm i$ d) ± 1
29. What are the last two digits of the number 9200?
 a) 19 b) 21
 c) 41 d) 01
30. What is the coefficient of x^{17} in the expansion of $\left(3x - \frac{x^3}{6}\right)^9$?
 a) $189/8$ b) $567/2$
 c) $21/16$ d) None of these
31. In how many ways can 7 persons stand in the form of a ring?
 a) $P(7, 2)$ b) $7!$
 c) $6!$ d) $7/2!$
32. If $C(n, 12) = C(n, 8)$, then what is the value of $C(22, n)$?
 a) 131 b) 231
 c) 256 d) 292
33. There are 4 candidates for the post of a lecturer in Mathematics and one is to be selected by votes of 5 men. What is the number of ways in which the votes can be given?
 a) 1048 b) 1072
 c) 1024 d) 625
34. If p be the length of the perpendicular from the origin on the straight line $ax + by = p$ and $b = \sqrt{3}/2$, then what is the angle between the perpendicular and the positive direction of x-axis?
 a) 30° b) 45°
 c) 60° d) 90°
35. What is the product of the perpendiculars from the two points $(\pm\sqrt{b^2 - a^2}, 0)$ to the line $ax \cos \phi + by \sin \phi = ab$?
 a) a^2 b) b^2
 c) ab d) a/b

36. What is the equation of the line passing through $(2, -3)$ and parallel to Y-axis?
 a) $Y = -3$ b) $Y = 3$
 c) $X = 2$ d) $X = -3$
37. What is the perpendicular distance of the point (x, y) from x-axis?
 a) x b) y
 c) $|x|$ d) $|y|$
38. What is the inclination of the line $\sqrt{3}x - y - 1 = 0$?
 a) 30° b) 60°
 c) 135° d) 150°
39. Consider a circle of radius R . What is the length of a chord which subtends an angle θ at the centre?
 a) $2R \sin\left(\frac{\theta}{2}\right)$ b) $2R \sin \theta$
 c) $2R \tan\left(\frac{\theta}{2}\right)$ d) $2R \tan \theta$
40. If the latus rectum of an ellipse is equal to one half its minor axis, what is the eccentricity of the ellipse?
 a) $1/2$ b) $\sqrt{3}/2$
 c) $3/4$ d) $\sqrt{15}/4$
41. The curve $y^2 = -4ax$ ($a > 0$) lies in
 a) First and fourth quadrants
 b) First and second quadrants
 c) Second and third quadrants
 d) Third and fourth quadrants
42. The sum of the focal distances of a point on the ellipse $x^2/4 + y^2/9 = 1$ is:
 a) 4 units b) 6 units
 c) 8 units d) 10 units.
43. If $\tan^2 B = \frac{1 - \sin A}{1 + \sin A}$ then what is the value of $A + 2B$?
 a) $\pi/2$ b) $\pi/3$
 c) $\pi/4$ d) $\pi/6$
44. If α and β are such that $\tan \alpha = 2 \tan \beta$, then what is $\sin(\alpha + \beta)$ equal to?
 a) 1 b) $2 \sin(\alpha - \beta)$
 c) $\sin(\alpha - \beta)$ d) $3 \sin(\alpha - \beta)$
45. Which one of the following pairs is not correctly matched?
 a) $\sin 2\pi : \sin(-2\pi)$
 b) $\tan 45^\circ : \tan(-315^\circ)$
 c) $\cot(\tan^{-1} 0.5) : \tan(\cos^{-1} 0.5)$
 d) $\tan 420^\circ : \tan(-60^\circ)$
46. $x = \sin \theta \cos \theta$ and $y = \sin \theta \cos \theta$ are satisfied by which one of the following equations?
 a) $y^2 - 2x = 1$ b) $y^2 + 2x = 1$
 c) $y^2 - 2x = -1$ d) $y^2 + 2x = -1$
47. If $\cot \theta = 5/12$ and θ lies in the third quadrant, then what is $(2 \sin \theta + 3 \cos \theta)$ equal to?
 a) -4
 b) $-p^2$ for some odd prime p
 c) $(-q/p)$ where p is an odd prime and q a positive integer with (q/p) not an integer
 d) $-p$ for some odd prime p
48. If $\cos A + \cos B = m$ and $\sin A + \sin B = n$, where $m, n \neq 0$, then what is $\sin(A + B)$ equal to?
 a) $\frac{mn}{m^2 + n^2}$ b) $\frac{2mn}{m^2 + n^2}$
 c) $\frac{m^2 + n^2}{2mn}$ d) $\frac{mn}{m + n}$
49. If $\tan A = 1/2$ and $\tan B = 1/3$, then what is the value of $4A + 4B$?
 a) $\pi/4$ b) $\pi/2$
 c) π d) 2π
50. Which one of the following is positive in the third quadrant?
 a) $\sin \theta$ b) $\cos \theta$
 c) $\tan \theta$ d) $\sec \theta$
51. What is the value of $\sin 420^\circ \cdot \cos 390^\circ + \cos(300^\circ) \cdot \sin(-330^\circ)$?
 a) 0 b) 1
 c) 2 d) -1
52. What is $\tan^4 A - \sec^4 A + \tan^2 A + \sec^2 A$ equal to?
 a) 0 b) 1
 c) 2 d) -1
53. If A, B and C are angles of a triangle such that $\tan A = 1$, $\tan B = 2$, then what is the value of $\tan C$?
 a) 0 b) 1
 c) 2 d) 3
54. If $\sin^{-1} x + \sin^{-1} y = \pi/2$ and $\cos^{-1} x - \cos^{-1} y = 0$, then values x and y are respectively
 a) $\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$ b) $\frac{1}{2}, \frac{1}{2}$
 c) $\frac{1}{2}, -\frac{1}{2}$ d) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$
55. What is the value of $\sin^{-1} \frac{4}{5} + 2 \tan^{-1} \frac{1}{3}$?
 a) $\frac{\pi}{3}$ b) $\frac{\pi}{2}$
 c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$
56. In a triangle ABC if the angles A, B, C are in AP, then which one of the following is correct?
 a) $c = a + b$ b) $c^2 = a^2 + b^2 - ab$
 c) $a^2 = b^2 + c^2 - bc$ d) $b^2 = a^2 + c^2 - ac$
57. The angle of elevation from a point on the bank of a river of the top of a temple on the other bank is 45° . Retreating 50m, the observer finds the

- new angle of elevation as 30° . What is the width of the river?
- a) 50 m b) $50\sqrt{3}$ m
c) $50/(\sqrt{3}-1)$ m d) 100 m
58. From the top of a lighthouse 70 m high with its base at sea level, the angle of depression of a boat is 15° . The distance of the boat from the foot of the lighthouse is:
- a) $70(2-\sqrt{3})$ m b) $70(2+\sqrt{3})$ m
c) $70(3-\sqrt{3})$ m d) $70(3+\sqrt{3})$ m
59. If $f(x) = \begin{cases} mx+1 & x \leq \frac{\pi}{2} \\ \sin x + n & x > \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, then which one of the following is correct?
- a) $m = 1, n = 0$ b) $m = n\pi/2 + 1$
c) $n = m(\pi/2)$ d) $m = n = \pi/2$
60. Let $f(x) = \begin{cases} 3x-4, & 0 \leq x \leq 2 \\ 2x+\ell, & 2 < x \leq 9 \end{cases}$ If f is continuous at $x = 2$, then what is the value of ℓ ?
- a) 0 b) 2
c) -2 d) -1
61. Let: $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined as $f(x) = x \mid x \mid$; for each $x \in \mathbb{R}$, \mathbb{R} being the set of real numbers. Which one of the following is correct?
- a) f is one-one but not onto
b) f is onto but not one-one
c) f is both one-one and onto
d) f is neither one-one nor onto
62. C is associated with
- a) 1, 4, 6, 7, 9, 11 b) 2, 4, 8, 9
c) 1, 4, 6, 7, 9 d) None of these
63. Consider the following in respect of the function $f(x) = |x-3|$:
- $f(x)$ is continuous at $x = 3$
 - $f(x)$ is differentiable at $x = 0$.
- Which of the above statements is/are correct?
- a) 1 only b) 2 only
c) Both 1 and 2 d) Neither 1 nor 2
64. Consider the following statements:
- $\lim_{x \rightarrow 0} \sin \frac{1}{x}$ does not exist
 - $\lim_{x \rightarrow 0} \sin \frac{1}{x}$ exist
- Which one of the above statements correct?
- a) 1 only b) 2 only
c) Both 1 and 2 d) Neither 1 nor 2
65. What is the probability of getting five heads and seven tails in 12 flips of a balanced coin?
- a) $C(12, 5)/(25)$ b) $C(12, 5)/(27)$
c) $C(12, 5)/(212)$ d) $C(12, 7)/(26)$
65. In a lottery, 16 tickets are sold and 4 prizes are awarded. If a person buys 4 tickets, what is the probability of his winning a prize?
- a) $4/164$ b) $175/256$
c) $1/4$ d) $81/256$
66. If $P(A) = 0.8$, $P(B) = 0.9$, $P(AB) = p$, which one of the following is correct?
- a) $0.72 \leq p \leq 0.8$ b) $0.7 \leq p \leq 0.8$
c) $0.72 < p < 0.8$ d) $0.7 < p < 0.8$
67. Three letters are randomly selected from the 26 capital letters of the English Alphabet. What is the probability that the letter 'A' will not be included in the choice?
- a) $1/2$ b) $23/26$
c) $12/13$ d) $25/26$
68. Three digital numbers are formed using the digits 0, 2, 4, 6, 8. A number is chosen at random out of these numbers. What is the probability that the number has the same digits?
- a) $1/16$ b) $1/25$
c) $16/25$ d) $1/645$
69. What is the probability that a leap year selected at random contains 53 Mondays?
- a) $1/7$ b) $2/7$
c) $7/366$ d) $26/183$
70. Four coins are tossed simultaneously. What is the probability of getting exactly 2 heads?
- a) $1/2$ b) $1/4$
c) $1/8$ d) $3/8$
71. If P, Q are (2, 5, -7), (-3, 2, 1) respectively, then what are the direction ratios of the line PQ?
- a) $\langle 10, 6, -16 \rangle$ b) $\langle 5, 3, 8 \rangle$
c) $\langle -5, -3, -8 \rangle$ d) None of these
72. What is the ratio in which the line joining the points (2, 4, 5) and (3, 5, -4) is internally divided by the xy-plane?
- a) 5:4 b) 3:4
c) 1:2 d) 7:5
73. What is the angle between the lines $x+z=0, y=0$ and $20x=15y=12z$?
- a) $\cos^{-1}(1/5)$ b) $\cos^{-1}(1/7)$
c) $\cos^{-1} \frac{45}{7\sqrt{61}}$ d) $\sin^{-1}(1/7)$
74. What is the equation of the plane through z-axis and parallel to the line $\frac{x-1}{\cos \theta} = \frac{y+2}{\sin \theta} = \frac{z-3}{0}$?
- a) $x \cot \theta + y = 0$ b) $x \tan \theta - y = 0$
c) $x + y \cot \theta = 0$ d) $x - y \tan \theta = 0$
75. What is the cosine of angle between the planes $x+y+z+1=0$ and $2x-2y+2z+1=0$?
- a) $1/2$ b) $1/3$

- c) $2/3$ d) None of the above
76. What is the angle between the planes $2x - y - 2z + 1 = 0$ and $3x - 4y + 5z - 3 = 0$?
- a) $\pi/6$ b) $\pi/4$
c) $\pi/3$ d) $\pi/2$
77. The mean weight of all the students in a certain class is 60 kg. The mean weight of the boys from the class is 70 kg. while that of the girls is 55 kg. What is the ratio of number of boys to that of girls?
- a) 2:1 b) 1:2
c) 1:4 d) 4:1
78. If n_1 and n_2 are the sizes, G_1 and G_2 the geometric means of two series respectively, then which one of the following expresses the geometric mean (G) of the combined series?
- a) $\log G = \frac{n_1 G_1 + n_2 G_2}{n_1 + n_2}$
b) $\log G = \frac{n_2 \log G_1 + n_1 \log G_2}{n_1 + n_2}$
c) $G = \frac{n_1 \log G_1 + n_2 \log G_2}{n_1 + n_2}$
d) None of these
79. If $\sum_{i=1}^n (x_i - 2) = 110$, $\sum_{i=1}^n (x_i - 5) = 20$, then what is the mean?
- a) $11/2$ b) $2/11$
c) $17/3$ d) $17/9$
80. The distributions X and Y with total number of observations 36 and 64, and mean 4 and 3 respectively are combined. What is the mean of the resulting distribution X + Y?
- a) 3.26 b) 3.32
c) 3.36 d) 3.42
81. Some measures of central tendency for n discrete observations are given below:
1. Arithmetic mean
 2. Geometric mean
 3. Harmonic mean
 4. Median
- A desirable property of a measure of central tendency is if every observation is multiplied by c , then the measure of central tendency is also multiplied by c , where $c > 0$. Which of the above measures satisfy the property?
- a) 1, 2 and 3 only
b) 1, 2 and 4 only
c) 3 and 4 only
d) 1, 2, 3 and 4
82. What is the arithmetic mean of first 16 natural numbers with weights being the number itself?
- a) $17/2$ b) $33/2$
c) 11 d) $187/2$
83. Let X and Y be two related variables. The two regression lines are given by $x - y + 1 = 0$ and $2x - y + 4 = 0$. The two regression lines pass through the point:
- a) $(-4, -3)$ b) $(-6, -5)$
c) $(3, -2)$ d) $(-3, -2)$
84. What is the derivative of $(\log_{\tan x} \cot x)(\log_{\cot x} \tan x)^{-1}$ at $x = \frac{\pi}{4}$?
- a) -1 b) 0
c) 1 d) $1/2$
85. If $x^y = e^{x-y}$, then dy/dx is equal to which one of the following?
- a) $\frac{(x-y)}{(1+\log x)^2}$ b) $\frac{y}{(1+\log x)}$
c) $\frac{(x+y)}{(1+\log x)}$ d) $\frac{(\log x)}{(1+\log x)^2}$
86. If $x = t^2$, $y = t^3$, then what is $\frac{d^2 y}{dx^2}$ equal to?
- a) 1 b) $3/2t$
c) $3/4t$ d) $3/2$
87. If $2x^2 - 3y^2 = 7$, what is $\frac{dy}{dx}$ equal to ($y \neq 0$)?
- a) $x^2/2y$ b) $x/2y$
c) x^2/y d) None of these
88. What is the x-coordinate of the point on the curve $f(x) = \sqrt{x}(7x - 6)$, where the tangent is parallel to x-axis?
- a) $-1/3$ b) $2/7$
c) $6/7$ d) $1/2$
89. What is the minimum value of $2x^2 - 3x + 5$?
- a) 0 b) $3/4$
c) $31/4$ d) $31/8$
90. Statement I: $y = -\tan^{-1}(x-1) + 1$ is an increasing function of x .
Statement II: dy/dx is positive for all values of x . Which one of the following is correct in respect of the above statements?
- a) Both statements I and II are independently correct and statement II is the correct explanation of statement I
b) Both statements I and II are independently correct but statement II is not the correct explanation of statement I
c) Statement I is correct but statement II is false.

- d) Statement I is false but statement II is correct.
91. Which one of the following statement is correct?
- a) The derivative of a function $f(x)$ at a point will exist if there is one tangent to the curve $y = f(x)$ at that point and the tangent is parallel to y-axis
- b) The derivative of a function $f(x)$ at a point will exist if there is one tangent to the curve $y = f(x)$ at that point and the tangent must be parallel to x-axis
- c) The derivative of a function $f(x)$ at a point will exist if there is one and only one tangent to the curve $y = f(x)$ at that point and the tangent is not parallel to y-axis
- d) None of the above

92. What is $\int \log(x+1) dx$ is equal to?

- a) $x \log(x+1) - x + c$
- b) $(x+1)\log(x+1) - x + c$
- c) $\frac{1}{x+1} + c$
- d) $\frac{\log(x+1)}{x+1} + c$

93. What is $\int \sec^n x \tan x dx$ equal to?

- a) $\frac{\sec^n x}{n} + c$
- b) $\frac{\sec^{n-1} x}{n-1} + c$
- c) $\frac{\tan^n x}{n} + c$
- d) $\frac{\tan^{n-1} x}{n-1} + c$

94. What is the area under the curve

$$y = |x| + |x-1|$$

between $x = 0$ and $x = 1$?

- a) $1/2$
- b) 1
- c) $3/2$
- d) 2

95. If $I_n = \int_0^{\pi/4} \tan^n x dx$ then what is $I_n + I_{n-2}$ equal to?

- a) 0
- b) 1
- c) -1
- d) $\pi/4$

96. If $f(x)$ is an even function, then what is

$$\int_0^{\pi} f(\cos x) dx \text{ equal to?}$$

- a) 0
- b) $\int_0^{\pi/2} f(\cos x) dx$

- c) $2 \int_0^{\pi/2} f(\cos x) dx$
- d) 1

97. What is $\int_0^1 x e^x dx$ equal to

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

98. Under which one of the following condition does the solution of $\frac{dy}{dx} = \frac{ax+b}{cy+d}$ represent a parabola?

- a) $a = 0, c = 0$
- b) $a = 1, b = 2, c \neq 0$
- c) $a = 0, c \neq 0, b \neq 0$
- d) $a = 1, c = 1$

99. What are the degree and order respectively of differential equation of the family of rectangular hyperbolas whose axis of symmetry are the coordinate axis?

- a) $1, 1$
- b) $1, 2$
- c) $2, 1$
- d) $2, 2$

100. What is the solution of the differential equation

$$\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0?$$

- a) $\sin^{-1} y + \sin^{-1} x = C$
- b) $\sin^{-1} y - \sin^{-1} x = C$
- c) $2 \sin^{-1} y + \sin^{-1} x = C$
- d) $2 \sin^{-1} y - \sin^{-1} x = C$

101. What is the general solution of the differential equation $e^x \tan y dx + (1 - e^x) \sec^2 y dy = 0$?

- a) $\sin y = c(1 - e^x)$
- b) $\cos y = c(1 - e^x)$
- c) $\cot y = c(1 - e^x)$
- d) None of the above

102. let $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ be a square matrix of order 3.

Then for any positive integer n , what is A^n equal to?

- a) A
- b) $3^n A$
- c) $(3^{n-1}) A$
- d) $3A$

103. Consider the following statements:

- If $\det A = 0$, then $\det(\text{adj } A) = 0$
 - If A is non-singular, then $\det(A^{-1}) = (\det A)^{-1}$
- a) 1 only
- b) 2 only
- c) Both 1 and 2
- d) Neither 1 nor 2

104. If $X = \begin{bmatrix} 1 & -2 \\ 0 & 3 \end{bmatrix}$, and I is a 2×2 identity matrix,

then $X^2 - 2X + 3I$ equal to which one of the following?

- a) $-I$
- b) $-2X$
- c) $2X$
- d) $4X$

105. If A and B are two matrices such that $AB = A$ and $BA = B$, then which one of the following is correct?

- a) $(A^T)^2 = A^T$ b) $(A^T)^2 = B^T$
c) $(A^T)^2 = (A^{-1})^{-1}$ d) None of these

106. A matrix X has $(a + b)$ rows and $(a + 2)$ columns; and a matrix Y has $(b + 1)$ rows and $(a + 3)$ columns. If both XY and YX exist, then what are the values of a, b respectively?

- a) 3, 2 b) 2, 3
c) 2, 4 d) 4, 3

107. If A is a square matrix, then what is $\text{adj } A^T - (\text{adj } A)^T$ equal to?

- a) $2 |A|$ b) $2 |A| I$
c) Null Matrix d) Unit Matrix

108. For what value of x does

$$(132) \begin{pmatrix} 1 & 3 & 0 \\ 3 & 0 & 2 \\ 2 & 0 & 1 \end{pmatrix} \begin{pmatrix} 0 \\ 3 \\ x \end{pmatrix} = (0) \text{ hold?}$$

- a) -1 b) 1
c) 9/8 d) -9/8

109. If the sum of the matrices $\begin{bmatrix} x \\ x \\ y \end{bmatrix}$, $\begin{bmatrix} y \\ y \\ z \end{bmatrix}$ and $\begin{bmatrix} z \\ 0 \\ 0 \end{bmatrix}$ is

$$\text{the matrix } \begin{bmatrix} 10 \\ 5 \\ 5 \end{bmatrix}, \text{ then what is the value of y?}$$

- a) -5 b) 0
c) 5 d) 10

110. If $\vec{p} \neq \vec{0}$ and the conditions $\vec{p} \cdot \vec{q} = \vec{p} \cdot \vec{r}$ and $\vec{p} \times \vec{q} = \vec{p} \times \vec{r}$ hold simultaneously, then which one of the following is correct?

- a) $\vec{q} \neq \vec{r}$ b) $\vec{q} = -\vec{r}$
c) $\vec{q} \cdot \vec{r} = 0$ d) $\vec{q} = \vec{r}$

111. Two vectors \vec{a} and \vec{b} are non-zero and non-collinear. What is the value of x for which the vectors $\vec{p} = (x-2)\vec{a} + \vec{b}$ and $\vec{q} = (x+1)\vec{a} - \vec{b}$ are collinear?

- a) 1 b) 1/2
c) 2/3 d) 2

112. let \vec{a} and \vec{b} be the position vectors of A and B respectively. If C is the point $3\vec{a} - 2\vec{b}$, then which one of the following is correct?

- a) C is in between A and B
b) A is in between C and B

- c) B is in between A and C
d) A, B, C are not collinear

113. What is the length of the vector $(1, 1)$?

- a) 0 b) 1
c) $\sqrt{2}$ d) $\frac{1}{2}$

114. If the angle between the vectors \vec{a} and \vec{b} is $\frac{\pi}{3}$, what is the angle between $-5\vec{a}$ and $-6\vec{b}$?

- a) $\frac{\pi}{6}$ b) $\frac{2\pi}{3}$
c) $\frac{2\pi}{5}$ d) $\frac{3\pi}{7}$

115. If $x\hat{i} + y\hat{j} + z\hat{k}$ is a unit vector and $x : y : z = \sqrt{3} : 2 : 3$, then what is the value of z?

- a) 3/16 b) 3
c) 3/4 d) 2

116. What is the value of m if the vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} - m\hat{j} + 5\hat{k}$ are coplanar?

- a) -2 b) 2
c) -4 d) 4

117. Which one of the following vectors is normal to the vector $\hat{i} + \hat{j} + \hat{k}$?

- a) $\hat{i} + \hat{j} - \hat{k}$ b) $\hat{i} - \hat{j} + \hat{k}$
c) $\hat{i} - \hat{j} - \hat{k}$ d) None of these

118. consider the following for any three non-empty sets A, B and C.

1. $A - (B \cup C) = (A - B) \cup (A - C)$
2. $A - B = A - (A \cap B)$
3. $A = (A \cap B) \cup (A - B)$

Which of the above is/are correct?

- a) Only 1 b) 2 and 3
c) 1 and 2 d) 1 and 3

119. If A, B and C are three sets and U is the universal set such that

$$n(U) = 700, n(A) = 200, n(B) = 300 \text{ and } n(A \cap B) = 100, \text{ then what is the Value of } (A' \cap B')?$$

- a) 100 b) 200
c) 300 d) 400

120. If A, B, C are three sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$, then which one of the following is correct?

- a) $A = B$ only b) $B = C$ only
c) $A = C$ only d) $A = B = C$

