

**YODDHAA
DEFENCE INSTITUTE****Date: 26th July, 2026****Time: 10:00 am – 12:30pm****MATHEMATICS****Max. Marks: 300**

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1. If both p and q belong to the set $\{1, 2, 3, 4\}$, then how many equations of the form $px^2 + qx + 1 = 0$ will have real roots?
 - (a) 12
 - (b) 10
 - (c) 7
 - (d) 6
 2. What is the value of $1 - 2 + 3 - 4 + 5 - \dots + 101$?
 - (a) 51
 - (b) 55
 - (c) 110
 - (d) 111
 3. If A, B and C are subsets of a given set, then which one of the following relations is not correct?
 - (a) $A \cup (A \cap B) = A \cup B$
 - (b) $A \cap (A \cup B) = A$
 - (c) $(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$
 - (d) $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$
 4. If the sum of first n terms of a series is $(n + 12)$, then what is its third term?
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
 5. What is the value of k for which the sum of the squares of the roots of $(2x^2 - 2(k - 2)x - (k + 1) = 0)$ is minimum?
 - (a) -1
 - (b) 1
 - (c) $\frac{3}{2}$
 - (d) 2

6. If the roots of the equation $a(b - c)x^2 + b(c - a)x + c(a - b) = 0$ are equal, then which one of the following is correct?
- a, b and c are in AP
 - a, b and c are in GP
 - a, b and c are in HP
 - a, b and c do not follow any regular pattern
7. If $|x^2 - 3x + 2| > x^2 - 3x + 2$, then which one of the following is correct?
- $x \leq 1$ or $x \geq 2$
 - $1 \leq x \leq 2$
 - $1 < x < 2$
 - x is any real value except 3 and 4
8. A geometric progression (GP) consists of 200 terms. If the sum of odd terms of the GP is m , and the sum of even terms of the GP is n , then what is its common ratio?
- m/n
 - n/m
 - $m + (n/m)$
 - $n + (m/n)$
9. If a set A contains 3 elements and another set B contains 6 elements, then what is the minimum number of elements that $(A \cup B)$ can have?
- 3
 - 6
 - 8
 - 9
10. What is the number of diagonals of an octagon?
- 48
 - 40
 - 28
 - 20
11. What is the value of the determinant $\begin{vmatrix} 1! & 2! & 3! \\ 2! & 3! & 4! \\ 3! & 4! & 5! \end{vmatrix}$?
- 0
 - 12
 - 24
 - 36
12. What is the value of $\left[\frac{i+\sqrt{3}}{2}\right]^{2019} + \left[\frac{i-\sqrt{3}}{2}\right]^{2019}$?
- 1
 - 1

- (c) $2i$
 (d) $-2i$

13. If α and β are the roots of $x^2 + x + 1 = 0$, then what is $\sum_{j=0}^3 (\alpha^j + \beta^j)$ equal to?

- (a) 8
 (b) 6
 (c) 4
 (d) 2

14. In a school, 50% students play cricket and 40% play football. If 10% of students play both the games, then what per cent of students play neither cricket nor football?

- (a) 10%
 (b) 15%
 (c) 20%
 (d) 25%

15. If $A = \{x: 0 \leq x \leq 2\}$ and $B = \{y, y \text{ is a prime number}\}$, then what is $A \cap B$ equal to?

- (a) $\emptyset$
 (b) $\{1\}$
 (c) $\{2\}$
 (d) $\{1, 2\}$

16. If $x = 1 + i$, then what is the value of $x^6 + x^4 + x^2 + 1$?

- (a) $6i - 3$
 (b) $-6i + 3$
 (c) $-6i - 3$
 (d) $6i + 3$

17. $1 + i^2 + i^4 + i^6 + \dots + i^{2n}$ is

- (a) Even
 (b) Negative
 (c) Zero
 (d) Cannot be determined

18. The 19th term from the end of the series $2 + 6 + 10 + \dots + 86$ is

- (a) 6
 (b) 18
 (c) 14
 (d) 10

19. Consider the following statements

- I. $z - \bar{z} = 0$ i.e., $z = \bar{z} \Leftrightarrow z$ is purely real i.e., $\text{Im}(z) = 0$

II. $|z_1 + z_2|^2 + |z_1 - z_2|^2 = 2\{|z_1|^2 + |z_2|^2\}$

III. $|z_1 + z_2|^2 = |z_1|^2 + |z_2|^2 \Leftrightarrow \frac{z_1}{z_2}$ is purely real.

Which of the above statement(s) is/are correct?

- (a) I and III
- (b) II and III
- (c) I and II
- (d) I, II and III.

20. If $-1 + \sqrt{-3} = re^{t\theta}$, then θ is equal to

- (a) $\frac{\pi}{3}$
- (b) $-\frac{\pi}{3}$
- (c) $\frac{2\pi}{3}$
- (d) $-\frac{2\pi}{3}$

21. 150 workers were engaged to finish a piece of work in a certain number of days. 4 workers dropped the second day, 4 more workers dropped the third day and so on. It takes eight more days to finish the work now. The number of days in which the work was completed is

- (a) 15
- (b) 20
- (c) 25
- (d) 30

22. i^i is equal to

- (a) $e^{\pi/2}$
- (b) $e^{-\pi/2}$
- (c) $-\pi/2$
- (d) None of these

23. How many words comprising of any three letters of the word "UNIVERSAL" can be formed

- (a) 504
- (b) 405
- (c) 540
- (d) 450

24. The number of 4 digit number that can be formed from the digits 0,1,2,3,4,5,6,7 so that each number contain digit 1 is

- (a) 1225
- (b) 1252
- (c) 1526
- (d) 480

25. We are to form different words with the letters of the word 'INTEGER'. Let m_1 be the number of words in which I and N are never together, and m_2 be the number of words which begin with I and end with R. Then m_1/m_2 is equal to

- (a) 30
- (b) 60

(c) 90

(d) 180

26. The number of numbers that can be formed with the help of the digits 1,2,3,4,3,2,1 so that odd digits always occupy odd places, is

(a) 24

(b) 18

(c) 12

(d) 30

27. Sum of odd terms is A and sum of even terms is B in the expansion of $(x + a)^n$, then

(a) $AB = \frac{1}{4}(x - a)^{2n} - (x + a)^{2n}$

(b) $2AB = (x + a)^{2n} - (x - a)^{2n}$

(c) $4AB = (x + a)^{2n} - (x - a)^{2n}$

(d) None of these

28. If the 4th term in the expansion of $(px + x^{-1})^m$ is 2.5 for all $x \in \mathbb{R}$ then

(a) $p = 5/2, m = 3$

(b) $p = \frac{1}{2}, m = 6$

(c) $p = -\frac{1}{2}, m = 6$

(d) None of these

29. Product of real roots of the equation $t^2x^2 + |x| + 9 = 0 (t \neq 0)$

(a) Is always +ve

(b) Is always -ve

(c) Does not exist

(d) None of these

30. The roots of $|x - 2|^2 + |x - 2| - 6 = 0$ are

(a) 0,4

(b) -1,3

(c) 4,2

(d) 5,1

31. The largest term in the expansion of $(3 + 2x)^{50}$, where $x = \frac{1}{5}$ is

(a) 5th(b) 8th(c) 7th(d) 9th

32. The greatest coefficient in the expansion of $(1 + x)^{2n+2}$ is

(a) $\frac{(2n)!}{n!^2}$

(b) $\frac{(2n+2)!}{[(n+1)!]^2}$

(c) $\frac{(2n+2)!}{n!(n+1)!}$

(d) $\frac{(2n)!}{n!(n+1)!}$

33. Which is the correct order for a given number α in increasing order

(a) $\log_2 \alpha, \log_3 \alpha, \log_e \alpha, \log_{10} \alpha$

(b) $\log_{10} \alpha, \log_3 \alpha, \log_e \alpha, \log_2 \alpha$

(c) $\log_{10} \alpha, \log_e \alpha, \log_2 \alpha, \log_3 \alpha$

(d) $\log_3 \alpha, \log_e \alpha, \log_2 \alpha, \log_{10} \alpha$

34. Let α, β be the roots of the equation $(x - a)(x - b) = c, c \neq 0$, then the roots of the equation

$(x - \alpha)(x - \beta) + c = 0$ are

(a) a, c

(b) b, c

(c) a, b

(d) a, d

35. If the angle of elevation of the top of a tower at a distance 500 m from its foot is 30° , then height of the tower is

(a) $\frac{1}{\sqrt{3}}$

(b) $\frac{500}{\sqrt{3}}$

(c) $\sqrt{3}$

(d) $\frac{1}{500}$

36. The shadow of a tower standing on a level ground is found to be 60 m longer when the sun's altitude is 30° than when it is 45° . The height of the tower is

(a) 60 m

(b) 30 m

(c) $60\sqrt{3}$ m

(d) $30(\sqrt{3} + 1)$ m

37. Let R be a relation on the set N be defined by $\{(x, y) \mid x, y \in N, 2x + y = 41\}$. Then R is

(a) Reflexive

(b) Symmetric

(c) Transitive

(d) None of these

38. Let R and S be two non-void relations on a set A . Which of the following statements is false

(a) R and S are transitive $\Rightarrow R \cup S$ is transitive

(b) R and S are transitive $\Rightarrow R \cap S$ is transitive

(c) R and S are symmetric $\Rightarrow R \cup S$ is symmetric

(d) R and S are reflexive $\Rightarrow R \cap S$ is reflexive

39. Let $A = \{1,2,3,4,5\}$; $B = \{2,3,6,7\}$. Then the number of elements in $(A \times B) \cap (B \times A)$ is
- 18
 - 6
 - 4
 - 0
40. In a college of 300 students, every student 5 newspaper and every newspaper is read by 60 students.
The no. of newspaper is
- At least 30
 - At most 20
 - Exactly 25
 - None of these
41. Let a relation R be defined by $R = \{(4,5); (1,4); (4,6); (7,6); (3,7)\}$ then $R^{-1} \circ R$ is
- $\{(1,1), (4,4), (4,7), (7,4), (7,7), (3,3)\}$
 - $\{(1,1), (4,4), (7,7), (3,3)\}$
 - $\{(1,5), (1,6), (3,6)\}$
 - None of these
42. Two fair dice are tossed. Let A be the event that the first die shows an even number and B be the event that second die shows an odd number. The two events A and B are
- Mutually exclusive
 - Independent and mutually exclusive
 - Dependent
 - None of these
43. The probabilities of a student getting I, II and III division in an examination are respectively $\frac{1}{10}, \frac{3}{5}$ and $\frac{1}{4}$. The probability that the student fail in the examination is
- $\frac{197}{200}$
 - $\frac{27}{200}$
 - $\frac{83}{100}$
 - None of these
44. If $(1 + 3p)/3, (1 - p)/4$ and $(1 - 2p)/2$ are the probabilities of three mutually exclusive events, then the set of all values of p is
- $\frac{1}{3} \leq p \leq \frac{1}{2}$
 - $\frac{1}{3} < p < \frac{1}{2}$

(c) $\frac{1}{2} \leq p \leq \frac{2}{3}$

(d) $\frac{1}{2} < p < \frac{2}{3}$

45. The probability that a leap year selected randomly will have 53 Sundays is

(a) $\frac{1}{7}$

(b) $\frac{2}{7}$

(c) $\frac{4}{53}$

(d) $\frac{4}{49}$

46. Three identical dice are rolled. The probability that same number will appear on each of them will be

(a) $\frac{1}{6}$

(b) $\frac{1}{36}$

(c) $\frac{1}{18}$

(d) $\frac{3}{28}$

47. Three of the six vertices of a regular hexagon are chosen at random. The probability that the triangle with these three vertices is equilateral, is equal to

(a) $\frac{1}{2}$

(b) $\frac{1}{5}$

(c) $\frac{1}{10}$

(d) $\frac{1}{20}$

48. Three distinct numbers are selected from 100 natural number. The probability that all the three numbers are divisible by 2 and 3 is

(a) $\frac{4}{25}$

(b) $\frac{4}{35}$

(c) $\frac{4}{55}$

(d) $\frac{4}{1155}$

49. If the mean of the distribution is 2.6, then the value of y is

Variate x	1	2	3	4	5
Frequency f of x	4	5	y	1	2

(a) 24

(b) 13

(c) 8

(d) 3

50. Mean of 100 items is 49 . It was discovered that three items which should have been 60,70,80 were wrongly read as 40,20,50 respectively. The correct mean is

(a) 48

(b) $82\frac{1}{2}$

(c) 50

(d) 80

51. The median of a set of 9 distinct observation is 20.5. If each of the largest 4 observation of the set is increased by 2 , then the median of the new set

(a) Is increased by 2

(b) Is decreased by 2

(c) Is two times the original median

(d) Remains the same as that of the original set

52. The probability that a man will be alive in 20 years is $\frac{3}{5}$ and the probability that his wife will be alive in 20 years is $\frac{2}{3}$. Then the probability that at least one will be alive in 20 years is

(a) $\frac{13}{15}$ (b) $\frac{7}{15}$ (c) $\frac{4}{15}$

(d) None of these

53. A coin is tossed three times in succession. If E is the event that there are at least two heads and F is the event in which first throw is a head, then $P\left(\frac{E}{F}\right) =$

(a) $\frac{3}{4}$ (b) $\frac{3}{8}$ (c) $\frac{1}{2}$ (d) $\frac{1}{8}$

54. In an experiment with 15 observations on x, the following results were available $\sum x^2 = 2830, \sum x = 170$. On observation that was 20 was found to be wrong and was replaced by the correct value 30 . Then the corrected variance is

(a) 78.00

(b) 188.66

(c) 177.33

(d) 8.33

55. The S.D. of a variate x is σ . The S.D. of the variate $\frac{ax+b}{c}$ where a, b, c are constant, is
- $\left(\frac{a}{c}\right) \sigma$
 - $\left|\frac{a}{c}\right| \sigma$
 - $\left(\frac{a^2}{c^2}\right) \sigma$
 - None of these
56. The value of co-variance of two variables x and y is $-\frac{148}{3}$ and the variance of x is $\frac{272}{3}$ and the variance of y is $\frac{131}{3}$. The coefficient of correlation is
- 0.48
 - 0.78
 - 0.87
 - None of these
57. For a bivariate distribution (x, y) if $\sum x = 50$, $\sum y = 60$, $\sum xy = 350$, $\bar{x} = 5$, $\bar{y} = 6$ variance of x is 4, variance of y is 9, then $r(x, y)$ is
- $5/6$
 - $5/36$
 - $11/3$
 - $11/18$
58. The two lines of regression are $2x - 7y + 6 = 0$ and $7x - 2y + 1 = 0$. The correlation coefficient between x and y is
- $-2/7$
 - $2/7$
 - $4/49$
 - None of these
59. The probability of happening an event A in one trial is 0.4. The probability that the event A happens at least once in three independent trials is
- 0.936
 - 0.784
 - 0.904
 - 0.216
60. The circular wire of diameter 10 cm is cut and placed along the circumference of a circle of diameter 1 metre. The angle subtended by the wire at the centre of the circle is equal to
- $\frac{\pi}{4}$ radian
 - $\frac{\pi}{3}$ radian

(c) $\frac{\pi}{5}$ radian

(d) $\frac{\pi}{10}$ radian

61. The value of $\sin^2 5^\circ + \sin^2 10^\circ + \sin^2 15^\circ + \dots + \sin^2 85^\circ + \sin^2 90^\circ$ is equal to

(a) 7

(b) 8

(c) 9

(d) $9\frac{1}{2}$

62. If $a \cos^3 \alpha + 3a \cos \alpha \sin^2 \alpha = m$ and $a \sin^3 \alpha + 3a \cos^2 \alpha \sin \alpha = n$, then $(m + n)^{\frac{2}{3}} +$

$(m - n)^{\frac{2}{3}}$ is equal to

(a) $2a^2$

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

(c) $2a^{\frac{2}{3}}$

(d) $2a^3$

63. If $\cos(\theta - \alpha) = a$, $\sin(\theta - \beta) = b$, then $\cos^2(a - \beta) + 2ab \sin(\alpha - \beta)$ is equal to

(a) $4a^2b^2$

(b) $a^2 - b^2$

(c) $a^2 + b^2$

(d) $-a^2b^2$

64. If $\sin A = n \sin B$, then $\frac{n-1}{n+1} \tan \frac{A+B}{2} =$

(a) $\sin \frac{d-8}{2}$

(b) $\tan \frac{A-B}{2}$

(c) $\cot \frac{d-8}{2}$

(d) None of these

65. If $x + \frac{1}{x} = 2 \cos \theta$, then $x^3 + \frac{1}{x^3} =$

(a) $\cos 3\theta$

(b) $2 \cos 3\theta$

(c) $\frac{1}{2} \cos 3\theta$

(d) $\frac{1}{3} \cos 3\theta$

66. If $\sin x + \operatorname{cosec} x = 2$, then $\sin^n x + \operatorname{cosec}^n x$ is equal to

(a) 2

(b) 2^n

(c) 2^{n-1}

(d) 2^{n-2}

67. If $\tan \theta = \frac{\sin \alpha - \cos \alpha}{\sin \alpha + \cos \alpha}$, then $\sin \alpha + \cos \alpha$ and $\sin \alpha - \cos \alpha$ must be equal to

- (a) $\sqrt{2}\cos \theta, \sqrt{2}\sin \theta$
- (b) $\sqrt{2}\sin \theta, \sqrt{2}\cos \theta$
- (c) $\sqrt{2}\sin \theta, \sqrt{2}\sin \theta$
- (d) $\sqrt{2}\cos \theta, \sqrt{2}\cos \theta$

68. If $\cos^6 \alpha + \sin^6 \alpha + K\sin^2 2\alpha = 1$, then $K =$

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

69. $\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ =$

- (a) $-3/16$
- (b) $5/16$
- (c) $3/16$
- (d) $-5/16$

70. The value of $\sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \sin \frac{7\pi}{14} \sin \frac{9\pi}{14} \sin \frac{11\pi}{14} \sin \frac{13\pi}{14}$ is equal to

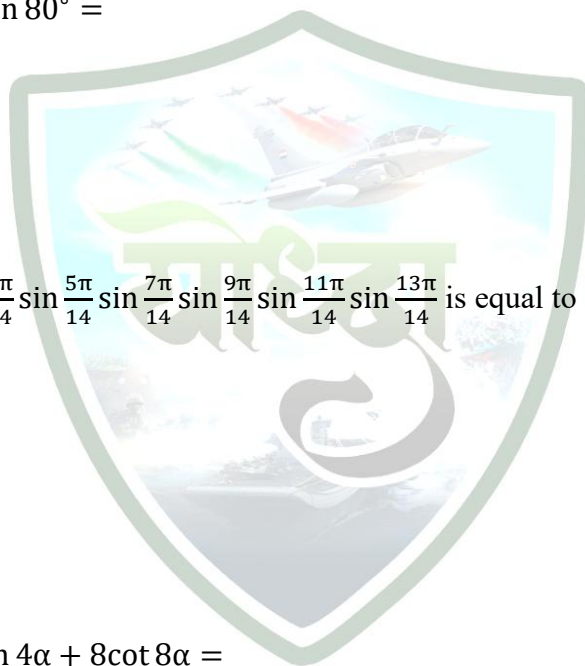
- (a) $\frac{1}{8}$
- (b) $\frac{1}{16}$
- (c) $\frac{1}{32}$
- (d) $\frac{1}{64}$

71. $\tan \alpha + 2\tan 2\alpha + 4\tan 4\alpha + 8\cot 8\alpha =$

- (a) $\tan \alpha$
- (b) $\tan 2\alpha$
- (c) $\cot \alpha$
- (d) $\cot 2\alpha$

72. $\sqrt{3}\operatorname{cosec} 20^\circ - \sec 20^\circ =$

- (a) 2
- (b) $\frac{2\sin 20^\circ}{\sin 40^\circ}$
- (c) 4
- (d) $\frac{4\sin 20^\circ}{\sin 40^\circ}$



73. $1 + \cos 56^\circ + \cos 58^\circ - \cos 66^\circ =$

- (a) $2\cos 28^\circ \cos 29^\circ \cos 33^\circ$
- (b) $4\cos 28^\circ \cos 29^\circ \cos 33^\circ$
- (c) $4\cos 28^\circ \cos 29^\circ \sin 33^\circ$
- (d) $2\cos 28^\circ \cos 29^\circ \sin 33^\circ$

74. If $x = \sin 130^\circ \cos 80^\circ$, $y = \sin 80^\circ \cos 130^\circ$, $z = 1 + xy$, which one of the following is true

- (a) $x > 0, y > 0, z > 0$
- (b) $x > 0, y < 0, 0 < z < 1$
- (c) $x > 0, y < 0, z > 1$
- (d) $x < 0, y < 0, 0 < z < 1$

75. If $\alpha, \beta, \gamma \in \left(0, \frac{\pi}{2}\right)$, then $\frac{\sin(\alpha+\beta+\gamma)}{\sin \alpha + \sin \beta + \sin \gamma}$ is

- (a) < 1
- (b) > 1
- (c) $= 1$
- (d) None of these

76. If $a \cos 2\theta + b \sin 2\theta = c$ has α and β as its solution, then the value of $\tan \alpha + \tan \beta$ is

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

77. What is the value of

$$\frac{\log_{\sqrt{\alpha\beta}}(H)}{\log_{\sqrt{\alpha\beta\gamma}}(H)} ?$$

- (a) $\log_{\alpha\beta}(\alpha)$
- (b) $\log_{\alpha}(\alpha\beta)$
- (c) $\log_{\alpha\beta}(\alpha\beta\gamma)$
- (d) $\log_{\alpha\beta}(\beta)$

78. The 59th term of an AP is 449 and the 449th term is 59. Which term is equal to 0 (zero)?

- (a) 501st term
- (b) 502nd term
- (c) 508th term
- (d) 509th term

79. For a set A , consider the following statements

1. $A \cup P(A) = P(A)$
2. $\{A\} \cap P(A) = A$
3. $P(A) - \{A\} = P(A)$

Where P denotes power set.

Which of the statement given above is/are correct?

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

80. What is the number of ways of arranging the letters of the word 'BANANA' so that no two N's appear together?

- (a) 40
- (b) 60
- (c) 80
- (d) 100

81. If the AM and HM of two numbers are 27 and 12 respectively, then what is their GM equal to?

- (a) 12
- (b) 18
- (c) 24
- (d) 27

82. If $A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$ then what is the value of $(A + B)$?

- (a) 0
- (b) $\frac{\pi}{4}$
- (c) $\frac{\pi}{2}$
- (d) π

83. What is the value of $\left(\frac{i+\sqrt{3}}{-i+\sqrt{3}}\right)^{200} + \left(\frac{i-\sqrt{3}}{i+\sqrt{3}}\right)^{200} + 1$?

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

84. The order of a set A is 3 and that of set B is 2. What is the number of relations from A to B ?

- (a) 4
- (b) 6
- (c) 32
- (d) 64

85. The function is

$f(x) = e^x, x \in \mathbb{R}$ is—

- (a) Antio byt not one-one
- (b) one-one into
- (c) one-one but not onto
- (d) neither one-one not onto

86. What is the maximum point on the curve $x = e^x y$?

- (a) (1, e)
- (b) (1, e^{-1})
- (c) (e , 1)
- (d) (e^{-1} , 1)

Directions—For the next 3 (three) questions to follow. The table below gives an incomplete frequency distribution with two missing frequencies f_1 and f_2

Value of x	Frequency
0	f_1
1	f_2
2	4
3	4
4	3

The total frequency is 18 and the arithmetic mean of x is 2.

87. What is the coefficient of variance?

- (a) $\frac{200}{3}$
- (b) $\frac{50\sqrt{5}}{9}$
- (c) $\frac{600}{\sqrt{5}}$
- (d) 150

88. What is the standard deviation?

- (a) $\frac{\sqrt{5}}{2}$
- (b) $\frac{\sqrt{5}}{3}$
- (c) $\frac{4}{3}$
- (d) $\frac{16}{4}$

89. What is the value of f_2 ?

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

90. The angle of elevation of the top of a flag post from a point 5 m away from its base is 75° . What is the approximate height of the flag post?

- (a) 15 m
- (b) 17 m
- (c) 19 m
- (d) 21 m

91. What is the sum of all natural numbers between 200 and 400 which are divisible by 7?

- (a) 6729
- (b) 8712
- (c) 8729
- (d) 9276

92. If $(A = P(\{1, 2\}))$ where (P) denotes the power set, then which one of the following is correct?

- (a) $\{1, 2\} \subset A$
- (b) $1 \in A$

(c) $\emptyset \in A$

(d) $\{1, 2\} \in A$

93. The mean and variance of a binomial distribution are 8 and 4 respectively. What is $P(X = 1)$ equal to?

(a) $\frac{1}{2^{12}}$

(b) $\frac{1}{2^8}$

(c) $\frac{1}{2^6}$

(d) $\frac{1}{2^4}$

94. An observed event B can occur after one of the three events A_1, A_2, A_3 . If $P(A_1) = P(A_2) = 0.4, P(A_3) = 0.2$ and $P\left(\frac{B}{A_i}\right) = 0.125$, what is the probability of A_1 after observing B ?

(a) $\frac{1}{3}$

(b) $\frac{20}{57}$

(c) $\frac{6}{19}$

(d) $\frac{2}{5}$

95. If $\frac{1}{2-\sqrt{-2}}$ is one of the roots of $ax^2 + bx + c = 0$ where a, b, c are real, then what are the values of a, b, c respectively?

(a) 6, -4, 1

(b) 4, 6, -1

(c) 3, -2, 1

(d) 6, 4, 1

96. If ω is a complex cube root of unity and $\omega^2 - \omega - 2$, then what is the value of $x^2 + 4x + 7$?

(a) -2

(b) 0

(c) -1

(d) 1

97. What is the principal value of $\operatorname{cosec}^{-1}(-\sqrt{2})$?

(a) $\frac{\pi}{4}$

(b) $\frac{\pi}{2}$

(c) $-\frac{\pi}{4}$

(d) 0

98. If $\cos x \neq -1$, then what is $\frac{\sin x}{1+\cos x}$ equal to?

(a) $-\cot \frac{x}{2}$

(b) $\cot \frac{x}{2}$

(c) $\tan \frac{x}{2}$

(d) $-\tan \frac{x}{2}$

99. If $x^2 + y^2 = 1$, then what is $\frac{1+x+iy}{1+x-iy}$ equal to?

(a) $x - iy$

(b) $x + iy$

(c) $2x$

(d) $-2iy$

100. If $f: R \rightarrow R$ and $g(x) = x + 3$ and $(f \circ g)(x) = (x + 3)^2$ then what is the value of $f(-3)$?
- (a) -9
(b) 0
(c) 9
(d) 9
101. If p and q are positive integers, which of the following equations has $p - \sqrt{q}$ as one of its roots?
- (a) $x^2 - 2px - (p^2 - q) = 0$
(b) $x^2 - 2px + (p^2 - q) = 0$
(c) $x^2 + 2px - (p^2 - q) = 0$
(d) $x^2 + 2px - (p^2 - q) = 0$
102. If $f(x) = kx^3 - 9x + 3$ is monotonically increasing in every interval, then which one of the following is correct?
- (a) $k < 3$
(b) $k > 3$
(c) $k \geq 3$
(d) $k \leq 3$
103. What is the value of $\frac{1+\tan 15^\circ}{1-\tan 15^\circ}$?
- (a) 1
(b) $\frac{1}{\sqrt{2}}$
(c) $\frac{1}{\sqrt{3}}$
(d) $\sqrt{3}$
104. If $\sin^{-1} \frac{12}{x} + \sin^{-1} \frac{5}{x} = \frac{\pi}{2}$ then what is the value of x ?
- (a) 1
(b) 7
(c) 13
(d) 17
105. Let X be the set of all graduates in India. Elements x and y in X are said to be related if they are graduates of the same university. Which one of the following statements is correct?
- (a) Relation is symmetric and transitive only
(b) Relation is reflexive and transitive only
(c) Relation is reflexive and symmetric only
(d) Relation is reflexive, symmetric and transitive
106. 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) $(\alpha^5 + \beta^5) = (\alpha\beta)^5$
(c) $(\alpha^6 + \beta^6) = 0$
(d) $(\alpha^8 + \beta^8) = (\alpha\beta)^8$

107. If angles A, B, C are in AP, then what is $\sin A + 2\sin B + \sin C$ equal to?

- (a) $4 \sin B \cos^2 \left(\frac{A-C}{2} \right)$
- (b) $4 \sin B \cos^2 \left(\frac{A-C}{4} \right)$
- (c) $4 \sin(2B) \cos^2 \left(\frac{A-C}{2} \right)$
- (d) $4 \sin(2B) \cos^2 \left(\frac{A-C}{4} \right)$

108. If the product of the roots of the equation $x^2 - 5x + k = 15$ is -3, then what is the value of k?

- (a) 12
- (b) 15
- (c) 16
- (d) 18

109. What is the value of $\sqrt{3} \operatorname{cosec} 20^\circ - \sec 20^\circ$?

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

110. If $A = \{a, b, c, d\}$, then what is the number of proper subsets of A?

- (a) 16
- (b) 15
- (c) 14
- (d) 12

111. Let a, b, c are in AP.

1. $\frac{1}{ab}, \frac{1}{ca}, \frac{1}{bc}$ are in AP.
2. $\frac{1}{\sqrt{b}+\sqrt{c}}, \frac{1}{\sqrt{c}+\sqrt{a}}, \frac{1}{\sqrt{a}+\sqrt{b}}$ are in AP.

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

112. What is the number of three-digit odd numbers formed by using the digits 1, 2, 3, 4, 5, 6 if repetition of digits is allowed?

- (a) 60
- (b) 108
- (c) 120
- (d) 216

113. What is $\tan \left(7\frac{1}{2} \right)$ equal to?

- (a) $\sqrt{6} + \sqrt{3} - \sqrt{2} + 2$
- (b) $\sqrt{6} + \sqrt{3} + \sqrt{2} + 2$
- (c) $\sqrt{6} - \sqrt{3} + \sqrt{2} - 2$
- (d) $\sqrt{6} + \sqrt{3} + \sqrt{2} - 2$

114. What is the value of $\frac{\cos 15^\circ + \cos 45^\circ}{\cos^3 15^\circ + \cos^3 45^\circ}$?

- (a) $\frac{1}{4}$
- (b) $\frac{1}{2}$
- (c) $\frac{1}{3}$
- (d) None of these

115. If p times the p th term of an AP q times the q th term, then what is the $(p+q)$ th term equal to?

- (a) $p+q$
- (b) pq
- (c) 1
- (d) 0

116. A team of 8 players is to be chosen from a group of 12 players. Out of the eight players one is to be elected as captain and another as vice-captain. In how many ways can this be done?

- (a) 7720
- (b) 27720
- (c) 6330
- (d) 495

117. What is the sum of the coefficients of all the terms in the expansion of $(45x - 49)^4$?

- (a) -256
- (b) -100
- (c) 100
- (d) 256

118. Two balls are selected from a box containing 2 blue and 7 red balls. What is the probability that at least one ball is blue?

- (a) $\frac{2}{9}$
- (b) $\frac{7}{9}$
- (c) $\frac{15}{12}$
- (d) $\frac{5}{12}$

119. The probability of guessing a correct answer is $\frac{x}{12}$. If the probability of not guessing the correct answer is $\frac{2}{3}$, then what is x equal to?

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

120. If p and q are the roots of the equation $x^2 - px + q = 0$, then what are the values of p and q respectively?

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