DO NOT OPEN THIS TEST BOOKLET

C.B.C. : DFRG-S-MTH

TEST BOOKLET

MATHEMATICS

B

Maximum Marks : 300

Time Allowed : Two Hours and Thirty Minutes

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET *DOES NOT* HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.**
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. *DO NOT* write ***anything else*** on the Test Booklet.
4. This Test Booklet contains 120 items (questions). Each item is printed both in **Hindi** and **English**. Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose *ONLY ONE* response for each item.
5. You have to mark all your responses *ONLY* on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong Answers :**

THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.

(i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.

(ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.

(iii) If a question is left blank, i.e., no answer is given by the candidate, there will be no penalty for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

ध्यान दें : अनुदेशों का हिन्दी रूपान्तर इस पुस्तिका के मुखपृष्ठ पर छपा है।

1. What is the value of $\operatorname{cosec}\left(-\frac{73\pi}{3}\right)$?

(a) $\frac{2}{\sqrt{3}}$

(b) $-\frac{2}{\sqrt{3}}$

(c) 2

(d) –2

2. What is the value of

$$\cos\left(\frac{5\pi}{17}\right)+\cos\left(\frac{7\pi}{17}\right)+2\cos\left(\frac{11\pi}{17}\right)\cos\left(\frac{\pi}{17}\right)\ ?$$

(a) 0

(b) 1

(c) $4\cos\left(\frac{6\pi}{17}\right)\cos\left(\frac{\pi}{17}\right)$

(d) $4\cos\left(\frac{11\pi}{17}\right)\cos\left(\frac{\pi}{17}\right)$

3. What is the value of $\tan\left(\frac{3\pi}{8}\right)$?

(a) $\sqrt{2}-1$

(b) $\sqrt{2}+1$

(c) $1-\sqrt{2}$

(d) $-(\sqrt{2}+1)$

4. What is $\tan^{-1}\cot(\operatorname{cosec}^{-1}2)$ equal to ?

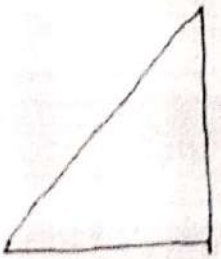
(a) $\frac{\pi}{8}$

(b) $\frac{\pi}{6}$

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

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

5. In a triangle ABC, $a=4$, $b=3$, $c=2$. What is cos3C equal to ?



(a) $\frac{7}{128}$

(b) $\frac{11}{128}$

(c) $\frac{7}{64}$

(d) $\frac{11}{64}$

6. What is $\cos36^\circ - \cos72^\circ$ equal to ?

(a) $\frac{\sqrt{5}}{2}$

(b) $-\frac{\sqrt{5}}{2}$

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

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

7. If $\sec x = \frac{25}{24}$ and x lies in the fourth quadrant, then what is the value of $\tan x + \sin x$?

(a) $-\frac{625}{168}$

(b) $-\frac{343}{600}$

(c) $\frac{625}{168}$

(d) $\frac{343}{600}$

8. What is the value of $\tan^2 165^\circ + \cot^2 165^\circ$?

(a) 7

(b) 14

(c) $11\frac{1}{2}$

(d) $8\sqrt{3}$

9. What is the value of

$$\sin\left(2n\pi + \frac{5\pi}{6}\right)\sin\left(2n\pi - \frac{5\pi}{6}\right),$$

where $n \in Z$?

(a) $-\frac{1}{4}$

(b) $-\frac{3}{4}$

(c) $\frac{1}{4}$

(d) $\frac{3}{4}$

10. If $1 + 2(\sin x + \cos x)(\sin x - \cos x) = 0$ where $0 < x < 360^\circ$, then how many values does x take ?

(a) Only one value

(b) Only two values

(c) Only three values

(d) Four values

11. Consider the following statements in respect of the line passing through origin and inclining at an angle of 75° with the positive direction of x-axis :

1. The line passes through the point $\left(1, \frac{1}{2-\sqrt{3}}\right)$.

2. The line entirely lies in first and third quadrants.

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

12. If $P(3, 4)$ is the mid-point of a line segment between the axes, then what is the equation of the line ?

(a) $3x + 4y - 25 = 0$

(b) $4x + 3y - 24 = 0$

(c) $4x - 3y = 0$

(d) $3x - 4y + 7 = 0$

13. The base AB of an equilateral triangle ABC with side 8 cm lies along the y-axis such that the mid-point of AB is at the origin and B lies above the origin. What is the equation of line passing through (8, 0) and parallel to the side AC?

(a) $x-\sqrt{3}y-8=0$

(b) $x+\sqrt{3}y-8=0$

(c) $\sqrt{3}x+y-8\sqrt{3}=0$

(d) $\sqrt{3}x-y-8\sqrt{3}=0$

14. The centre of the circle passing through origin and making positive intercepts 4 and 6 on the coordinate axes, lies on the line

(a) $2x-y+1=0$

(b) $3x-2y-1=0$

(c) $3x-4y+6=0$

(d) $2x+3y-26=0$

15. The centre of an ellipse is at (0, 0), major axis is on the y-axis. If the ellipse passes through (3, 2) and (1, 6), then what is its eccentricity?

(a) $\frac{\sqrt{3}}{2}$

(b) $\sqrt{3}$

(c) $\frac{\sqrt{5}}{2}$

(d) $\sqrt{5}$

Consider the following for the next three (03) items that follow:

Let $f(x)$ be a function satisfying $f(x+y)=f(x)f(y)$ for all $x, y \in N$ such that $f(1)=2$:

16. If $\sum_{x=2}^{n} f(x)=2044$, then what is the value of n?

(a) 8

(b) 9

(c) 10

(d) 11

17. What is $\sum_{x=1}^{5} f(2x-1)$ equal to?

(a) 341

(b) 682

(c) 1023

(d) 1364

18. What is $\sum_{x=1}^{6} 2^x f(x)$ equal to?

(a) 1365

(b) 2730

(c) 4024

(d) 5460

Consider the following for the next three (03) items that follow :

A university awarded medals in basket ball, football and volleyball. Only x students ($x < 6$) got medal in all the three sports and the medals went to a total of $15x$ students. It awarded $5x$ medals in basketball, $(4x + 15)$ medals in football and $(x + 25)$ medals in volleyball.

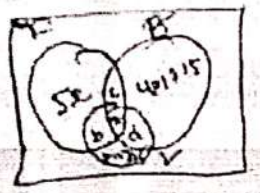
19. How many received medals in exactly two of the three sports ?

(a) $30 - 4x$

(b) $35 - 7x$

(c) $40 - 7x$

(d) $45 - 5x$



20. How many received medals in at least two of three sports ?

(a) $30 - 6x$

(b) $35 - 6x$

(c) $40 - 5x$

(d) $40 - 6x$

21. How many received medals in exactly one of three sports ?

(a) $21x - 40$

(b) $21x - 35$

(c) $20x - 35$

(d) $20x - 25$

Consider the following for the next three (03) items that follow :

Let $A = \begin{pmatrix} 0 & \sin^2\theta & \cos^2\theta \\ \cos^2\theta & 0 & \sin^2\theta \\ \sin^2\theta & \cos^2\theta & 0 \end{pmatrix}$ and

$A = P + Q$ where P is symmetric matrix and Q is skew-symmetric matrix.

22. What is P equal to ?

(a) $\begin{pmatrix} 0 & 1/2 & 1/2 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{pmatrix}$

(b) $\begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix}$

(c) $\cos 2\theta \begin{pmatrix} 0 & -1 & 1 \\ 1 & 0 & -1 \\ -1 & 1 & 0 \end{pmatrix}$

(d) $\cos 2\theta \begin{pmatrix} 0 & -1/2 & 1/2 \\ 1/2 & 0 & -1/2 \\ -1/2 & 1/2 & 0 \end{pmatrix}$

23. What is Q equal to ?

(a) $\begin{pmatrix} 0 & 1/2 & 1/2 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{pmatrix}$

(b) $\begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix}$

(c) $\cos 2\theta \begin{pmatrix} 0 & -1 & 1 \\ 1 & 0 & -1 \\ -1 & 1 & 0 \end{pmatrix}$

(d) $\cos 2\theta \begin{pmatrix} 0 & -1/2 & 1/2 \\ 1/2 & 0 & -1/2 \\ -1/2 & 1/2 & 0 \end{pmatrix}$

24. What is the minimum value of determinant of A ?

(a) $\frac{1}{4}$

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

(c) $\frac{3}{4}$

(d) 1

Consider the following for the next three (03) items that follow :

ABC is a triangular plot with $AB = 16$ m, $BC = 10$ m and $CA = 10$ m. A lamp post is situated at the middle point of the side AB. The lamp post subtends an angle $45°$ at the vertex B.

25. What is the height of the lamp post ?

(a) 6 m

(b) 7 m

(c) 8 m

(d) 9 m

26. What is $\frac{AB}{\sin C}$ equal to ?

(a) 17 m

(b) $\frac{50}{3}$ m

(c) $\frac{40}{3}$ m

(d) 16 m

27. What is $\cos A + \cos B + \cos C$ equal to ?

(a) 1

(b) $\frac{41}{25}$

(c) $\frac{37}{25}$

(d) $\frac{33}{25}$

Consider the following for the next three (03) items that follow :

There are two points P and Q due south of a leaning tower, which leans towards north. P is at a distance x and Q is at a distance y from the foot of the tower $(x > y)$. The angles of elevation of the top of the tower from P and Q are $15°$ and $75°$ respectively.

28. At what height is the top of the tower above the ground level ?

(a) $\frac{x-y}{2\sqrt{3}}$

(b) $\frac{x-y}{4\sqrt{3}}$

(c) $\frac{x-y}{4}$

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

29. If θ is the inclination of the tower to the horizontal, then what is $\cot\theta$ equal to ?

(a) $2+\frac{\sqrt{3}(x-y)}{x+y}$

(b) $2-\frac{\sqrt{3}(x-y)}{x+y}$

(c) $2+\frac{\sqrt{3}(x+y)}{x-y}$

(d) $2-\frac{\sqrt{3}(x+y)}{x-y}$

30. What is the length of the tower ?

(a) $\frac{x-y}{2\sqrt{3}}\sqrt{1+\left\{2+\frac{\sqrt{3}(x+y)}{x-y}\right\}^2}$

(b) $\frac{x-y}{2\sqrt{3}}\sqrt{1+\left\{2-\frac{\sqrt{3}(x+y)}{x-y}\right\}^2}$

(c) $\frac{x-y}{4\sqrt{3}}\sqrt{1+\left\{2+\frac{\sqrt{3}(x+y)}{x-y}\right\}^2}$

(d) $\frac{x-y}{4\sqrt{3}}\sqrt{1+\left\{2-\frac{\sqrt{3}(x+y)}{x-y}\right\}^2}$

Consider the following for the next three (03) items that follow :

Let $z=\frac{1+i\sin\theta}{1-i\sin\theta}$ where $i=\sqrt{-1}$

31. What is the modulus of z ?

(a) 1

(b) $\sqrt{2}$

(c) $1+\sin^2\theta$

(d) $\frac{1+\sin^2\theta}{1-\sin^2\theta}$

32. What is angle θ such that z is purely real ?

(a) $\frac{n\pi}{2}$

(b) $\frac{(2n+1)\pi}{2}$

(c) $n\pi$

(d) $2n\pi$ only

where n is an integer

33. What is angle θ such that z is purely imaginary ?

(a) $\frac{n\pi}{2}$

(b) $\frac{(2n+1)\pi}{2}$

(c) $n\pi$

(d) $2n\pi$

where n is an integer

Consider the following for the next three (03) items that follow :

Let P be the sum of first n positive terms of an increasing arithmetic progression A. Let Q be the sum of first n positive terms of another increasing arithmetic progression B. Let $P : Q = (5n + 4) : (9n + 6)$

34. What is the ratio of the first term of A to that of B ?

(a) 1/3

(b) 2/5

(c) 3/4

(d) 3/5

35. What is the ratio of their 10th terms ?

(a) 11/29

(b) 22/49

(c) 33/59

(d) 44/69

36. If d is the common difference of A, and D is the common difference of B, then which one of the following is always correct ?

(a) $D > d$

(b) $D < d$

(c) $7D > 12d$

(d) None of the above

Consider the following for the next three (03) items that follow :

Consider the binomial expansion of $(p + qx)^9$:

37. What is the value of q if the coefficients of x^3 and x^6 are equal ?

(a) p

(b) $9p$

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

(d) p^2

38. What is the ratio of the coefficients of middle terms in the expansion (when expanded in ascending powers of x) ?

(a) pq

(b) p/q

(c) $4p/5q$

(d) $1/(pq)$

39. Under what condition the coefficients of x^2 and x^4 are equal ?

(a) $p : q = 7 : 2$

(b) $p^2 : q^2 = 7 : 2$

(c) $p : q = 2 : 7$

(d) $p^2 : q^2 = 2 : 7$

Consider the following for the next three (03) items that follow :

Consider the word 'QUESTION' :

40. How many 4-letter words each of two vowels and two consonants with or without meaning, can be formed ?

(a) 36

(b) 144

(c) 576

(d) 864

41. How many 8-letter words with or without meaning, can be formed such that consonants and vowels occupy alternate positions ?

(a) 288

(b) 576

(c) 1152

(d) 2304

42. How many 8-letter words with or without meaning, can be formed so that all consonants are together ?

(a) 5760

(b) 2880

(c) 1440

(d) 720

Consider the following for the next three (03) items that follow :

Let Δ be the determinant of a matrix A, where $A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$ and C_{11}, C_{12}, C_{13} be the cofactors of a_{11}, a_{12}, a_{13} respectively.

43. What is the value of $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13}$?

(a) 0

(b) 1

(c) Δ

(d) $-\Delta$

44. What is the value of $a_{21}C_{11} + a_{22}C_{12} + a_{23}C_{13}$?

(a) 0

(b) 1

(c) Δ

(d) $-\Delta$

45. What is the value of $\begin{vmatrix} a_{21} & a_{31} & a_{11} \\ a_{23} & a_{33} & a_{13} \\ a_{22} & a_{32} & a_{12} \end{vmatrix}$?

(a) 0

(b) 1

(c) Δ

(d) $-\Delta$

46. How many four-digit natural numbers are there such that all of the digits are odd ?

(a) 625

(b) 400

(c) 196

(d) 120

47. What is $\sum_{r=0}^{n} 2^r C(n, r)$ equal to ?

(a) 2^n

(b) 3^n

(c) 2^{2n}

(d) 3^{2n}

48. If different permutations of the letters of the word 'MATHEMATICS' are listed as in a dictionary, how many words (with or without meaning) are there in the list before the first word that starts with C?

(a) 302400

(b) 403600

(c) 907200

(d) 1814400

49. Consider the following statements :

1. If f is the subset of $Z \times Z$ defined by $f = \{(xy, x-y); x, y \in Z\}$, then f is a function from Z to Z.

2. If f is the subset of $N \times N$ defined by $f = \{(xy, x+y); x, y \in N\}$, then f is a function from N to N.

Which of the statements given above is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

50. Consider the determinant

$$\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}.$$

If $a_{13} = yz$, $a_{23} = zx$, $a_{33} = xy$ and the minors of a_{13}, a_{23}, a_{33} are respectively $(z-y)$, $(z-x)$, $(y-x)$ then what is the value of Δ?

(a) $(z-y)(z-x)(y-x)$

(b) $(x-y)(y-z)(x-z)$

(c) $(x-y)(z-x)(y-z)(x+y+z)$

(d) $(xy+yz+zx)(x+y+z)$

51. If $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & \sin\theta & -\cos\theta \end{pmatrix}$, then which of the following are correct?

1. $A + adjA$ is a null matrix

2. $A^{-1} + adjA$ is a null matrix

3. $A - A^{-1}$ is a null matrix

Select the correct answer using the code given below :

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

52. If X is a matrix of order 3×3, Y is a matrix of order 2×3 and Z is a matrix of order 3×2, then which of the following are correct ?

1. $(ZY)X$ is a square matrix having 9 entries.
2. $Y(XZ)$ is a square matrix having 4 entries.
3. $X(YZ)$ is not defined.

Select the correct answer using the code given below :

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

53. For how many quadratic equations, the sum of roots is equal to the product of roots ?

(a) 0
(b) 1
(c) 2
(d) Infinitely many

54. Consider the following statements :

1. The set of all irrational numbers between $\sqrt{2}$ and $\sqrt{5}$ is an infinite set.
2. The set of all odd integers less than 100 is a finite set.

Which of the statements given above is/are correct ?

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

55. Consider the following statements :

1. $2+4+6+\ldots+2n = n^2+n$
2. The expression n^2+n+41 always gives a prime number for every natural number n

Which of the above statements is/are correct ?

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

56. Let $p, q\ (p>q)$ be the roots of the quadratic equation $x^2+bx+c=0$ where $c>0$. If $p^2+q^2-11pq=0$, then what is $p-q$ equal to ?

(a) $3\sqrt{c}$
(b) $3c$
(c) $9\sqrt{c}$
(d) $9c$

57. What is the diameter of a circle inscribed in a regular polygon of 12 sides, each of length 1 cm ?

(a) $1+\sqrt{2}$ cm
(b) $2+\sqrt{2}$ cm
(c) $2+\sqrt{3}$ cm
(d) $3+\sqrt{3}$ cm

58. Let $A = \{7, 8, 9, 10, 11, 12, 13, 14, 15, 16\}$ and let $f: A \to N$ be defined by $f(x)$ = the highest prime factor of x. How many elements are there in the range of f?

(a) 4

(b) 5

(c) 6

(d) 7

59. Let R be a relation from N to N defined by $R = \{(x, y) : x, y \in N \text{ and } x^2 = y^3\}$. Which of the following are *not* correct?

1. $(x, x) \in R$ for all $x \in N$
2. $(x, y) \in R \Rightarrow (y, x) \in R$
3. $(x, y) \in R$ and $(y, z) \in R \Rightarrow (x, z) \in R$

Select the correct answer using the code given below:

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

60. Consider the following:

1. $A \cap B = A \cap C \Rightarrow B = C$
2. $A \cup B = A \cup C \Rightarrow B = C$

Which of the above is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

61. Three fair dice are tossed once. What is the probability that they show different numbers that are in AP?

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

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

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

(d) $\frac{1}{72}$

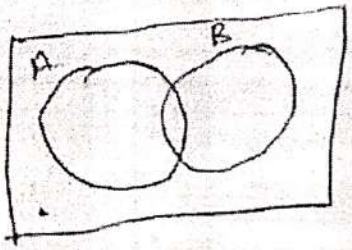
62. If $P(A) = 0{\cdot}5$, $P(B) = 0{\cdot}7$ and $P(A \cap B) = 0{\cdot}3$, then what is the value of $P(A' \cap B') + P(A' \cap B) + P(A \cap B')$?

(a) 0·6

(b) 0·7

(c) 0·8

(d) 0·9



63. Five coins are tossed once. What is the probability of getting at most four tails?

(a) $\frac{31}{32}$

(b) $\frac{15}{16}$

(c) $\frac{29}{32}$

(d) $\frac{7}{8}$

64. Three fair dice are thrown. What is the probability of getting a total greater than or equal to 15?

(a) $\frac{19}{216}$

(b) $\frac{1}{12}$

(c) $\frac{17}{216}$

(d) $\frac{5}{54}$

65. The probability that a person hits a target is 0·5. What is the probability of at least one hit in 4 shots?

(a) $\frac{1}{8}$

(b) $\frac{1}{16}$

(c) $\frac{15}{16}$

(d) $\frac{7}{8}$

66. A box contains 2 white balls, 3 black balls and 4 red balls. What is the number of ways of drawing 3 balls from the box with at least one black ball?

(a) 84

(b) 72

(c) 64

(d) 48

67. During war one ship out of 5 was sunk on an average in making a certain voyage. What is the probability that exactly 3 out of 5 ships would arrive safely?

(a) $\frac{16}{625}$

(b) $\frac{32}{625}$

(c) $\frac{64}{625}$

(d) $\frac{128}{625}$

68. A card is drawn from a pack of 52 cards. A gambler bets that it is either a spade or an ace. The odds against his winning are

(a) 9 : 4

(b) 35 : 17

(c) 17 : 35

(d) 4 : 9

69. The coefficient of correlation between ages of husband and wife at the time of marriage for a given set of 100 couples was noted to be 0·7. Assume that all these couples survive to celebrate the silver jubilee of their marriage. The coefficient of correlation at that point of time will be

(a) 1

(b) 0·9

(c) 0·7

(d) 0·3

70. The completion of a construction job may be delayed due to strike. The probability of strike is 0·6. The probability that the construction job gets completed on time if there is no strike is 0·85 and the probability that the construction job gets completed on time if there is a strike is 0·35. What is the probability that the construction job will not be completed on time ?

(a) 0·35

(b) 0·45

(c) 0·55

(d) 0·65

Consider the following for the next two (02) items that follow :

The mean and standard deviation (SD) of marks obtained by 50 students of a class in 4 subjects are given below :

Subject	Mathematics	Physics	Chemistry	Biology
Mean Marks	40	28	38	36
SD	15	12	14	16

71. Which one of the following subjects shows highest variability of marks ?

(a) Mathematics

(b) Physics

(c) Chemistry

(d) Biology

72. What is the coefficient of variation of marks in Mathematics ?

(a) 37·5%

(b) 38·0%

(c) 38·5%

(d) 39·0%

Consider the following for the next three (03) items that follow :

Consider the following grouped frequency distribution :

Class	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	1	2	4	6	4	3

73. What is the median of the distribution ?

(a) 34

(b) 34·5

(c) 35

(d) 35·5

74. What is mean deviation about the median ?

(a) 11·4

(b) 11·1

(c) 10·8

(d) 10·5

75. What is the mean deviation about the mean ?

(a) 10·15

(b) 10·65

(c) 11·15

(d) 11·65

76. Under which one of the following conditions does the function
$f(x) = (p \sec x)^2 + (q \operatorname{cosec} x)^2$
attain minimum value ?

(a) $\tan^2 x = \frac{q}{p}$

(b) $\cot^2 x = \frac{q}{p}$

(c) $\tan^2 x = pq$

(d) $\cot^2 x = pq$

77. Where does the function
$f(x) = \sum_{j=1}^{7} (x-j)^2$
attain its minimum value ?

(a) $x = 3{\cdot}5$

(b) $x = 4$

(c) $x = 4{\cdot}5$

(d) $x = 5$

78. Consider the following statements in respect of the function

$$f(x) = \begin{cases} |x|+1, & 0 < |x| \le 3 \\ 1, & x = 0 \end{cases}$$

1. The function attains maximum value only at $x = 3$
2. The function attains local minimum only at $x = 0$

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

79. What is $\int_0^1 \ln\left(\frac{1}{x} - 1\right) dx$ equal to ?

(a) -1

(b) 0

(c) 1

(d) $\ln 2$

80. If $\int_0^{\pi/2} (\sin^4 x + \cos^4 x) dx = k$, then what is the value of $\int_0^{20\pi} (\sin^4 x + \cos^4 x) dx$?

(a) k

(b) $10k$

(c) $20k$

(d) $40k$

81. What is $\int_{-\pi/2}^{\pi/2} (e^{\cos x} \sin x + e^{\sin x} \cos x) dx$ equal to ?

(a) $\frac{e^2 - 1}{e}$

(b) $\frac{e^2 + 1}{e}$

(c) $\frac{1 - e^2}{e}$

(d) 0

82. What is the area of the region enclosed in the first quadrant by $x^2 + y^2 = \pi^2$, $y = \sin x$ and $x = 0$?

(a) $\frac{\pi^3}{4} - 1$

(b) $\frac{\pi^3}{4} - 2$

(c) $\frac{\pi^3}{2} - 1$

(d) $\frac{\pi^2}{4} - 2$

83. Consider the following statements :

1. The degree of the differential equation $\frac{dy}{dx}+\cos\left(\frac{dy}{dx}\right)=0$ is 1.

2. The order of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3+\cos\left(\frac{dy}{dx}\right)=0$ is 2.

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

84. What is the differential equation of the family of parabolas having vertex at origin and axis along positive y-axis ?

(a) $x\frac{dy}{dx}+2y=0$

(b) $x\frac{dy}{dx}-2y=0$

(c) $y\frac{dx}{dy}+2x=0$

(d) $y\frac{dx}{dy}-2x=0$

85. What is the solution of the differential equation $(dy-dx)+\cos x(dy+dx)=0$?

(a) $y=\tan\left(\frac{x}{2}\right)-x+c$

(b) $y=\frac{1}{2}\tan\left(\frac{x}{2}\right)-x+c$

(c) $y=2\tan\left(\frac{x}{2}\right)-x+c$

(d) $y=\tan\left(\frac{x}{2}\right)-2x+c$

86. Let x be the mean of squares of first n natural numbers and y be the square of mean of first n natural numbers. If $\frac{x}{y}=\frac{55}{42}$, then what is the value of n ?

(a) 24

(b) 25

(c) 27

(d) 30

87. What is the probability of getting a composite number in the list of natural numbers from 1 to 50 ?

(a) $\frac{7}{10}$

(b) $\frac{17}{25}$

(c) $\frac{18}{25}$

(d) $\frac{33}{50}$

88. If $n > 7$, then what is the probability that $C(n, 7)$ is a multiple of 7 ?

(a) 0

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

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

(d) 1

89. Two numbers x and y are chosen at random from a set of first 10 natural numbers. What is the probability that $(x+y)$ is divisible by 4 ?

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

(b) $\frac{2}{9}$

(c) $\frac{8}{45}$

(d) $\frac{7}{45}$

90. A number x is chosen at random from first n natural numbers. What is the probability that the number chosen satisfies $x + \frac{1}{x} > 2$?

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

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

(c) $\frac{(n-1)}{n}$

(d) 1

91. What is $\int \frac{(\cos x)^{1.5} - (\sin x)^{1.5}}{\sqrt{\sin x \cdot \cos x}} dx$ equal to ?

(a) $\sqrt{\sin x} - \sqrt{\cos x} + c$

(b) $\sqrt{\sin x} + \sqrt{\cos x} + c$

(c) $2\sqrt{\sin x} + 2\sqrt{\cos x} + c$

(d) $\frac{1}{2}\sqrt{\sin x} + \frac{1}{2}\sqrt{\cos x} + c$

92. If $y = \frac{x\sqrt{x^2-16}}{2} - 8\ln\left|x + \sqrt{x^2-16}\right|$, then what is $\frac{dy}{dx}$ equal to ?

(a) $x\sqrt{x^2-16}$

(b) $x - \sqrt{x^2-16}$

(c) $\sqrt{x^2-16}$

(d) $4\sqrt{x^2-16}$

93. If $y = (x^x)^x$, then which one of the following is correct ?

(a) $\frac{dy}{dx} + xy(1+2\ln x) = 0$

(b) $\frac{dy}{dx} - xy(1+2\ln x) = 0$

(c) $\frac{dy}{dx} - 2xy(1+\ln x) = 0$

(d) $\frac{dy}{dx} + 2xy(1+\ln x) = 0$

94. What is the maximum value of $3(\sin x - \cos x) + 4(\cos^3 x - \sin^3 x)$?

(a) 1

(b) $\sqrt{2}$

(c) $\sqrt{3}$

(d) 2

95. What is the area of the region (in the first quadrant) bounded by $y = \sqrt{1-x^2}$, $y = x$ and $y = 0$?

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

(b) $\frac{\pi}{6}$

(c) $\frac{\pi}{8}$

(d) $\frac{\pi}{12}$

96. What is the area of the region bounded by $x - |y| = 0$ and $x - 2 = 0$?

(a) 1

(b) 2

(c) 4

(d) 8

97. If $f(\alpha) = \sqrt{\sec^2\alpha - 1}$, then what is $\frac{f(\alpha) + f(\beta)}{1 - f(\alpha)f(\beta)}$ equal to ?

(a) $f(\alpha - \beta)$

(b) $f(\alpha + \beta)$

(c) $f(\alpha)f(\beta)$

(d) $f(\alpha\beta)$

98. If $f(x) = \ln(x + \sqrt{1+x^2})$, then which one of the following is correct ?

(a) $f(x) + f(-x) = 0$

(b) $f(x) - f(-x) = 0$

(c) $2f(x) = f(-x)$

(d) $f(x) = 2f(-x)$

99. What is $\lim_{x \to 0} \frac{x}{\sqrt{1-\cos 4x}}$ equal to ?

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

(b) $-\frac{1}{2\sqrt{2}}$

(c) $\sqrt{2}$

(d) Limit does not exist

100. What is $\lim_{x \to \frac{\pi}{2}} \frac{4x - 2\pi}{\cos x}$ equal to ?

(a) -4

(b) -2

(c) 2

(d) 4

101. If $f(x) = \frac{x^2 + x + |x|}{x}$, then what is $\lim_{x \to 0} f(x)$ equal to ?

(a) 0

(b) 1

(c) 2

(d) $\lim_{x \to 0} f(x)$ does not exist

102. What is $\lim_{h\to 0}\frac{\sin^2(x+h)-\sin^2 x}{h}$ equal to ?

(a) $\sin^2 x$

(b) $\cos^2 x$

(c) $\sin 2x$

(d) $\cos 2x$

103. Let $f(x)$ be a function such that $f'(x) = g(x)$ and $f''(x) = -f(x)$. Let $h(x) = \{f(x)\}^2 + \{g(x)\}^2$. Then consider the following statements :

1. $h'(3) = 0$
2. $h(1) = h(2)$

Which of the statements given above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

104. If $y = \ln^2\left(\frac{x^2-x+1}{x^2+x+1}\right)$, then what is $\frac{dy}{dx}$ at $x=0$ equal to ?

(a) -2

(b) 0

(c) 1

(d) 2

105. If $\frac{d}{dx}\left(\frac{1+x^4+x^8}{1-x^2+x^4}\right) = ax+bx^3$, then which one of the following is correct ?

(a) $a=b$

(b) $a=2b$

(c) $a+b=0$

(d) $2a=b$

106. An equilateral triangle is inscribed in a parabola $x^2=\sqrt{3}y$ where one vertex of the triangle is at the vertex of the parabola. If p is the length of side of the triangle and q is the length of the latus rectum, then which one of the following is correct ?

(a) $p=q$

(b) $p=\sqrt{3}q$

(c) $p=2\sqrt{3}q$

(d) $2\sqrt{3}p=q$

107. Consider the points $A(2, 4, 6)$, $B(-2, -4, -2)$, $C(4, 6, 4)$ and $D(8, 14, 12)$. Which of the following statements is/are correct ?

1. The points are the vertices of a rectangle $ABCD$.
2. The mid-point of AC is the same as that of BD.

Select the correct answer using the code given below :

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

108. Consider the equation of a sphere $x^2+y^2+z^2-4x-6y-8z-16=0$. Which of the following statements is/are correct ?

1. z-axis is tangent to the sphere.
2. The centre of the sphere lies on the plane $x+y+z-9=0$.

Select the correct answer using the code given below :

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

109. A plane cuts intercepts 2, 2, 1 on the coordinate axes. What are the direction cosines of the normal to the plane ?

(a) <2/3, 2/3, 1/3>

(b) <1/3, 2/3, 2/3>

(c) $\left\langle \frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}} \right\rangle$

(d) $\left\langle \frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}} \right\rangle$

110. Consider the following statements :

1. The direction ratios of y-axis can be <0, 4, 0>
2. The direction ratios of a line perpendicular to z-axis can be <5, 6, 0>

Which of the statements given above is/are correct ?

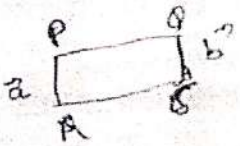
(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

111. $PQRS$ is a parallelogram. If $\overrightarrow{PR}=\vec{a}$ and $\overrightarrow{QS}=\vec{b}$, then what is $\overrightarrow{PQ}$ equal to ?



(a) $\vec{a}+\vec{b}$

(b) $\vec{a}-\vec{b}$

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

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

112. Let $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\vec{a}+2\vec{b}$ and $5\vec{a}-4\vec{b}$ are perpendicular. What is the angle between $\vec{a}$ and $\vec{b}$?

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

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

(c) $\frac{\pi}{3}$

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

113. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be unit vectors lying on the same plane. What is

$$\left\{\left(3\vec{a}+2\vec{b}\right)\times\left(5\vec{a}-4\vec{c}\right)\right\}\cdot\left(\vec{b}+2\vec{c}\right)$$

equal to ?

(a) -8

(b) -32

(c) 8

(d) 0

114. What are the values of x for which the angle between the vectors $2x^2\hat{i}+3x\hat{j}+\hat{k}$ and $\hat{i}-2\hat{j}+x^2\hat{k}$ is obtuse ?

(a) $0<x<2$

(b) $x<0$

(c) $x>2$

(d) $0\leq x\leq 2$

115. The position vectors of vertices A, B and C of triangle ABC are respectively $\hat{j}+\hat{k}$, $3\hat{i}+\hat{j}+5\hat{k}$ and $3\hat{j}+3\hat{k}$. What is angle C equal to ?

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

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

(c) $\frac{\pi}{3}$

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

116. Let $x=[y]$ and $y=[x]-x$, where $[.]$ is the greatest integer function. If x is not an integer but positive, then what is the value of x?

(a) -1

(b) 0

(c) 1

(d) 2

117. If $f(x)=4x+1$ and $g(x)=kx+2$ such that $fog(x)=gof(x)$, then what is the value of k ?

(a) 7

(b) 5

(c) 4

(d) 3

118. What is the minimum value of the function $f(x)=\log_{10}(x^2+2x+11)$?

(a) 0

(b) 1

(c) 2

(d) 10

119. What is $\int (x^x)^2(1+\ln x)dx$ equal to ?

(a) $x^{2x}+c$

(b) $\frac{1}{2}x^{2x}+c$

(c) $2x^{2x}+c$

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

120. What is $\int e^x\{1+\ln x+x\ln x\}dx$ equal to ?

(a) $xe^x\ln x+c$

(b) $x^2e^x\ln x+c$

(c) $x+e^x\ln x+c$

(d) $xe^x+\ln x+c$