SEAL

Test Booklet Number	Test - 0904	Roll Number
11852	**MATHEMATICS**	

[Time : 1 Hour] [Maximum Marks : 100]

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you answer the questions given in this Test Booklet :

1. Answers to questions in this Test Booklet are to be given on a computerised **Answer Sheet** provided to the candidate **separately.**
2. Candidate must fill up Name, Category, Test Booklet Number, Subject Code and Roll Number in the answer sheet carefully as per instructions given.
3. This Test Booklet consists of 50 questions. All questions are compulsory and carry equal marks.
4. Each question in this Test Booklet has four possible alternative answers namely, (a), (b), (c) and (d), one of which is correct. Candidate should choose the correct answer against each question out of four alternative answers.
5. Candidate is instructed to answer the questions by **darkening (●)** with **Ball Point Pen** only in the circle bearing the correct answer.
6. Candidate should not attempt more than one answer in each question. More than one attempt in any form against a question shall be treated as incorrect.
7. Marking of answer other than darkening shall be cancelled and darkening should remain within the circle or otherwise computer shall not accept during evaluation of answer-script.
8. Rough work must not be done on the Answer Sheet. Use the blank space given in the Test Booklet for rough work.
9. Candidate is to handover both the Test Booklet and Answer sheet to the Invigilator before leaving the Examination Hall.
10. **NEGATIVE MARKING :** Each question carries 2 (two) marks for correct response. For each incorrect response, $\frac{1}{2}$ (half) mark will be deducted from the total score. More than one answer indicated against a question will be deemed as incorrect response and will be negatively marked.

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MATHEMATICS

1. Which of the following is an odd function?

   a) $f(x) = k$

   b) $f(x) = \text{Sin } x + \text{Cos } x$

   c) $f(x) = \text{Sin}\left[\log\left(x + \sqrt{x^2 + 1}\right)\right]$

   d) $f(x) = 1 + x + 2x^2$

2. The smallest positive n for which $\left(\frac{1+i}{1-i}\right)^n = 1$ is

   a) 1

   b) 2

   c) 3

   d) 4

3. If z is a complex number such that $\left|\frac{z-5i}{z+5i}\right| = 1$ then the locus of z is

   a) x – axis

   b) the line y = 5

   c) a circle through the origin

   d) y – axis

4. If $A = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$, then A (Adj A) is equal to

   a) $\begin{bmatrix} 10 & -10 \\ -10 & 10 \end{bmatrix}$

   b) $\begin{bmatrix} 10 & 10 \\ 10 & 10 \end{bmatrix}$

   c) $\begin{bmatrix} 0 & 10 \\ 10 & 0 \end{bmatrix}$

   d) $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$

5. If $\begin{vmatrix} x & 2x & 3x \\ x+y & 3x+2y & 6x+3y \\ x+y+z & 4x+3y+2z & 10x+6y+3z \end{vmatrix} = x^m$

   then the value of m is

   a) 1

   b) 2

   c) 3

   d) 4

6. For any real a, b, c both the roots of the equation $(x-a)(x-b) + (x-b)(x-c) + (x-c)(x-a) = 0$

   a) positive

   b) negative

   c) real

   d) imaginary

7. The positive value of *m* for which the roots of equation $12x^2 + mx + 5 = 0$ are in the ratio 3 : 2 is

   a) $5\sqrt{5}$

   b) $5\sqrt{10}$

   c) $\frac{5}{12}$

   d) $\frac{12}{5}$

8. The largest integer *k* for which (16)! is divisible by 2^k, is

   a) 16

   b) 15

   c) 14

   d) 8

9. The number of all 5 - digit numbers, divisible by 4, which can be formed from the digits 0, 1, 2, 3, 4 (without repetition) is

a) 36

b) 30

c) 28

d) 24

10. The coefficient of middle term in the expansion of $(1 + x)^{2n}$ is

a) $\frac{1.3.5 \ldots (2n-1)}{n!} 2^n$

b) $\frac{1.3.5 \ldots (2n-1)}{(n!)^2} 2^n$

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

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

11. If the coefficients of 2nd, 3rd and 4th terms in the expansion of $(1 + x)^{2n}$ are in A.P., then

a) $2n^2 + 9n + 7 = 0$

b) $2n^2 - 9n + 7 = 0$

c) $2n^2 - 9n - 7 = 0$

d) $2n^2 - 9n + 12 = 0$

12. If 1 + 4 + 7 + ... to n terms, is equal to k n(3n – 1), then k equals

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

b) 1

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

d) 2

13. If a, b, c are in A. P.; b, c, d are in G. P. and c, d, e are in H.P., then a, c, e

a) are in A. P.

b) are in G. P.

c) are in H. P.

d) satisfy a + e = c

14. Let S_k denote the sum of first k terms of an A. P. If the ratio of S_m and S_n is $m^2 : n^2$, then the ratio of p^{th} and q^{th} terms of the A. P. is

a) $\frac{p-1}{q-1}$

b) $\frac{p}{q}$

c) $\frac{2p-1}{2q-1}$

d) $\frac{2p+1}{2q+1}$

15. The value of $\cos\{2\cos^{-1}x + \sin^{-1}x\}$ at $x = \frac{1}{5}$ is

a) $\frac{2\sqrt{6}}{5}$

b) $\frac{-2\sqrt{5}}{6}$

c) $\frac{-2\sqrt{6}}{5}$

d) $\frac{2\sqrt{5}}{6}$

16. If $\sin^3\theta - \operatorname{cosec}^3\theta = x^3 + y^3$ and $\sin^6\theta + \operatorname{cosec}^6\theta = x^6 + y^6$, then x^3y^3 is equal to

a) –2

b) 2

c) –1

d) 1

17. If the value of Cot $\left(7\frac{1}{2}\right)^0 = \frac{2\sqrt{2}+A}{\sqrt{3}-1}$, then A equals

a) $\sqrt{3}-1$

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

c) $\sqrt{3}+1$

d) $\sqrt{3}+\sqrt{2}$

18. The statement $p + p^1$ is

a) a contradiction

b) a tautology

c) the dual of p.p

d) the dual of $p'.(p')'$

19. $\lim_{x \to 0} \frac{1-\cos x\sqrt{\cos 2x}}{x^2}$ equals

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

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

c) $\frac{\sqrt{3}}{2}$

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

20. $\frac{d}{dx}\left[\tan^{-1}(\sec x + \tan x)\right]$ is equal to

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

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

c) 1

d) -1

21. If $3f(x) + 5f\left(\frac{1}{x}\right) = x + 1$ and $y = xf(x)$, then $\frac{dy}{dx}$ at $x = 1$ is

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

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

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

d) $\frac{-1}{4}$

22. The tangent to the curve $xy + 3x - 3y = 1$ at a point on the curve makes an angle $\tan^{-1}2$ with the positive x - axis. Then the point must be

a) (2, 5) or (4, –1)

b) (6, –9) or (7, –5)

c) (4, –5) or $\left(6, -\frac{17}{3}\right)$

d) (1, 1) or (5, –7)

23. The values of a and b such that the function $f(x) = a\ln(x) + bx^2 + x$ has extreme values at $x = 1$ and $x = 2$

a) $a = -\frac{2}{3}, b = -\frac{1}{6}$

b) $a = \frac{2}{3}, b = -\frac{1}{6}$

c) $a = -\frac{2}{3}, b = \frac{1}{6}$

d) $a = \frac{2}{3}, b = \frac{1}{6}$

24. If $f(x) = x(x-1)(x-2)$, $x \in [0, 2]$, satisfies the conditions of Rolle's theorem, then for

a) no value of c in $[0, 2]$, $f'(c) = 0$

b) one value of c in $[0, 2]$, $f'(c) = 0$

c) two values of c in $[0, 2]$, $f'(c) = 0$

d) more than two values of c in $[0, 2]$, $f'(c) = 0$

25. $\int \frac{1}{e^x - 1} dx$ equals

a) $\log\left|\frac{e^x - 1}{e^x}\right| + c$

b) $\log\left|\frac{e^x + 1}{e^x}\right| + c$

c) $\log\left|\frac{4 - e^x}{e^x}\right| + c$

d) $\log\left|\frac{e^x - 1}{e^x + 1}\right| + c$

26. $\int_{\pi}^{10\pi} |\sin x| \, dx$ is equal to

a) 18

b) 20

c) 40

d) 56

27. If $\int_{1}^{4} |x - 3| \, dx = 2A + B$ then one of the following can not be true

a) $A = 1$, $B = 1/2$

b) $A = 3/2$, $B = 4$

c) $A = 1/2$, $B = 3/2$

d) $A = 2$, $B = -3/2$

28. If the area bounded by the curve $y = f(x)$, x - axis and the ordinates $x = 1$ and $x = b$ is $(b - 1)\sin(3b + 4)$, then

a) $f(x) = \cos(3x + 4) + 3(x - 1)\sin(3x + 4)$

b) $f(x) = \sin(3x + 4) + 3(x - 1)\cos(3x + 4)$

c) $f(x) = \sin(3x + 4) - 3(x - 1)\cos(3x + 4)$

d) $f(x) = \cos(3x + 4) - 3(x - 1)\sin(3x + 4)$

29. The smaller area of the circle $x^2 + y^2 = 1$, cut off by the line $y = \frac{1}{2}$ is $\frac{\pi}{3} + d$, where d equals

a) $\frac{-\sqrt{3}}{4}$

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

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

d) $\frac{\sqrt{3}}{2}$

30. The equation of the curve satisfying the differential equation $(x^2 + 1)\frac{dy}{dx} = 2xy$ and passing through the point (0, 1) is

a) $y = x^3 + 1$

b) $y = \tan x + 1$

c) $y = x^2 + 1$

d) $y = x^3 - x^2 + 1$

31. If $f(0) = f'(0) = 0$ and $f''(x) = \tan^2 x$, then $f(x)$ is

a) $\log \sec x - \frac{1}{2}x^2$

b) $\log \cos x + \frac{1}{2}x^2$

c) $\log \sec x + \frac{1}{2}x^2$

d) $\log \cos x - \frac{1}{2}x^2$

32. If the lines $ax = 1 - 2y$, $3y = 1 - bx$ and $cx + 4y - 1 = 0$ are concurrent, then a, b, c

a) satisfy $a + b + c = 0$

b) are in H. P.

c) are in G. P.

d) are in A. P.

33. If the circle $x^2 + y^2 + 4x + 2y + c = 0$ bisects the circumference of the circle $x^2 + y^2 - 2x - 12y - d = 0$ then $c + d$ is equal to

a) – 60

b) – 90

c) 40

d) 56

34. The number of the common tangents to the circles $x^2 + y^2 - 4x + 6y - 3 = 0$ and $x^2 + y^2 - 8x + 6y + 21 = 0$, is

a) zero

b) one

c) three

4) four

35. If $x + y = k$ is normal to the curve $y^2 = 12x$, then value of k is

a) 3

b) 9

c) – 9

d) – 3

36. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$, having its centre at (0, 3) is

a) $\frac{7}{2}$

b) 3

c) 4

d) $\sqrt{12}$

37. The circumcentre of the triangle formed by (–1, 2), (2, –3), (7, 0) is (3, 1). The orthocentre is

a) (2, – 3)

b) (2, 3)

c) (–2, 3)

d) (–2, –3)

38. If the vertices of a ΔABC are A (0, –1, –2), B (3, 1, 4) and C (5, 7, 1) then $\angle A$ = ?

a) 30°

b) 45°

c) 60°

d) 120°

39. The shortest distance between the lines whose vector equations are

$\vec{r} = \hat{i} + \hat{j} + k(2\hat{i} - \hat{j} + \hat{k})$ and

$\vec{r} = 2\hat{i} + \hat{j} - \hat{k} + \mu[3\hat{i} - 5\hat{j} + 2\hat{k}]$ is

a) $\frac{10}{\sqrt{29}}$

b) $\frac{20}{\sqrt{59}}$

c) $\frac{10}{\sqrt{59}}$

d) none of these

40. The radius of circular section of the sphere $|\vec{r}| = 5$ cut by the plane $\vec{r}.(\hat{i} + \hat{j} + \hat{k}) = 3\sqrt{3}$ is

a) 3

b) 4

c) 5

d) 6

41. If $\vec{a}, \vec{b}, \vec{c}$ are three non-zero vectors such that $\vec{a}.\vec{b} = \vec{a}.\vec{c}$, then

a) $\vec{b} = \vec{c}$

b) $\vec{a} \perp \vec{b} + \vec{c}$

c) $\vec{a} \perp \vec{b} - \vec{c}$ and $\vec{b} \neq \vec{c}$

d) Either $\vec{a} \perp \vec{b} - \vec{c}$ or $\vec{b} = \vec{c}$

42. If $|\vec{x}| = |\vec{y}| = |\vec{x} + \vec{y}| = 1$ then $|\vec{x} - \vec{y}|$ is equal to

a) 1

b) $\sqrt{3}$

c) 2

d) $\sqrt{2}$

43. If the vectors

$2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are coplanar, the value of λ is

a) 4

b) –4

c) 2

d) 1

44. A train of length 200 m travelling at 30 m/sec overtakes another of length 300 m travelling at 20 m/sec. The time taken by the first train to pass the second is

a) 10 sec

b) 30 sec

c) 45 sec

d) 50 sec

45. If the horizontal range of a projectile is $4\sqrt{3}$ times its maximum height, then the angle of projection is

a) 25°

b) 30°

c) 45°

d) 60°

46. Two forces, each equal to P, act at right angles to each other. Their effect is neutralised by a third force acting along the internal bisector of the angle between the forces in the opposite direction. Then the third force is

a) 2P

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

c) $\sqrt{2}P$

d) $\frac{1}{\sqrt{2}}P$

47. If A and B are events such that P(A) = 0.4, P(A∪B) = 0.9, and P(A | B) = 0.4, then P(B) is

a) $\frac{5}{6}$

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

c) $\frac{1}{6}$

d) $\frac{3}{5}$

48. A box contains 15 good chips and 5 defective chips, If 4 chips are selected at random, then the probability that at least one defective chip is selected is

a) $\frac{232}{323}$

b) $\frac{91}{323}$

c) $\frac{453}{969}$

d) $\frac{514}{969}$

49. The variance of first n natural numbers is

a) $\frac{n^2+1}{12}$

b) $\frac{n^2-1}{12}$

c) $\frac{n^2-1}{6}$

d) $\frac{n^2+1}{2}$

50. The mean and standard deviation of the following grouped data are 55.8 and 9.16 respectively :

Class Interval	*Frequency*
30 – 40	6
40 – 50	10
50 – 60	15
60 – 70	12
70 – 80	7
Total	50

If the lower and the upper limits of each class interval is first divided by 2 and then increased by 5, the mean and standard deviation are respectively.

a) 27.9, 9.16

b) 32.9, 4.58

c) 55.8, 9.16

d) 60.8, 4.58