SEAL

Test Booklet Number	Test - 1004	Roll Number
11330	**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 instruction 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 HB pencil only) to the circle bearing the correct answer.
6. After attempting a question, if candidate wants to change his/her answer, erase completely to change the response and re-dark another circle.
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 this purpose.
9. Candidate is to hand over the 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. The function

   $f(x)=\sin\left((\log(x+\sqrt{x^2+1})\right)$ is

   a) an even function
   b) an odd function
   c) a periodic function
   d) neither even nor odd function

2. For any complex number Z, the number of solutions ofthe equal $Z^2+\bar{Z}=0$ is

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

3. Number of non-zero integral solutions of the equation $(1-i)^x=2^x$ is

   a) 1
   b) 0
   c) Infinite
   d) 2

4. If A and B are square matrices of the same order, then $(A+B)^2=A^2+2AB+B^2$ is true only if

   a) AB = I
   b) BA = I
   c) AB = BA
   d) BA = –AB

5. If $\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix}=x^n$

   then the value of n is

   a) 0
   b) 1
   c) 2
   d) 3

6. The roots of the equation, with real coefficients, $a(b-c)x^2+b(c-a)x+c(a-b)=0$ are

   a) rational
   b) irrational
   c) equal
   d) imaginary

7. If α , β are the roots of $ax^2+bx+c=0$, then the equation $ax^2-bx(x-1)+c(x-1)^2=0$ has roots

   a) $\frac{\alpha}{1-\alpha},\frac{\beta}{1-\beta}$
   b) $\frac{1-\alpha}{\alpha},\frac{1-\beta}{\beta}$
   c) $\frac{\alpha}{\alpha+1},\frac{\beta}{\beta+1}$
   d) $\frac{\alpha+1}{\alpha},\frac{\beta+1}{\beta}$

8. The number of ways in which five people can be seated in a car with two people in the front seat and three in the rear, if two

particular persons out of the five can not drive:

a) 120

b) 72

c) 12

d) 10

9. If the co-efficients 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) $-(2n^2 + 9n - 7) = 0$

10. If x, y, z are positive integers, then (x+y) (y+z) (z+x) is

a) $< 8xyz$

b) $= 8xyz$

c) $> 8xyz$

d) $\leq 8xyz$

11. Let a and b be the roots of $x^2 - 3x + p = 0$ and c and d be the roots of $x^2 - 12x + q = 0$, whereas a, b, c and d from an increasing G.P., then the ratio of q+p : q–p is equal to

a) 8 : 7

b) 11 : 10

c) 17 : 15

d) 16 : 13

12. The first and the last term of an A.P. are a and l respectively. If S is the sum of all its terms, then the common difference of the A.P. is

a) $\dfrac{l^2 - a^2}{2S - (l+a)}$

b) $\dfrac{l^2 - a^2}{2S - (l-a)}$

c) $\dfrac{l^2 + a^2}{2S + (l+a)}$

d) $\dfrac{l^2 + a^2}{2S - (l+a)}$

13. If x, y, $z \in$ [−1, 1] such that $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \dfrac{3\pi}{2}$,

then $x^{2006} + y^{2007} + z^{2008}$ equals

a) 1

b) 2

c) 3

d) 0

14. If sin x + cosec x = 2, then $\sin^n x + \text{cosec}^n x$ equals

a) 2

b) 2^n

c) 2^{n-1}

d) 2^{n-2}

15. The least value of $2\sin^2\theta + 3\cos^2\theta$ is

a) 1

b) 2

c) 3

d) 5

16. If ${}^{56}P_{r+6} : {}^{54}P_{r+3} = 30800 : 1$ then the value of r is :

a) 31

b) 41

c) 51

d) 61

17. If the co-efficient of the middle term in the expansion of $(1+x)^{2n+2}$ is p and the co-efficients of middle terms in the expansion of $(1+x)^{2n+1}$ are q and r respectively then

a) $P+q=r$

b) $p+r=q$

c) $p=q+r$

d) $p+q+r=0$

18. $\underset{x\to\pi}{\text{Lt}} \dfrac{\sin 3x - 3\sin x}{(\pi - x)^3}$ equals

a) 4

b) −4

c) 3

d) −3

19. $\underset{x\to 2}{\text{Lt}} \dfrac{\sqrt{1+\sqrt{2+x}}-\sqrt{3}}{x-2}$ is

a) $\dfrac{1}{8\sqrt{3}}$

b) $\dfrac{1}{4\sqrt{3}}$

c) 0

d) 1

20. Which of the following is not a statement?

a) Asia is a continent.

b) 2 is an even integer.

c) Give me a glass of water.

d) The number 17 is not a prime.

21. If $\sin^{-1}[3t-4t^3]$ and $y=\cos^{-1}\sqrt{1-t^2}$ then $\dfrac{dy}{dx}$ is equal to

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

b) 3

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

d) $\dfrac{1}{3}$

22. $\dfrac{d}{dx}\left[\tan^{-1}\left(\sqrt{\dfrac{1+\sin x}{1-\sin x}}\right)\right]$ is

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

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

c) 1

d) −1

23. If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$ attains its maximum and minimum at p and q respectively such that $p^2 = q$, then a equals

a) 0
b) 1
c) 2
d) –1

24. The points on the circle $x^2 + y^2 - 2x - 4y + 1 = 0$ where the tangent line is parallel to x -axis are :

a) (1,4), (1,0)
b) (0,1), (0,4)
c) (1,1), (4,4)
d) (4,1), (0,1)

25. Let f(x) and g(x) be differentiable for [0,1] such that f(0) = 0, g(0) = 0, f(1)=6. Let there exist a real number c in (0,1) such that $f'(c) = 2g'(c)$, then the value of g(1) must be

a) 1
b) 3
c) –2
d) –1

26. $\int \frac{1+x^2}{1+x^4} dx$ equals

a) $\tan^{-1} x^2 + c$

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

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

d) $\tan^{-1}\left(\frac{x^2-1}{x^2-\sqrt{2}x+1}\right) + c$

27. The value of the integral

$\int_0^1 \cot^{-1}\left[1-x+x^2\right] dx$ is

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

28. $\int_1^4 |x-3|\, dx$ equals

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

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

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

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

29. AOB is the quadrant of the ellipse

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ in which OA = a, OB = b. The area bounded between the arc AB and the chord AB of the ellipse is

a) $\frac{ab}{4}(\pi - 2)$

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

c) $\frac{ab}{4}(\pi+2)$

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

30. The solution of the following differential equation

$(1 + y + x^2y)\,dx + (x + x^2)\,dy = 0$ under the conditions, $y = 0$ when $x = 1$, is

a) $xy = \tan^{-1} x - \frac{\pi}{4}$

b) $xy = -\tan^{-1} x + \frac{\pi}{4}$

c) $xy = \tan^{-1} 2x + \frac{\pi}{4}$

d) $\frac{x}{y} = -\tan^{-1} x + \frac{\pi}{4}$

31. If the integrating factor of $x(1-x^2)\,dy + (2x^2y - y - ax^3)\,dx = 0$ is $e^{\int p\,dx}$, then P is equal to

a) $\frac{2x^2 - ax^3}{x(1-x^2)}$

b) $2x^2 - 1$

c) $\frac{2x^2 - 1}{ax^3}$

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

32. A line L and the lines $x + 2y - 1 = 0$ and $2x + y - 1 = 0$ are concurrent and L passes through origin. Then the equation of the line L is

a) $x - y = 0$

b) $x + y = 0$

c) $x + 2y = 0$

d) $2x + y = 0$

33. The equation $x^2 - y^2 - 4x + 4 = 0$ represents

a) a pair of straight lines

b) a circle

c) a parabola

d) an ellipse

34. The equations of the two diameters of a circle are $x + y = 6$ and $x + 2y = 4$ and the radius of the circle is 10. The equation of the circle is

a) $x^2 + y^2 - 16x + 4y - 32 = 0$

b) $x^2 + y^2 - 6x - 4y + 24 = 0$

c) $x^2 + 2y^2 + 32 = 0$

4) $x^2 + y^2 + 8x + 4y + 32 = 0$

35. The equation of the ellipse having major and minor axes along x and y axes respectively, the distance between whose foci is 8 units and the distance between the directices is 18 units, is :

a) $\frac{x^2}{20} + \frac{y^2}{30} = 1$

b) $\frac{x^2}{36} + \frac{y^2}{20} = 1$

c) $\frac{x^2}{6}+\frac{y^2}{4}=1$

d) $\frac{x^2}{8}+\frac{y^2}{18}=1$

36. If (a,b) is the mid-point of a chord passing through the vertex of the parabola $y^2 = 4x$, then

a) $a = 2b$

b) $2a = b$

c) $a^2 = 2b$

d) $2a = b^2$

37. The equation of the circle which passes through the centre of the circle $x^2 + y^2 + 8x + 10y - 7 = 0$ and is concentric with the circle $2x^2 + 2y^2 - 8x - 12y - 9 = 0$ is

a) $x^2 + y^2 - 4x - 6y - 87 = 0$

b) $x^2 + y^2 + 4x + 6y - 87 = 0$

c) $x^2 + y^2 - 4x + 6y + 87 = 0$

d) $x^2 + y^2 + 8x + 10y - 59 = 0$

38. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}. |\vec{a}|=3, |\vec{b}|=5, |\vec{c}|=7$, then the angle between $\vec{a}$ and $\vec{b}$ is

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

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

c) $\frac{5\pi}{3}$

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

39. If $\vec{a}$ and $\vec{b}$ are the adjacent sides of a parallelogram, then $|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}|$ is a necessary and sufficient condition for the parallelogram to be a

a) rhombus

b) square

c) rectangle

d) trapezium

40. If the $\vec{a}$, $\vec{b}$, and $\vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=0$, then the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ is

a) 1

b) 3

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

d) -1

41. If the vectors $2\hat{i}-\hat{j}+\hat{k}, \hat{i}+2\hat{j}-3\hat{k}$ and $3\hat{i}+a\hat{j}+5\hat{k}$ are coplanar, then a equals

a) 4

b) -4

c) 2

d) 1

42. A line makes the angles a, b and g with the axes respectively, then

$\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ equals

a) 1

b) -1

c) 2

d) –2

43. The image of the point (1, 2, –1) in the plane $\hat{r}.(3\hat{i} - 5\hat{j} + 4\hat{k}) = 5$ is

a) $\left(\frac{73}{25}, -\frac{6}{5}, \frac{39}{25}\right)$

b) $\left(\frac{73}{25}, \frac{6}{5}, \frac{39}{25}\right)$

c) (–1, –2, 1)

d) (1, 2, 1)

44. The image of the point (1, 6, 3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ is

a) (0, 1, 7)

b) (1, 0, 7)

c) (–1, 0, 7)

d) (–1, 0, –7)

45. The mean and variance of 8 observations are 9 and 9.25. If 6 of the observations are 6, 7, 10, 12, 12 and 13, the remaining two observations are

a) 6, 8

b) 4, 6

c) 6, 9

d) 4, 8

46. The standard deviation of the following distribution is

Class	10-20	20-30	30-40	40-50	50-60	60-70	70-80	total
Freq	10	20	30	25	43	15	7	150

a) 15.26

b) 15.29

c) 15.62

d) 15.71

47. Three number from 1 to 30 are chosen. The probability that they are not consecutive is

a) $\frac{144}{145}$

b) $\frac{143}{145}$

c) $\frac{142}{145}$

d) Zero

48. A speaks truith in 60% cases and B speaks truth in 70% cases. The probability that they will say the same thing while describing an event is

a) 0.56

b) 0.54

c) 0.38

d) 0.94

49. The equation of the plane containing the line $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ and the point (0, 7, –7) is

a) x + y + z = 1

b) $x + y + z = 2$

c) $x + y + z = 0$

d) $x + 2y + 3z = 0$

50. The length of the sides of a triangle are $9 + x^2$, $9 + x^2$ and $18 - 2x^2$. The area of the triangle is maximum when x equals

a) 0

b) $\sqrt{2}$

c) $\sqrt{3}$

d) $-\sqrt{3}$