जब तक आपको यह परीक्षण पुस्तिका खोलने को न कहा जाए तब तक न खोलें

टी.बी.सी. : **AEBC–B–MTH**

परीक्षण पुस्तिका अनुक्रम

क्रम संख्या 1126153

परीक्षण पुस्तिका

गणित

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समय : दो घण्टे और तीस मिनट

पूर्णांक : 300

अ नु दे श

1. **परीक्षा प्रारम्भ होने के तुरन्त बाद आप इस परीक्षण पुस्तिका की पड़ताल अवश्य कर लें कि इसमें कोई बिना छपा, फटा या छूटा हुआ पृष्ठ अथवा प्रश्नांश आदि न हो। यदि ऐसा है, तो इसे सही परीक्षण पुस्तिका से बदल लें।**
2. **कृपया ध्यान रखें कि OMR उत्तर-पत्रक में उचित स्थान पर रोल नम्बर और परीक्षण पुस्तिका अनुक्रम A, B, C या D को ध्यान से एवं बिना किसी चूक या विसंगति के भरने और कूटबद्ध करने की जिम्मेदारी उम्मीदवार की है। किसी भी प्रकार की चूक/विसंगति की स्थिति में उत्तर-पत्रक निरस्त कर दिया जाएगा।**
3. इस परीक्षण पुस्तिका पर साथ में दिए गए कोष्ठक में आपको अपना अनुक्रमांक लिखना है। परीक्षण पुस्तिका पर **और कुछ न** लिखें। 2658345
4. इस परीक्षण पुस्तिका में **120** प्रश्नांश (प्रश्न) दिए गए हैं। प्रत्येक प्रश्नांश **हिन्दी** और **अंग्रेजी** दोनों में छपा है। प्रत्येक प्रश्नांश में चार प्रत्युत्तर (उत्तर) दिए गए हैं। इनमें से एक प्रत्युत्तर को चुन लें, जिसे आप उत्तर-पत्रक पर अंकित करना चाहते हैं। यदि आपको ऐसा लगे कि एक से अधिक प्रत्युत्तर सही हैं, तो उस प्रत्युत्तर को अंकित करें जो आपको सर्वोत्तम लगे। प्रत्येक प्रश्नांश के लिए **केवल एक ही** प्रत्युत्तर चुनना है।
5. आपको अपने सभी प्रत्युत्तर अलग से दिए गए उत्तर-पत्रक पर **ही** अंकित करने हैं। उत्तर-पत्रक में दिए गए निर्देश देखें।
6. **सभी** प्रश्नांशों के अंक समान हैं।
7. इससे पहले कि आप परीक्षण पुस्तिका के विभिन्न प्रश्नांशों के प्रत्युत्तर उत्तर-पत्रक पर अंकित करना शुरू करें, आपको प्रवेश प्रमाण-पत्र के साथ प्रेषित अनुदेशों के अनुसार कुछ विवरण उत्तर-पत्रक में देने हैं।
8. आप अपने सभी प्रत्युत्तरों को उत्तर-पत्रक में भरने के बाद तथा परीक्षा के समापन पर **केवल उत्तर-पत्रक** अधीक्षक को सौंप दें। आपको अपने साथ परीक्षण पुस्तिका ले जाने की अनुमति है।
9. कच्चे काम के लिए पत्रक, परीक्षण पुस्तिका के अन्त में संलग्न हैं।
10. **गलत उत्तरों के लिए दण्ड :**

    वस्तुनिष्ठ प्रश्न-पत्रों में उम्मीदवार द्वारा दिए गए गलत उत्तरों के लिए दण्ड दिया जाएगा।

    (i) प्रत्येक प्रश्न के लिए चार वैकल्पिक उत्तर हैं। उम्मीदवार द्वारा प्रत्येक प्रश्न के लिए दिए गए एक गलत उत्तर के लिए प्रश्न हेतु नियत किए गए अंकों का **एक-तिहाई** दण्ड के रूप में काटा जाएगा।

    (ii) यदि कोई उम्मीदवार एक से अधिक उत्तर देता है, तो इसे **गलत उत्तर** माना जाएगा, यद्यपि दिए गए उत्तरों में से एक उत्तर सही होता है, फिर भी उस प्रश्न के लिए उपर्युक्तानुसार ही उसी तरह का दण्ड दिया जाएगा।

    (iii) यदि उम्मीदवार द्वारा कोई प्रश्न हल नहीं किया जाता है, अर्थात् उम्मीदवार द्वारा उत्तर नहीं दिया जाता है, तो उस प्रश्न के लिए **कोई दण्ड नहीं** दिया जाएगा।

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Note : **English version of the instructions is printed on the back cover of this Booklet.**

1. The sum of the first k terms of a series S is $3k^2 + 5k$. Which one of the following is correct?

(a) The terms of S form an arithmetic progression with common difference 14.

(b) The terms of S form an arithmetic progression with common difference 6.

(c) The terms of S form a geometric progression with common ratio 10/7.

(d) The terms of S form a geometric progression with common ratio 11/4.

2. The sum of the first 8 terms of a GP is five times the sum of its first 4 terms. If $r \neq 1$ is the common ratio, then what is the number of possible real values of r?

(a) One

(b) Two

(c) Three

(d) More than three

3. If one root of the equation $x^2 - kx + k = 0$ exceeds the other by $2\sqrt{3}$, then which one of the following is a value of k?

(a) 3 (b) 6

(c) 9 (d) 12

4. If $x + \frac{5}{y} = 4$ and $y + \frac{5}{x} = -4$, then what is $(x + y)$ equal to?

(a) 0 (b) 1

(c) 4 (d) 5

5. If 5th, 7th and 13th terms of an AP are in GP, then what is the ratio of its first term to its common difference?

(a) −3

(b) −2

(c) 2

(d) 3

6. If p, 1, q are in AP and p, 2, q are in GP, then which of the following statements is/are correct?

I. p, 4, q are in HP.

II. $(1/p)$, 1/4, $(1/q)$ are in AP.

Select the answer using the code given below.

(a) I only

(b) II only

(c) Both I and II

(d) Neither I nor II

7. If $x = (1111)_2$, $y = (1001)_2$ and $z = (110)_2$, then what is $x^3 - y^3 - z^3 - 3xyz$ equal to?

(a) $(1111001)_2$

(b) $(1001111)_2$

(c) $(1)_2$

(d) $(0)_2$

8. If

$$\Delta = \begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix}$$

and A, B, C, D, G are the cofactors of the elements a, b, c, d, g respectively, then what is $bB + cC - dD - gG$ equal to?

(a) 0

(b) 1

(c) Δ

(d) $-\Delta$

9. Consider the following statements in respect of the determinant

$$\Delta = \begin{vmatrix} k(k+2) & 2k+1 & 1 \\ 2k+1 & k+2 & 1 \\ 3 & 3 & 1 \end{vmatrix}$$

I. Δ is positive if $k > 0$.

II. Δ is negative if $k < 0$.

III. Δ is zero if $k = 0$.

How many of the statements given above are correct?

(a) None

(b) One

(c) Two

(d) All three

10. If

$$\begin{vmatrix} -2 & 3+i & -1 \\ 3-i & 0 & i-1 \\ -1 & -1-i & 1 \end{vmatrix} = A + iB$$

where $i = \sqrt{-1}$, then what is $A + B$ equal to?

(a) -10

(b) -6

(c) 0

(d) 6

11. If $A^2 + B^2 + C^2 = 0$, then what is the value of the following?

$$\begin{vmatrix} 1 & \cos C & \cos B \\ \cos C & 1 & \cos A \\ \cos B & \cos A & 1 \end{vmatrix}$$

(a) -1

(b) 0

(c) 1

(d) 2

12. If ω is a non-real cube root of unity, then what is a root of the following equation?

$$\begin{vmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{vmatrix} = 0$$

(a) $x = 0$

(b) $x = 1$

(c) $x = \omega$

(d) $x = \omega^2$

13. What is $\left(\frac{\sqrt{3}+i}{\sqrt{3}-i}\right)^3$ equal to?

(a) -1

(b) 0

(c) 1

(d) 3

14. If $x^2 - x + 1 = 0$, then what is

$$\left(x - \frac{1}{x}\right)^2 + \left(x - \frac{1}{x}\right)^4 + \left(x - \frac{1}{x}\right)^8$$

equal to?

(a) 81

(b) 85

(c) 87

(d) 90

15. How many 7-letter words (with or without meaning) can be constructed using all the letters of the word CAPITAL so that all consonants come together in each word?

(a) 360 (b) 300

(c) 288 (d) 240

16. If $z \neq 0$ is a complex number, then what is $\text{amp}(z) + \text{amp}(\bar{z})$ equal to?

(a) 0 (b) $\pi/2$

(c) π (d) 2π

17. How many sides are there in a polygon which has 20 diagonals?

(a) 6 (b) 7

(c) 8 (d) 10

18. In how many ways can the letters of the word DELHI be arranged keeping the positions of vowels and consonants unchanged?

(a) 6 (b) 9

(c) 12 (d) 24

19. What is the number of positive integer solutions of $x + y + z = 5$?

(a) 3 (b) 5

(c) 6 (d) 9

20. What is the number of rational terms in the expansion of $(3^{\frac{1}{2}} + 5^{\frac{1}{4}})^{12}$?

(a) 2 (b) 3

(c) 4 (d) 6

21. If the sum of binomial coefficients in the expansion of $(x + y)^n$ is 256, then the greatest binomial coefficient occurs in which one of the following terms?

(a) Third

(b) Fourth

(c) Fifth

(d) Ninth

22. If $k < (\sqrt{2} + 1)^3 < k + 2$, where k is a natural number, then what is the value of k?

(a) 11 (b) 13

(c) 15 (d) 17

23. If

$$[x \ 1 \ 1]\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ x \end{bmatrix} = [45]$$

then which one of the following is a value of x?

(a) -2 (b) -1

(c) 0 (d) 1

24. If

$$A = \begin{bmatrix} y & z & x \\ z & x & y \\ x & y & z \end{bmatrix}$$

where x, y, z are integers, is an orthogonal matrix, then what is the value of $x^2 + y^2 + z^2$?

(a) 0 (b) 1

(c) 4 (d) 14

25. Consider the following in respect of a non-singular matrix M :

I. $|M^2| = |M|^2$

II. $|M| = |M^{-1}|$

III. $|M| = |M^T|$

How many of the above are correct?

(a) None

(b) One

(c) Two

(d) All three

26. If

$$f(\theta) = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$$

then what is $\{f(\pi)\}^2$ equal to?

(a) $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

27. If

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$

then what is $A^2 - 4A$ equal to?

(a) $-5I_3$

(b) $-I_3$

(c) I_3

(d) $5I_3$

where I_3 is the identity matrix of order 3.

28. If the number of selections of r as well as $(n+r)$ things from $5n$ different things are equal, then what is the value of r?

(a) n

(b) $2n$

(c) $3n$

(d) $4n$

29. What is the number of selections of at most 3 things from 6 different things?

(a) 20

(b) 22

(c) 41

(d) 42

30. If

$$A = \begin{bmatrix} x & y & z \\ y & z & x \\ z & x & y \end{bmatrix}$$

where x, y, z are integers, is an orthogonal matrix, then what is A^2 equal to?

(a) Null matrix

(b) Identity matrix

(c) A

(d) $-A$

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

Let $p = \sin 35°$, $q = \sin 25°$ and $r = \sin(-95°)$.

31. What is $(p + q + r)$ equal to?

(a) -1

(b) 0

(c) $2\sin 5°$

(d) $2\cos 5°$

32. What is $(pq + qr + rp)$ equal to?

(a) $-3/4$

(b) 0

(c) $1/4$

(d) $3/4$

33. What is $(p^2 + q^2 + r^2)$ equal to?

(a) $1/2$

(b) 1

(c) $3/2$

(d) 2

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

Let $p = |\sin\alpha - \sin(\alpha - 90°)|$.

34. What is the minimum value of p?

(a) 0

(b) $1/2$

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

(d) 1

35. What is the maximum value of p?

(a) 1

(b) $\sqrt{2}$

(c) $\sqrt{3}$

(d) 2

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

The sides of a triangle ABC are $AB = 3$ cm, $BC = 5$ cm and $CA = 7$ cm.

36. Consider the following statements :

I. The triangle is obtuse-angled triangle.

II. The sum of acute angles of the triangle is also acute.

Which of the statements given above is/are correct?

(a) I only

(b) II only

(c) Both I and II

(d) Neither I nor II

37. What is $\angle B$ equal to?

(a) 60°

(b) 105°

(c) 120°

(d) 150°

38. What is the area of the triangle?

(a) $15\sqrt{3}/4$ square cm

(b) $15\sqrt{3}/2$ square cm

(c) $15\sqrt{3}$ square cm

(d) $30\sqrt{3}$ square cm

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

The top (M) of a tower is observed from three points P, Q and R lying in a horizontal straight line which passes directly along the foot (N) of the tower. The angles of elevations of M from P, Q and R are 30°, 45° and 60° respectively. Let $PQ = a$ and $QR = b$.

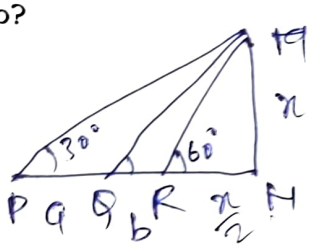
39. What is PN equal to?

(a) $\left(\frac{3-\sqrt{3}}{2}\right)a$

(b) $\left(\frac{3+\sqrt{3}}{2}\right)a$

(c) $\left(\frac{3-\sqrt{3}}{4}\right)a$

(d) $\left(\frac{3+\sqrt{3}}{4}\right)a$



40. What is MN equal to?

(a) $\left(\frac{3+\sqrt{3}}{2}\right)b$

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

(c) $\left(\frac{3-\sqrt{3}}{4}\right)b$

(d) $\left(\frac{3+\sqrt{3}}{4}\right)b$

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

Let $p = \tan 2\alpha - \tan\alpha$ and $q = \cot\alpha - \cot 2\alpha$.

41. What is (p/q) equal to?

(a) $-\tan\alpha \cdot \tan 2\alpha$

(b) $-\cot\alpha \cdot \cot 2\alpha$

(c) $\tan\alpha \cdot \tan 2\alpha$

(d) $\cot\alpha \cdot \cot 2\alpha$

42. What is $(p+q)$ equal to?

(a) $\sec 4\alpha$

(b) $\operatorname{cosec} 4\alpha$

(c) $2\sec 4\alpha$

(d) $2\operatorname{cosec} 4\alpha$

43. What is $\tan^2\alpha$ equal to?

(a) $(pq)/(p+q)$

(b) $(p+2q)/p$

(c) $p/(p+2q)$

(d) $p/(2p+q)$

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

Let $2\sin\alpha + \cos\alpha = 2$, where $0 < \alpha < 90°$.

44. What is $\tan\alpha$ equal to?

(a) 1/2

(b) 1

(c) 3/4

(d) 2

45. What is $2\sin 2\alpha + \cos 2\alpha$ equal to?

(a) 11/10

(b) 11/5

(c) 12/5

(d) 13/5

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

In a triangle ABC, two sides BC and CA are in the ratio 2 : 1 and their opposite corresponding angles are in the ratio 3 : 1.

46. One of the angles of the triangle is

(a) 15°

(b) 30°

(c) 45°

(d) 75°

47. Consider the following statements :

I. The triangle is right-angled.

II. One of the sides of the triangle is 3 times the other.

III. The angles A, C and B of the triangle are in AP.

Which of the statements given above is/are correct?

(a) I only

(b) II and III only

(c) I and III only

(d) I, II and III

48. A man at M, standing 100 m away from the base (P) of a chimney of height 50 m, observes the angle of elevation of the highest point (Q) of the smoke to be 45°. The highest point of the chimney is at R. Further P, R and Q are in a straight line and the straight line is perpendicular to PM. What is the angle RMQ equal to?

(a) $\tan^{-1}\left(\frac{1}{2}\right)$

(b) $\tan^{-1}\left(\frac{1}{3}\right)$

(c) $\tan^{-1}\left(\frac{2}{3}\right)$

(d) $\tan^{-1}\left(\frac{3}{4}\right)$

49. If k is a root of $x^2 - 4x + 1 = 0$, then what is $\tan^{-1} k + \tan^{-1}\frac{1}{k}$ equal to?

(a) $-\pi/2$

(b) 0

(c) $\pi/4$

(d) $\pi/2$

50. If $\tan^{-1} k + \tan^{-1}\frac{1}{2} = \frac{\pi}{4}$, then what is the value of k?

(a) 1

(b) 1/2

(c) 1/3

(d) 1/4

51. Under what condition will the lines $m^2x + ny - 1 = 0$ and $n^2x - my + 2 = 0$ be perpendicular?

(a) $mn - 1 = 0$

(b) $mn + 1 = 0$

(c) $m + n = 0$

(d) $m - n = 0$

52. If p and q are real numbers between 0 and 1 such that the points $(p, 1)$, $(1, q)$ and $(0, 0)$ form an equilateral triangle, then what is $(p + q)$ equal to?

(a) $\sqrt{2}$

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

(c) $2 - \sqrt{3}$

(d) $4 - 2\sqrt{3}$

53. The vertices of a triangle are $A(1, 1)$, $B(0, 0)$ and $C(2, 0)$. The angular bisectors of the triangle meet at P. What are the coordinates of P?

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

(b) $(1, \sqrt{3} - 1)$

(c) $(1, 1/2)$

(d) $(1/2, \sqrt{2} - 1)$

54. Let $A(3, -1)$ and $B(1, 1)$ be the end points of line segment AB. Let P be the middle point of the line segment AB. Let Q be the point situated at a distance $\sqrt{2}$ units from P on the perpendicular bisector line of AB. What are the possible coordinates of Q?

(a) (2, 1)

(b) (3, 1)

(c) (2, 2)

(d) (1, 3)

55. ABC is an equilateral triangle and AD is the altitude on BC. If the coordinates of A are (1, 2) and that of D are (−2, 6), then what is the equation of BC?

(a) $3x + 4y - 18 = 0$

(b) $4x + 3y - 1 = 0$

(c) $4x - 3y + 26 = 0$

(d) $3x - 4y + 30 = 0$

56. What is the equation of the circle whose diameter is 10 cm and the equations of two of its diameters are $x + y = 0$ and $x - y = 0$?

(a) $x^2 + y^2 = 1$

(b) $x^2 + y^2 = 25$

(c) $x^2 + y^2 = 100$

(d) $x^2 + y^2 - 2x - 2y - 23 = 0$

57. A square is inscribed in a circle $x^2 + y^2 + 2x + 2y + 1 = 0$ and its sides are parallel to coordinate axes. Which one of the following is a vertex of the square?

(a) (−2, 2)

(b) (−2, −2)

(c) $\left(-1+\frac{1}{\sqrt{2}}, -1-\frac{1}{\sqrt{2}}\right)$

(d) None of the above

58. A tangent to the parabola $y^2 = 4x$ is inclined at an angle 45° with the positive direction of x-axis. What is the point of contact of the tangent and the parabola?

(a) (1, 1)

(b) $(2, 2\sqrt{2})$

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

(d) (1, 2)

59. What is the distance between the two foci of the hyperbola $25x^2 - 75y^2 = 225$?

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

(b) $4\sqrt{3}$ units

(c) $\sqrt{6}$ units

(d) $2\sqrt{6}$ units

60. If any point on an ellipse is $(3\sin\alpha, 5\cos\alpha)$, then what is the eccentricity of the ellipse?

(a) 4/3 (b) 4/5

(c) 3/4 (d) 1/2

61. If a line in 3 dimensions makes angles α, β and γ with the positive directions of the coordinate axes, then what is $\cos(\alpha+\beta)\cos(\alpha-\beta)$ equal to?

(a) $\cos^2\gamma$

(b) $-\cos^2\gamma$

(c) $\sin^2\gamma$

(d) $-\sin^2\gamma$

62. $A(1, 2, -1)$, $B(2, 5, -2)$ and $C(4, 4, -3)$ are three vertices of a rectangle. What is the area of the rectangle?

(a) 8 square units

(b) 9 square units

(c) $\sqrt{66}$ square units

(d) $\sqrt{68}$ square units

63. ABC is a triangle right-angled at B. If $A(k, 1, -1)$, $B(2k, 0, 2)$ and $C(2+2k, k, 1)$ are the vertices of the triangle, then what is the value of k?

(a) −3 (b) −1

(c) 1 (d) 3

64. If a line

$$\frac{x+1}{p} = \frac{y-1}{q} = \frac{z-2}{r}$$

where $p = 2q = 3r$, makes an angle θ with the positive direction of y-axis, then what is $\cos 2\theta$ equal to?

(a) −31/49

(b) −37/49

(c) 31/49

(d) 37/49

65. What is the equation of the plane passing through the point (1, 1, 1) and perpendicular to the line whose direction ratios are $\langle 3, 2, 1 \rangle$?

(a) $x + 2y + 3z = 6$

(b) $3x + 2y + z = 6$

(c) $x + y + z = 3$

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

66. A line makes angles α, β and γ with the positive directions of the coordinate axes. If $\vec{a} = (\sin^2\alpha)\hat{i} + (\sin^2\beta)\hat{j} + (\sin^2\gamma)\hat{k}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$, then what is $\vec{a} \cdot \vec{b}$ equal to?

(a) -2

(b) -1

(c) 1

(d) 2

67. Consider the following statements in respect of a vector $\vec{d} = (\vec{a} \times \vec{b}) \times \vec{c}$:

I. $\vec{d}$ is coplanar with $\vec{a}$ and $\vec{b}$.

II. $\vec{d}$ is perpendicular to $\vec{c}$.

Which of the statements given above is/are correct?

(a) I only

(b) II only

(c) Both I and II

(d) Neither I nor II

68. The position vectors of three points A, B and C are $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively such that $3\vec{a} - 4\vec{b} + \vec{c} = \vec{0}$. What is $AB : BC$ equal to?

(a) 3 : 1

(b) 1 : 3

(c) 3 : 4

(d) 1 : 4

69. The position vectors of three points A, B and C are $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively, where $\vec{c} = (\cos^2\theta)\vec{a} + (\sin^2\theta)\vec{b}$. What is $(\vec{a} \times \vec{b}) + (\vec{b} \times \vec{c}) + (\vec{c} \times \vec{a})$ equal to?

(a) $\vec{0}$

(b) $2\vec{c}$

(c) $3\vec{c}$

(d) Unit vector

70. Let $\vec{a}$, $\vec{b}$, $(\vec{a} \times \vec{b})$ be unit vectors. What is $(\vec{a} \cdot \vec{b})$ equal to?

(a) 0

(b) 1/2

(c) 1

(d) 3

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

Let $x = \sec\theta - \cos\theta$ and $y = \sec^4\theta - \cos^4\theta$.

71. What is $\left(\frac{dy}{dx}\right)^2$ equal to?

(a) $\frac{4(y^2+4)}{(x^2+4)}$ (b) $\frac{4(y^2-4)}{(x^2-4)}$

(c) $\frac{16(y^2+4)}{(x^2+4)}$ (d) $\frac{16(y^2-4)}{(x^2-4)}$

72. What is $\left(\frac{x^2+4}{y^2+4}\right)\frac{dy}{dx}\left[(x^2+4)\frac{d^2y}{dx^2} - 16y\right]$ equal to?

(a) $16x$ (b) $16y$

(c) $-16x$ (d) $-16y$

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

Let ABC be a triangle right-angled at B and $AB + AC = 3$ units.

73. What is $\angle A$ equal to if the area of the triangle is maximum?

(a) $\pi/6$ (b) $\pi/4$

(c) $\pi/3$ (d) $5\pi/12$

74. What is the maximum area of the triangle?

(a) $\sqrt{3}/2$ square unit

(b) $\sqrt{3}$ square units

(c) $\sqrt{6}/2$ square units

(d) $\sqrt{6}$ square units

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

Let $(x+y)^{p+q} = x^p y^q$, where p, q are positive integers.

75. The derivative of y with respect to x

(a) depends on p only

(b) depends on q only

(c) depends on both p and q

(d) is independent of both p and q

76. If $p + q = 10$, then what is $\frac{dy}{dx}$ equal to?

(a) $\frac{y}{x}$

(b) xy

(c) $x^{10}y^{10}$

(d) $\left(\frac{y}{x}\right)^{10}$

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

The slope of the tangent to the curve $y = f(x)$ at $(x, f(x))$ is 4 for every real number x and the curve passes through the origin.

77. What is the nature of the curve?

(a) A straight line passing through (1, 4)

(b) A straight line passing through (−1, 4)

(c) A parabola with vertex at origin and focus at (2, 0)

(d) A parabola with vertex at origin and focus at (1, 0)

78. What is the area bounded by the curve, the x-axis and the line $x = 4$?

(a) 8 square units

(b) 16 square units

(c) 32 square units

(d) 64 square units

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

Let $f(x) = \begin{cases} x^3, & x^2 < 1 \\ x^2, & x^2 \geq 1 \end{cases}$

79. What is $\lim_{x \to 0} f'(x)$ equal to?

(a) 2

(b) 1

(c) 0

(d) Limit does not exist

80. Consider the following statements :

I. The function is continuous at $x = -1$.

II. The function is differentiable at $x = 1$.

Which of the statements given above is/are correct?

(a) I only

(b) II only

(c) Both I and II

(d) Neither I nor II

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

Let the function $y = (1 - \cos x)^{-1}$, where $x \neq 2n\pi$ and n is an integer.

81. What is the range of the function?

(a) $[0, \infty)$

(b) $[0{\cdot}5, \infty)$

(c) $[1, \infty)$

(d) $(-\infty, 0{\cdot}5]$

82. What is $\int y\,dx$ equal to?

(a) $-\tan(x/2) + c$

(b) $-\cot(x/2) + c$

(c) $\tan(x/2) + c$

(d) $\cot(x/2) + c$

where c is the constant of integration.

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

Let the function $f(x) = \sin[x]$, where $[\cdot]$ is the greatest integer function and $g(x) = |x|$.

83. What is $\lim_{x \to 0} \{f(x)\, g(x)\}$ equal to?

(a) -1

(b) 0

(c) 1

(d) Limit does not exist

84. What is $\lim_{x \to 0} \frac{f(x)}{g(x)}$ equal to?

(a) $-\sin 1$

(b) $\sin 1$

(c) 0

(d) Limit does not exist

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

Let the curve $f(x) = |x - 3|$.

85. What is the domain of the function $f(x)$?

(a) $(0, \infty)$

(b) $(3, \infty)$

(c) $(-\infty, \infty)$

(d) $(-\infty, \infty) \setminus \{3\}$

86. What is the area bounded by the curve $f(x)$ and $y = 3$?

(a) 3 square units

(b) 4·5 square units

(c) 7·5 square units

(d) 9 square units

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

Let $f = \{(1, 1), (2, 4), (3, 7), (4, 10)\}$.

87. If $f(x) = px + q$, then what is the value of $(p + q)$?

(a) -1

(b) 0

(c) 1

(d) 5

88. Consider the following statements :

I. f is one-one function.

II. f is onto function if the codomain is the set of natural numbers.

Which of the statements given above is/are correct?

(a) I only

(b) II only

(c) Both I and II

(d) Neither I nor II

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

Let the function $f(x) = x^2 - 1$.

89. What is $\lim_{x \to 1} \{f \circ f(x)\}$ equal to?

(a) -1

(b) 0

(c) 1

(d) 2

90. What is the area bounded by the function $f(x)$ and the x-axis?

(a) 1/3 square unit

(b) 2/3 square unit

(c) 4/3 square units

(d) 2 square units

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

Let $y = \sin^{-1}\left(x - \frac{4x^3}{27}\right)$.

91. What is y equal to?

(a) $\sin^{-1} x$ (b) $\sin^{-1}\left(\frac{x}{3}\right)$

(c) $3\sin^{-1} x$ (d) $3\sin^{-1}\left(\frac{x}{3}\right)$

92. What is $\frac{dy}{dx}$ equal to?

(a) $\frac{1}{\sqrt{9-x^2}}$ (b) $\frac{1}{\sqrt{3-x^2}}$

(c) $\frac{3}{\sqrt{9-x^2}}$ (d) $\frac{9}{\sqrt{9-x^2}}$

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

Let the function $f(x) = x^2 + 9$.

93. What is $\lim_{x\to 0} \frac{\sqrt{f(x)} - 3}{\sqrt{f(x)+7} - 4}$ equal to?

(a) 2 / 3 (b) 1

(c) 4 / 3 (d) 2

94. Consider the following statements :

I. $f(x)$ is an increasing function.

II. $f(x)$ has local maximum at $x = 0$.

Which of the statements given above is/are correct?

(a) I only

(b) II only

(c) Both I and II

(d) Neither I nor II

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

The function $f(x)$ satisfies $f\left(\frac{x}{y}\right) = \frac{f(x)}{f(y)}$ for all positive real values of x and y, and $f(2) = 3$.

95. What is $f(16)$ equal to?

(a) 18

(b) 27

(c) 54

(d) 81

96. What is $f(1)\,f(4)$ equal to?

(a) 4

(b) 8

(c) 9

(d) 18

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

A function f is such that $f(xy) = f(x + y)$ for all real values of x and y, and $f(5) = 10$.

97. What is $f(0)$ equal to?

(a) 0

(b) 1

(c) 5

(d) 10

98. What is $f(20) + f(-20)$ equal to?

(a) 0

(b) 10

(c) 20

(d) 40

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

Let $f(x) = [x^2]$, where $[\cdot]$ is the greatest integer function.

99. What is $\int_{\sqrt{2}}^{\sqrt{3}} f(x)\,dx$ equal to?

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

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

(c) $3 - \sqrt{2}$

(d) 1

100. What is $\int_{\sqrt{2}}^{2} f(x)\,dx$ equal to?

(a) $6 - \sqrt{3} - 2\sqrt{2}$

(b) $6 - \sqrt{3} - \sqrt{2}$

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

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

Consider the following for the **four (04)** items that follow :

The frequency distribution of height of students of a class is given below :

Height (in cm)	*Number of Students*
160–162	12
162–164	15
164–166	24
166–168	13

101. What is the total number of students whose height is less than or equal to 165 cm?

(a) 15

(b) 39

(c) 51

(d) None of the above

102. What is the median height of the class?

(a) 162·41 cm

(b) 163·41 cm

(c) 164·41 cm

(d) 165·41 cm

103. The height which occurs most frequently in the class is

(a) 163·5 cm

(b) 163·9 cm

(c) 164·5 cm

(d) 164·9 cm

104. The most appropriate graphical representation of the given frequency distribution is

(a) bar chart

(b) percentage bar chart

(c) histogram

(d) pie chart

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

The sum and the sum of squares of the observations corresponding to length X (in cm) and weight Y (in gm) of 50 tropical tubers are given as $\Sigma X = 200$, $\Sigma Y = 250$, $\Sigma X^2 = 900$ and $\Sigma Y^2 = 1400$.

105. Which one of the following is correct?

(a) Variance (X) > Variance (Y)

(b) Variance (X) < Variance (Y)

(c) Variance (X) = Variance (Y)

(d) Cannot be determined from the given data

106. Which one of the following statements is correct?

(a) Coefficient of variation of X is strictly more than coefficient of variation of Y.

(b) Coefficient of variation of X is strictly less than coefficient of variation of Y.

(c) Coefficient of variation of X is same as coefficient of variation of Y.

(d) Coefficient of variation cannot be determined from the given data.

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

Let X be a random variable following binomial distribution with parameters $n = 6$ and $p = k$. Further, $9P(X = 4) = P(X = 2)$.

107. What is the value of k?

(a) 1/2 (b) 1/3

(c) 1/4 (d) 1/5

108. What is the value of $P(X = 3)$?

(a) 135/1024

(b) 5/128

(c) 45/1024

(d) 70/1024

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

A committee of 6 members is formed from a group of 7 gentlemen and 4 ladies.

109. What is the probability that the committee includes exactly 3 gentlemen?

(a) 10/33 (b) 30/77

(c) 100/231 (d) 5/11

110. What is the probability that the committee includes at least 2 ladies?

(a) 41/66 (b) 47/66

(c) 49/66 (d) 53/66

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

The probabilities that A, B and C become managers are 3/10, 1/2 and 4/5 respectively. The probabilities that bonus scheme will be introduced if A, B and C become managers are 4/9, 2/9 and 1/3 respectively.

111. What is the probability that the bonus scheme will be introduced?

(a) 17/45 (b) 19/45

(c) 23/45 (d) 26/45

112. If the bonus scheme has been introduced, then what is the probability that the manager appointed was B?

(a) 5/23 (b) 6/23

(c) 7/23 (d) 8/23

113. The arithmetic mean of 100 observations is 50. If 5 is subtracted from each observation and then divided by 20, then what is the new arithmetic mean?

(a) 2·25 (b) 3·5

(c) 4·25 (d) 5·5

114. The standard deviation of 100 observations is 10. If 5 is added to each observation and then divided by 20, then what will be the new standard deviation?

(a) 0·25 (b) 0·5

(c) 0·75 (d) 1·00

115. If $P(A) = 1/3$, $P(B) = 1/2$ and $P(A \cap B) = 1/4$, then what is the value of $P(B \mid A^c)$?

(a) 1/8 (b) 3/8

(c) 5/8 (d) 7/8

116. If $P(A) = 1/3$, $P(B) = 1/2$ and $P(A \cap B) = 1/4$, then what is the value of $P(A^c \cap B^c)$?

(a) 1/4 (b) 5/12

(c) 7/12 (d) 11/12

117. If two fair dice are tossed, then what is the probability that the sum of the numbers on the faces of the dice is strictly greater than 7?

(a) 1/3 (b) 5/12

(c) 7/12 (d) 3/4

118. The probability of a man hitting a target is 1/5. If the man fires 7 times, then what is the probability that he hits the target at least twice?

(a) $1-\left(\frac{3}{5}\right)\left(\frac{4}{5}\right)^6$

(b) $1-\left(\frac{3}{5}\right)\left(\frac{4}{5}\right)^7$

(c) $1-\left(\frac{11}{5}\right)\left(\frac{4}{5}\right)^6$

(d) $1-\left(\frac{11}{5}\right)\left(\frac{4}{5}\right)^7$

119. Let X be a random variable following binomial distribution whose mean and variance are 200 and 160 respectively. What is the value of the number of trials (n)?

(a) 500 (b) 1000

(c) 1500 (d) 2000

120. What is the arithmetic mean of $8^2, 9^2, 10^2, \ldots, 15^2$?

(a) 133·5 (b) 135·5

(c) 137·5 (d) 139·5