

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

क्रम संख्या

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परीक्षण पुस्तिका अनुक्रम

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परीक्षण पुस्तिका

गणित



समय : दो घण्टे और तीस मिनट

पूर्णांक : 300

अनुदेश

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 (सीरीज कोड) A, B, C या D को, ध्यान से एवं बिना किसी चूक या विसंगति के भरने और कूटबद्ध करने की ज़िम्मेदारी 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।
4. इस परीक्षण पुस्तिका में 120 प्रश्नांश (प्रश्न) दिए गए हैं। प्रत्येक प्रश्नांश हिन्दी और अंग्रेज़ी 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 अंत में संलग्न हैं।
10. ग़लत उत्तरों के लिए दण्ड :
वस्तुनिष्ठ प्रश्न-पत्रों में उम्मीदवार द्वारा दिए गए ग़लत उत्तरों के लिए दण्ड दिया जाएगा।
(i) प्रत्येक प्रश्न के लिए चार वैकल्पिक उत्तर हैं। उम्मीदवार द्वारा प्रत्येक प्रश्न के लिए दिए गए एक ग़लत 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 ग़लत 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।

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

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

1. The Cartesian product $A \times A$ has 16 elements among which are $(0, 2)$ and $(1, 3)$. Which of the following statements is/are correct ?

1. It is possible to determine set A.
2. $A \times A$ contains the element $(3, 2)$.

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~~

2. Let $A = \{1, 2, 3, \dots, 20\}$. Define a relation R from A to A by $R = \{(x, y) : 4x - 3y = 1\}$, where $x, y \in A$. Which of the following statements is/are correct ?

1. The domain of R is $\{1, 4, 7, 10, 13, 16\}$.
2. The range of R is $\{1, 5, 9, 13, 17\}$.
3. The range of R is equal to codomain of R.

Select the correct answer using the code given below :

- ~~(a) 1 only~~
 (b) 2 only
 (c) 1 and 2
~~(d) 2 and 3~~

3. Consider the following statements :

1. The relation f defined by

$$f(x) = \begin{cases} x^3, & 0 \leq x \leq 2 \\ 4x, & 2 \leq x \leq 8 \end{cases} \text{ is a function.}$$

2. The relation g defined by

$$g(x) = \begin{cases} x^2, & 0 \leq x \leq 4 \\ 3x, & 4 \leq x \leq 8 \end{cases} \text{ is a function.}$$

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

4. Consider the following statements :

1. $A = (A \cup B) \cup (A - B)$
2. $A \cup (B - A) = (A \cup B)$
3. $B = (A \cup B) - (A - B)$

Which of the statements given above are correct ?

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

5. A function satisfies $f(x-y) = \frac{f(x)}{f(y)}$, where $f(y) \neq 0$. If $f(1) = 0.5$, then what is $f(2) + f(3) + f(4) + f(5) + f(6)$ equal to ?

- (a) $\frac{15}{32}$
- (b) $\frac{17}{32}$
- (c) $\frac{29}{64}$
- (d) $\frac{31}{64}$



6. What is $2 \cot\left(\frac{1}{2} \cos^{-1} \frac{\sqrt{5}}{3}\right)$ equal to ?

- (a) -1
- (b) 1
- (c) $3 + \sqrt{5}$
- (d) $3 - \sqrt{5}$

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7. If $\sec^{-1}p - \operatorname{cosec}^{-1}q = 0$, where $p > 0, q > 0$; then what is the value of $p^{-2} + q^{-2}$?

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

8. What is $1 + \sin^2\left(\cos^{-1}\left(\frac{3}{\sqrt{17}}\right)\right)$ equal to ?

- (a) $\frac{25}{17}$
- (b) $\frac{8}{17}$
- (c) $\frac{9}{17}$
- (d) $\frac{47}{17}$

9. If $\tan(\pi \cos \theta) = \cot(\pi \sin \theta)$, $0 < \theta < \frac{\pi}{2}$; then what is the value of $8 \sin^2\left(\theta + \frac{\pi}{4}\right)$?

- (a) 16
- (b) 2
- (c) 1
- (d) $\frac{1}{2}$

10. If $\tan \alpha = \frac{1}{7}$, $\sin \beta = \frac{1}{\sqrt{10}}$; $0 < \alpha, \beta < \frac{\pi}{2}$, then what is the value of $\cos(\alpha + 2\beta)$?

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

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

Let $f(x) = x^2 - 1$ and $gof(x) = x - \sqrt{x} + 1$.

11. Which one of the following is a possible expression for $g(x)$?

(a) $\sqrt{x+1} - \sqrt[4]{x+1}$

(b) $\sqrt{x+1} - \sqrt[4]{x+1} + 1$

(c) $\sqrt{x+1} + \sqrt[4]{x+1}$

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

12. What is $g(15)$ equal to ?

(a) 1

(b) 2

(c) 3

(d) 4

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

Let a function f be defined on $\mathbb{R} - \{0\}$ and $2f(x) + f\left(\frac{1}{x}\right) = x + 3$.

13. What is $f(0.5)$ equal to ?

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

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

(c) 1

(d) 2

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14. If f is differentiable, then what is $f'(0.5)$ equal to ?

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

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

(c) 2

(d) 4

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

A function is defined by

$$f(x) = \begin{vmatrix} x+1 & 2 & 3 \\ 2 & x+4 & 6 \\ 3 & 6 & x+9 \end{vmatrix}$$

15. The function is decreasing on :

(a) $\left[-\frac{28}{3}, 0\right]$

(b) $\left[0, \frac{28}{3}\right]$

(c) $\left[0, \frac{50}{3}\right]$

(d) $\left[0, \frac{56}{3}\right]$

16. The function attains local minimum value at :

(a) $x = -\frac{28}{3}$

(b) $x = -1$

(c) $x = 0$

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

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

Given that $4x^2 + y^2 = 9$.

17. What is the maximum value of y ?

- (a) $\frac{3}{2}$
- (b) 3
- (c) 4
- (d) 6



18. What is the maximum value of xy ?

- (a) $\frac{9}{4}$
- (b) $\frac{3}{2}$
- (c) $\frac{4}{9}$
- (d) $\frac{2}{3}$



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

A function is defined by $f(x) = \pi + \sin^2 x$.

19. What is the range of the function ?

- (a) $[0, 1]$
- (b) $[\pi, \pi + 1]$
- (c) $[\pi - 1, \pi + 1]$
- (d) $[\pi - 1, \pi - 1]$

20. What is the period of the function ?

- (a) 2π
- (b) π
- (c) $\frac{\pi}{2}$
- (d) The function is non-periodic

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

Let $I = \int_{-2\pi}^{2\pi} \frac{\sin^4 x + \cos^4 x}{1 + 3^x} dx$

21. What is $\int_0^{\pi} (\sin^4 x + \cos^4 x) dx$ equal to ?

- (a) $\frac{3\pi}{8}$
- (b) $\frac{3\pi}{4}$
- (c) $\frac{3\pi}{2}$
- (d) 3π

22. What is I equal to ?

- (a) 0
- (b) $\frac{3\pi}{4}$
- (c) $\frac{3\pi}{2}$
- (d) 3π

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

Let $f(x) = \begin{cases} ax(x+1) + b, & x < 1 \\ x - 1, & 1 \leq x \leq 2 \end{cases}$

23. If the function $f(x)$ is differentiable at $x = 1$, then what is the value of $(a + b)$?

- (a) $-\frac{1}{3}$
- (b) -1
- (c) 0
- (d) 1

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

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

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

(c) 0

(d) 1

25. If $f(x) = |\ln|x||$ where $0 < x < 1$, then what is $f'(0.5)$ equal to?

(a) -2

(b) -1

(c) 0

(d) 2



26. If $f'(x) = \cos(\ln x)$ and $y = f\left(\frac{2x-3}{x}\right)$, then

what is $\frac{dy}{dx}$ equal to?

(a) $\cos\left(\ln\left(\frac{2x-3}{x}\right)\right)$

(b) $-\frac{3}{x^2} \sin\left(\ln\left(\frac{2x-3}{x}\right)\right)$

(c) $\frac{3}{x^2} \cos\left(\ln\left(\frac{2x-3}{x}\right)\right)$

(d) $-\frac{3}{x^2} \cos\left(\ln\left(\frac{2x-3}{x}\right)\right)$

27. What is $\int_0^{8\pi} |\sin x| dx$ equal to?

(a) 2

(b) 4

(c) 8

(d) 16

28. What is the area between the curve $f(x) = x|x|$ and x-axis for $x \in [-1, 1]$?

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

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

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

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

29. What are the order and the degree respectively of the differential equation

$$x^2 \left(\frac{d^3y}{dx^3}\right)^2 + \left(\frac{dy}{dx}\right)^4 + \sin x = 0?$$

(a) 3, 4

(b) 1, 4

(c) 2, 2

(d) 3, 2

30. What is the differential equation of all parabolas of the type $y^2 = 4a(x-b)$?

(a) $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

(b) $\frac{d^2y}{dx^2} + x^2 \left(\frac{dy}{dx}\right)^2 = 0$

(c) $y^2 \frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

(d) $y \frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

31. If $z\bar{z} = |z + \bar{z}|$, where $z = x + iy$, $i = \sqrt{-1}$, then the locus of z is a pair of:

- (a) straight lines
- (b) rectangular hyperbolas
- (c) parabolas
- (d) circles

32. If $1! + 3! + 5! + 7! + \dots + 199!$ is divided by 24, what is the remainder?

- (a) 3
- (b) 6
- (c) 7
- (d) 9

33. What is the value of $\sqrt{12+5i} + \sqrt{12-5i}$, where $i = \sqrt{-1}$?

- (a) 24
- (b) 25
- (c) $5\sqrt{2}$
- (d) $5(\sqrt{2} - 1)$

34. If $A = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, then what is the value of $\det(I + AA')$, where I is the 3×3 identity matrix?

- (a) 15
- (b) 6
- (c) 0
- (d) -1

35. If A, B and C are square matrices of order 3 and $\det(BC) = 2 \det(A)$, then what is the value of $\det(2A^{-1}BC)$?

- (a) 16
- (b) 8
- (c) 4
- (d) 2

36. If the n^{th} term of a sequence is $\frac{2n+5}{7}$, then what is the sum of its first 140 terms?

- (a) 2840
- (b) 2780
- (c) 2920
- (d) 5700

37. Let A be a skew-symmetric matrix of order 3. What is the value of $\det(4A^4) - \det(3A^3) + \det(2A^2) - \det(A) + \det(-I)$ where I is the identity matrix of order 3?

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

38. If $A = \begin{bmatrix} 0 & 3 & 4 \\ -3 & 0 & 5 \\ -4 & -5 & 0 \end{bmatrix}$, then which one of the following statements is correct ?

- (a) A^2 is symmetric matrix with $\det(A^2) = 0$.
- (b) A^2 is symmetric matrix with $\det(A^2) \neq 0$.
- (c) A^2 is skew-symmetric matrix with $\det(A^2) = 0$.
- (d) A^2 is skew-symmetric matrix with $\det(A^2) \neq 0$.

39. If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$, then which of the following statements are correct ?

1. A^n will always be singular for any positive integer n .
2. A^n will always be a diagonal matrix for any positive integer n .
3. A^n will always be a symmetric matrix for any positive integer n .

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

40. If $(a + b)$, $2b$, $(b + c)$ are in HP, then which one of the following is correct ?

- (a) a , b and c are in AP
- (b) $a - b$, $b - c$ and $c - a$ are in AP
- (c) a , b and c are in GP
- (d) $a - b$, $b - c$ and $c - a$ are in GP

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

Consider the equation $(1 - x)^4 + (5 - x)^4 = 82$.

41. What is the number of real roots of the equation ?

- (a) 0
- (b) 2
- (c) 4
- (d) 8

42. What is the sum of all the roots of the equation ?

- (a) 24
- (b) 12
- (c) 10
- (d) 6

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

Consider equation-I : $z^3 + 2z^2 + 2z + 1 = 0$ and equation-II : $z^{1985} + z^{100} + 1 = 0$.

43. What are the roots of equation-I ?

- ~~(a) $1, \omega, \omega^2$~~
- (b) $-1, \omega, \omega^2$
- ~~(c) $1, -\omega, \omega^2$~~
- (d) $-1, -\omega, -\omega^2$

44. Which one of the following is a root of equation-II ?

(a) -1

(b) $-\omega$

(c) $-\omega^2$

(d) ω

45. What is the number of common roots of equation-I and equation-II ?

(a) 0

(b) 1

(c) 2

(d) 3

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

A quadratic equation is given by $(a + b)x^2 - (a + b + c)x + k = 0$, where a, b, c are real.

46. If $k = \frac{c}{2}$, ($c \neq 0$), then the roots of the equation are :

(a) Real and equal

(b) Real and unequal

(c) Real iff $a > c$

(d) Complex but not real

47. If $k = c$, then the roots of the equation are :

(a) $\frac{a+c}{a+b}$ and $\frac{b}{a+b}$

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

(c) 1 and $\frac{c}{a+b}$

(d) -1 and $-\frac{c}{a+b}$

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

Let $(1 + x)^n = 1 + T_1x + T_2x^2 + T_3x^3 + \dots + T_nx^n$.

48. What is $(T_1 + 2T_2 + 3T_3) + \dots + nT_n$ equal to ?

(a) 0

(b) 1

~~(c) 2^n~~

(d) $n2^{n-1}$

49. What is $1 - T_1 + 2T_2 - 3T_3 + \dots + (-1)^n nT_n$ equal to ?

(a) 0

(b) -2^{n-1}

(c) $n2^{n-1}$

(d) 1

50. What is $T_1 + T_2 + T_3 + \dots + T_n$ equal to ?

(a) 2^n

(b) $2^n - 1$

(c) 2^{n-1}

(d) $2^n + 1$

51. If r is the coefficient of correlation between x and y , then what is the correlation coefficient between $(3x + 4)$ and $(-3y + 3)$?

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

52. A fair coin is tossed 6 times. What is the probability of getting a result in the 6th toss which is different from those obtained in the first five tosses?

- (a) $\frac{7}{16}$
- (b) $\frac{1}{16}$
- (c) $\frac{1}{32}$
- (d) $\frac{1}{64}$

53. If H is the Harmonic Mean of three numbers ${}^{10}C_4$, ${}^{10}C_5$, and ${}^{10}C_6$, then what is the value of $\frac{270}{H}$?

- (a) 1
- (b) $\frac{14}{17}$
- (c) $\frac{17}{14}$
- (d) $\frac{1}{31}$

54. In a class, there are n students including the students P and Q . What is the probability that P and Q sit together if seats are assigned randomly?

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

55. In a Binomial distribution $B(n, p)$, $n = 6$ and $9P(X = 4) = P(X = 2)$. What is p equal to?

- (a) $\frac{1}{4}$
- (b) $\frac{1}{2}$
- (c) $\frac{3}{4}$
- (d) $\frac{4}{5}$

Consider the following for the next five (05) items that follow :

Three boys P, Q, R and three girls S, T, U are to be arranged in a row for a group photograph.

56. What is the probability that all three boys sit together ?

- (a) $\frac{1}{5}$
- (b) $\frac{1}{4}$
- (c) $\frac{1}{3}$
- (d) $\frac{1}{12}$



57. What is the probability that boys and girls sit alternatively ?

- (a) $\frac{4}{5}$
- (b) $\frac{1}{10}$
- (c) $\frac{5}{6}$
- (d) $\frac{1}{7}$

58. What is the probability that no two girls sit together ?

- (a) $\frac{2}{5}$
- (b) $\frac{3}{5}$
- (c) $\frac{1}{18}$
- (d) $\frac{1}{5}$

59. What is the probability that P and Q take the two end positions ?

- (a) $\frac{1}{15}$
- (b) $\frac{7}{15}$
- (c) $\frac{14}{15}$
- (d) $\frac{11}{45}$

60. What is the probability that Q and U sit together ?

- (a) $\frac{2}{3}$
- (b) $\frac{1}{4}$
- (c) $\frac{5}{6}$
- (d) $\frac{1}{3}$

61. What is the length of projection of the vector $\hat{i} + 2\hat{j} + 3\hat{k}$ on the vector $2\hat{i} + 3\hat{j} - 2\hat{k}$?

(a) $\frac{1}{\sqrt{17}}$

(b) $\frac{2}{\sqrt{17}}$

(c) $\frac{3}{\sqrt{17}}$

(d) $\frac{2}{\sqrt{14}}$

62. If $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = 144$ and $|\vec{b}| = 4$, then what is the value of $|\vec{a}|$?

(a) 3

(b) 4

(c) 5

(d) 6

63. If θ is the angle between vectors \vec{a} and \vec{b} such that $\vec{a} \cdot \vec{b} \geq 0$, then which one of the following is correct ?

(a) $0 \leq \theta \leq \pi$

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

(c) $0 \leq \theta \leq \frac{\pi}{2}$

(d) $0 < \theta < \frac{\pi}{2}$

64. The vectors $60\hat{i} + 3\hat{j}$, $40\hat{i} - 8\hat{j}$ and $\beta\hat{i} - 52\hat{j}$ are collinear if:

(a) $\beta = 20$

(b) $\beta = 40$

(c) $\beta = -40$

(d) $\beta = 26$

65. Consider the following in respect of the vectors $\vec{a} = (0, 1, 1)$ and $\vec{b} = (1, 0, 1)$:

1. The number of unit vectors perpendicular to both \vec{a} and \vec{b} is only one.

2. The angle between the vectors is $\frac{\pi}{3}$.

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

66. If L is the line with direction ratios $\langle 3, -2, 6 \rangle$ and passing through $(1, -1, 1)$, then what are the coordinates of the points on L whose distance from $(1, -1, 1)$ is 2 units ?

(a) $\left(-\frac{11}{7}, \frac{13}{7}, \frac{19}{7}\right)$ and $\left(\frac{1}{7}, \frac{3}{7}, \frac{5}{7}\right)$

(b) $\left(\frac{19}{7}, -\frac{11}{7}, \frac{13}{7}\right)$ and $\left(-\frac{1}{7}, \frac{3}{7}, -\frac{5}{7}\right)$

(c) $\left(\frac{13}{7}, \frac{11}{7}, \frac{19}{7}\right)$ and $\left(-\frac{1}{7}, -\frac{3}{7}, \frac{5}{7}\right)$

(d) $\left(\frac{13}{7}, -\frac{11}{7}, \frac{19}{7}\right)$ and $\left(\frac{1}{7}, -\frac{3}{7}, -\frac{5}{7}\right)$

67. Which one of the planes is parallel to the line $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$?

- (a) $2x + 2y + z - 1 = 0$
- (b) $2x - y - 2z + 5 = 0$
- (c) $2x + 2y - 2z + 1 = 0$
- (d) $x - 2y + z - 1 = 0$

68. What is the angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$?

- (a) 0°
- (b) 30°
- (c) 60°
- (d) 90°



69. What is the equation of the sphere concentric with the sphere $x^2 + y^2 + z^2 - 2x - 6y - 8z - 5 = 0$ and which passes through the origin ?

- (a) $x^2 + y^2 + z^2 - 2x - 8z = 0$
- (b) $x^2 + y^2 + z^2 - 2x - 6y = 0$
- (c) $x^2 + y^2 + z^2 - 6y - 8z = 0$
- (d) $x^2 + y^2 + z^2 - 2x - 6y - 8z = 0$

1
3
4

70. A point P lies on the line joining A(1, 2, 3) and B(2, 10, 1). If z-coordinate of P is 7, what is the sum of other two coordinates ?

- (a) -15
- (b) -13
- (c) -11
- (d) -9

71. Let $t_1, t_2, t_3 \dots$ be in GP. What is $(t_1 t_3 \dots t_{21})^{\frac{1}{11}}$ equal to ?

- (a) t_{10}
- (b) t_{10}^2
- (c) t_{11}
- (d) t_{11}^2

72. Which one of the following is a square root of $-\sqrt{-1}$?

- (a) $1 + i$
- (b) $\frac{1-i}{\sqrt{2}}$
- (c) $\frac{1+i}{\sqrt{2}}$
- (d) $\frac{1}{\sqrt{2}}i$

73. What is the maximum number of points of intersection of 10 circles ?

- (a) 45
- (b) 60
- (c) 90
- (d) 120

74. A set S contains $(2n + 1)$ elements. There are 4096 subsets of S which contain at most n elements. What is n equal to ?

- (a) 5
- (b) 6
- (c) 7
- (d) 8

75. If $\begin{vmatrix} x^2 + 3x - x - 1 & x + 3 \\ x + 1 & -2x & x - 4 \\ x - 3 & x + 4 & 3x \end{vmatrix}$
 $= ax^4 + bx^3 + cx^2 + dx + e,$

then what is the value of e ?

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

76. If all elements of a third order determinant are equal to 1 or -1, then the value of the determinant is :

- (a) 0 only
- (b) an even number but not necessarily 0
- (c) an odd number
- (d) 0, 1 or -1

77. If $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 3 & 0 \\ 1 & 0 & 1 \end{bmatrix}$, then what is the value of $\det[\text{adj}(\text{adj}A)]$?

- (a) 5
- (b) 25
- (c) 125
- (d) 625

78. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then what is

$23A^3 - 19A^2 - 4A$ equal to ?

- (a) Null matrix of order 3
- (b) Identity matrix of order 3
- (c) $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$
- (d) $\begin{bmatrix} 7 & 0 & 0 \\ 0 & 7 & 0 \\ 0 & 0 & 7 \end{bmatrix}$

79. The value of the determinant of a matrix A of order 3 is 3. If C is the matrix of cofactors of the matrix A, then what is the value of determinant of C^2 ?

- (a) 3
- (b) 9
- (c) 81
- (d) 729

80. If $A_k = \begin{bmatrix} k-1 & k \\ k-2 & k+1 \end{bmatrix}$, then what is $\det(A_1) + \det(A_2) + \det(A_3) + \dots + \det(A_{100})$ equal to ?

- (a) 100
- (b) 1000
- (c) 9900
- (d) 10000

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

A parabola passes through (1, 2) and satisfies the differential equation $\frac{dy}{dx} = \frac{2y}{x}$, $x > 0, y > 0$.

81. What is the directrix of the parabola ?

(a) $y = -\frac{1}{8}$

(b) $y = \frac{1}{8}$

(c) $x = -\frac{1}{8}$

(d) $x = \frac{1}{8}$

82. What is the length of latus rectum of the parabola ?

(a) 1

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

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

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

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

Let $f(x) = \frac{a^{x-1} + b^{x-1}}{2}$ and $g(x) = x - 1$.

83. What is $\lim_{x \rightarrow 1} \frac{f(x) - 1}{g(x)}$ equal to ?

(a) $\frac{\ln(ab)}{4}$

(b) $\frac{\ln(ab)}{2}$

(c) $\ln(ab)$

(d) $2 \ln(ab)$

DFTK-S-MTH

84. What is $\lim_{x \rightarrow 1} f(x)^{\frac{1}{g(x)}}$ equal to ?

(a) \sqrt{ab}

(b) ab

(c) $2ab$

(d) $\frac{\sqrt{ab}}{2}$

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

Let $f(x) = \sqrt{2-x} + \sqrt{2+x}$.

85. What is the domain of the function ?

(a) $(-2, 2)$

(b) $[-2, 2]$

(c) $\mathbb{R} - (-2, 2)$

(d) $\mathbb{R} - [-2, 2]$

86. What is the greatest value of the function ?

(a) $\sqrt{3}$

(b) $\sqrt{6}$

(c) $\sqrt{8}$

(d) 4

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

Let $f(x) = |x|$ and $g(x) = [x] - 1$, where $[.]$ is the greatest integer function.

Let $h(x) = \frac{f(g(x))}{g(f(x))}$.

87. What is $\lim_{x \rightarrow 0^+} h(x)$ equal to ?

(a) -2

(b) -1

(c) 0

(d) 1

88. What is $\lim_{x \rightarrow 0^-} h(x)$ equal to ?

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

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

$$\text{Let } f(x) = \begin{cases} \frac{x-3}{|x-3|} + a; & x < 3 \\ a - b; & x = 3 \text{ and} \\ \frac{x-3}{|x-3|} + b; & x > 3 \end{cases}$$

$f(x)$ be continuous at $x = 3$.

89. What is the value of a ?

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

90. What is the value of b ?

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

91. The sum of deviations of n numbers from 10 and 20 are p and q respectively. If $(p - q)^2 = 10000$, then what is the value of n ?

- (a) 10
- (b) 20
- (c) 50
- (d) 100

92. If $\bar{X} = 20$ is the mean of 10 observations x_1, x_2, \dots, x_{10} ; then what is the value of

$$\sum_{i=1}^{10} \left(\frac{3x_i - 4}{5} \right) ?$$

- (a) 0
- (b) 12
- (c) 112
- (d) 1012

93. If the mean and the sum of squares of 10 observations are 40 and 16160 respectively, then what is the standard deviation ?

- (a) 16
- (b) 6
- (c) 5
- (d) 4

94. Three dice are thrown. What is the probability of getting a sum which is a perfect square ?

- (a) $\frac{17}{108}$
- (b) $\frac{5}{108}$
- (c) $\frac{19}{108}$
- (d) $\frac{23}{108}$

95. A, B, C and D are mutually exclusive and exhaustive events.

$$\text{If } 2P(A) = 3P(B) = 4P(C) = 5P(D),$$

then what is $77P(A)$ equal to ?

(a) 12

(b) 15

(c) 20

(d) 30

96. Two distinct natural numbers from 1 to 9 are picked at random. What is the probability that their product has 1 in its unit place ?

(a) $\frac{1}{81}$

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

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

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

97. Two dice are thrown. What is the probability that difference of numbers on them is 2 or 3 ?

(a) $\frac{7}{36}$

(b) $\frac{7}{18}$

(c) $\frac{5}{18}$

(d) $\frac{11}{36}$

98. What is the mean of the numbers 1, 2, 3, ..., 10 with frequencies ${}^9C_0, {}^9C_1, {}^9C_2, \dots, {}^9C_9$, respectively ?

(a) 1.1×2^8

(b) 1.2×7^4

(c) 5.5

(d) 0.55

99. The probability that a person recovers from a disease is 0.8. What is the probability that exactly 2 persons out of 5 will recover from the disease ?

(a) 0.00512

(b) 0.02048

(c) 0.2048

(d) 0.0512

100. Suppose that there is a chance for a newly constructed building to collapse, whether the design is faulty or not. The chance that the design is faulty is 10%. The chance that the building collapses is 95% if the design is faulty, otherwise it is 45%. If it is seen that the building has collapsed, then what is the probability that it is due to faulty design ?

(a) 0.10

(b) 0.19

(c) 0.45

(d) 0.95

101. What is the equation of directrix of parabola $y^2 = 4bx$, where $b < 0$ and $b^2 + b - 2 = 0$?

- (a) $x + 1 = 0$
- (b) $x - 2 = 0$
- (c) $x - 1 = 0$
- (d) $x + 2 = 0$

102. The points $(-a, -b)$, $(0, 0)$, (a, b) and (a^2, ab) are:

- (a) lying on the same circle
- (b) vertices of a square
- (c) vertices of a parallelogram that is not a square
- (d) collinear

103. Given that $16p^2 + 49q^2 - 4r^2 - 56pq = 0$. Which one of the following is a point on a pair of straight lines $(px + qy + r)(px + qy - r) = 0$?

- (a) $(2, \frac{7}{2})$
- (b) $(2, -\frac{7}{2})$
- (c) $(4, -7)$
- (d) $(4, 7)$

104. If $3x + y - 5 = 0$ is the equation of a chord of the circle $x^2 + y^2 - 25 = 0$, then what are the coordinates of the mid-point of the chord?

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

105. Consider the following in respect of the equation $\frac{x^2}{24-k} + \frac{y^2}{k-16} = 2$.

1. The equation represents an ellipse if $k = 19$.
2. The equation represents a hyperbola if $k = 12$.
3. The equation represents a circle if $k = 20$.

How many of the statements given above are correct?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

106. Consider the following statements in respect of hyperbola $\frac{x^2}{\cos^2 \theta} - \frac{y^2}{\sin^2 \theta} = 1$:

1. The two foci are independent of θ .
2. The eccentricity is $\sec \theta$.
3. The distance between the two foci is 2 units.

How many of the statements given above are correct?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

107. Consider the following in respect of the circle $4x^2 + 4y^2 - 4ax - 4ay + a^2 = 0$:

1. The circle touches both the axes.
2. The diameter of the circle is $2a$.
3. The centre of the circle lies on the line $x + y = a$.

How many of the statements given above are correct ?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

108. For what values of k is the line $(k - 3)x - (5 - k^2)y + k^2 - 7k + 6 = 0$ parallel to the line $x + y = 1$?

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

109. The line $x + y = 4$ cuts the line joining $P(-1, 1)$ and $Q(5, 7)$ at R . What is $PR : RQ$ equal to ?

- (a) $1 : 1$
- (b) $1 : 2$
- (c) $2 : 1$
- (d) $1 : 3$

110. What is the sum of the intercepts of the line whose perpendicular distance from origin is 4 units and the angle which the normal makes with positive direction of x -axis is 15° ?

- (a) 8
- (b) $4\sqrt{6}$
- (c) $8\sqrt{6}$
- (d) 16

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

Let $a_1, a_2, a_3 \dots$ be in AP such that

$$a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{25} + a_{30} + a_{34} = 300.$$

111. What is

$$a_1 + a_5 - a_{10} - a_{15} - a_{20} - a_{25} + a_{30} + a_{34}$$

equal to ?

- (a) 0
- (b) 25
- (c) 125
- (d) 250

112. What is $\sum_{n=1}^{34} a_n$ equal to ?

- (a) 900
- (b) 1025
- (c) 1200
- (d) 1275

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

Let $p = \cos\left(\frac{\pi}{5}\right)\cos\left(\frac{2\pi}{5}\right)$ and $q = \cos\left(\frac{4\pi}{5}\right)\cos\left(\frac{8\pi}{5}\right)$;

113. What is the value of $p + q$?

- (a) $-\frac{1}{2}$
- (b) $-\frac{1}{4}$
- (c) 0
- (d) $\frac{1}{2}$

114. What is the value of pq ?

- (a) $-\frac{1}{16}$
- (b) $-\frac{1}{4}$
- (c) $\frac{1}{4}$
- (d) $\frac{1}{16}$

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

Let $p = \frac{1}{3} - \frac{\tan 3x}{\tan x}$ and

$q = 1 - 3 \tan^2 x$, $0 < x < \pi$, $x \neq \frac{\pi}{2}$.

115. What is pq equal to ?

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

116. For how many values of x does $\frac{1}{p}$ become zero ?

- (a) No value
- (b) Only one value
- (c) Only two values
- (d) Only three values

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

Let $\sin x + \sin y = \sqrt{3}(\cos y - \cos x)$; $x + y = \frac{\pi}{2}$,
 $0 < x, y < \frac{\pi}{2}$.

117. What is a value of $\sin 3x + \sin 3y$?

- (a) -1
- (b) 0
- (c) 1
- (d) 3

118. What is a value of $\cos^3 x + \cos^3 y$?

- (a) $\frac{3\sqrt{3}}{8}$
- (b) $\frac{3\sqrt{6}}{8}$
- (c) $\frac{3\sqrt{6}}{4}$
- (d) 1

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

The angles A, B and C of a triangle ABC are in the ratio 3 : 5 : 4.

119. What is the value of $a + b + \sqrt{2}c$ equal to ?

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

120. What is the ratio of $a^2 : b^2 : c^2$?

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