A UNIT OF CENTURION EDUCTION PVT. LTD

NDA-II 2019

QUESTION PAPER

SET (D)

1. Under which one of the following conditions will the quadratic equation $x^2 + mx + 2 = 0$ always have real roots ?

(a) $2\sqrt{3} \leq m^2 < 8$

(b) $\sqrt{3} \leq m^2 < 4$

(c) $m^2 \geq 8$

(d) $m^2 \leq \sqrt{3}$

2. What is the value of

$$\left[\frac{i+\sqrt{3}}{2}\right]^{2019} + \left[\frac{i-\sqrt{3}}{2}\right]^{2019} ?$$

(a) 1

(b) -1

(c) $2i$

(d) $-2i$

3. If α and β are the roots of $x^2 + x + 1 = 0$, then what is $\sum_{j=0}^{3}\left(\alpha^j + \beta^j\right)$ equal to ?

(a) 8

(b) 6

(c) 4

(d) 2

4. In a school, 50% students play cricket and 40% play football. If 10% of students play both the games, then what per cent of students play neither cricket nor football ?

(a) 10%

(b) 15%

(c) 20%

(d) 25%

5. If $A = \{x : 0 \leq x \leq 2\}$ and $B = \{y; y$ is a prime number$\}$, then what is $A \cap B$ equal to ?

(a) $\varnothing$

(b) $\{1\}$

(c) $\{2\}$

(d) $\{1, 2\}$

6. If $x = 1 + i$, then what is the value of $x^6 + x^4 + x^2 + 1$?

(a) $6i - 3$

(b) $-6i + 3$

(c) $-6i - 3$

(d) $6i + 3$

7. What is the value of

$$2 + \cfrac{1}{2 + \cfrac{1}{2 + \cfrac{1}{2 + \ldots \infty}}} ?$$

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

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

(c) 3

(d) 4

8. If $P(n, r) = 2520$ and $C(n, r) = 21$, then what is the value of $C(n + 1, r + 1)$?

(a) 7

(b) 14

(c) 28

(d) 56

9. How many terms are there in the expansion of
$(1+2x+x^2)^5+(1+4y+4y^2)^5$?

(a) 12

(b) 20

(c) 21

(d) 22

10. If the middle term in the expansion of $\left(x^2+\frac{1}{x}\right)^{2n}$ is $184756x^{10}$, then what is the value of n ?

(a) 10

(b) 8

(c) 5

(d) 4

11. If $A=\begin{pmatrix}1 & 2\\ 2 & 3\\ 3 & 4\end{pmatrix}$ and $B=\begin{pmatrix}1 & 2\\ 2 & 1\end{pmatrix}$, then which one of the following is correct ?

(a) Both AB and BA exist

(b) Neither AB nor BA exists

(c) AB exists but BA does not exist

(d) AB does not exist but BA exists

12. If $n!$ has 17 zeros, then what is the value of n ?

(a) 95

(b) 85

(c) 80

(d) No such value of n exists

13. Let $A \cup B =$
$\{x|(x-a)(x-b)>0$, where $a<b\}$.
What are A and B equal to ?

(a) $A=\{x|x>a\}$ and $B=\{x|x>b\}$

(b) $A=\{x|x<a\}$ and $B=\{x|x>b\}$

(c) $A=\{x|x<a\}$ and $B=\{x|x<b\}$

(d) $A=\{x|x>a\}$ and $B=\{x|x<b\}$

14. If the constant term in the expansion of $\left(\sqrt{x}-\frac{k}{x^2}\right)^{10}$ is 405, then what can be the values of k ?

(a) ± 2

(b) ± 3

(c) ± 5

(d) ± 9

15. What is $C(47, 4)+C(51, 3)+C(50, 3)+C(49, 3)+C(48, 3)+C(47, 3)$ equal to ?

(a) $C(47, 4)$

(b) $C(52, 5)$

(c) $C(52, 4)$

(d) $C(47, 5)$

16. What is the scalar projection of $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$ on $\vec{b} = 4\hat{i} - 4\hat{j} + 7\hat{k}$?

(a) $\frac{\sqrt{6}}{9}$

(b) $\frac{19}{9}$

(c) $\frac{9}{19}$

(d) $\frac{\sqrt{6}}{19}$

17. If the magnitude of the sum of two non-zero vectors is equal to the magnitude of their difference, then which one of the following is correct ?

(a) The vectors are parallel

(b) The vectors are perpendicular

(c) The vectors are anti-parallel

(d) The vectors must be unit vectors

18. Consider the following equations for two vectors $\vec{a}$ and $\vec{b}$:

1. $\left(\vec{a}+\vec{b}\right)\cdot\left(\vec{a}-\vec{b}\right) = \left|\vec{a}\right|^2 - \left|\vec{b}\right|^2$

2. $\left(\left|\vec{a}+\vec{b}\right|\right)\left(\left|\vec{a}-\vec{b}\right|\right) = \left|\vec{a}\right|^2 - \left|\vec{b}\right|^2$

3. $\left|\vec{a}\cdot\vec{b}\right|^2 + \left|\vec{a}\times\vec{b}\right|^2 = \left|\vec{a}\right|^2\left|\vec{b}\right|^2$

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

19. Consider the following statements :

1. The magnitude of $\vec{a}\times\vec{b}$ is same as the area of a triangle with sides $\vec{a}$ and $\vec{b}$

2. If $\vec{a}\times\vec{b} = \vec{0}$ where $\vec{a} \neq \vec{0}$, $\vec{b} \neq \vec{0}$, then $\vec{a} = \lambda\vec{b}$

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

20. If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them, then what is $\sin^2\left(\frac{\theta}{2}\right)$ equal to ?

(a) $\frac{\left|\vec{a}+\vec{b}\right|^2}{4}$

(b) $\frac{\left|\vec{a}-\vec{b}\right|^2}{4}$

(c) $\frac{\left|\vec{a}+\vec{b}\right|^2}{2}$

(d) $\frac{\left|\vec{a}-\vec{b}\right|^2}{2}$

21. The equation $ax + by + c = 0$ represents a straight line

(a) for all real numbers a, b and c

(b) only when $a \neq 0$

(c) only when $b \neq 0$

(d) only when at least one of a and b is non-zero

22. What is the angle between the lines $x\cos\alpha + y\sin\alpha = a$ and $x\sin\beta - y\cos\beta = a$?

(a) $\beta - \alpha$

(b) $\pi + \beta - \alpha$

(c) $\frac{(\pi + 2\beta + 2\alpha)}{2}$

(d) $\frac{(\pi - 2\beta + 2\alpha)}{2}$

23. What is the distance between the points $P(m\cos 2\alpha, m\sin 2\alpha)$ and $Q(m\cos 2\beta, m\sin 2\beta)$?

(a) $|2m\sin(\alpha - \beta)|$

(b) $|2m\cos(\alpha - \beta)|$

(c) $|m\sin(2\alpha - 2\beta)|$

(d) $|m\sin(2\alpha - 2\beta)|$

24. An equilateral triangle has one vertex at $(-1, -1)$ and another vertex at $\left(-\sqrt{3}, \sqrt{3}\right)$. The third vertex may lie on

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

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

(c) $(1, 1)$

(d) $(1, -1)$

25. If the angle between the lines joining the end points of minor axis of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ with one of its foci is $\frac{\pi}{2}$, then what is the eccentricity of the ellipse ?

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

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

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

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

26. A point on a line has coordinates $(p+1, p-3, \sqrt{2}p)$ where p is any real number. What are the direction cosines of the line?

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

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

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

(d) Cannot be determined due to insufficient data

27. A point on the line

$$\frac{x-1}{1} = \frac{y-3}{2} = \frac{z+2}{7}$$

has coordinates

(a) (3, 5, 4)

(b) (2, 5, 5)

(c) (–1, –1, 5)

(d) (2, –1, 0)

28. If the line $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-k}{2}$ lies on the plane $2x - 4y + z = 7$, then what is the value of k?

(a) 2

(b) 3

(c) 5

(d) 7

29. A straight line passes through the point (1, 1, 1) makes an angle 60° with the positive direction of z-axis, and the cosine of the angles made by it with the positive directions of the y-axis and the x-axis are in the ratio $\sqrt{3}:1$. What is the acute angle between the two possible positions of the line?

(a) 90°

(b) 60°

(c) 45°

(d) 30°

30. If the points $(x, y, -3)$, (2, 0, –1) and (4, 2, 3) lie on a straight line, then what are the values of x and y respectively?

(a) 1, –1

(b) –1, 1

(c) 0, 2

(d) 3, 4

31. If both p and q belong to the set {1, 2, 3, 4}, then how many equations of the form $px^2 + qx + 1 = 0$ will have real roots?

(a) 12

(b) 10

(c) 7

(d) 6

32. What is the value of
$1-2+3-4+5-\ldots\ldots+101$?

(a) 51

(b) 55

(c) 110

(d) 111

33. If A, B and C are subsets of a given set, then which one of the following relations is ***not*** correct ?

(a) $A \cup (A \cap B) = A \cup B$

(b) $A \cap (A \cup B) = A$

(c) $(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$

(d) $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$

34. If the sum of first n terms of a series is $(n + 12)$, then what is its third term ?

(a) 1

(b) 2

(c) 3

(d) 4

35. What is the value of k for which the sum of the squares of the roots of $2x^2 - 2(k-2)x - (k+1) = 0$ is minimum ?

(a) -1

(b) 1

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

(d) 2

36. If the roots of the equation
$a(b-c)x^2 + b(c-a)x + c(a-b) = 0$
are equal, then which one of the following is correct ?

(a) a, b and c are in AP

(b) a, b and c are in GP

(c) a, b and c are in HP

(d) a, b and c do not follow any regular pattern

37. If $\left|x^2 - 3x + 2\right| > x^2 - 3x + 2$, then which one of the following is correct ?

(a) $x \leq 1$ or $x \geq 2$

(b) $1 \leq x \leq 2$

(c) $1 < x < 2$

(d) x is any real value except 3 and 4

38. A geometric progression (GP) consists of 200 terms. If the sum of odd terms of the GP is m, and the sum of even terms of the GP is n, then what is its common ratio ?

(a) m/n

(b) n/m

(c) $m + (n/m)$

(d) $n + (m/n)$

39. If a set A contains 3 elements and another set B contains 6 elements, then what is the minimum number of elements that $(A \cup B)$ can have ?

(a) 3

(b) 6

(c) 8

(d) 9

40. What is the number of diagonals of an octagon ?

(a) 48

(b) 40

(c) 28

(d) 20

41. What is the value of the determinant

$$\begin{vmatrix} 1! & 2! & 3! \\ 2! & 3! & 4! \\ 3! & 4! & 5! \end{vmatrix} ?$$

(a) 0

(b) 12

(c) 24

(d) 36

42. What are the values of x that satisfy the equation

$$\begin{vmatrix} x & 0 & 2 \\ 2x & 2 & 1 \\ 1 & 1 & 1 \end{vmatrix} + \begin{vmatrix} 3x & 0 & 2 \\ x^2 & 2 & 1 \\ 0 & 1 & 1 \end{vmatrix} = 0 ?$$

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

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

(c) $-1 \pm \sqrt{6}$

(d) $-2 \pm \sqrt{6}$

43. If $x + a + b + c = 0$, then what is the value of

$$\begin{vmatrix} x+a & b & c \\ a & x+b & c \\ a & b & x+c \end{vmatrix} ?$$

(a) 0

(b) $(a+b+c)^2$

(c) $a^2 + b^2 + c^2$

(d) $a + b + c - 2$

44. If $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$, then the expression $A^3 - 2A^2$ is

(a) a null matrix

(b) an identity matrix

(c) equal to A

(d) equal to $-A$

45. Let m and n $(m < n)$ be the roots of the equation $x^2 - 16x + 39 = 0$. If four terms p, q, r and s are inserted between m and n to form an AP, then what is the value of $p + q + r + s$?

(a) 29

(b) 30

(c) 32

(d) 35

46. Let a, b, c be in AP and $k \neq 0$ be a real number. Which of the following are correct ?

1. ka, kb, kc are in AP
2. $k-a, k-b, k-c$ are in AP
3. $\frac{a}{k}, \frac{b}{k}, \frac{c}{k}$ are in AP

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

47. How many two-digit numbers are divisible by 4 ?

(a) 21

(b) 22

(c) 24

(d) 25

48. Let S_n be the sum of the first n terms of an AP. If $S_{2n} = 3n + 14n^2$, then what is the common difference ?

(a) 5

(b) 6

(c) 7

(d) 9

49. If 3rd, 8th and 13th terms of a GP are p, q and r respectively, then which one of the following is correct ?

(a) $q^2 = pr$

(b) $r^2 = pq$

(c) $pqr = 1$

(d) $2q = p + r$

50. What is the solution of $x \leq 4, y \geq 0$ and $x \leq -4, y \leq 0$?

(a) $x \geq -4, y \leq 0$

(b) $x \leq 4, y \geq 0$

(c) $x \leq -4, y = 0$

(d) $x \geq -4, y = 0$

51. If $x^{\log_7 x} > 7$ where $x > 0$, then which one of the following is correct ?

(a) $x \in (0, \infty)$

(b) $x \in \left(\frac{1}{7}, 7\right)$

(c) $x \in \left(0, \frac{1}{7}\right) \cup (7, \infty)$

(d) $x \in \left(\frac{1}{7}, \infty\right)$

52. How many real roots does the equation $x^2 + 3|x| + 2 = 0$ have ?

(a) Zero

(b) One

(c) Two

(d) Four

53. Consider the following statements in respect of the quadratic equation
$4(x-p)(x-q) - r^2 = 0$,
where p, q and r are real numbers :

1. The roots are real

2. The roots are equal if $p = q$ and $r = 0$

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

54. Let $S = \{2, 4, 6, 8, \ldots\ldots\ldots 20\}$.
What is the maximum number of subsets does S have ?

(a) 10

(b) 20

(c) 512

(d) 1024

55. A binary number is represented by $(cdccddcccddd)_2$, where $c > d$. What is its decimal equivalent ?

(a) 1848

(b) 2048

(c) 2842

(d) 2872

56. If $\text{cosec}\theta = \frac{29}{21}$ where $0 < \theta < 90°$, then what is the value of $4\sec\theta + 4\tan\theta$?

(a) 5

(b) 10

(c) 15

(d) 20

57. Consider the following statements :

1. $\cos\theta + \sec\theta$ can never be equal to 1·5.

2. $\tan\theta + \cot\theta$ can never be less than 2.

Which of the above statements is/are correct ?

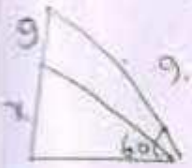
(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

58. A ladder 9 m long reaches a point 9 m below the top of a vertical flagstaff. From the foot of the ladder, the elevation of the flagstaff is 60°. What is the height of the flagstaff?



(a) 9 m

(b) 10·5 m

(c) 13·5 m

(d) 15 m

59. What is the length of the chord of a unit circle which subtends an angle θ at the centre?

(a) $\sin\left(\frac{\theta}{2}\right)$

(b) $\cos\left(\frac{\theta}{2}\right)$

(c) $2\sin\left(\frac{\theta}{2}\right)$

(d) $2\cos\left(\frac{\theta}{2}\right)$

60. What is $\tan\left\{2\tan^{-1}\left(\frac{1}{3}\right)\right\}$ equal to?

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

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

(c) $\frac{3}{8}$

(d) $\frac{1}{9}$

Directions for the following three (03) items :

Read the following information and answer the three items that follow :

A curve $y = me^{mx}$ where $m > 0$ intersects y-axis at a point P.

61. What is the slope of the curve at the point of intersection P?

(a) m

(b) m^2

(c) $2m$

(d) $2m^2$

62. How much angle does the tangent at P make with y-axis?

(a) $\tan^{-1}m^2$

(b) $\cot^{-1}(1+m^2)$

(c) $\sin^{-1}\left(\frac{1}{\sqrt{1+m^4}}\right)$

(d) $\sec^{-1}\sqrt{1+m^4}$

63. What is the equation of tangent to the curve at P?

(a) $y = mx + m$

(b) $y = -mx + 2m$

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

(d) $y = m^2x + m$

Directions for the following two (02) items :

Read the following information and answer the two items that follow :

Let $f(x) = x^2$, $g(x) = \tan x$ and $h(x) = ln\, x$.

64. For $x = \frac{\sqrt{\pi}}{2}$, what is the value of $[ho(gof)](x)$?

(a) 0

(b) 1

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

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

65. What is $[fo(fof)](2)$ equal to ?

(a) 2

(b) 8

(c) 16

(d) 256

66. What is $\int \frac{dx}{2x^2 - 2x + 1}$ equal to ?

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

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

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

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

67. What is $\int \frac{dx}{x(1+ln\, x)^n}$ equal to $(n \neq 1)$?

(a) $\frac{1}{(n-1)(1+ln\, x)^{n-1}} + c$

(b) $\frac{1-n}{(1+ln\, x)^{1-n}} + c$

(c) $\frac{n+1}{(1+ln\, x)^{n+1}} + c$

(d) $-\frac{1}{(n-1)(1+ln\, x)^{n-1}} + c$

68. Which one of the following is the differential equation that represents the family of curves $y = \frac{1}{2x^2 - c}$ where c is an arbitrary constant ?

(a) $\frac{dy}{dx} = 4xy^2$

(b) $\frac{dy}{dx} = \frac{1}{y}$

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

(d) $\frac{dy}{dx} = -4xy^2$

Directions for the following two (02) items :

Read the following information and answer the two items that follow :

Consider the equation $x^y = e^{x-y}$

69. What is $\frac{dy}{dx}$ at $x = 1$ equal to ?

(a) 0

(b) 1

(c) 2

(d) 4

70. What is $\frac{d^2y}{dx^2}$ at $x = 1$ equal to ?

(a) 0

(b) 1

(c) 2

(d) 4

Directions for the following three (03) items :

Read the following information and answer the three items that follow :

Consider the function $f(x) = g(x) + h(x)$

where $g(x) = \sin\left(\frac{x}{4}\right)$ and $h(x) = \cos\left(\frac{4x}{5}\right)$

71. What is the period of the function $g(x)$?

(a) π

(b) 2π

(c) 4π

(d) 8π

72. What is the period of the function $h(x)$?

(a) π

(b) $\frac{4\pi}{5}$

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

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

73. What is the period of the function $f(x)$?

(a) 10π

(b) 20π

(c) 40π

(d) 80π

Directions for the following two (02) items :

Read the following information and answer the two items that follow :

Consider the function

$f(x) = 3x^4 - 20x^3 - 12x^2 + 288x + 1$

74. In which one of the following intervals is the function increasing ?

(a) (–2, 3)

(b) (3, 4)

(c) (–3, –2)

(d) (–4, –3)

75. In which one of the following intervals is the function decreasing ?

(a) (–2, 3)

(b) (3, 4)

(c) (4, 6)

(d) (6, 9)

76. For the variables x and y, the two regression lines are $6x + y = 30$ and $3x + 2y = 25$. What are the values of $\bar{x}$, $\bar{y}$ and r respectively ?

(a) $\frac{20}{3}, \frac{35}{9}, -0{\cdot}5$

(b) $\frac{20}{3}, \frac{35}{9}, 0{\cdot}5$

(c) $\frac{35}{9}, \frac{20}{3}, -0{\cdot}5$

(d) $\frac{35}{9}, \frac{20}{3}, 0{\cdot}5$

77. The class marks in a frequency table are given to be 5, 10, 15, 20, 25, 30, 35, 40, 45, 50. The class limits of the first five classes are

(a) 3-7, 7-13, 13-17, 17-23, 23-27

(b) 2·5-7·5, 7·5-12·5, 12·5-17·5, 17·5-22·5, 22·5-27·5

(c) 1·5-8·5, 8·5-11·5, 11·5-18·5, 18·5-21·5, 21·5-28·5

(d) 2-8, 8-12, 12-18, 18-22, 22-28

78. The mean of 5 observations is 4·4 and variance is 8·24. If three of the five observations are 1, 2 and 6, then what are the other two observations ?

(a) 9, 16

(b) 9, 4

(c) 81, 16

(d) 81, 4

79. If a coin is tossed till the first head appears, then what will be the sample space ?

(a) {H}

(b) {TH}

(c) {T, HT, HHT, HHHT, ...}

(d) {H, TH, TTH, TTTH, ...}

80. Consider the following discrete frequency distribution :

x	1	2	3	4	5	6	7	8
f	3	15	45	57	50	36	25	9

What is the value of median of the distribution ?

(a) 4

(b) 5

(c) 6

(d) 7

81. Two dice are thrown simultaneously. What is the probability that the sum of the numbers appearing on them is a prime number ?

(a) $\frac{5}{12}$

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

(c) $\frac{7}{12}$

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

82. If 5 of a Company's 10 delivery trucks do not meet emission standards and 3 of them are chosen for inspection, then what is the probability that none of the trucks chosen will meet emission standards ?

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

(b) $\frac{3}{8}$

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

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

83. There are 3 coins in a box. One is a two-headed coin; another is a fair coin; and third is biased coin that comes up heads 75% of time. When one of the three coins is selected at random and flipped, it shows heads. What is the probability that it was the two-headed coin ?

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

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

(c) $\frac{4}{9}$

(d) $\frac{5}{9}$

84. Consider the following statements :

1. If A and B are mutually exclusive events, then it is possible that $P(A) = P(B) = 0{\cdot}6$.
2. If A and B are any two events such that $P(A|B) = 1$, then $P(\overline{B}|\overline{A}) = 1$.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

85. If a fair die is rolled 4 times, then what is the probability that there are exactly 2 sixes ?

(a) $\frac{5}{216}$

(b) $\frac{25}{216}$

(c) $\frac{125}{216}$

(d) $\frac{175}{216}$

86. Mean of 100 observations is 50 and standard deviation is 10. If 5 is added to each observation, then what will be the new mean and new standard deviation respectively ?

(a) 50, 10

(b) 50, 15

(c) 55, 10

(d) 55, 15

87. If the range of a set of observations on a variable X is known to be 25 and if $Y = 40 + 3X$, then what is the range of the set of corresponding observations on Y ?

(a) 25

(b) 40

(c) 75

(d) 115

88. If V is the variance and M is the mean of first 15 natural numbers, then what is $V + M^2$ equal to ?

(a) $\frac{124}{3}$

(b) $\frac{148}{3}$

(c) $\frac{248}{3}$

(d) $\frac{124}{9}$

89. A car travels first 60 km at a speed of 3v km/hr and travels next 60 km at 2v km/hr. What is the average speed of the car ?

(a) 2·5v km/hr

(b) 2·4v km/hr

(c) 2·2v km/hr

(d) 2·1v km/hr

90. The mean weight of 150 students in a certain class is 60 kg. The mean weight of boys is 70 kg and that of girls is 55 kg. What are the number of boys and girls respectively in the class ?

(a) 75 and 75

(b) 50 and 100

(c) 70 and 80

(d) 100 and 50

91. What is the minimum value of $\frac{a^2}{\cos^2 x} + \frac{b^2}{\sin^2 x}$ where $a > 0$ and $b > 0$?

(a) $(a + b)^2$

(b) $(a - b)^2$

(c) $a^2 + b^2$

(d) $|a^2 + b^2|$

92. If the angles of a triangle ABC are in AP and $b : c = \sqrt{3} : \sqrt{2}$, then what is the measure of angle A ?

(a) $30°$

(b) $45°$

(c) $60°$

(d) $75°$

93. If $\tan A - \tan B = x$ and $\cot B - \cot A = y$, then what is the value of $\cot(A - B)$?

(a) $\frac{1}{x} + \frac{1}{y}$

(b) $\frac{1}{y} - \frac{1}{x}$

(c) $\frac{xy}{x+y}$

(d) $1 + \frac{1}{xy}$

94. What is $\sin(\alpha+\beta) - 2\sin\alpha\cos\beta + \sin(\alpha-\beta)$ equal to ?

(a) 0

(b) $2\sin\alpha$

(c) $2\sin\beta$

(d) $\sin\alpha + \sin\beta$

95. If $2\tan A = 3\tan B = 1$, then what is $\tan(A - B)$ equal to ?

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

(b) $\frac{1}{6}$

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

(d) $\frac{1}{9}$

96. What is $\cos 80° + \cos 40° - \cos 20°$ equal to ?

(a) 2

(b) 1

(c) 0

(d) –19

97. If angle C of a triangle ABC is a right angle, then what is $\tan A + \tan B$ equal to ?

(a) $\frac{a^2 - b^2}{ab}$

(b) $\frac{a^2}{bc}$

(c) $\frac{b^2}{ca}$

(d) $\frac{c^2}{ab}$

98. What is $\cot\left(\frac{A}{2}\right) - \tan\left(\frac{A}{2}\right)$ equal to ?

(a) $\tan A$

(b) $\cot A$

(c) $2\tan A$

(d) $2\cot A$

99. What is $\cot A + \operatorname{cosec} A$ equal to ?

(a) $\tan\left(\frac{A}{2}\right)$

(b) $\cot\left(\frac{A}{2}\right)$

(c) $2\tan\left(\frac{A}{2}\right)$

(d) $2\cot\left(\frac{A}{2}\right)$

100. What is $\tan 25^\circ \tan 15^\circ + \tan 15^\circ \tan 50^\circ + \tan 25^\circ \tan 50^\circ$ equal to ?

(a) 0

(b) 1

(c) 2

(d) 4

101. What is the area of the region bounded by $|x| < 5$, $y = 0$ and $y = 8$?

(a) 40 square units

(b) 80 square units

(c) 120 square units

(d) 160 square units

102. Consider the following statements in respect of the function $f(x) = \sin\left(\frac{1}{x}\right)$ for $x \neq 0$ and $f(0) = 0$:

1. $\lim_{x \to 0} f(x)$ exists

2. $f(x)$ is continuous at $x = 0$

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

103. What is the value of $\lim_{x \to 0} \frac{\sin x^\circ}{\tan 3x^\circ}$?

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

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

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

(d) 1

104. What is the degree of the differential equation $\frac{d^3y}{dx^3} + \left(\frac{dy}{dx}\right)^2 - x^2\left(\frac{d^4y}{dx^4}\right) = 0$?

(a) 1

(b) 2

(c) 3

(d) 4

105. Which one of the following is the second degree polynomial function $f(x)$ where $f(0) = 5$, $f(-1) = 10$ and $f(1) = 6$?

(a) $5x^2 - 2x + 5$

(b) $3x^2 - 2x - 5$

(c) $3x^2 - 2x + 5$

(d) $3x^2 - 10x + 5$

Directions for the following three (03) items :

Read the following information and answer the three items that follow :

Let $f(x) = x^2 + 2x - 5$ and $g(x) = 5x + 30$

106. What are the roots of the equation $g[f(x)] = 0$?

(a) 1, –1

(b) –1, –1

(c) 1, 1

(d) 0, 1

107. Consider the following statements :

1. $f[g(x)]$ is a polynomial of degree 3.

2. $g[g(x)]$ is a polynomial of degree 2.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

108. If $h(x) = 5f(x) - xg(x)$, then what is the derivative of $h(x)$?

(a) –40

(b) –20

(c) –10

(d) 0

Directions for the following two (02) items :

Read the following information and answer the two items that follow :

Consider the integrals

$$I_1 = \int_0^{\pi} \frac{x\,dx}{1+\sin x} \quad \text{and} \quad I_2 = \int_0^{\pi} \frac{(\pi - x)\,dx}{1-\sin(\pi + x)}$$

109. What is the value of I_1 ?

(a) 0

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

(c) π

(d) 2π

110. What is the value of $I_1 + I_2$?

(a) 2π

(b) π

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

(d) 0

111. The differential equation which represents the family of curves given by $\tan y = c(1 - e^x)$ is

(a) $e^x \tan y\,dx + (1 - e^x)\,dy = 0$

(b) $e^x \tan y\,dx + (1 - e^x)\sec^2 y\,dy = 0$

(c) $e^x (1 - e^x)\,dx + \tan y\,dy = 0$

(d) $e^x \tan y\,dy + (1 - e^x)\,dx = 0$

112. What is the derivative of $2^{(\sin x)^2}$ with respect to $\sin x$?

(a) $\sin x\, 2^{(\sin x)^2}\, ln\, 4$

(b) $2\sin x\, 2^{(\sin x)^2}\, ln\, 4$

(c) $ln(\sin x)\, 2^{(\sin x)^2}$

(d) $2\sin x \cos x\, 2^{(\sin x)^2}$

113. For what value of k is the function

$$f(x) = \begin{cases} 2x + \frac{1}{4}, & x < 0 \\ k, & x = 0 \\ \left(x + \frac{1}{2}\right)^2, & x > 0 \end{cases}$$ continuous ?

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

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

(c) 1

(d) 2

114. What is the area of the region enclosed between the curve $y^2 = 2x$ and the straight line $y = x$?

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

(b) $\frac{4}{3}$ square units

(c) $\frac{1}{3}$ square units

(d) 1 square unit

115. If $f(x) = \frac{x^3}{3} - \frac{5x^2}{2} + 6x + 7$ increases in the interval T and decreases in the interval S, then which one of the following is correct ?

(a) $T = (-\infty, 2) \cup (3, \infty)$ and $S = (2, 3)$

(b) $T = \phi$ and $S = (-\infty, \infty)$

(c) $T = (-\infty, \infty)$ and $S = \phi$

(d) $T = (2, 3)$ and $S = (-\infty, 2) \cup (3, \infty)$

116. A coin is biased so that heads comes up thrice as likely as tails. For three independent tosses of a coin, what is the probability of getting at most two tails ?

(a) 0·16

(b) 0·48

(c) 0·58

(d) 0·98

117. A bag contains 20 books out of which 5 are defective. If 3 of the books are selected at random and removed from the bag in succession without replacement, then what is the probability that all three books are defective ?

(a) 0·009

(b) 0·016

(c) 0·026

(d) 0·047

118. The median of the observations 22, 24, 33, 37, $x+1$, $x+3$, 46, 47, 57, 58 in ascending order is 42. What are the values of 5th and 6th observations respectively ?

(a) 42, 45

(b) 41, 43

(c) 43, 46

(d) 40, 40

119. Arithmetic mean of 10 observations is 60 and sum of squares of deviations from 50 is 5000. What is the standard deviation of the observations ?

(a) 20

(b) 21

(c) 22·36

(d) 24·70

120. If p and q are the roots of the equation $x^2 - 30x + 221 = 0$, what is the value of $p^3 + q^3$?

(a) 7010

(b) 7110

(c) 7210

(d) 7240