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UPSC NDA Exam 2008-I Mathematics Solved Paper

MATHEMATICS

1. Under which one of the following conditions will the two planes $x + y + z = 7$ and $\alpha x + \beta y + \gamma z = 3$, be parallel (but not coincident) ?
   (a) $\alpha = \beta = \gamma = 1$ only
   (b) $\alpha = \beta = \gamma = \dfrac{3}{7}$ only
   (c) $\alpha = \beta = \gamma$
   (d) None of the above

2. The straight line $\dfrac{x-3}{2} = \dfrac{y-4}{3} = \dfrac{z-5}{4}$ is parallel to which one of the following ?
   (a) $4x + 3y - 5z = 0$
   (b) $4x + 5y - 4z = 0$
   (c) $4x + 4y - 5z = 0$
   (d) $5x + 4y - 5z = 0$

3. If θ is the acute angle between the diagonals of a cube, then which one of the following is correct ?
   (a) $\theta < 30°$ (b) $\theta = 60°$
   (c) $30° < \theta < 60°$ (d) $\theta > 60°$

4. Which one of the following planes contains the z-axis ?
   (a) $x - z = 0$ (b) $z + y = 0$
   (c) $3x + 2y = 0$ (d) $3x + 2z = 0$

5. Equation of a circle passing through origin is $x^2 + y^2 - 6x + 2y = 0$. What is the equation of one of its diameters ?
   (a) $x + 3y = 0$ (b) $x + y = 0$
   (c) $x = y$ (d) $3x + y = 0$

6. Which one of the following is correct ? The eccentricity of the conic
   $$\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1, (\lambda \geq 0).$$
   (a) increases with increase in λ.
   (b) decreases with increase in λ.
   (c) does not change with λ
   (d) None of the above

7. Point (1, 2) relative to the circle $x^2 + y^2 + 4x - 2y - 4 = 0$ is a/an
   (a) exterior point
   (b) interior point, but not centre
   (c) boundary point
   (d) centre

8. If the circle $x^2 + y^2 + 2gx + 2fy + c = 0 \, (c > 0)$ touches the y-axis, then which one of the following is correct ?
   (a) $g = -\sqrt{c}$ only   (b) $g = \pm\sqrt{c}$
   (c) $f = \sqrt{c}$ only   (d) $f = \pm\sqrt{c}$

9. If $A(2, 3), B(1, 4), C(0, -2)$ and $D(x, y)$ are the vertices of a parallelogram, then what is the value of (x, y) ?
   (a) $(1, -3)$ (b) $(2, 4)$
   (c) $(1, 1)$ (d) $(0, 0)$

10. If O be the origin and $A(x_1, y_1), B(x_2, y_2)$ are two points, then what is $(OA)(OB)\cos\angle AOB$?
   (a) $x_1^2 + x_2^2$ (b) $y_1^2 + y_2^2$
   (c) $x_1 x_2 + y_1 y_2$ (d) $x_1 y_1 + x_2 y_2$

11. If $y = f(x), p = \dfrac{dy}{dx}$ and $q = \dfrac{d^2y}{dx^2}$, then what is $\dfrac{d^2x}{dy^2}$ equal to ?
   (a) $-\dfrac{q}{p^2}$ (b) $-\dfrac{q}{p^3}$
   (c) $\dfrac{1}{q}$ (d) $\dfrac{q}{p^2}$

12. What is the solution of the differential equation $\dfrac{dy}{dx} = xy + x + y + 1$?
   (a) $y = \dfrac{x^2}{2} + x + c$
   (b) $\log(y + 1) = \dfrac{x^2}{2} + x + c$
   (c) $y = x^2 + x + c$
   (d) $\log(y + 1) = x^2 + x + c$

13. What is $\int \log(x + 1) \, dx$ is equal to ?
   (a) $x\log(x + 1) - x + c$
   (b) $(x + 1)\log(x + 1) - x + c$
   (c) $\dfrac{1}{x+1} + c$
   (d) $\dfrac{\log(x + 1)}{x + 1} + c$

14. What is the area of the region bounded by the line $3x - 5y = 15, x = 1, x = 3$ and x-axis in sq unit ?
   (a) $\dfrac{36}{5}$ (b) $\dfrac{18}{5}$
   (c) $\dfrac{9}{5}$ (d) $\dfrac{3}{5}$

15. What are the order and degree, respectively of the differential equation $\left(\dfrac{d^2y}{dx^2}\right)^{5/6} = \left(\dfrac{dy}{dx}\right)^{1/3}$?
   (a) 2, 1   (b) 2, 5
   (c) $2, \dfrac{5}{6}$ (d) $1, \dfrac{1}{3}$

16. What is the value of $\int_0^1 xe^{x^2} dx$?
   (a) $\dfrac{(e - 1)}{2}$ (b) $e^2 - 1$
   (c) $2(e - 1)$ (d) $e - 1$

17. If $x = \sin t - t\cos t$ and $y = t\sin t + \cos t$, then what is $\dfrac{dy}{dx}$ at point $t = \dfrac{\pi}{2}$?
   (a) 0   (b) $\dfrac{\pi}{2}$
   (c) $-\dfrac{\pi}{2}$ (d) 1

18. If $\int \dfrac{dx}{f(x)} = \log\{f(x)\}^2 + c$, then what is $f(x)$ equal to ?
   (a) $2x + \alpha$ (b) $x + \alpha$
   (c) $\dfrac{x}{2} + \alpha$ (d) $x^2 + \alpha$

19. What is the area of the largest rectangular field which can be enclosed with 200 m of fencing ?
    (a) $1600 \, m^2$ (b) $2100 \, m^2$
    (c) $2400 \, m^2$ (d) $2500 \, m^2$

20. If $\vec{a}$ is a position vector of a point $(1, -3)$ and A is another point $(-1, 5)$, then what are the coordinates of the point B such that $\overrightarrow{AB} = \vec{a}$?
    (a) $(2, 0)$ (b) $(0, 2)$
    (c) $(-2, 0)$ (d) $(0, -2)$

21. If $\vec{a} = 2\hat{i} - 3\hat{j} - \hat{k}, \vec{b} = \hat{i} + 4\hat{j} - 2\hat{k}$; then what is $(\vec{a} + \vec{b}) \times (\vec{a} - \vec{b})$ equal to ?
    (a) $2(\vec{a} \times \vec{b})$ (b) $-2(\vec{a} \times \vec{b})$
    (c) $(\vec{a} \times \vec{b})$ (d) $-(\vec{a} \times \vec{b})$

22. If $\vec{a}$ is a non-zero vector of modulus a and λ is a non-zero scalar and $\lambda \vec{a}$ is a unit vector then
    (a) $\lambda = \pm 1$ (b) $a = |\lambda|$
    (c) $a = \dfrac{1}{|\lambda|}$ (d) $a = \dfrac{1}{\lambda}$ only

23. Let $\vec{a}$ and $\vec{b}$ be the position vectors of A and B respectively. If C is the point $3\vec{a} - 2\vec{b}$, then which one of the following is correct ?
    (a) C is in between A and B
    (b) A is in between C and B
    (c) B is in between A and C
    (d) A, B, C are not collinear

24. Consider the following
    If $\vec{a}$ and $\vec{b}$ are the vectors forming consecutive sides of a regular hexagon $ABCDEF$, then
    1. $\overrightarrow{CE} = \vec{b} - 2\vec{a}$ 2. $\overrightarrow{AE} = 2\vec{b} - \vec{a}$
    3. $\overrightarrow{FA} = \vec{a} - \vec{b}$
    Which of the above are correct ?
    (a) 1 and 2 only   (b) 2 and 3 only
    (c) 1 and 3 only   (d) 1, 2 and 3

25. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}$ is perpendicular to the plane of $\vec{b}, \vec{c}$; and the angle between $\vec{b}$ and $\vec{c}$ is $\dfrac{\pi}{3}$. Then, what is $|\vec{a} + \vec{b} + \vec{c}|$?
    (a) 1   (b) 2
    (c) 3   (d) 4

26. What is the locus of the point (x, y) for which the vectors $(\hat{i} - x\hat{j} - 2\hat{k})$ and $(2\hat{i} + \hat{j} + y\hat{k})$ are orthogonal ?
    (a) A circle   (b) An ellipse
    (c) A parabola   (d) A straight line

27. What is the number of vectors of length 5 unit perpendicular to the vectors $\vec{a} = (1, 1, 0)$ and $\vec{b} = (0, 1, 1)$?
    (a) 1   (b) 2
    (c) 3   (d) 4

28. What is the value of $\displaystyle\lim_{x \to \infty} \dfrac{\sin x}{x}$?
    (a) 1   (b) 0
    (c) ∞ (d) -1

29. If $y = \sin^{-1} x + \sin^{-1}\sqrt{1 - x^2}$, what is $\dfrac{dy}{dx}$ equal to ?
    (a) $\cos^{-1} x + \cos^{-1}\sqrt{1 - x^2}$
    (b) $\dfrac{1}{\cos x} + \dfrac{1}{\cos\sqrt{1 - x^2}}$
    (c) $\dfrac{\pi}{2}$
    (d) 0

30. What is $\displaystyle\lim_{x \to 0} \dfrac{a^x - b^x}{x}$?
    (a) $\log\left(\dfrac{a}{b}\right)$ (b) $\log\left(\dfrac{b}{a}\right)$
    (c) ab (d) $\log(ab)$

31. Let $f(x) = \begin{cases} 3x - 4, & 0 \le x \le 2 \\ 2x + l, & 2 < x \le 9 \end{cases}$
    If f is continuous at $x = 2$, then what is the value of l ?
    (a) 0   (b) 2
    (c) -2 (d) -1

32. If $f(x) = \log_e[\log_e x]$, then what is $f'(e)$ equal to ?
    (a) e^{-1} (b) e
    (c) 1   (d) 0

33. If $f(x) = e^{\sin(\log \cos x)}$ and $g(x) = \log \cos x$, then what is the derivative of $f(x)$ with respect to $g(x)$?
    (a) $f(x)\cos[g(x)]$ (b) $f(x)\sin[g(x)]$
    (c) $g(x)\cos[f(x)]$ (d) $g(x)\sin[f(x)]$

34. What is the smallest value of m for which $f(x) = x^2 + mx + 5$ is increasing in the interval $1 \le x \le 2$?
    (a) $m = 0$ (b) $m = -1$
    (c) $m = -2$ (d) $m = -3$

35. What is the maximum value of $x \cdot y$ subject to the condition $x + y = 8$?
    (a) 8   (b) 16
    (c) 24   (d) 32

36. If $f(x) = x$ and $g(x) = |x|$, then what is $(f + g)(x)$ equal to ?
    (a) 0 for all $x \in R$ (b) $2x$ for all $x \in R$
    (c) $\begin{cases} 2x, & \text{for } x \ge 0 \\ 0, & \text{for } x < 0 \end{cases}$ (d) $\begin{cases} 0, & \text{for } x \ge 0 \\ 2x, & \text{for } x < 0 \end{cases}$

37. If $g(x) = \sin x, x \in R$ and $f(x) = \dfrac{1}{\sin x}$, $x \in \left(0, \dfrac{\pi}{2}\right)$

what is $(g \circ f)(x)$ equal to ?

(a) 1

(b) $\dfrac{1}{\sin(\sin x)}$

(c) $\dfrac{1}{\sin^2(x)}$

(d) $\sin\left(\dfrac{1}{\sin x}\right)$

38. For the curve $\sqrt{x} + \sqrt{y} = 1$, what is the value of $\dfrac{dy}{dx}$ at $\left(\dfrac{1}{4}, \dfrac{1}{4}\right)$?

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

(b) 1

(c) -1

(d) 2

39. Let $f : R \to R$ be defined as

$$f(x) = \sin(|x|)$$

Which one of the following is correct ?

(a) f is not differentiable only at 0

(b) f is differentiable at 0 only

(c) f is differentiable everywhere

(d) f is non-differentiable at many points

40. If $y = \dfrac{1}{\log_{10} x}$, then what is $\dfrac{dy}{dx}$ equal to ?

(a) x

(b) $x \log_e 10$

(c) $-\dfrac{(\log_x 10)^2 (\log_{10} e)}{x}$

(d) $x \log_{10} e$

41. What is the inverse of the function $y = 5^{\log x}$?

(a) $x = 5^{1/\log y}$

(b) $x = y^{1/\log 5}$

(c) $x = 5^{\log y}$

(d) $x = y^{\log 5}$

42. Which one of the following is correct ?

The function $f : A \to R$ where

$A = \left\{ x \in R, -\dfrac{\pi}{2} < x < \dfrac{\pi}{2} \right\}$ defined by $f(x) = \tan x$.

(a) Injective

(b) Not injective

(c) Bijective

(d) Not bijective

43. Which one of the following real valued functions is never zero ?

(a) Polynomial function

(b) Trigonometric function

(c) Logarithmic function

(d) Exponential function

44. Under what condition are the two lines

$y = \dfrac{m}{l}x + \alpha, \ z = \dfrac{n}{l}x + \beta;$ and

$y = \dfrac{m'}{l'}x + \alpha', \ z = \dfrac{n'}{l'}x + \beta'$ orthogonal ?

(a) $\alpha\alpha' + \beta\beta' + 1 = 0$

(b) $(\alpha + \alpha')(\beta + \beta') = 0$

(c) $ll' + mm' + nn' = 1$

(d) $ll' + mm' + nn' = 0$

Directions : *Each of the next 4 (four) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below*

Codes :

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

45. Assertion (A) : If $f(x) = \log x$, then $f(x) > 0$ for all $x > 0$.

Reason (R) : $f(x) = \log x$ is defined for all $x > 0$.

46. Assertion (A) : $f(x) = x \sin\left(\dfrac{1}{x}\right)$ is differentiable at $x = 0$.

Reason (R) : $f(x)$ is continuous at $x = 0$.

47. Let $X = \{\theta \in [0, 2\pi] : \sin\theta = \cos\theta\}$

Assertion (A) : The number of elements in X is 2.

Reason (R) : $\sin\theta$ and $\cos\theta$ are both negative both in second and fourth quadrants.

48. Assertion (A) : $\{x \in R \mid x^2 < 0\}$ is not a set. Here R is the set of real numbers.

Reason (R) : For every real number x, $x^2 \geq 0$.

49. What is the probability that in a family of 4 children there will be at least one boy ?

(a) $\dfrac{15}{16}$

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

(c) $\dfrac{1}{16}$

(d) $\dfrac{7}{8}$

50. In a school there are 40% science students and the remaining 60% are arts students. It is known that 5% of the science students are girls and 10% of the arts students are girls. One student selected at random is a girl. What is the probability that she is an arts student ?

(a) $\dfrac{1}{3}$

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

(c) $\dfrac{1}{5}$

(d) $\dfrac{3}{5}$

51. Given $P(A \cup B) = \dfrac{5}{6}, P(A \cap B) = \dfrac{1}{3}$ and $P(\bar{B}) = \dfrac{1}{2}$.

What is $P(\bar{A})$?

(a) $\dfrac{1}{6}$

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

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

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

52. The outcomes of 5 tosses of a coin are recorded in a single sequence as H (head) and T (tail) for each toss. What is the number of elementary events in the sample space ?

(a) 5

(b) 10

(c) 25

(d) 32

53. Which of the following numbers is nearest to the probability that three randomly selected persons are born on three different days of the week ?

(a) 0.7

(b) 0.6

(c) 0.5

(d) 0.4

54. One bag contains 5 white balls and 3 black balls and a second bag contains 2 white balls and 4 black balls. One ball is drawn from the first bag and placed unseen in the second bag. What is the probability that a ball now drawn from the second bag is black ?

(a) $\dfrac{15}{56}$

(b) $\dfrac{35}{56}$

(c) $\dfrac{37}{56}$

(d) $\dfrac{25}{48}$

55. Consider the following statements
   The appropriate number of classes while constructing a frequency distribution should be chosen such that
   1. the class-frequency first increases to a peak and then declines.
   2. the class-frequency should cluster around the class mid point.
   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

56. The populations of four towns A, B, C and D as on 2001 are as follows

Town	Population
A	6863
B	519
C	12185
D	1755

   What is the most appropriate diagram to present the above data ?
   (a) Pie diagram   (b) Bar chart
   (c) Cubic chart   (d) Histogram

57. Consider the two series of observations A and B as follows

Series A	1019	1008	1015	1006	1002
Series B	1.9	0.8	1.5	0.6	0.2

   If the standard deviation of the Series A is $\sqrt{38}$, then what is the standard deviation of the Series B ?
   (a) 3.8   (b) $\sqrt{0.38}$
   (c) 0.38   (d) $\sqrt{38}$

58. If n_1 and n_2 are the sizes, G_1 and G_2 the geometric means of two series respectively, then which one of the following expresses the geometric mean (G) of the combined series ?
   (a) $\log G = \dfrac{n_1 G_1 + n_2 G_2}{n_1 + n_2}$
   (b) $\log G = \dfrac{n_2 \log G_1 + n_1 \log G_2}{n_1 + n_2}$
   (c) $G = \dfrac{n_1 \log G_1 + n_2 \log G_2}{n_1 + n_2}$
   (d) None of the above

59. Let $\bar{x}$ be the mean of n observations $x_1, x_2, \ldots, x_n$. If $(a - b)$ is added to each observation, then what is the mean of new set of observations ?
   (a) 0   (b) $\bar{x}$
   (c) $\bar{x} - (a - b)$ (d) $\bar{x} + (a - b)$

60.
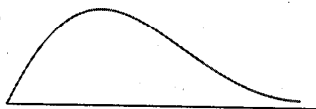
   The frequency curve for the distribution of income in a region is positively skewed as shown in the figure above. Then, for this distribution
   (a) Mean < Mode < Median
   (b) Mode < Median < Mean

   (c) Mode < Mean < Median
   (d) Median < Mean < Mode

61. What is the area of the rectangle of which $\vec{r} = a\,\hat{i} + b\,\hat{j}$ is a semidiagonal ?
   (a) $a^2 + b^2$ (b) $2(a^2 + b^2)$
   (c) $4(a^2 + b^2)$ (d) $4ab$

62. After paying 30 out of 40 instalments of a debt of Rs 3600, one third of the debt is unpaid. If the instalments are forming an arithmetic series, then what is the first instalment ?
   (a) Rs 50   (b) Rs 51
   (c) Rs 105   (d) Rs 110

63. If x is real and $x^2 - 3x + 2 > 0$, $x^2 - 3x - 4 \leq 0$, then which one of the following is correct ?
   (a) $-1 \leq x \leq 4$
   (b) $2 \leq x \leq 4$
   (c) $-1 < x \leq 1$
   (d) $-1 \leq x < 1$ or $2 < x \leq 4$

64. What is the coefficient of $x^3 y^4$ in $(2x + 3y^2)^5$?
   (a) 240   (b) 360
   (c) 720   (d) 1080

65. A straight line is passing through the points represented by the complex numbers $a + ib$ and $\dfrac{1}{-a + ib}$, where $(a, b) \neq (0, 0)$.
   Which one of the following is correct ?
   (a) It passes through the origin
   (b) It is parallel to the x-axis
   (c) It is parallal to the y-axis
   (d) It passes through $(0, b)$

66. Let R be the relation defined on the set of natural number N as aRb; $a, b \in N$, if a divides b. Then, which one of the following is correct ?
   (a) R is reflexive only
   (b) R is symmetric only
   (c) R is transitive only
   (d) R is reflexive and transitive

67. What is the number of five-digit numbers formed with 0, 1, 2, 3, 4 without any repetition of digits ?
   (a) 24   (b) 48   (c) 96   (d) 120

68. A group consists of 5 men and 5 women. If the number of different five-person committees containing k men and $(5 - k)$ women is 100, what is the value of k ?
   (a) 2 only   (b) 3 only
   (c) 2 or 3   (d) 4

69. The product of first nine terms of a GP is, in general, equal to which one of the following ?
   (a) The 9th power of the 4th term
   (b) The 4th power of the 9th term
   (c) The 5th power of the 9th term
   (d) The 9th power of the 5th term

70. The difference between the nth term and $(n - 1)$th term of a sequence is independent of n. Then the sequence follows which one of the following ?
   (a) AP   (b) GP
   (c) HP   (d) None of these

71. Which one of the following is correct ? If z and w are complex numbers and $\overline{w}$ denotes the conjugate of w, then $|z + w| = |z - w|$ holds only, if
    (a) $z = 0$ or $w = 0$
    (b) $z = 0$ and $w = 0$
    (c) $z \cdot \overline{w}$ is purely real
    (d) $z \cdot \overline{w}$ is purely imaginary

72. If $x = 2^{1/3} - 2^{-1/3}$, then what is the value of $2x^3 + 6x$?
    (a) 1   (b) 2
    (c) 3   (d) 4

73. What is the square root of $\dfrac{1}{2} - i\dfrac{\sqrt{3}}{2}$?
    (a) $\pm\left(\dfrac{\sqrt{3}}{2} + \dfrac{i}{2}\right)$ (b) $\pm\left(\dfrac{\sqrt{3}}{2} - \dfrac{i}{2}\right)$
    (c) $\pm\left(\dfrac{1}{2} + i\dfrac{\sqrt{3}}{2}\right)$ (d) $\pm\left(\dfrac{1}{2} - i\dfrac{\sqrt{3}}{2}\right)$

74. What is the approximate value of $(1.02)^8$?
    (a) 1.171   (b) 1.175
    (c) 1.177   (b) 1.179

75. If $x^{(\log_{10}|x|)} = 2$, what is the value of x ?
    (a) 2 only   (b) –2 only
    (c) 2 or –2   (d) 1 or –1

76. What is the value of $\sqrt{5\sqrt{5\sqrt{5\sqrt{\ldots \infty}}}}$?
    (a) 5   (b) $\sqrt{5}$
    (c) 1   (d) $(5)^{1/4}$

77. If 7 points out of 12 are in the same straight line, then what is the number of triangles formed ?
    (a) 84   (b) 175
    (c) 185   (d) 201

78. What is the last digit of $3^{3^{4n}} + 1$, where n is a natural number ?
    (a) 2   (b) 7
    (c) 8   (d) None of these

79. If $X = \begin{bmatrix} 1 & -2 \\ 0 & 3 \end{bmatrix}$, and I is a 2×2 identity matrix, then $X^2 - 2X + 3I$ equals to which one of the following ?
    (a) $-I$ (b) $-2X$
    (c) $2X$ (d) $4X$

80. If the matrix B is the adjoint of the square matrix A and α is the value of the determinant of A, then what is AB equal to ?
    (a) α (b) $\left(\dfrac{1}{\alpha}\right)I$ (c) I (d) αI

    where I is identity matrix

81. What is the determinant $\begin{vmatrix} bc & a & a^2 \\ ca & b & b^2 \\ ab & c & c^2 \end{vmatrix}$ equal to ?

    (a) $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$ (b) $\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix}$

    (c) $\begin{vmatrix} 1 & a & a^3 \\ 1 & b & b^3 \\ 1 & c & c^3 \end{vmatrix}$ (d) $\begin{vmatrix} a & a^2 & a^3 \\ b & b^2 & b^3 \\ c & c^2 & c^3 \end{vmatrix}$

82. If $x^2 + y^2 + z^2 = 1$, then what is the value of $\begin{vmatrix} 1 & z & -y \\ -z & 1 & x \\ y & -x & 1 \end{vmatrix} = ?$
    (a) 0   (b) 1   (c) 2   (d) $2 - 2xyz$

83. If $|A_{n \times n}| = 3$ and $|\text{adj } A| = 243$, what is the value of n ?
    (a) 4   (b) 5   (c) 6   (d) 7

84. Under what condition does $A(BC) = (AB)C$ hold, where A, B, C are three matrices ?
    (a) AB and BC both must exist
    (b) Only AB must exist
    (c) Only BC must exist
    (d) Always true

85. If A is matrix of order 3×2 and B is matrix of order 2×3, then what is $|kAB|$ equal to (where k is any scalar quantity) ?
    (a) $k|AB|$ (b) $k^2|AB|$
    (c) $k^3|AB|$ (d) $|AB|$

86. If $\begin{bmatrix} 5 & 0 \\ 0 & 7 \end{bmatrix}^{-1} \begin{bmatrix} x \\ -y \end{bmatrix} = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$, then which one of the following is correct ?
    (a) $x = 5, y = 14$ (b) $x = -5, y = 14$
    (c) $x = -5, y = -14$ (d) $x = 5, y = -14$

87. Which one of the following statements is correct ?
    The system of linear equations,
    $$2x + 3y = 4 \text{ and } 4x + 6y = 7, \text{ has}$$
    (a) no solution
    (b) a unique solution
    (c) exactly 3 solutions
    (d) an infinite number of solutions

88. Suppose the system of equations
    $$a_1 x + b_1 y + c_1 z = d_1$$
    $$a_2 x + b_2 y + c_2 z = d_2$$
    $$a_3 x + b_3 y + c_3 z = d_3$$
    has a unique solution x_0, y_0, z_0. If $x_0 = 0$, then which one of the following is correct ?
    (a) $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$ (b) $\begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix} = 0$
    (c) $\begin{vmatrix} d_1 & a_1 & c_1 \\ d_2 & a_2 & c_2 \\ d_3 & a_3 & c_3 \end{vmatrix} = 0$ (d) $\begin{vmatrix} d_1 & a_1 & b_1 \\ d_2 & a_2 & b_2 \\ d_3 & a_3 & b_3 \end{vmatrix} = 0$

89. If a, b, c are in GP, then what is the value of
$$\begin{vmatrix} a & b & a+b \\ b & c & b+c \\ a+b & b+c & 0 \end{vmatrix} ?$$
(a) 0   (b) 1
(c) −1   (d) None of these

90. What is the measure of the angle $114°35'30''$ in radian ?
(a) 1 rad   (b) 2 rad
(c) 3 rad   (d) 4 rad

91. Consider the following statements
  1. $\phi \in \{\phi\}$ 2. $\{\phi\} \subseteq \phi$
  Which of the statements given above is/are correct ?
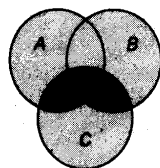(a) 1 only   (b) 2 only
(c) Both 1 and 2   (d) Neither 1 nor 2

92. Which one of the following is correct ?
(a) $A \cup P(A) = P(A)$ (b) $A \cap P(A) = A$
(c) $A - P(A) = A$ (d) $P(A) - \{A\} = P(A)$
  Here $P(A)$ denotes the power set of a set A.

93.

What does the shaded region in the above diagram represent ?
(a) $(A \cap B) \cap C$ (b) $(A \cup B) \cap C$
(c) $(A \cup B) - C$ (d) None of these

94. For the real numbers p, q, r, x, y, let $p < x < q$ and $p < y < r$. Which one of the following is correct ?
(a) $p < x < y < r$ (b) $p < x < q < r$
(c) $p < y < x < q$ (d) None of these

95. The binary number 0.111111 .... (where the digit 1 is recurring) is equivalent in decimal system to which one of the following ?
(a) $\dfrac{1}{10}$ (b) $\dfrac{11}{10}$
(c) 1   (d) $\dfrac{10}{11}$

96. The difference of two numbers 10001100 and 1101101 in binary system is expressed in decimal system by which one of the following ?
(a) 27   (b) 29
(c) 31   (d) 33

97. Let C be the set of complex number and z_1, z_2 are in C.
  1. $\text{agr}(z_1) = \text{agr}(z_2) \Rightarrow z_1 = z_2$
  2. $|z_1| = |z_2| \Rightarrow z_1 = z_2$
  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

98. What is arg (bi) where $b > 0$?
(a) 0   (b) $\dfrac{\pi}{2}$
(c) π (d) $\dfrac{3\pi}{2}$

99. Let $A = \{x \in R| -9 \le x < 4\};$
  $B = \{x \in R| -13 < x \le 5\}$ and
  $C = \{x \in R| -7 \le x \le 8\}.$
  Then, which one of the following is correct ?
(a) $-9 \in (A \cap B \cap C)$
(b) $-7 \in (A \cap B \cap C)$
(c) $4 \in (A \cap B \cap C)$
(d) $5 \in (A \cap B \cap C)$

100. Which one of the following is correct ?
  If $\dfrac{1}{b-c} + \dfrac{1}{b-a} = \dfrac{1}{a} + \dfrac{1}{c}$, then a, b, c are in
(a) AP   (b) HP
(c) GP   (d) None of these

101. One root of the equation $x^2 = px + q$ is reciprocal of the other and $p \ne \pm 1$. What is the value of q ?
(a) $q = -1$ (b) $q = 1$
(c) $q = 0$ (d) $q = \dfrac{1}{2}$

102. The numerical value of the perimeter of a square exceeds that of its area by 4. What is the side of the square ?
(a) 1 unit   (b) 2 unit
(c) 3 unit   (d) 4 unit

103. If the equation $x^2 + kx + 1 = 0$ has the roots α and β, then what is the value of $(\alpha + \beta) \times (\alpha^{-1} + \beta^{-1})$?
(a) k^2 (b) $\dfrac{1}{k^2}$
(c) $2k^2$ (d) $\dfrac{1}{(2k^2)}$

104. If t_r is the rth in the expansion of $(1 + x)^{101}$, then what is the ratio $\dfrac{t_{20}}{t_{19}}$ equal to ?
(a) $\dfrac{20x}{19}$ (b) $83x$ (c) $19x$ (d) $\dfrac{83x}{19}$

105. If ω is a complex non-real cube root of unity, then ω satisfies which one of the following equations ?
(a) $x^2 - x + 1 = 0$ (b) $x^2 + x + 1 = 0$
(c) $x^2 + x - 1 = 0$ (d) $x^2 - x - 1 = 0$

106. What is tan $(\cos^{-1} x)$ equal to ?
(a) $\dfrac{\sqrt{1-x^2}}{x}$ (b) $\dfrac{x}{1+x^2}$
(c) $\dfrac{\sqrt{1+x^2}}{x}$ (d) $\sqrt{1-x^2}$

107. What is the value of $\left(\sin 22\frac{1°}{2} + \cos 22\frac{1°}{2} \right)^4$?

   (a) $\dfrac{3+2\sqrt{2}}{2}$ (b) $\dfrac{1+2\sqrt{2}}{2}$

   (c) $\dfrac{3\sqrt{2}+2}{2}$ (d) 1

108. If $\sin^{-1} x - \cos^{-1} x = \dfrac{\pi}{6}$, then what is the value of x ?

   (a) $x = -\dfrac{1}{2}$ (b) $x = 1$

   (c) $x = \dfrac{1}{2}$ (d) $x = \dfrac{\sqrt{3}}{2}$

109. PT, a tower of height 2^x metre, P being the foot, T being the top of the tower. A, B are points on the same line with P. If $AP = 2^{x+1}$ m, $BP = 192$ m and if the angle of elevation of the tower as seen from B is double the angle of the elevation of the tower as seen from A, then what is the value of x ?

   (a) 6   (b) 7
   (c) 8   (d) 9

110. In a triangle ABC, $b = \sqrt{3}$ cm, $c = 1$ cm, $\angle A = 30°$, what is the value of a ?

   (a) $\sqrt{2}$ cm   (b) 2 cm

   (c) 1 cm   (d) $\dfrac{1}{2}$ cm

111. Let $-1 \le x \le 1$. If $\cos(\sin^{-1} x) = \dfrac{1}{2}$, then how many value does $\tan(\cos^{-1} x)$ assume ?

   (a) One   (b) Two
   (c) Four   (d) Infinite

112. Which one of the following is correct ?
$\left(1 + \cos 67\frac{1°}{2} \right) \left(1 + \cos 112\frac{1°}{2} \right)$ is

   (a) an irrational number and is greater than 1
   (b) a rational number but not an integer
   (c) an integer
   (d) an irrational number and is less than 1

113. If $\sin 2A = \dfrac{4}{5}$, then what is the value of $\tan A \left(0 \le A \le \dfrac{\pi}{4} \right)$?

   (a) 1   (b) −1

   (c) $\dfrac{1}{2}$ (d) 2

114. What is the value of $\dfrac{\cos 10° - \sin 10°}{\cos 10° + \sin 10°}$?

   (a) $\tan 35°$ (b) $\tan 10°$

   (c) $\dfrac{1}{\sqrt{2}}$ (d) 1

115. For what value of x does the equation $4 \sin x + 3 \sin 2x - 2 \sin 3x + \sin 4x = 2\sqrt{3}$ hold ?

   (a) $\dfrac{\pi}{6}$ (b) $\dfrac{\pi}{4}$

   (c) $\dfrac{\pi}{3}$ (d) $\dfrac{\pi}{2}$

116. The equation $\sin^{-1}(3x - 4x^3) = 3\sin^{-1}(x)$ is true for all values of x lying in which one of the following intervals ?

   (a) $\left[-\dfrac{1}{2}, \dfrac{1}{2} \right]$ (b) $\left[\dfrac{1}{2}, 1 \right]$

   (c) $\left[-1, -\dfrac{1}{2} \right]$ (d) $[-1, 1]$

117. Which one of the following pairs is not correctly matched ?
   (a) $\sin 2\pi$: $\sin(-2\pi)$
   (b) $\tan 45°$: $\tan(-315°)$
   (c) $\cot(\tan^{-1} 0.5)$: $\tan(\cot^{-1} 0.5)$
   (d) $\tan 420°$: $\tan(-60°)$

118. What is the value of $\sin\left(\dfrac{5\pi}{12} \right)$?

   (a) $\dfrac{\sqrt{3}+1}{2}$ (b) $\dfrac{\sqrt{6}+\sqrt{2}}{4}$

   (c) $\dfrac{\sqrt{3}+\sqrt{2}}{4}$ (d) $\dfrac{\sqrt{6}+1}{2}$

119. What is the correct sequence of the following values ?
   1. $\sin\left(\dfrac{\pi}{12} \right)$ 2. $\cos\left(\dfrac{\pi}{12} \right)$

   3. $\cot\left(\dfrac{\pi}{12} \right)$

   Select the correct answer using the code given below
   (a) $3 > 2 > 1$ (b) $1 > 2 > 3$
   (c) $1 > 3 > 2$ (d) $3 > 1 > 2$

120. If (a, b), (c, d) and $(a - c, b - d)$ are collinear, then which one of the following is correct ?
   (a) $bc - ad = 0$
   (b) $ab - cd = 0$
   (c) $bc + ad = 0$
   (d) $ab + cd = 0$

Answers : General Studies

1	(c)	51	(b)	101	(a)
2	(c)	52	(b)	102	(b)
3	(d)	53	(b)	103	(a)
4	(c)	54	(a)	104	(d)
5	(a)	55	(b)	105	(b)
6	(b)	56	(b)	106	(a)
7	(a)	57	(b)	107	(a)
8	(d)	58	(b)	108	(d)
9	(a)	59	(d)	109	(c)
10	(c)	60	(d)	110	(c)
11	(b)	61	(d)	111	(b)
12	(b)	62	(b)	112	(d)
13	(b)	63	(a)	113	(c)
14	(b)	64	(c)	114	(a)
15	(b)	65	(a)	115	(a)
16	(a)	66	(d)	116	(b)
17	(a)	67	(c)	117	(a)
18	(c)	68	(c)	118	(b)
19	(d)	69	(d)	119	(a)
20	(b)	70	(a)	120	(a)
21	(b)	71	(a)		
22	(c)	72	(c)		
23	(b)	73	(a)		
24	(d)	74	(a)		
25	(b)	75	(c)		
26	(d)	76	(a)		
27	(b)	77	(c)		
28	(b)	78	(d)		
29	(d)	79	(c)		
30	(a)	80	(d)		
31	(c)	81	(b)		
32	(a)	82	(c)		
33	(a)	83	(c)		
34	(c)	84	(a)		
35	(b)	85	(c)		
36	(c)	86	(c)		
37	(d)	87	(a)		
38	(c)	88	(b)		

39	(d)	89	(a)
40	(c)	90	(b)
41	(a)	91	(d)
42	(a)	92	(a)
43	(d)	93	(b)
44	(d)	94	(b)
45	(d)	95	(c)
46	(d)	96	(c)
47	(c)	97	(d)
48	(a)	98	(b)
49	(a)	99	(b)
50	(b)	100	(b)