

NDA/NA



22 PREVIOUS YEARS' SOLVED PAPERS

(2014 to Apr 2025)

CHAPTERWISE AND TOPICWISE

**MATHEMATICS
GENERAL ABILITY**

Latest

April
2025 (NDA-1)
Paper

**Trend
Analysis**

of Last 6 Years
Papers

**Detailed
Solutions**

with 100%
Accuracy

7270+

Previous Years'
Questions

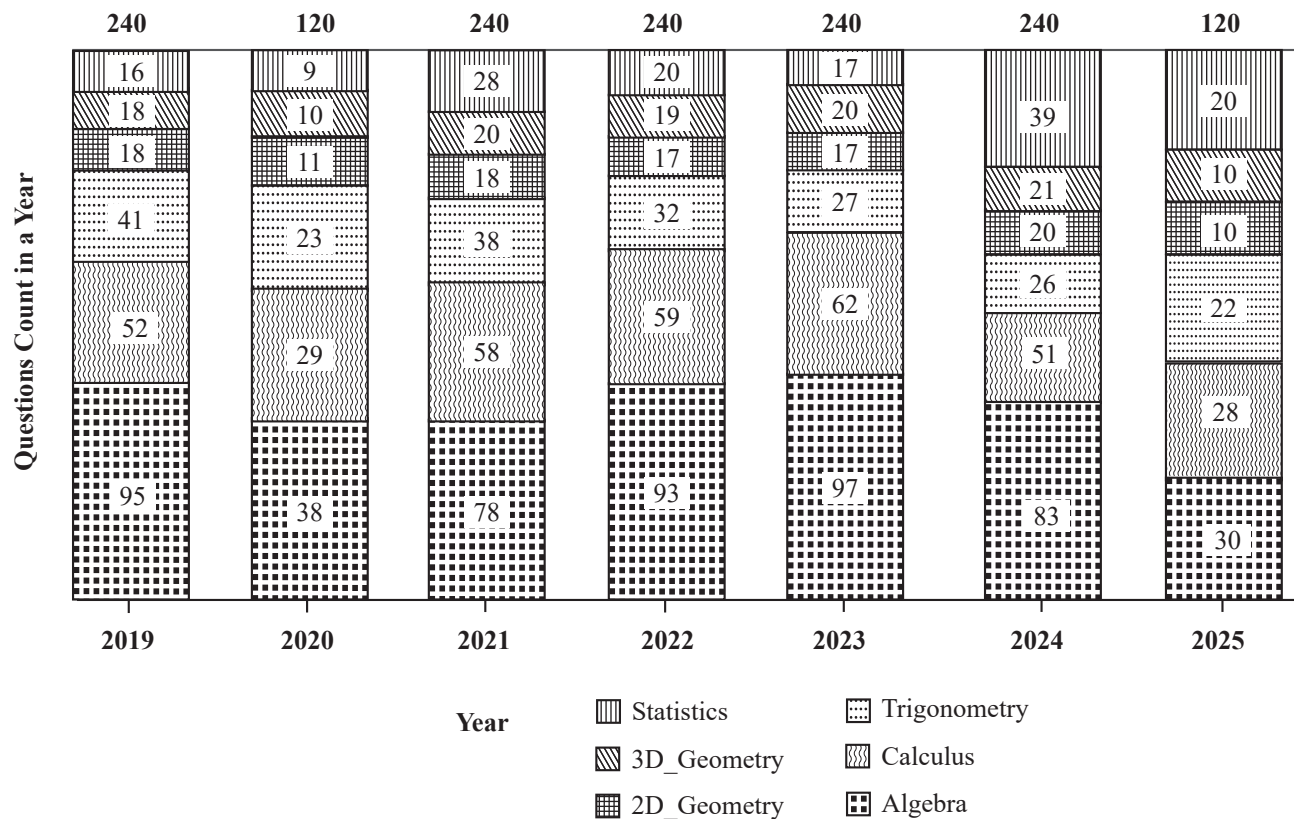


NDA Past 6 Years Paper Analysis

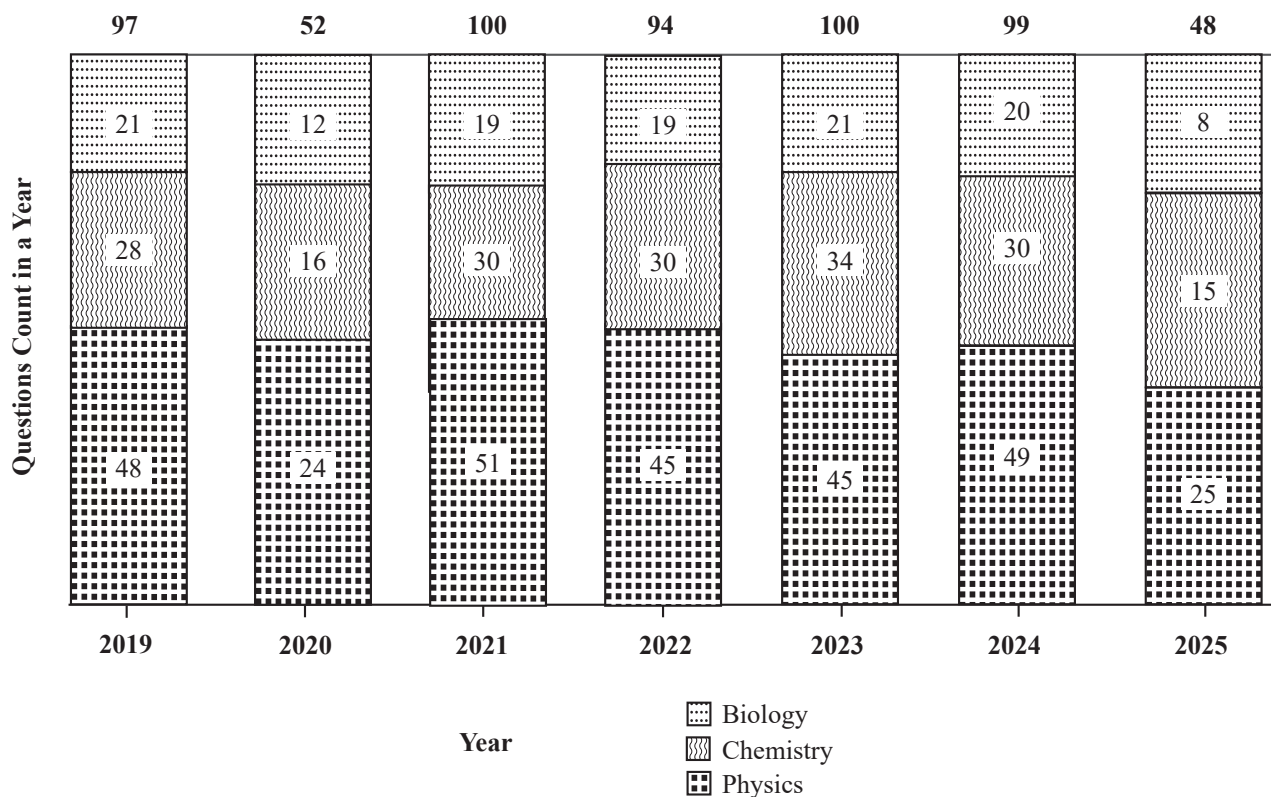
MATHEMATICS

	2020-I	2021-I	2021-II	2022-I	2022-II	2023-I	2023-II	2024-I	2024-II	2025-I
1. Basic Maths	1	0	0	1	0	3	0	0	5	0
2. Logarithm	2	1	1	0	1	0	0	3	2	0
3. Sets	4	1	1	4	8	0	1	1	3	0
4. Quadratic Equations	2	4	4	4	2	5	4	3	7	2
5. Trigonometric Functions	18	13	13	10	9	6	8	9	7	11
6. Properties of Triangle	4	2	2	1	4	6	2	3	3	5
7. Height and Distance	0	2	2	2	3	2	0	0	0	3
8. Binomial Theorem	3	3	3	2	3	3	4	4	1	3
9. Sequence and Series	2	6	6	5	3	5	6	2	5	4
10. Permutations and Combinations	3	4	4	8	7	9	2	6	4	6
11. Complex Number	3	5	5	2	3	4	6	5	6	3
12. Basics of Coordinate Geometry	1	1	1	1	0	0	0	1	4	2
13. Straight Lines	7	5	5	6	2	2	5	6	1	3
14. Circles	1	1	1	1	2	0	2	3	1	2
15. Parabola and Ellipse	2	1	1	2	3	2	5	2	2	2
16. Hyperbola and Rectangular Hyperbola	0	1	1	0	0	0	1	0	0	1
17. Relation and Function	4	5	5	5	8	6	11	7	9	7
18. Inverse Trigonometric Functions	1	2	2	2	1	0	3	2	2	3
19. Matrices	4	2	2	5	3	3	4	2	6	5
20. Determinants	3	8	8	5	6	9	7	8	1	6
21. Methods of Differentiation	3	3	3	4	5	5	2	1	0	4
22. Limits	4	2	2	2	4	4	5	1	1	5
23. Continuity and Differentiability	2	3	3	2	0	2	4	2	4	2
24. Application of Derivatives	6	5	5	4	4	3	3	4	4	4
25. Indefinite Integration	4	3	3	2	3	0	0	4	3	1
26. Definite Integration	1	2	2	2	3	5	3	7	4	2
27. Area Under the Curve	1	1	1	2	3	3	1	1	2	3
28. Differential Equations	4	5	5	4	2	3	2	4	2	0
29. Vector Algebra	6	8	8	5	6	6	5	5	5	5
30. 3-D Geometry	4	2	2	5	3	4	5	5	6	5
31. Probability	10	5	5	7	12	8	14	12	14	11
32. Statistics	9	14	14	13	7	12	5	7	6	9
33. Binary Numbers	1	0	0	2	0	0	0	0	0	1

Yearwise Weightage in Mathematics



Yearwise Weightage in Science



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Trigonometric Functions

Trigonometric Ratios and Identity

1. Consider the following statements: [2014-I]

- The function $f(x) = \sin x$ decreases on the interval $(0, \pi/2)$.
- The function $f(x) = \cos x$ increases on the interval $(0, \pi/2)$.

Which of the above statements is/are correct ?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

2. What is the value of $\cos 36^\circ$? [2014-I]

- (a) $\frac{\sqrt{5}-1}{4}$ (b) $\frac{\sqrt{5}+1}{4}$
(c) $\frac{\sqrt{10+2\sqrt{5}}}{4}$ (d) $\frac{\sqrt{10-2\sqrt{5}}}{4}$

3. Consider the following statements: [2014-I]

- Value of $\sin \theta$ oscillates between -1 and 1 .
- Value of $\cos \theta$ oscillates between 0 and 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

4. Consider the following statements: [2014-I]

- $n \left(\sin^2 67^\circ \frac{1}{2} - \sin^2 22^\circ \frac{1}{2} \right) > 1$ For all positive integers $n \geq 2$.
- If x is any positive real number, then $nx > 1$ for all positive integers $n \geq 2$.

Which of the above statements is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

5. What is $\frac{1 + \sin A}{1 - \sin A} - \frac{1 - \sin A}{1 + \sin A}$ equal to? [2014-I]

- (a) $\sec A - \tan A$ (b) $2 \sec A \cdot \tan A$
(c) $4 \sec A \cdot \tan A$ (d) $4 \operatorname{cosec} A \cdot \cot A$

6. What is $\frac{\cot 224^\circ - \cot 134^\circ}{\cot 226^\circ + \cot 316^\circ}$ equal to? [2014-I]

- (a) $-\operatorname{cosec} 88^\circ$ (b) $-\operatorname{cosec} 2^\circ$
(c) $-\operatorname{cosec} 44^\circ$ (d) $-\operatorname{cosec} 46^\circ$

7. What is $\cos 20^\circ + \cos 100^\circ + \cos 140^\circ$ equal to? [2014-I]

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

8. What is $\sin^2(3\pi) + \cos^2(4\pi) + \tan^2(5\pi)$ equal to? [2014-I]

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

9. What is $\sqrt{1 + \sin 2\theta}$ equal to? [2014-II]

- (a) $\cos \theta - \sin \theta$ (b) $\cos \theta + \sin \theta$
(c) $2 \cos \theta + \sin \theta$ (d) $\cos \theta + 2 \sin \theta$

10. If $\cot A = 2$ and $\cot B = 3$, then what is the value of $A + B$? [2014-II]

- (a) $\pi/6$ (b) π
(c) $\pi/2$ (d) $\pi/4$

11. What is $\sin^2 66^\circ \frac{1}{2} - \sin^2 23^\circ \frac{1}{2}$ equal to? [2014-II]

- (a) $\sin 47^\circ$ (b) $\cos 47^\circ$
(c) $2 \sin 47^\circ$ (d) $2 \cos 47^\circ$

12. What is $\frac{\cos 7x - \cos 3x}{\sin 7x - 2 \sin 5x + \sin 3x}$ equal to? [2014-II]

- (a) $\tan x$ (b) $\cot x$
(c) $\tan 2x$ (d) $\cot 2x$

13. If $\sin A \sin(60^\circ - A) \sin(60^\circ + A) = k \sin 3A$, then what is k equal to? [2014-II]

- (a) $1/4$ (b) $1/2$
(c) 1 (d) 4

14. Let θ be a positive angle. If the number of degrees in θ is divided by the number of radians in θ , then an irrational number $\frac{180}{\pi}$ results. If the number of degrees in θ is multiplied by the number of radians in θ , then an irrational $\frac{125\pi}{9}$ number results. The angle θ must be equal to [2015-I]

- (a) 30° (b) 45°
(c) 50° (d) 60°

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

Let α be the root of the equation $25\cos^2 \theta + 5\cos \theta - 12 = 0$, where $\pi/2 < \alpha < \pi$.

15. What is $\tan \alpha$ equal to? [2015-II]

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

16. What is $\sin 2\alpha$ equal to? [2015-I]

- (a) $\frac{24}{25}$ (b) $-\frac{24}{25}$
(c) $-\frac{5}{12}$ (d) $-\frac{21}{25}$

17. $(1 - \sin A + \cos A)^2$ is equal to [2015-I]

- (a) $2(1 - \cos A)(1 + \sin A)$ (b) $2(1 - \sin A)(1 + \cos A)$
(c) $2(1 - \cos A)(1 - \sin A)$ (d) None of the above

18. What is $\frac{\cos \theta}{1 - \tan \theta} + \frac{\sin \theta}{1 - \cot \theta}$ equal to? [2015-II]

- (a) $\sin \theta - \cos \theta$ (b) $\sin \theta + \cos \theta$
(c) $2 \sin \theta$ (d) $2 \cos \theta$

19. On simplifying $\frac{\sin^3 A + \sin 3A}{\sin A} + \frac{\cos^3 A - \cos 3A}{\cos A}$, we get [2015-II]

- (a) $\sin 3A$ (b) $\cos 3A$
(c) $\sin A + \cos A$ (d) 3

20. If $A = (\cos 12^\circ - \cos 36^\circ)(\sin 96^\circ + \sin 24^\circ)$ and $B = (\sin 60^\circ - \sin 12^\circ)(\cos 48^\circ - \cos 72^\circ)$, then what is $\frac{A}{B}$ equal to? [2016-I]

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

21. What is the value of [2016-II]

$$\left(1 + \cos \frac{\pi}{8}\right) \left(1 + \cos \frac{3\pi}{8}\right) \left(1 + \cos \frac{5\pi}{8}\right) \left(1 + \cos \frac{7\pi}{8}\right)?$$

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

22. If $\sin 18^\circ = \frac{\sqrt{5}-1}{4}$, then what is the value of $\sin 81^\circ$? [2016-II]

- (a) $\frac{\sqrt{3} + \sqrt{5} + \sqrt{5} - \sqrt{5}}{4}$ (b) $\frac{\sqrt{3} + \sqrt{5} + \sqrt{5} + \sqrt{5}}{4}$
(c) $\frac{\sqrt{3} - \sqrt{5} + \sqrt{5} - \sqrt{5}}{4}$ (d) $\frac{\sqrt{3} + \sqrt{5} - \sqrt{5} - \sqrt{5}}{4}$

23. What is $\frac{1 - \tan 2^\circ \cot 62^\circ}{\tan 152^\circ - \cot 88^\circ}$ equal to? [2016-II]

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

24. If $\sin A = \frac{3}{5}$, where $45^\circ < A < 540^\circ$, then $\cos \frac{A}{2}$ is equal to [2017-I]

- (a) $\frac{1}{\sqrt{10}}$ (b) $-\sqrt{\frac{3}{10}}$
(c) $\frac{\sqrt{3}}{\sqrt{10}}$ (d) None of the above

25. What is $\frac{1}{\sin 10^\circ} - \frac{\sqrt{3}}{\cos 10^\circ}$ equal to? [2017-II]

- (a) 0 (b) 1
(c) 2 (d) 4

26. The expression $\frac{\sin \alpha + \sin \beta}{\cos \alpha + \cos \beta}$ is equal to [2017-I]

- (a) $\tan \left(\frac{\alpha + \beta}{2}\right)$ (b) $\cot \left(\frac{\alpha + \beta}{2}\right)$
(c) $\sin \left(\frac{\alpha + \beta}{2}\right)$ (d) $\cos \left(\frac{\alpha + \beta}{2}\right)$

27. What is the value of $\tan 18^\circ$? [2017-II]

- (a) $\frac{\sqrt{5}-1}{\sqrt{10+2\sqrt{5}}}$ (b) $\frac{\sqrt{5}-1}{\sqrt{10+\sqrt{5}}}$
(c) $\frac{\sqrt{10+2\sqrt{5}}}{\sqrt{5}-1}$ (d) $\frac{\sqrt{10+\sqrt{5}}}{\sqrt{5}-1}$

28. If $\sec \theta - \operatorname{cosec} \theta = \frac{4}{3}$, then what is $(\sin \theta - \cos \theta)$ equal to? [2017-II]

- (a) -2 only (b) $\frac{1}{2}$ only
(c) Both -2 and $\frac{1}{2}$ (d) Neither $\frac{1}{2}$ nor -2

29. The value of $\tan 9^\circ - \tan 27^\circ - \tan 63^\circ + \tan 81^\circ$ is equal to [2017-II]

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

30. The value of $\sqrt{3} \operatorname{cosec} 20^\circ - \sec 20^\circ$ is equal to [2017-II]

- (a) 4 (b) 2
(c) 1 (d) -4

31. Angle α is divided into two parts A and B such that $A - B = x$ and $\tan A : \tan B = p : q$. The value of $\sin x$ is equal to [2017-II]

- (a) $\frac{(p+q)\sin \alpha}{p-q}$ (b) $\frac{p \sin \alpha}{p+q}$
(c) $\frac{p \sin \alpha}{p-q}$ (d) $\frac{(p+q)\sin \alpha}{p-q}$

32. $\sqrt{1 + \sin A} = -\left(\sin \frac{A}{2} + \cos \frac{A}{2}\right)$ is true if [2017-II]

- (a) $\frac{3\pi}{2} < A < \frac{5\pi}{2}$ only (b) $\frac{\pi}{2} < A < \frac{3\pi}{2}$ only
(c) $\frac{3\pi}{2} < A < \frac{7\pi}{2}$ (d) $0 < A < \frac{3\pi}{2}$

33. What is $\frac{\sin 5x - \sin 3x}{\cos 5x + \cos 3x}$ equal to? [2018-I]

- (a) $\sin x$ (b) $\cos x$
(c) $\tan x$ (d) $\cot x$

34. What is $\sin 105^\circ + \cos 105^\circ$ equal to? [2018-II]

- (a) $\sin 50^\circ$ (b) $\cos 50^\circ$
(c) $\frac{1}{\sqrt{2}}$ (d) 0

35. Suppose $\cos A$ is given. If only one value of $\cos \left(\frac{A}{2}\right)$ is possible, then A must be [2018-II]

- (a) An odd multiple of 90° (b) A multiple of 90°
(c) An odd multiple of 180° (d) A multiple of 180°

36. What is the period of the function $f(x) = \sin x$? [2018-I]

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

37. What is $\frac{2 \tan \theta}{1 + \tan^2 \theta}$ equal to? [2018-II]

- (a) $\cos 2\theta$ (b) $\tan 2\theta$
(c) $\sin 2\theta$ (d) $\operatorname{cosec} 2\theta$

38. If $\theta = \frac{\pi}{8}$, then what is the value of

$$(2 \cos \theta + 1)^{10} (2 \cos 2\theta - 1)^{10} (2 \cos \theta - 1)^{10} (2 \cos 4\theta - 1)^{10}?$$

- (a) 0 (b) 1
(c) 2 (d) 4

39. What is the value of $\frac{\sin 34^\circ \cos 236^\circ - \sin 56^\circ \sin 124^\circ}{\cos 28^\circ \cos 88^\circ + \cos 178^\circ \sin 208^\circ}$? [2019-I]

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

40. $\tan 54^\circ$ can be expressed as [2019-I]

- (a) $\frac{\sin 9^\circ + \cos 9^\circ}{\sin 9^\circ - \cos 9^\circ}$ (b) $\frac{\sin 9^\circ - \cos 9^\circ}{\sin 9^\circ + \cos 9^\circ}$
(c) $\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ}$ (d) $\frac{\sin 36^\circ}{\cos 36^\circ}$

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

If $p = X \cos \theta - Y \sin \theta$, $q = X \sin \theta + Y \cos \theta$ and $p^2 + 4pq + q^2 = AX^2 + BY^2$, $0 \leq \theta \leq \frac{\pi}{2}$

41. What is the value of θ ? [2019-I]

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

42. What is the value of A ? [2019-I]

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

43. What is the value of B ? [2019-I]

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

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

It is given that $\cos(\theta - \alpha) = a$, $\cos(\theta - \beta) = b$.

44. What is $\cos(\alpha - \beta)$ equal to? [2019-I]

- (a) $ab + \sqrt{1 - a^2} \sqrt{1 - b^2}$ (b) $ab - \sqrt{1 - a^2} \sqrt{1 - b^2}$
(c) $a\sqrt{1 - b^2} - b\sqrt{1 - a^2}$ (d) $a\sqrt{1 - b^2} + b\sqrt{1 - a^2}$

45. What is $\sin^2(\alpha - \beta) + 2ab \cos(\alpha - \beta)$ equal to? [2019-I]

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

46. If $\sin \alpha + \cos \alpha = p$, then what is $\cos^2(2\alpha)$ equal to? [2019-I]

- (a) p^2 (b) $p^2 - 1$ (c) $p^2(2 - p^2)$ (d) $p^2 + 1$

47. If $\tan \theta = \frac{1}{2}$ and $\tan \phi = \frac{1}{3}$, then what is the value of $(\theta + \phi)$? [2019-I]

- (a) 0 (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

48. If $\cos A = \frac{3}{4}$, then what is the value of $\sin\left(\frac{A}{2}\right) \sin\left(\frac{3A}{2}\right)$? [2019-I]

- (a) $\frac{5}{8}$ (b) $\frac{5}{16}$ (c) $\frac{5}{24}$ (d) $\frac{7}{32}$

49. What is the value of $\tan 75^\circ + \cot 75^\circ$? [2019-I]

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

50. What is the value of $\cos 46^\circ \cos 47^\circ \cos 48^\circ \cos 49^\circ \cos 50^\circ \dots \cos 135^\circ$? [2019-I]

- (a) -1 (b) 0 (c) 1 (d) Greater than 1

51. What is $(1 + \tan \alpha \tan \beta)^2 + (\tan \alpha - \tan \beta)^2 - \sec^2 \alpha \sec^2 \beta$ equal to? [2019-I]

- (a) 0 (b) 1 (c) 2 (d) 4

52. If $p = \operatorname{cosec} \theta - \cot \theta$ and $q = (\operatorname{cosec} \theta + \cot \theta)^{-1}$, then which one of the following is correct? [2019-I]

- (a) $pq = 1$ (b) $p = q$ (c) $p + q = 1$ (d) $p + q = 0$

53. If $\sin \theta + \cos \theta = \sqrt{2} \cos \theta$, then what is $\cos \theta - \sin \theta$ equal to? [2019-I]

- (a) $-\sqrt{2} \cos \theta$ (b) $-\sqrt{2} \sin \theta$
(c) $\sqrt{2} \sin \theta$ (d) $2 \sin \theta$

54. If $\sin \theta = -1/2$ and $\tan \theta = 1/\sqrt{3}$, then in which quadrant does θ lie? [2019-I]

- (a) First (b) Second
(c) Third (d) Fourth

55. If $\operatorname{cosec} \theta = \frac{29}{21}$ where $0 < \theta < 90^\circ$, then what is the value of $4 \sec \theta + 4 \tan \theta$? [2019-II]

- (a) 5 (b) 10 (c) 15 (d) 20

56. Consider the following statements: [2019-II]

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

57. If $\tan A - \tan B = x$ and $\cot B - \cot A = y$, then what is the value of $\cot(A - B)$? [2019-II]

- (a) $\frac{1}{x} + \frac{1}{y}$ (b) $\frac{1}{y} - \frac{1}{x}$ (c) $\frac{xy}{x + y}$ (d) $1 + \frac{1}{xy}$

58. What is $\sin(\alpha + \beta) - 2 \sin \alpha \cos \beta + \sin(\alpha - \beta)$ equal to? [2019-II]

- (a) 0 (b) $2 \sin \alpha$ (c) $2 \sin \beta$ (d) $\sin \alpha + \sin \beta$

59. If $2 \tan A = 3 \tan B = 1$, then what is $\tan(A - B)$ equal to? [2019-II]

- (a) $\frac{1}{5}$ (b) $\frac{1}{6}$ (c) $\frac{1}{7}$ (d) $\frac{1}{9}$

60. What is $\cos 80^\circ + \cos 40^\circ - \cos 20^\circ$ equal to? [2019-II]

- (a) 2 (b) 1 (c) 0 (d) -19

61. What is $\cot\left(\frac{A}{2}\right) - \tan\left(\frac{A}{2}\right)$ equal to? [2019-II]

- (a) $\tan A$ (b) $\cot A$ (c) $2 \tan A$ (d) $2 \cot A$

62. What is $\cot A + \operatorname{cosec} A$ equal to? [2019-II]

- (a) $\tan\left(\frac{A}{2}\right)$ (b) $\cot\left(\frac{A}{2}\right)$ (c) $2\tan\left(\frac{A}{2}\right)$ (d) $2\cot\left(\frac{A}{2}\right)$

63. What is $\tan 25^\circ \tan 15^\circ + \tan 15^\circ \tan 50^\circ + \tan 25^\circ \tan 50^\circ$ equal to? [2019-II]

- (a) 0 (b) 1 (c) 2 (d) 4

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

Let $\frac{\tan 3A}{\tan A} = k$, where $A \neq 0$ and $k \neq \frac{1}{3}$

64. What is $\tan^2 A$ equal to? [2020-I & II]

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

65. For real values of $\tan A$, k cannot lie between [2020-I & II]

- (a) $\frac{1}{3}$ and 3 (b) $\frac{1}{2}$ and 2 (c) $\frac{1}{5}$ and 5 (d) $\frac{1}{7}$ and 7

66. If $\tan \theta = \frac{\cos 17^\circ - \sin 17^\circ}{\cos 17^\circ + \sin 17^\circ}$, then what is the value of θ ? [2020-I & II]

- (a) 0° (b) 28° (c) 38° (d) 52°

67. A and B are positive acute angles such that $\cos 2B = 3\sin^2 A$ and $3\sin 2A = 2\sin 2B$. What is the value of $(A + 2B)$? [2020-I & II]

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

68. What is $\sin 3x + \cos 3x + 4\sin^3 x - 3\sin x + 3\cos x - 4\cos^3 x$ equal to? [2020-I & II]

- (a) 0 (b) 1 (c) $2 \sin 2x$ (d) $4 \cos 4x$

69. The value of ordinate of the graph of $y = 2 + \cos x$ lies in the interval [2020-I & II]

- (a) $[0, 1]$ (b) $[0, 3]$ (c) $[-1, 1]$ (d) $[1, 3]$

70. What is the value of $8 \cos 10^\circ \cdot \cos 20^\circ \cdot \cos 40^\circ$? [2020-I & II]

- (a) $\tan 10^\circ$ (b) $\cot 10^\circ$ (c) $\operatorname{cosec} 10^\circ$ (d) $\sec 10^\circ$

71. What is the value of $\cos 48^\circ - \cos 12^\circ$? [2020-I & II]

- (a) $\frac{\sqrt{5}-1}{4}$ (b) $\frac{1-\sqrt{5}}{4}$ (c) $\frac{\sqrt{5}+1}{2}$ (d) $\frac{1-\sqrt{5}}{8}$

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

Let $a \sin^2 x + b \cos^2 x = c$; $b \sin^2 y + a \cos^2 y = d$ and $p \tan x = q \tan y$.

72. What is $\tan^2 x$ equal to? [2020-I & II]

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

73. What is $\frac{d-a}{b-d}$ equal to? [2020-I & II]

- (a) $\sin^2 y$ (b) $\cos^2 y$ (c) $\tan^2 y$ (d) $\cot^2 y$

74. What is $\frac{p^2}{q^2}$ equal to? [2020-I & II]

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

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

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

Let $t_n = \sin^n \theta + \cos^n \theta$.

75. What is $\frac{t_3 - t_5}{t_5 - t_7}$ equal to? [2020-I & II]

- (a) $\frac{t_1}{t_3}$ (b) $\frac{t_3}{t_5}$ (c) $\frac{t_5}{t_7}$ (d) $\frac{t_1}{t_7}$

76. What is $t_1^2 - t_2$ equal to? [2020-I & II]

- (a) $\cos 2\theta$ (b) $\sin 2\theta$ (c) $2\cos \theta$ (d) $2\sin \theta$

77. What is the value of t_{10} where $\theta = 45^\circ$? [2020-I & II]

- (a) 1 (b) $\frac{1}{4}$ (c) $\frac{1}{16}$ (d) $\frac{1}{32}$

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

Let $\alpha = \beta = 15^\circ$

78. What is the value of $\sin \alpha + \cos \beta$? [2020-I & II]

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

79. What is the value of $\sin 7\alpha - \cos 7\beta$? [2020-I & II]

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

80. What is $\sin(\alpha + 1^\circ) + \cos(\beta + 1^\circ)$ equal to? [2020-I & II]

- (a) $\sqrt{3} \cos 1^\circ + \sin 1^\circ$ (b) $\sqrt{3} \cos 1^\circ - \frac{1}{2} \sin 1^\circ$
(c) $\frac{1}{\sqrt{2}}(\sqrt{3} \cos 1^\circ - \sin 1^\circ)$ (d) $\frac{1}{2}(\sqrt{3} \cos 1^\circ + \sin 1^\circ)$

81. If $\sin x + \sin y = \cos y - \cos x$, where $0 < y < x < \frac{\pi}{2}$, then what is $\tan\left(\frac{x-y}{2}\right)$ equal to? [2020-I & II]

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

82. What is $\cot 2x \cot 4x - \cot 4x \cot 6x - \cot 6x \cot 2x$ equal to? [2021-II]

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

83. If $\tan x = -\frac{3}{4}$ and x is in the second quadrant, then what is the value of $\sin x \cdot \cos x$? [2021-II]

- (a) $\frac{6}{25}$ (b) $\frac{12}{25}$ (c) $-\frac{6}{25}$ (d) $-\frac{12}{25}$

84. What is the value of the following? [2021-II]

$$\operatorname{cosec}\left(\frac{7\pi}{6}\right) \sec\left(\frac{5\pi}{3}\right)$$

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

85. What is the value of the following? [2021-II]

$$\tan 31^\circ \tan 33^\circ \tan 35^\circ \dots \tan 57^\circ \tan 59^\circ$$

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

153. What is the length of the longest interval in which the function $f(x) = 3 \sin x - 4 \sin^3 x$ is increasing? [2017-I]

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

154. What is the maximum value of the function $f(x) = 4 \sin^2 x + 1$? [2017-I]

- (a) 5 (b) 3 (c) 2 (d) 1

155. If $K = \sin\left(\frac{\pi}{18}\right)\sin\left(\frac{5\pi}{18}\right)\sin\left(\frac{7\pi}{18}\right)$, then what is the value of K ? [2017-I]

- (a) $\frac{1}{2}$ (b) $\frac{1}{4}$
(c) $\frac{1}{8}$ (d) $\frac{1}{16}$

156. If $\sin \theta = 3 \sin (\theta + 2\alpha)$, then the value of $\tan (\theta + \alpha) + 2 \tan \alpha$ is equal to [2017-I]

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

157. If $\tan (\alpha + \beta) = 2$ and $\tan (\alpha - \beta) = 1$, then $\tan (2\alpha)$ is equal to [2017-I]

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

158. Match List-I with List-II and select the correct answer using the code given below the lists: [2017-II]

List-I (Function)		List-II (Maximum value)	
A.	$\sin x + \cos x$	1.	$\sqrt{10}$
B.	$3 \sin x + 4 \cos x$	2.	$\sqrt{2}$
C.	$2 \sin x + \cos x$	3.	5
D.	$\sin x + 3 \cos x$	4.	$\sqrt{5}$

Code:

	A	B	C	D
(a)	2	3	1	4
(b)	2	3	4	1
(c)	3	2	1	4
(d)	3	2	4	1

159. If $\sin x = \frac{1}{\sqrt{5}}$, $\sin y = \frac{1}{\sqrt{10}}$ where $0 < x < \frac{\pi}{2}$, $0 < y < \frac{\pi}{2}$, then what is $(x + y)$ equal to? [2018-I]

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

160. If $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$, then what is $\frac{\tan x}{\tan y}$ equal to? [2018-I]

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

161. If $\sin \alpha + \sin \beta = 0 = \cos \alpha + \cos \beta$, where $0 < \beta < \alpha < 2\pi$, then which one of the following is correct? [2018-I]

- (a) $\alpha = \pi - \beta$ (b) $\alpha = \pi + \beta$
(c) $\alpha = 2\pi - \beta$ (d) $2\alpha = \pi + 2\beta$

162. If $\cos \alpha + \cos \beta + \cos \gamma = 0$, where $0 < \alpha \leq \frac{\pi}{2}$, $0 < \beta \leq \frac{\pi}{2}$, $0 < \gamma \leq \frac{\pi}{2}$, then what is the value of $\sin \alpha + \sin \beta + \sin \gamma$? [2018-II]

- (a) 0 (b) 3 (c) $\frac{5\sqrt{2}}{2}$ (d) $\frac{3\sqrt{2}}{2}$

163. If $\sec (\theta - \alpha)$, $\sec \theta$ and $\sec (\theta + \alpha)$ are in AP, where $\cos \alpha \neq 1$, then what is the value of $\sin^2 \theta + \cos \alpha$? [2018-II]

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

164. A is an angle in the fourth quadrant. If satisfies the trigonometric equation $3(3 - \tan^2 A - \cot A)^2 = 1$.

Which one of the following is a value of A ? [2018-II]

- (a) 300° (b) 315°
(c) 330° (d) 345°

165. What is/are the solutions of the trigonometric equation $\operatorname{cosec} x + \cot x = \sqrt{3}$ where $0 < x < 2\pi$? [2018-II]

- (a) $\frac{5\pi}{3}$ only (b) $\frac{\pi}{3}$ only
(c) π only (d) $\pi, \frac{\pi}{3}, \frac{5\pi}{3}$

166. If $\cos \alpha$ and $\cos \beta$ ($0 < \alpha < \beta < \pi$) are the roots of the quadratic equation $4x^2 - 3 = 0$, then what is the value of $\sec \alpha \times \sec \beta$? [2018-II]

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

167. If $A = \sin^2 \theta + \cos^4 \theta$, the for all real θ , which one of the following is correct? [2018-II]

- (a) $1 \leq A \leq 2$ (b) $\frac{3}{4} \leq A \leq 1$
(c) $\frac{13}{16} \leq A \leq 1$ (d) $\frac{3}{4} \leq A \leq \frac{13}{16}$

168. What is the least value of $25 \operatorname{cosec}^2 x + 36 \sec^2 x$? [2019-I]

- (a) 1 (b) 11 (c) 120 (d) 121

169. If $\sin 2\theta = \cos 3\theta$, where $0 < \theta < \frac{\pi}{2}$, then what is $\sin \theta$ equal to? [2019-II]

- (a) $\frac{\sqrt{5}+1}{4}$ (b) $\frac{\sqrt{5}-1}{4}$ (c) $\frac{\sqrt{5}+1}{16}$ (d) $\frac{\sqrt{5}-1}{16}$

170. What is the minimum value of

$$\frac{a^2}{\cos^2 x} + \frac{b^2}{\sin^2 x} \text{ where } a > 0 \text{ and } b > 0?$$

[2019-II]

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

171. What is the maximum value of $\sin x \cdot \cos x$? [2020-I & II]

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

172. What is the minimum value of $3 \cos\left(A + \frac{\pi}{3}\right)$ where $A \in R$? [2020-I & II]

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

173. The number of integer values of k , for which the equation $2 \sin x = 2k + 1$ has a solution, is [2021-I]
 (a) zero (b) one (c) two (d) four
174. What is the maximum value of $\sin 2x \cdot \cos 2x$? [2021-I]
 (a) $\frac{1}{2}$ (b) 1 (c) 2 (d) 4
175. Let the equation $\sec x \cdot \operatorname{cosec} x = p$ have a solution, where p is a positive real number. What should be the smallest value of p ? [2021-II]
 (a) $\frac{1}{2}$ (b) 1
 (c) 2 (d) Minimum does not exist
176. If $\tan \alpha + \tan \beta = 1 - \tan \alpha \cdot \tan \beta$, where $\tan \alpha \cdot \tan \beta \neq 1$, then which of the following is one of the values of $(\alpha + \beta)$? [2022-I]
 (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$
177. What is the maximum value of the function [2022-II]
 $f(x) = \frac{1}{\tan x + \cot x}$, where $0 < x < \frac{\pi}{2}$?
 (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) 1 (d) 2
178. If $1 + 2(\sin x + \cos x)(\sin x - \cos x) = 0$ where $0 < x < 360^\circ$, then how many values does x take? [2022-II]
 (a) Only one value (b) Only two values
 (c) Only three values (d) Four values
179. What is the maximum value of $3(\sin x - \cos x) + 4(\cos^3 x - \sin^3 x)$? [2022-II]
 (a) 1 (b) $\sqrt{2}$ (c) $\sqrt{3}$ (d) 2

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

Let $x = \frac{\sin^2 A + \sin A + 1}{\sin A}$ where $0 < A \leq \frac{\pi}{2}$

180. What is the minimum value of x ? [2023-I]
 (a) 1 (b) 2 (c) 3 (d) 4
181. At what value of A does x attain the minimum value? [2023-II]
 (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

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

Given that $m(\theta) = \cot^2 \theta + n^2 \tan^2 \theta + 2n$, where n is a fixed positive real number.

182. What is the least value of $m(\theta)$? [2023-I]
 (a) n (b) $2n$ (c) $3n$ (d) $4n$
183. Under what condition does m attain the least value? [2023-II]
 (a) $n = \tan^2 \theta$ (b) $n = \cot^2 \theta$ (c) $n = \sin^2 \theta$ (d) $n = \cos^2 \theta$
184. If $\tan(\pi \cos \theta) = \cot(\pi \sin \theta)$, $0 < \theta < \frac{\pi}{2}$; then what is the value of $8 \sin^2 \left(\theta + \frac{\pi}{4} \right)$? [2023-II]
 (a) 16 (b) 2 (c) 1 (d) $\frac{1}{2}$
185. What is the number of solutions of $(\sin \theta - \cos \theta)^2 = 2$ where $-\pi < \theta < \pi$? [2024-I]
 (a) Only one (b) Only two (c) Four (d) No solution
186. Under which one of the following conditions does the equation $(\cos \beta - 1)x^2 + (\cos \beta)x + \sin \beta = 0$ in x have a real root for $\beta \in [0, \pi]$? [2024-II]
 (a) $1 - \cos \beta < 0$ (b) $1 - \cos \beta \leq 0$
 (c) $1 - \cos \beta > 0$ (d) $1 - \cos \beta \geq 0$

ANSWER KEY

- | | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1. (d) | 2. (b) | 3. (a) | 4. (a) | 5. (c) | 6. (b) | 7. (d) | 8. (b) | 9. (b) | 10. (d) |
| 11. (b) | 12. (b) | 13. (a) | 14. (c) | 15. (a) | 16. (b) | 17. (b) | 18. (b) | 19. (d) | 20. (c) |
| 21. (d) | 22. (a) | 23. (b) | 24. (d) | 25. (d) | 26. (a) | 27. (a) | 28. (b) | 29. (d) | 30. (a) |
| 31. (d) | 32. (c) | 33. (c) | 34. (c) | 35. (c) | 36. (d) | 37. (c) | 38. (b) | 39. (a) | 40. (c) |
| 41. (c) | 42. (b) | 43. (a) | 44. (a) | 45. (a) | 46. (c) | 47. (c) | 48. (b) | 49. (b) | 50. (b) |
| 51. (a) | 52. (b) | 53. (c) | 54. (c) | 55. (b) | 56. (a) | 57. (a) | 58. (a) | 59. (c) | 60. (c) |
| 61. (d) | 62. (b) | 63. (b) | 64. (b) | 65. (a) | 66. (b) | 67. (d) | 68. (a) | 69. (d) | 70. (b) |
| 71. (b) | 72. (a) | 73. (c) | 74. (b) | 75. (a) | 76. (b) | 77. (c) | 78. (d) | 79. (d) | 80. (d) |
| 81. (c) | 82. (c) | 83. (d) | 84. (c) | 85. (c) | 86. (b) | 87. (b) | 88. (a) | 89. (b) | 90. (d) |
| 91. (b) | 92. (a) | 93. (d) | 94. (a) | 95. (c) | 96. (d) | 97. (b) | 98. (c) | 99. (c) | 100. (c) |
| 101. (c) | 102. (b) | 103. (a) | 104. (b) | 105. (b) | 106. (b) | 107. (a) | 108. (b) | 109. (c) | 110. (b) |
| 111. (b) | 112. (a) | 113. (a) | 114. (d) | 115. (b) | 116. (d) | 117. (c) | 118. (c) | 119. (a) | 120. (d) |
| 121. (c) | 122. (b) | 123. (b) | 124. (d) | 125. (a) | 126. (b) | 127. (b) | 128. (b) | 129. (c) | 130. (c) |
| 131. (a) | 132. (d) | 133. (b) | 134. (a) | 135. (b) | 136. (a) | 137. (d) | 138. (c) | 139. (d) | 140. (b) |
| 141. (d) | 142. (d) | 143. (c) | 144. (b) | 145. (d) | 146. (d) | 147. (b) | 148. (c) | 149. (a) | 150. (a) |
| 151. (a) | 152. (a) | 153. (a) | 154. (a) | 155. (c) | 156. (b) | 157. (a) | 158. (b) | 159. (c) | 160. (a) |
| 161. (b) | 162. (d) | 163. (d) | 164. (a) | 165. (b) | 166. (a) | 167. (b) | 168. (d) | 169. (b) | 170. (a) |
| 171. (c) | 172. (a) | 173. (c) | 174. (a) | 175. (c) | 176. (b) | 177. (b) | 178. (d) | 179. (b) | 180. (c) |
| 181. (d) | 182. (d) | 183. (b) | 184. (c) | 185. (b) | 186. (d) | | | | |



EXPLANATIONS



1. (d) As we know, $\sin x$ increases on the

interval $\left(0, \frac{\pi}{2}\right)$ and $\cos x$ decreases on the interval $\left(0, \frac{\pi}{2}\right)$

Hence, both statements are not correct.

2. (b)

3. (a) Since, $\sin \theta \in [-1, 1]$; $\theta \in \mathbb{R}$, then the value of $\sin \theta$ lies between -1 to 1 .

$\cos \theta \in [-1, 1]$; $\theta \in \mathbb{R}$, then the value of $\cos \theta$ lies between -1 to 1 .

4. (a) **Statement 1:**

$$\begin{aligned} & \text{Given } n \left(\sin^2 67\frac{1^\circ}{2} - \sin^2 22\frac{1^\circ}{2} \right) \\ &= n \left(\sin^2 \frac{135^\circ}{2} - \sin^2 \frac{45^\circ}{2} \right) \\ &= n \left(\sin \frac{135^\circ}{2} + \sin \frac{45^\circ}{2} \right) \left(\sin \frac{135^\circ}{2} - \sin \frac{45^\circ}{2} \right) \\ &= n \left[2 \sin \left(\frac{135^\circ + 45^\circ}{2} \right) \cdot \cos \left(\frac{135^\circ - 45^\circ}{2} \right) \right] \\ &= n \left[2 \cdot \cos \left(\frac{135^\circ + 45^\circ}{2} \right) \cdot \sin \left(\frac{135^\circ - 45^\circ}{2} \right) \right] \\ &= n \left[2 \cdot \sin \left(\frac{90^\circ}{2} \right) \cdot \cos \left(\frac{45^\circ}{2} \right) \right] \\ &= n \left[2 \cdot \cos \left(\frac{90^\circ}{2} \right) \cdot \sin \left(\frac{45^\circ}{2} \right) \right] \\ &= 2n \left(2 \sin \frac{45^\circ}{2} \cdot \cos \frac{45^\circ}{2} \right) \quad (\sin 45^\circ \cdot \cos 45^\circ) \\ &= 2n \cdot \sin \left(2 \times \frac{45^\circ}{2} \right) \left(\frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} \right) \\ &= 2n \cdot \sin 45^\circ \times \frac{1}{2} = n \cdot \frac{1}{\sqrt{2}} = \frac{n}{\sqrt{2}} \\ &\therefore \frac{n}{\sqrt{2}} > 1 \text{ for all positive integers } n \geq 2. \\ &\therefore \text{Statement 1 is true} \end{aligned}$$

Statement 2:

$$nx > 1, \forall n \geq 2$$

$$\Rightarrow |n| > \frac{1}{x}, \forall n \geq 2$$

$x \in (0, \infty)$, then we take $x = 1$

$n > 1$, but n is always greater or equal to 2 for all x positive real number.

$\therefore$ Statement 2 is false.

$$\begin{aligned} 5. (c) \quad & \frac{1 + \sin A}{1 - \sin A} - \frac{1 - \sin A}{1 + \sin A} \\ &= \frac{(1 + \sin A)^2 - (1 - \sin A)^2}{(1 - \sin A)(1 + \sin A)} \\ &= \frac{4 \sin A}{\cos^2 A} = 4 \sec A \cdot \tan A \end{aligned}$$

$$\begin{aligned} 6. (b) \quad & \frac{\cot 224^\circ - \cot 134^\circ}{\cot 226^\circ + \cot 316^\circ} \\ &= \frac{\cot(180^\circ + 44^\circ) - \cot(180^\circ - 46^\circ)}{\cot(180^\circ + 46^\circ) + \cot(270^\circ + 46^\circ)} \\ &= \frac{\cot 44^\circ + \cot 46^\circ}{\cot 46^\circ - \tan 46^\circ} = \frac{\tan 46^\circ + \tan 44^\circ}{\tan 44^\circ - \tan 46^\circ} \\ &= \frac{\sin(46^\circ + 44^\circ)}{\sin(44^\circ - 46^\circ)} = -\operatorname{cosec} 2^\circ \end{aligned}$$

$$\begin{aligned} 7. (d) \quad & \text{Given, } \cos 20^\circ + \cos 100^\circ + \cos 140^\circ \\ &= (\cos 140^\circ + \cos 20^\circ) + \cos 100^\circ \\ &= 2 \cos \left(\frac{160^\circ}{2} \right) \cdot \cos \left(\frac{120^\circ}{2} \right) + \cos 100^\circ \\ &= 2 \cdot \cos 80^\circ \cdot \frac{1}{2} + \cos 100^\circ \\ &= 2 \cos 90^\circ \cdot \cos 10^\circ \\ &= 2 \times 0 \times \cos 10^\circ = 0 \end{aligned}$$

$$\begin{aligned} 8. (b) \quad & \text{Given, } \sin^2(3\pi) + \cos^2(4\pi) + \tan^2(5\pi) \\ &= \sin^2(3\pi) + \cos^2(\pi + 3\pi) + \tan^2(5\pi) \\ &= (\sin^2(3\pi) + \cos^2(3\pi)) + \tan^2(2 \times 2\pi + \pi) \\ &= 1 + \tan^2 \pi = \sec^2 \pi = 1 \end{aligned}$$

$$\begin{aligned} 9. (b) \quad & \text{Given, Consider, } \sqrt{1 + \sin 2\theta} \\ &= \sqrt{\sin^2 \theta + \cos^2 \theta + 2 \sin \theta \cos \theta} \\ &= \sqrt{(\sin \theta + \cos \theta)^2} = \sin \theta + \cos \theta \end{aligned}$$

$$\begin{aligned} 10. (d) \quad & \text{Given, } \cot A = 2 \text{ and } \cot B = 3 \\ & \cot(A + B) = \frac{\cot A \cot B - 1}{\cot A + \cot B} \end{aligned}$$

$$= \frac{6-1}{2+3} = \frac{5}{5} = 1$$

$$\Rightarrow \cot(A + B) = \cot\left(\frac{\pi}{4}\right) \Rightarrow A + B = \frac{\pi}{4}$$

$$\begin{aligned} 11. (b) \quad & \text{Given, } \sin^2 66\frac{1^\circ}{2} - \sin^2 23\frac{1^\circ}{2} \\ &= \left[\sin \left(90^\circ - 23\frac{1^\circ}{2} \right) \right]^2 - \sin^2 23\frac{1^\circ}{2} \\ &= \cos^2 23\frac{1^\circ}{2} - \sin^2 23\frac{1^\circ}{2} \\ &= \cos 2 \left(23\frac{1^\circ}{2} \right) = \cos 47^\circ \end{aligned}$$

$$\begin{aligned} 12. (b) \quad & \text{Given, } \frac{\cos 7x - \cos 3x}{\sin 7x - 2 \sin 5x + \sin 3x} \\ &= \frac{-2 \sin \frac{7x+3x}{2} \cdot \sin \frac{7x-3x}{2}}{2 \sin \frac{7x+3x}{2} \cdot \cos \frac{7x-3x}{2} - 2 \sin 5x} \\ &\left(\begin{aligned} \because \sin C + \sin D &= 2 \sin \left(\frac{C+D}{2} \right) \cdot \cos \left(\frac{C-D}{2} \right) \\ \text{and } \cos C - \cos D &= -2 \sin \left(\frac{C+D}{2} \right) \sin \left(\frac{C-D}{2} \right) \end{aligned} \right) \\ &= \frac{-2 \sin 5x \cdot \sin 2x}{2 \sin 5x \cos 2x - 2 \sin 5x} \\ &= \frac{-2 \sin 5x \cdot \sin 2x}{-2 \sin 5x [1 - \cos 2x]} \\ &= \frac{\sin 2x}{1 - 1 + 2 \sin^2 x} \quad (\because \cos 2x = 1 - 2 \sin^2 x) \\ &= \frac{2 \sin x \cos x}{2 \sin^2 x} = \cot x \end{aligned}$$

$$\begin{aligned} 13. (a) \quad & \text{Given, } \sin A \cdot \sin(60^\circ - A) \sin(60^\circ + A) \\ &= k \sin 3A \\ &\Rightarrow \sin A \cdot \frac{\sin 3A}{4 \sin A} = k \cdot \sin 3A \\ &\left[\because \sin(60^\circ + A) \cdot \sin(60^\circ - A) = \frac{\sin 3A}{4 \sin A} \right] \\ &\Rightarrow \frac{\sin 3A}{4} = k \cdot \sin 3A \end{aligned}$$

By comparing L.H.S. and R.H.S., we get

$$k = \frac{1}{4}$$

14. (c) Let $\theta = 50^\circ$

As we know that $180^\circ = \pi$ radian

$$\therefore 50^\circ = \frac{50\pi}{180} \text{ radian}$$

Now according to question

$$\frac{50^\circ \times 180^\circ}{50^\circ \pi} = \frac{180}{\pi}$$

Now number of degree in ' θ ' is multiplied by number of radian in θ .

$$\therefore 50^\circ \times \frac{50\pi}{180} = \frac{2500\pi}{180} = \frac{125\pi}{9}$$

$\therefore$ Option (c) is correct.

15. (a) Here α is the root of equation

$$25 \cos^2 \theta + 5 \cos \theta - 12 = 0$$

$$\therefore 25 \cos^2 \alpha + 5 \cos \alpha - 12 = 0$$

$$\Rightarrow 25 \cos^2 \alpha + 20 \cos \alpha$$

$$-15 \cos \alpha - 12 = 0$$

$$\Rightarrow 5 \cos \alpha (5 \cos \alpha + 4) - 3(5 \cos \alpha + 4) = 0$$

$$\Rightarrow (5 \cos \alpha - 3)(5 \cos \alpha + 4) = 0$$

$$\therefore \cos \alpha = \frac{3}{5} \text{ or } \cos \alpha = \frac{-4}{5}$$

$$\text{But, } \frac{\pi}{2} < \alpha < \pi$$

$$\therefore \cos \alpha = \frac{-4}{5}$$

($\because$ In 2nd quadrant, $\cos \alpha$ value is negative)

$$\text{Since, } \sin \alpha = \sqrt{1 - \cos^2 \alpha} = \sqrt{1 - \frac{16}{25}}$$

$$\Rightarrow \sin \alpha = \frac{3}{5}$$

$$\therefore \tan \alpha = \frac{\sin \alpha}{\cos \alpha} = \frac{3}{5} \times \frac{-5}{4} = \frac{-3}{4}$$

16. (b) $\because \sin 2\alpha = 2 \sin \alpha \cdot \cos \alpha$

$$= 2 \left(\frac{3}{5} \right) \left(\frac{-4}{5} \right) = \frac{-24}{25}$$

17. (b) $(1 - \sin A + \cos A)^2$

$$= 1 + \sin^2 A + \cos^2 A - 2 \sin A$$

$$- 2 \sin A \cdot \cos A + 2 \cos A$$

$$= 2 - 2 \sin A - 2 \sin A \cos A + 2 \cos A$$

$$= 2(1 + \cos A)(1 - \sin A)$$

18. (b) Given, $\frac{\cos \theta}{1 - \tan \theta} + \frac{\sin \theta}{1 - \cot \theta}$

$$= \frac{\cos \theta}{1 - \frac{\sin \theta}{\cos \theta}} + \frac{\sin \theta}{1 - \frac{\cos \theta}{\sin \theta}}$$

$$= \frac{\cos^2 \theta}{\cos \theta - \sin \theta} - \frac{\sin^2 \theta}{\cos \theta - \sin \theta}$$

$$= \frac{\cos^2 \theta - \sin^2 \theta}{\cos \theta - \sin \theta} = \cos \theta + \sin \theta$$

19. (d) Given,

$$\frac{\sin^3 A + \sin 3A}{\sin A} + \frac{\cos^3 A - \cos 3A}{\cos A}$$

$$= \frac{\sin^3 A + 3 \sin A - 4 \sin^3 A}{\sin A} + \frac{\cos^3 A - [4 \cos^3 A - 3 \cos A]}{\cos A}$$

$$= \frac{3 \sin A - 3 \sin^3 A}{\sin A} + \frac{(-3 \cos^3 A + 3 \cos A)}{\cos A}$$

$$= 6 - 3(\cos^2 A + \sin^2 A) = 3$$

20. (c) Given $A = (\cos 12^\circ - \cos 36^\circ)$

$(\sin 96^\circ + \sin 24^\circ)$ and

$$B = (\sin 60^\circ - \sin 12^\circ)(\cos 48^\circ - \cos 72^\circ)$$

$$\therefore \frac{A}{B} = \frac{(2 \sin 24^\circ \sin 12^\circ)(2 \sin 60^\circ \cos 36^\circ)}{(2 \cos 36^\circ \sin 24^\circ)(2 \sin 60^\circ \sin 12^\circ)}$$

$$\Rightarrow \frac{A}{B} = 1$$

$$21. (d) \left[1 + \cos \frac{\pi}{8} \right] \left[1 + \cos \frac{3\pi}{8} \right]$$

$$\left[1 + \cos \frac{5\pi}{8} \right] \left[1 + \cos \frac{7\pi}{8} \right]$$

We know that,

$$\cos \frac{7\pi}{8} = \cos \left[\pi - \frac{\pi}{8} \right] = -\cos \frac{\pi}{8}$$

$$\text{and } \cos \frac{5\pi}{8} = \cos \left[\pi - \frac{3\pi}{8} \right] = -\cos \frac{3\pi}{8}$$

$$\therefore \left(1 + \cos \frac{\pi}{8} \right) \left(1 + \cos \frac{3\pi}{8} \right)$$

$$\left(1 - \cos \frac{\pi}{8} \right) \left(1 - \cos \frac{3\pi}{8} \right)$$

$$= \left(1 - \cos^2 \frac{\pi}{8} \right) \left(1 - \cos^2 \frac{3\pi}{8} \right)$$

$$= \sin^2 \frac{\pi}{8} \cdot \sin^2 \frac{3\pi}{8}$$

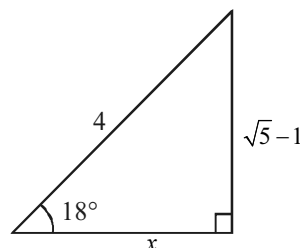
$$= \frac{1}{4} \left[2 \sin^2 \frac{\pi}{8} \cdot 2 \sin^2 \frac{3\pi}{8} \right]$$

$$= \frac{1}{4} \left[\left(1 - \cos \frac{\pi}{4} \right) \left(1 - \cos \frac{3\pi}{4} \right) \right]$$

$$\left(\because 1 - \cos \theta = 2 \sin^2 \frac{\theta}{2} \right)$$

$$= \frac{1}{4} \left[\left(1 - \frac{1}{\sqrt{2}} \right) \left(1 + \frac{1}{\sqrt{2}} \right) \right] = \frac{1}{8}$$

22. (a)



$$\therefore \sin 18^\circ = \frac{\sqrt{5}-1}{4}$$

$$\Rightarrow x^2 = 4^2 - (\sqrt{5}-1)^2$$

$$\Rightarrow x = \sqrt{10+2\sqrt{5}}$$

$$\Rightarrow \cos 18^\circ = \frac{\sqrt{10+2\sqrt{5}}}{4}$$

$$\Rightarrow 2 \cos^2 9^\circ - 1 = \frac{\sqrt{10+2\sqrt{5}}}{4}$$

$$\cos^2 9^\circ = \frac{\sqrt{10+2\sqrt{5}} + 4}{8}$$

$$\cos 9^\circ = \sqrt{\frac{4 + \sqrt{10+2\sqrt{5}}}{8}}$$

Since, $\cos 9^\circ = \sin 81^\circ$

$$\therefore \sin 81^\circ = \sqrt{\frac{4 + \sqrt{10+2\sqrt{5}}}{8}}$$

$$= \frac{\sqrt{3+\sqrt{5}} + \sqrt{5-\sqrt{5}}}{4}$$

$$23. (b) L = \frac{1 - \tan 2^\circ \cot 62^\circ}{\tan 152^\circ - \cot 88^\circ}$$

$$= \frac{1 - \tan 2^\circ \cot(90^\circ - 28^\circ)}{\tan(180^\circ - 28^\circ) - \cot(90^\circ - 2^\circ)}$$

$$= - \left[\frac{1 - \tan 2^\circ \tan 28^\circ}{\tan 2^\circ + \tan 28^\circ} \right]$$

$$\Rightarrow L = - \frac{1}{\tan(2^\circ + 28^\circ)}$$

$$= - \frac{1}{\tan 30^\circ} = -\sqrt{3}$$

24. (d) Given, $\sin A = \frac{3}{5}$ and $450^\circ < A < 540^\circ$

$$\Rightarrow 225^\circ < \frac{A}{2} < 270^\circ$$

$$\therefore \cos A = \frac{-4}{5} \quad (\because A \text{ lies in 2nd quadrant})$$

$$\therefore \cos^2 \frac{A}{2} = \frac{1 + \cos A}{2} = \frac{1}{10}$$

$$\therefore \frac{A}{2} \text{ lies in the 3rd quadrant}$$

$$\Rightarrow \cos \frac{A}{2} = \frac{-1}{\sqrt{10}}$$

$$25. (d) \frac{1}{\sin 10^\circ} - \frac{\sqrt{3}}{\cos 10^\circ}$$

$$= \frac{2 \times 2 \left[\frac{1}{2} \cos 10^\circ - \frac{\sqrt{3}}{2} \sin 10^\circ \right]}{2 \sin 10^\circ \cos 10^\circ}$$

$$= \frac{4(\cos 60^\circ \cos 10^\circ - \sin 60^\circ \sin 10^\circ)}{\sin 20^\circ}$$

$$= 4 \cdot \frac{\cos 70^\circ}{\sin 20^\circ} = 4 \cdot \frac{\sin 20^\circ}{\sin 20^\circ} = 4$$

2025-I

NDA/NA Solved Paper

Paper I: Mathematics

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 $\frac{10}{7}$
- (d) The terms of S form a geometric progression with common ratio $\frac{11}{4}$

2. The sum of the first 8 terms of a G.P. 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 A.P. are in G.P., 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 A.P. and $p, 2, q$ are in G.P., then which of the following statements is/are correct?

I. $p, 4, q$ are in H.P.

II. $\left(\frac{1}{p}\right), \frac{1}{4}, \left(\frac{1}{q}\right)$ are in A.P.

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 co-factors 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 $\arg(z) + \arg(\bar{z})$ equal to?
 (a) 0 (b) $\frac{\pi}{2}$ (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 $\left(\frac{1}{3^2} + \frac{1}{5^4}\right)^{12}$?
 (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 $\begin{bmatrix} x & 1 & 1 \\ 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ x \end{bmatrix} = [45]$ 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?
 where I_3 is the identity matrix of order 3.
 (a) $-5I_3$ (b) $-I_3$ (c) I_3 (d) $5I_3$
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 $p = \sin 35^\circ$, $q = \sin 25^\circ$ and $r = \sin (-95^\circ)$.

31. What is $(p + q + r)$ equal to?
 (a) -1 (b) 0 (c) $2 \sin 5^\circ$ (d) $2 \cos 5^\circ$
32. What is $(pq + qr + rp)$ equal to?
 (a) $-\frac{3}{4}$ (b) 0 (c) $\frac{1}{4}$ (d) $\frac{3}{4}$
33. What is $(p^2 + q^2 + r^2)$ equal to?
 (a) $\frac{1}{2}$ (b) 1 (c) $\frac{3}{2}$ (d) 2

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

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

34. What is the minimum value of p ?
 (a) 0 (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (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

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 $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{4}$, then what is the value of $P(B|A^c)$?
- (a) $\frac{1}{8}$ (b) $\frac{3}{8}$
(c) $\frac{5}{8}$ (d) $\frac{7}{8}$
116. If $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{4}$, then what is the value of $P(A^c \cap B^c)$?
- (a) $\frac{1}{4}$ (b) $\frac{5}{12}$
(c) $\frac{7}{12}$ (d) $\frac{11}{12}$
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) $\frac{1}{3}$ (b) $\frac{5}{12}$
(c) $\frac{7}{12}$ (d) $\frac{3}{4}$

118. The probability of a man hitting a target is $\frac{1}{5}$. 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 $8^2, 9^2, 10^2, \dots, 15^2$?
- (a) 133.5 (b) 135.5
(c) 137.5 (d) 139.5

Paper II: General Ability

PART-A

Passage

Directions: Read the following passage carefully and answer the questions that follow by selecting the correct option from the given options, based solely on the passage. Mark your answer on the Answer Sheet accordingly.

An attempt to determine the number of languages in the world is affected by other factors. A few new languages do continue to be discovered, even these days, as unexplored regions of the world begin to be opened up. The discovery does not usually take place straight away. Often there are similarities with an already known language which make the investigators assume that what they have found is just a dialect of that language. Only after a considerable period of contact does it transpire that the speech is so different that has to be considered a different language. It takes a language survey to establish the facts, and there are still many countries where such surveys are incomplete or have not even begun. The people may be known, but the identity of their language may not be. Because many such peoples are bilingual or multilingual, and converse with outsiders in lingua franca, it may take a while before linguists come to realize that there is an ethnic language there at all.

1. Which one of the following is NOT the reason for the difficulty in estimating the number of languages of the world?
- (a) New languages continue to be discovered
(b) There are still unexplored regions
(c) New languages are considered a dialect of a known language
(d) People who speak the language do not claim their language

2. Which one of the following is a way to establish the discovery of a new language?
- (a) By establishing contact over a period of time with the speakers of the language
(b) By finding the similarities of the language with other languages
(c) By comparing with the lingua franca of the region
(d) By conducting a survey of all languages of the region
3. Which one of the following statements is correct?
- (a) Language surveys have been conducted by all nations
(b) There is hardly any language to be discovered in the world
(c) All the languages are either complete languages or dialects of other major languages
(d) No new language needs to be discovered since all languages are known to the world
4. 'The people may be known, but the identity of their language may not be,' means
- (a) People are recognised as different ethnic groups but not necessarily their language
(b) People are recognised as different ethnic groups and their language is recognised
(c) People are not recognised as different ethnic groups, and so are their languages
(d) Because the people are not from different ethnic groups and their language is recognised

5. Which one of the following words from passage means 'come to be known' ?

- (a) transpire (b) lingua franca
- (c) straight (d) variant

Directions: The following items have a sentence in direct or indirect speech with four options. One of the options converts the direct or indirect speech into indirect or direct correctly. Select the correct option and mark your response on the Answer Sheet.

6. Convert from direct speech to indirect speech:

Charu said to her friend, "I want you to be here at 6.00 p.m. tomorrow for the meeting."

- (a) Charu told her friend that she wanted her to be there at 6.00 p.m. the next day for the meeting
- (b) Charu told her friend that she wanted her to be there at 6.00 p.m. tomorrow for the meeting
- (c) Charu requested her friend that she wanted her to be there at 6.00 p.m. tomorrow for the meeting
- (d) Charu told her friend that she will want her to be here at 6.00 p.m. the next day for the meeting

7. Convert from direct speech to indirect speech:

Nitin said to his brother, "What a beautiful painting it is ?"

- (a) Nitin wondered to his brother that what a beautiful painting it was
- (b) Nitin wondered before his brother that it was a beautiful painting
- (c) Nitin exclaimed that it is a beautiful painting
- (d) Nitin asked his brother whether it was beautiful painting

8. Convert from direct speech to indirect speech:

The teacher asked her students why they had been quiet in the previous class.

- (a) The teacher asked her students, "Why were they keeping quiet in the previous class ?"
- (b) The teacher said to her students, "Why were you quiet in the previous class?"
- (c) The teacher said to her students, "Why had you been quiet in the previous class?"
- (d) The teacher said to her students, "Why were you quiet in previous class ?"

Directions: Following items have four sentences, one of which is correct. Find the correct option and mark your response in the Answer Sheet.

9. Which one of the following sentences is correct?

- (a) He is considered as the brightest intellectual in the country
- (b) He is considered as one among the brightest intellectual in the country
- (c) He is considered as one among the brighter intellectual in the country
- (d) He is considered as one of the intellectual in the country

10. Which one of the following sentences is correct?

- (a) No other mountain is taller than the Himalayas
- (b) No other mountain is taller than the Himalayas
- (c) No other mountains taller than the Himalayas
- (d) No other mountain is taller then the Himalayas

Directions: In the following items, a pair of words is provided. You are required to select the option that most appropriately describes the meaning of both the words and mark your response on the Answer Sheet accordingly.

11. Confident and Confidant

- (a) Confident means certain, and confidant means close friend
- (b) Confidant means certain, and confident means close friend
- (c) Confident means belief, and confidant means an emissary
- (d) Confident means assurance and confidant means intimate person

12. Broke and brook

- (a) Broke means abundance and brook means a flowing water body
- (b) Broke means bankrupt and brook means a stream
- (c) Broke means fractured and brook means nonsense
- (d) Broke means negotiate and brook means a stream

13. Accept and Except

- (a) Accept means apart from and except means recognise
- (b) Accept means recognise and except means include
- (c) Accept means consent and except means apart from
- (d) Accept means allude and except means apart from

14. Accord and Accrued

- (a) Accord means collected and accrued means arrived
- (b) Accord means agreement and accrued means arrived
- (c) Accord means accepted and accrued means received
- (d) Accord means agreement and accrued means accumulated

15. Accord and Accrued

- (a) Guarantee is an agreement and warranty is a service contract
- (b) rantee is a business agreement and warranty is a service contract
- (c) Guarantee is a promise and warranty is a service contract
- (d) Guarantee is acceptance and warranty is a service contract

Directions: In the following items a sentence or a phrase is given with word that is underlined. followed by four options. Select the most appropriate option that is nearest in meaning to the underlined word and mark your response on the Answer Sheet accordingly.

16. The Constitution of India ensures proportionate representation from all regions.

- (a) balanced (b) partial
- (c) unlikely (d) suffragette

17. There is a feeling of disenchantment among the members of the group.

- (a) delight (b) disappointment
- (c) idealism (d) unrelenting

18. She believed that it was imminent that he would be chosen as the leader of the group.

- (a) timely (b) distant
- (c) unlikely (d) inevitable

19. The brave soldiers left an indelible impression on the people of the land.

- (a) permanent (b) fleeting
- (c) hilarious (d) eradicable

20. The manager always provides instantaneous replies to all queries.

- (a) immediate (b) delayed
- (c) deliberate (d) unwanted

ANSWER KEY

Paper I: Mathematics

1. (b)	2. (c)	3. (b)	4. (a)	5. (a)	6. (c)	7. (d)	8. (a)	9. (b)	10. (b)
11. (b)	12. (a)	13. (a)	14. (c)	15. (c)	16. (a)	17. (c)	18. (c)	19. (c)	20. (c)
21. (c)	22. (b)	23. (d)	24. (b)	25. (c)	26. (d)	27. (d)	28. (b)	29. (d)	30. (b)
31. (b)	32. (a)	33. (c)	34. (a)	35. (b)	36. (c)	37. (c)	38. (a)	39. (b)	40. (b)
41. (c)	42. (d)	43. (c)	44. (c)	45. (b)	46. (b)	47. (c)	48. (b)	49. (d)	50. (c)
51. (a)	52. (d)	53. (a)	54. (b)	55. (d)	56. (b)	57. (c)	58. (d)	59. (b)	60. (b)
61. (b)	62. (c)	63. (d)	64. (a)	65. (b)	66. (d)	67. (c)	68. (b)	69. (a)	70. (a)
71. (c)	72. (c)	73. (c)	74. (a)	75. (d)	76. (a)	77. (a)	78. (c)	79. (c)	80. (d)
81. (b)	82. (b)	83. (b)	84. (d)	85. (c)	86. (d)	87. (c)	88. (a)	89. (a)	90. (c)
91. (d)	92. (c)	93. (c)	94. (d)	95. (d)	96. (c)	97. (d)	98. (c)	99. (b)	100. (a)
101. (d)	102. (c)	103. (d)	104. (c)	105. (b)	106. (a)	107. (c)	108. (a)	109. (a)	110. (d)
111. (c)	112. (a)	113. (a)	114. (b)	115. (b)	116. (b)	117. (b)	118. (c)	119. (b)	120. (c)

Paper II: General Ability

1. (d)	2. (d)	3. (c)	4. (a)	5. (a)	6. (a)	7. (b)	8. (b)	9. (a)	10. (a)
11. (a)	12. (b)	13. (c)	14. (d)	15. (c)	16. (a)	17. (b)	18. (d)	19. (a)	20. (a)
21. (c)	22. (d)	23. (a)	24. (d)	25. (d)	26. (a)	27. (b)	28. (d)	29. (b)	30. (c)
31. (d)	32. (d)	33. (b)	34. (c)	35. (a)	36. (b)	37. (a)	38. (c)	39. (b)	40. (c)
41. (c)	42. (b)	43. (b)	44. (c)	45. (a)	46. (a)	47. (b)	48. (d)	49. (c)	50. (c)
51. (c)	52. (d)	53. (a)	54. (b)	55. (b)	56. (a)	57. (b)	58. (b)	59. (a)	60. (d)
61. (b)	62. (b)	63. (c)	64. (b)	65. (a)	66. (a)	67. (c)	68. (d)	69. (a)	70. (b)
71. (b)	72. (b)	73. (d)	74. (a)	75. (c)	76. (a)	77. (b)	78. (b)	79. (d)	80. (c)
81. (d)	82. (b)	83. (a)	84. (c)	85. (c)	86. (d)	87. (c)	88. (d)	89. (d)	90. (d)
91. (c)	92. (a)	93. (d)	94. (b)	95. (d)	96. (b)	97. (d)	98. (d)	99. (b)	100. (b)
101. (a)	102. (a)	103. (a)	104. (d)	105. (d)	106. (b)	107. (a)	108. (a)	109. (a)	110. (a)
111. (b)	112. (d)	113. (c)	114. (d)	115. (b)	116. (a)	117. (b)	118. (d)	119. (c)	120. (a)
121. (d)	122. (c)	123. (d)	124. (a)	125. (b)	126. (a)	127. (c)	128. (b)	129. (d)	130. (c)
131. (d)	132. (b)	133. (d)	134. (c)	135. (d)	136. (a)	137. (b)	138. (c)	139. (b)	140. (a)
141. (a)	142. (a)	143. (a)	144. (a)	145. (c)	146. (d)	147. (c)	148. (b)	149. (b)	150. (c)



Paper I: Mathematics

1. (b) We know, sum of
- k
- terms of an A.P.

$$S_k = \frac{k}{2}[2a + (k-1)d]$$

$$\Rightarrow S_k = \left(a - \frac{d}{2}\right)k + \left(\frac{d}{2}\right)k^2 \quad \dots(i)$$

Hence, $S_k = 3k^2 + 5k$ represents an AP

Comparing it with (i), we get

$$\Rightarrow 3 = \frac{d}{2}$$

$$\Rightarrow d = 6$$

Hence, the terms of S form an arithmetic progression with common difference 6.

2. (c)
- $S_8 = 5S_4$
- [G.P.]

$$\Rightarrow \frac{a(r^8 - 1)}{(r - 1)} = 5 \times \frac{a(r^4 - 1)}{(r - 1)}$$

$$\Rightarrow r^8 - 1 = 5r^4 - 5$$

$$\Rightarrow (r^4)^2 - 5r^4 + 4 = 0$$

$$\text{Let } r^4 = x$$

$$\Rightarrow x^2 - 5x + 4 = 0$$

$$\Rightarrow (x - 4)(x - 1) = 0 \Rightarrow x = 4, 1$$

$$\Rightarrow r^4 = 4; r^4 = 1$$

$$\Rightarrow r = \pm \sqrt[4]{2}; r = \pm 1$$

$$\Rightarrow r = -1, \sqrt{2}, -\sqrt{2} (\because r \neq 1)$$

3. (b) Let
- α_1
- and
- α_2
- be two roots
- $x^2 - kx + k = 0$

$$|\alpha_1 - \alpha_2| = 2\sqrt{3}$$

$$\Rightarrow \left| \frac{\sqrt{D}}{a} \right| = 2\sqrt{3}$$

$$\Rightarrow \frac{\sqrt{k^2 - 4k}}{1} = 2\sqrt{3} \quad [\because D = b^2 - 4ac]$$

$$\Rightarrow k^2 - 4k = 12 \Rightarrow k^2 - 4k - 12 = 0$$

$$\Rightarrow k^2 - 6k + 2k - 12 = 0$$

$$\Rightarrow k(k - 6) + 2(k - 6) = 0$$

$$\Rightarrow k = 6, k = -2$$

4. (a)
- $x + \frac{5}{y} = 4$

$$\Rightarrow xy = 4y - 5 \quad \dots(i)$$

$$\text{and } y + \frac{5}{x} = -4$$

$$\Rightarrow xy = -4x - 5 \quad \dots(ii)$$

By (i) and (ii), we get

$$4y - 5 = -4x - 5$$

$$\Rightarrow 4y + 4x = 0 \Rightarrow x + y = 0$$

5. (a) Given
- a_5, a_7
- and
- a_{13}
- of an AP are in GP;

$$\text{Hence, } a_7^2 = a_5 \times a_{13}$$

$$\Rightarrow (a + 6d)^2 = (a + 4d)(a + 12d)$$

$$\Rightarrow a^2 + 36d^2 + 12ad = a^2 + 16ad + 48d^2$$

$$\Rightarrow 12d^2 + 4ad = 0$$

$$\Rightarrow d(12d + 4a) = 0$$

$$\Rightarrow 4a = -12d \Rightarrow \frac{a}{d} = -3$$

6. (c) Given
- $p, 1, q$
- are in AP and
- $p, 2, q$
- are in GP;

$$\text{Hence, } 2 = p + q \text{ and } 4 = pq \quad \dots(i)$$

I. To check $p, 4, q$ are in HP,

$$\frac{2pq}{p+q} = \frac{2 \times 4}{2} = 4 \quad [\text{Using (i)}]$$

$$\Rightarrow p, 4, q \text{ are in HP}$$

$$\text{II. } \left(\frac{1}{p}\right), \frac{1}{4}, \left(\frac{1}{q}\right) \text{ are in AP,}$$

Since $p, 4, q$ are in HP,

$$\Rightarrow \frac{1}{p}, \frac{1}{4}, \frac{1}{q} \text{ are in AP}$$

Hence, Both I and II are correct.

7. (d) Given

$$x = (1111)_2; y = (1001)_2; z = (110)_2$$

$$\Rightarrow x = 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$\Rightarrow x = 8 + 4 + 2 + 1 = 15$$

$$\text{Similarly, } y = 9 \text{ and } z = 6$$

$$\text{We know, } x^3 - y^3 - z^3 - 3xyz = 0 \text{ if } x - y - z = 0$$

$$\text{Here, } 15 - 9 - 6 = 0$$

$$\Rightarrow x^3 - y^3 - z^3 - 3xyz = 0$$

8. (a) Given determinant
- $\Delta = \begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix}$
- ;

$$bB + cC - dD - gG \quad [\text{where } B, C, D, G \text{ are co-factors of elements } b, c, d, g]$$

$$= -b(di - gf) + c(dh - eg) + d(bi - ch) - g(bf - ec)$$

$$= 0$$

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

Expanding the determinant by first row,

$$= k(k+2)[k+2-3]$$

$$- (2k+1)[2k+1-3]$$

$$+ [3(2k+1) - 3(k+2)]$$

$$= k^3 - 3k^2 + 3k - 1 = (k-1)^3$$

$$\Rightarrow \Delta = (k-1)^3$$

(I) If $k > 0$ then Δ is not necessarily positive(II) $k < 0 \Rightarrow$ then Δ is definitely negative(III) If $k = 0 \Rightarrow \Delta = -1$

Hence, only (ii) is correct.

10. (b) Given
- $\begin{vmatrix} 2 & 3+i & -1 \\ 3-i & 0 & i-1 \\ -1 & -1-i & 1 \end{vmatrix} = A + iB$

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

$$= 2(i^2 - 1) - (3+i)[3-i+i-1]$$

$$- 1(3-i)(-1-i)$$

$$= -4 - 6 - 2i + 3 + 3i - i - i^2$$

$$= -6 = -6 + 0i$$

$$\Rightarrow A = -6, B = 0$$

$$\therefore A + B = -6$$

11. (b) If
- $A^2 + B^2 + C^2 = 0 \Rightarrow A = 0, B = 0, C = 0$

for all real values of A, B and C

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

$$\begin{vmatrix} 1 & \cos 0 & \cos 0 \\ \cos 0 & 1 & \cos 0 \\ \cos 0 & \cos 0 & 1 \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{vmatrix} = 0$$

12. (a)
- $\begin{vmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{vmatrix} = 0$

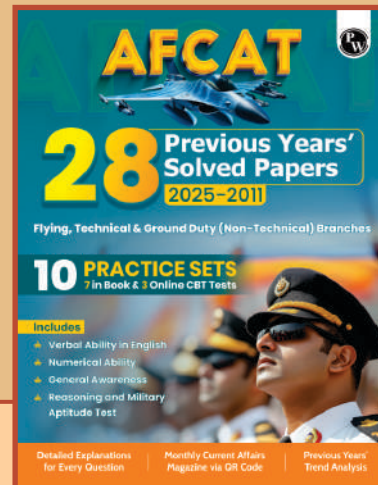
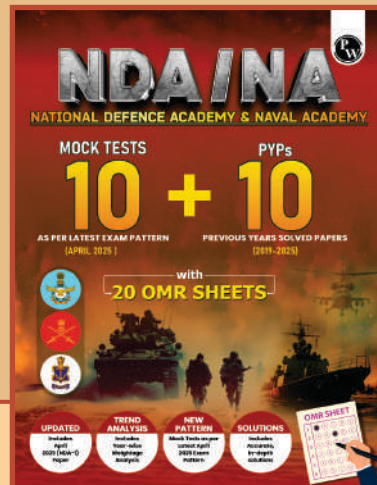
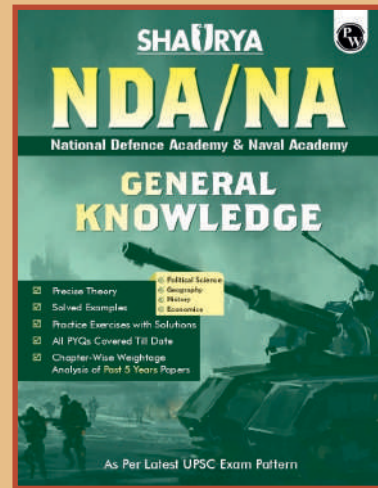
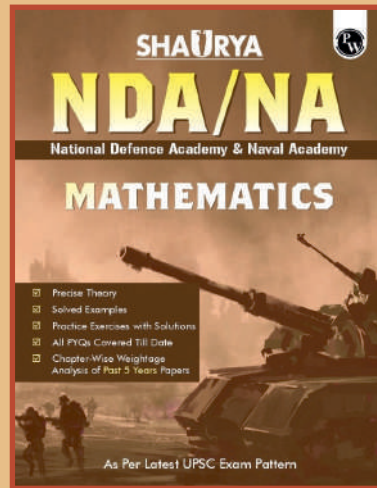
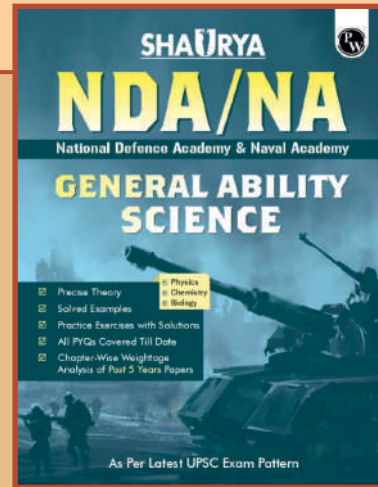
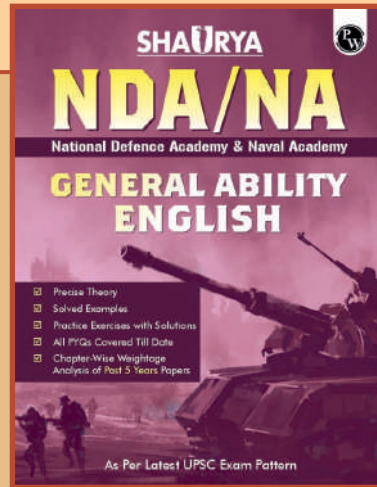
$$C_1 \rightarrow C_1 + C_2 + C_3$$

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

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

$$[\because 1 + \omega + \omega^2 = 0]$$

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