THE VOLUME DEFENCE AND EDUCATION ACADEMY

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NDA MODEL QUESTIONS — MATHEMATICS

Advanced Level | Chapter wise MCQs | 70 Questions | 1 Mark Each

CHAPTER 1: ALGEBRA

1. If α, β, γ are roots of $x^3 - 6x^2 + 11x - 6 = 0$, then $\alpha^2 + \beta^2 + \gamma^2$ equals:

(A) 14

(B) 16

(C) 11

(D) 8

2. Number of real roots of $x^4 - 5x^2 + 4 = 0$:

(A) 0

(B) 2

(C) 4

(D) 1

3. If $|z - 2 + 2i| \leq 1$, the least value of $|z|$ is:

(A) $2\sqrt{2}$

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

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

(D) 1

4. Sum of series $1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \ldots + n(n+1)$ equals:

(A) $n(n+1)(n+2)/3$

(B) $n(n+1)/2$

(C) $n^2(n+1)/2$

(D) $n(n+1)(2n+1)/6$

5. If $\log_2 x + \log_4 x + \log_8 x = 11/6$, then x equals:

(A) 4

(B) 8

(C) 2

(D) 16

6. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then $A^2 - 5A$ equals:

(A) I

(B) $2I$

(C) O

(D) $3I$

7. The number of solutions of $2^x + 3^x = 5^x$ is:

(A) 1

(B) 2

(C) 0

(D) Infinite

8. If ${}^nP_r = 720$ and ${}^nC_r = 120$, then r equals:

(A) 2

(B) 4

(C) 3

(D) 6

9. If AM of two numbers is 10 and GM is 8, the two numbers are:

(A) 5 and 15

(B) 6 and 14

(C) 9 and 11

(D) 4 and 16

10. The coefficient of x^5 in the expansion of $(1 + x^2)^5(1 + x)^4$ is:

(A) 40

(B) 30

(C) 60

(D) 50

CHAPTER 2: TRIGONOMETRY

1. If $\sin\theta + \csc\theta = 2$, then $\sin^{20}\theta + \csc^{20}\theta$ equals:

(A) 2

(B) 4

(C) 1

(D) 0

2. Value of $\cos 20^\circ \cdot \cos 40^\circ \cdot \cos 80^\circ$ is:

(A) 1/4

(B) 1/8

(C) 1/2

(D) 1/16

3. In $\triangle ABC$, the identity $\tan A + \tan B + \tan C = \tan A \cdot \tan B \cdot \tan C$ is valid for:

(A) Right triangle

(B) Obtuse triangle

(C) Any triangle ABC

(D) Equilateral only

4. The maximum value of $3\sin x + 4\cos x$ is: (A) 3 (B) 4 (C) 5 (D) 75. If $\cos(A - B) = 3/5$ and $\sin A \sin B = 1/5$, then $\cos 2A + \cos 2B$ equals:

(A) 0

(B) 6/5

(C) 4/5

(D) 2/5

6. Number of solutions of $\cos 2\theta = \sin\theta$ in $[0^\circ, 360^\circ]$ is:

(A) 2

(B) 3

(C) 1

(D) 4

7. If $A + B + C = \pi$, then $\sin 2A + \sin 2B + \sin 2C$ equals:

(A) $4\sin A \sin B \sin C$

(B) $4\cos A \cos B \cos C$

(C) 0

(D) $2\sin A\sin B\sin C$

8. $\tan 3A - \tan 2A - \tan A$ equals:

(A) 0

(B) $\tan A \cdot \tan 2A \cdot \tan 3A$

(C) 1

(D) $\tan A + \tan 2A$

9. General solution of $\sin 2\theta = \cos\theta$ is:

(A) $\theta = n\pi + (-1)^n \pi/6$ or $(2n+1)\pi/2$

(B) $\theta = n\pi/2$

(C) $\theta = 2n\pi \pm \pi/3$

(D) $\theta = n\pi$

10. The smallest positive value of x satisfying $\tan x + \cot x = 4$ is:

(A) $\pi/6$

(B) $\pi/8$

(C) $\pi/12$

(D) $\pi/4$

CHAPTER 3: CALCULUS

1. If $f(x) = |x-1| + |x-3|$, number of points where f is not differentiable:

(A) 0

(B) 2

(C) 1

(D) 3

2. $\lim_{x\to 0}(e^x - 1 - x)/x^2$ equals:

(A) 0

(B) 1

(C) 1/2

(D) ∞

3. $\int_0^{\pi/2} \sin^2 x/(\sin^2 x + \cos^2 x)dx$ **equals:**

(A) 0

(B) $\pi/4$

(C) $\pi/2$

(D) 1

4. $f(x) = x^3 - 3x$ **has a local maximum at** $x =$

(A) -1

(B) 1

(C) 0

(D) 3

5. $\int x/(1 + x^2)^{3/2}dx$ **equals:**

(A) $\ln(1 + x^2) + C$

(B) $-1/(1 + x^2) + C$

(C) $\arctan x + C$

(D) $-1/\sqrt{1 + x^2} + C$

6. The curve $y = x^3 - 3x + 2$ **has an inflection point at** $x =$

(A) -1

(B) 0

(C) 1

(D) 2

7. Area bounded by $y = x^2$ **and** $y = x$ **is:**

(A) 1/6

(B) 1/3

(C) 1/2

(D) 1/4

8. $\lim_{n\to\infty}(1+1/n)^n$ equals:

(A) 1

(B) e

(C) e^2

(D) ∞

9. $\int \sin^3 x dx$ equals:

(A) $-\cos x + C$

(B) $-(3\cos x - \cos 3x)/4 + C$

(C) $\cos^3 x/3 + C$

(D) $\cos^3 x/3 - \cos x + C$

10. If $d^2y/dx^2 + 4y = 0$ with $y(0) = 0$ and $y'(0) = 2$, solution y equals:

(A) $2\cos 2x$

(B) $\cos 2x$

(C) $\sin 2x$

(D) $2\sin 2x$

CHAPTER 4: STATISTICS & PROBABILITY

1. $P(A) = 0.3, P(B) = 0.4, P(A \cap B) = 0.2$. P(at least one of A, B) =

(A) 0.5

(B) 0.7

(C) 0.6

(D) 0.1

2. If variance of x is 4, variance of $3x + 5$ is:

(A) 4

(B) 17

(C) 36

(D) 12

3. A die is thrown 4 times. $P(\text{at least one 6}) =$

(A) 1/1296

(B) 671/1296

(C) 625/1296

(D) 5/1296

4. If $CV = 50\%$ and mean $= 20$, standard deviation is:

(A) 5

(B) 20

(C) 25

(D) 10

5. In Binomial distribution $B(n = 10, p = 0.4)$, variance $=$

(A) 2.4

(B) 4

(C) 1.6

(D) 0.4

6. Bayes' theorem is primarily used to calculate:

(A) Joint probability

(B) Marginal probability

(C) Posterior probability

(D) Compound probability

7. Cards numbered 1–20. $P(\text{prime or odd}) =$

(A) 1/2

(B) 13/20

(C) 7/10

(D) 9/20

8. Harmonic mean of 1, 1/2, 1/3 is:

(A) 6/11

(B) 3

(C) 2/3

(D) 1/2

9. P(A ∪ B)=0.8, P(A)=0.5, A & B independent. P(B) =

(A) 0.3

(B) 0.4

(C) 0.6

(D) 0.25

10. If correlation coefficient $r = 0.8$, coefficient of determination is:

(A) 0.8

(B) 0.64

(C) 80%

(D) 64%

CHAPTER 5: MATRICES & DETERMINANTS

1. If $A^2 = A$ (idempotent), then $(I - A)^3 + A =$

(A) I

(B) A

(C) O

(D) $2A$

2. The system $Ax = b$ has NO solution when:

(A) $\det A > 0$

(B) $\text{rank}(A) = n$

(C) $\text{rank}(A) \neq \text{rank}[A|b]$

(D) $\det A = 1$

3. If $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$, then $A^{50} =$

(A) $-I$

(B) O

(C) A

(D) I

4. Value of $\begin{vmatrix} a+b & a & b \\ a & a+c & c \\ b & c & b+c \end{vmatrix} =$

(A) 0

(B) $4abc$

(C) abc

(D) $2abc$

5. For a skew-symmetric matrix of odd order, determinant is always:

(A) 0

(B) 1

(C) -1

(D) Depends on matrix

6. If eigenvalues of A are 2, 3 and 4, then $\det(A) =$

(A) 9

(B) 24

(C) 12

(D) 48

7. Inverse of $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$ is:

(A) $\begin{bmatrix} 3 & -5 \\ -1 & 2 \end{bmatrix}$

(B) $\begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$

(C) $\begin{bmatrix} 2 & -5 \\ -1 & 3 \end{bmatrix}$

(D) $\begin{bmatrix} -3 & 5 \\ 1 & -2 \end{bmatrix}$

8. Rank of $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ is:

(A) 3

(B) 1

(C) 2

(D) 0

9. If A is an orthogonal matrix, then $A^T A =$

(A) I

(B) O

(C) A

(D) A^2

10. Characteristic equation of $A = \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix}$ is:

(A) $\lambda^2 - 6\lambda + 5 = 0$

(B) $\lambda^2 + 5\lambda + 6 = 0$

(C) $\lambda^2 - 6 = 0$

(D) $\lambda^2 - 5\lambda + 6 = 0$

CHAPTER 6: COORDINATE GEOMETRY

1. Locus of point equidistant from (3,0) and (-3,0) is:

(A) $x = 3$

(B) $x = 0$

(C) $y = 3$

(D) $y = 0$

2. Length of tangent from (5,4) to circle $x^2 + y^2 = 9$ is:

(A) $\sqrt{32}$

(B) $\sqrt{41}$

(C) $\sqrt{16}$

(D) $\sqrt{34}$

3. Equation of ellipse with foci $(\pm 2, 0)$ and major axis length 10 is:

(A) $x^2/25 + y^2/4 = 1$

(B) $x^2/21 + y^2/25 = 1$

(C) $x^2/25 + y^2/21 = 1$

(D) $x^2/29 + y^2/25 = 1$

4. For hyperbola $x^2/9 - y^2/16 = 1$, eccentricity is:

(A) 5/3

(B) 4/3

(C) 5/4

(D) 3/5

5. If line $y = mx + c$ is tangent to $y^2 = 4ax$, then $c =$

(A) am

(B) a/m

(C) m/a

(D) am^2

6. Radical axis of two circles is perpendicular to line joining their:

(A) Points of intersection

(B) Points of tangency

(C) Centers

(D) Foci

7. Number of common tangents to $x^2 + y^2 = 1$ and $x^2 + y^2 - 6x + 5 = 0$ is:

(A) 4

(B) 2

(C) 1

(D) 3

8. For polar curve $r = a(1 + \cos\theta)$, enclosed area is:

(A) πa^2

(B) $3\pi a^2/2$

(C) $2\pi a^2$

(D) $\pi a^2/2$

9. Angle between asymptotes of $x^2/a^2 - y^2/b^2 = 1$ is:

(A) $2\arctan(b/a)$

(B) $\arctan(a/b)$

(C) $2\arctan(a/b)$

(D) $\arctan(b/a)$

10. Lines $3x + y + 2 = 0, 2x - y + 3 = 0$ and $x + 4y - 3 = 0$ are:

(A) Concurrent

(B) Parallel

(C) Forming a triangle

(D) Two parallel, one different

CHAPTER 7: VECTORS & 3D GEOMETRY

1. If $\vec{a}, \vec{b}, \vec{c}$ are coplanar, scalar triple product $[\vec{a}\vec{b}\vec{c}] =$

(A) 1

(B) 0

(C) 3

(D) -1

2. Angle between lines $(x - 1)/2 = (y + 2)/3 = (z - 1)/4$ and $(x - 3)/1 = (y + 1)/2 = (z - 2)/3$:

(A) $\arccos(20/\sqrt{406})$

(B) $\pi/4$

(C) $\pi/3$

(D) $\pi/6$

3. A vector perpendicular to both $(\hat{\imath}+\hat{\jmath})$ and $(\hat{\jmath}+\hat{k})$ is:

(A) $\hat{\imath}+\hat{k}$

(B) $-\hat{\imath}+\hat{\jmath}-\hat{k}$

(C) $\hat{\imath}-\hat{\jmath}+\hat{k}$

(D) $\hat{\jmath}-\hat{\imath}$

4. Shortest distance between $\vec{r}=\hat{\imath}+2\hat{\jmath}+3\hat{k}+\lambda(\hat{\imath}-\hat{\jmath}+\hat{k})$ and $\vec{r}=2\hat{\imath}+3\hat{\jmath}+4\hat{k}+\mu(2\hat{\imath}+3\hat{\jmath}+\hat{k})$ is:

(A) 1

(B) $1/\sqrt{6}$

(C) $\sqrt{2}$

(D) $1/\sqrt{3}$

5. If $\vec{a}\times\vec{b}=\vec{c}\times\vec{d}$ and $\vec{a}\times\vec{c}=\vec{b}\times\vec{d}$, then $(\vec{a}-\vec{d})$ is parallel to:

(A) $\vec{b}-\vec{c}$

(B) $\vec{a}-\vec{b}$

(C) $\vec{c}-\vec{d}$

(D) $\vec{b}+\vec{c}$

6. Volume of tetrahedron with coterminous edges $(\hat{\imath}+\hat{\jmath}),(\hat{\jmath}+\hat{k}),(\hat{k}+\hat{\imath})$ is:

(A) 1/3

(B) 2/3

(C) 1

(D) 1/6

7. Equation of plane through (1,2,3) with normal (2,-1,3) is:

(A) $2x - y + 3z = 9$

(B) $2x - y + 3z = 6$

(C) $x + 2y + 3z = 9$

(D) $2x - y + 3z = 0$

8. If $|\vec{a} + \vec{b}|[cite_start] = |\vec{a} - \vec{b}|$, vectors $\vec{a}$ and $\vec{b}$ are:

(A) Parallel

(B) Perpendicular

(C) Equal

(D) Anti-parallel

9. Foot of perpendicular from (1,2,3) to plane $2x + y - 2z + 5 = 0$ is:

(A) $(1,2,-1)$

(B) $(2,3,1)$

(C) $(-1/3,5/3,13/3)$

(D) $(0,1,2)$

10. Direction ratios of intersection of planes $x + y + z = 0$ and $x - y + z = 0$ are:

(A) (1,0,1)

(B) (0,1,0)

(C) (1,1,0)

(D) (-1,0,1)