Barishal Board-2017

Higher Mathematics 1st Paper (Creative) Subject Code : 2 6 5

Time — 2 hours 35 minutes Full marks — 50

[N.B. The figures in the right margin indicate full marks. Answer five questions taking at least two from each group.]

Group A – Algebra and Geometry

1. ▶ $A = \begin{bmatrix} 4 & 2 \\ 3 & 5 \end{bmatrix}$; $B = \begin{bmatrix} 6 \\ 1 \end{bmatrix}$ and $X = \begin{bmatrix} x \\ y \end{bmatrix}$.

a. For which value of p, $\begin{bmatrix} p-2 & 3 \\ 4 & 5 \end{bmatrix}$ will be a singular square matrix? 2

b. With the view of stem find $A^2 - 5A + 6I$, where $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. 4

c. With the view of stem if $Ax = B$, then find x, y by Cramer's law. 4

2. **Scenario 1:** MUJIBNAGAR

Scenario 2: $f(x) = \frac{2x+7}{3x-2}$; $x \in \mathbb{R} - \left\{\frac{2}{3}\right\}$

a. If ${}^nC_3 = \frac{4}{5} \times {}^nC_2$ then find the value of *n*. 2

b. In how many ways, the word from the scenario 1 can arrange, such that the vowel cannot be together. 4

c. From Scenario 2, show that, $f^{-1}(x) = f(x)$. 4

3. ▶ **Scenario 1:** $x - 2y + 1 = 0$

Scenario 2: $\vec{P} = \hat{i} - 2\hat{j} + \hat{k}$; $\vec{Q} = 2\hat{i} + \hat{j} - 3\hat{k}$.

a. Find the point which internally divides the line joining the points (1, 2) and (3, 6) through the ratio 2 : 3. 2

b. Determine the equation of two straight lines which passes through the point (1, 2) and make 45° angle with the straight line presented by the Scenario 1. 4

c. Find the component of $\vec{Q}$ along $(\vec{P} + \vec{Q})$, from Scenario 2. 4

4. ✪ Scenario 1: $x^2 + y^2 + 3x - 5y + 6 = 0; x + 2y + 1 = 0$

Scenario 2: $4x - 3y - 7 = 0$

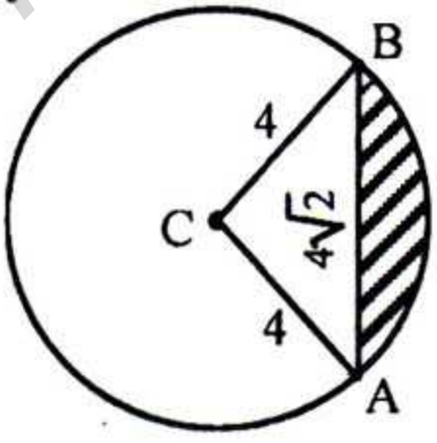
a. Find the centre and radius of the circle $3x^2 + 3y^2 - 12x + 15y - 6 = 0$. 2

b. Find the equation of a circle whose centre lies on the equation of the straight line presented by Scenario 1 and passes through the origin and the centre of the circle of Scenario 1. 4

c. Find the equation of the straight lines which are parallel to the line presented by the scenario 2, whose distance from the point (1, 2) is $5\frac{1}{2}$ unit. 4

Group B – Trigonometry and Calculus

5. ▶ Scenario 1:



Scenario 2: $\sin C + \sin D = p, \cos C + \cos D = q$

a. If $\tan\theta = \frac{b}{a}$ then find the value of $\frac{a\cos\theta + b\sin\theta}{a\cos\theta - b\sin\theta}$. 2

b. From Scenario 1, find the area of the shaded region. 4

c. From Scenario 2, prove that, $\sin\frac{C-D}{2} = \pm\frac{1}{2}\sqrt{4-p^2-q^2}$. 4

6. ✪ Scenario 1: In triangle ABC, $a = \sqrt{3}b$ and $A = 2B$

Scenario 2: $\ln y = bz$.

a. Find the value of $\lim_{x\to 0}(\text{cosec}x - \cot x)$. 2

b. From Scenario 1, find the angles of the triangle ABC. 4

c. From Scenario 2, prove that, $(1-x^2)y_2 - xy_1 = b^2y$ if $\cos z = x$. 4

7. ▶ $f(x) = x^3 - 9x^2 + 24x - 12$, $\varphi(x) = \frac{1}{\sqrt{12-16x^2}}$

and $\psi(x) = \tan^{-1}\left(\frac{x}{5}\right)$

a. Differentiate x^x, with respect to x. 2

b. Find the maximum and minimum value of $f(x)$, from Scenario. 4

c. Find from Scenario: (i) $\int \varphi(x)\,dx$; (ii) $\int \psi(x)\,dx$. 4

8. ▶ Scenario 1: $f(\theta) = \cos^3\theta$, $g(\theta) = \sin\theta$,

Scenario 2: $x^2 + y^2 = 36$

a. Determine $\int \frac{dx}{1+e^x}$. 2

b. Determine from Scenario 1: 4

(i) $\int_0^{\pi/2}\sqrt{1+g(\theta)}\,d\theta$; (ii) $\int_0^{\pi/2} f(\theta)\sqrt[3]{g(\theta)}\,d\theta$

c. Find the area bounded by the circle from the Scenario 2, using integration. 4

Higher Mathematics 1st Paper (MCQ)

Subject Code : 2 6 5

Time — 25 minutes

Full marks — 25

[N.B. Choose the best answer among the options. Fill the circle in the answer sheet with ball point pen. Each question has value 1.]

1. ★ If I_3 is the matrix of order 3 then $(I_3)^{-1} = ?$

a. 0 b. I_3 c. $\frac{1}{3}I_3$ d. $3I_3$

2. A and B be 3×3 matrices then $|A - B| = 0$ implies —

a. $A = 0_{mat}$ or $B = 0_{mat}$ b. $|A| = 0$ or $|B| = 0$

c. $|A| = 0$ and $|B| = 0$ d. $A = 0_{mat}$ and $B = 0_{mat}$

3. The number of ways of painting the faces of cube with six different colors —

i. ${}^6C_0$ ii. 6! iii. ${}^6C_6$

Which one is correct?

a. i and ii b. i and iii c. ii and iii d. i, ii and iii

4. The number of different signals made by 5 flags from 8 flags of different colours is —

a. ${}^8P_5$ b. 5! c. 8! d. ${}^8C_5$

5. The distance between the straight lines $x - y - 2 = 0$ and $2x - 2y + 4 = 0$ is —

a. $3\sqrt{2}$ b. $\frac{3}{\sqrt{2}}$ c. $2\sqrt{2}$ d. $\sqrt{2}$

6. Angle between the straight lines $y = -2x$ and $2y = x$ is —

a. 90° b. $\tan^{-1}\left(\frac{5}{4}\right)$ c. $\tan^{-1}\left(\frac{-5}{4}\right)$ d. 0°

7. If ordinate of a polar coordinate is 90° then the abscissa of that point in Cartesian coordinate is —

a. $x = r$ b. $x = 0$ c. $y = r$ d. $y = 0$

8. Equation of a straight line passes through the origin and perpendicular to x-axis is —

a. $y = 0$ b. $x = 0$ c. $y = mx$ d. $y + k = 0$

9. ★ Equation of the diameter of the circle $x^2 + y^2 - 12x + 4y + 6 = 0$ is —

a. $x + y = 0$ b. $x = y$

c. $x + 3y = 0$ d. $3x + 2y = 0$

10. The domain of the function $f(x) = \frac{\sin^{-1}(x-3)}{\sqrt{9-x^2}}$ is —

a. [2, 3] b. [2, 3) c. [1, 2] d. [1, 2)

11. If $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$ then $|\vec{a} \times \vec{b}|$ is —

a. 1 b. $\sqrt{-1}$ c. $\sqrt{3}$ d. $\sqrt{-3}$

12. For the unit vector of $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$.

i. $\hat{a} = \frac{\vec{a}}{|\vec{a}|}$ ii. $\hat{a} = 1$ iii. $|\vec{a}| \neq 0$

Which one is correct?

a. i and ii b. i and iii c. i d. ii and iii

13. Which of the following determinant is zero?

a. $\begin{vmatrix} 1 & 0 & 2 \\ 2 & 0 & 1 \\ 1 & 3 & 0 \end{vmatrix}$ b. $\begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$

c. $\begin{vmatrix} 4 & 0 & 8 \\ 2 & 3 & 4 \\ 1 & 5 & 2 \end{vmatrix}$ d. $\begin{vmatrix} 0 & 0 & 1 \\ 1 & 2 & 3 \\ 0 & 6 & 0 \end{vmatrix}$

14. Equation of a tangent to the circle $x^2 + y^2 - 2x - 4y + 4 = 0$ at (0, 2) is —

a. $x = 0$ b. $x = 2$ c. $y = 0$ d. $y = 2$

15. A function is said to be onto if —

i. domain = range

ii. domain = codomain

iii. codomain = range

Which one is correct?

a. i b. ii c. iii d. i, ii and iii

16. ★ Value of $\operatorname{cosec}(-660°)$ is —

a. $-\frac{2}{\sqrt{3}}$ b. $-\frac{\sqrt{3}}{2}$

c. $\frac{2}{\sqrt{3}}$ d. $\frac{\sqrt{3}}{2}$

17. Value of $2\sin^2 15°$ is —

a. $\frac{2-\sqrt{3}}{2}$ b. $\frac{2+\sqrt{3}}{2}$

c. $\frac{\sqrt{3}+1}{2}$ d. $\frac{\sqrt{3}-1}{2}$

18. If angle θ increases from 0° to 90° then the value of sinθ?

a. Reaches 0 from 1 by decreasing

b. Reaches – 1 from 0 by decreasing

c. Reaches 0 from – 1 by increasing

d. Reaches 1 from 0 by increasing

19. Which one of the following is infinite limit?

a. $\lim_{x \to 0} \frac{1}{x^3}$ b. $\lim_{x \to \infty} \frac{1}{x^3}$

c. $\lim_{x \to 0} e^x$ d. $\lim_{x \to 0} e^{-x}$

20. $\frac{d}{dx}(\sqrt{1 + \sin 2x}/\sin x + \cos x) = ?$

a. 1 b. 0 c. 2 sin 2x d. 2 cos 2x

21. ★ In a triangle ABC, if BC = 3, CA = 4 and AB = 5 then —

i. $C = \frac{\pi}{2}$ ii. perimeter of ΔABC is 24

iii. area of ΔABC = 6 sq. unit

Which is correct of the following?

a. i and ii b. i and iii c. ii and iii d. i, ii and iii

22. $x^3 + x^2y + xy^2 = 0$ is —

a. an explicit function b. an implicit function

c. parametric function d. composite function

23. $\int \ln x \, dx = ?$

a. $\frac{1}{x}$ b. $x\ln x - x$ c. $x \ln x + x$ d. $\frac{1}{x^2}$

24. $\int_0^1 \frac{3dx}{1+x^2} = ?$

a. $\frac{3\pi}{4}$ b. $-\frac{3\pi}{4}$

c. $\frac{\pi}{4}$ d. $-\frac{\pi}{4}$

25. $\int \frac{e^\theta \, d\theta}{1 + e^\theta} = ?$

a. $\ln(1 + e^\theta) + c$ b. $1 + e^\theta + c$

c. $\ln e^\theta + c$ d. $\theta + c$

Ans.	1	b	2	d	3	b	4	a	5	c	6	a	7	b	8	b	9	c	10	b	11	c	12	b	13	c
	14	a	15	c	16	c	17	a	18	d	19	a	20	b	21	b	22	b	23	b	24	a	25	a		