Dhaka, Dinajpur, Sylhet and Jashore Boards-2018

Higher Mathematics 2nd Paper (Creative) Subject Code : | 2 | 6 | 6 |

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 Trigonometry

1. ▶ Scenario-1 : $f(x) = 3x + 1$.
   Scenario-2 : $|z - 5| = 3$
   a. What do you mean by $\mathbb{R}$ and $\mathbb{C}$? What is the relation between them?   2
   b. Show that the solution set of $2|f(x-2)| \le 1$ on the real line. 4
   c. What does the locus of secnario-2 represent genometrically if $z = x + iy$? Sketch it.   4

2. ★ The price of each kg of food F_1 and F_2 and the amount of vitamin C and D in them are as follows :

Types of food	Vitamin C	Vitamin D	The cost per killo
F_1	6	2	3
F_2	3	5	5

   a. Write two advantages of Linear Programming.   2
   b. Daily requirements of C and D are minimum 60 units and 50 units respectively. Formulate a linear program to fulfil the daily requirement of vitamins at minimum cost.   4
   c. Solve the linear programming problem obtained in question no 2(b) graphically to find daily minimum cost.   4

3. ★ Scenario-1 : $\dfrac{1}{x} + \dfrac{1}{p-x} = \dfrac{1}{q}$

   Scenario-2 : $\left(2x^3 - \dfrac{1}{x}\right)^{20}$

a. If $p = q = 1$, then from scenario-1 find out the nature of the roots. 2
b. In scenario-1, if the difference between two roots is r, find out the relation among p, q and r. 4
c. Find out the coefficient of x^{12} in the expansion of scenario-2. 4

4. ▶

Scenario-1 : $\sin^{-1}\left(\dfrac{4}{5}\right) + \cos^{-1}\left(\dfrac{2}{\sqrt{5}}\right) - \cot^{-1}\left(\dfrac{2}{11}\right)$

Scenario-2 : $4(\sin^2\theta + \cos\theta) = 5,\ -2\pi < \theta < 2\pi$

a. Prove that, $2\sin^{-1}x = \sin^{-1}\left(2x\sqrt{1-x^2}\right)$ 2
b. Find out the value of scenario-1. 4
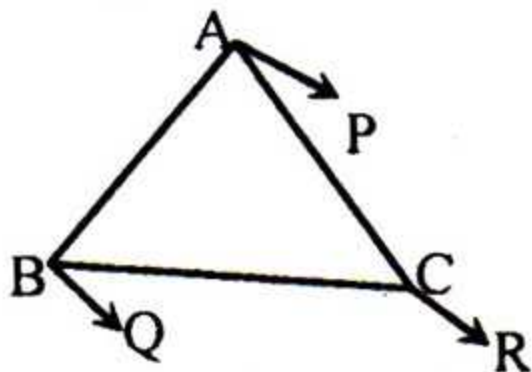c. Solve the equation given in scenario-2. 4

Group B – Geometry, Mechanics and Statistics

5. ▶ Scenario-1 : $\dfrac{x^2}{16} + \dfrac{y^2}{9} = 1$.

Scenario-2 : $4x^2 - 5y^2 - 16x + 10y - 9 = 0$.

a. Find out the equation of the directrix of the parabola, $x^2 = -12y$. 2
b. If the straight line $x - y - 5 = 0$ touches the conic of scenario-1, find out the coordinates of the tangent point. 4
c. Express the equation of scenario-2 in a standard form. Find out the length of latus rectum and its equation. 4

6. ★

P, Q, R are three like parallel forces acting at the vertices of a triangle ABC.

a. What is the resultant of two equal forces acting at a point at an angle 60°? 2

b. If the resultant of the forces passes through the incenter of the triangle ABC, show that $P : Q : R = \sin A : \sin B : \sin C$. 4

c. From the stem, find out the relation among the forces P, Q and R if their resultant passes through the centroid of the triangle ABC. 4

7. ▶ Scenario-1 : A train stops at two stations. The distance between the two stations is 4 kilometers and it takes 8 minutes to reach the next station.

Scenario-2 : A particle is moving on a straight line with uniform accelaration whose average velocities are v_1, v_2 and v_3 at gradual times t_1, t_2 and t_3 respectively.

a. Explain the relative velocity. 2

b. From scenario-1, if the train moves the first half at the uniform acceleration x and 2nd half at the uniform retardation y, show that $x + y = 8xy$. 4

c. From scenario-2, prove that $\dfrac{t_1 + t_2}{v_1 - v_2} = \dfrac{t_2 + t_3}{v_2 - v_3}$ 4

8. ▶ Scenario-1 : One dice and two coins are thrown simultaneously.

Scenario-2 : A frequencey distribution table :

Age (year)	20-30	30-40	40-50	50-60	60-70
Number of labours	25	40	20	10	5

a. If $P(A) = \dfrac{1}{3}$ and $P(A \cap B) = \dfrac{1}{5}$, find out $P(B/A)$? 2

b. Find the probability of getting odd numbers in dice constructing the sample space using scenario-1. 4

c. Find the standard deviation from scenario-2. 4

Higher Mathematics 2nd Paper (MCQ)

Subject Code : | 2 | 6 | 6 |

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. Which one is the example of Associative law in the field axioms of real numbers?
   a. $2 + 3 = 3 + 2$
   b. $(2 + 3) + 4 = 2 + (3 + 4)$
   c. $2 + 0 = 2$
   d. $2(3 + 4) = 2.3 + 2.4$

2. What is the value of $i^{4n} - i + i^{4n+1} - 1, n \in \mathbb{N}$?
   a. $-i$ b. i c. 0 d. 1

3. What is the value of $\sec^2(\cot^{-1}\sqrt{2}) - \sin^2(\cos^{-1}1)$?
   a. $\frac{1}{2}$ b. 1 c. $\frac{3}{2}$ d. 3

4. ★

   In stem —
   i. the resolved part of P along OA $= \frac{\sqrt{3}P}{2}$
   ii. the resolved part of P along OB $= \frac{P}{2}$
   iii. the resolved part of P along OC $= P$
   Which one is correct?
   a. i and ii
   b. i and iii
   c. ii and iii
   d. i, ii and iii

5. Which one is the absolute measure of Dispersion?
   a. Co-efficient of standard Deviation
   b. Quartile Deviation
   c. Co-efficient of Range
   d. Co-efficient of Mean Deviation

6. What is the general solution of $\sin\left(x - \frac{\pi}{2}\right) = 0$ for $n \in \mathbb{Z}$?
   a. $n\pi + \frac{\pi}{2}$
   b. $2n\pi + \frac{\pi}{2}$
   c. $n\pi - \frac{\pi}{2}$
   d. $2n\pi - \frac{\pi}{2}$

7. For the parabola $y^2 = -2x$;
   i. equation of latus rectum is $2x = 1$
   ii. length of latus rectum is 2 unit
   iii. co-ordinates of focus is $\left(-\frac{1}{2}, 0\right)$
   Which one is correct?
   a. i and ii
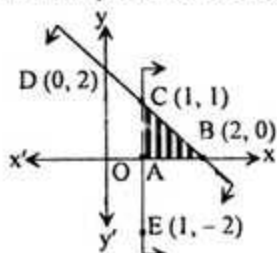   b. i and iii
   c. ii and iii
   d. i, ii and iii

8. Which one is correct for the event A and its complementary event A^C in probability?
   a. $0 < P(A) < 1$
   b. $0 \le P(A^C) < 1$
   c. $0 < P(A^C) < 1$
   d. $0 \le P(A) \le 1$

9. What is the value of $2\sin\theta - \sin C$ for $A = \sin^{-1}\frac{1}{2}$, $B = \cos^{-1}\frac{1}{2}$ and the external angle θ of C in $\triangle ABC$?
   a. 0 b. 1 c. 2 d. 3

Look at the stem and answer the questions No. 10 and 11 :

10. Which inequality is true for the straight line AC?
    a. $x > 1$
    b. $x \ge 1$
    c. $y \ge -2$
    d. $y > 1$

11. Which one is true for the minimum value of $z = x - y$ in the feasible region?
    a. -2 b. 0 c. 1 d. 2

12. Which one is the solution set of the inequality $|x - 1| \le 1$?
    a. $[-1, 1]$ b. $[0, 2]$ c. $(0, 2]$ d. $(-1, 1]$

13. Which one is the angle between 1st two of the three forces 1N, 1N and 2N acting at a point in equilibrium?
    a. $0°$ b. $90°$ c. $120°$ d. $180°$

14. ★ Linear Programming needs —
    i. quardratic equation
    ii. non-negative variables   iii. linear inequalities
    Which one is correct?
    a. i and ii
    b. i and iii
    c. ii and iii
    d. i, ii and iii

15. If a particle be thrown vertically upwards with initial velocity v from the ground, what is the greatest height of the particle?
    a. $\frac{v}{g}$ b. $\frac{v}{2g}$ c. $\frac{v^2}{g}$ d. $\frac{v^2}{2g}$

16. ★ What is the another root of a quadratic equation whose one root is $\frac{1}{2 - \sqrt{5}}$?
    a. $-2 - \sqrt{5}$
    b. $2 - \sqrt{5}$
    c. $-2 + \sqrt{5}$
    d. $2 + \sqrt{5}$

17. What is the velocity of a particle at greatest height of its path after projecting with velocity $\frac{u}{\sqrt{3}}$ at the angle 30°?
    a. $\frac{2u}{\sqrt{3}}$ b. $\frac{u}{\sqrt{3}}$ c. $\frac{u}{2}$ d. $\frac{u}{2\sqrt{2}}$

18. Which function is polynomial?
    a. $2x^2 - 5\sqrt{x} + 1$
    b. $x^3 - \frac{3}{x^2} + 4x + 1$
    c. $x^3 + 2x^2 - 3x + x^{-1}$
    d. $2x^2 - x + 1$

Answer the questions No. 19 and 20 on the basis of the following stem : $\frac{x^2}{3} - \frac{y^2}{2} = 1$ is an equation of a conic.

19. Which is the eccentricity of the conic?
    a. $\frac{\sqrt{13}}{2}$ b. $\frac{\sqrt{13}}{3}$ c. $\frac{\sqrt{5}}{\sqrt{2}}$ d. $\frac{\sqrt{5}}{\sqrt{3}}$
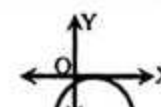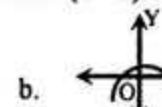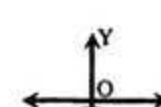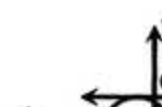
20. Which is the length of latus rectum of the conic?
    a. 9 b. $3\sqrt{2}$ c. $\frac{8}{3}$ d. $\frac{4}{\sqrt{3}}$

21. What is the probability of a number to be prime as well as even selected randomly from 0, 1, 2, 4, 5 and 10?
    a. $\frac{1}{6}$ b. $\frac{2}{3}$ c. $\frac{1}{3}$ d. $\frac{5}{6}$

22. Which sketch is true for the conic $(x - 1)^2 = -4y$?

23. What is the general argument of $1 - \sqrt{3}i$?
    a. $2n\pi - \frac{\pi}{3}; n \in \mathbb{Z}$
    b. $2n\pi + \frac{\pi}{3}; n \in \mathbb{Z}$
    c. $2n\pi - \frac{5\pi}{3}; n \in \mathbb{Z}$
    d. $2n\pi + \frac{5\pi}{3}; n \in \mathbb{Z}$

24. What is the sum of co-efficients of three consecutive terms in the expansion of $-x(1 + x)^{-1}$?
    a. -3 b. -1 c. 1 d. 3

25. Which one is true for $\alpha = \frac{-1 + \sqrt{3}i}{2}$ and its conjugate $\bar{\alpha}$?
    a. $\alpha \bar{\alpha} = \alpha^2$
    b. $\alpha + \bar{\alpha} = 2\alpha$
    c. $\alpha + \bar{\alpha} = -1$
    d. $\bar{\alpha} + \alpha^2 = -1$

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