

# Jashore Board-2017

Higher Mathematics 2<sup>nd</sup> Paper (Creative) Subject Code : 

2	6	6
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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:**  $L = \{x \in \mathbb{R} : 2x^2 + 5x < 0\}$ .

**Scenario-2:**  $f(x) = x^2 - x$ .

- a. Solve:  $|2x - 7| > 5$ . 2
- b. Express the inequality of the solution set I. by using the symbol of absolute value. 4
- c. Solve  $f(x) \leq 0$  by the help of number line. 4

2. **► Scenario-1:**  $x + iy = 2e^{-i\theta}$ . **Scenario-2:**  $F = y - 2x$ .

Conditions:  $x + 2y \leq 6$ ,  $x + y \geq 4$ ,  $x, y \geq 0$ .

- a. If  $z = x + iy$  then find the locus represented by  $|z + i| = |\bar{z} + 2|$ . 2
- b. From scenario-1, prove that  $x^2 + y^2 = 4$ . 4
- c. Find the maximum value of  $F$  by graphical method of the linear programming in scenario-2. 4

3. **★ Scenario-1:** The roots of  $x^2 - 5x + 3 = 0$  are  $\alpha, \beta$ .

**Scenario-2:**  $\frac{1+x}{\sqrt{1-2x}}$ .

- a. For what values of  $x$  the expansion  $(3 - 2x)^{\frac{1}{2}}$  is valid? 2

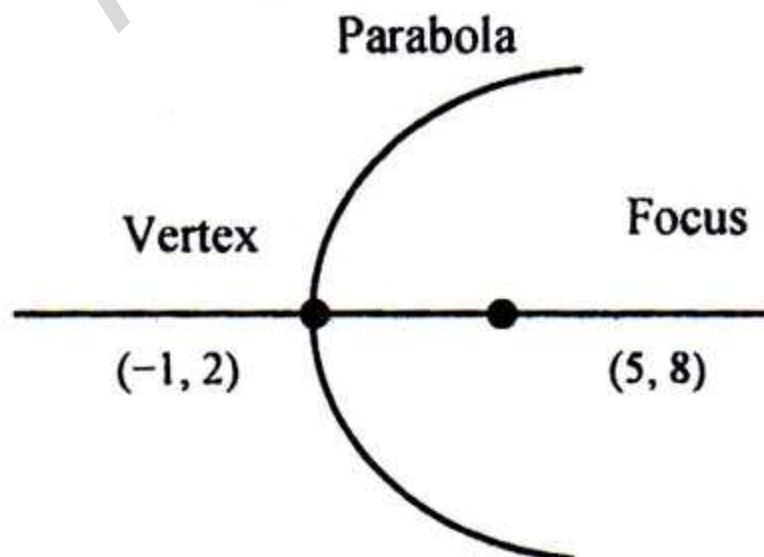
- b. With the help of the scenario-1, find the equation whose roots are  $\frac{3}{5-\alpha}, \frac{3}{5-\beta}$ . 4
- c. Find the co-efficient of  $x^3$  of the expansion given in the scenario-2. 4
4. ► **Scenario-1:**  $\cot\theta - \tan\theta = \frac{6}{5}$ .

**Scenario-2:**  $2\sin 2\theta + 2(\sin\theta + \cos\theta) + 1 = 0$ .

- a. Prove that  $\tan^{-1}(\cot 3x) + \tan^{-1}(-\cot 5x) = 2x$ . 2
- b. From scenario-1, prove that,  $\theta = \frac{1}{2} \sin^{-1} \frac{5}{\sqrt{34}}$ . 4
- c. Find the general solution of the equation given in the scenario-2. 4

### Group B – Geometry, Mechanics and statistics

5. ★ **Scenario-1:**



**Scenario-2:** The foci of a hyperbola are (6, 1), (10, 1) and eccentricity is 3.

- Find the eccentricity of  $3x^2 + 5y^2 = 1$ . 2
- Obtain the equation of the parabola from the scenario-1. 4
- Obtain the equation of the hyperbola from the scenario-2. 4

**6. ► Scenario-1:** The line of action of three equilibrium forces L, M, N act parallel to BC, CA, AB of a triangle ABC. The length of three sides are 25, 60, 65cm respectively. The sum of two forces L and M be 51 gm-wt.

**Scenario-2:** Two unlike parallel forces 8N and 4N respectively act at two points on a uniform rod 20cm. apart.

- The forces 4N and  $2\sqrt{3}$ N act at a point at an angle  $30^\circ$  to each other. Find sum of the resolved parts of the forces along the line of action of 4N. 2
- Find the value of the forces from the Scenario-1. 4
- In scenario-2, if each force is increased by 4N then what will be the displacement of point of action of the resultant? 4

**7. ► Scenario-1:** A biker, seeing a horse rider at distance 15 metre runs after the horse rider at acceleration  $5\text{m/sec}^2$  from the rest position. The horse rider is going with uniform velocity 12.5 m/sec.

**Scenario-2:** An object is projected from the top of a 60 metre pillar with initial velocity 100 m/sec at an angle  $30^\circ$  with horizon.

- Starting from a static point a particle moves to the acceleration of speed  $2 \text{ metre/sec}^2$ . What distance will it overcome at 3rd second? 2
- According to the scenario-1, what distance the biker will catch the horse rider? 4
- According to the scenario-2, what distance from the foot of the pillar where the object strikes the ground? 4

**8. ► Scenario-1:**

Class interval	10-16	17-22	23-28	29-34	35-40	41-46	47-52
Frequency	5	4	10	12	8	4	7

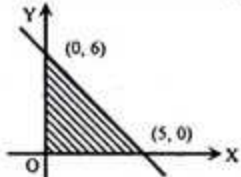
**Scenario-2:** In a college out of 100 students of eleven class 30 played football, 40 played cricket and 20 students played both football and cricket. A student is chosen at random.

- Find the value of  $P(A \cup B)$  if  $P(A) = \frac{1}{2}$ ,  $P(B) = \frac{3}{5}$  and A, B independent. 2
- From scenario-1, determine quartile deviation. 4
- According to the scenario-2, if the boy played cricket then what is the probability of his playing football? 4

[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 the forces 11N and 13N acting orthogonally to each other, what will be the resultant force?  
a.  $2\sqrt{6}$ N    b.  $\sqrt{290}$ N    c. 24 N    d. 290 N
2.  If  $\alpha, \beta, \gamma$  are the roots of the equation  $2x^3 - 3x^2 - 3x + 2 = 0$ , what is the value of  $\sum \alpha\beta$ ?  
a.  $-\frac{3}{2}$     b. -1    c. 1    d.  $\frac{3}{2}$

Answer questions 3 and 4 according to the following stem:



3. If the shaded area is the feasible region of a linear program, what are the conditions?  
a.  $6x + 5y \geq 30; x, y > 0$     b.  $6x + 5y \leq 30; x, y > 0$   
c.  $6x + 5y \geq 30; x, y \geq 0$     d.  $6x + 5y \leq 30; x, y \geq 0$
4. If the objective function of the linear program  $z = 2y - x$ , what will be the maximum value of  $z$ ?  
a. 10    b. 12    c. 16    d. 17
5. For the equation  $3x^2 + x + 2 = 0$ —  
i. roots are real and equal  
ii. sum of the roots is  $-\frac{1}{3}$     iii. product of the roots is  $\frac{2}{3}$

Which one is correct?

- a. i and ii    b. i and iii    c. ii and iii    d. i, ii and iii
6. What is the value of  $\sec^{-1}\left(\frac{25}{24}\right) + \sin^{-1}\left(\frac{24}{25}\right)$ ?  
a.  $-\pi$     b.  $-\frac{\pi}{2}$     c.  $\frac{\pi}{2}$     d.  $\pi$
7. What is the principal argument of  $-1 + i$ ?  
a.  $-\frac{3\pi}{4}$     b.  $-\frac{\pi}{4}$     c.  $\frac{3\pi}{4}$     d.  $\frac{5\pi}{4}$
8. If P is the point on the parabola  $y^2 = 12x$  whose ordinate is 12, what is the focal distance of the point P?  
a. 9    b. 12    c. 15    d. 16
9. A rod AB of 30 metres long, 20 kg weight is suspended from A and P kg weight is suspended from B. Their resultant acts at the point C. If the length of AC is 20 metres, What is the value of the force P?  
a. 10 N    b. 30 N    c. 40 N    d. 50 N

10.  For the hyperbola  $\frac{y^2}{4} - \frac{x^2}{5} = 1$ .

- i. Length of transverse axis is 4 unit
- ii. Co-ordinates of the vertices  $(\pm\sqrt{5}, 0)$
- iii. Eccentricity is  $\frac{3}{2}$

Which one is correct?

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

Answer questions no. 11 and 12 according to the following equation:  
 $5x^2 + 7y^2 = 1$

11. What is the length of the major axis of the ellipse?  
a.  $\frac{2}{\sqrt{5}}$     b.  $\frac{2}{5}$     c.  $\frac{2}{\sqrt{7}}$     d.  $\frac{2}{7}$

12. What is the eccentricity of the ellipse?  
a.  $\sqrt{\frac{2}{7}}$     b.  $\frac{2}{7}$     c.  $\frac{2\sqrt{3}}{\sqrt{7}}$     d.  $\frac{2\sqrt{3}}{7}$
13. What is the mean deviation of the four numbers 2, 3, 4, 7?  
a. 0    b.  $\frac{2}{3}$     c.  $\frac{3}{2}$     d. 4
14. Three forces 3N, 5N, 7N acting at a point in different lines are in equilibrium. What is the angle between two smaller forces?  
a.  $60^\circ$     b.  $120^\circ$   
c.  $\cos^{-1}\left(\frac{31}{42}\right)$     d.  $\cos^{-1}\left(\frac{17}{14}\right)$
15. In the expansion of  $(1 + 3x)^{17}$ —  
i. number of terms is 18  
ii. there are two middle terms  
iii. co-efficient of  $x^6$  is  ${}^{17}C_6 \cdot 3^6$   
Which one is correct?  
a. i and ii    b. i and iii  
c. ii and iii    d. i, ii and iii

Answer the questions 16 and 17 according to the following stem:  
A cricketer hit a cricket ball at an angle  $60^\circ$  with the horizon with the velocity 20m/sec.

16.  What is the travelling time of the ball?  
a.  $\frac{10}{g}$  sec    b.  $\frac{10\sqrt{3}}{g}$  sec  
c.  $\frac{20}{g}$  sec    d.  $\frac{20\sqrt{3}}{g}$  sec
17.  What is the maximum height of the ball from the ground?  
a.  $\frac{50}{g}$  m    b.  $\frac{100}{g}$  m  
c.  $\frac{150}{g}$  m    d.  $\frac{300}{g}$  m
18. How many integer numbers are in the solution of  $-3 \leq 2x < 8$ ?  
a. 3    b. 4    c. 5    d. 6
19. Which one is the general solution of  $2 \cos \frac{\theta}{5} + 1 = 0$ ?  
a.  $(2n + 1)\frac{5\pi}{3}$     b.  $(2n + 1)\frac{10\pi}{3}$   
c.  $10n\pi \pm \frac{10\pi}{3}$     d.  $10n\pi \pm \frac{5\pi}{3}$
20. What is the value of  $i^{-70} + 1$ ?  
a. 0    b. 2  
c.  $1 - i$     d.  $1 + i$
21. What is the solution of  $(x - 4)(x - 5) > 0$ ?  
a.  $x > 4$  and  $x < 5$     b.  $x < 4$  and  $x > 5$   
c.  $x < 4$  and  $x > 5$     d.  $x > 4$  and  $x < 5$
22. A dice is thrown three times, what is the probability of getting 6 on the top in three cases?  
a.  $\frac{1}{216}$     b.  $\frac{1}{72}$     c.  $\frac{1}{6}$     d.  $\frac{1}{2}$
23. What is the co-efficient of  $x^2$  in the expansion of  $\frac{1}{\sqrt{1-7x}}$ ?  
a.  $-\frac{147}{4}$     b.  $-\frac{147}{8}$     c.  $\frac{147}{8}$     d.  $\frac{147}{4}$
24. If  $\omega$ , one of the imaginary cube roots of unity, what is the value of  $\omega^{92} + \omega^{16}$ ?  
a. -1    b.  $-\omega$     c.  $-\omega^2$     d.  $2\omega$
25. What is the quadratic equation whose one root is  $1 + \sqrt{2}$ ?  
a.  $x^2 - 2x - 1 = 0$     b.  $x^2 + 2x - 1 = 0$   
c.  $x^2 - 2x + 1 = 0$     d.  $x^2 + 2x + 1 = 0$

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