

# Model Question of HSC Examination 2020

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

2	6	6
---	---	---

Time — 2 hours 35 minutes

Full marks — 50

*[N.B. — Right marking indicate the full marks, taking at least two from each group answer the five questions]*

## Group A – Algebra & Trigonometry

1. ► **Scenariiao-1:**  $p = a - b$ ;  $a, b \in \mathbb{R}$ .

**Scenariiao-2:**  $f = 3y - x$ ,  $g = x + y$ ,  $h = x - y$ ;  $x, y \in \mathbb{R}$

- a. Prove that,  $(-a)(-b) = ab$ ;  $a, b \in \mathbb{R}$ . 2
- b. According to Scenariiao-1 – prove that,  $|P| \geq ||a| - |b||$  4
- c. According to Scenariiao-2 – Find the minimum value of  $z = 2y - x$ , using the condition  $f \leq 10$ ,  $g \leq 6$ ,  $h \leq 2$ ;  $x, y \geq 0$ . 4

2. ► **Scenario:**  $Z_1 = a + ib$ ,  $Z_2 = c + ib$ ;  $a, b \in \mathbb{R}$

- a. If  $\omega$  is a cube root of unity, Show that  $(1 - \omega + \omega^2)^2 + (1 + \omega - \omega^2)^2 = -4$  2
- b. According to scenario – if  $x : y = z_1 : z_2$  then show that  $(c^2 + d^2)x^2 - 2(ac + bc)xy + (a^2 + b^2)y^2 = 0$  4
- c. If  $a^2 + b^2 = 1$ , Prove that a real value of  $x$  will satisfy the equation  $\frac{1 + (i)3x}{1 + ix} = z_2$  4

3. ★ **Scenario:**  $p(x) = ax^2 + px + q = 0$ .

- a. Expand the binomial  $\left(x - \frac{1}{x}\right)^6$  by Pascal's triangle law. 2
- b. According to scenario – if  $a = 1$  and the difference of the cots of the equation is 1, Prove that  $p^2 + 4q^2 = (1 + 2q)^2$  4
- c. If  $\alpha, \beta$  are the roots of the equation  $p(x) = 0$ , from the equation whose roots are  $\alpha + \beta^{-1}, \beta + \alpha^{-1}$  4
4. **★ Scenario:**  $g(x) = \cos x \cos 2x \cos 3x, q = \cos^{-1} \frac{x}{a} + \cos^{-1} \frac{y}{b}$
- a. Prove that,  $\tan^{-1} \sqrt{x} = \frac{1}{2} \cos^{-1} \frac{1-x}{1+x}$  2
- b. According to scenario – if  $q = \theta$ , then show that  $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{2xy \cos \theta}{ab} = \sin^2 \theta$  4
- c. If  $g(x) = \frac{1}{4}$ , Find the value of  $x$  in the interval. ( $0 < x < \pi$ ) 4

### Group B – Mechanics, Conics and Dispersion of Probability

5. **► Scenario:** The equation of straight line AB is  $3x - 4y - 10 = 0$  and co-ordinate of three points  $s_1 (1, -8), s_2 (3, 0)$  and  $s_3 (-3, 0)$
- a. Show that  $\frac{2b^2}{a}$  is the length of latus rectum of  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  2

- b. According to scenario – taking the axes of ellipse as the x and y – axes find the equation of ellipse whose foci  $s_2, s_3$  and eccentricity  $\frac{1}{3}$ . 4
- c. According to scenario – if the straight line AB is the directrix of the hyperbola then find the equation of hyperbola whose foci is  $s_1$  and eccentricity  $\sqrt{5}$  4
6. ► **Scenario:** Two forces P and Q are acting along OA and OB respectively with an angle of  $\alpha$ . The resultant force of them is R.
- a. Describe lamis theorem. 2
- b. If the forces P and Q ( $P > Q$ ) are unlike parallel act at A and B respectively and P, Q are both increased by m, show that the resultant will more through a distance  $d = \frac{m}{P - Q}$  AB. 4
- c. In the resolved part of R along P is Q, Show that the angle between the given forces is  $\alpha = \cos^{-1} \frac{Q - P}{Q} = 2 \sin^{-1} \sqrt{\left(\frac{P}{2Q}\right)}$ , and resultant  $R = \sqrt{Q^2 - p^2 + 2PQ}$ . 4

7. **★ Scenario-1:** Dhaka metro rail will depart from shewrapara station and after  $t$  time crossing  $s$  distance it will stop at shahbag station.

**Scenario-2:** A stone is released in to a well which is  $h$  meter deep and after  $t$  second the falling sound of the stone at the bottom of the well is heard.

a. A man walks 10 km to the north at speed 5km/h then 12km to the west in 3 hours. Determine his average velocity. 2

b. According to Scenario-2, if the velocity of the sound is  $v$ , prove that  $\frac{h}{v} + \sqrt{\frac{2h}{v}} = t$ . 4

c. According to Scenario-1, if the metro rail moves first part of the motion at uniform acceleration  $x$  and moves other part at uniform retardation  $y$  then show that,  $\frac{t^2}{2s} = \frac{1}{x} + \frac{1}{y}$  4

8. **► Scenario-1:** A dice and 2 coins are thrown.

**Scenario-2:** A frequency distribution table is given below—

Class	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55
frequency	5	8	11	15	19	16	12	9	7	4

a. 3 cards are taken from a packet. What is the probability of the 3 cards not to be ace? 2

b. According to Scenario-1 Determine the probability of getting even numbers and two heads. 4

c. According to Scenario-2 Determine the quartile deviation. 4

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  $S = \{x \in \mathbb{R} : (x - 3)(x - 5) < 0\}$  then —  
 i.  $\text{Inf } S = 3$   
 ii.  $\text{Sup } S = 5$   
 iii.  $S = [3, 5]$   
 Which one is correct?  
 (a) i & ii                      (b) i & iii  
 (c) ii & iii                     (d) i, ii & iii
2. By objective function —  
 i. Value of decision variable can be determined  
 ii. Maximum value can be determined  
 iii. Minimum value can be determined  
 Which one is correct?  
 (a) i & ii                      (b) i & iii  
 (c) ii & iii                     (d) i, ii & iii
3. ★ If  $x = -1 + i$ , what is the value of  $x^3 + 3x^2 + 4x + 7$ ?  
 (a)  $6 + i$                       (b) 8  
 (c) 5                              (d)  $9 + 2i$
4. What is the argument of  $-1 - i\sqrt{3}$ ?  
 (a)  $-\frac{\pi}{6}$                         (b)  $\frac{\pi}{3}$   
 (c)  $-\frac{2\pi}{3}$                         (d)  $\frac{\pi}{6}$
5. If  $z_1 = 2 + i$  and  $z_2 = 3 + i$ , then what is the modulus of  $z_1 \bar{z}_2$ ?  
 (a) 6                              (b) 7  
 (c)  $5\sqrt{2}$                         (d)  $5\sqrt{3}$
6. What is equation of locus expressed by  $|x + iy| = 6$ ?  
 (a) Straight line              (b) Circle  
 (c) Hyperbola                 (d) Ellipse
7. If three roots of the equation  $x^3 - 2x^2 + 3x + 5 = 0$  are,  $\alpha + \beta + \gamma$  then  $\alpha + \beta + \gamma =$  what?  
 (a) -2                              (b) -1  
 (c) 2                                (d) 3
8. In the 7<sup>th</sup> and 8<sup>th</sup> term in the expansion of  $(1 + x)^{10}$  are equal then what is the value of  $x$ ?  
 (a)  $\frac{3}{8}$                               (b)  $\frac{4}{7}$   
 (c)  $\frac{7}{4}$                               (d)  $\frac{8}{3}$
9. In quadratic equation  $-2x^2 - 3x + 2 = 0$   
 i. roots are 1, 2  
 ii. discriminant is 25  
 iii. roots are real, unequal and rational.  
 Which one is correct?  
 (a) i & ii                        (b) i & iii  
 (c) ii & iii                      (d) i, ii & iii
10. ★ The conic  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$   
 i. hyperbola when  $a^2 = b^2$   
 ii. ellipse when  $a \neq b$   
 iii. circle when  $a = b$   
 Which one is correct?  
 (a) i & ii                        (b) i & iii  
 (c) i, ii & iii                  (d) ii & iii
11.  $\sin^{-1}(-\cos x) + \sin^{-1}(\cos x) =$  what?  
 (a)  $-2x$                         (b)  $-3x$   
 (c)  $+2x$                         (d)  $3x$
12.  $y = \cos^{-1} x$  —  
 i. is an inverse trigonometric function  
 ii. its domain  $[-1, 1]$   
 iii. its range  $[0, \pi]$   
 Which one is correct?  
 (a) i & ii                        (b) ii & iii  
 (c) i & iii                        (d) i, ii & iii
13. If the resultant force 6N and 4N is 2N then what is the included angle?  
 (a)  $60^\circ$                         (b)  $90^\circ$   
 (c)  $120^\circ$                         (d)  $180^\circ$

14. What is the equation of parabola having directrix  $y + 2 = 0$ ?

- (a)  $x^2 = 4y$                       (b)  $y^2 = 4x$   
 (c)  $x^2 = 8y$                       (d)  $y^2 = 8x$

15. What is the length of latusrectum of hyperbola  $x^2 - 3y^2 - 2x = 8$ ?

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

16. The rain drops falls at an angle  $45^\circ$  with velocity 8 m/sec. How much speed does a cyclist need to move so that the rain drops falls velocity on the cyclist?

- (a) 7                                    (b)  $\frac{8}{\sqrt{2}}$   
 (c)  $7\sqrt{2}$                             (d)  $8\sqrt{2}$

17. If a ball is thrown upward vertically with velocity 29.6 m/s then what is the highest height?

- (a) 4.41 m                            (b) 8.82 m  
 (c) 44.1 m                            (d) 88.2 m

18. A particle is projected with a velocity 78.4 m/s at an angle  $30^\circ$  from a horizontal plane, what is the rising time?

- (a) 2                                    (b) 4  
 (c) 8                                    (d) 16

19. If three dices are thrown simulataneously then what is the probability of getting same number of three dice?

- (a)  $\frac{1}{216}$                                 (b)  $\frac{1}{36}$

- (c)  $\frac{1}{6}$                                     (d)  $\frac{35}{36}$

20. ★ There are 4 white balls and 6 black balls in a box. If two balls are chosen randomly then what is the probability of not getting black ball?

- (a)  $\frac{2}{15}$                                   (b)  $\frac{1}{3}$   
 (c)  $\frac{8}{15}$                                   (d)  $\frac{2}{3}$

21. What is the probability of certain event?

- (a) 0                                    (b) 1  
 (c) 0.5                                (d) 2

22. ★ What is the supremum of  $B = \{1 - 3^{-n}, n \in \mathbb{N}\}$

- (a) 1                                    (b) 2  
 (c)  $\frac{2}{3}$                                     (d) 0

23. If  $5x - x^2 - 6 > 0$  which one is correct?

- (a)  $x < 2$                               (b)  $2 > x > 3$   
 (c)  $2 < x < 3$                         (d)  $x > 3$  or  $x < 2$

24. The roots of  $x^4 + a^2x^2 + a^4 = 0$  are .....

- (a) real                                (b) complex  
 (c) rational                            (d) equal

25. solution of  $2 \cos^2\theta + \sin\theta = 1; 0 \leq \theta \leq 2\pi$

- (a)  $\frac{\pi}{4}$                                   (b)  $\frac{7\pi}{6}$   
 (c)  $\frac{\pi}{3}$                                     (d)  $\frac{2\pi}{3}$

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