

# Model Question of HSC Examination 2020

Higher Mathematics 1<sup>st</sup> Paper (Creative) Subject Code : 

2	6	5
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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 & Geometry

1. ►  $B = \begin{bmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^3 - 1 & y^3 - 1 & z^3 - 1 \end{bmatrix}$ ,  $P = \begin{bmatrix} 1 & 2 & -3 \\ 4 & -5 & 6 \end{bmatrix}$   
and  $Q = \begin{bmatrix} 0 & 2 \\ 1 & 2 \\ 0 & -1 \end{bmatrix}$

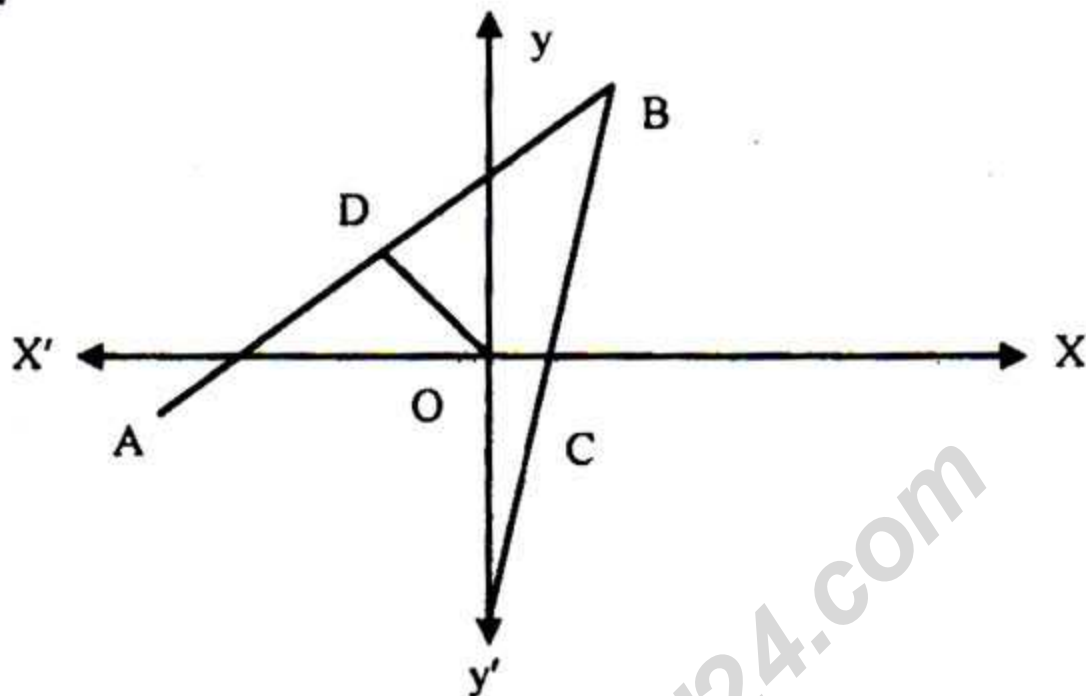
- a. If  $x = 1$ ,  $y = 2$ ,  $z = 3$  find the value of  $|B|$ . 2  
b. Prove that  $B = (xyz-1)(x-y)(y-z)(z-x)$  4  
c. Prove that  $PQ \neq QP$  4

2. ★ (i)  $\vec{A} = 2i+4j+5k$  and  $\vec{B} = i+2j+3k$

(ii) Length of seven sides are 1, 2, 3, 4, 5, 6, 7 cm.

- a. If  $A(4,2,7)$  and  $B(3, 4, -1)$ ;  $O$  is origin. Find the value of  $|\vec{AB}|$ . 2  
b. Find the projection of vector  $\vec{A}$  on the vector  $\vec{B}$ . 4  
c. Show that the number of ways in which four sides can be chosen to form quadrilateral is 32. 4

3. ★

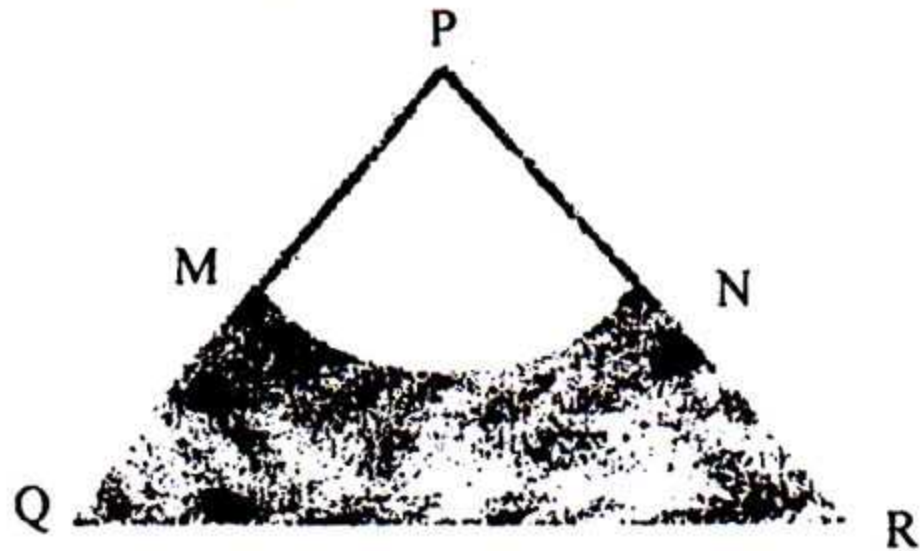


In fig. Equation of AB is  $3x - 4y + 12 = 0$ ,  
 $\angle ABC = 45^\circ$ ,  $OD \perp AB$  and  $C(2, -1)$

- a. If the distance of the point  $(a, 5)$  from the y-axis and the point  $(7, 2)$  are equal, find the value of  $a$ . 2
  - b. Find the equation of OD. 4
  - c. Find the equation of BC. 4
4. ►  $x^2 + y^2 - 8x - 10y - 8 = 0$  — (i)  
 $x^2 + y^2 = 81$  — (ii)
- a. Find the common chord of two circles and radius of circle (i). 2
  - b. Find the equation of tangent of circle (i) which is parallel to  $5x - 12y - 9 = 0$  4
  - c. A chord is bisected at  $(-2, 3)$  of circle (ii) find the length of the chord. 4

## Group B – Trigonometry & Calculus

5. ►

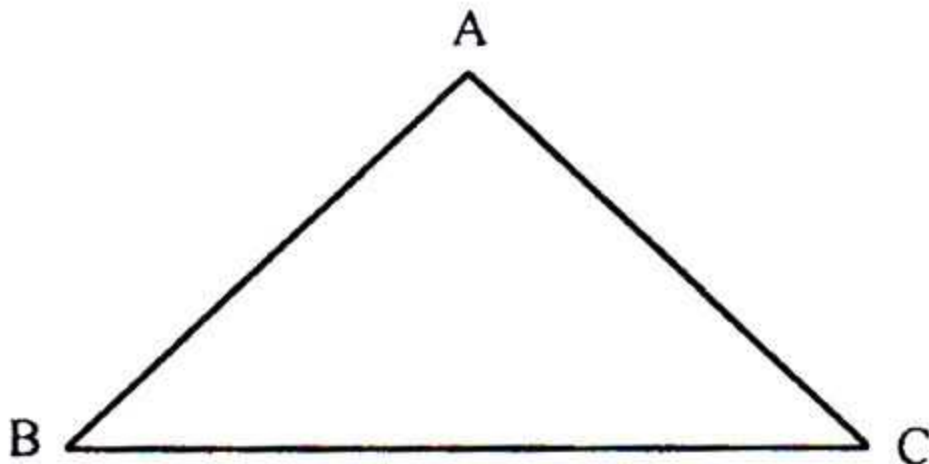


PQR is an equilateral triangle, its perimeter is 18 cm and M and N are the midpoints of PQ and PR respectively and  $\tan \frac{x}{2} =$

$$\sqrt{\frac{1-e}{1+e}} \tan \frac{y}{2}.$$

- Prove that  $\sin 65^\circ + \cos 65^\circ = \sqrt{2} \cos 20^\circ$  2
- Find the shaded area MNRQ. 4
- Prove that  $\cos y = \frac{\cos x - e}{1 - e \cos x}$  4

6. ►





In  $\Delta ABC$ ,  $AB = c$ ,  $BC = a$  and  $AC = b$ .

a. Prove that  $\frac{\cos^3 x + \sin^3 x}{\cos x + \sin x} = 1 - \frac{1}{2} \sin 2x$  2

b. If  $A = \frac{\pi}{3}$ , prove that  $\sin^3 x + \sin^3(2A + x) + \sin^3(4A + x) = \frac{3}{4} \sin 3x$  4

c. If  $\frac{1}{a+b} + \frac{1}{b+c} = \frac{3}{a+b+c}$ , prove that  $\angle B = 60^\circ$  4

7.  $\blacktriangleright f(x) = x + \frac{1}{x}$  and  $g(x) = \tan^{-1} \frac{2 \cos x^2 - 3 \sin x^2}{3 \cos x^2 + 2 \sin x^2}$

a. Evaluate  $\lim_{x \rightarrow -3} \frac{x+3}{x^2-4x-21}$  2

b. Show that the maximum value of  $f(x)$  is smaller than its minimum value. 4

c. Find the value of  $g'(-2)$ . 4

8.  $\blacktriangleright f(x) = \frac{1}{x^2(x-1)}$  — (i)

and  $9x^2 + 25y^2 = 225$  — (ii)

a. Evaluate :  $\int \frac{\sin x}{3-4 \cos x} dx$  2

b. Evaluate :  $\int_2^3 f(x) dx$  4

c. Find the area of (ii) with the help of integration. 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.]

$A = \begin{bmatrix} -1 & 2 \\ -5 & -3 \end{bmatrix}$ ,  $B = I$ , using the information

answer the question (1-4) :

1. What is the sum of the cofactor of (-3) and 2?

- (a) -2                      (b) -1  
(c) 0                        (d) 4

2. **★** Which one is correct for  $(A + 2B) + (A - 2B)$ ?

- (a)  $\begin{bmatrix} -2 & 4 \\ -10 & -6 \end{bmatrix}$               (b)  $\begin{bmatrix} 2 & 4 \\ -10 & -6 \end{bmatrix}$   
(c)  $\begin{bmatrix} -2 & 4 \\ 10 & -6 \end{bmatrix}$                 (d)  $\begin{bmatrix} -2 & -4 \\ -10 & -6 \end{bmatrix}$

3. What is the value of  $(3 - |B|)$ ?

- (a) 0                        (b) 1  
(c) 2                        (d) 3

4. Which one is correct?

- (a)  $AB = B$               (b)  $AB = A + B$   
(c)  $BA = B$               (d)  $BA = AB$

5. What is the equation of the line passing through the points (8, 0), (4, 4) and (0, 8)?

- (a)  $8x + y = 8$   
(b)  $x + 8y = 8$   
(c)  $x + y = 8$   
(d)  $x + y + 8 = 0$

6. What is the slope of the perpendicular bisector of the line joining (3, 8) and (6, 5)?

- (a)  $\frac{9}{13}$                       (b) 1  
(c) -1                        (d)  $-\frac{13}{9}$

7. **★** What is double of the area of the triangle with the vertices (2a, 0), (0, 2b) and (0, 0)?

- (a) 4ab                      (b) 2ab  
(c) ab                        (d) 5ab

8. **★** Where will be the mid-point of the line segment joining the interception of the line  $x + y + 6 = 0$  with the co-ordinate axes?

- (a) 1<sup>st</sup> quadrant  
(b) 2<sup>nd</sup> quadrant  
(c) 3<sup>rd</sup> quadrant  
(d) 4<sup>th</sup> quadrant

9. What is the centre of the circle  $x^2 + y^2 - 8x = 8y$ ?

- (a) (4, 0)                      (b) (0, 4)  
(c) (4, 4)                      (d) (8, 8)

10. Which one of the following lies on the circle  $2x^2 + 2y^2 + 8x = 10y$ ?

- (a) (-3, 0)  
(b) (3, 0)  
(c) (1, 1)  
(d) (-1, 1)

11. **★** How many rearrangement can be formed taking all the letters of the word 'TALL'?

- (a) 11                        (b) 12  
(c) 23                        (d) 24

12. If  $\operatorname{cosec}3A + \sin3A = 2$ , what is the value of  $\operatorname{cosec}^33A + \sin^43A$ ?

- (a)  $2 \cos \frac{\pi}{2}$                       (b)  $2 \sin \frac{\pi}{2}$   
(c)  $2 \operatorname{cosec} \frac{\pi}{6}$                       (d)  $2 \sec \frac{\pi}{6}$

13. If  $y = \cos^2x$  what is the range of the function?

- (a)  $[-1, 0]$                       (b)  $[-1, 0[$   
(c)  $[0, 1]$                         (d)  $[0, 1[$



14. What is the domain of the function,  $f$

$$f(x) = \frac{1}{|x^2 - 1|}$$

- (a)  $\mathbb{R} - \{0\}$
- (b)  $\mathbb{R} - \{1\}$
- (c)  $\mathbb{R} - \{1, -1\}$
- (d)  $\mathbb{R} - \{1, 0\}$

$\vec{A} = \hat{i} + \hat{j} + 3\hat{k}$  and  $\vec{B} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ . Using this information answer the questions (15-17):

15. What is the dot product of the given vectors?

- (a) -5
- (b) -7
- (c) 7
- (d) 11

16. What is the projection of  $\vec{A}$  on  $\vec{B}$ ?

- (a)  $\frac{-7}{\sqrt{17}}$
- (b)  $-\frac{5}{\sqrt{17}}$
- (c)  $\frac{7}{\sqrt{17}}$
- (d)  $\frac{11}{\sqrt{17}}$

17. What is the length of  $\vec{A} + \vec{B}$ ?

- (a)  $\sqrt{21}$
- (b)  $\sqrt{42}$
- (c)  $2\sqrt{21}$
- (d)  $2\sqrt{42}$

Equation of a circle is  $x^2 - 4x + y^2 = 140$ . Using this information answer the questions (18-20):

18. What is the radius of the circle?

- (a) 2
- (b) 8
- (c) 10
- (d) 12

19. What is the length of tangent from a point (15, 0)?

- (a) 5
- (b) 10
- (c) 12
- (d) 13

20. Given equation defines —

- i. Diameter of the circle is 12
- ii. Centre of the circle lies on x-axis
- iii. The circle passes through the (2, 12)

Which one is correct?

- (a) i, ii
- (b) i, iii

- (c) ii, iii
- (d) i, ii and iii

21. What is the equation of circle with centre (0, 0) and radius  $\sqrt{\frac{9}{2}}$  unit?

- (a)  $2x^2 + 2y^2 = 9$
- (b)  $9x^2 + 9y^2 = 4$
- (c)  $2x^2 + 2y^2 = 81$
- (d)  $9x^2 + 9y^2 = 2$

22. A tangent at any point on the circle defines that —

- i. It's normal to the radius passing through point of contact
- ii. It has only one common point on the circle
- iii. It keeps equal distance from the point (0, 0)

Which one is correct?

- (a) i, ii
- (b) i, iii
- (c) ii, iii
- (d) i, ii and iii

$y = \ln 5x$  Using this information answer the questions (23-24):

23. What is the value of  $\frac{dy}{dx}$  at (1, 10)?

- (a)  $\ln 1$
- (b)  $\ln 2$
- (c)  $\ln 5$
- (d)  $\ln 10$

24. Which is correct for  $y_2$ , the second derivative of  $y$ ?

- (a)  $x^{-1}$
- (b)  $-x^{-2}$
- (c)  $5x^{-1}$
- (d)  $-5x^{-2}$

25. If,  $3I = \int_0^{\frac{\pi}{4}} \cos 2x \, dx$ , what is the value of  $I$ ?

- (a)  $-\frac{\pi}{2}$
- (b)  $\frac{\pi}{2}$
- (c)  $-\frac{1}{6}$
- (d)  $\frac{1}{6}$

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