

# 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. ►  $A = \begin{bmatrix} a - b - c & 2a & 2a \\ 2b & b - c - a & 2b \\ 2c & 2c & c - a - b \end{bmatrix}$

a. If the matrix  $\begin{bmatrix} p + 5 & 2 \\ 3 & p \end{bmatrix}$  is singular then, what is the value of  $p$ ? 2

b. Show that the determinant of  $A$  is  $= (a + b + c)^3$  4

c. If  $a = 0$ ,  $b = 1$ ,  $c = 2$  then, find  $A^{-1}$  4

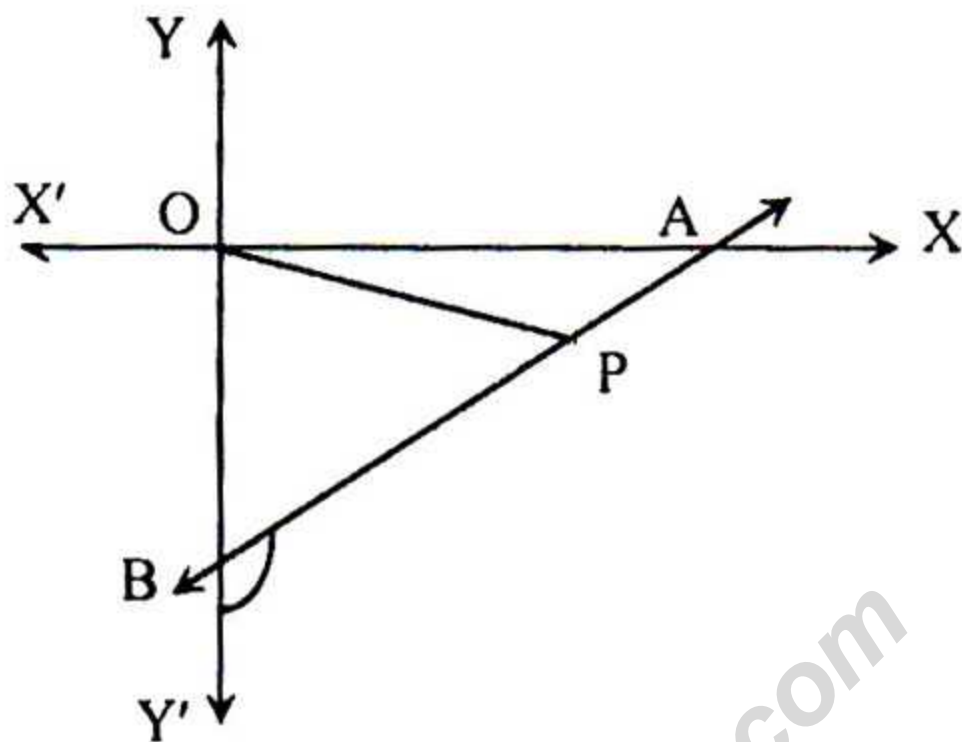
2. ►  $\vec{a} = 3\hat{i} + 2\hat{j} - \hat{k}$ ,  $\vec{b} = 5\hat{i} + 4\hat{j} + \hat{k}$

a. Find the magnitude of resultant of  $\vec{a}$  and  $\vec{b}$ . 2

b. Find the projection of  $\vec{b}$  along the vector  $\vec{a}$ . 4

c. Find the unit vector perpendicular to the vectors  $\vec{a}$  and  $\vec{b}$ . 4

3. ►



The equation of the line AB is  $2x - 3y = 6$  and p is point on AB such that,  $AP : PB = 2 : 3$

- Find the equation of straight line passes through O and perpendicular to AB. 2
- Find the area of  $\Delta OPB$ . 4
- Find the slope of the bisector of  $\angle ABY'$  4

4. ★ The straight line  $2x - y = 0$  is a chord of the circle  $x^2 + y^2 = 10x$ .

- Find the length of x- intercept cuts off by the circle. 2
- Find the equation of the circle whose diameter is the chord of the stem. 4

- c. Find the equation of the circle with center (5, 10) and which touches the circle of the stem externally. 4

### Group B – Trigonometry and Calculus

5. ★  $f(x) = \frac{\cot(-x) + \operatorname{cosec}x}{\cos x + \sin(-x)}$ ,  $g(\alpha) = \tan \alpha$

a. Find the value of  $\cos^2 \frac{\pi}{24} + \cos^2 \frac{19\pi}{24} + \cos^2 \frac{31\pi}{24} + \cos^2 \frac{27\pi}{24}$  2

b. Find the value of  $f(x)$ , when  $\cot x = \frac{3}{4}$  and  $\cos x$  is negative. 4

c. Show that,  $g(\alpha) g(2\alpha) g(3\alpha) \dots g\{(2n - 1)\alpha\} = 1$ , when  $4n\alpha = \pi$ . 4

6. ►  $f(x) = \left(\frac{\pi}{2} - x\right) \tan x$ ,  $g(x) = \cos 2x$

a. Find the derivatives of  $\log_a x$  and  $x \sin^{-1} x$  respect to  $x$ . 2

b. Find the value of  $\lim_{x \rightarrow \frac{\pi}{2}} f(x)$ . 4

c. Differentiate  $g(x)$  from first principle with respect to  $x$ . 4

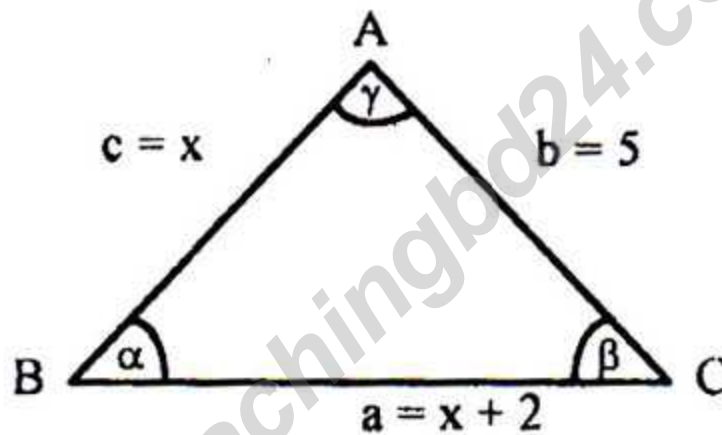
7. ►  $f(x) = \sin x$

a. If  $4 \cdot nC_2 = nP_3$ , then find the value of  $n$ . 2

b. If  $y = f(m \sin^{-1} x)$ , then show that  $(1 - x^2) y_2 - xy_1 + m^2 y = 0$  4

c. Find the integration of  $\int \{f(x)\}^4 dx$ . 4

8. ★



a. If  $\cos \alpha = \sin \beta - \cos \gamma$  then prove that,  $\alpha = \beta + \gamma$  2

b. Prove that,  $\cos^2 \frac{\alpha}{2} + \cos^2 \frac{\beta}{2} + \cos^2 \frac{\gamma}{2} = 2 + 2 \sin \frac{\alpha}{2} \sin \frac{\beta}{2} \sin \frac{\gamma}{2}$ . 4

c. Find the area of a triangle, when  $\angle \alpha = 60^\circ$  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. The order of the matrices A and B are  $3 \times 2$  then what is the order of the matrix AB?

(a)  $2 \times 2$                       (b)  $2 \times 3$   
 (c)  $3 \times 2$                       (d)  $3 \times 3$

2. Which one is the (2, 3) th cofactor in

the determinant  $\begin{vmatrix} 2 & -6 & 2 \\ 3 & -0 & -9 \\ -1 & 8 & 7 \end{vmatrix}$

(a) -90    (b) 10    (c) 20    (d) 90

- Answer the equations 3 and 4 based on the following stem.

$$A = \begin{bmatrix} 3 & -2 \\ 2 & 2 \end{bmatrix}, D = \begin{vmatrix} p & 0 & 0 \\ 2 & -4 & 1 \\ 3 & -1 & 0 \end{vmatrix}$$

3. If  $|A| = D$ , then what is the value of p?

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

4. Which one is the following  $A^{-1}$ ?

(a)  $\begin{bmatrix} 3 & 2 \\ -2 & 2 \end{bmatrix}$                       (b)  $\begin{bmatrix} 2 & -2 \\ 2 & 3 \end{bmatrix}$   
 (c)  $\begin{bmatrix} 3 & -2 \\ 2 & 2 \end{bmatrix}$                       (d)  $\begin{bmatrix} 2 & 3 \\ 2 & -2 \end{bmatrix}$

5. The angle between the line  $5x - 5$

$$\sqrt{3}y + 2 = 0 \text{ and } 3\sqrt{3}x + 3y - 4 = 0$$

(a)  $30^\circ$                       (b)  $45^\circ$   
 (c)  $60^\circ$                       (d)  $90^\circ$

6. If the vertices of a parallelogram are (1, 1), (4, 4), (4, 8) and (1, 5) then the length of one diagonal is —

(a)  $3\sqrt{2}$   
 (b) 4  
 (c)  $\sqrt{10}$   
 (d) 8

7. Which one is the radius of the circle  $2x^2 + 2y^2 - 4x - 7y + 1 = 0$ ?

(a)  $\frac{\sqrt{57}}{4}$                       (b)  $\frac{\sqrt{73}}{4}$   
 (c)  $\frac{\sqrt{61}}{4}$                       (d)  $\frac{\sqrt{69}}{4}$

8. The circle  $x^2 + y^2 + 4x - 6y = 0$

- i. passes through the origin  
 ii. cuts off intercept of length 4 unit from x-axis  
 iii. center is (-2, 3)

Which sentences of the above are correct?

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

- Answer the questions 9 and 10 based on the following stem:

A circle with centre (3, 4) and touches the x-axis

9. Which is the coordinates of the point of contact?

(a) (-4, 0)                      (b) (-3, 0)  
 (c) (3, 0)                        (d) (4, 0)

10. Which one is the equation of the circle?

(a)  $x^2 + y^2 - 6x - 8y + 9 = 0$   
 (b)  $x^2 + y^2 - 6x - 8y + 16 = 0$   
 (c)  $x^2 + y^2 + 6x + 8y + 9 = 0$   
 (d)  $x^2 + y^2 + 6x + 8y + 16 = 0$

11. The length of x-intercept cuts off by the circle whose diameter is the line segment joining the points (0, -1) and (2, 3) is

(a) 2                      (b) 3  
 (c) 4                        (d)  $3\sqrt{2}$

12. In how many ways can a person give computer password of 6 letters all of which have 'M' at the beginning?

(a)  ${}^{25}P_5$                       (b)  ${}^{25}P_6$   
 (c)  ${}^{26}P_5$                       (d)  ${}^{26}P_6$

13. With 7 points of which any three are not collinear —

- i. 21 straight line can be drawn  
 ii. 35 triangles can be formed  
 iii. form a plane figure which has 14 diagonals

Which sentences of the above are correct?

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

14. If  $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$  and  $\vec{b} = 3\hat{i} - \hat{j} + 2\hat{k}$  then the included angle between

$\vec{a} + \vec{b}$  and  $\vec{a} - \vec{b}$  is?

- (a)  $30^\circ$
- (b)  $45^\circ$
- (c)  $90^\circ$
- (d)  $120^\circ$

15. Which is the value of  $\hat{i} \cdot (\hat{j} \times \hat{k})$ ?

- (a) 0
- (b) 1
- (c) -1
- (d)  $\hat{i}$

16.  $\star$  If  $\sec A + \tan A = 2$ , what is the value of  $\sec A - \tan A = ?$

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

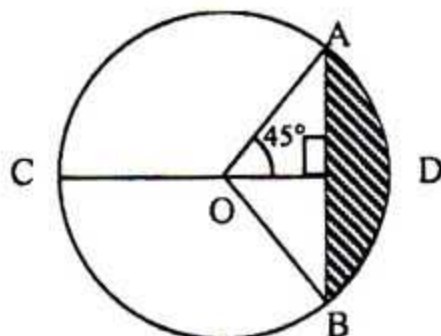
17. If the length of the three sides of a triangle are 13, 14 and 15 unit then which one is its area?

- (a) 64 sq. unit
- (b) 80 sq. unit
- (c) 84 sq. unit
- (d) 88 sq. unit

18. What is the value of  $\cos 330^\circ$ ?

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

Answer the questions 19 and 20 based on the following stem:



In the figure O is the center of the circle and  $CD = 10$  cm.

19. What is the length of the arc AD?

- (a) 3.927 cm
- (b) 7.854 cm
- (c) 9.635 cm
- (d) 9.818 cm

20. Which one is the area of the shaded region?

- (a)  $28.54 \text{ cm}^2$
- (b)  $19.63 \text{ cm}^2$
- (c)  $12.5 \text{ cm}^2$
- (d)  $7.13 \text{ cm}^2$

21.  $\lim_{x \rightarrow 0} \frac{\sin^2 x}{x} = ?$

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

22. If  $y = e^{-x}$ , then  $y''' = ?$

- (a)  $-e^{-x}$
- (b)  $e^{-x}$
- (c)  $3e^{-x}$
- (d)  $-3e^{-x}$

$f(x) = \ln(1-x)$  and  $g(x) = \tan x^2$

Answer the questions (23 - 25) using the above stem.

23.  $\frac{d}{dx} \{g(x)\} = ?$

- (a)  $2x \sec x^2$
- (b)  $\sec^2 x^2$
- (c)  $2 \tan x \sec x^2$
- (d)  $2x \sec^2 x^2$

24.  $f''(2) = ?$

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

25.  $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x = ?$

- (a)  $\infty$
- (b) 0
- (c) 1
- (d) 2

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