

Model Question of HSC Examination 2020

Higher Mathematics 1st Paper (Creative) Subject Code :

2	6	5
---	---	---

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. ► If $A = \begin{bmatrix} 5 & 2 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & -2 \\ -4 & 3 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 1 & 3 \\ 3 & 2 & 1 \end{bmatrix}$,

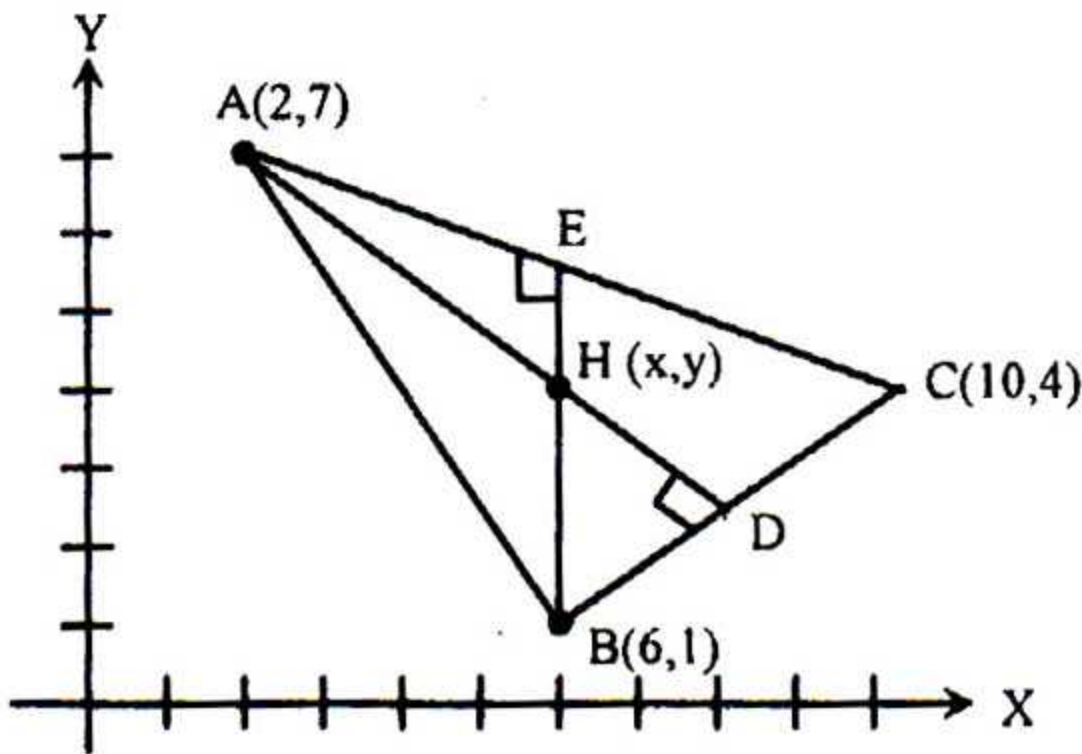
$$X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, Y = \begin{bmatrix} 5 \\ 1 \\ 4 \end{bmatrix}$$

- a. Find the value of x if the transpose matrix of $\begin{bmatrix} x & 4 \\ 3 & 2 \end{bmatrix}$ is singular. 2
- b. Determine $(AB)^{-1}$. 4
- c. If $CX = Y$, then determining solvability find the value of X by the method of determinant. 4

2. ► The password of Robin's *smartphone* is 1073859

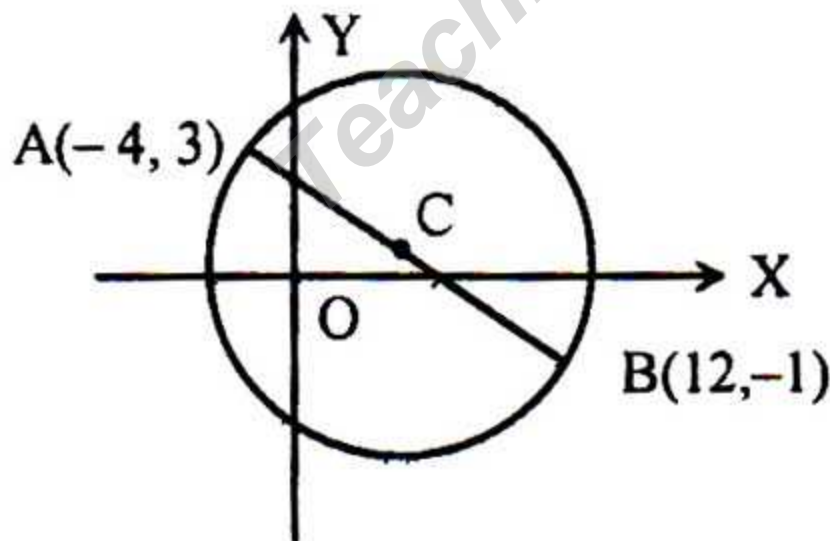
- a. In examination a maximum number is to be secured in each of 6 subjects for passing. In how many ways can a student fail? 2
- b. How many arrangements can be made with the letters of the italic word of the stem so that the vowels are taking together and the letter 't' on the last place. 4
- c. How many significant even numbers of 7 digits can be formed from the digits of the password? 4

3. ★



- Find the locus of the set of points whose distance from the origin and the point $(0, 4)$ are in the ratio $2:3$. 2
- Find such an equation of straight line which is parallel to AB and passes through the point C . 4
- Find the orthocenter $O(x, y)$. 4

4. ►



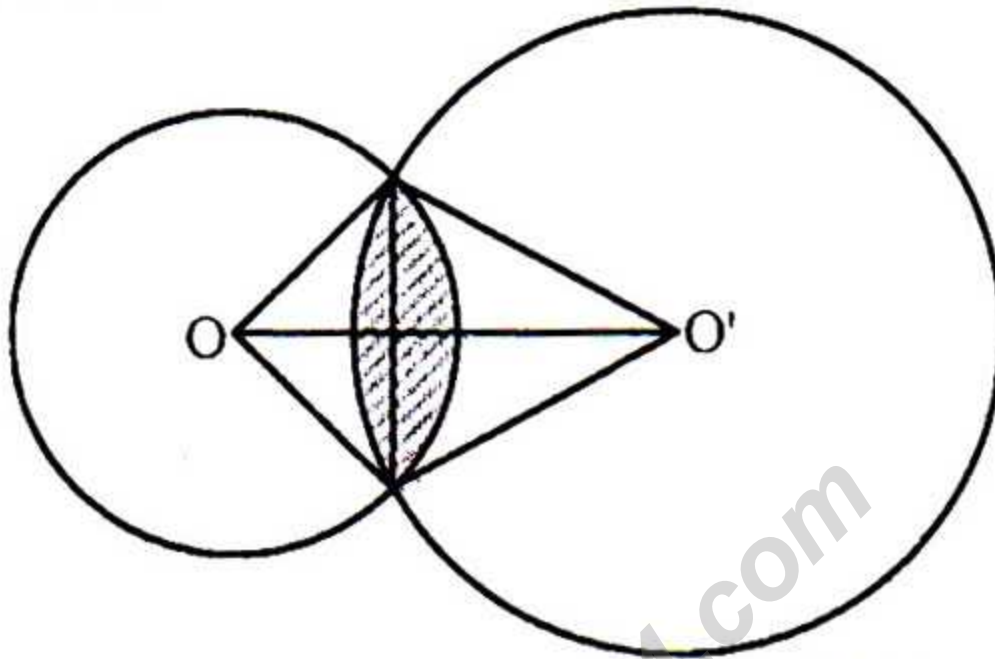
In figure AB is a diameter of a circle centered in C .

- Find the equation of the tangent to the circle $x^2 + y^2 - 3x + 10y = 15$ at $(4, -11)$. 2
- Find the intercepts cut off from x -axis and y -axis by the given circle. 4

- c. Determine the equation of a circle passes through the point A, B and origin. 4

Group B – Trigonometry & Calculus

5. ★ Scenario : 1-



Scenario : 2- $5 \sin x + 2 \cos x = 5; 0^\circ \leq x \leq 270^\circ$

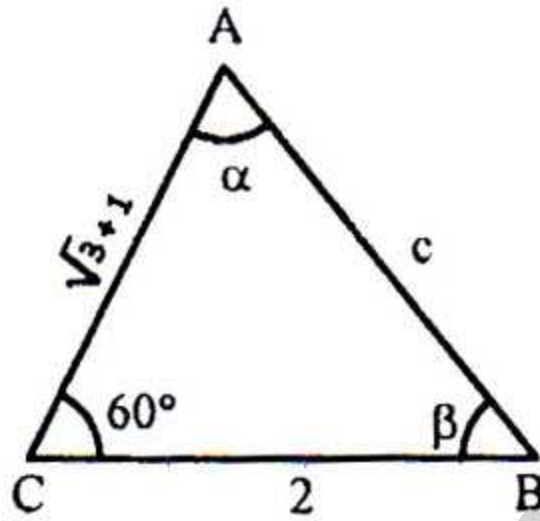
- a. The angles of a triangle are arithmetic progression. The ratio of the greatest in radian and smallest in degree is $\pi : 36$. Find the angles in degree? 2
- b. From Scenario : 1 find the area of the shaded region if the radius of O and O' centered circle is 8 cm and 10 cm respectively and $OO' = 15$ cm. 4
- c. From Scenario : 2 find the solution of the equation by graph in the given interval. 4

6. ► Scenario: I; $f(x) = \frac{x-3}{2x+1}$ and

Scenario: II; $g(x) = -x^2 + 3x + 2$

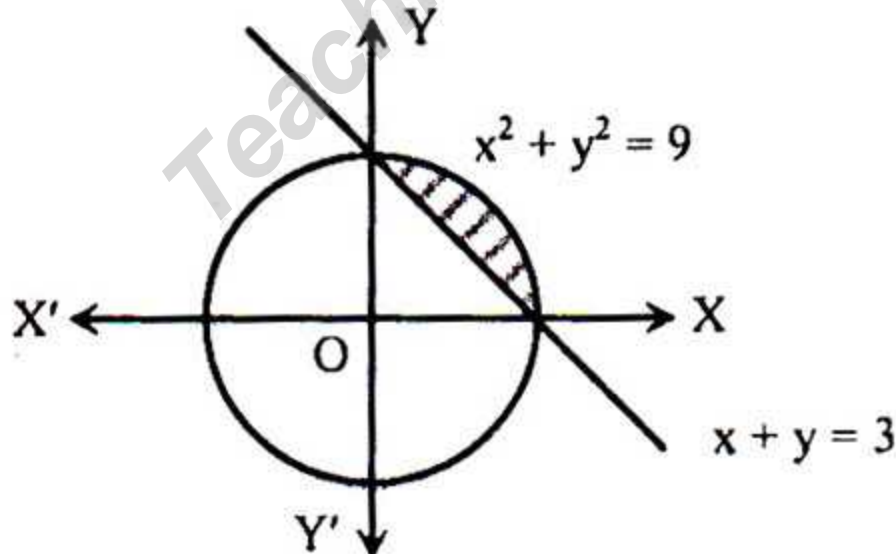
- a. If $(a + b + c)(b + c - a) = 3bc$, find the value of angle A. 2
- b. Determine the domain and range of the Scenario : II. 4
- c. If $A = \mathbb{R} - \left\{-\frac{1}{2}\right\}$, $B = \mathbb{R} - \left\{\frac{1}{2}\right\}$ and $f : A \rightarrow B$ is defined by Scenario : I, find f^{-1} . 4

7. ► In figure ABC is a triangle and $x^2 + y^2 - 4x - 7 = 0$ is an equation of curve.



- a. Find the maximum value of $f(x) = x^3 - 18x^2 + 96x$ in the interval $[0, 9]$. 2
- b. Find the points where the tangent of the curve is perpendicular to y -axis. 4
- c. Find the value of α , β and c . 4

8. ★



- a. If $\ln y = \tan^{-1} x$ then show that $(1 + x^2)y_2 + (2x - 1)y_1 = 0$ 2
- b. Find the tangents of the circle which are perpendicular to x -axis. 4
- c. Find the area of the shaded region. 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. Which one is the singular matrix?

- (a) $\begin{bmatrix} -1 & -2 \\ 3 & -5 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 5 \\ 2 & -4 \end{bmatrix}$
 (c) $\begin{bmatrix} -4 & 6 \\ 2 & -3 \end{bmatrix}$ (d) $\begin{bmatrix} 4 & -6 \\ -2 & -3 \end{bmatrix}$

2. ★ If $X = \begin{bmatrix} 2 & 3 \\ -1 & -2 \end{bmatrix}$ which one is correct?

- (a) Idempotent matrix
 (b) Nilpotent matrix
 (c) Involutionary matrix
 (d) Symmetric matrix

Answer the questions (3 & 4) in the light of information given below:

$$X = \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$$

3. What is the condition the matrix X will be scalar?

- (a) $a = b = c$ (b) $a \neq b = c$
 (c) $a = b + c$ (d) $c = a + b$

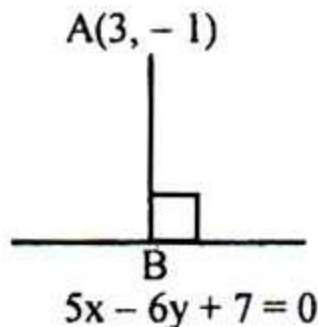
4. For what values of a, b, c the matrix will be identity matrix?

- (a) $a = b = c$ (b) $a = b = c = 1$
 (c) $a = b = c = 0$ (d) $b = a + c$

5. What is the slope of the line passing through (3, -4) and (7, 2)?

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

6.



Which is the equation of AB?

- (a) $5x - 6y + 13 = 0$ (b) $6x + 5y + 13 = 0$
 (c) $6x + 5y - 13 = 0$ (d) $6x - 5y - 13 = 0$

Answer the questions (7 & 8) in the light of information given below:

The length of the perpendicular from the point $(1, \sqrt{3})$ to the line $x\sqrt{3} - y + 8 = 0$ is P and the perpendicular makes an angle θ with x-axis?

7. What is the value of P?

- (a) 2 (b) 4
 (c) 10 (d) 20

8. What is the value of θ ?

- (a) 30° (b) 60°
 (c) 120° (d) 150°

9. Find the length of the intercept on the x-axis by the circle drawn on the line segment joining the points (0, -1) and (2, 3) as a diameter?

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

10. At the point (4, -11), the circle $x^2 + y^2 - 3x + 10y - 15 = 0$ has-

- i. the equation of the tangent $5x - 12y = 152$
 ii. the equation of the normal $12x + 5y + 7 = 0$
 iii. length of the tangent 15 unit

Which of the following is correct?

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

Answer the questions (11 & 12) in the light of information given below:

The line $3x + by - 1 = 0$ touches the circle $x^2 + y^2 - 8x - 2y + 4 = 0$

11. ★ What is the distance between the centre and line?

- (a) 3 (b) $\sqrt{13}$
 (c) 13 (d) 169

12. ★ Which pair is the value of b?

- (a) $2, -\frac{1}{6}$ (b) $12, -1$
 (c) $2, -6$ (d) $-\frac{1}{2}, -\frac{1}{6}$

13. How many different word can be formed from 7 consonants and 3 vowels consisting of 3 consonants and 2 vowels?

- (a) 4200 (b) 5600
 (c) 8320 (d) 12600

Answer the questions (14 & 15) in the light of information given below:

A committee of 6 persons is to be formed within 8 boys and girls.

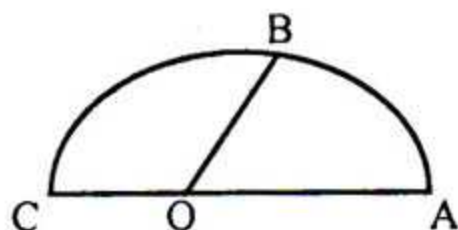
14. In how many ways the committee can be formed taking the girls in each case?

- (a) 16 (b) 28
(c) 70 (d) 105

15. In how many ways committee can be formed not taking the girls in each?

- (a) 315 (b) 105
(c) 70 (d) 28

16.



In half circle OABC, $r = 4$ cm, $\angle AOB = 0.8$ radian.

- i. $AC = 8$ cm
ii. $\angle BOC = 2.3416$ radian
iii. length of arc AB is 3.2 cm

Which of the following is correct?

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

17. ★ What is the length of the arc in cm if produced an angle 40° in a circle of the radius 5 cm.

- (a) 3.491 (b) 3.520
(c) 3.641 (d) 3.928

18. In triangle ABC, $\cos A + \cos C = \cos B$ then what is the value of $\angle A$?

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

19. If $f(x) = x + 1$ and $g(x) = 2x$ then what is the value of $(f \circ g^{-1})(2)$?

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

20. The function $f(x) = 3^x$

- i. Domain $[0, \infty]$
ii. Range $(0, \infty)$
iii. $f^{-1}(x) = \frac{\ln(x)}{\ln 3}$

Which of the following is correct?

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

21. What is the slope of the curved line $y = x^3 - 7x^2 + 5x$ at point (5, 4)?

- (a) 14 (b) 12
(c) 10 (d) 9

22. ★ What is the value of $\lim_{x \rightarrow \infty} \frac{x^2 + x}{4x^3 - 1}$?

- (a) ∞
(b) 1
(c) 0
(d) $\frac{1}{4}$

23. If $y = \frac{1}{x}$ then what is the 20th derivative of y?

- (a) $\frac{20!}{x^{20}}$ (b) $\frac{20!}{x^{21}}$
(c) $\frac{21!}{x^{21}}$ (d) $\frac{21!}{x^{20}}$

Answer the questions (24 & 25) in the light of information given below:

For any value x slope of a curve $\frac{dy}{dx} = 2x$

24. Which is the anti-derivative of the slope?

- (a) $\frac{x^2}{2} + c$
(b) $x^2 + c$
(c) $-\frac{x^2}{2} + c$
(d) $-x^2 + c$

25. Which of the following is an equation of the curve at the point (2, 5)?

- (a) $y = x^2 + 1$
(b) $y = x^2 - 1$
(c) $y = x^2 + 3$
(d) $y = x^3 - 3$

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