

# Model Question of SSC Examination 2020 for All Board

Higher Mathematics

Subject Code : 

1	2	6
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Time — 2 hours 30 minutes

Full Marks — 50

[N.B. — The figures in the right margin indicate full marks. Answer five questions taking at least one from each Group.]

## Group A – Algebra

1. **★** The functions :  $f : \mathbb{R} \rightarrow \mathbb{R}$  and  $g : \mathbb{R} \rightarrow \mathbb{R}$  are defined by

$$f(x) = x^7 + 5 \text{ and } g(x) = (x - 5)^{\frac{1}{7}} \text{ respectively.}$$

- a. Find the value of  $g^{-1}(-1)$  2
- b. Ascertain whether  $f(x)$  is onto function. 4
- c. Show that  $f = g^{-1}$ . 4

2. **▶**  $x + 4$  is a factor of  $P(x) = x^3 + 5x^2 + 6x + a$

- a. What is the value of  $a$ ? 2
- b. If  $Q(x) = x^3 + 6x^2 + 7x + 10$ . Find the common factor of  $P(x)$  and  $Q(x)$ . 4
- c. If  $P(y)$  yields the same remainder upon division by  $y-m$  and  $y-n$  where  $m \neq n$ , show that  $m^2 + n^2 + mn + 5m + 5n + 6 = 0$ . 4

3. **▶** Consider the expression  $A_n = \{1 - (-1)^n x\}^n$   $n \in \mathbb{N}$ .

- a. What do you mean by binomial expression and binomial expansion. 2
- b. Expand  $A_8$  up to  $x^3$  in ascending power of  $x$ . Find the approximate value of  $(0.99)^8$  up to four decimal places. 4
- c. Determine the coefficient of  $x^7$  in the expansion of  $A_7 A_8$ . 4

## Group B – Geometry and Vector

4. ► ABCD is a quadrilateral inscribed in a circle with center at the point O.
- Who was Ptolemy? 2
  - Prove that  $AC \cdot BD = AB \cdot CD + AD \cdot BC$  4
  - Draw a circle which touches the given circle at the point A and passes through a point Q outside it (The description and symbols of drawing are essential) 4
5. ★ The distance of any point of the form  $(x, x)$  from a point  $R(3, -3)$  is twice the distance of the point from the y-axis.
- What are the values of  $x$ ? 2
  - If there are two points P and Q satisfying the stimulus condition, find the nature of  $\Delta PQR$ . 4
  - Find the area of the triangle PQR in terms of its sides and perimeter. 4
6. ►  $\underline{a}$ ,  $\underline{b}$ ,  $\underline{c}$  and  $\underline{d}$  are respectively the position vectors of the vertices A, B, C and D of a rectangle ABCD.
- Is  $AB = \underline{b} - \underline{a}$  true? Write in favor of your answer. 2
  - Show, by the help of vectors, that the diagonals of the rectangle ABCD bisect each other. 4
  - If  $AB = 6$  cm,  $BC = 4$  cm and ABCD is rotated about one of its length, then find the area of the whole surface and volume of the solid so formed. 4

## Group C - Trigonometry & Probability

7. ★ Given,  $A = \sec\theta - \tan\theta$

a. If  $\theta = \frac{\pi}{4}$ , what is the value of  $A^2 + 2A$ . 2

b. Prove that  $\sin\theta = \frac{1 - A^2}{1 + A^2}$  4

c. Show that  $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{A}$  4

8. ► According to the report of a rural health centre, the babies in a certain rural area in the period of last five years were born as in the following table:

Nature of baby's weights	Number of babies
Under weight	255
Normal weight	550
Over weight	195

Out of these babies, one baby is selected at random.

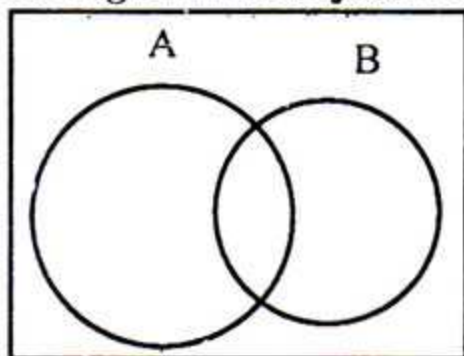
a. What do you mean by certain and impossible events? 2

b. Find the probability that the baby was born (i) exactly with normal weight (ii) with under weight or over weight. 4

c. What is the probability that the baby was born (i) with not less than normal weight (ii) with more than normal weight? 4

[N.B— Answer all the questions. Each question carries one mark. Block fully, with a ball-point pen, the circle of the letter that stands for the correct/best answer in the "Answer Sheet" for Multiple Choice Questions Examination.]

1. Which one of the following represents the shaded region of the adjacent diagram?



- (a)  $A \cup B$                       (b)  $A \cap B$   
 (c)  $A' \cup B'$                     (d)  $A' \cap B'$

2. ★ The set symbols R, Q, Q', Z and I have their usual meanings. Which one of the following is correct?

- (a)  $R = Q \cup Q'$                   (b)  $R \subseteq Q \cup N \cup I$   
 (c)  $Q \subseteq N \cup I$                     (d)  $Q' \subseteq Q \cup N \cup I$

3. What is the value of  $(a-b)^3 + (b-c)^3 + (c-a)^3 - 3(a-b)(b-c)(c-a)$ ?

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

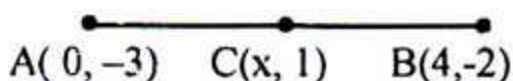
4. The expression  $xy^{-1} + yz^{-1} + zx^{-1}$  is—

- i. Cyclic  
 ii. Symmetric  
 iii. Polynomial

Which one is correct?

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

Read the stem and answer the following questions no 5 and 6.



5. ★ What is the value of x?

- (a) 14                                  (b) 15  
 (c) 16                                  (d) 17

6. ★ What is the value of AC:BC?

- (a) 1:4                                  (b) 1:2  
 (c) 3:4                                  (d) 4:3

7. Which one of the following equations represents the graph which is symmetric about both the axis?

- (a)  $y = x^2$                               (b)  $y^2 = x$   
 (c)  $y-3 = x$                             (d)  $x^2 + y^2 = 4$

8. What is the ratio of the sum of squares of the sides of a triangle and the sum of squares of its medians?

- (a)  $\frac{2}{3}$                                       (b)  $\frac{4}{5}$   
 (c)  $\frac{4}{3}$                                       (d)  $\frac{3}{2}$

9. If the area of the circumcircle of a triangle is  $36\pi$  sq. cm. What is the diameter of the nine point circle of the same triangle in cm.?

- (a) 3                                        (b) 6  
 (c) 9                                        (d) 12

10. The roots of the equation  $x^2 - 6x + 9 = 0$  are—

- i. Equal                                    ii. Rational  
 iii. Three each

Which one is correct?

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

11. Which one is the solution of

$3^{px-1} = 27q^{px-4}$ ?

- (a)  $\frac{p}{4}$                                         (b)  $\frac{p}{4}$   
 (c)  $\frac{4}{p}$                                         (d) p

12. If  $\tan\theta = \frac{5}{12}$  and  $180^\circ < \theta < 270^\circ$ , what is the value of  $\sin\theta$ ?

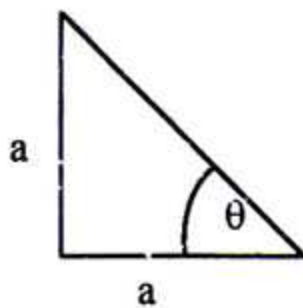
- (a)  $-\frac{13}{12}$                                     (b)  $-\frac{12}{13}$   
 (c)  $-\frac{5}{12}$                                     (d)  $-\frac{5}{13}$

13. ★ What is the term independent of x in

the expansion of  $\left(x + \frac{1}{x^2}\right)^6$ ?

- (a) 6                                        (b) 12  
 (c) 15                                        (d) 30

14. What is the value of  $\sec^2 \theta + \tan^2 \theta$  in the adjacent right angled triangle?



- (a) 1 (b) 3  
(c) 5 (d) 6
15.  $\star$  If  $p(x+q) < r$  and  $p < 0$ , then which one of the following is true?

- (a)  $x < \frac{r}{p} - q$  (b)  $x > \frac{r}{p} - q$   
(c)  $x < q - \frac{r}{p}$  (d)  $x > q - \frac{r}{p}$

16. If the slopes of two perpendicular straight lines are  $m_1$  and  $m_2$ , then—

- i.  $m_1 = m_2$   
ii.  $m_1 \times m_2 = 1$   
iii.  $m_1 \times m_2 = -1$

Which one is correct?

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

17. The range of a function  $f: x \rightarrow 2x^3 + 1$  is  $\{1, 3, 17, 55\}$ . What is its domain?

- (a)  $\{0, 1, 2, 3\}$  (b)  $\{1, 2, 3, 4\}$   
(c)  $\{1, 2, 3, 5, 7\}$  (d)  $\{1, 2, 4, 6\}$

18.  $\star$  What is the range of  $y = \log_{10} x$ ?

- (a)  $(-\infty, 0)$  (b)  $(0, \infty)$   
(c)  $[0, \infty)$  (d)  $(-\infty, \infty)$

19. What is the ratio of the volumes of a right circular cone and a cylinder of equal heights standing on equal bases?

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

20. Four coins are tossed together. What is the highest number of times of getting head?

- (a) 1 time (b) 2 time  
(c) 3 time (d) 4 time

21. If the corresponding angles of two triangles are equal, then they are—

- (a) Congruent  
(b) Equal in all respects  
(c) Concurrent  
(d) Always not equal

22. If  $\underline{b} + \underline{c}$ ,  $2\underline{b}$  and  $2\underline{c}$  are the position vectors of the points A, B and C respectively and D is the mid-point of

BC, then  $\overrightarrow{AD}$  is equal to—

- i.  $\vec{0}$   
ii.  $\overrightarrow{AA}$   
iii.  $\overrightarrow{DD}$

Which one is correct?

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

23.  $\star$  The events having the probability 0 are—

- i. The sun will move around the earth  
ii. The sun will set in the east  
iii. Any one of head and tail will be on the top face in the toss of a coin

Which one is correct?

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

24. What is the  $n^{\text{th}}$  term of the series  $1, \frac{2}{3}, \frac{3}{5},$

$\frac{4}{7}, \frac{5}{9}, \dots$ ?

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

25. What is the sum of the infinite series

$1 + \frac{1}{\sqrt{2}} + \frac{1}{2} + \frac{1}{2\sqrt{2}} + \frac{1}{4} + \dots$ ?

- (a) 3.114 (b) 3.144  
(c) 3.414 (d) 3.441

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