

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. **★** $F(a) = \frac{1}{1-a^3}$ and $P(x, y, z) = (x + y + z)(xy + yz + zx)$.

a. Verify whether $P(x, y, z)$ is cyclic or symmetric. 2

b. Express $F(a)$ into a partial fraction. 4

c. If $P(x, y, z) = xyz$, show that $\frac{1}{(x + y + z)^7} = \frac{1}{x^7} + \frac{1}{y^7} + \frac{1}{z^7}$. 4

2. **▶** $32y^x - y^{2x} = 256$ (i), $4^x = y^2$ (ii), $f(z) = \ln \frac{5+z}{5-z}$

..... (iii)

a. Show the solution in number line : $8 \geq 2 - 2x$. 2

b. Find (x, y) using (i) and (ii). 4

c. Find the domain and range of $f(z)$. 4

3. **▶** $9 + 99 + 999 + 9999 + \dots$ is an infinite series and x_1, x_2, x_3, x_4 are four consecutive terms in the expansion of $(1 + a)^n$.

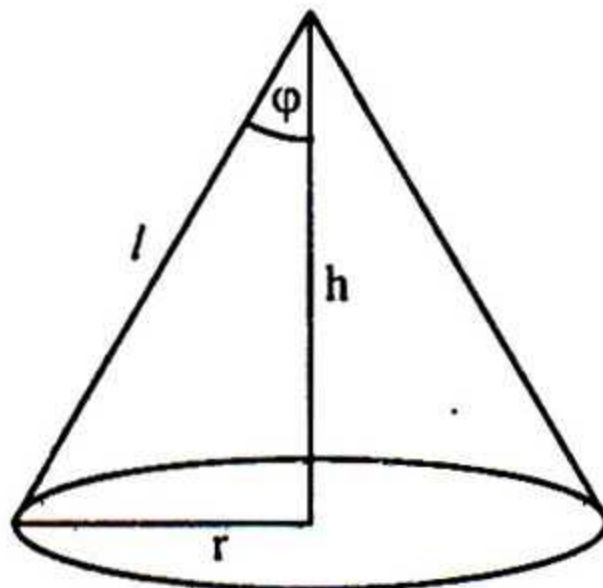
a. Write down the sequence of the general term ' $\cos\left(\frac{n\pi}{2}\right)$ '. 2

b. Find the sum of first n terms of the infinite series. 4

c. Prove that, $\frac{x_1}{x_1 + x_2} + \frac{x_3}{x_3 + x_4} = \frac{2x_2}{x_2 + x_3}$. 4

Group B – Geometry and Vector

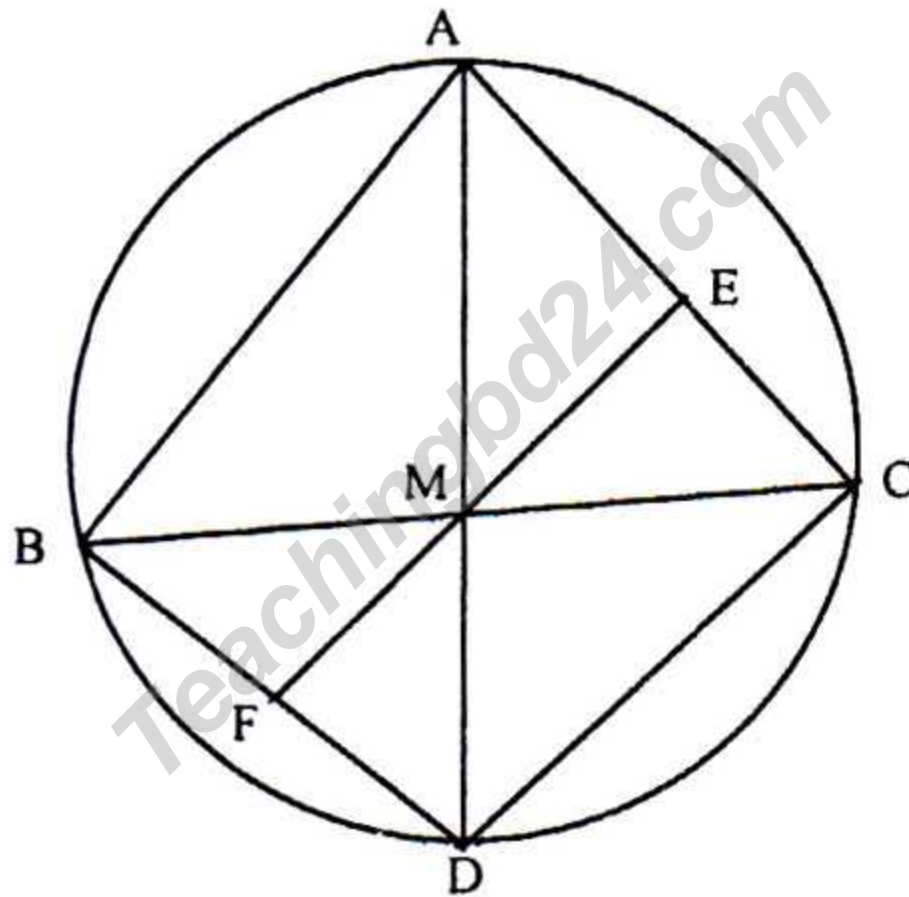
4. **★**



In the figure, r is the radius of the base, h is height and φ is a semi vertical angle of a right circular cone.

- Find the surface area and volume of a sphere of radius 6cm. 2
- Show that, $S = \frac{\pi h^2 \tan \varphi}{\cos \varphi} = \pi r^2 \operatorname{cosec} \varphi$ where S is the area of the curved surface. 4
- If the volume of the cone is 1178cc and $h = 12\text{cm}$, find the semi vertical angle in degree. 4

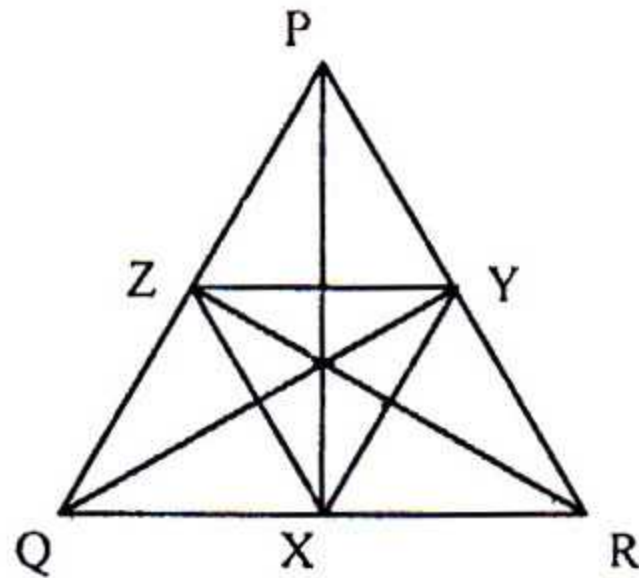
5. ►



In the cyclic quadrilateral ABCD diagonals AD and BC intersect at M in right angle. $ME \perp AC$ and extended EM intersect BD at F.

- Describe the Ptolemy's theorem according to the stimulus figure. 2
- Prove that, $BF = FD$. 4
- Construct a triangle, taking BC as base, $\angle BAC$ as vertical angle and AD as sum of two other sides. 4

6. ►



In ΔPQR , X, Y and Z are the middle points of QR, RP and PQ respectively.

- a. Write down a relation between \overrightarrow{XY} and \overrightarrow{QR} putting the necessary arrow sign on the sides of the ΔPQR . 2
- b. Prove that, $\overrightarrow{PX} + \overrightarrow{QY} + \overrightarrow{RZ} = \underline{0}$. 4
- c. If $P \equiv (2, -1)$, $Q \equiv (-4, 2)$ and $R \equiv (2, 5)$, find the area of the ΔXYZ . 4

Group C - Trigonometry & Probability

7. ► $x \cos A - y \sin A = z$.
 - a. Show that, $\tan B + \cot B = \sec B \operatorname{cosec} B$. 2
 - b. Show that, $y \cos A + x \sin A = \pm \sqrt{x^2 + y^2 - z^2}$ 4
 - c. If $x = 3$, $y = -2 \sin A$ and $z = 0$, find the value of A where $0 < A < 2\pi$. 4
8. ★ A dice is thrown once and an unbiased coin is tossed together for an experiment.
 - a. Define sample with example. 2
 - b. What is the probability of getting an even number or a number divisible by 3 from the dice only? 4
 - c. Draw the probability tree and find the probability of getting odd numbers from the dice and tail from the coin. 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. The product of the diagonals of a cyclic square is 200 sq. cm. What is the length (in cm) of the sides of the square?

(a) 10 (b) $10\sqrt{2}$
 (c) 20 (d) 100

2. Sum of the roots of $ax^2 - 2ax + 1 = 0$ is—

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

Answer (3 – 4) on the basis of the quadratic equation $4x - 2 - x^2 = 0$

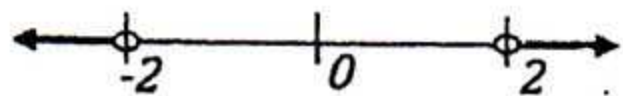
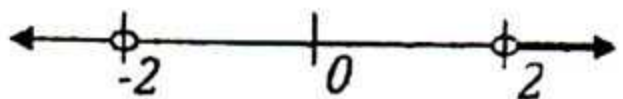
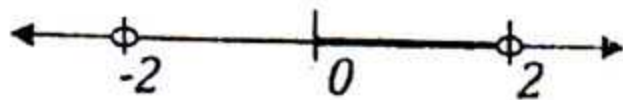
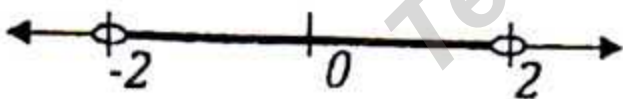
3. **★** What is the discriminant of the equation?

(a) 20 (b) 8
 (c) $2\sqrt{5}$ (d) $2\sqrt{2}$

4. **★** What is the nature of the roots of the equation?

(a) Real and irrational
 (b) Real and rational
 (c) Real and equal
 (d) Not real

5. Solution set in number line of $|x| > 2$ is—



6. Which one of the following points lies in the graph of $2x + 3y < 6$.

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

7. $A \subset B$ if and only if—

(a) $A \cap B = B$ (b) $A \cup B = A$
 (c) $B' \subset A'$ (d) $A \cap B' = \emptyset$

8. **★** In respect of equivalent of sets, for any three sets A, B and C—

i. $A \sim A$
 ii. If $A \sim B$ then $B \sim A$
 iii. If $A \sim B$ and $B \sim C$ then $A \sim C$.

Which one of the following is correct?

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

9. If $f(x) = x^2 + 1, x \in \mathbb{R}_+$ then $f^{-1}(x) = ?$

(a) $\pm\sqrt{x-1}, x \geq 1$ (b) $\frac{1}{x^2+1}, x \in \mathbb{R}$

(c) $\pm\frac{1}{\sqrt{x-1}}, x \neq 1$ (d) $\frac{1}{x^2+1}, x \neq 0$.

10. If $(x + a)$ is a factor of the polynomial $P(x)$ then—

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

11. **★** In any triangle—

i. intersecting point of the perpendicular bisectors of any two sides is the circumcenter
 ii. intersecting point of the perpendiculars drawn from each of the vertex to the opposite sides is the orthocenter
 iii. interesting point of the bisectors of any two angles is the centroid.

Which one of the following is correct?

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

12. General term of the sequence $1, \sqrt{3}, \sqrt{5}, \sqrt{7}, 3, \dots$ is—

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

13. What is the sum upto n-th term of the series : $a + ar + ar^2 + ar^3 + \dots$ where $r > 1$?

(a) ar^{n-1} (b) $a\frac{1-r^n}{1-r}$
 (c) $a\frac{r^n-1}{r-1}$ (d) $\frac{a}{r^n-1}$

Answer (14 – 15) on the basis of the infinite series : $\frac{1}{(2z+1)} + \frac{1}{(2z+1)^2} + \frac{1}{(2z+1)^3} + \dots$

14. The sum to infinity of the series exist if—

- (a) $\left| \frac{1}{2z+1} \right| > 1$ (b) $\left| \frac{1}{2z+1} \right| > 1$
 (c) $|2z+1| < 1$ (d) $|2z+1| > 1$

15. For $z = 1$, What is the sum to infinity?

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

16. ★ If $\operatorname{cosec} A = \sqrt{2}$, $\tan 2A = ?$

- (a) 0 (b) 1
 (c) $\sqrt{3}$ (d) undefined

17. In which quadrant (-330°) lie?

- (a) 1st (b) 2nd
 (c) 3rd (d) 4th

18. $\log_{\sqrt{a}} b \times \log_{\sqrt{b}} c \times \log_{\sqrt{c}} a = ?$

- (a) 0 (b) 1
 (c) 6 (d) 8

19. If $a > 0$, $a \neq 1$ and $b \neq 0$ then

- i. $\log_a b = x$ if and only if $a^x = b$.
 ii. $\log_a (a^x) = x$
 iii. $a^{\log_a b} = b$.

Which one of the following is correct?

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

Answer (20 – 21) according to the following information :

$$\begin{array}{cccccc}
 & & & & & 1 \\
 & & & & & 1 & 1 \\
 & & & & & 1 & 2 & 1 \\
 & & & & & 1 & 3 & 3 & 1 \\
 & & & & & 1 & 4 & 6 & 4 & 1 \\
 & & & & & 1 & 5 & 10 & 10 & 5 & 1
 \end{array}$$

20. What is the value of 'n' according to the triangle?

- (a) 5 (b) 6
 (c) 10 (d) 32

21. What is the co-efficient in 5th term?

- (a) -15 (b) 5
 (c) 15 (d) 405

22. What is the volume (in cc) of a pyramid whose height is 12 cm and base is a square of length 10 cm.

- (a) 1200 (b) 480
 (c) 400 (d) 360

23. It rained 6 days in October 2017. What is the probability that it will rain on 19 October 2018?

- (a) $\frac{31}{365}$ (b) $\frac{19}{31}$
 (c) $\frac{6}{365}$ (d) $\frac{6}{31}$

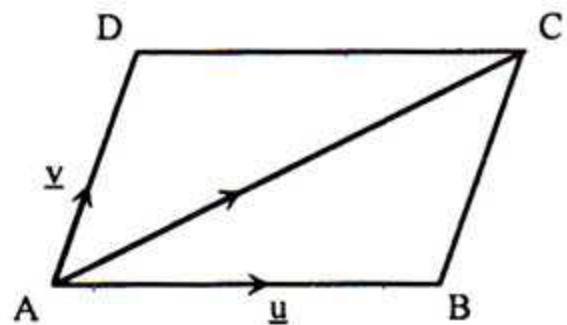
24. ★ $y = x$ is an equation of straight line which—

- i. passes through the origin
 ii. makes an angle 45° with x-axis
 iii. is equidistant from both the axes only in 1st quadrant.

Which one of the following is correct?

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

25. ★



In the parallelogram ABCD, $\vec{AC} = ?$

- (a) $\underline{u} - \underline{v}$ (b) $\underline{v} - \underline{u}$
 (c) $2\underline{u} + 2\underline{v}$ (d) $\underline{u} + \underline{v}$

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