Please check the examination details below before entering your candidate information

Candidate Name	Class	Section

BLOOM Mathematics Olympiad (BMO)

Question Paper 2023-24

Class 9

Total Questions: **50 + 5** (Tie-Breaking Section)

Total Time Allotted : 60 minutes	**Total Marks** 60

Instructions

1. There are **50 Multiple Choice Questions** in this booklet having 4 options out of which **ONLY ONE** is correct.
2. There are two sections in the Question Paper; Section 1 having 40 Questions carrying 1 Mark each & Section 2 having 10 Higher Difficulty Order Questions carrying 2 Marks each.
3. All questions are compulsory. There is **NO negative** marking for incorrect answers.
4. Total time allotted to complete the paper is 60 minutes.
5. Please fill in your details in the space provided on this page before attempting the paper.

OMR Sheet Instructions

1. Before starting the paper, fill in all the details in the OMR Sheet.
2. Additional 10 minutes will be provided to fill up the OMR sheet, before the start of the exam.
3. Use HB Pencil to darken the circle of the correct Option in OMR sheet. The correct way to darken the circle in OMR sheet is shown below.

   ● ○ ○ ○
4. Use black or blue ball point pen/HB pencil to fill the information in the OMR sheet. Partially filled OMR sheet will not be checked.
5. Return the OMR sheet to the invigilator after the exam.

CODE#1

M9

BLOOM CAP
Founded by | arihant

Section 1 (1 Mark)

1. If both $x = 2$ and $x = \frac{1}{2}$ are factor of $Px^2 + 5x + r$, then P is equal to

(a) $\frac{3}{4}r$ (b) $2r$

(c) $\frac{r}{2}$ (d) r

2. If α and β are the zeroes of the quadratic polynomial $f(x) = x^2 - 4x + 3$, then the value of $\alpha^3\beta^4 + \alpha^4\beta^3$ is

(a) 108 (b) 116

(c) 104 (d) 16

3. If $\frac{3+\sqrt{7}}{3-\sqrt{7}} = 8 + a\sqrt{7}$, then the value of a is equal to

(a) 2 (b) 5

(c) 3 (d) 6

4. The pair of equations $3^{x+y} = 81$ and $81^{x-y} = 3$ has

(a) no solution

(b) unique solution

(c) more than two solutions

(d) infinitely many solutions

5. If $\left[\left(\frac{x^2}{\sqrt{1+x^2}} + \frac{1}{\sqrt{1+x^2}}\right)^2\right]^2 = 1$, then the value of x is equal to

(a) 1 (b) – 1

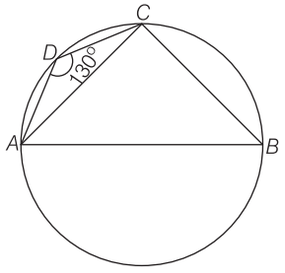
(c) 0 (d) None of these

6. The value of $2 + \frac{1}{2 + \frac{1}{2 + \ldots \infty}}$ is equal to

(a) $\sqrt{2}$ (b) $1 + 2\sqrt{2}$

(c) $1 + \sqrt{2}$ (d) $1 \pm \sqrt{2}$

7. In the given figure, $ABCD$ is a cyclic quadrilateral whose side AB is the diameter of the circle passing through A, B, C and D. If $\angle ADC = 130°$, then $\angle BAC$ is



(a) 40° (b) 60°

(c) 70° (d) 80°

8. In ΔABC, a line PQ parallel to BC cuts AB at P and AC at Q. If BQ bisect $\angle PQC$, then

(a) $BC = BQ$ (b) $BC = CQ$

(c) $BC \neq CQ$ (d) $BC \neq BQ$

9. In ΔABC, the bisectors of $\angle B$ and $\angle C$ of ΔABC intersect each other at point O, then $\angle BOC$ is

(a) 90° (b) $90° - \angle A$

(c) $90° + \frac{\angle A}{2}$ (d) $90° + \angle A$

10. P is the point (3, 5) and Q is the point (11, m^2). If sum of abscissas and ordinates of both points is equal, then the total number of possible value of m is

(a) 2 (b) 3

(c) 4 (d) – 6

11. If A and B are the centres of two intersecting circle, where C is the point of intersection of the two circle, then choose the correct option.

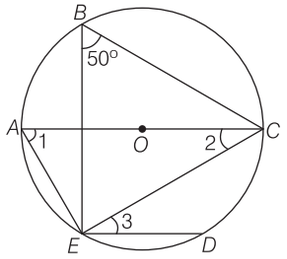
(a) $AB = BC = 2AC$ (b) $2AB = BC = AC$

(c) $AB = BC = AC$ (d) None of these

12. If $x = (4 + \sqrt{5})^{1/2} - (4 - \sqrt{5})^{1/2}$ and $y = (4 + \sqrt{5})^{1/2} + (4 - \sqrt{5})^{1/2}$. Then, the value of $(x^2 + y^2)^2$ is

(a) 225 (b) 324 (c) 400 (d) 256

13. The chord ED is parallel to the diameter AC as shown in the figure, then the value of $\angle CED$ is



(a) 40° (b) 60° (c) 50° (d) 90°

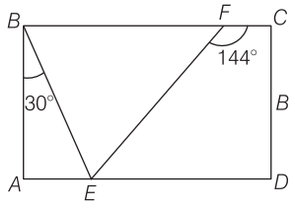
14. A double cone is formed by a complete revolution of the ΔABC about the side AB. The sides $BC = 6.5$ cm, $CA = 2$ cm and the perpendicular from C on $AB = 1.6$ cm. Then, the volume of the double cone is approximately

(a) 24 cm^3 (b) 25 cm^3 (c) 22 cm^3 (d) 20 cm^3

15. The value of $\left(\sqrt[6]{27} - \sqrt{6\frac{3}{4}}\right)^2$ is

(a) $\frac{3}{2}$ (b) $\frac{27}{4}$ (c) $\frac{3}{4}$ (d) 3

16. Rectangle $ABCD$, $\angle ABE = 30°$ and $\angle CFE = 144°$. Find the measure of $\angle BEF$.



(a) 84° (b) 36° (c) 96° (d) 74°

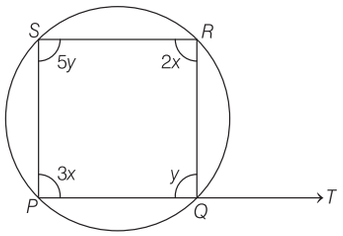
17. The largest sphere is curved out of a cube of side 9.5 cm. Then, the volume of the sphere is

(a) 448 cm^3 (b) 500 cm^3
(c) 449.10 cm^3 (d) 445.12 cm^3

18. The angle between two altitudes of a parallelogram through the vertex of an obtuse angle of the parallelogram is 60°. Then, the angle of the parallelogram is

(a) 60, 60 (b) 40, 140
(c) 60, 120 (d) 90, 90

19. In the given figure, $PQRS$ is a cyclic quadrilateral and PQT is a line, $\angle P = 3x$, $\angle R = 2x$, $\angle S = 5y$ and $\angle Q = y$. Then, x and $\angle RQT$ is



(a) $x = 36°$ and $\angle RQT = 150°$
(b) $x = 30°$ and $\angle RQT = 150°$
(c) $x = 36°$ and $\angle RQT = 30°$
(d) $x = 30°$ and $\angle RQT = 30°$

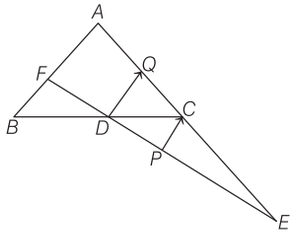
20. If $x = 1 + 5^{1/3} + 5^{2/3}$, then the value of $x^3 - 3x^2 - 12x + 6$ is

(a) 18 (b) 22 (c) 16 (d) 30

21. If $\frac{\sqrt{3}+1}{\sqrt{3}-1} - \frac{\sqrt{3}-1}{\sqrt{3}+1} = a + b\sqrt{3}$, then the value of a and b is

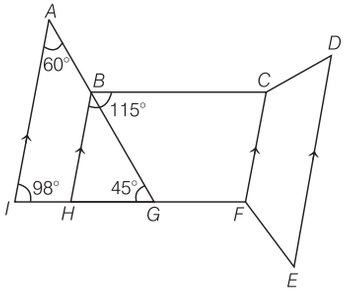
(a) $a = 0, b = 2$ (b) $a = 0, b = 1$
(c) $a = 4, b = 2$ (d) $a = 0, b = 4$

22. In ΔABC, the side AC is produced to E such that $CE = \frac{1}{2}AC$. If D is the mid-point of BC and ED produced meets AB at F and CP, DQ are drawn parallel to BA, then FD is



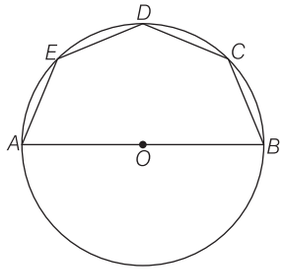
(a) $\frac{1}{2}FE$ (b) $\frac{1}{3}FE$ (c) FE (d) $\frac{1}{4}FE$

23. Study the figure shown here (not drawn to scale). If ABG is a straight line and $AI \parallel BH$, then find $\angle ABH$ and reflex $\angle ABC$, respectively.



(a) 110°, 220° (b) 120°, 225°
(c) 120°, 235° (d) 110°, 215°

24. In the given figure, AOB is the diameter of circle with centre O. Then, the value of $\angle AED + \angle BCD$ is

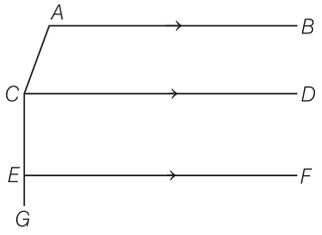


(a) 140° (b) 150° (c) 180° (d) 270°

25. In the given figure, $AB - BC = -1, BE - BD = 6$ and $DE - BD = -2$, if $AB = 4$, what is the length of CD?

(a) –3 (b) 2 (c) 3 (d) –1

26. In the given figure, $AB \parallel CD \parallel EF$. CE is joined and produced to G. If $\angle BAC = 130°$, $\angle ACE = 140°$, then find $\angle DCE$ and $\angle FEG$, respectively.



(a) 50°, 130° (b) 90°, 90°
(c) 140°, 40° (d) 45°, 135°

27. $OPQR$ is a rhombus, whose three vertices P, Q and R lie on the circle with centre O. If the radius of the circle is 14 cm, then the area of the rhombus is

(a) $98\ \text{cm}^2$ (b) $98\sqrt{3}\ \text{cm}^2$
(c) $196\ \text{cm}^2$ (d) $98\sqrt{7}\ \text{cm}^2$

28. The lengths of the sides of ΔABC are consecutive integers. If ΔABC has the same perimeter as an equilateral triangle with a side of length 9 cm, then find the area of ΔABC.

(a) $\frac{1}{4}\sqrt{231}\text{cm}^2$ (b) $\frac{9}{4}\sqrt{77}\ \text{cm}^2$
(c) $\frac{9}{4}\sqrt{231}\text{cm}^2$ (d) $\frac{1}{4}\sqrt{77}\ \text{cm}^2$

29. The value of l, so that y-$2p$ is a factor of $\frac{y^3}{4p^2} - 2y + lp$ is

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

30. The greatest number among $3^{50}, 4^{40}, 5^{30}, 6^{20}$ is

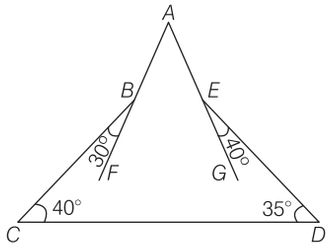
(a) 4^{40} (b) 3^{50} (c) 5^{30} (d) 6^{20}

31. Solve for the value of x and y

$$3^{2x} - 2^y = 77 \text{ and } 3^x - 2^{y/2} = 7$$

(a) $x = 2, y = 2$ (b) $x = 2, y = 4$
(c) $x = 4, y = 2$ (d) $x = 4, y = 4$

32. In the given figure, $\angle BCD = 40°$, $\angle EDC = 35°$, $\angle CBF = 30°$ and $\angle DEG = 40°$, then $\angle BAE$ is



(A) 30° (b) 40° (c) 35° (d) 45°

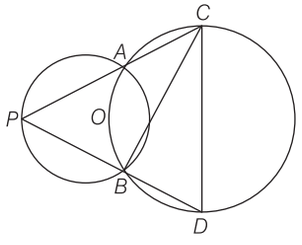
33. If $x^4 + \frac{1}{x^4} = 47$, then the value of $x^3 + \frac{1}{x^3}$ is

(a) 9 (b) 18 (c) 0 (d) 6

34. Let U be the upper class boundary of a class in a frequency distribution and M be the mid-point of the class. Which one of the following is the lower class boundary of the class?

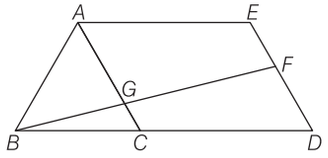
(a) $M + \frac{(M+L)}{2}$ (b) $L + \frac{M+L}{2}$
(c) $2M - U$ (d) $M - 2L$

35. In the given figure, the centre O of the smaller circle lies on the circumference of the bigger circle. If $\angle APB = 75°$ and $\angle BCD = 40°$. Then, $\angle AOB$ and $\angle ACB$, respectively.



(a) 150°, 30° (b) 75°. 30°
(c) 30°, 150° (d) 30°, 75°

36. In the given figure, ABC is an isosceles triangle in which $AB = AC$. $AEDC$ is a parallelogram. If $\angle CDF = 80°$ and $\angle BFE = 110°$, then $\angle FBA$ is



(a) 40° (b) 50°
(c) 60° (d) 70°

37. The value of K, if $(2, -3)$ is a solution of the equation $3x + Ky = -3$ and the coordinates of another point is not lying on its graph is

(a) $K = 3, (-1, 0)$

(b) $K = 3, \left(-\frac{1}{2}, -\frac{1}{2}\right)$

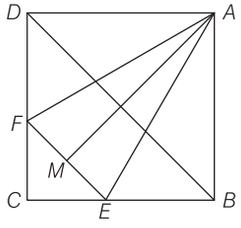
(c) $K = -3, (-1, -1)$

(d) $K = 3, (0, -1)$

38. The range of the data 15, 20, 6, 5, 30, 35, 92, 35, 90, 18, 82 is

(a) 88 (b) 87 (c) 92 (d) 90

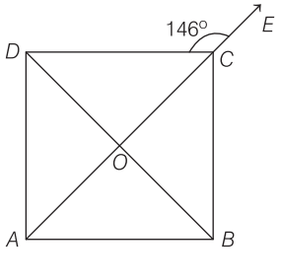
39. In the given figure, if $ABCD$ is a square and EF is parallel to diagonal BD and $EM = FM$, then which of the following is correct?



(a) $DF = \frac{1}{2} BE$ (b) $DF = \frac{1}{3} BE$

(c) $DF = BE$ (d) None of these

40. In the given figure, $ABCD$ is a rectangle in which diagonal AC is produced to E. If $\angle ECD = 146°$, then $\angle AOB$ is



(a) 146° (b) 112° (c) 120° (d) 102°

Section 2 (2 Marks)

41. Match the following lists, if $\sqrt{2} = 1.414$, $\sqrt{3} = 1.732$, $\sqrt{5} = 2.236$ and $\pi = 3.141$.

	List I		List II
(P)	$\frac{2}{\sqrt{5} - \sqrt{3}}$	(1)	4.357
(Q)	$\frac{\pi}{2} + \frac{3}{\sqrt{5}}$	(2)	3.968
(R)	$\frac{1}{2\sqrt{5} - 3\sqrt{2}}$	(3)	2.912
(S)	$\pi + \frac{1}{\sqrt{2}}$	(4)	3.848

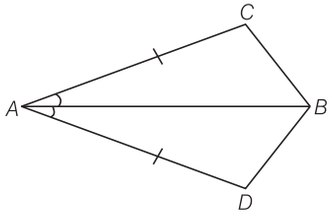
(a) P-1, Q-2, R-3, S-4 (b) P-2, Q-3, R-1, S-4
(c) P-3, Q-1, R-2, S-4 (d) P-4, Q-1, R-2, S-3

42. **Assertion** (A) In a cyclic quadrilateral $ABCD$, $\angle A - \angle C = 120°$, then the larger angle of two is 120°.

Reason (R) Opposite angles of cyclic quadrilateral are supplementary.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is the not correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

43. **Assertion** (A) In a quadrilateral $ACBD$, $AC = AD$ and AB bisects $\angle A$ (see figure) by SAS congruence criteria.



Reason (R) Two triangles are congruent if two sides and the included angle of one triangle is equal to the corresponding two sides and included angle of the other.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is the not correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

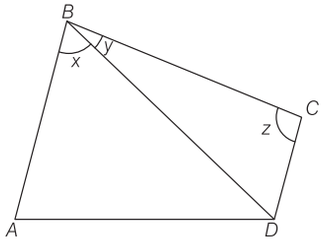
44. **Assertion** (A) The expression $3x^4 - 4x^{3/2} + x^2 = 2$ is not a polynomial because the term $-4x^{3/2}$ contains a rational power of x.

Reason (R) The highest exponent in various terms of an algebraic expression in one variable is called its degree.

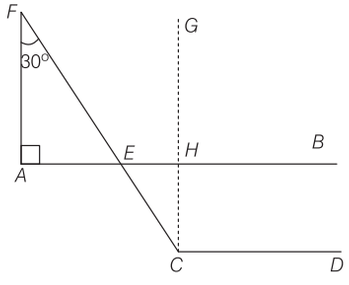
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is the not correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

45. Which of the following option is correct?

Statement I In the given figure, $AB \parallel DC$. If $x = \frac{4}{3}y$ and $y = \frac{3}{8}z$. Then, the value of $x = 48°$, $y = 36°$ and $z = 96°$.

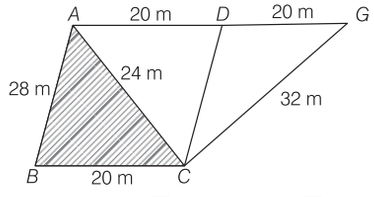


Statement II In the given figure, $AB \parallel CD$ and $\angle F = 30°$. Then, $\angle ECD = 100°$.



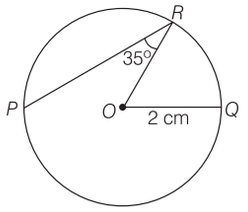
	I	II		I	II
(a)	T	T	(b)	F	F
(c)	T	F	(d)	F	T

46. The ratio of the shaded area to the area of the quadrilateral $ABCD$ is



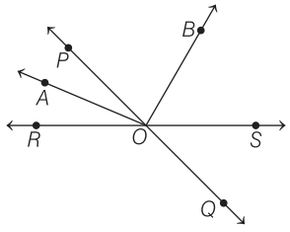
(a) $\frac{\sqrt{6}}{2}$ (b) $\frac{\sqrt{6}}{2-\sqrt{6}}$ (c) $\frac{\sqrt{6}}{2+\sqrt{6}}$ (d) $\frac{2+\sqrt{6}}{6}$

47. In the given figure, O is the centre of circle. Distance between P and Q is 4 cm. Then, the $(\angle ROQ)^2$ is



(a) 4900 (b) 8100
(c) 2500 (d) 6400

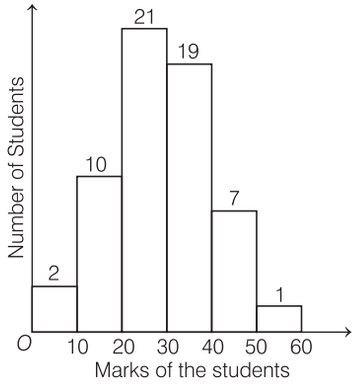
48. In the given figure, lines PQ and RS intersect each other at point O, ray OA and OB bisect $\angle POR$ and $\angle POS$, respectively. If $\angle POA : \angle POB = 2 : 7$, then $\angle SOQ : \angle BOQ$ is



(a) $\frac{3}{11}$ (b) $\frac{2}{11}$ (c) $\frac{4}{11}$ (d) $\frac{5}{11}$

Directions (Q. Nos. 49-50) Read the passage carefully and answer the following questions.

Amit is a Mathematics teacher in Jaipur. After periodic test 3, he asks students to collect the Mathematics marks of all the students of class IX-A, B and C. A student is able to collect marks from some students. Asha scored least mark 6 in the class and Ram scored highest marks 59 in the class. He prepares the frequency distribution table using the collected marks and draws histogram using the table as shown in adjoining figure.



On the basis of above information, answer the following questions.

49. How many students scored 50% and below marks?

(a) 30 (b) 27 (c) 33 (d) 35

50. What is the ratio of the student who scored more than 30 and less than 20 respectively?

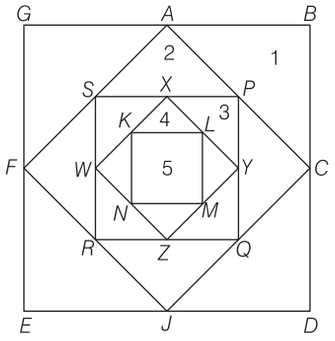
(a) $\frac{4}{9}$ (b) $\frac{9}{4}$ (c) $\frac{5}{9}$ (d) $\frac{9}{5}$

Tie-Breaking Section

Instructions

1. This section consists of 5 Questions.
2. The score achieved in this section will not be included in the total marks.
3. If overall marks of two or more students are same, winner will be decided based on the score in this section.
4. Participation in this section is optional, and students may choose to attempt it or not.

1. In the given figure, square 2 is formed by joining the mid-points of square 1, square 3 is formed by joining the mid-points of square 2 and so on. So total five squares are drawn. The side of the square 1 is a cm. What is the sum of perimeters of all the five squares?



(a) $7a + 3\sqrt{2}a$

(b) $7a - 3\sqrt{2}a$

(c) $\sqrt{4}a + 2a$

(d) None of the above

2. Let A and B be two solid spheres such that surface area of B is 300% higher than the surface area of A. The volume of A is found to be K% lower than the volume of B. The value of K must be

(a) 85.5 (b) 92.5

(c) 90.5 (d) 87.5

3. Let P, Q, R and S are four points on the circumference of a circle of radius r, such that PQR is an equilateral triangle and PS is a diameter of the circle. What is the perimeter of the quadrilateral $PQSR$?

(a) $2r\,(1+\sqrt{3})$ (b) $2r + \sqrt{3}$

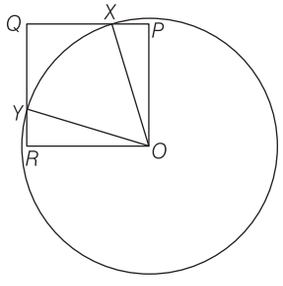
(c) $r\,(1+\sqrt{3})$ (d) None of these

4. Simplify $\dfrac{99741 \times 99743 + 1}{(99742)^2}$

(a) 1 (b) 2

(c) 3 (d) 4

5. In the given figure, $OPQR$ is a square. A circle drawn with centre O and cut the square at X and Y. Then, which of the following option is true?



(a) $OY = \dfrac{1}{3}QY$ (b) $QX = 4QY$

(c) $QX = QY$ (d) $QX = 2QY$