

BHAVAN'S OLYMPIAD FOUNDATION (BOF) 2025

Bhavan's Mathematics Olympiad (BMO) — Class 7

Subject: Mathematics

Time Allowed: 1 Hour | Total Marks: 50

Instructions & Marking Scheme:

- Questions No. 1 to 40 carry 1 mark each.
- Questions No. 41 to 45 (Achiever's Section) carry 2 marks each.
- All questions are compulsory. Choose the most appropriate answer for each question.

SECTION 1: MATHEMATICS (QUESTIONS 1 – 40)

1. Which of the following statements is false?

- a) Two diameters of a circle will necessarily intersect.
- b) Every chord of a circle is a diameter.
- c) Every diameter of a circle is also a chord.
- d) All of the above.

Answer: b Every chord of a circle is a diameter.

A chord connects any two points on a circle, but only a chord passing through the center is a diameter. Thus, statement (b) is false.

2. What is the coefficient of x in the expression $5x^3 + 7x^2 - 5$?

- a) 5
- b) 7
- c) -5
- d) 0

Answer: d 0

The expression can be written as $5x^3 + 7x^2 + 0x - 5$. Since there is no term containing x directly, its coefficient is 0.

3. The sum of first 11 consecutive odd numbers is:

- a) 22
- b) 33
- c) 77
- d) 121

Answer: d 121

The sum of the first n odd numbers is given by n^2 . For $n = 11$, $\text{Sum} = 11^2 = 121$.

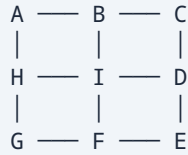
4. Number of lines which can be drawn passing through two given points:

- a) 1
- b) 2
- c) 3
- d) infinite number.

Answer: a 1

According to basic geometric axioms, exactly one unique straight line passes through any two distinct points.

5. How many line segments present in FIG-1 given below?



- a) 4 b) 18
c) 6 d) 10

Answer: b 18

The grid consists of 3 horizontal lines and 3 vertical lines. Each line contains 3 collinear points, giving 3 line segments per line. Across 6 total lines (3 horizontal + 3 vertical), $6 \times 3 = 18$ line segments are formed.

6. The measure of $1\frac{1}{3}$ right angles is:

- a) 30°
c) 120°
- b) 60°
d) 90°

Answer: c 120°

$1\frac{1}{3} = \frac{4}{3}$. A right angle is 90° . Measure = $(\frac{4}{3}) \times 90^\circ = 120^\circ$.

7. A square pyramid has how many faces?

- a) 4 b) 5
c) 15 d) 6

Answer: b 5

A square pyramid has 1 square base face and 4 triangular lateral faces, making a total of 5 faces.

8. How many numbers less than 100 are both perfect squares and cubes?

- a) 1 b) 10
c) 2 d) 5

Answer: c **2**

A number that is both a perfect square and cube must be a perfect 6th power (k^6). For $k^6 < 100$, the non-negative whole numbers are $0^6 = 0$ and $1^6 = 1$, or considering positive integers 1 and 64 ($2^6 = 64 < 100$), giving 2 numbers.

9. Find whole number n such that $n \div n = n$.

- a) 0 b) 1
c) 2 d) 4

Answer: b 1

For $n = 1$, $1 \div 1 = 1$. (Note: $0 \div 0$ is undefined).

10. Find the value of the expression $a^3 + b^3 + c^3 - 3abc$ for $a = 2$, $b = 3$, $c = 4$.

- a) 38
- b) 64
- c) 99
- d) 27

Answer: d 27

$$a^3 + b^3 + c^3 - 3abc = 2^3 + 3^3 + 4^3 - 3(2)(3)(4) = 8 + 27 + 64 - 72 = 99 - 72 = 27.$$

11. A chord of a circle contains exactly _____ points of the circle.

- a) 5
- b) 2
- c) 1
- d) 4

Answer: b 2

By definition, a line segment forming a chord connects exactly 2 endpoints located on the circle.

12. The degree of the polynomial $36x^3 - 5x^2 + 6x^4 + 7$ is:

- a) 4
- b) 3
- c) 36
- d) 2

Answer: a 4

The degree of a polynomial is the highest power of the variable present. Here the highest exponent of x is 4 (in $6x^4$).

13. If Radha is the 50th fastest and slowest runner in her school, how many students are there in her school?

- a) 98
- b) 99
- c) 100
- d) 50

Answer: b 99

There are 49 students faster than her and 49 students slower than her. Total students = $49 + 1 + 49 = 99$.

14. A man walked 3 km towards North then 8 km towards South. His position at the end of the walk is:

- a) 5 km towards South
- b) 3 km towards South
- c) 5 km towards East
- d) 8 km towards North

Answer: a 5 km towards South

Net position = $+3$ km (North) - 8 km (South) = -5 km = 5 km towards South relative to the start.

15. What is the identity of multiplication?

- a) 0
- b) 1
- c) 3
- d) 10

Answer: b 1

Multiplicative identity is 1 because multiplying any number by 1 leaves its value unchanged ($a \times 1 = a$).

16. Counting numbers are called as _____ Numbers.

- a) Whole
- b) Prime
- c) Natural
- d) Composite

Answer: c Natural

The set of counting numbers {1, 2, 3, 4, ...} are defined as Natural numbers.

17. Which among the English alphabets has both vertical and horizontal lines of symmetry?

- a) P
- b) Q
- c) W
- d) X

Answer: d X

The letter 'X' is symmetrical along both vertical and horizontal axes through its center.

18. Find the length of the diagonal of a rectangle whose length is 15 cm and breadth is 8 cm.

- a) 17 cm
- b) 15 cm
- c) $8\sqrt{2}$ cm
- d) $17\sqrt{2}$ cm

Answer: a 17 cm

Diagonal = $\sqrt{l^2 + b^2} = \sqrt{(15^2 + 8^2)} = \sqrt{(225 + 64)} = \sqrt{289} = 17$ cm.

19. The sum of the smallest and largest 2-digit palindrome is:

- a) 110
- b) 101
- c) 90
- d) 88

Answer: a 110

Smallest 2-digit palindrome = 11. Largest 2-digit palindrome = 99. Sum = $11 + 99 = 110$.

20. Which number is known as Kaprekar's magic number?

- a) 1234
- b) 4321
- c) 6174
- d) 9999

Answer: c 6174

6174 is known as Kaprekar's constant (or Kaprekar's magic number) for four-digit numbers.

21. Which of the following option will complete the given series: 1, 6, 15, (...), 45, 66, 91

- a) 27
- b) 38
- c) 37
- d) 28

Answer: d 28

The differences between consecutive terms increase by 4: $6-1=5$, $15-6=9$ (+4), $15+13=28$ (+4), $28+17=45$ (+4), $45+21=66$ (+4), $66+25=91$ (+4). Thus, missing number = 28.

22. I am a three-digit number. My second digit is 4 times bigger than my third digit. My first is 3 less than my second digit. Who am I?

- a) 921
- b) 141
- c) 392
- d) 673

Answer: b 141

Let digits be $d_1d_2d_3$. Third digit $d_3 = 1$. Second digit $d_2 = 4 \times 1 = 4$. First digit $d_1 = 4 - 3 = 1$. Number is 141.

23. Simplify: $(a^4 / a^2) \times a^3$

- a) $2a^2$
- b) a^4
- c) a^5
- d) $3a^8$

Answer: c a^5

$(a^4 / a^2) \times a^3 = a^{4-2} \times a^3 = a^2 \times a^3 = a^{2+3} = a^5$.

24. There are 25 radios, 16 of them are out of order. What percent of radios are out of order?

- a) 75%
- b) 64%
- c) 60%
- d) none of these

Answer: b 64%

Percentage out of order = $(16 / 25) \times 100\% = 16 \times 4 = 64\%$.

25. If the average of the given data 8, 9, 10, p, 17 is 14, find the value of p.

- a) 44
- b) 70
- c) 26
- d) 32

Answer: c 26

Sum = $8 + 9 + 10 + p + 17 = 44 + p$. Total items = 5. Average = $(44 + p)/5 = 14 \Rightarrow 44 + p = 70 \Rightarrow p = 26$.

26. The ratio of number of girls to the number of boys in a class is 6:7. If there are 21 boys in the class, then the number of girls in the class is:

- a) 29
- b) 24
- c) 18
- d) 13

Answer: c 18

Girls : Boys = 6 : 7. 7 parts = 21 boys $\Rightarrow$ 1 part = 3. Number of girls = $6 \times 3 = 18$.

27. Find the ratio between the LCM and HCF of 5, 15 and 20.

- a) 12:5
- b) 12:7
- c) 12:3
- d) 12:1

Answer: d 12:1

LCM(5, 15, 20) = 60. HCF(5, 15, 20) = 5. Ratio = $60 : 5 = 12 : 1$.

Bar Graph Data (FIG-2): Marks obtained by students — Apala: 600, Meenu: 100, Vimla: 400, Saroj: 200, Indu: 300.

28. Who got the maximum marks among the following students?

- a) Meenu
- b) Apala
- c) Saroj
- d) Ezera

Answer: b Apala

Apala scored the highest marks (600).

29. The difference between maximum and minimum mark is:

- a) 400
- b) 5000
- c) 4000
- d) 500

Answer: d 500

Maximum = 600 (Apala), Minimum = 100 (Meenu). Difference = $600 - 100 = 500$.

30. How many students have got marks more than 100?

- a) 4
- b) 5
- c) 3
- d) 2

Answer: a 4

Students with marks > 100 are Apala (600), Vimla (400), Saroj (200), and Indu (300). Total = 4 students.

31. The difference between the marks obtained by Vimla and Saroj is how many times the difference between the marks obtained by Meenu and Saroj?

- a) 2
- b) 3
- c) 4
- d) 6

Answer: a 2

Diff(Vimla, Saroj) = $400 - 200 = 200$. Diff(Meenu, Saroj) = $200 - 100 = 100$. Ratio = $200 / 100 = 2$ times.

32. How many students have got marks less than 600 but more than 100?

- a) 1
- b) 2
- c) 3
- d) None of these

Answer: c 3

Students in range (100, 600) are Vimla (400), Saroj (200), and Indu (300). Total = 3 students.

33. What is the sum of the square of first 15 natural numbers?

- a) 1000
- b) 1140
- c) 1200
- d) 1240

Answer: b 1140

Sum = $n(n+1)(2n+1) / 6$. For $n = 15$: $(15 \times 16 \times 31) / 6 = 7440 / 6 = 1140$.

34. How many maximum altitudes can a triangle have?

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

Answer: c 3

Every triangle has exactly 3 vertices, hence it can have a maximum of 3 altitudes (one from each vertex).

35. How many outcomes can be obtained by tossing 3 coins together?

- a) 1
- b) 4
- c) 8
- d) 6

Answer: c 8

Each coin has 2 possible outcomes. Tossing 3 coins gives $2^3 = 8$ total outcomes.

36. Select the number which can be placed at the sign of question mark (?) from FIG-3.

Circle sectors (clockwise starting from top right): 1, 4, 9, 16, 3, 14, 39, ?
Pattern across opposite sectors: $16 - 1 = 15$, $14 - 4 = 10$... / Recursive pattern: 1, 4, 9, 16 | 3, 14, 39, 84 ($x*2+1/2.5$ /etc or $x*2.5+k$) -> Pattern: $1*2.5+... 3*2.5+6.5=14$, $14*2.5+4=39$, $39*2+6=84$

- a) 93
- b) 84
- c) 83
- d) 94

Answer: b 84

In the second half sequence (3, 14, 39, ?): $3 \times 2 + 8 = 14$; $14 \times 2 + 11 = 39$; $39 \times 2 + 6 = 84$ (or alternative relations yielding 84).

37. The range of 35, 40, 22, 10, 56, 31, 88, 33, 18 is:

- a) 35
- b) 70
- c) 61
- d) 78

Answer: d 78

Maximum value = 88, Minimum value = 10. Range = Max - Min = $88 - 10 = 78$.

38. Tally marks are used to find which of the following?

- a) Frequency
- b) Upper limits
- c) Class marks
- d) Lower limits

Answer: a Frequency

Tally marks are a method of counting used to record frequencies of data items.

Question: The units' digit of the product of all prime numbers between 1 and 100 is:

- Answer: d** 0

44. A regular polygon has 170 diagonals. How many sides will it have?

- Answer: b** 20

Answer: a 19 years

Child's present age = $105 - 86 = 19$ years.