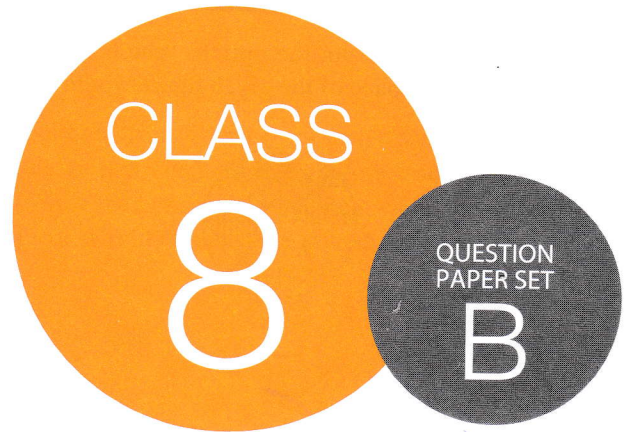


**SOF INTERNATIONAL
MATHEMATICS OLYMPIAD
2023-24**



DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Total Questions: 50 | Time: 1 hr.

Guidelines for the Candidate

- You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
- Write your **Name, School Code, Class, Section, Roll No.** and **Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
- The Question Paper comprises four sections:
Logical Reasoning (15 Questions), **Mathematical Reasoning** (20 Questions), **Everyday Mathematics** (10 Questions) and **Achievers Section** (5 Questions)
 Each question in Achievers Section carries 3 marks, whereas all other questions carry one mark each.
- All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
- There is only ONE correct answer. Choose only ONE option for an answer.
- To mark your choice of answers by darkening the circles on the OMR Sheet, use **HB Pencil** or **Blue / Black ball point pen** only. E.g.
 Q.16: Rahul bought 4 kg 90 g of apples, 2 kg 60 g of grapes and 5 kg 300 g of mangoes. The total weight of all the fruits he bought is _____.
 A. 11.450 kg B. 11.000 kg C. 11.350 kg D. 11.250 kg
 As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet.
- Rough work should be done in the blank space provided in the booklet.
- Return the OMR Sheet to the invigilator at the end of the exam.
- Please fill in your personal details in the space provided before attempting the paper.



Name:.....

SOF Olympiad Roll No.:..... Contact No.:.....



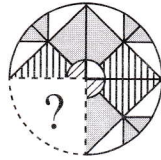
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LOGICAL REASONING

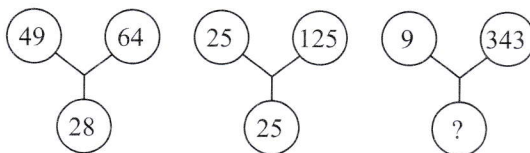
1. Select a figure from the options which when placed in the blank space of the given figure would complete the pattern.



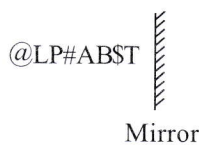
- A.
- B.
- C.
- D.

2. Neha travels 4 km towards East. Then she turns right and travels 6 km. After this, she turns left and travels 2 km. Finally, she turns right and travels 2 km again to reach a playground. How far and in which direction is she now from her starting point?
- A. 10 km, South-East
 B. 8 km, North-West
 C. 10 km, East
 D. 8 km, South-West

3. Find the missing number, if same rule is followed in all the three figures.



- A. 12
 B. 21
 C. 10
 D. 15
4. Select the correct mirror image of the given combination of letters and symbols.



- A. @LP#AB\$T

- B. L\$B#V#P\$T@
 C. T\$P#B\$T@
 D. @Lb#AB\$L

5. In the following question, two rows of numbers are given. The resultant number in each row is to be worked out separately. Based on the following rules the question below the rows of numbers is to be answered. The operations on the numbers progress from left to right.

Rules :

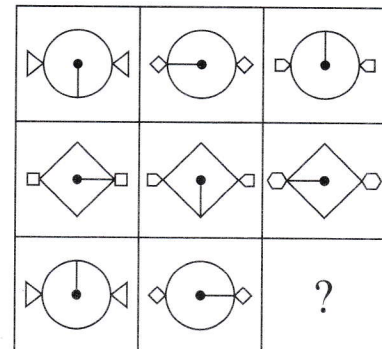
- (i) If a composite odd number is followed by a prime number, then the odd number is to be divided by the prime number.
- (ii) If an even number is followed by an odd number, then both are to be added.
- (iii) If an even number is followed by another even number, then both are to be multiplied.
- (iv) If an odd prime number is followed by an even prime number, then the first number is to be subtracted from the second number.

15 5 2
4 11 3

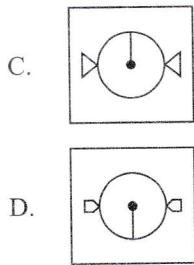
What is the sum of resultants of first and second rows?

- A. 15
 B. 4
 C. 20
 D. 17

6. Select a figure from the options which completes the given figure matrix.



- A.
- B.



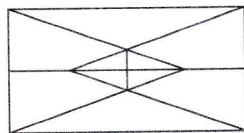
7. In a family, G is the father of K and V is the brother of K. S is the mother of V and daughter of H. How is G related to H?

- A. Son
- B. Father
- C. Son-in-law
- D. Father-in-law

8. If '*' stands for '+', '^' stands for '÷', '%' stands for '×' and '∨' stands for '-', then the value of $25 * 72 \wedge 12 \% 3 \vee 11$ is

- A. 54
- B. 32
- C. 22
- D. 38

9. Find the number of triangles formed in the given figure.

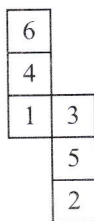


- A. 12
- B. 13
- C. 14
- D. More than 14

10. In a certain code language, 'sun rise sunday' means 'pin tic sip', 'east or west' means 'kim din zip' and 'sun direction east' means 'tic kim bin'. Which of the following means 'direction' in that language?

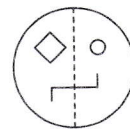
- A. tic
- B. pin
- C. din
- D. bin

11. Which of the following number lies on the face opposite to the face having 4, when the given sheet is folded to form a cube?



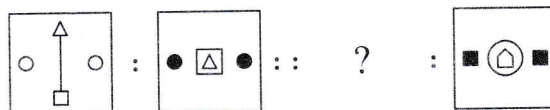
- A. 5
- B. 3
- C. 2
- D. 6

12. A circular transparent sheet with a pattern and a dotted line on it is given. Select a figure from the options as to how the pattern would appear when the transparent sheet is folded along the dotted line.



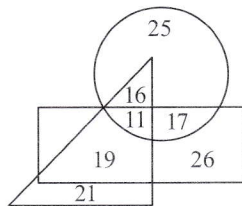
- A.
- B.
- C.
- D.

13. There is a certain relationship between the pair of figures on the either side of ::. Identify the relationship between the given pair and find the missing figure.



- A.
- B.
- C.
- D.

14. In the given Venn diagram, rectangle represents female students, triangle represents students studying in a government school and circle represents students who want to become an engineer. Which of the following numbers will represent male students who are studying in a government school and want to become an engineer?



A. 19

- B. 17
C. 16
D. 11

15. P, Q, R, S, T and U are six teachers sitting around a circular table facing the centre. P is sitting second to the left of R. T is sitting between U and S. R is sitting third to the right of S. Who is sitting between U and Q?

- A. R
B. P
C. S
D. None of these

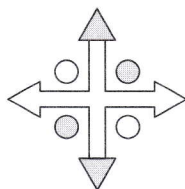
MATHEMATICAL REASONING

16. $\left(\frac{-5}{7}\right)^{3/4}$ when divided by $\left(\frac{-5}{7}\right)^{7/6}$ becomes $\left(\frac{-5}{7}\right)^{7-x}$, then find the value of x .

- A. $\frac{7}{12}$
B. $\frac{89}{12}$
C. $\frac{-5}{12}$
D. None of these

17. The cube root of x varies inversely as the square of y . If $x = 8$, when $y = 3$, then find x when $y = 1\frac{1}{2}$.
- A. 512
B. 64
C. 87
D. 121

18. Find the sum of number of lines of symmetry and order of rotational symmetry in the given figure.



- A. 0
B. 2
C. 4
D. 3

19. Which of the following statements is correct?

A. The diagonals of a parallelogram are equal.

- B. The diagonals of a rectangle are perpendicular to each other.
C. If the diagonals of a quadrilateral intersect at right angles, it is not necessarily a rhombus.
D. Every quadrilateral is either a trapezium or a parallelogram or a kite.

20. The smallest number with which 120 should be multiplied, so that the product becomes a perfect square is _____.

- A. 60
B. 30
C. 45
D. 50

21. Find the additive inverse of $\{(-78) \div (-13)\} \div (-2)$.

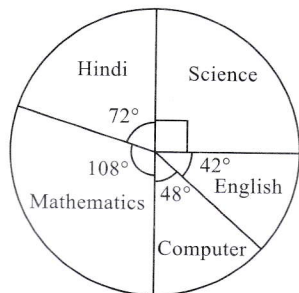
- A. -2
B. $\frac{1}{3}$
C. 2
D. 3

22. If $x + \frac{1}{2 + \frac{1}{2 + \frac{1}{2 - \frac{1}{2}}}} = 2$, then find the value of x .

- A. $\frac{30}{19}$
B. $\frac{7}{18}$
C. $\frac{18}{7}$
D. $\frac{19}{30}$

Direction (23-24): The given pie chart shows the number of students liked different subjects. Study the pie chart carefully and answer the following questions.

Total number of students = 1080



23. How many more students liked Mathematics and Computer together than Science?

- A. 198
- B. 252
- C. 157
- D. 310

24. What percent of total students like English?

- A. $7\frac{5}{8}\%$
- B. $3\frac{2}{5}\%$
- C. $11\frac{2}{3}\%$
- D. None of these

25. Difference of two perfect cubes is 631. If the larger number is 1 more than the smaller number, then find the two numbers.

- A. 15, 14
- B. 15, 16
- C. 20, 21
- D. 8, 9

26. If the mean of 6 observations: $x, x + 2, x + 4, x + 6, x + 8, x + 10$ is 30, then find the mean of three greatest observations.

- A. 41
- B. 33
- C. 37
- D. None of these

27. The cost of painting the whole surface area of a cube at the rate of ₹ 13 per cm^2 is ₹ 343.98. Then, the volume of the cube is

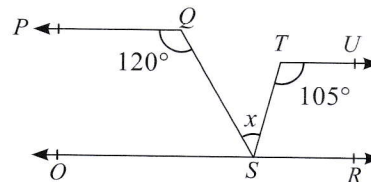
- A. 6859 cm^3
- B. 8000 cm^3
- C. 9.261 cm^3
- D. 10.648 cm^3

28. The coefficient of p^3 in the given expression is

$$3p(p^2 - p) - 3p^2(p^3 + 2p) - 2(p^3 - 3p)$$

- A. -3
- B. 6
- C. 5
- D. -5

29. In the given figure (not drawn to scale), $PQ \parallel OR$ and $TU \parallel OR$. If $\angle PQS = 120^\circ$ and $\angle STU = 105^\circ$, then find the value of x .



- A. 45°
- B. 60°
- C. 35°
- D. 50°

30. Simplify : $\left(9y^2 - 4xy + \frac{4x^2}{9}\right) \div \left(3y - \frac{2x}{3}\right)$

- A. $3y - \frac{2x}{3}$
- B. $3y + \frac{2x}{3}$
- C. $2y - \frac{3x}{2}$
- D. $2y + \frac{3x}{2}$

31. For which of the following values of x , $\frac{13+x}{x-2}$ is not a rational number?

- A. -2
- B. 3
- C. 2
- D. -3

32. The solution of which of the following equations is a perfect square?

- A. $5x - 7 = 2x + 8$
- B. $5x + 21 = 2(x + 21)$
- C. $5\left(x - \frac{4}{5}\right) = 4x$
- D. None of these

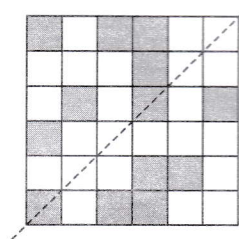
33. At what percentage above the C.P. must an article be marked, so as to gain 52% after allowing a customer, a discount of 5%?

- A. 45%
- B. 35%
- C. 50%
- D. 60%

34. A number x is 52% of the another number y . If the sum of these two numbers is 57% of 800, then y is equal to ____.

- A. 300
- B. 512
- C. 156
- D. 148

35. How many more squares must be shaded to make the given figure symmetrical along the dotted line?



- A. 7
- B. 4
- C. 5
- D. 6

EVERYDAY MATHEMATICS

36. A P.T. teacher wants to arrange maximum possible number of 6000 students in a field such that the number of rows is equal to the number of columns. Find the number of rows, if 71 students were left out after the arrangement.

- A. 77
- B. 87
- C. 76
- D. 78

37. The thickness of a hollow metallic cylinder is 2 cm. It is 70 cm long with outer radius of 14 cm. Find the volume of the metal used in making the cylinder, assuming that it is open at both the ends. Also find its weight, if the metal weighs 8 g per cm^3 .

- A. 10440 cm^3 , 91250 g
- B. 13440 cm^3 , 90000 g
- C. 11440 cm^3 , 91520 g
- D. 12440 cm^3 , 91550 g

38. Sumit bought rice worth ₹ 750 and spent ₹ 50 on transport and packing. He sold three-fourths of it at a loss of 10% and the remaining at a gain of 10%. Find his gain or loss on the whole transaction.

- A. ₹55, loss
- B. ₹40, loss
- C. ₹60, gain
- D. ₹35, gain

39. Six years ago, the ratio of the ages of Kunal and Sagar was 6 : 5. Four years hence, the ratio of their ages will be 11 : 10. What is the present age of Sagar?

- A. 18 years
- B. 16 years

- C. 15 years
- D. 14 years

40. Three pipes A, B and C can fill a cistern in 35 minutes. After working together for 14 minutes, C is closed and A and B fill the cistern in 42 minutes. Find the time in which cistern can be filled by pipe C alone.

- A. 1 hour 30 minutes
- B. 1 hour 25 minutes
- C. 1 hour 20 minutes
- D. 1 hour 10 minutes

41. The weight of one bacteria is (7.54×10^{-4}) kg and weight of other bacteria is (3×10^{-5}) kg. Find the total weight of both the bacteria in standard form.

- A. 7.84×10^{-5} kg
- B. 7.84×10^{-3} kg
- C. 78.4×10^{-5} kg
- D. 7.84×10^{-4} kg

42. $\frac{3}{4}$ part of a tank is full of water. When 30 litres of water is taken out, the tank becomes empty. What is the capacity of the tank?

- A. 36 litres
- B. 42 litres
- C. 40 litres
- D. 38 litres

43. In a company, the average salary of male employees is ₹ 8200 and that of female employees is ₹ 7200. If the average salary per employee is ₹ 7900, then the percentage of female employees of the total employees is _____.

- A. 30 %
- B. 40 %
- C. 50 %
- D. 25 %

44. To collect rain water, Mini made a cubical tank which can hold 91125 m^3 water. She uses this water for watering the plants of her garden. What is the height of the tank?
- A. 50 m
 - B. 25 m

- C. 45 m
- D. 40 m

45. Arun purchased a motorcycle for ₹ 54000. The value of motorcycle depreciating 10%, 15% and 20% in three consecutive years. What will be the value after 3 years?
- A. ₹ 33048
 - B. ₹ 38058
 - C. ₹ 23088
 - D. ₹ 43068

ACHIEVERS SECTION

46. Find the value of $p : q$, where

$$p = \left(\frac{z^m}{z^n}\right)^{m+n-l} \times \left(\frac{z^n}{z^l}\right)^{n+l-m} \times \left(\frac{z^l}{z^m}\right)^{l+m-n},$$

where l, m, n being different values and

$$q = \left(x^{\frac{1}{a-b}}\right)^{\frac{1}{a-c}} \times \left(x^{\frac{1}{b-c}}\right)^{\frac{1}{b-a}} \times \left(x^{\frac{1}{c-a}}\right)^{\frac{1}{c-b}},$$

where a, b, c being different values.

- A. 1 : 3
 - B. 1 : 1
 - C. 2 : 3
 - D. None of these
47. Read the given statements carefully and select the correct option.

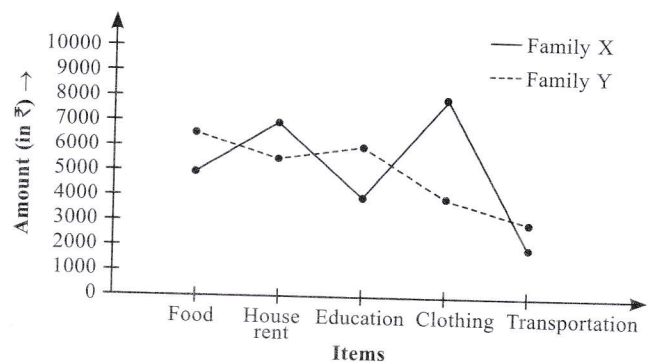
Statement-I : Twenty-two men can complete a piece of work in 17 days. If they worked for 2 days, then the number of more men should now be employed so as to complete the work in another 10 days, is 11.

Statement-II : In a camp, 95 men had provisions of food for 200 days. If after 5 days, 30 men left the camp, then the remaining food last for 250 days.

- A. Both Statement-I and Statement-II are true.
 - B. Both Statement-I and Statement-II are false.
 - C. Statement-I is true but Statement-II is false.
 - D. Statement-I is false but Statement-II is true.
48. Solve the following:
- (i) The total surface area of a rectangular block is 11700 cm^2 . If length, breadth and height of the block are in the ratio 4 : 2 : 3, then find the length of the block.
 - (ii) How many coins of radius 0.75 cm and thickness 0.2 cm are to be melted to make a right circular cylinder of height 8 cm and base radius 3 cm?
- | | |
|----------|------|
| (i) | (ii) |
| A. 45 cm | 640 |
| B. 60 cm | 640 |
| C. 30 cm | 320 |
| D. 50 cm | 280 |

49. Fill in the blanks and select the correct option.
- (i) The least number by which 648 be multiplied to make it a perfect cube is _____.
 - (ii) The cube of an odd number is _____.
 - (iii) The least number by which 3087 be divided to make it a perfect cube is _____.
- | | | |
|------|------|-------|
| (i) | (ii) | (iii) |
| A. 3 | odd | 7 |
| B. 9 | even | 3 |
| C. 9 | odd | 9 |
| D. 8 | even | 9 |

50. The given double line graph shows the monthly expenditure of two families on various items. Study the graph carefully and answer the following questions.



- (i) Which family spent more on all the given items over the month and by how much?
 - (ii) Find the ratio of amount spent by family X on Food, Education and Clothing together to the amount spent by family Y on House rent, Clothing and Transportation together.
- | | |
|---------------------|---------|
| (i) | (ii) |
| A. Family X, ₹ 1000 | 17 : 25 |
| B. Family Y, ₹ 1500 | 25 : 34 |
| C. Family X, ₹ 1000 | 34 : 25 |
| D. Family Y, ₹ 2000 | 25 : 34 |

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