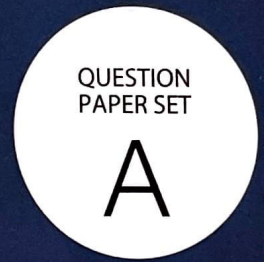




**SOF INTERNATIONAL  
MATHEMATICS OLYMPIAD  
2023-24**



**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.



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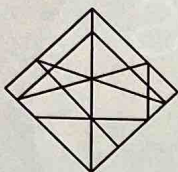
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1. Select a figure from the options which is exactly embedded in the given figure as one of its parts.



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

5. How many such pairs of letters are there in the word EVERYTHING which have as many letters between them in the word as in the English alphabets?

- A. One
- B. Two
- C. Three
- D. More than three

6. In a certain code language, 'month of may' is written as 'kic tip sop', 'rain in morning' is written as 'toc bip dip' and 'beautiful may morning' is written as 'tip fit toc'. Which of the following stands for 'fit'?

- A. morning
- B. month
- C. may
- D. beautiful

2. Study the given information carefully and answer the following question.

'L \* M' means 'L is the mother of M'.

'L @ M' means 'L is the son-in-law of M'.

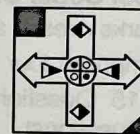
'L + M' means 'L is the father of M'.

'L - M' means 'L is the wife of M'.

How is K related to E in 'G - K @ H \* E'?

- A. Brother
- B. Brother-in-law
- C. Son
- D. Uncle

7. Select the correct mirror image of the given figure, if mirror is placed vertically to the right.

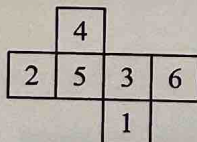


- A.
- B.
- C.
- D.

3. Select the odd one out.

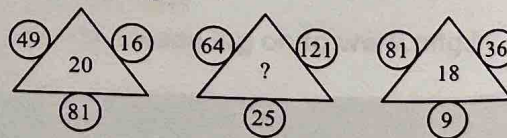
- A. 12 - 148
- B. 15 - 229
- C. 14 - 200
- D. 13 - 167

4. Which of the following numbers lie on the face opposite to the face having number 5, when the given net is folded to form a cube?



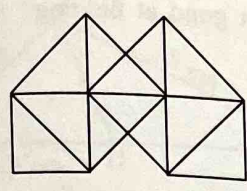
- A. 6
- B. 1
- C. 4
- D. 2

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



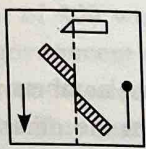
- A. 24
- B. 22
- C. 25
- D. 23

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



- A. 18
- B. 19
- C. 20
- D. More than 20

10. A square 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.

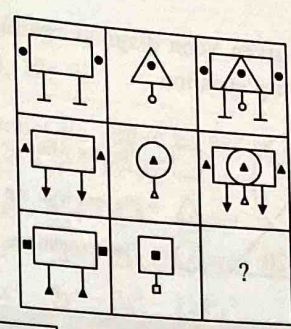


- A.
- B.
- C.
- D.

11. Seven friends P, Q, R, S, T, U and V are sitting in a row facing towards East but not in the same order. T is sitting third to the right of R. V and R are sitting at the corners. S is sitting between V and U. Q is sitting second to the left of U. Who among the following are the immediate neighbours of P?

- A. R and Q
- B. Q and T
- C. S and T
- D. R and U

12. Which of the following figures will complete the given figure matrix?



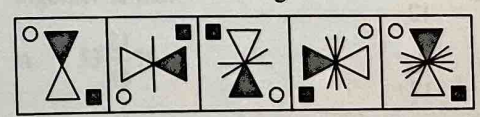
- A.
- B.
- C.
- D.

13. In the number 5736928, each digit is replaced by its previous digit, i.e., '2' is replaced by '1', '3' is replaced by '2' and so on and then the digits are arranged in ascending order from left to right. Which digit will be fourth from the left end in the new number formed?

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

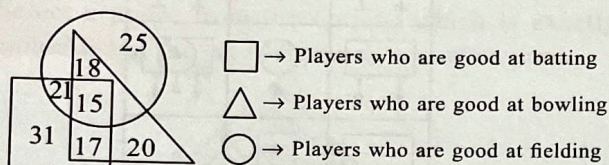
14. Select a figure from the options which will continue the same series as established by the Problem Figures.

Problem Figures



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

15. Study the given Venn diagram carefully and answer the following question.

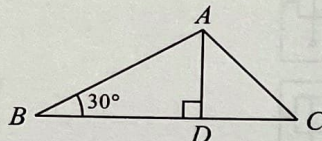


Which of the following numbers represents the players who are good at both batting and bowling but are not good at fielding?

- A. 15  
B. 21  
C. 17  
D. 18

## MATHEMATICAL REASONING

16. In the given figure (not drawn to scale), if  $AD$  is the bisector of  $\angle BAC$ , then find the measure of  $\angle ACD$



- A.  $150^\circ$   
B.  $120^\circ$   
C.  $90^\circ$   
D.  $30^\circ$

17. The base radii of the two cones are the same but their volumes are  $4\pi \text{ m}^3$  and  $9\pi \text{ m}^3$  respectively. The ratio of their heights is

- A.  $\sqrt{2} : \sqrt{3}$   
B.  $2 : 3$   
C.  $4 : 9$   
D.  $16 : 81$

18. If  $a = \frac{1}{4}$ ,  $b = \frac{-2}{3}$  and  $c = \frac{1}{2}$ , then find the additive inverse of  $a - (b + c)$ .

- A.  $\frac{5}{12}$   
B.  $\frac{1}{12}$   
C.  $\frac{-5}{12}$   
D.  $\frac{-1}{12}$

19. If  $APB$  and  $CQD$  are two parallel lines, then the bisectors of the angles  $APQ$ ,  $BPQ$ ,  $CQP$  and  $PQD$  forms a

- A. Kite  
B. Rhombus  
C. Rectangle  
D. Trapezium

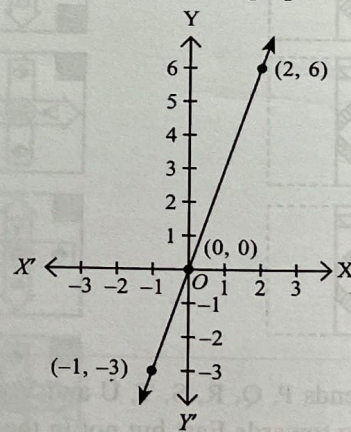
20. Simplify :  $\frac{\sqrt{80} + \sqrt{112}}{\sqrt{20} + \sqrt{28}}$

- A.  $\sqrt{2}$   
B. 2  
C. 4  
D. 8

21. The product of two numbers is 18225. If one of the numbers is 9 times the other number, then find the smallest number.

- A. 45  
B. 55  
C. 35  
D. 25

22. The equation of line whose graph is given, is

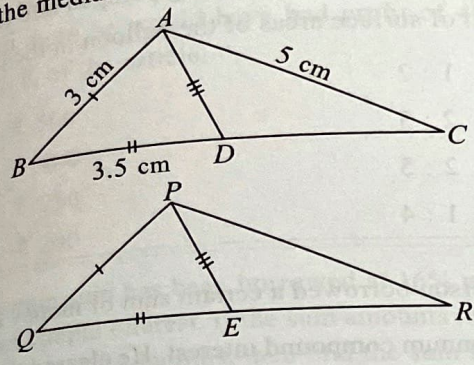


- A.  $y = -x$   
B.  $y = x$   
C.  $y = 2x$   
D.  $y = 3x$

23. If  $x^2 + \frac{1}{x^2} = 51$ , then find the value of  $x^3 - \frac{1}{x^3}$ .

- A. 364  
B. 410  
C. 356  
D. 328

24. In the given figures (not drawn to scale),  $AD$  and  $PE$  are the medians. Then, the value of  $PR$  is

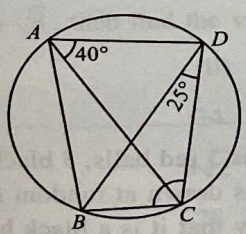


- A. 7 cm
- B. 3 cm
- C. 5 cm
- D. 6 cm

25. In a survey, out of 400 women, 250 were found to be working in government offices and rest in private sector. If a woman is selected at random, then what will be the probability that she is working in private sector?

- A.  $\frac{1}{4}$
- B.  $\frac{3}{8}$
- C.  $\frac{2}{5}$
- D.  $\frac{3}{5}$

26. In the given figure (not drawn to scale),  $ABCD$  is a quadrilateral inscribed in a circle. Diagonals  $AC$  and  $BD$  are joined. If  $\angle CAD = 40^\circ$  and  $\angle BDC = 25^\circ$ , then find  $\angle BCD$ .



- A.  $85^\circ$
- B.  $120^\circ$
- C.  $115^\circ$
- D.  $95^\circ$

27. The graph of the linear equation  $4x + y = 12$  is a line which meets the  $y$ -axis at the point \_\_\_\_\_.

- A. (0, 4)
- B. (4, 0)

- C. (12, 0)
- D. (0, 12)

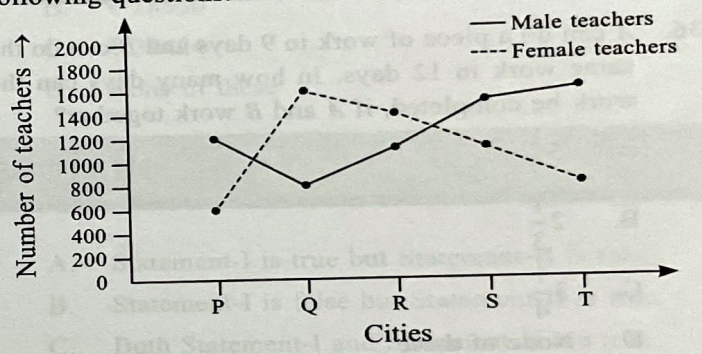
28. What must be added to  $3x^4 + 7x^2y^2 + 2y^4$  to get  $2x^3 - 3y^4 + x^4 - 8x^2y^2$ ?

- A.  $2x^3 + 5y^4 + 2x^4 - 15x^2y^2$
- B.  $2x^3 - 5y^3 - 2x^4 - 15x^2y^2$
- C.  $2x^3 - 5y^4 - 2x^4 - 15x^2y^2$
- D.  $2x^3 - 6y^3 - 3x^4 - 15x^2y^2$

29. The lengths of three sides of a triangle are 40 cm, 24 cm and 32 cm respectively. The length of the altitude of the triangle corresponding to the smallest side is

- A. 32 cm
- B. 18 cm
- C. 30 cm
- D. 12 cm

**Direction (30-31):** The given double line graph shows the number of male and female teachers in five different cities. Study the given graph carefully and answer the following questions.



30. What percentage of total teachers in cities P and R together is male?

- A.  $53\frac{21}{43}\%$
- B.  $29\frac{25}{41}\%$
- C.  $31\frac{21}{43}\%$
- D. None of these

31. What is the ratio of number of male teachers in cities Q, R and S together to the number of female teachers in cities P, S and T together?

- A. 25 : 34
- B. 34 : 25
- C. 17 : 25
- D. 25 : 17

32. If  $x = \left( \left( \frac{1}{2} \right)^{-1} \times (-4)^{-1} \right)^{-1}$  and  $y = \left( \frac{1}{4} \right)^{-1}$ , then find the value of  $x^y + y^x$ .
- A.  $\frac{195}{8}$   
 B.  $\frac{257}{16}$   
 C.  $\frac{-257}{16}$   
 D. 0

33. If it is given that a straight line 'a' and a point 'b' which is not on the straight line 'a', then how many line(s) can be drawn passing through point 'b' which is/are parallel to line 'a'?
- A. 0  
 B. 1  
 C. 2  
 D. Infinite

34. The radius of a spherical balloon increases from 7 cm to 14 cm as air is being pumped into it. Find the ratio of surface areas of the balloon in the two cases.
- A. 1 : 2  
 B. 2 : 3  
 C. 2 : 5  
 D. 1 : 4

35. A person borrowed a certain sum of money at  $16\frac{2}{3}\%$  per annum compound interest. He cleared the debt by paying ₹ 20,825 at the end of 2 years. Find the sum borrowed.
- A. ₹ 15,300  
 B. ₹ 15,800  
 C. ₹ 14,300  
 D. ₹ 14,800

## EVERYDAY MATHEMATICS

36. A can do a piece of work in 9 days and B can do the same work in 12 days. In how many days can the work be completed, if A and B work together?

- A.  $5\frac{1}{7}$   
 B.  $2\frac{1}{3}$   
 C.  $3\frac{1}{4}$   
 D. None of these

37. 40% of the employees of a certain company are men and 75% of the men earn more than ₹ 25,000 per year. If 45% of the company's employees earn more than ₹ 25,000 per year, then what fraction of the women employed by the company do not earn more than ₹ 25,000 per year?

- A.  $\frac{2}{11}$   
 B.  $\frac{1}{4}$   
 C.  $\frac{1}{3}$   
 D.  $\frac{3}{4}$

38. A part of monthly expenses of a family on milk is fixed which is ₹ 700 and remaining varies with quantity of milk taken extra at the rate of ₹ 25 per litre. Taking quantity of milk required extra as  $x$  litres and total expenditure on milk as ₹  $y$ , write a linear equation from the above information.

- A.  $-25x + y = 700$   
 B.  $20x + y = 500$   
 C.  $20x + 10y = 300$   
 D.  $x + 25y = 900$

39. Two trains of lengths 150 m and 175 m are running towards each other on parallel tracks at the rate of 54 km/h and 36 km/h respectively. Find the time taken when trains be clear of each other from the moment they meet.

- A. 12 secs  
 B. 13 secs  
 C. 14 secs  
 D. 15 secs

40. A bag contains 3 red balls, 5 black balls and 4 white balls. A ball is drawn at random from the bag. Find the probability that it is a black ball.

- A.  $\frac{1}{4}$   
 B.  $\frac{1}{2}$   
 C.  $\frac{5}{12}$   
 D.  $\frac{7}{12}$

41. A person bought an article and sold it at a loss of 10%. If he had bought it for 20% less and sold it for ₹ 110 more he would have had profit of 40%. Find the C.P. of the article.

- A. ₹ 500
- B. ₹ 400
- C. ₹ 250
- D. ₹ 200

42. A certain sum has been borrowed at 16% per annum under simple interest. If the sum amounts to ₹ 12,000 in 1 year and 3 months, then find the sum borrowed.

- A. ₹ 9000
- B. ₹ 10000
- C. ₹ 15000
- D. ₹ 8500

43. One year ago, the ratio of Gaurav and Sachin's age was 6 : 7 respectively. Four years from now, the ratio would become 7 : 8. Find the present age of Sachin.

- A. 32 years
- B. 40 years
- C. 35 years
- D. 36 years

44. A school library has books on Hindi, English, Mathematics, Science and Social Science.  $\frac{2}{19}$  of all the books are Hindi,  $\frac{3}{17}$  of the books are Mathematics,

$\frac{4}{17}$  of the books are English and  $\frac{3}{19}$  of the books are Social Science. If there are 6137 books in all, then find the difference between the number of books of Mathematics and Social Science.

- A. 116
- B. 114
- C. 118
- D. 115

45. A hemispherical dome of a building needs to be painted from outside. If the circumference of the base of the dome is 17.6 m, then find the cost of painting it at the rate of ₹ 8 per 100 cm<sup>2</sup>.

- A. ₹ 35680
- B. ₹ 28650
- C. ₹ 39424
- D. None of these

### ACHIEVERS SECTION

46. Solve the following and select the correct option.

(i) If  $p = \frac{2-\sqrt{5}}{2+\sqrt{5}}$  and  $q = \frac{2+\sqrt{5}}{2-\sqrt{5}}$ , then find the value of  $p^2 - q^2$ .

(ii) If  $m = 3 + \sqrt{8}$ , then find the value of  $m^2 + \frac{1}{m^2}$ .

- | (i)               | (ii)        |
|-------------------|-------------|
| A. $-144\sqrt{5}$ | 34          |
| B. $79\sqrt{5}$   | $5\sqrt{2}$ |
| C. $140\sqrt{5}$  | 28          |
| D. $-80\sqrt{5}$  | $7\sqrt{2}$ |

47. Read the given statements carefully and select the correct option.

**Statement-I** : The quadrilateral formed by angle bisectors of a cyclic quadrilateral is also cyclic.

**Statement-II** : If ABCD is a cyclic quadrilateral such that AB is a diameter of the circle circumscribing it and  $\angle ADC = 140^\circ$ , then  $\angle BAC = 50^\circ$ .

- A. Statement-I is true but Statement-II is false.
- B. Statement-I is false but Statement-II is true.
- C. Both Statement-I and Statement-II are true.
- D. Both Statement-I and Statement-II are false.

48. Match the linear equations in Column-I with their solutions in Column-II and select the correct option.

- | Column-I                      | Column-II                                |
|-------------------------------|------------------------------------------|
| (P) $2x - 3y = -7$            | (i) $\left(\sqrt{2}, \frac{5}{2}\right)$ |
| (Q) $x - \frac{y}{2} - 5 = 0$ | (ii) $(-20, -11)$                        |
| (R) $2y - 3 = \sqrt{2}x$      | (iii) $(1, -8)$                          |
- A. (P) → (iii); (Q) → (i); (R) → (ii)
  - B. (P) → (ii); (Q) → (iii); (R) → (i)
  - C. (P) → (i); (Q) → (iii); (R) → (ii)
  - D. (P) → (ii); (Q) → (i); (R) → (iii)

49. Read the given statements carefully and state T for true and F for false.

- (i) If each side of a triangle is doubled, then the percentage increase in the area of triangle is 200%.
- (ii) If the lengths of the sides of a triangle are 5 cm, 12 cm and 13 cm, then the length of perpendicular drawn from the vertex to the side whose length is 13 cm, is 60 cm.

	(i)	(ii)
A.	F	T
B.	T	F
C.	T	T
D.	F	F

50. Fill in the blanks and select the correct option.

- (i) The mirror image of the point (7, 5) along the  $y$ -axis is \_\_\_\_\_ .
- (ii) The distance of the point (3, 4) from the origin is \_\_\_\_\_ .
- (iii) The perpendicular distance of a point from the  $x$ -axis is 3 units and that from the  $y$ -axis is 6 units. The coordinates of point, if it lies in II quadrant, is \_\_\_\_\_ .

	(i)	(ii)	(iii)
A.	(7, - 5)	6 units	(3, 6)
B.	(- 7, - 5)	5 units	(- 3, - 6)
C.	(- 7, 5)	5 units	(- 6, 3)
D.	(- 7, 5)	7 units	(6, - 3)

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