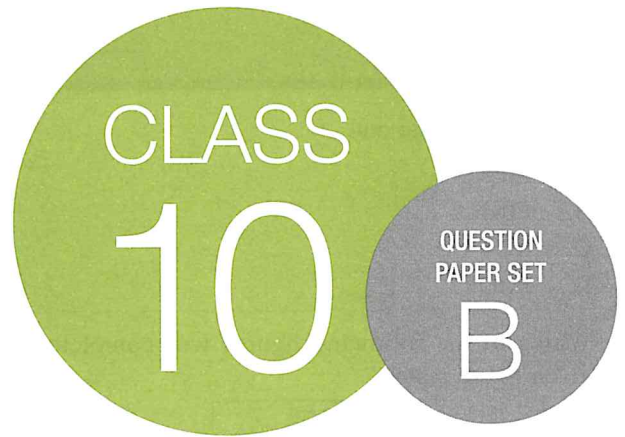


**SOF INTERNATIONAL
MATHEMATICS OLYMPIAD
2019-20**



DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Total Questions: 50 | Time: 1 hr.

Name:.....

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

Guidelines for the Candidate

1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. 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.
3. 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.
4. All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
5. There is only ONE correct answer. Choose only ONE option for an answer.
6. 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.
7. Rough work should be done in the blank space provided in the booklet.
8. Return the OMR Sheet to the invigilator at the end of the exam.
9. Please fill in your personal details in the space provided on this page before attempting the paper.

16. A B C D



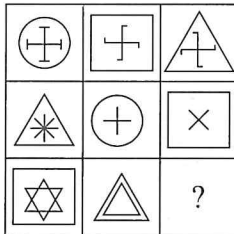
SCIENCE OLYMPIAD FOUNDATION
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LOGICAL REASONING

1. Find the odd one out.

- A. MPRU
- B. FIKN
- C. RUVY
- D. JMOR

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



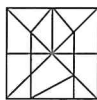
- A.
- B.
- C.
- D.

3. Which of the following options will continue the given number series?

0.5, 2, 4.5, 8, 12.5, ___?

- A. 15
- B. 17
- C. 16.5
- D. 18

4. Which of the following figures is exactly embedded in the given figure as one of its parts?



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

5. Select the correct water image of the given figure.



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

6. Two rows of numbers are given. The resultant number in each row is to be worked out separately based on the following rules and the question below the rows of numbers is to be answered. The operations on numbers progress from left to right.

Rules:

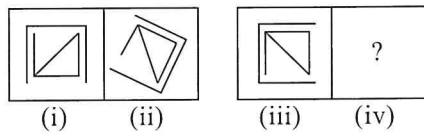
- (i) If an odd number is followed by another composite odd number, then they are to be multiplied.
- (ii) If an even number is followed by an odd number, then they are to be added.
- (iii) If an even number is followed by a number which is a perfect square, then the even number is to be subtracted from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

15	3	65
4	81	12

Find the number obtained on dividing the resultant of the first row by the resultant of the second row.

- A. 9
- B. 5
- C. 10
- D. 14

7. There is a certain relationship between figures (i) and (ii). Establish a similar relationship between figures (iii) and (iv) by selecting a suitable figure from the options that would replace the (?) in Fig. (iv).



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

8. Payal walks 25 m towards South, then she turns right and walks 30 m, then she turns left and walks 15 m. How far and in which direction is she now from her starting point?

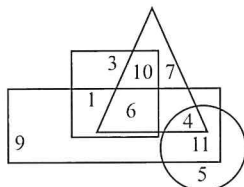
- A. 50 m, South-West
 B. 50 m, South-East
 C. 45 m, South-East
 D. 40 m, South

9. Find the missing number, if a certain rule is followed either row-wise or column-wise.

7	21	42
9	27	?
14	42	84

- A. 64
 B. 54
 C. 63
 D. 52

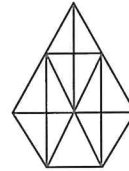
10. In the given Venn diagram, rectangle represents youths, triangle represents educated, circle represents honest and square represents teachers.



Which of the following numbers represents honest educated youth who is not a teacher?

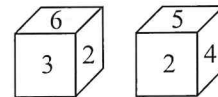
- A. 4
 B. 11
 C. 6
 D. 5

11. How many triangles are there in the given figure?



- A. 20
 B. 25
 C. 30
 D. None of these

12. Two positions of a dice are shown below.



Which of the following numbers is on the face opposite to the face having number 5?

- A. 3
 B. 6
 C. 4
 D. 2

13. A word arrangement machine, when given an input line of words rearranges them by following a particular rule in each step. The following is an illustration of input and steps of rearrangement.

Input : came along not says else key lot have

Step I : along came not says else key lot have

Step II : along came else not says key lot have

Step III : along came else have not says key lot

Step IV : along came else have key not says lot

Step V : along came else have key lot not says

Step V is the last step of the given input.

Which of the following will be the last step for the given below input?

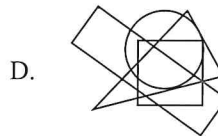
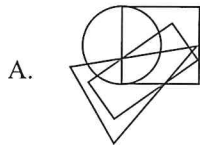
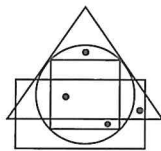
Input : rate cut hour long but shot trap work

- A. V
 B. VI
 C. III
 D. IV

14. In a certain code language, BREAKDOWN is written as CTHEKCMTJ. How will EXECUTIVE be written in the same code language?

- A. FZGHVSGSA
 B. FZHGYSGSA
 C. FZHGUSASG
 D. FZHGUSGSA

15. Which of the following options does not satisfy the same conditions of placement of the dots as in the given figure?



MATHEMATICAL REASONING

16. If the polynomial $f(x) = ax^3 + bx - c$ is exactly divisible by the polynomial $g(x) = x^2 + bx + c$, $c \neq 0$, then which of the following options is true?

- A. $c = 2b^2$
 B. $ab = 1$
 C. $ac = 2b$
 D. All of these

17. Circle C_1 passes through the centre of circle C_2 and is tangential to it. If the area of C_1 is 4 cm^2 , then the area of C_2 is _____.

- A. 8 cm^2
 B. $8\sqrt{\pi} \text{ cm}^2$
 C. 16 cm^2
 D. $16\sqrt{\pi} \text{ cm}^2$

18. Evaluate : $\tan 12^\circ \tan 38^\circ \tan 52^\circ \tan 60^\circ \tan 78^\circ$

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

19. If the sum of n terms of three A.P.'s are S_1 , S_2 and S_3 . The first term of each A.P. is unity and the common differences are 1, 2 and 3 respectively, then $\frac{S_1 + S_3}{S_2}$ is equal to

- A. 0
 B. 1
 C. 2
 D. 3

20. Two parallel sides of a trapezium are 60 cm and 77 cm and other sides are 25 cm and 26 cm. Find the area of the trapezium.

- A. 1644 cm^2
 B. 1464 cm^2
 C. 1504 cm^2
 D. 1600 cm^2

21. The sum of LCM and HCF of two numbers is 8340. If the LCM of these numbers is 8300 more than their HCF, then find the product of the two numbers.

- A. 147200
 B. 166400
 C. 264000
 D. 146480

22. If the mean of the following distribution is 54, then find the value of m .

Class intervals	0-20	20-40	40-60	60-80	80-100
Frequency	7	m	10	9	13

- A. 11
 B. 66
 C. 39
 D. 21

23. For which value of p , the given system of equations has a unique solution?

$$x + 2y = 1; x + py = 5$$

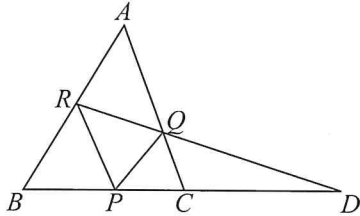
- A. $p = 2$
 B. $p = 0$
 C. $p \neq 2$
 D. $p \neq 0$

24. Which of the following options is correct?

- A. If n is any natural number, then $6^n - 5^n$ always ends with 1.
 B. For any integer t , every even integer is of the form $2t + 1$.
 C. Both A and B
 D. Neither A nor B

25. If the mid-point of the line segment joining $A\left(\frac{x}{2}, \frac{y+1}{2}\right)$ and $B(x+1, y-3)$ is $C(5, -2)$, then find the value of x and y respectively.
- A. 6, -1
 B. -4, 6
 C. 4, -6
 D. 3, 6

26. In the given figure, $PQ \parallel BA$; $PR \parallel CA$. If $PD = x$, then find $BD \times CD$.

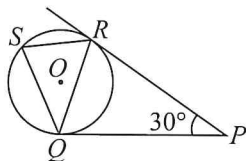


- A. $2x$
 B. x^2
 C. $2x^2$
 D. $\frac{x^2}{2}$

27. A balloon is moving with the wind in a horizontal line at a height of $36\sqrt{3}$ m. The angle of elevation of the balloon from a point A on the ground is 60° . After some time, the angle of elevation changes to 30° . Find the distance travelled by the balloon.
- A. 72 m
 B. 78 m
 C. 86 m
 D. 82 m

28. The roots of the quadratic equation $\frac{1}{p+q+x} = \frac{1}{p} + \frac{1}{q} + \frac{1}{x}$, ($p+q \neq 0$) are _____.
- A. p, q
 B. $-p, q$
 C. $p, -q$
 D. $-p, -q$

29. In the given figure (not drawn to scale), tangents PQ and PR are drawn from an external point P to the circle with centre O , such that $\angle RPQ = 30^\circ$. A chord RS is drawn parallel to the tangent PQ . Find $\angle RQS$.

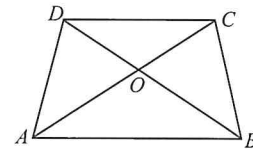


- A. 40°
 B. 30°
 C. 75°
 D. 50°

30. Which of the points $A(0, 6)$, $B(-2, 0)$, $C(0, -5)$, $D(3, 0)$ and $E(1, 2)$ do(es) not lie on x -axis?
- A. A and C only
 B. B and D
 C. A, C and E
 D. E only

31. If α and β are the zeroes of the quadratic equation $x^2 - 12x + 32 = 0$, then a quadratic equation whose zeroes are $\frac{1}{2\alpha+\beta}$ and $\frac{1}{2\beta+\alpha}$ is
- A. $320x^2 + 36x + 1 = 0$
 B. $320x^2 - 36x - 1 = 0$
 C. $320x^2 - 36x + 1 = 0$
 D. $320x^2 + 36x - 1 = 0$

32. In the given trapezium $ABCD$, $AB \parallel CD$ and $AB = 2CD$. If area of $\triangle AOB = 84 \text{ cm}^2$, then the area of $\triangle COD$ is _____.



- A. 22 cm^2
 B. 25 cm^2
 C. 21 cm^2
 D. 24 cm^2

33. A reduction of 15% in the price of rice enables a purchaser to obtain 3 kg more for ₹ 150. The reduced price per kg is _____.
- A. ₹ 8.50
 B. ₹ 9
 C. ₹ 10
 D. ₹ 7.50

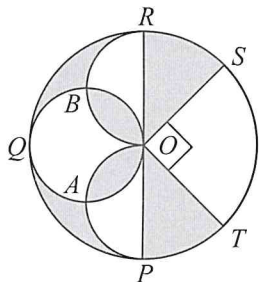
34. In 50 tosses of a coin, tail appears 32 times. If a coin is tossed at random, then what is the probability of getting a head?
- A. $\frac{1}{32}$
 B. $\frac{1}{18}$
 C. $\frac{16}{25}$
 D. $\frac{9}{25}$

35. If $\cot \theta = \frac{15}{8}$, then evaluate $\frac{(2+2\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(2-2\cos\theta)}$.
- A. $\frac{8}{15}$
 B. $\frac{15}{8}$
 C. $\frac{64}{225}$
 D. $\frac{225}{64}$

36. There is 60% increase in an amount in 6 years at simple interest. What will be the compound interest on ₹ 12000 after 3 years at the same rate of interest?
- A. ₹ 2160
B. ₹ 3972
C. ₹ 3120
D. ₹ 6240
-
37. A and B together can do a piece of work in 30 days. A worked for 16 days, B finishes the remaining work alone in 44 days. In how many days shall B finish the whole work alone?
- A. 30 days
B. 40 days
C. 60 days
D. 70 days
-
38. To construct a wall 18 m long, 0.5 m thick and 9 m high, bricks of dimensions $20\text{ cm} \times 15\text{ cm} \times 10\text{ cm}$ each are used. If the mortar occupies $\frac{1}{10}$ th of the volume of the wall, then find the number of bricks used.
- A. 32960
B. 24420
C. 24300
D. 24296
-
39. 5% of the voters in an election did not cast their votes. In the election, there were only two candidates. The winner by obtaining 52% of the total votes defeated his competitor by 2280 votes. The total number of voters was
- A. 60000
B. 52000
C. 63500
D. None of these.
-
40. The production of TV in a factory increases uniformly by a fixed number every year. It produced 8000 sets in 6th year and 11300 in 9th year. Find the total production in 6 years.
- A. 40500
B. 20000
C. 20500
D. 31500
-
41. Ram, Raghav, Tarun and Varun together had a total amount of ₹ 240 with them. Ram had half of the total amount that others had. Raghav had one-third of the total amount that others had. Tarun had one-fourth of the total amount that others had. Find the amount that Varun had.
- A. ₹ 64
B. ₹ 70
C. ₹ 52
D. ₹ 58
-
42. In a party, the number of men, women and children guests are 72, 84 and 48 respectively. Find the minimum number of rooms required, if in each room, the same number of guests are to be seated all of them being of the same category.
- A. 20
B. 14
C. 17
D. 18
-
43. Ankit purchased 1000 articles at the rate of ₹ 5 each and sold 850 articles at the rate of ₹ 7 each and rest of the articles at the rate of ₹ 3.50 each. Find the average profit per article sold.
- A. ₹ 1.50
B. ₹ 2.47
C. ₹ 1.75
D. None of these
-
44. How many seconds will a 500 metre long train take to cross a man walking with a speed of 3 km/hr in the direction of the moving train, if the speed of the train is 63 km/hr?
- A. 25 seconds
B. 30 seconds
C. 40 seconds
D. 45 seconds
-
45. Two customers Shyam and Ekta are visiting a particular shop in the same week (Tuesday to Saturday). Each is equally likely to visit the shop on any one day as on another. What is the probability that both will visit the shop on different days?
- A. $\frac{3}{5}$
B. $\frac{4}{5}$
C. $\frac{12}{25}$
D. $\frac{1}{5}$

ACHIEVERS SECTION

46. The given figure is made up of a large circle $PQRST$ with centre O and diameter 28 cm, a small circle $QAOB$, two semi-circles and a sector OST . Find the total shaded area of the figure.



- A. $(198\pi - 98) \text{ cm}^2$
 B. $(49\pi + 198) \text{ cm}^2$
 C. $(150\pi + 100) \text{ cm}^2$
 D. $(147\pi - 196) \text{ cm}^2$
-
47. The jack, queen, king and 8, all of diamonds are lost from a pack of 52 playing cards. If a card is drawn from the remaining well-shuffled pack, then find the probability of getting a
- (a) Queen card
 (b) Red card
 (c) Red king card.
- | | (a) | (b) | (c) |
|----|----------------|-----------------|----------------|
| A. | $\frac{1}{12}$ | $\frac{1}{12}$ | $\frac{1}{24}$ |
| B. | $\frac{1}{16}$ | $\frac{3}{16}$ | $\frac{1}{24}$ |
| C. | $\frac{3}{16}$ | $\frac{1}{12}$ | $\frac{1}{48}$ |
| D. | $\frac{1}{16}$ | $\frac{11}{24}$ | $\frac{1}{48}$ |

48. Select the correct option.
- A. The 15th term from the end in the A.P. 13, 16, 19, ..., 160 is 108.
 B. If the first, second and last terms of an A.P. are 6, 9 and 33 respectively, then the number of terms of the A.P. is 10.
 C. The sum of an A.P. 2, 5, 8, ..., 152 is 3925.
 D. All of these

49. Study the statements carefully and select the correct option.

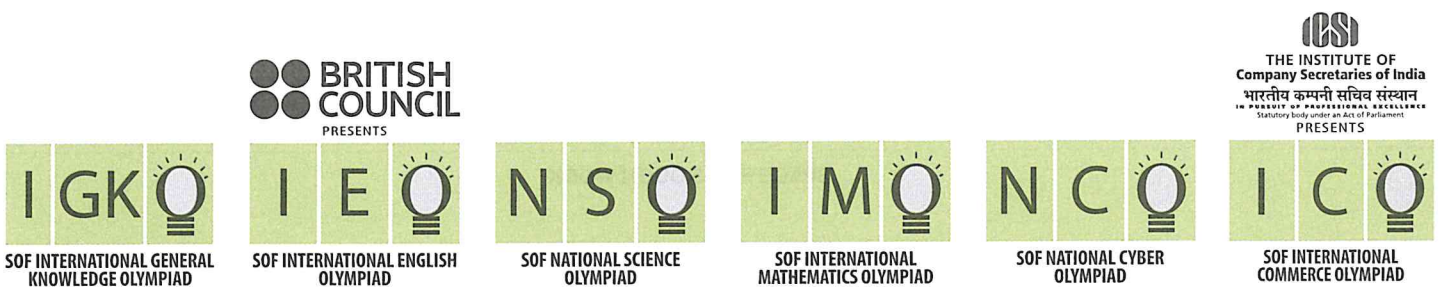
Statement-I : If the roots of the equation $x^2 + k(4x + k - 1) + 2 = 0$ are real and equal, then $k = \frac{2}{3}$ or -1 .


Statement-II : The roots of the equation $ax^2 + bx + c = 0$ are real and equal, if and only if $b^2 - 4ac \geq 0$.

- 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.
-
50. A hollow cone is cut by a plane parallel to the base and the upper portion is removed. If the curved surface area of the remainder is $\frac{8}{9}$ of the curved surface area of the whole cone, then find the ratio of the line segments into which the altitude of the cone is divided by the plane.
- A. 2 : 3
 B. 1 : 2
 C. 1 : 3
 D. 3 : 4

 SPACE FOR ROUGH WORK

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