CLASS 10

QUESTION PAPER SET A

IMO

SOF INTERNATIONAL MATHEMATICS OLYMPIAD 2022-23

DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Total Questions: 50 | Time: 1 hr.

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, 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.

   16. ● Ⓑ Ⓒ Ⓓ
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.

SCIENCE OLYMPIAD FOUNDATION
Inspiring Young Minds Through Knowledge Olympiads

Name:..... Contact No.:.....

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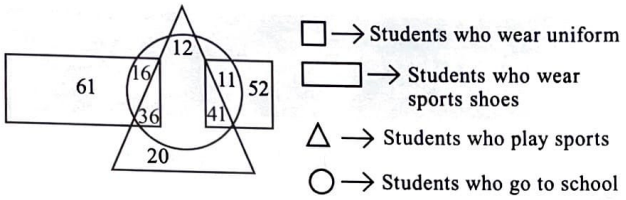
1. Riding a bike, Ashish travels 5 km towards South, then he turns left and travels 15 km. Again he turns left and travels 15 km. Finally, he turns right and travels 5 km to reach his destination. How far and in which direction is he from the starting point?

A. $10\sqrt{5}$ km, North-East
B. $5\sqrt{10}$ km, South-West
C. $10\sqrt{5}$ km, South-West
D. $5\sqrt{10}$ km, North-East

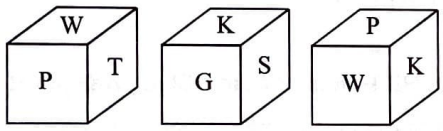
2. Study the given Venn diagram carefully and answer the following question.



Which number represents students who go to school and play sports wearing uniform but not sports shoes?

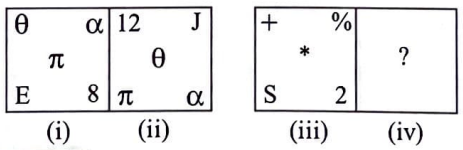
A. 36
B. 41
C. 11
D. 12

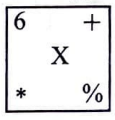
3. Three positions of a cube are given below. Which alphabet will be at the top, if alphabet G is at the bottom?

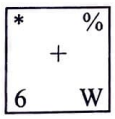


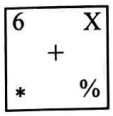
A. T
B. W
C. K
D. P

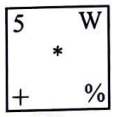
4. There is a certain relationship between figures (i) and (ii). Establish a similar relationship between figures (iii) and (iv) by selecting a suitable figure from the options that would replace the '?' in figure (iv).



A. 

B. 

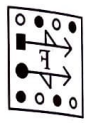
C. 

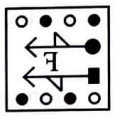
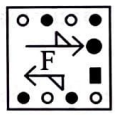
D. 

5. If in a certain code language, CUSTOMER is written as DWVXPOHV, then how will PREVIOUS be written in that code language?

A. QTIZJPXW
B. OTHZKPXW
C. QTHZJQXW
D. OTIZJPXW

6. Choose the correct mirror image of the given figure, if the mirror is placed vertically to the right.



A. 
B.
C. 
D.

7. If 'M' stands for '+', 'N' stands for '×', 'P' stands for '÷' and 'S' stands for '–', then which of the following options become correct?

A. 18 N 40 P 8 S 6 M 4 = 64
B. 18 M 40 S 8 P 6 N 4 = 55
C. 18 S 40 N 8 P 6 M 4 = 91
D. 18 M 40 P 8 N 6 S 4 = 44

8. Read the following information carefully and answer the given question.

'A + B' means A is sister of B.
'A – B' means A is husband of B.
'A × B' means A is brother of B.
'A ÷ B' means A is daughter of B.

How is P related to M in the expression M ÷ L – N + P × Q?

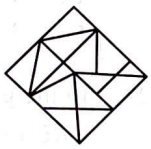
A. Father
B. Maternal uncle
C. Son
D. Grandfather

9. How many such alphabets are there in the given arrangement each of which is immediately preceded by an even number and immediately followed by a consonant?

T P 4 K 4 7 6 L C 5 8 A J L 5 T S 3 E Z 2 Y R T

A. Three
B. One
C. Four
D. Two

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



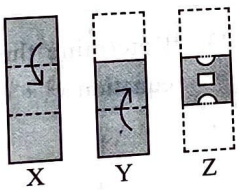
A.

B.

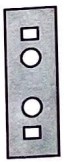
C.

D.

11. There is a set of three figures X, Y and Z showing a sequence of folding of a piece of paper. Figure (Z) shows the manner in which the folded paper has been cut. Select a figure from the options which would most closely resemble the unfolded form of fig. (Z).



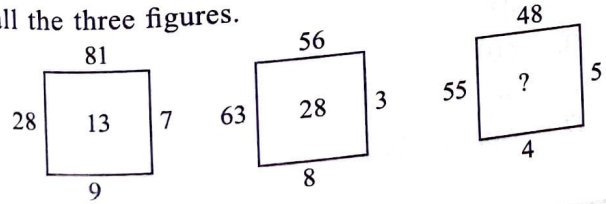
A.

B. 

C.

D.

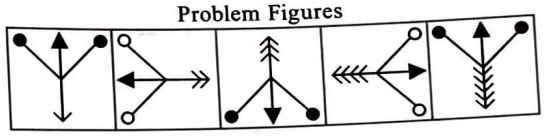
12. Find the missing number, if same rule is followed in all the three figures.

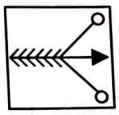


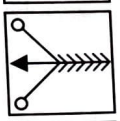
A. 21
B. 25
C. 23
D. 27

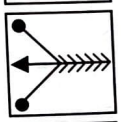
13. Select a figure from the options which will continue the same series as established by the Problem Figures.

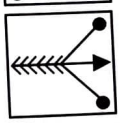
Problem Figures



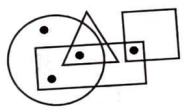
A. 

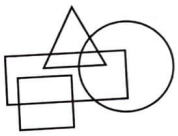
B. 

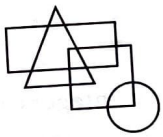
C. 

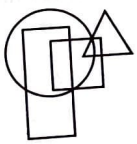
D. 

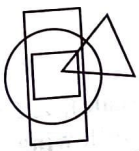
14. Select a figure from the options which satisfies the same conditions of placement of the dots as in the given figure.



A. 

B. 

C. 

D. 

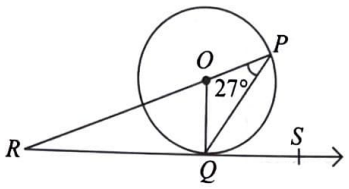
15. How many such pairs of letters are there in the word SINGAPORE each of which has as many letters between them in the word as in the English alphabets?

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

16. A two-digit number is such that, it exceeds the number formed by reversing the digits by 9. Also, the sum of the digits of the number is 7. Find the product of the digits.

A. 12
B. 18
C. 8
D. None of these

17. In the given figure (not drawn to scale), if O is the centre of the circle with $\angle QPR = 27°$, then find the value of $\angle SQP$.



A. 46°
B. 63°
C. 38°
D. 54°

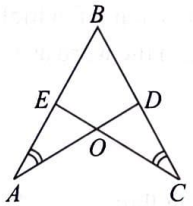
18. Find the value of $\frac{[(676)^{1/2}]^4}{[(2197)^{1/3}]^4}$.

A. 25
B. 32
C. 16
D. 8

19. If P and Q are two positive integers such that $P = x^2y^3$ and $Q = xy^2$, where x, y are prime numbers, then HCF (P, Q) is

A. x^2y
B. xy^2
C. x^2y^3
D. x^2y^2

20. In given figure (not drawn to scale), $\angle A = \angle C$ and $AB = BC$. Then which of the following options is correct?

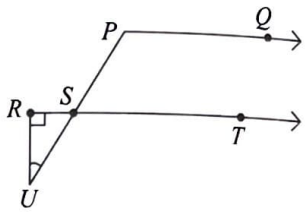


A. $\angle OEB = \angle ODB$
B $\Delta ABD \cong \Delta CBE$
C. $\angle AEO = \angle CDO$
D. All of these

21. In what ratio is the line segment joining the points $(-3, 2)$ and $(6, 1)$ is divided by Y-axis?

A. 1 : 3
B. 2 : 1
C. 1 : 2
D. 3 : 1

22. In the given figure (not drawn to scale), if $PQ \| ST$ and $\angle RUS = 37°$, then find the measure of $\angle SPQ$.



A. 147°
B. 123°
C. 127°
D. 143°

23. Determine the value of α, for which the quadratic equation $x^2 + (2\alpha - 1)x + \alpha^2 = 0$ has equal roots.

A. $\frac{1}{4}$
B. $\frac{3}{4}$
C. $\frac{7}{8}$
D. $\frac{2}{5}$

24. The height of a building is half the height of the tower on it. The angle of elevation of the top of the building as seen from a point on the ground is 30°. Find the angle of elevation of the top of the tower as seen from the same point.

A. 45°
B. 60°
C. 30°
D. None of these

25. The semi-perimeter and two sides of a triangle are 21 cm, 14 cm and 15 cm respectively. Find the area of the triangle.

A. 136 cm^2
B. 98 cm^2
C. 105 cm^2
D. 84 cm^2

26. If one root of the polynomial $f(x) = 3x^2 + 11x + p$ is reciprocal of the other, then the value of p is

A. 0
B. 3
C. $\frac{1}{3}$
D. -3

27. The construction of a ΔPQR in which $QR = 6.4$ cm and $\angle Q = 60°$ is not possible when $(PQ + PR)$ is

A. 6 cm
B. 6.5 cm
C. 8 cm
D. 7 cm

28. Two A.P.'s have the same common difference. The first term of one of the A.P. is 12 and that of the other A.P. is 9. Find the difference between their 30^{th} term.

A. 7
B. 4
C. 6
D. 3

29. If $x = a(\sec\theta + \tan\theta)$ and $y = b(\tan\theta - \sec\theta)$, then

A. $xy - ab = 0$
B. $xy + ab = 0$
C. $\frac{x}{a} + \frac{y}{b} = 1$
D. $x^2y^2 = ab$

30. The probability of getting a good pen in a lot of 380 pens is 0.75. The number of bad pens in the lot is

A. 80
B. 120
C. 95
D. 135

31. A right circular cone of height 7 cm and base radius 9 cm is removed from a solid cylinder of same height and same base. Find the volume of remaining solid.

A. 876 cm^3
B. 1324 cm^3
C. 1244 cm^3
D. 1188 cm^3

32. In a parallelogram $ABCD$, if $\angle A = (3x - 20)°$, $\angle B = (y + 15)°$ and $\angle C = (x + 40)°$, then the values of x and y respectively are

A. 30, 95
B. 95, 30
C. 60, 30
D. 30, 60

33. The area of a sector of radius 2.8 cm is 3.08 cm^2. Find the central angle of the sector.

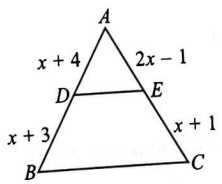
A. 60°
B. 45°
C. 75°
D. 70°

34. The following data is arranged in ascending order. If the mean of the given data is 36, then find the value of x.

17, 23, 31, 33, $x + 3$, 37, 41, 43, 48

A. 34
B. 31
C. 32
D. 48

35. In the given figure (not drawn to scale), $DE \parallel BC$. Find the value of x.



A. $\sqrt{5}$
B. $\sqrt{6}$
C. $\sqrt{3}$
D. $\sqrt{7}$

36. The top of a broken tree has its top end touching the ground at a distance 15 m from the bottom, the angle made by the broken end with the ground is 30°. Then the length of broken part is

A. 10 m
B. $\sqrt{3}$ m
C. $5\sqrt{3}$ m
D. $10\sqrt{3}$ m

37. There are two cylinders P and Q, the ratio of the height of P to that of Q is 5 : 2 and ratio of the radius of P to that of Q is 4 : 3. Then, the ratio of the volume of P to that of Q is

A. 31 : 21
B. 21 : 13
C. 40 : 9
D. 14 : 13

38. A bag contains 9 green balls and some pink balls. If the probability of drawing a pink ball is four times the probability of drawing a green ball, then find the number of pink balls in the bag.

A. 24
B. 28
C. 36
D. 42

39. A car travels a distance of 288 km at a uniform speed. If the speed had been 4 km/h less, then it would have taken 1 hour more to cover the same distance. Find the speed of the car.

A. 36 km/hr
B. 42 km/hr
C. 32 km/hr
D. 48 km/hr

40. A cricketer has a mean score of 48 runs in 12 innings. How many runs he need to score in the thirteenth inning so that the mean score becomes 54?

A. 163
B. 97
C. 148
D. 126

41. A horse is tethered to one corner of a rectangular grass field 57 m by 53 m by a 5.6 m long rope. Over how much area of the field can it graze?

A. 32.54 m^2
B. 24.64 m^2
C. 18.72 m^2
D. 42.46 m^2

42. Find the cost of laying grass in a triangular field of sides 30 m, 24 m and 18 m at the rate of ₹ 15 per m^2.

A. ₹ 3240
B. ₹ 2850
C. ₹ 4280
D. ₹ 3650

43. Mohan says to Sushant , "If you give me ₹ 700, I shall be twice as rich as you." But Sushant says to Mohan, "If you give me ₹ 300, I shall be thrice as rich as you." Find the amount that Sushant have.

A. ₹ 1200
B. ₹ 1300
C. ₹ 1400
D. ₹ 1500

44. The production of TV in a factory increases uniformly by a fixed number every year. It produced 8000 sets in 6^{th} year and 11300 in 9^{th} year. Find the total production of TVs in the 6 years.

A. 40500
B. 20000
C. 20500
D. 31500

45. The present age of Meena is 8 times the age of her daughter. 8 years hence, the ratio of ages of Meena and her daughter will be 10 : 3. What is the present age of Meena?

A. 32 years
B. 36 years
C. 40 years
D. Cannot be determined

46. Read the following statements and select the correct option.

Statement-I : $\text{cosec}^2\theta + \sec^2\theta = (\text{cosec}\theta \cdot \sec\theta)^2$

Statement-II : If $\cos^2\theta - \sin^2\theta = \tan^2\theta$, then $\sec^2\theta = \sqrt{3}$.

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.

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

(i) If the system of equations $2x + 3y = 5$; $4x + ky = 10$ has infinite many solutions, then the value of k is **P**.

(ii) The value of $x + y$ for the system of equations $2x - \frac{3y}{4} = 3$; $5x = 2y + 7$ is **Q**.

	P	Q
A.	8	9
B.	7	6
C.	9	8
D.	6	7

48. Solve the following questions and select the correct option.

(i) Determine the first term of the AP, whose fifth term is 19 and the difference of the eighth term from the thirteenth term is 20.

(ii) How many two-digit numbers are there, which when divided by 4 yield 3 as remainder?

	(i)	(ii)
A.	5	22
B.	3	23
C.	11	28
D.	13	27

49. Read the following statements carefully and state 'T' for true and 'F' for false.

(i) If $x = a$ is the solution of the equation $x^2 - (a + b)x + k = 0$, then the value of k is a/b.

(ii) If $a^2b^2x^2 + 2abx + 1 = 0$, then one of the solution of the equation is $x = -ab$.

(iii) The nature of roots of the equation $3x^2 - 6\sqrt{2}x + 2 = 0$ is real and distinct.

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

50. If a card is drawn from a well-shuffled deck of 52 playing cards, then which of the following is incorrect?

A. The probability of getting a jack of red colour is $\frac{1}{26}$.
B. The probability of getting a face card is $\frac{3}{13}$.
C. The probability of getting an ace is $\frac{1}{4}$.
D. None of these

SPACE FOR ROUGH WORK