CLASS 10

QUESTION PAPER SET

C

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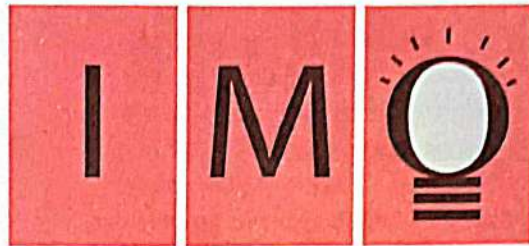
SOF INTERNATIONAL MATHEMATICS OLYMPIAD 2022-23

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.

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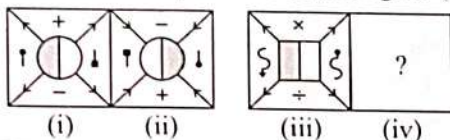
A.

B.

C.

D.

2. How many such pairs of letters are there in the word CONNECTION each of which has the same number of letters between them as in the English alphabets?

   A. One
   B. Three
   C. Four
   D. More than four

3. Read the given information carefully and answer the following question.
   'A # B' means A is son of B;
   'A $ B' means A is wife of B;
   'A * B' means A is husband of B and
   'A % B' means A is daughter of B.
   Which of the following means R is the daughter-in-law of Y?
   A. T%S$R#Y
   B. T%R$S#Y
   C. R%T#S$Y
   D. T%Y$S#R

4. How many such digits are there in the given arrangement, each of which is immediately preceded by a prime number and immediately followed by an even number?
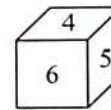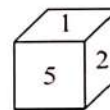
   4 2 3 8 7 6 1 4 6 3 9 4 7 1 6 2 8 3 8 4 2

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

5. Which of the following figures will complete the given figure pattern?

   A.

   B.

   C.

   D.
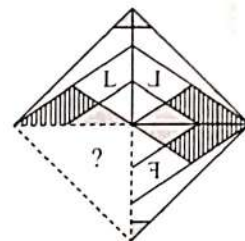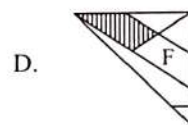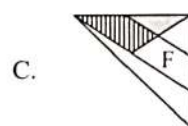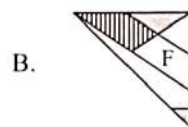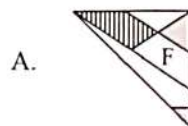
6. Three positions of a dice are shown below. Which number is on the face opposite to the face having number 2?
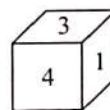
   A. 4
   B. 6
   C. 3
   D. 5

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

   A. 413
   B. 434
   C. 344
   D. 562

8. Select the odd one out.
   A. H361K
   B. C100G
   C. J196B
   D. G121D

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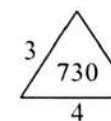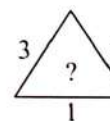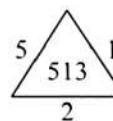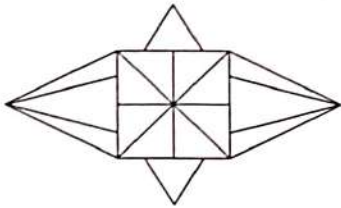

A. 20
B. 22
C. 23
D. More than 23

10. The following letters are coded as follows:

Letters	A	L	P	R	E	J	G	N
Codes	7	1	4	3	9	8	6	2

While coding the given word, following conditions are also to be observed.

Conditions :

(i) If both the middle most and the last letters of the word are vowels, then their codes are to be interchanged.
(ii) If both the first and the middle most letters of the word are consonants, then both are coded as the code of first letter.
(iii) If the middle letter is a consonant, then it will be coded as the code of last letter.

Find the code for ENLARGE.

A. 9217369
B. 9219367
C. 9129376
D. 9216367

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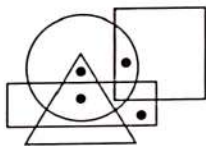
A.

B.

C.

D.

12. A group of friends A, B, C, D, E, F, G and H are sitting around a square table facing the centre. A, B, C and D are sitting in the corners of the square in an alphabetic order. A and B are sitting on the extreme top left corner and extreme top right corner of the square respectively. G is second to the right of H. E is sitting between B and C. H is not sitting just next to C and F is sitting between C and D. Who is sitting between G and F?

A. H
B. B
C. D
D. A

13. Select a figure from the options which will complete the given figure matrix.
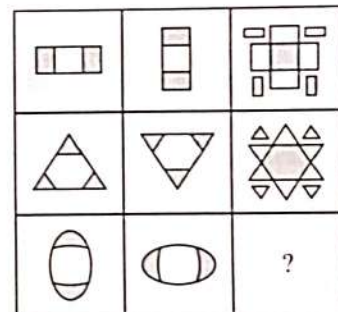
A.

B.

C.

D.

14. A word arrangement machine when given an input line of words rearrange them following a particular rule in each step. The following is an illustration of input and rearrangement.

Input : now kindly go to your home please
Step I : your now kindly go to home please
Step II : your to now kindly go home please
Step III : your to please now kindly go home
**Step IV :** your to please now kindly home go
And Step IV is the last step of the above input.
As per the rule followed in above steps, which of the following is definitely the input for the given step II?
Step II : window open is close near come dust

A. close window is open come dust near
B. window is close come dust near open
C. come dust near open window is close
D. Can't be determined

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

Problem Figures
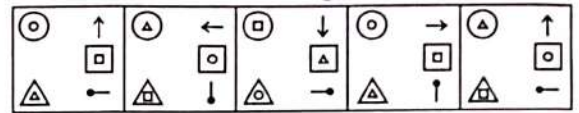
A.

B.

C.

D.

MATHEMATICAL REASONING
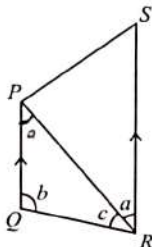
16. The sum of the squares of two consecutive even positive integers is 452. Find the greater integer.

A. 18
B. 16
C. 12
D. 14

17. If $x = r \sin\theta \cos\phi$, $y = r \sin\theta \sin\phi$ and $z = r \cos\theta$, then _____.

A. $x^2 + y^2 + z^2 = r^2$
B. $x^2 + y^2 - z^2 = r^2$
C. $x^2 - y^2 + z^2 = r^2$
D. $z^2 + y^2 - x^2 = r^2$

18. In the given figure (not drawn to scale), if $PQ \| SR$ and $a = \dfrac{2}{7}b$, $b = \dfrac{7}{3}c$, then find the value of c.

A. 30°
B. 105°
C. 45°
D. 75°

19. Which of the following linear equation has solution $x = 7$ and $y = 2$?

A. $7x - 12y = 23$
B. $x - 2y = 11$
C. $4x - 7y = 14$
D. $2x + 3y = 8$

20. A bag contains 6 orange, 9 yellow and 12 pink balls. A ball is drawn from the bag at random. Find the probability that the ball drawn is neither an orange ball nor a pink ball.

A. $\dfrac{5}{9}$
B. $\dfrac{2}{3}$
C. $\dfrac{7}{9}$
D. $\dfrac{1}{3}$

21. From the top of a 75 m high tower, the angles of depression of the top and bottom of a pole are 45° and 60° respectively. Find the height of pole. (Use $\sqrt{3} = 1.732$)

A. 48.50 m
B. 31.70 m
C. 28.50 m
D. 42.46 m

22. A pendulum swings through an angle of 30° and describes an arc 8.8 cm in length. The length of the pendulum is
   A. 15 cm
   B. 16 cm
   C. 15.5 cm
   D. 16.8 cm

23. The curved surface area of a cone is 770 cm². If the circumference of its base is 55 cm, then find the slant height.
   A. 35 cm
   B. 28 cm
   C. 14 cm
   D. 42 cm

$\pi r \ell = 770$
$r\ell = \frac{770 \times 7}{22}$
$r\ell = 35 \times 7$
$2\pi r = 55$
$r = \frac{55 \times 7}{2 \times 22}$
$r = \frac{35}{4}$
$\ell =$

24. The coordinates of points A and B are $(4, -8)$ and $(-6, 5)$ respectively. If P divides the line segment AB so that $\dfrac{AP}{AB} = \dfrac{5}{8}$, then find the x-coordinate of P.
   A. $\dfrac{16}{3}$
   B. $\dfrac{-13}{2}$
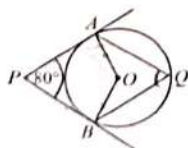   C. $\dfrac{7}{3}$
   D. $\dfrac{-9}{4}$

25. The HCF and LCM of two numbers are 23 and 276 respectively. If one of the number is 69, then find the other number.
   A. 92
   B. 46
   C. 84
   D. 115

26. If α, β are the zeroes of the polynomial $f(x) = x^2 - p(x + 1) - c$ such that $(\alpha + 1)(\beta + 1) = 0$, then c is equal to
   A. 1
   B. 0
   C. -1
   D. 2

27. In the given figure (not drawn to scale), O is the centre of the circle. If PA and PB are tangents, then the value of $\angle AQB$ is

   A. 100°
   B. 80°
   C. 60°
   D. 50°

28. Solve the system of equations : $ax + by = a - b$ and $bx - ay = a + b$ (where $x \neq 0, y \neq 0$) _____.
   A. $x = 1, y = -1$
   B. $x = 4, y = -7$
   C. $x = 3, y = -3$
   D. $x = -3, y = 8$

29. Simplify : $\dfrac{5^n - 5^{n-1}}{5^n + 5^{n+1}}$.
   A. $\dfrac{3}{5}$
   B. $\dfrac{8}{15}$
   C. $\dfrac{2}{15}$
   D. $\dfrac{2}{5}$
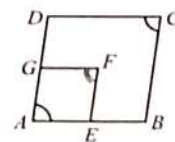
30. If the mean of observations $a_1, a_2, ..., a_n$ is $\bar{a}$, then find the mean of $a_1 - b, a_2 - b, ..., a_n - b$.
   A. $\dfrac{\bar{a}}{b}$
   B. $\bar{a} + b$
   C. $\bar{a} - b$
   D. $b\bar{a}$

31. In $\triangle PQR$, $PQ = 3.5$ cm, $QR = 4.7$ cm and $RP = 5.3$ cm. There is an another triangle XYZ in which $XY = 7$ cm and $\triangle PQR \sim \triangle XYZ$. Find the perimeter of $\triangle XYZ$.
   A. 18 cm
   B. 27 cm
   C. 21 cm
   D. 32 cm

32. In the given figure (not drawn to scale), $ABCD$ and $AEFG$ are two parallelograms. If $\angle C = 55°$, then find $\angle GFE$.

   A. 65°
   B. 75°
   C. 85°
   D. 55°

33. Find the value of $x^3 - 8y^3 - 36xy - 216$, when $x = 2y + 6$.
   A. -1
   B. 2
   C. 0
   D. 3

34. In a quadrilateral $ABCD$, $(\angle A + \angle C)$ is 2 times $(\angle B + \angle D)$. If $\angle A = 140°$ and $\angle D = 60°$, then $\angle B =$
   A. 60°
   B. 80°
   C. 120°
   D. None of these

35. In the given series of A.P., find the 17th term from the end.
   $$7, 11, 15, ..., 175$$
   A. 111
   B. 76
   C. 87
   D. 94

EVERYDAY MATHEMATICS

36. At the end of the year 2002, Ram was half as old as his grandfather. The sum of the years in which they both were born is 3854. Age of Ram at the end of year 2003 is _____.
   A. 50 years
   B. 35 years
   C. 51 years
   D. 36 years

37. An open metallic conical tank is 3 m deep and its circular top has a diameter of 8 m. Find the cost of tin plating in its inner surface at the rate of ₹ 0.5 per 100 cm². (Take $\pi = 3.14$)
   A. ₹ 4220
   B. ₹ 3800
   C. ₹ 3140
   D. ₹ 2700

38. A statue, 2.4 m tall, stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is 60° and from the same point the angle of elevation of the top of the pedestal is 45°. Find the height of the pedestal.
   A. $1.2(\sqrt{3}+1)$ m
   B. $4.7\sqrt{3}$ m
   C. $5.4\sqrt{3}$ m
   D. $(\sqrt{3}-1)$ m

39. A and B can complete a work in 15 days and 10 days respectively. They started doing the work together but after 2 days, B had to leave and A alone completed the remaining work. In how many days the whole work was completed?
   A. 8 days
   B. 10 days
   C. 12 days
   D. 15 days

40. A library charges ₹ 5 for issuing a book for day one and ₹ 1 per day thereafter. If Ritu had taken a book for x days and y be the total amount needs to be paid, then which of the following linear equation best represents the above situation?
   A. $x = y + 4$
   B. $2x = y - 3$
   C. $2y = x - 3$
   D. $y = x + 4$

41. The top of an ice cream cone is in the shape of hemisphere. If the height of the conical part is 5.8 cm and base radius is 2.1 cm, then find the volume of the ice cream cone.
   A. 68.25 cm³
   B. 46.20 cm³
   C. 54.75 cm³
   D. 73.60 cm³

42. If two pipes running together can fill a cistern in 4 hours. One pipe fills the cistern in 6 hours less than the time taken by the other. How many hours does the slower pipe take to fill up the cistern?
   A. 6 hours
   B. 12 hours
   C. 8 hours
   D. None of these

43. Sandeep has a plot in the shape of a triangle perimeter of which is 54 m. If two sides of the plot are 17 m and 12 m, then find the area of the plot.
   A. 124 m²
   B. 64 m²
   C. 136 m²
   D. 90 m²

44. In a book shelf, there are 87 books of Mathematics and remaining books are of other subjects. If the probability of selecting a book of Mathematics is $\frac{3}{7}$, then find the number of books of other subjects.

A. 116
B. 86
C. 93
D. 136

45. In a bangle shop, if the shopkeeper displays the bangles in the form of a square, then he is left with 38 bangles. If he wants to increase the size of square by one unit each side of the square he finds that 25 bangles fall short in completing the square. The actual number of bangles which he had with him in the shop was _____.

A. 1690
B. 999
C. 538
D. Can't be determined

ACHIEVERS SECTION

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

(i) If n^{th} term of an A.P. is given by $t_n = 5n - 2$, then find the common difference of the A.P.

(ii) If 8 times of 8th term of an A.P. is equal to 15 times of 15th term of the same A.P., then find its 23rd term.

	(i)	(ii)
A.	5	0
B.	7	103
C.	5	87
D.	11	204

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

Statement-I : Y-axis divides the line segment joining the points $P(-4, 2)$ and $Q(8, 3)$ in the ratio of $2 : 1$.

Statement-II : If $A(5, 3)$ and $B(x, 5)$ are the points of diameter AB of a circle with centre $O(2, 4)$, then the value of x is 2.

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

(i) The zeroes of the quadratic polynomial $\sqrt{3}x^2 - 8x + 4\sqrt{3}$ are $2\sqrt{3}$ and $\frac{2}{\sqrt{3}}$.

(ii) If α and β are the zeroes of the quadratic polynomial $f(x) = x^2 - x - 4$, then the value of $\frac{1}{\alpha} + \frac{1}{\beta} - \alpha\beta$ is $\frac{10}{7}$.

(iii) If the sum of the zeroes of the polynomial $5x^2 - (3 + k)x + 7$ is zero, then the value of k is 0.

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

49. Match the following and select the correct option.

	Column-I	Column-II
(P)	If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, then $\dfrac{\cos\theta - \sin\theta}{\sqrt{2}} = $ _____	(i) $\tan\theta$
(Q)	$\sqrt{\sec^2\theta - 1} = $ _____	(ii) $\dfrac{\sqrt{3}}{2}$
(R)	$\cos^2\theta(1 + \tan^2\theta) = $ _____	(iii) $\sin\theta$
(S)	$\dfrac{\sin 60° + \tan 60°}{3} = $ _____	(iv) 1

A. (P)-(iii), (Q)-(i), (R)-(iv), (S)-(ii)
B. (P)-(i), (Q)-(iii), (R)-(iv), (S)-(ii)
C. (P)-(ii), (Q)-(i), (R)-(iv), (S)-(iii)
D. (P)-(iv), (Q)-(i), (R)-(ii), (S)-(iii)

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

(i) The pair of linear equations $2kx + 5y = 7$, $6x - 5y = 11$ has a unique solution, if _____.

(ii) The pair of linear equations $x + 2y = 5$ and $3x + 12y = 10$ has _____ solution(s).

(iii) The pair of linear equations $2x + 5y = k$, and $kx + 15y = 18$ has infinitely many solutions, if _____.

	(i)	(ii)	(iii)
A.	$k \neq -3$	unique	$k = 6$
B.	$k \neq 2$	no	$k = 5$
C.	$k \neq -3$	unique	$k = 5$
D.	$k \neq -1$	infinitely many	$k = 6$

SPACE FOR ROUGH WORK