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SCO INTERNATIONAL MATH OLYMPIAD 2023-24

CLASS 11

QUESTION PAPER SET H

Guidelines for the Candidate

1. Before the exam begins, you will have an additional 20 minutes to complete the OMR Sheet with personal information.

2. On the OMR Sheet, clearly write your name, **school code, class, roll number, and mobile number**..

3. Four sections make up the question paper:

   General Math ,**Reason/Assertion** ,**Case Study** and **Achievers Section** (5 Questions).

   Total Questions - 50

4. Every inquiry must be answered. There are no failing grades. Calculator use is not allowed.

5. There is just ONE right response. Select ONE response choice only.

6. Use only an HB pencil or a blue or black ballpoint pen to indicate your choice of responses by darkening the corresponding circles on the OMR Sheet. E.g.

   Q.1: What is the capital of India?

   A. Kolkata   B.   Mumbai   C.   Delhi   D.   Chennai

   You must shade the circle next to option C on the OMR Sheet since that is the right response**.**

   Q.1.Ⓐ Ⓑ ● Ⓓ

7. At the conclusion of the test, hand over the OMR Sheet to the Invigilator.

8. Before attempting the paper, kindly provide your personal information in the box provided on this page. .

School Connect Online

Name:..

Registration ID.:.. Contact No.:..

1.	**Assertion: The Roster form of A = {x | x is a consonant in the word "COMPUTER"} is A = {C,M,P,T,R}** **Reason: There are 5 consonants in the word COMPUTER** A) Only Assertion is true B) Only Reason is true C) Both Assertion and Reason are true and Reason is the correct explanation of the assertion D) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
2.	**N = {1, 2, 3, ..., 50}** **P is a subset of N such that it contains only multiples of 5.** **What will be the value of n(P)?** A) 12 B) 10 C) 8 D) 11
3.	**If A = {a,b,c,d,e,f} and B = {x,y,z} then A ∩ B = ?** A) Φ B) 0 C) {a,b,c,d,e,f} D) {x,y,z}
4.	**If X = {1,2,3,4} and Y = {5,6,7}, then the cardinal number of the powerset of cartesian product of X and Y will be:** A) 2^{10} B) 2^{13} C) 2^{14} D) 2^{12}
5.	**Assertion: A function g is defined as g: B → R, where B = {-2, -1, 0, 1, 2}** **The function g is defined as: g(x) = 2x + 3** **The set of ordered pairs will be {(-2, -1), (-1, 1), (0, 3), (1, 5), (2, 7)}** **Reason: Ordered pairs are generated in the form of (g(x), -x)** A. Only Assertion is true B. Only Reason is true C. Both Assertion and Reason are true and Reason is the correct explanation of the assertion D. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
6.	**The value of sin(450°) is:** A) 1 B) 2 C) 0 D) -1

7.	The value of 2sin60°cos30° - tan30°cosec60° will be:
	    A) $\frac{5}{6}$
	    B) 4/3
	    C) $\frac{2}{5}$
	    D) 6/7

8.	A fan blade completes 300 rotations in 2 minutes. How many radians does it rotate through in one second?
	    A) 3π radians
	    B) 4π radians
	    C) 5π radians
	    D) 2π radians

9.	Assertion: $y(x) = x^3 + 1$ will always be a positive integer for all values of x
	Reason: Function y is dependent on values of x
	
	    A. Only Assertion is true
	    B. Only Reason is true
	    C. Both Assertion and Reason are true and Reason is the correct explanation of the assertion
	    D. Neither Assertion nor Reason is true

10.	For what value of n will $2^n > n^2$?
	    A) 3
	    B) 4
	    C) 5
	    D) 2

11.	Two numbers a and b have geometric mean of 5 and arithmetic mean of 12.
	The equation having a and b as roots will be:
	    A) $x^2 - 24x + 25 = 0$
	    B) $x^2 - 12x + 25 = 0$
	    C) $x^2 - 24x + 5 = 0$
	    D) $x^2 + 24x + 25 = 0$

12.	Assertion: For the equation $3x + i2y = 5 + i4$, the real values of x and y will be $x = \frac{5}{3}$ and $y = 2$
	Reason: We equate the real part together and imaginary part together to solve for x and y
	
	    A. Only Assertion is true
	    B. Only Reason is true
	    C. Both Assertion and Reason are true and Reason is the correct explanation of the assertion
	    D. Neither Assertion nor Reason is true

13.	If a = 2 + 3i and b = 7 - 5i, then what will be the value of ab?
	    A) 25 + 11i
	    B) 29 + 11i
	    C) 25 - 11i

	D) 29 - 11i

14.	If ω is the cube root of unity, then what will be the value of $\omega^{720} \times \boldsymbol{\omega^6}$?
	   A) 1
	   B) -1
	   C) 2
	   D) 0

15.	For what value of k will the equation $3x^2 + 2kx + k^2 - 4 = 0$ give negative discriminant?
	   A) $k < \pm\sqrt{5}$
	   B) $k < \pm\sqrt{2}$
	   C) $k < \pm\sqrt{7}$
	   D) $k < \pm\sqrt{6}$

16.	**Assertion: The solution set of 2x - 3 > 4x + 5 is x < -4**
	Reason: The x terms need to be adjusted on one side of inequality and the constants on the other side as the first step.
	   A. Only Assertion is true
	   B. Only Reason is true
	   C. Both Assertion and Reason are true and Reason is the correct explanation of the assertion
	   D. Neither Assertion nor Reason is true

17.	What will be the interval notation for 6x + 5 < 18?
	   A) $\left(-\infty, \frac{13}{5}\right)$
	   B) $\left(\infty, \frac{13}{6}\right)$
	   C) $\left(-\infty, -\frac{13}{6}\right)$
	   D) $\left(-\infty, \frac{13}{6}\right)$

18.	A coffee shop sells 2 types of coffee: Type A and Type B. Type A costs Rs.10/cup and Type B costs Rs.20/cup. A company owner has a budget of Rs.300 to purchase these coffees for an event at his organisation. He want to buy at least 10 Type A and at least 5 Type B coffees. How can you represent the situation using linear inequations?
	(Consider Type A as x and Type B as y)
	
	   A) $x + 2y \le 30$
	                                $x \ge 10$
	                                $y \ge 2$
	   B) $x + y \le 30$
	                                $x \ge 10$
	                                $y \ge 5$
	   C) $x + 2y \le 30$
	                                $x \ge 10$
	                                $y \ge 5$

	D) $3x + 2y \leq 30$ $$x \geq 10$$ $$y \geq 5$$
19.	What will be the maximum value of x? $$3x + 45 \leq 87$$ A) 13 B) 12 C) 15 D) 14
20.	Ruhi has given two unit tests, and she scored 40 and 45 marks in them. She wants to maintain an average of at least 50 marks in 3 tests of hers. What is the minimum score she should achieve in her third exam? A) Minimum 65 marks B) Maximum 45 marks C) Minimum 100 marks D) Maximum 50 marks
21.	In the word "EXTRAORDINARY," how many different arrangements are there if the vowels (A, E, I, O) must always come together? A) 60482 B) 60480 C) 50550 D) 47086
22.	You are tasked with forming a conference committee for a major event in the IT department. There are 50 qualified individuals available for the event. However, you can select only 5 members for the committee, and you want to ensure that the committee represents a diverse range of skills and expertise like coding, communication, presentation, etc. How many different combinations of the committee can you form from the group of 50 qualified individuals without considering the order in which they are chosen? A) 49! / (5! x 45!) B) 52! / (5! x 45!) C) 50! / (5! x 45!) D) 50! / (6! x 45!)
23.	Assertion: $log_{10}(2x) + log_{10}(x + 1) = 3$, will give the expression $x^2 + x - 500 = 0$ Reason: $log_{10}(a) + log_{10}(b) = log_{10}(ab)$ A. Only Assertion is true B. Only Reason is true C. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion D. Neither Assertion nor Reason is true

24.	What is the coefficient of x^3 in the expansion of $(x + y)^5$? A) 10 B) 5 C) 15 D) 20
25.	Assertion: In the expansion of $(3x - 4)^n$, the coefficient of the term containing x^4 is 84. The value of n = 4 Reason: The coefficient of term containing x^4 = 84, then n - k = 4 A. Only Assertion is true B. Only Reason is true C. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion D. Neither Assertion nor Reason is true
26.	If the first term in an AP is 7 and the common difference is 4, then the sum of first n terms = ? A) $2n^2 + 5n$ B) $2n^2 + 3n$ C) $n^2 + 5n$ D) $2n^2 - 5n$
27.	Assertion: In an arithmetic progression (AP), the sum of the first 8 terms is 120, and the sum of the first 12 terms is 216. The sum of the first 20 terms of this AP = 450 Reason: Subtracting first equation from second equation will give values of a and d A. Only Assertion is true B. Only Reason is true C. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion D. Neither Assertion nor Reason is true
28.	In a geometric progression (GP), the first term a is 2, and the common ratio r is 3. Find the sum of the first 4 terms of this GP. A) 80 B) 75 C) 60 D) 84
29.	What will be the simplified value of $log_3(x) = 0$? A) 0 B) 1 C) 2 D) -1
30.	If the two lines 3x + 2y = 6 and 6x + 4y = 12 coincide, what can we conclude about the two lines?

	A) They represent the same line on the plane B) They represent intersecting lines in different planes C) They give unique solution and point of intersection D) The information is less to decide
31.	A line is given as y = 2x + 4 **What will be the angle made by it with the positive x-axis?** A) $\tan^{-1}(4)$ B) $\tan^{-1}(0.5)$ C) $\tan^{-1}(2)$ D) $\tan^{-1}(1)$
32.	**Which of these represents the equation of a circle with centre (2,-5) and radius 3 units?** A) $(x + 2)^2 + (y + 5)^2 = 9$ B) $(x - 2)^2 + (y - 5)^2 = 9$ C) $(x - 2)^2 + (y + 5)^2 = 9$ D) $(x + 2)^2 - (y + 5)^2 = 9$
33.	**The equation of the parabola with focus at the point (2,3) and directrix x = -1 is:** **(Hint: Consider only positive value of a)** A) $(x + 2)^2 = 12(y - 3)$ B) $(x - 2)^2 = 12(y + 3)$ C) $(x + 2)^2 = 12(y + 3)$ D) $(x - 2)^2 = 12(y - 3)$
34.	**Rohit has come up with an equation 2x - y + z = 3 and Aman has come up with an equation x + y - z = 2.** **They want to check if these lines can have point of intersection or not. If the point of intersection exists, what will it be?** A) There is no point of intersection B) There will be parametric form of point of intersection C) Cannot say anything as information is missing D) None of these
35.	**Assertion: If two lines are skew, they are said to be parallel to each other.** **Reason: They lie on the same plane.** A) Only Assertion is true B) Only Reason is true C) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion D) Neither Assertion nor Reason is true
36.	**If two planes are perpendicular to each other, and one of them has the equation 3x - y + 2z = 5, then what will be the equation of the other plane?** A) x - 2y + 3z = 7 B) x + 2y - 3z = 7

	C) x + 2y + 3z = 2 D) x + 2y + 3z = 7
37.	**What will be the value of** $\lim\limits_{x \to 0} \dfrac{\tan(3x)}{x}$**?** A) 1 B) Undefined C) 0 D) 3
38.	**The derivative of** $f(x) = \sqrt{x^2 + 1}$ **with respect to** x **is:** A) $\dfrac{x}{\sqrt{x^2+1}}$ B) $\dfrac{x}{x^2+1}$ C) $\dfrac{1}{\sqrt{x^2+1}}$ D) $\dfrac{2x}{\sqrt{x^2+1}}$
39.	**Assertion: The derivative of** $\ln(2x^2 + 3)$ **is** $4x/(2x^2 + 3)$ **Reason: We will use Chain Rule to find the final value of derivative** A. Only Assertion is true B. Only Reason is true C. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion D. Neither Assertion nor Reason is true

40.	**Imagine you are a project manager overseeing a construction project. As part of your responsibilities, you encounter an equation that relates to a critical aspect of the project's design.**
	 In the context of your construction project, you come across the equation 4x+2y=8. This equation pertains to a key element of the project's structural design. Understanding this equation is crucial for ensuring the project's success. What is the significance of the slope and the y-intercept of this line equation for your construction project?
	 A) Slope = -2
	     y-intercept = 8
	 B) Slope = 2
	     y-intercept = 8
	 C) Slope = -2
	     y-intercept = -8
	 D) Slope = -2
	     y-intercept = 8

41.	**Statement: All solutions to a linear system of equations are unique.** **What will be the negation to this statement?** A) There exists a linear system of equations with multiple solutions. B) There exists a linear system of equations with two solutions. C) There exists a linear system of equations with one solution. D) None of these

42.	Compound Statement: "A polynomial has real coefficients and a degree of 2." What will be the component statement of it?
	A) "No polynomial has real coefficients." "A polynomial has a degree of 2." B) "A polynomial has real coefficients." "A polynomial has a degree of 2." C) "A polynomial has real coefficients." "A polynomial does not have a degree of 2." D) "A polynomial has real coefficients." "A polynomial has no number with degree of 2."
43.	"A number is a perfect square if and only if it is a positive integer." What can you say about the validity of the statement?
	A) The statement is false B) The statement is lacking information C) The statement is true D) None of these
44.	In a survey of 100 people, 70% preferred Zara, 20% preferred Gucci, and the rest had no preference. Calculate the standard error of the proportion who preferred Gucci.
	A) 0.01265 B) 0.1265 C) 1.01265 D) 0.065
45.	A survey was conducted to determine the favorite ice cream flavors among a group of 200 people. The results are as follows: 50 people liked chocolate. 60 people liked vanilla. 30 people liked strawberry. The rest had different ice cream preferences. Based on the survey data, calculate the percentage of people who had different ice cream preferences. Interpret what this percentage implies about the diversity of ice cream flavor preferences in the surveyed group.
	A) 35% B) 30% C) 40% D) 20%
46.	In a mathematics competition, there were 60 participants. The scores of the participants are normally distributed with a mean of 75 and a standard deviation of 10. What is the approximate number of participants who scored above 85?
	A) 6 participants B) 10 participants C) 24 participants D) 48 participants

47.	Imagine you are playing a board game with friends, and it involves rolling two standard six-sided dice. The goal is to understand the probability of achieving certain outcomes during the game.
	In the board game, you roll two dice simultaneously to move your game piece. Your objective is to calculate the probability of obtaining a total sum of either 5 or 9 on the dice when it's your turn to roll.
	What is the likelihood (probability) that you will roll a sum of either 5 or 9 when you roll two dice in the board game?
	    A) 3/5
	    B) 2/9
	    C) 7/8
	    D) 5/6

48.	A spinner is divided into 8 equal parts, numbered from 1 to 8. If the spinner is spun twice, what is the probability of the second spin landing on a number greater than the first spin?
	    A) 5/16
	    B) 8/9
	    C) 7/16
	    D) 5/16

49.	In a standard deck of 52 playing cards, what is the probability of drawing either a card with a heart or a card with a spade when one card is drawn at random?
	    A) ¼
	    B) ½
	    C) ⅕
	    D) ⅖

50.	In a school, there are 80 students who participate in extracurricular activities, which include either chess club or drama club. Of these, 50 students are in the chess club, and 40 students are in the drama club. If 20 students are members of both clubs, what is the probability that a randomly selected student from the school is a member of either the chess club or the drama club (or both)?
	    A) 68%
	    B) 72%
	    C) 87%
	    D) 95%

SPACE FOR ROUGH WORK