CLASS

12

SAMPLE PAPER

SCIENCE OLYMPIAD FOUNDATION

International Mathematics Olympiad

The actual test paper has 50 questions. Time allowed : 60 minutes. There are 3 sections, 20 questions in section I, 20 in section II and 10 in section III.

Section I : Logical Reasoning, **Section II :** Mathematical Reasoning & **Section III :** Everyday Mathematics

SYLLABUS

Sets, Relations and functions, Mathematical induction, Logarithms, Complex numbers, Linear inequations, Quadratic equations, Sequences and series, Trigonometry, Cartesian system of rectangular coordinates, Straight lines and family of straight lines, Circles, Conic section, Permutations and combinations, Binomial theorem, Exponential and logarithmic series, Mathematical logic, Statistics & Probability, Three dimensional geometry, Vectors, Stocks, Shares and debentures, Average and partition values, Index numbers, Matrices and determinants, Limits, Differential calculus, Integral calculus, Verbal and nonverbal reasoning.

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LOGICAL REASONING

1. The "Golden Rectangle" of the ancient Greeks was considered to have the most pleasing proportion of any rectangle. The ratio of width (w) to height (h) of the rectangle is expressed in the following proportion and is shown in the drawing below.

$$\frac{w}{h} = \frac{2}{\sqrt{5}-1}$$

Jason is planning to paint a rectangular mural using the proportions of the "Golden Rectangle." If the mural is 15 meters wide, how high should it be?

(A) 1.6 meters (B) 9.3 meters (C) 16.5 meters (D) 24.2 meters

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2. The given table shows the boiling points in degrees Celsius for some different elements.Which of the following elements have boiling points that are lower than –190°C ?

(A) Chlorine and Oxygen
(B) Oxygen and nitrogen
(C) Chlorine, helium, and hydrogen
(D) Helium, hydrogen, and nitrogen

BOILING POINTS OF SOME ELEMENTS

Element	Boiling Point (in °C)
Chlorine	– 34.6
Helium	– 269.0
Hydrogen	– 252.9
Nitrogen	– 195.8
Oxygen	– 183.0

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3. A certain radioactive element decays over time according to the equation $y = A\left(\frac{1}{2}\right)^{\frac{t}{300}}$, where A = the number of grams present initially and t = time in years. If 1000 grams were present initially, how many grams will remain after 900 years?

(A) 500 grams (B) 250 grams (C) 125 grams (D) 62.5 grams

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4. Which is the first incorrect step in simplifying $\log_4 \frac{4}{64}$?

Step 1: $\log_4 \frac{4}{64} = \log_4 4 - \log_4 64$ Step 2 : $= 1 - 16$ Step 3 : $= -15$

(A) Step 1 (B) Step 2 (C) Step 3 (D) Each step is correct

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5. Which of the following sentence is true about the graphs of $y = 3(x-5)^2 + 1$ and $y = 3(x+5)^2 + 1$?

(A) Their vertices are maximum
(B) The graphs have the same shape with different vertices
(C) The graphs have different shapes with different vertices
(D) One graph has a vertex that is a maximum, while the other graph has a vertex that is a minimum

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6. If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $\vec{c} = \vec{a} + \vec{b}$ and $\vec{a} \cdot \vec{b} = 0$ then

(A) $a^2 + b^2 + c^2 = 0$ (B) $a^2 - b^2 = c^2$ (C) $a^2 + b^2 = c^2$ (D) $\vec{c} = \vec{a} \times \vec{b}$

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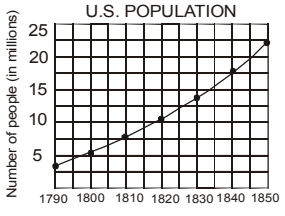
7. In 1790, the United States had a population of approximately 4,000,000 people, as shown on the graph.
According to the graph, in what year had the population grown to approximately twice that number?

(A) 1797 (B) 1808 (C) 1813
(D) 1822



MATHEMATICAL REASONING

8. Which expression represents $f(g(x))$ if $f(x) = x^2 - 1$ and $g(x) = x + 3$?

(A) $x^3 + 3x^2 - x - 3$ (B) $x^2 + 6x + 8$ (C) $x^2 + x + 2$ (D) $x^2 + 8$

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9. From a deck of card two are drawn. The probability that both are of same suit is

(A) $\frac{1}{2}$ (B) $\frac{1}{13}$ (C) $\frac{4}{17}$ (D) $\frac{2}{17}$

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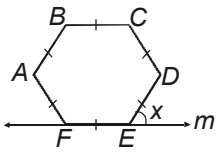
10. Figure ***ABCDEF*** below is a regular hexagon with line m passing through side *FE*. What is the measure of *x* ?



(A) 75° (B) 60°

(C) 51° (D) 45°

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11. On a recent test, Jyoti wrote the equation $\frac{x^2-16}{x-4} = x+4$. Which of the following statements is correct about the equation she wrote?

(A) The equation is always true (B) The equation is always true, except when $x = 4$

(C) The equation is never true (D) The equation is sometimes true when $x = 4$

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12. If *x* is a real number, which best describes the values of *x* for which the inequality $\sqrt{x} > 0$ is true?

(A) All $x > 0$ (B) All $x \geq 0$ (C) All values of *x* (D) No values of *x*

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13. Given the equation $y = x^n$ where $x > 0$ and $n < 0$, which statement is valid for real values of *y*?

(A) $y > 0$ (B) $y = 0$ (C) $y < 0$ (D) $y \leq 0$

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14. If the equation $y = 2^x$ is graphed, which of the following values of *x* would produce a point closest to the *x*-axis?

(A) 1/4 (B) 3/4 (C) 5/3 (D) 8/3

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15. The graph of $\left(\frac{x}{2}\right)^2 - \left(\frac{y}{3}\right)^2 = 1$ is a hyperbola. Which set of equations represents the asymptotes of the hyperbola's graph ?

(A) $y = \frac{3}{2}x, y = -\frac{3}{2}x$ (B) $y = \frac{3}{2}x, y = -\frac{2}{3}x$

(C) $y = \frac{1}{2}x, y = -\frac{1}{2}x$ (D) $y = \frac{1}{3}x, y = -\frac{1}{3}x$

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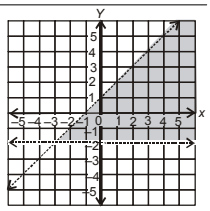
16. What system of inequalities best represents the graph shown?



(A) $y > -2$ and $y > x + 1$ (B) $y > -2$ and $y < x + 1$

(C) $y < -2$ and $y > x + 1$ (D) $y < -2$ and $y < x + 1$

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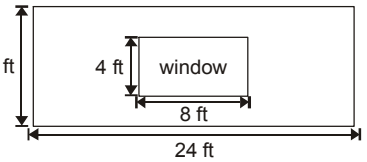
17. If $\int_{\pi/6}^{\pi/3} \frac{\sqrt{\sin x}}{\sqrt{\cos x} + \sqrt{\sin x}}\,dx = \frac{k}{4}$ then value of *k* equals

(A) $\pi/12$ (B) $\pi/3$ (C) $\pi/2$ (D) $\pi/7$

EVERYDAY MATHEMATICS

18. Mrs. Ballad decided to apply wallpaper on one wall of her living room. A diagram of the rectangular wall with its window is shown. A roll of wallpaper covers approximately 30 square feet. What is the minimum number of rolls she will have to buy in order to cover the entire wall excluding the window?



(A) 2 rolls (B) 5 rolls (C) 6 rolls (D) 7 rolls

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19. A box contains 7 large red marbles, 5 large yellow marbles, 3 small red marbles, and 5 small yellow marbles. If a marble is drawn at random, what is the probability that it is yellow, given that it is one of the large marbles?

(A) 5/12 (B) 7/20 (C) 5/8 (D) 1/5

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20. A restaurant manager bought 20 packages of bagels. Some packages contained 6 bagels each, and the rest contained 12 bagels each. There were 168 bagels in all. How many packages of 12 bagels did the manager buy?

(A) 6 (B) 8 (C) 9 (D) 12

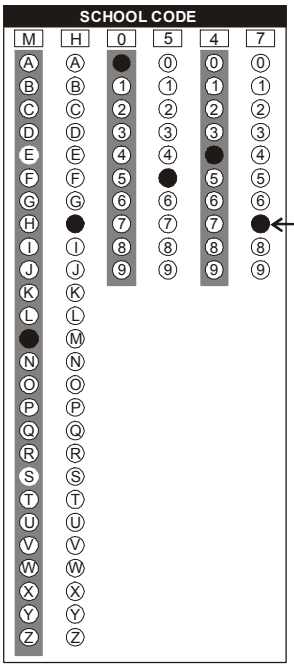
SAMPLE ANSWER SHEET

1. NAME : If your name is SACHIT A IYER, then you should write as follows :

S	A	C	H	I	T		A		I	Y	E	R														

2. Father's Name : If your father's name is SATISH KUMAR SHARMA, then you should write as follows :

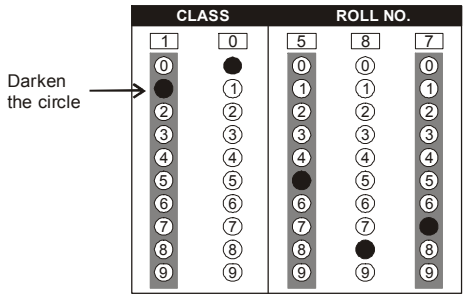
S	A	T	I	S	H		K	U	M	A	R		S	H	A	R	M	A								



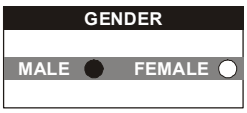
3. SCHOOL CODE
Write your school code i.e. if your school code is MH0547 darken as follows :

4. CLASS
If you are in Class 10, then you should darken as follows :

5. ROLL NO.
If your roll no. is 587, then you should write and darken the circles as follows :



6. GENDER
If you are a boy, then darken **Male** circle



7. If your choice for Answer 1 is C, then you should darken the circle as follows : **1.** Ⓐ Ⓑ ● Ⓓ

MARK YOUR ANSWERS WITH HB PENCIL/BALL POINT PEN (BLUE/BLACK)

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1. Ⓐ Ⓑ Ⓒ Ⓓ	**5.** Ⓐ Ⓑ Ⓒ Ⓓ	**9.** Ⓐ Ⓑ Ⓒ Ⓓ	**13.** Ⓐ Ⓑ Ⓒ Ⓓ	**17.** Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ	**6.** Ⓐ Ⓑ Ⓒ Ⓓ	**10.** Ⓐ Ⓑ Ⓒ Ⓓ	**14.** Ⓐ Ⓑ Ⓒ Ⓓ	**18.** Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ	**7.** Ⓐ Ⓑ Ⓒ Ⓓ	**11.** Ⓐ Ⓑ Ⓒ Ⓓ	**15.** Ⓐ Ⓑ Ⓒ Ⓓ	**19.** Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ	**8.** Ⓐ Ⓑ Ⓒ Ⓓ	**12.** Ⓐ Ⓑ Ⓒ Ⓓ	**16.** Ⓐ Ⓑ Ⓒ Ⓓ	**20.** Ⓐ Ⓑ Ⓒ Ⓓ

ANSWERS

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1. (B)	2. (D)	3. (C)	4. (B)	5. (B)	6. (C)	7. (C)	8. (B)	9. (C)	10. (B)
11. (B)	12. (A)	13. (A)	14. (A)	15. (A)	16. (B)	17. (B)	18. (C)	19. (A)	20. (B)