

CLASS

11

## SAMPLE PAPER

Science  
Olympiad  
Foundation

For Excellence in Science, Maths & IT

### INTERNATIONAL MATHEMATICS OLYMPIAD

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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, Relation and function, Mathematical induction, Logarithms, Complex number, Linear inequations, Differentiation, Sequence and series (A.P. & G.P, Misc.), Trigonometric functions, Cartesian system of rectangular coordinates, Straight line and family of straight lines, Circle, Conic section, Trigonometry, Permutation and combinations, Binomial theorem, Statistics, Mathematical logic, Limits.

## LOGICAL REASONING

1. Tony and Sunil are participating in a jog-a-thon to raise money for charity. Tony will raise Rs. 20, plus Rs. 2 for each lap he jogs. Sunil will raise Rs. 30, plus Rs. 1.50 for each lap he jogs. The total amount of money each will raise can be calculated using the following expressions where  $n$  represents the number of laps run :

$$\text{Tony : } 20 + 2n \quad ; \quad \text{Sunil : } 30 + 1.50n$$

After how many laps will they have raised the same amount of money?

- (A) 3                      (B) 6.5                      (C) 14.5                      (D) 20                      (E) None of these.

2. There is a proportional relationship between the size of a projected image on a screen and the distance of the screen from the projector.

An image that is projected onto a screen 10 feet away is a rectangle with dimensions of 2 feet by 3 feet. If the screen is moved to a distance of 15 feet from the projector, what will be the dimensions of the larger image projected onto the screen?

- (A) 3 feet by 4.5 feet                      (B) 4 feet by 6 feet  
(C) 4.5 feet by 6.75 feet                      (D) 7 feet by 8 feet                      (E) None of these.

3. A formula for computing a value  $r$  is  $r = \frac{mx + my}{wz}$ , where  $m, x, y, w$  and  $z$  are positive integers. An increase in which variable would result in a corresponding decrease in  $r$ ?

- (A)  $m$                       (B)  $x$                       (C)  $y$                       (D)  $z$                       (E) None of these.

4. Matt's mathematics class is playing "Guess My Rule." The teacher writes this table of values on the chalkboard, and the class finds an equation that fits the values in the table. Which of these equations describes the relationship between the values in the table?

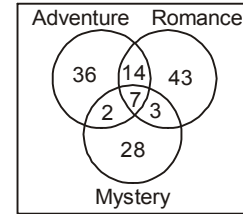
Table of Values

$x$	$y$
-3	-11
0	-2
2	4
5	13

- (A)  $y = 2x - 2$                       (B)  $y = -2x - 2$                       (C)  $y = -3x - 2$                       (D)  $y = 3x - 2$   
(E) None of these.

5. The Venn diagram below shows the types of novels the literature club members read during their summer break.

Literature Club Summer Reading



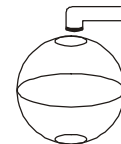
- Which of the following is NOT supported by the information in the Venn diagram?  
(A) 21 members read both an adventure novel and a romance novel  
(B) 64 members read only an adventure novel or a mystery novel  
(C) 26 members read all three types of novels  
(D) 67 members read a romance novel  
(E) None of these.

6. A guitar manufacturer uses a computer-controlled machine to make electric guitars. The table below shows the total number of guitars made after 2, 4, 8 and 16 hours. If  $g$  represents the total number of guitars made after  $h$  hours, which equation represents the pattern shown in the table?

Hours ( $h$ )	Total Number of Guitars Made ( $g$ )
2	18
4	42
8	90
16	186

- (A)  $g = 12h - 6$                       (B)  $g = 12h$   
(C)  $g = 3h^2 - 6$                       (D)  $g = 3h^2 + 6$                       (E) None of these.

7. Look at this container. Water flows into this container at a constant rate. Which graph could represent the height of the water in the container over time?



- (A)                      (B)                      (C)                      (D)

- (E) None of these.

## MATHEMATICAL REASONING

8. In an examination of 9 papers, a candidate has to pass in more papers than the number of papers in which he fails in order to get the success. The number of ways in which he can fail

- (A) 128                      (B) 256                      (C) 255                      (D)  $9 \times 8!$                       (E) None of these.

9. What is the solution to the system of equations shown below?

$$\begin{cases} 2x - y + 3z = 8 \\ x - 6y - z = 0 \\ -6x + 3y - 9z = 24 \end{cases}$$

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- (A)  $(0, 4, 4)$  (B)  $\left(1, 4, \frac{10}{3}\right)$  (C) no solution (D) infinitely many solutions  
 (E) None of these.

10. What is the  $n$ th term in the arithmetic series below?

- $3 + 7 + 11 + 15 + 19 \dots$
- (A)  $4n$  (B)  $3 + 4n$  (C)  $2n + 1$  (D)  $4n - 1$  (E) None of these.

11. A train is made up of a locomotive, 7 different cars, and a caboose. If the locomotive must be first, and the caboose must be last, how many different ways can the train be ordered?

- (A) 5040 (B) 181,440 (C) 362,880 (D) 823,543 (E) None of these.

12. If  $A + B = \frac{\pi}{4}$  then value of  $(1 + \tan A)(1 + \tan B)$  equals

- (A) 1 (B) 2 (C) -2 (D) -1 (E) None of these

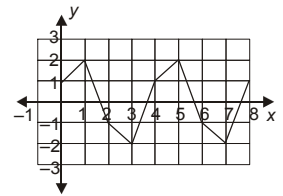
13. What are the coordinates of the image of point  $P(-3, -7)$  after a reflection about the line  $y = 2$ ?

- (A)  $(-3, 9)$  (B)  $(-3, 11)$  (C)  $(5, -7)$  (D)  $(7, -7)$  (E) None of these.

14. Look at this function

As the value of  $x$  increases, the  $y$ -values form a repeating pattern. If this pattern continues, what is the  $y$ -value when  $x = 26$ ?

- (A) -2 (B) -1  
 (C) 1 (D) 2  
 (E) None of these.



15. What is the range of the function  $f(x) = x^2 + 3$  if the domain is  $\{-3, 0, 3\}$ ?

- (A)  $\{3, 12\}$  (B)  $\{-6, 3, 12\}$  (C) All real numbers  
 (D) All real numbers greater than or equal to 3 (E) None of these.

16. The sum of three consecutive odd integers is 21. If  $x$  is the least of these odd integers, which equation must be true?

- (A)  $3x = 21$  (B)  $3x + 3 = 21$  (C)  $3x + 4 = 21$  (D)  $3x + 6 = 21$  (E) None of these.

17. The harmonic mean of the roots of the equation  $(2 + \sqrt{3})x^2 - (3 + \sqrt{5})x + (6 + 2\sqrt{5}) = 0$  is

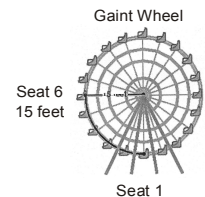
- (A) 2 (B) 7 (C) 8 (D) 4 (E) None of these.

### EVERYDAY MATHEMATICS

18. Julie works at the amusement park with the maintenance crew. She needs to replace a string of burned-out lights along the arc shown between seat 1 and seat 6. The arc makes up  $\frac{1}{4}$  of the Gaint Wheel.

The 20 seats of the wheel are equally spaced, and the supports from the center of the wheel to each seat are 15 feet in length. How long, to the nearest foot, does the string of replacement lights need to be?

- (A) 24 feet (B) 30 feet (C) 47 feet (D) 90 feet (E) None of these.



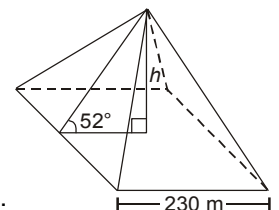
19. The typical wingspan of the little blue heron is 4 inches more than half the typical wingspan of the great blue heron. If  $g$  represents the typical wingspan of the great blue heron, which expression represents the typical wingspan of the little blue heron?

- (A)  $4\left(\frac{1}{2}g\right)$  (B)  $\frac{1}{2}g + 4$  (C)  $2g + 4$  (D)  $\frac{1}{2}(g + 4)$  (E) None of these.

20. This diagram shows the angle of inclination of the triangular faces of the Great Pyramid in Egypt.

When it was built, the length of each side of the square base was 230 meters. Which equation represents the height,  $h$ , of the Great Pyramid when it was built?

- (A)  $h = 115 \sin 52^\circ$  (B)  $h = 115 \tan 52^\circ$   
 (C)  $h = \frac{115}{\sin 52^\circ}$  (D)  $h = \frac{115}{\tan 52^\circ}$  (E) None of these.



### ANSWER KEY

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