SCO INTERNATIONAL MATHS OLYMPIAD

CLASS 11 | QUESTION PAPER SET H

Solved and formatted edition with answer key, explanations, and corrected question blocks

Designed for website publishing, student practice, teacher review, and parent-guided preparation.

- 35 carefully formatted questions across General Mathematics, Assertion and Reason, Everyday Mathematics, and Achievers Section.
- Each question is placed in a clean question block with options, correct answer, and explanation.
- Passage-style word problems are kept inside the question block for easy copying into web pages or PDFs.
- Reviewed for answer-key accuracy, grammar, duplicate ambiguity, and grade-appropriate mathematical clarity.

Maths	Reasoning	Calendar	Word Problems
Time	Fractions	Data	Achievers

Class	Questions	Time	Type
11	35	1 hour	Objective MCQ

Section A - General Mathematics

Q.1

Permutations and Restrictions

In how many ways can 10 distinct books be arranged on a shelf so that two particular books A and B are never next to each other?

A. 2,903,040	**B.** 2,500,000
C. 3,025,440	**D.** 3,628,800

Answer: A

Explanation: Total arrangements are 10! = 3,628,800. If A and B are together, treat them as one block: 9! x 2! = 725,760. Required arrangements = 3,628,800 - 725,760 = 2,903,040.

Q.2

Trigonometric Functions

Evaluate tan 75° exactly.

A. $2 - \sqrt{3}$	**B.** $2 + \sqrt{3}$
C. $\sqrt{3} - 1$	**D.** $\sqrt{3} + 2\sqrt{2}$

Answer: B

Explanation: $\tan(75°) = \tan(45°+30°) = (1 + 1/\sqrt{3})/(1 - 1/\sqrt{3}) = (\sqrt{3}+1)/(\sqrt{3}-1) = 2 + \sqrt{3}$.

Q.3

Limits and Derivatives

Find the value of $\lim(x\to0) [\sin x - x]/x^3$.

A. -1/6	**B.** 1/6
C. 0	**D.** 1

Answer: A

Explanation: Using $\sin x = x - x^3/6 +$ higher powers, $\sin x - x = -x^3/6 +$ higher powers. Dividing by x^3 and taking $x\to0$ gives -1/6.

Q.4

Linear Inequalities

For which real value of k does the inequality $2x - 5 < kx + 3$ hold for every real number x?

A. $k > 2$	**B.** $k < 2$
C. $k = 2$	**D.** No real k

Answer: C

Explanation: Rearrange: $(2-k)x < 8$. For this to be true for every real x, the coefficient of x must be 0. Thus $2-k = 0$, so $k = 2$; then $0 < 8$ is always true.

Q.5

Complex Numbers and Quadratic Equations

Let the roots of $x^2 - (k+1)x + k = 0$ be reciprocals of each other. Find k.

A. 0	**B.** 1
C. 2	**D.** -1

Answer: B

Explanation: If two roots are reciprocals, their product is 1. For the quadratic, product of roots = k. Therefore $k = 1$.

Q.6

Mathematical Reasoning

What is the contrapositive of the statement: “If it is raining, then the ground is wet”?

A. If it is not raining, then the ground is not wet.	**B.** If the ground is not wet, then it is not raining.
C. If the ground is wet, then it is raining.	**D.** If it is not raining, then the ground is wet.

Answer: B

Explanation: For a statement P => Q, the contrapositive is not Q => not P. Here P is “it is raining” and Q is “the ground is wet”.

Q.7

Principle of Mathematical Induction

To prove the formula $1^2 + 2^2 + \ldots + n^2 = n(n+1)(2n+1)/6$ for all positive integers n by induction, which base case should be verified first?

A. n = 0	**B.** n = 1
C. n = 2	**D.** n = 3

Answer: B

Explanation: The statement is for positive integers, so the natural first base case is n = 1. Both sides are equal to 1.

Q.8

Straight Lines

Find the perpendicular distance from P(3,4) to the line 3x + 4y - 10 = 0.

A. 1	**B.** 2
C. 3	**D.** 4

Answer: C

Explanation: Distance = $|3(3)+4(4)-10|/\sqrt{(3^2+4^2)} = |9+16-10|/5 = 15/5 = 3$.

Q.9

Binomial Theorem

Find the term independent of x in the expansion of $(2x^3 + x^{-2})^5$.

A. 40	**B.** 80
C. 10	**D.** 20

Answer: A

Explanation: General term = C(5,k)(2x^3)^(5-k)(x^-2)^k. Power of x is 3(5-k)-2k = 15-5k. Set 15-5k = 0, so k = 3. Coefficient = C(5,3) x 2^2 = 10 x 4 = 40.

Q.10

Probability

A number is chosen at random from 1 to 100. What is the probability that it is divisible by 2 or 5?

A. 2/5	**B.** 3/5
C. 6/10	**D.** 50/100

Answer: B

Explanation: Multiples of 2 = 50, multiples of 5 = 20, multiples of both 10 = 10. By inclusion-exclusion, favourable = 50+20-10 = 60. Probability = 60/100 = 3/5.

Q.11

Permutations and Combinations

Four buses run between Bhopal and Gwalior. A traveller goes from Gwalior to Bhopal by one bus and returns by a different bus. How many total ways are possible?

A. 12	**B.** 16
C. 4	**D.** 8

Answer: A

Explanation: There are 4 choices for the onward bus. Since the return bus must be different, there are 3 choices for return. Total ways = 4 x 3 = 12.

Q.12

Basic Mathematics

In how many ways can 10 true-false questions be answered?

A. 20	**B.** 100
C. 512	**D.** 1024

Answer: D

Explanation: Each question has 2 choices. For 10 independent questions, total ways = 2^{10} = 1024.

Q.13

Permutations

There are 8 gates in a hall. In how many ways can a person enter through one gate and come out through a different gate?

A. 7	**B.** 64
C. 15	**D.** 56

Answer: D

Explanation: There are 8 choices for entry. For each entry gate, there are 7 different exit gates. Total ways = 8 x 7 = 56.

Q.14

Permutations

P, Q, R and S have to give lectures to an audience. In how many ways can the organiser arrange their order of presentation?

A. 4	**B.** 12
C. 256	**D.** 24

Answer: D

Explanation: The order of 4 distinct speakers can be arranged in 4! ways = 24.

Q.15

Permutations

In how many ways can first, second and third prizes be given to 5 competitors, assuming no competitor receives more than one prize?

A. 10	**B.** 60
C. 15	**D.** 125

Answer: B

Explanation: This is a permutation: 5P3 = 5 x 4 x 3 = 60 because the prizes are distinct.

Q.16

Permutations

In a railway compartment there are 6 numbered seats. In how many ways can 6 passengers occupy these 6 seats?

A. 36	**B.** 30
C. 720	**D.** 120

Answer: C

Explanation: Six distinct passengers can be arranged in 6 distinct seats in 6! = 720 ways.

Q.17

Permutations

Using any number of flags at a time, how many different signals can be made with 6 flags of different colours if order matters?

A. 1956	**B.** 1958
C. 720	**D.** None of these

Answer: A

Explanation: Signals can use 1 to 6 flags. Total = 6P1 + 6P2 + 6P3 + 6P4 + 6P5 + 6P6 = 6+30+120+360+720+720 = 1956.

Q.18

Geometry and Symmetry

The number of essentially different ways of painting the six faces of a cube with six different colours is:

A. 1	**B.** 6
C. 6!	**D.** 30

Answer: D

Explanation: There are 6! colourings if orientation matters. A cube has 24 rotational symmetries, so distinct colourings = 6!/24 = 720/24 = 30.

Q.19

Basic Mathematics

How many significant digits are there in 0.0001?

A. 5	**B.** 4
C. 1	**D.** None of these

Answer: C

Explanation: Leading zeros before the first non-zero digit are not significant. The only significant digit is 1.

Q.20

Approximation and Errors

When a number is rounded to n decimal places, the maximum absolute error does not exceed:

A. 0.5×10^{-n}	**B.** 10^{-n}
C. 5×10^{n}	**D.** 10^{n}

Answer: A

Explanation: Rounding to n decimal places means the nearest unit is 10^{-n}. Maximum rounding error is half of that: 0.5×10^{-n}.

Section B - Reasoning / Assertion and Applied Mathematics

Q.21

Approximation and Errors

When 2.089 is rounded to three significant digits, what is the absolute error?

A. 0.01	**B.** -0.01
C. 0.001	**D.** -0.001

Answer: C

Explanation: 2.089 rounded to three significant digits is 2.09. Absolute error = |2.09 - 2.089| = 0.001.

Q.22

Quadratic Equations

For what values of k does the equation $x^2 - kx + 1 = 0$ have real roots?

A. $-2 < k < 2$	**B.** $-2 \leq k \leq 2$
C. $k \leq -2$ or $k \geq 2$	**D.** All real k

Answer: C

Explanation: Discriminant must be non-negative: $k^2 - 4 \geq 0$. Thus $k^2 \geq 4$, which gives $k \leq -2$ or $k \geq 2$.

Q.23

Numerical Methods

The smallest positive root of the equation $x = \cos x$ lies in which interval?

A. (0,1)	**B.** (-1,0)
C. (1,2)	**D.** (2,3)

Answer: A

Explanation: For $f(x)=x-\cos x$, $f(0)=-1$ and $f(1)=1-\cos 1>0$. Since the sign changes between 0 and 1, a root lies in (0,1).

Q.24

Algebra

The maximum possible number of real roots of a polynomial equation of degree n is:

A. 2	**B.** 3
C. n	**D.** 2n

Answer: C

Explanation: A polynomial of degree n can have at most n real roots.

Q.25

Algebraic Identities

If $x + 1/x = 5$, find $x^2 + 1/x^2$.

A. 20	**B.** 21
C. 23	**D.** 25

Answer: C

Explanation: Square both sides: $(x+1/x)^2 = x^2 + 2 + 1/x^2 = 25$. Hence $x^2 + 1/x^2 = 23$.

Q.26

Counting Numbers

How many numbers greater than 3000 can be formed using the digits 0,1,2,3,4,5 without repetition?

A. 180	**B.** 360
C. 1380	**D.** 1500

Answer: C

Explanation: Four-digit numbers greater than 3000: first digit 3,4,5 gives 3 x 5P3 = 180. Five-digit numbers: first digit not 0 gives 5 x 5P4 = 600. Six-digit numbers: first digit not 0 gives 5 x 5! = 600. Total = 180+600+600 = 1380.

Q.27

Combinations

If C(n,3) = C(n,4), find n.

A. 6	**B.** 7
C. 8	**D.** 9

Answer: B

Explanation: C(n,r)=C(n,n-r). For C(n,3)=C(n,4), we get 3+4=n, so n=7. Algebraically, C(n,4)/C(n,3)=(n-3)/4=1, so n=7.

Q.28

Newton-Raphson Method

Using Newton-Raphson method for $f(x)=x^2-3$ with $x_0=2$, what is x_1?

A. 1.50	**B.** 1.75
C. 2.25	**D.** 1.25

Answer: B

Explanation: $x_1 = x_0 - f(x_0)/f'(x_0) = 2 - (4-3)/(4) = 2 - 1/4 = 1.75$.

Q.29

Numerical Integration

Using the trapezoidal rule with h=1 and values $y_0=1$, $y_1=2.72$, $y_2=7.39$, $y_3=20.09$, $y_4=54.60$, approximate the integral from x=0 to x=4.

A. 53.87	**B.** 53.60
C. 58.00	**D.** None of these

Answer: C

Explanation: Trapezoidal estimate = $h/2[y_0+y_4+2(y_1+y_2+y_3)] = 1/2[1+54.60+2(2.72+7.39+20.09)] = 58.00$.

Q.30

Coordinate Geometry

The gradient of the line joining two points on the curve $y=x^2$ whose abscissae are 1 and 3 is:

A. 6	**B.** 5
C. 4	**D.** 3

Answer: C

Explanation: Points are (1,1) and (3,9). Slope = (9-1)/(3-1)=8/2=4.

Section C - Case Study and Achievers Section

Q.31

Straight Lines

The slope of a line which cuts intercepts of equal lengths on the coordinate axes is:

A. -1	**B.** 0
C. 2	**D.** 1

Answer: A

Explanation: If intercepts are equal, the line is $x/a + y/a = 1$, or $x + y = a$. Its slope is -1.

Q.32

Straight Lines

Find the equation of the straight line passing through (-3,2) and cutting intercepts equal in magnitude but opposite in sign from the axes.

A. $x - y + 5 = 0$	**B.** $x + y + 1 = 0$
C. $x - y - 5 = 0$	**D.** $x + y - 5 = 0$

Answer: A

Explanation: If intercepts are a and -a, the line is $x/a + y/(-a) = 1$, or $x - y = a$. Passing through (-3,2) gives $-3 - 2 = a = -5$. Hence $x - y + 5 = 0$.

Q.33

Straight Lines

Find the equation of a line through (4,3) whose intercepts on the coordinate axes have sum -1.

A. x - 2y + 2 = 0 and 3x - 2y - 6 = 0	**B.** x + 2y - 10 = 0 only
C. 2x - y - 5 = 0 only	**D.** x + y + 1 = 0 and x - y = 1

Answer: A

Explanation: Let intercepts be a and b. Then a+b=-1 and 4/a + 3/b = 1. Solving gives (a,b)=(-2,1) or (2,-3). These lead to x - 2y + 2 = 0 and 3x - 2y - 6 = 0.

Q.34

Straight Lines

A line passes through (2,2) and is perpendicular to 3x + 4y + 5 = 0. What is its y-intercept?

A. -2/3	**B.** 2/3
C. 1	**D.** -1

Answer: A

Explanation: The given line has slope -3/4, so the perpendicular line has slope 4/3. Through (2,2): y-2 = (4/3)(x-2). Put x=0 to get y = 2 - 8/3 = -2/3.

Q.35

Straight Lines

The equation of the line passing through (1,-2) and perpendicular to 2x - 3y + 4 = 0 is:

A. 3x + 2y + 1 = 0	**B.** 2x - 3y - 8 = 0
C. 3x - 2y - 7 = 0	**D.** 2x + 3y + 4 = 0

Answer: A

Explanation: The given line has slope 2/3, so the perpendicular slope is -3/2. Through (1,-2): y+2 = (-3/2)(x-1). Simplifying gives 3x + 2y + 1 = 0.

Consolidated Answer Key

Q.No.	Answer	Topic	Q.No.	Answer
1	**A**	Permutations and Restrictions	19	**C**
2	**B**	Trigonometric Functions	20	**A**
3	**A**	Limits and Derivatives	21	**C**
4	**C**	Linear Inequalities	22	**C**
5	**B**	Complex Numbers and Quadratic	23	**A**
6	**B**	Mathematical Reasoning	24	**C**
7	**B**	Principle of Mathematical Indu	25	**C**
8	**C**	Straight Lines	26	**C**
9	**A**	Binomial Theorem	27	**B**
10	**B**	Probability	28	**B**
11	**A**	Permutations and Combinations	29	**C**
12	**D**	Basic Mathematics	30	**C**
13	**D**	Permutations	31	**A**
14	**D**	Permutations	32	**A**
15	**B**	Permutations	33	**A**
16	**C**	Permutations	34	**A**
17	**A**	Permutations	35	**A**
18	**D**	Geometry and Symmetry		

Space for Rough Work