School Connect Online

SCO INTERNATIONAL MATHS OLYMPIAD

CLASS 12 QUESTION PAPER

Official Question Paper | Set H | Answer Key & Explanations

- relations, functions, algebra, calculus, vectors, 3D geometry, linear programming, and probability
- conceptual problem-solving with real-world modelling, proof logic, and multi-step calculations

Relations & Functions	Algebra	Calculus	Vectors & 3D	Probability
Matrices	Determinants	Integration	Differential Equations	Olympiad Reasoning

Official Question Paper - Edition

Class	12
Exam	SCO International Maths Olympiad
Question Paper Set	H
Academic Session	2025-26
Total Questions	35
Time	60 minutes
Format	General Mathematics, Case Study, Assertion-Reason, Achievers Section

General Mathematics

Q1. On the set A = {1, 2, 3, ..., 12}, define a relation R by aRb if a − b is divisible by 3. How many equivalence classes does R form?

A. 2
B. 3
C. 4
D. 6

Answer: B

Explanation: Numbers with the same remainder on division by 3 belong together. The classes are remainders 0, 1, and 2; therefore there are 3 equivalence classes.

Q2. Evaluate $\sin^{-1}(3/5) + \cos^{-1}(3/5)$.

A. 0
B. π/4
C. π/2
D. π

Answer: C

Explanation: For x in [−1,1], $\sin^{-1}x + \cos^{-1}x = \pi/2$. Taking x = 3/5 gives π/2.

Q3. If A = [[1, 2], [3, 4]], which matrix is A^{-1}?

A. [[-2, 1], [3/2, −1/2]]
B. [[2, −1], [−3/2, 1/2]]
C. [[4, −2], [−3, 1]]
D. [[1, 2], [3, 4]]

Answer: A

Explanation: det(A) = 1×4 − 2×3 = −2. A^{-1} = (1/−2)[[4, −2], [−3, 1]] = [[−2, 1], [3/2, −1/2]].

Q4. Find the value of the determinant | 2 1 3; 0 −1 4; 5 2 0 |.

A. 9
B. 14
C. 19
D. 24

Answer: C

Explanation: Expanding along the first row: 2(−8) − 1(−20) + 3(5) = −16 + 20 + 15 = 19.

Q5. The function f(x) = |x − 2| at x = 2 is:

A. neither continuous nor differentiable
B. continuous but not differentiable
C. differentiable but not continuous
D. continuous and differentiable

Answer: B

Explanation: The graph has no break at x = 2, so it is continuous. The left-hand derivative is −1 and the right-hand derivative is +1, so it is not differentiable.

Q6. If $y = x^x$ for $x > 0$, find dy/dx at x = 1.

A. 0
B. 1
C. e
D. 2

Answer: B

Explanation: Taking logarithms: ln y = x ln x. Hence y'/y = ln x + 1. At x = 1, y = 1 and ln 1 = 0, so y' = 1.

Q7. Find the maximum value of f(x) = x(12 − x) for real x.

A. 24
B. 32
C. 36
D. 48

Answer: C

Explanation: $f(x) = 12x - x^2$ is a downward-opening parabola. Its vertex is at x = 12/2 = 6, and f(6) = 36.

Q8. Evaluate $\int_0^1 3x^2\,dx$.

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

Answer: B

Explanation: $\int 3x^2\,dx = x^3$. From 0 to 1, the value is $1^3 - 0^3 = 1$.

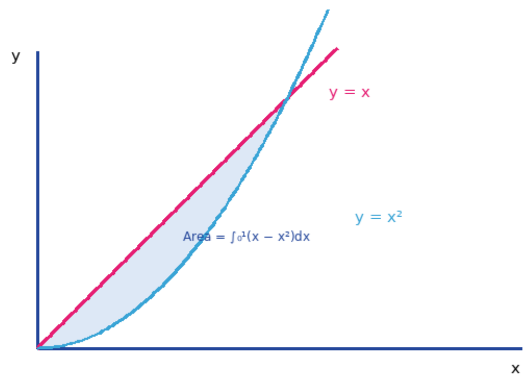
Q9. If f(x) is an odd function, then $\int_{-2}^{2} f(x)\,dx$ equals:

A. −2
B. 0
C. 2
D. depends on f(0)

Answer: B

Explanation: The integral of an odd function over symmetric limits [−a, a] is 0 because positive and negative areas cancel.

Q10. Find the area bounded by y = x and $y = x^2$ between x = 0 and x = 1.



A. 1/6
B. 1/3
C. 1/2
D. 2/3

Answer: A

Explanation: On [0,1], $x \ge x^2$. Area = $\int_0^1 (x - x^2)dx = [x^2/2 - x^3/3]_0^1 = 1/2 - 1/3 = 1/6$.

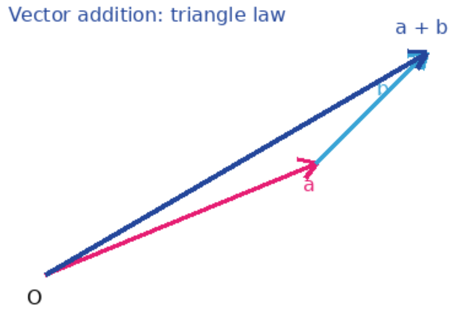
Q11. Solve the differential equation $dy/dx = 3y$ with $y(0) = 2$.

A. $y = 2e^x$
B. $y = 2e^{3x}$
C. $y = 3e^{2x}$
D. $y = 2 + 3x$

Answer: B

Explanation: $dy/y = 3dx$. Integrating gives $\ln y = 3x + C$, so $y = Ce^{3x}$. Since $y(0)=2$, $C=2$.

Q12. For vectors a = (1, 2, 2) and b = (2, −1, 2), find cos θ, where θ is the angle between them.



A. 2/9
B. 4/9
C. 5/9
D. 7/9

Answer: B

Explanation: a·b = 2 − 2 + 4 = 4. |a| = 3 and |b| = 3, so cos θ = 4/(3×3) = 4/9.

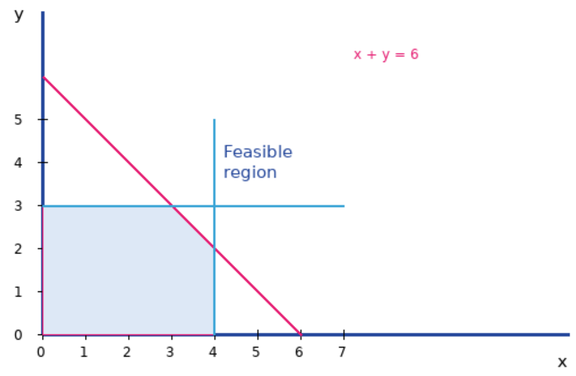
Q13. Find the perpendicular distance of the point (1,2,3) from the plane $2x - y + 2z - 5 = 0$.

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

Answer: A

Explanation: Distance = $|2(1) - 2 + 2(3) - 5| / \sqrt{(2^2 + (-1)^2 + 2^2)} = |1|/3 = 1/3$.

Q14. Maximize $Z = 3x + 2y$ subject to $x + y \le 6$, $x \le 4$, $y \le 3$, $x \ge 0$, $y \ge 0$. What is the maximum value?



A. 12
B. 15
C. 16
D. 18

Answer: C

Explanation: Check the feasible vertices (0,0), (4,0), (4,2), (3,3), and (0,3). Z values are 0, 12, 16, 15, and 6. Maximum = 16 at (4,2).

Q15. A disease affects 1% of a population. A test has 95% sensitivity and 90% specificity. If a person tests positive, approximately what is the probability that the person actually has the disease?

A. 4.5%
B. 8.8%
C. 50%
D. 95%

Answer: B

Explanation: $P(D|+) = 0.01 \times 0.95 / [0.01 \times 0.95 + 0.99 \times 0.10] = 0.0095/0.1085 \approx 0.0876$, or about 8.8%.

Q16. If A = [[2, 0], [0, 5]], find $|A|$ and $|A^{-1}|$.

A. 10 and 10
B. 10 and 1/10
C. 7 and 1/7
D. 1/10 and 10

Answer: B

Explanation: For a diagonal matrix, determinant is product of diagonal entries: $|A| = 2 \times 5 = 10$. Also $|A^{-1}| = 1/|A| = 1/10$.

Q17. Find the area of the triangle with vertices (0,0), (4,0), and (0,3).

A. 6 square units
B. 7 square units
C. 12 square units
D. 24 square units

Answer: A

Explanation: This is a right triangle with base 4 and height 3. Area = $(1/2) \times 4 \times 3 = 6$ square units.

Q18. Evaluate $\int_0^1 x\, e^x \, dx$.

A. 0
B. 1
C. $e - 1$

D. e

Answer: B

Explanation: Using integration by parts, $\int x e^x dx = x e^x - e^x$. From 0 to 1: $(e - e) - (0 - 1) = 1$.

Q19. If dy/dx = x and y(0) = 3, then y equals:

A. $x^2 + 3$

B. $x^2/2 + 3$

C. x + 3

D. $3e^x$

Answer: B

Explanation: Integrating dy/dx = x gives $y = x^2/2 + C$. Since y(0)=3, C=3.

Q20. A fair coin is tossed 5 times. What is the probability of getting exactly 3 heads?

A. 5/32

B. 5/16

C. 3/8

D. 1/2

Answer: B

Explanation: Number of favourable outcomes = C(5,3)=10. Total outcomes = $2^5=32$. Probability = 10/32 = 5/16.

Case Study

Q21. Case: A logistics company models distance covered by an automated cart as $s(t)=t^3-6t^2+9t$ meters for $0\le t\le 5$. At what time is the cart momentarily at rest?

A. t = 1 only

B. t = 3 only

C. t = 1 and t = 3

D. never

Answer: C

Explanation: Velocity is $s'(t)=3t^2-12t+9=3(t-1)(t-3)$. It is zero at t=1 and t=3.

Q22. Case: An online learning platform finds that the number of active users follows $N(t)=500e^{0.2t}$. What is the instantaneous growth rate when t=5?

A. 100e

B. 500e

C. $100e^5$

D. 0.2e

Answer: A

Explanation: $N'(t)=0.2\times500e^{0.2t}=100e^{0.2t}$. At t=5, $e^{0.2\times5}$ = e, so the rate is 100e users per unit time.

Q23. Case: A robotics arm moves from A(1,2,3) to B(4,6,3). What is the magnitude of displacement vector AB?

A. 3

B. 4

C. 5

D. 7

Answer: C

Explanation: AB = (3,4,0). Magnitude = $\sqrt{(3^2+4^2+0^2)}=5$.

Q24. Case: A quality check has two stages. The probability of passing stage 1 is 0.8 and, after passing stage 1, the probability of passing stage 2 is 0.75. What is the probability of passing both stages?

A. 0.55
B. 0.60
C. 0.75
D. 0.80

Answer: B

Explanation: P(pass both)=P(stage 1)×P(stage 2 | stage 1)=0.8×0.75=0.60.

Q25. Case: A rectangular poster has fixed perimeter 40 cm. If its sides are x and 20−x, what value of x gives maximum area?

A. 5 cm
B. 8 cm
C. 10 cm
D. 12 cm

Answer: C

Explanation: Area $A=x(20-x)=20x-x^2$. The maximum occurs at the vertex x=20/2=10 cm, giving a square.

Assertion-Reason

Q26. Assertion (A): If a matrix A is invertible, then det(A) ≠ 0. Reason (R): A square matrix is invertible exactly when its determinant is non-zero.

A. A and R are true, and R explains A
B. A and R are true, but R does not explain A
C. A is true, R is false
D. A is false, R is true

Answer: A

Explanation: The reason is the standard invertibility criterion for square matrices and directly explains the assertion.

Q27. Assertion (A): A continuous function is always differentiable. Reason (R): Differentiability at a point implies continuity at that point.

A. A and R are true, and R explains A
B. A and R are true, but R does not explain A
C. A is true, R is false
D. A is false, R is true

Answer: D

Explanation: The assertion is false, as |x| is continuous at 0 but not differentiable there. The reason is true: differentiability implies continuity.

Q28. Assertion (A): $\int_{-a}^{a} f(x)dx = 0$ if f is odd. Reason (R): For an odd function, f(−x)=−f(x).

A. A and R are true, and R explains A
B. A and R are true, but R does not explain A
C. A is true, R is false
D. A is false, R is true

Answer: A

Explanation: The symmetry f(−x)=−f(x) makes the signed areas cancel on symmetric limits.

Q29. Assertion (A): In a linear programming problem, the optimum occurs at a corner point of the feasible region, when it exists. Reason (R): A linear objective function has straight-line level curves.

A. A and R are true, and R explains A
B. A and R are true, but R does not explain A
C. A is true, R is false
D. A is false, R is true

Answer: A

Explanation: Parallel level lines of a linear objective move across the polygonal feasible region until they touch an extreme point.

Q30. Assertion (A): If two events are independent, then $P(A \cap B)=P(A)P(B)$. Reason (R): Independence means the occurrence of one event does not change the probability of the other.

A. A and R are true, and R explains A
B. A and R are true, but R does not explain A
C. A is true, R is false
D. A is false, R is true

Answer: A

Explanation: The reason states the meaning of independence, which is algebraically expressed by $P(A \cap B)=P(A)P(B)$.

Achievers Section

Q31. Let $f(x)=x^3-3x^2+4$. How many local extrema does f have?

A. 0
B. 1
C. 2
D. 3

Answer: C

Explanation: $f'(x)=3x^2-6x=3x(x-2)$. Critical points are x=0 and x=2. The derivative changes sign at both, so there are two local extrema.

Q32. If A is a 2×2 matrix with det(A)=5, what is det(3A)?

A. 15
B. 30
C. 45
D. 60

Answer: C

Explanation: For a 2×2 matrix, $\det(kA)=k^2\det(A)$. Thus $\det(3A)=3^2\times5=45$.

Q33. A plane passes through the points A(1,0,0), B(0,1,0), and C(0,0,1). What is its equation?

A. x+y+z=1
B. x+y+z=0
C. x−y+z=1
D. 2x+y+z=1

Answer: A

Explanation: Each point satisfies x+y+z=1: (1,0,0), (0,1,0), and (0,0,1). Hence the plane equation is x+y+z=1.

Q34. Find $\int_0$^{π/2} $\sin^2 x\,dx$.

A. π/8
B. π/4
C. π/2

D. 1

Answer: B

Explanation: Using $\sin^2 x=(1-\cos 2x)/2$, the integral is $[x/2 - \sin 2x/4]_0$^{π/2}=π/4.

Q35. A bag contains 4 red and 6 blue balls. Two balls are drawn without replacement. What is the probability that they are of different colours?

A. 8/15
B. 3/5
C. 2/3
D. 4/5

Answer: A

Explanation: P(different) = P(RB)+P(BR) = (4/10)(6/9)+(6/10)(4/9)=48/90=8/15.

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	C	5	B
6	B	7	C	8	B	9	B	10	A
11	B	12	B	13	A	14	C	15	B
16	B	17	A	18	B	19	B	20	B
21	C	22	A	23	C	24	B	25	C
26	A	27	D	28	A	29	A	30	A
31	C	32	C	33	A	34	B	35	A