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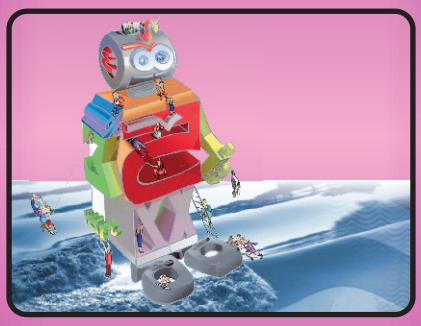
OLYMPIAD EXPLORER



Workbook for

Nationwide Interactive MATHS Olympiad & Other National/International Olympiads/Talent Search Exams.

Based on CBSE, ICSE, GCSE, State Board Syllabus & NCF (NCERT)

100's of Q's with answers

- Chapterwise Practice Q's
- Revision Q's
- Sample Paper

Class 10

EDUHEAL FOUNDATION

• LEARNING FOR LIFE •

EduHeal Foundation conducts 5 Olympiads annually reaching out to 3,500 + Schools ● 4 Lakh + Students ● 50,000 Coordinating Teachers and having 500 Resource persons in English / Maths / Science / Biotech / Computer & 300 Regional Coordinators.

PRIZES

WORKSHOP • TEACHER TRAINING PROG. • MAGAZINE/LAB GRANT • PRINCIPAL LEADERSHIP AWARD.

Contents

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SYLLABUS GUIDELINES
CLASS - X

Based on CBSE, ICSE & GCSE Syllabus & NCF guidelines devised by NCERT

UNIT I: NUMBER SYSTEMS

1. REAL NUMBERS

Euclid's division lemma, Fundamental Theorem of Arithmetic - statements after reviewing work done earlier and after illustrating and motivating through examples. Irrationality of $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ decimal expansions of rational numbers in terms of terminating/non-terminating recurring decimals.

UNIT II: ALGEBRA

3. POLYNOMIALS

Zeros of a polynomial. Relationship between zeros and coefficients of a polynomial with particular reference to quadratic polynomials. Statement and simple problems on division algorithm for polynomials with real coefficients.

4. PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Pair of linear equations in two variables. Geometric representation of different possibilities of solutions/inconsistency.

Algebraic conditions for number of solutions. Solution of pair of linear equations in two variables algebraically – by substitution, by elimination and by cross multiplication. Simple situational problems must be included. Simple problems on equations reducible to linear equations may be included.

5. QUADRATIC EQUATIONS

Standard form of a quadratic equation $ax^2 + bx + c = 0 (a \neq 0)$. Solution of the quadratic equations (only real roots) by factorization and by completing the square, i.e. by using quadratic formula. Relationship between discriminant and nature of roots. Problems related to day to day activities to be incorporated.

6. ARITHMETIC PROGRESSIONS

Motivation for studying AP. Derivation of standard results of finding the nth term and sum of first n terms.

UNIT III: TRIGONOMETRY

1. **TRIGONOMETRIC RATIOS**

Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence (well defined); motivate the ratios, whichever are defined at 0° & 90°. Values (with proofs) of the trigonometric ratios of 30°, 45° & 60°. Relationships between the ratios.

2. **TRIGONOMETRIC IDENTITIES**

Proof and applications of the identity $\sin^2 A + \cos^2 A = 1$ Only simple identities to be given. Trigonometric ratios of complementary angles.

3. **HEIGHTS AND DISTANCES**

Simple and believable problems on heights and distances.

Problems should not involve more than two right triangle. Angles of elevation/ depression should be only 30°, 45°, 60°.

UNIT IV: COORDINATE GEOMETRY

1. **LINES (In two-dimensions)**

Review the concepts of coordinate geometry done earlier including graphs of linear equations.

Awareness of geometrical representation of quadratic polynomials. Distance between two points and section formula (internal). Area of a triangle.

UNIT V : GEOMETRY

1. TRIANGLES

Definitions, examples, counter examples of similar triangles.

1. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then other two sides are divided in the same ratio.
2. If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.
3. If in two triangles, then the corresponding angles are equal, their corresponding sides are proportional then the triangles are similar.
4. If the corresponding sides of two triangles are proportional, their corresponding angles are equal then the two triangles are similar.
5. If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, then the two triangles are similar.
6. If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.
7. The ratio of the areas of two similar triangles is equal to the ratio of the squares on their corresponding sides.
8. In a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.
9. In a triangle, if the square on one side is equal to sum of the squares on the other two sides, the angles opposite two the first side is a right triangle.

2. CIRCLES

Tangents to a circle motivated by chords drawn from points coming closer and closer to the point.

1. The tangent at any point of a circle is perpendicular to the radius through the point of contact.
2. The lengths of tangents drawn from an external point to circle are equal.

3. CONSTRUCTIONS

1. Division of a line segment in a given ratio (internally)
2. Tangent to a circle from a point outside it.
3. Construction of a triangle similar to a given triangle.

UNIT VI: MENSURATION

1. AREAS OF PLANE FIGURES

Motivate the area of a circle; area of sectors and segments of a circle. Problems based on areas and perimeter/circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of 60°, 90° & 120° only. Plane figures involving triangles, simple quadrilaterals and circle should be taken.)

2. SURFACE AREAS AND VOLUMES

(i) Problems on finding surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/ cones. Frustum of a cone.

(ii) Problems involving converting one type of metallic solid into another and other mixed problems. (Problems with combination of not more than two different solids be taken.)

UNIT VII: STATISTICS & PROBABILITY

1. STATISTICS

Mean, median and mode of grouped data (bimodal situation to be avoided). Cumulative frequency graph.

2. PROBABILITY

Classical definition of probability. Connection with probability as given in Class IX. Simple problems on single events, not using set notation.

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CHAPTER 1 Real Numbers

Q.1. $1.23\overline{48}$ is

(a) An integer (b) A rational number

(c) An irrational number (d) A natural number

Q.2. The fraction $\frac{2\left(\sqrt{2}+\sqrt{6}\right)}{3\left(\sqrt{2}+\sqrt{3}\right)}$ is equal to

(a) $\frac{2\sqrt{2}}{3}$ (b) 1

(c) $\frac{2\sqrt{3}}{3}$ (d) $\frac{4}{3}$

Q.3. The product of two consecutive natural numbers is always

(a) An even number (b) An odd number

(c) A prime number (d) Divisible by 3

Q.4. H.C.F. of (10224, 1608) is

(a) 20 (b) 24

(c) 25 (d) 21

Q.5. The value of $\frac{1}{1+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}+\frac{1}{\sqrt{4}+\sqrt{5}}+\frac{1}{\sqrt{5}+\sqrt{6}}+\frac{1}{\sqrt{6}+\sqrt{7}}+\frac{1}{\sqrt{7}+\sqrt{8}}+\frac{1}{\sqrt{8}+\sqrt{9}}$ is

(a) 0 (b) 1

(c) 2 (d) 4

Q.6. If $\sqrt{a}>\sqrt{b}>\sqrt{c}>\sqrt{d}$ where a, b, c, d are consecutive natural numbers. Then which of the following is true?

(a) $\sqrt{a}-\sqrt{b}>\sqrt{c}-\sqrt{d}$ (b) $\sqrt{c}-\sqrt{d}>\sqrt{a}-\sqrt{b}$

(c) $\sqrt{a}-\sqrt{c}>\sqrt{b}-\sqrt{d}$ (d) $\sqrt{c}-\sqrt{d}=\sqrt{a}-\sqrt{b}$

Q.7. If $t=\frac{1}{1-\sqrt[4]{2}}$, then t is equal to

(a) $\left(1-\sqrt[4]{2}\right)\left(2-\sqrt{2}\right)$ (b) $\left(1-\sqrt[4]{2}\right)\left(2+\sqrt{2}\right)$

(c) $-\left(1+\sqrt[4]{2}\right)\left(1+\sqrt{2}\right)$ (d) $\left(1+\sqrt[4]{2}\right)\left(2+\sqrt{2}\right)$

Q.8. The sum of nine consecutive whole numbers is 99. The largest of these numbers is
(a) 16 (b) 15
(c) 18 (d) 19

Q.9. The 100th root of $10^{\left(10^{10}\right)}$ is
(a) $10^{8^{10}}$ (b) 10^{10^8}
(c) $\left(\sqrt{10}\right)^{\left(\sqrt{10}\right)^{10}}$ (d) $10^{\left(\sqrt{10}\right)^{\sqrt{10}}}$

Q.10. If $x = 9 + 4\sqrt{5}$ and $xy = 1$, then $\frac{1}{x^2} + \frac{1}{y^2}$ is
(a) 80 (b) 322
(c) 83 (d) 44

Q.11. The rational number between $\frac{1}{3}$ and $\frac{1}{2}$ is
(a) $\frac{2}{5}$ (b) $\frac{1}{5}$
(c) $\frac{3}{5}$ (d) $\frac{4}{5}$

Q.12. The value of $\frac{a+\sqrt{a^2-b^2}}{\sqrt{a^2+b^2}+b} + \frac{\sqrt{a^2+b^2}-b}{a-\sqrt{a^2-b^2}}$ is
(a) $\frac{a^2}{b^2}$ (b) $\frac{b^2}{a^2}$
(c) $\frac{a}{b}$ (d) $\frac{b}{a}$

Q.13. The real number $r = \frac{\sqrt{3}+\sqrt{5}}{\sqrt{3+\sqrt{5}}}$ satisfies the inequality
(a) $\sqrt{2} < r < 2$ (b) $\frac{1}{\sqrt{2}} < r < \sqrt{2}$
(c) $2 < r < \sqrt{5}$ (d) $\sqrt{5} < r < 3$

Q.14. If $a679b$ is a five-digit number in base 10 and is divisible by 72, then the values of a and b are
(a) 3, 2 (b) 6, 2
(c) 2, 3 (d) 2, 6

Q.15. If $x = \frac{\sqrt{3}+1}{2}$, then the value of $4x^3 + 2x^2 - 8x + 7$ is
(a) 10 (b) 5
(c) 7 (d) 3

Q.16. When a number is divided by 6, its remainder is always
(a) Greater than 6
(b) Lies between 6 and 12
(c) Greater or equal to zero but less than 6
(d) Less than zero.

Q.17. The number of 3-digit numbers which end in 7 and are divisible by 11 is
(a) 5 (b) 7
(c) 9 (d) 8

Q.18. $x_1, x_2, x_3 \ldots, x_{10}$ are integers none of which are divisible by 3. The remainder when $x_1^2 + x_2^2 + x_3^2 + \ldots + x_{10}^2$ is divided by 3 is
(a) 0 (b) 0 or 2
(c) 1 or 2 (d) 1

Q.19. Sum of all integers less than 100 which leave a remainder 1 when divided by 3 and leave a remainder 2 when divided by 4 is
(a) 416 (b) 550
(c) 660 (d) 770

Q.20. A certain number leaves a remainder 4 when divided by 6. The remainder when the number is divided by 9 is
(a) 1 or 4 (b) 4 or 7
(c) 1 or 7 (d) 1, 4 or 7

Q.21. If $x = 3 + \sqrt{8}$, then the value of $x^3 + \frac{1}{x^3}$ is
(a) 200 (b) 198
(c) 315 (d) 265

Q.22. Set of natural number is a subset of
(a) Set of even numbers
(b) Set of odd numbers
(c) Set of composite numbers
(d) Set of real numbers

Q.23. An eight digit number is a multiple of 73 and 137. If the second digit from left is 7, then 6th digit from the left of the number is
(a) 7 (b) 5
(c) 6 (d) 3

Q.24. The greatest number which divides 2011 and 2623 leaving remainders 9 and 5 respectively, is
(a) 150 (b) 154
(c) 160 (d) 170

Q.25. If both '*a*' and '*b*' are rational numbers, then '*a*' and '*b*' satisfying $\frac{3-\sqrt{5}}{3+2\sqrt{5}} = a\sqrt{5} - b$ are
(a) $a = \frac{9}{11}, b = \frac{19}{11}$ (b) $a = \frac{19}{11}, b = \frac{9}{11}$
(c) $a = \frac{2}{11}, b = -\frac{8}{11}$ (d) $a = \frac{10}{11}, b = \frac{21}{11}$

Q.26. The H.C.F. of two numbers is 23 and their L.C.M. is 1449. If one of the numbers is 161, then other number is
(a) 207 (b) 414
(c) 107 (d) 205

Q.27. If the HCF of 408 and 1032 is expressible in the form $1032m - 408 \times 5$, then m will be
(a) –3 (b) 2
(c) 3 (d) 5

Q.28. $1/\left(\sqrt{3}-\sqrt{2}\right)$ is not equal to
(a) $\sqrt{3}+\sqrt{2}$ (b) $\sqrt{2}/\left(\sqrt{6}-2\right)$
(c) $\left(\sqrt{3}-\sqrt{2}\right)/\left(5-2\sqrt{6}\right)$ (d) $\sqrt{3}/\left(9-\sqrt{6}\right)$

Q.29. If $m = \frac{cab}{a-b}$, then b equals
(a) $\frac{m(a-b)}{ca}$ (b) $\frac{cab-ma}{-m}$
(c) $\frac{1}{1+c}$ (d) $\frac{ma}{m+ca}$

Q.30. If '*a*' and '*b*' are rational numbers and $\frac{2+\sqrt{3}}{2-\sqrt{3}} = a + b\sqrt{3}$, then b equals
(a) 4 (b) 3
(c) 5 (d) 6

Q.31. According to the fundamental theorem of Arithmetic, if p(a prime number) divides b^2, and b is positive, then
(a) b divides p (b) b^2 divides p
(c) p^2 divides b^2 (d) p divides b

Q.32. Which of the expression is the same as $\frac{1}{\left(\sqrt[3]{2}-1\right)}$
(a) $\sqrt[3]{2}+1$ (b) $\sqrt[3]{4}+1$
(c) $\sqrt[3]{4}+\sqrt[3]{2}+1$ (d) $\sqrt[3]{4}+2\sqrt[3]{2}+1$

Q.33. If a is dividend, b is divisor, q is quotient and r is remainder such that $0 \le r < b$, then according to Euclid's Division Lemma
(a) $b = aq + r$ (b) $q = qb + r$
(c) $a = qr + b$ (d) $a = bq + r$

Q.34. If $\left(a+\frac{1}{a}\right)^2 = 3$, then $a^3 + \frac{1}{a^3}$ equals
(a) $\frac{10\sqrt{3}}{3}$ (b) $3\sqrt{3}$
(c) 0 (d) $7\sqrt{7}$

Q.35. The number in the form of $2m + 3$, where m is a whole number be always
(a) An odd number (b) An even number
(c) A perfect square (d) Divisible by 3

Q.36. If $4^{44} + 4^{44} + 4^{44} + 4^{44} = 4^x$, then x is
(a) 45 (b) 40
(c) 412 (d) 55

Q.37. The number of subsets of $A = \{0, 7, 8\}$ will be
(a) 3 (b) 5
(c) 6 (d) 8

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ANSWERS

1.	(b)	2.	(d)	3.	(a)	4.	(b)	5.	(c)	6.	(b)	7.	(c)	8. (b)
9.	(b)	10.	(b)	11.	(a)	12.	(d)	13.	(a)	14.	(a)	15.	(a)	16. (c)
17.	(d)	18.	(d)	19.	(a)	20.	(d)	21.	(b)	22.	(d)	23.	(a)	24. (b)
25.	(a)	26.	(a)	27.	(b)	28.	(d)	29.	(d)	30.	(a)	31.	(d)	32. (c)
33.	(d)	34.	(c)	35.	(a)	36.	(a)	37.	(d)					

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CHAPTER 2 Polynomials & Quadratic Equations

Q.1. The degree of polynomial $x^3x^{-2} + 7$ is
(a) 2 (b) 1
(c) –2 (d) none of these

Q.2. $ax^3 + bx^2 + cx + d = 0$ is said to be cubic polynomial if
(a) $d \neq 0$ (b) $c \neq 0$
(c) $b \neq 0$ (d) $a \neq 0$

Q.3. If p and q are the roots of the equation $x^2 + px + q = 0$, then
(a) $p = 1, q = 0$ (b) $p = 0, q = 1$
(c) $p = –2, q = 0$ (d) $p = –2, q = 1$

Q.4. If $a + b + c = 0$, then $ax^2 + bx + c = 0$ has one root
(a) 0 (b) 1
(c) –1 (d) 2

Q.5. If a and b are the roots of the quadratic equation $x^2 + px + 12 = 0$ with the condition $a – b = 1$, then the value of 'p' is
(a) 1 (b) 7
(c) –7 (d) 7 or –7

Q.6. If the equation $x^2 – bx + 1 = 0$ does not possess real roots, then
(a) $–3 < b < 3$ (b) $–2 < b < 2$
(c) $b > 2$ (d) $b < –2$

Q.7. If α and β are the zeros of the polynomial $f(x) = x^2 + px + q$, then a polynomial having $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ as its zeros is
(a) $x^2 + qx + p$ (b) $x^2 – px + q$
(c) $qx^2 + px + 1$ (d) $px^2 + qx + 1$

Q.8. If one root of a quadratic equation is $\frac{1}{\sqrt{4}-\sqrt{3}}$, then the quadratic equation can be
(a) $x^2 - 2\sqrt{4}x + 1 = 0$ (b) $x^2 - \sqrt{4}x - 1 = 0$
(c) $x^2 + 2\sqrt{4}x + 1 = 0$ (d) $x^2 - 2\sqrt{3}x + 1 = 0$

Q.9. The product of two consecutive odd numbers is 143. The numbers are
(a) 11 and 13 (b) 13 and 15
(c) –11 and 13 (d) 15 and 16

Q.10. If a and b are the roots of $x^2 – px + q = 0$, then $a^2 + b^2$ is
(a) $p^2 + q^2$ (b) $p^2 + 2q$
(c) $p^2 – q^2$ (d) $p^2 – 2q$

Q.11. If α, β are the zeros of the polynomial $f(x) = x^2 – p(x + 1) – c$, then $(\alpha + 1)(\beta + 1)$ is equal to
(a) $c – 1$ (b) $1 – c$
(c) c (d) $1 + c$

Q.12. If $x = 1$ is a common root of the equations $ax^2 + ax + 3 = 0$ and $x^2 + x + b = 0$, then ab is equal to
(a) 3 (b) 2.5
(c) 5 (d) none of these

Q.13. The degree of polynomial $\sqrt[3]{x^3}\sqrt{x^{-2}} + 7$ is
(a) 3 (b) 1
(c) 0 (d) –2

Q.14. If $f(x) = ax^2 + bx + c$ has no real zeros and $a + b + c < 0$ then
(a) $c = 0$ (b) $c > 0$
(c) $c < 0$ (d) $c \geq 0$

Q.15. A convex polygon has 44 diagonals. The number of its sides is
(a) 10 (b) 11
(c) 12 (d) 13

Q.16. α and β are two numbers such that $\alpha + \beta = 6$, $\alpha – \beta = 8$. Then α and β are the roots of the quadratic equation
(a) $x^2 + 6x + 7 = 0$ (b) $x^2 – 6x – 7 = 0$
(c) $x^2 + 6x – 8 = 0$ (d) $x^2 – 6x + 8 = 0$

Q.17. If a and b can take values 1, 2, 3, 4, then the number of the equations of the form $ax^2 + bx + 1 = 0$ having real roots is
(a) 10 (b) 7
(c) 6 (d) 12

Q.18. If one zero of the polynomial $f(x) = (k^2 + 4)x^2 + 13x + 4k$ is reciprocal of the other, then k is equal to
(a) 2 (b) –2
(c) 1 (d) –1

Q.19. If $\log_{10}(x^2 – 3x + 6) = 1$, then the value of x (where $\log_b a = c \Rightarrow b^c = a$) is
(a) 10 or 2 (b) 4 or –2
(c) 4 only (d) 4 or –1

Q.20. If α and β are the zeros of the quadratic polynomial $f(x) = x^2 – 5x + k$ such that $\alpha – \beta = 1$, then the value of k is

(a) –6 (b) 5
(c) –5 (d) 6

Q.21. If one root of $x^2 + ax + 4 = 0$ is twice the other root, then the value of 'a' is
(a) $-3\sqrt{2}$ (b) $8\sqrt{2}$
(c) $\sqrt{2}$ (d) $-2\sqrt{2}$

Q.22. If a and b are two positive numbers such that $a^2 + b^2 = 4$, $\frac{1}{a^2}+\frac{1}{b^2}=1$, then a and b are the roots of the quadratic equation
(a) $x^2-2\sqrt{2}x+2=0$ (b) $x^2+2\sqrt{2}x-2=0$
(c) $x^2-2x+2\sqrt{2}=0$ (d) $x^2 - 2x + 1 = 0$

Q.23. The roots of $\frac{15}{x^2-4}-\frac{2}{x-2}=1$ are
(a) –5 and 3 (b) –3 and 5
(c) Only 3 (d) Only 5

Q.24. The number of point of intersection of the polynomial $p(x) = x^3 + 8$ with x-axis is
(a) 4 (b) 1
(c) 3 (d) 2

Q.25. The value of $\sqrt{6+\sqrt{6+\sqrt{6+\ldots}}}$ is
(a) 4 (b) 3
(c) –2 (d) 3.5

Q.26. For $x^2 + 2x + 5$ to be a factor of $x^4 + px^2 + q$, the value of p and q should respectively be
(a) 2, 5 (b) 5, 25
(c) 6, 25 (d) 5, 2

Q.27. If $x – k$ divides $x^3 – 6x^2 + 11x – 6 = 0$, then k can't be equal to
(a) 1 (b) 2
(c) 3 (d) 4

Q.28. If $\sqrt{9x^2+6x+1}<2-x$ then
(a) $x\in\left(-\frac{3}{2},\frac{1}{4}\right)$ (b) $x\in\left(-\frac{3}{2},\frac{1}{4}\right]$
(c) $x\in\left[-\frac{3}{2},\frac{1}{4}\right)$ (d) $x<\frac{1}{4}$

Q.29. If x is real, then the minimum value of $\frac{x^2-x+1}{x^2+x+1}$ is
(a) $\frac{1}{3}$ (b) 3
(c) $\frac{1}{2}$ (d) 1

Q.30. The roots of $|x^2 – x – 6| = x + 2$ are
(a) –2, 1, 4 (b) –2, 2, 4
(c) 0, 1, 4 (d) 0, 2, 4

Q.31. If $x^2 – cx + d = 0$, $x^2 – ax + b = 0$ have a common root and the second equation has equal roots then $2(b + d)$
(a) $a + c$ (b) ac
(c) $a – c$ (d) $c – a$

Q.32. The harmonic mean of the roots of the equation $\left(5+\sqrt{2}\right)x^2-\left(4+\sqrt{5}\right)x+\left(8+2\sqrt{5}\right)=0$ is
(a) 2 (b) 4
(c) 7 (d) 8

Q.33. If the roots of the equation $x^2 – 4x – \log_3 a = 0$ are real, then the least value of a is
(a) 81 (b) $\frac{1}{81}$
(c) 64 (d) $\frac{1}{64}$

Q.34. If α, β are the roots of the equation $ax^2 – 2bx + c = 0$ then $\alpha^3\beta^3 + \alpha^2\beta^3 + \alpha^3\beta^2 =$
(a) $\frac{c^2(2b+c)}{a^3}$ (b) $\frac{bc^2}{a^3}$
(c) $\frac{c^3}{a^3}$ (d) $\frac{c^2(b+2c)}{a^3}$

Q.35. If $k > 0$ and the product of the roots of $x^2 – 3kx + 2e^{2\log k} – 1 = 0$ is 7, then the sum of the roots is
(a) 2 (b) 4
(c) 6 (d) 8

Q.36. If $\sin\theta$, $\cos\theta$ are roots of the equation $ax^2 + bx + c = 0$, then
(a) $a^2 – b^2 + 2ac = 0$ (b) $a^2 + b^2 + 2ac = 0$
(c) $a – b + 2ac = 0$ (d) $a + b + 2ac = 0$

Q.37. If the equation $(\sin\theta – 1)x^2 + (\sin\theta)x + \cos\theta = 0$ has real roots, then θ =

(a) $[0, \pi]$ (b) $\left[0, \frac{3\pi}{2}\right]$

(c) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ (d) $[0, 2\pi]$

Q.38. $\tan A$, $\tan B$ are roots of $x^2 - 2x + 2 = 0$, then $\sin^2(A + B) =$

(a) $\frac{4}{5}$ (b) $\frac{1}{2}$

(c) $\frac{3}{5}$ (d) $\frac{1}{4}$

Q.39. If the sum of the roots of $ax^2 + bx + c = 0$ is equal to the sum of the squares of their reciprocals, then $bc^2 + ab^2 =$

(a) $2ac$ (b) $2a^2c$

(c) $2ac^2$ (d) $2a^2c^2$

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ANSWERS

1.	(b)	2.	(d)	3.	(a)	4.	(b)	5.	(d)	6.	(b)	7.	(c)	8.	(a)	9.	(a)	10.	(d)
11.	(b)	12.	(a)	13.	(c)	14.	(c)	15.	(b)	16.	(b)	17.	(b)	18.	(a)	19.	(d)	20.	(d)
21.	(a)	22.	(a)	23.	(a)	24.	(b)	25.	(b)	26.	(c)	27.	(d)	28.	(a)	29.	(a)	30.	(b)
31.	(b)	32.	(b)	33.	(b)	34.	(a)	35.	(c)	36.	(a)	37.	(c)	38.	(a)	39.	(b)		

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NATIONWIDE INTERACTIVE MATHS OLYMPIAD (NIMO) SAMPLE PAPER

Total duration : 60 Minutes **Total Marks :** 50

SECTION - A

MENTAL ABILITY

1. Given set : (246, 257, 358), Choose the similar set?
(a) (145, 235, 325) (b) (143, 253, 246)
(c) (273, 365, 367) (d) None of these

2. Write the missing term 95, 115.5, 138, (.....) 189
(a) 154.5 (b) 162.5 (c) 164.5 (d) None of these

3. In a certain code language, '*Mink Yang Pe'* means '*Fruits are ripe', 'Pe Lao May Mink'* means '*Oranges are not ripe'* and '*May Pe Nue Mink'* means '*Mangoes are not ripe'*. Which word in that language means '*Oranges'?*
(a) May (b) Pe (c) Lao (d) None of these

4. In an examination, Raj got more marks than Mukesh but not as many as Priya. Priya got more marks than Gaurav and Kavita. Gaurav got less marks than Mukesh but his marks are not the lowest in the group. Who is second in the descending order of marks?
(a) Priya (b) Kavita (c) Raj (d) None of these

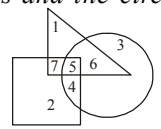
Direction : *Read the following information carefully and answer the following question:*

Seven executives P, Q, R, S, T, U and W reach office in a particular sequence. U reaches immediately before P but does not immediately follow S. R is the last one to reach office. T follows immediately after P and is subsequently followed by W.

5. Among the executives, who reaches the office first?
(a) Q (b) S (c) U (d) None of these

6. A man leaves for his office from his house. He walks towards East. After moving a distance of 20 m, he turns towards South and walks 10m. Then he walks 35 m towards the West and further 5m towards the North. He then turns towards East and walks 15m. What is the straight distance in metres between his initial and final positions?
(a) 0 (b) 5 (c) 10 (d) None of these

Direction : *Question 7 is based on the diagram given below. In the diagram, the triangle stands for graduates, square stands for membership of professional organisations and the circle stands for membership of social organisations.*

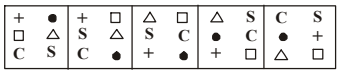


7. Number of graduates in professional organisations
(a) 5 and 7 (b) 5, 6 and 7 (c) 6 and 7 (d)None of these

8. If L denotes ×, M denotes ÷, P denotes + and Q denotes –, then
16 P 24 M 8 Q 6 M 2 L 3 = ?
(a) $\frac{13}{6}$ (b) $-\frac{1}{6}$ (c) 10 (d) None of these

Direction : *Given question consists of five figures marked A, B, C, D and E called the Problem Figures and three other figures marked (a), (b) and (c) called the Answer Figures. Select a figure from amongst the Answer Figures which will continue the same series as established by the five Problem Figures.*

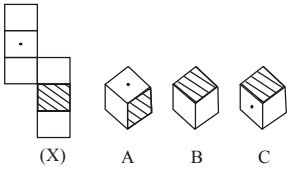
9. Problem figures



Answer figures

(a)  (b)  (c)  (d)None of these

Direction : *Choose from the alternative, the boxes that will be formed when figure (X) is folded:*

10. 

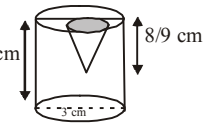
(a) A and B only (b) A, B and C only
(c) B only (d) None of these

SECTION - B
MATHEMATICS

11. If 3, 8, 10, x, 14, 16, 18, 19 are in ascending order and their median is 13. Then numerical value of x is
(a) 10 (b) 11 (c) 12 (d) None of these

12. Solution set of $\frac{11-2x}{5} \geq \frac{9-3x}{8} + \frac{3}{4}, x \in N$ is
(a) {1, 2, 3.....11} (b) {1, 2, 3 .....13}
(c) {1, 2, 3,.....12} (d) None of these

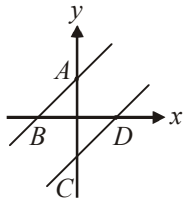
13. A metallic cylinder has radius 3 cm and height 5 cm. It is made of a metal A. To reduce its weight, a conical hole is drilled in the cylinder as shown and it is completely filled with a lighter metal B. The conical hole has a radius of $\frac{3}{2}$ cm and its depth is $\frac{8}{9}$ cm. Then the ratio of the volume of the metal A to the volume of the metal B in the solid is

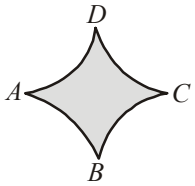


(a) 2 : 133 (b) 133 : 2 (c) 45 : 133 (d) None of these

14. The angle of elevation of a cloud from a point 50 m above a lake is 30° and the measure of the angle of depression of its reflection in the lake is 60° then the height of the cloud is
(a) 150 cm (b) 200 cm (c) 100 cm (d)None of these

15. In the figure, AB and CD are the lines $2x - y + 6 = 0$ and $x - 2y = 4$ respectively. Co-ordinates of A and D are
(a) (0, 6), (–3, 0) (b) (6, 0), (0, –2)
(c) (0, 6), (4, 0) (d) None of these



16. 

The quadrants shown in the figure are each of 14 cm . Then the area of the shaded portion is $\left(\pi = \frac{22}{7}\right)$
(a) 168 cm^2 (b) 60 cm^2
(c) 160 cm^2 (d) None of these

17. The value of $\frac{3\sin 72°}{\cos 18°} - \frac{\sec 32°}{\text{cosec } 58°}$ is
(a) 1 (b) 2 (c) 3 (d) None of these

18. In ΔABC, $\angle ABC = 90°$ and D is any point on side BC. If AD = 10 cm, BD = 6 cm and DC = 9cm. Then the length of AC is
(a) 10 cm (b) 17 cm (c) 16 cm (d) None of these

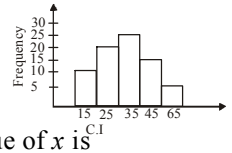
19. The ratio in which the line joining A (6, 5) and B (4, –3) is divided by the line y = 2 is
(a) 3 : 5 (b) 3 : 2 (c) 3 : 4 (d) None of these

20. It $3\tan^2 A - 1 = 0$ then the value of $4\cos^3 A - 3\cos A$ is
(a) 4 (b) 0 (c) 1 (d) None of these

21. If $(x - 3)$ and $(x + 5)$ are both factors of the expression $2x^3 + px^2 + q + 15$. Then the value of constant p and q are

(a) $p = -3, q = 32$ (b) $p = -3, q = -32$
(c) $p = 3, q = -32$ (d) None of these

22. The mean of the histogram is

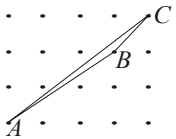


(a) 28 (b) 50
(c) 38 (d) None of these

23. If $2^{2x} - 3 \times 2^{x+2} + 32 = 0$, then the value of x is
(a) 3 (b) 4 (c) 8 (d) None of these

24. If $x = 9 - 4\sqrt{5}$ then the value of $\sqrt{x} - \frac{1}{\sqrt{x}}$ is
(a) 2 (b) 4 (c) –6 (d) None of these

25. The horizontal and vertical distance between adjacent points of the grid shown, is one unit. The area of the triangle ABC is



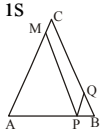
(a) 1/4 (b) 1/2 (c) 3/4 (d) None of these

26. A pentagon with area 40 has equal sides but not necessarily equal angles. The sum of the five distances from a point inside the pentagon to the side of the pentagon is 16. The side-length of the pentagon is
(a) $\frac{5}{2}$ (b) 5 (c) 8 (d) None of these

27. If $a_n = \frac{1}{n} - \frac{1}{n+1}$, then $a_1 + a_2 + ...+ a_{100}$ equals
(a) $\frac{99}{100}$ (b) $\frac{100}{101}$ (c) 1 (d) None of these

28. If $x^2 + 6x + y^2 - 4y + 13 = 0$, then $x + y$ is
(a) –1 (b) –2
(c) 0 (d) None of these

29. In ΔABC, $AC = BC = 15$; PM is parallel to BC and PQ is parallel to AC. The perimeter of $PQCM$ is



(a) 40 (b) 20 (c) 30 (d) None of these

30. If a two-digit integer is q times the sum of its digits, then the number formed by interchanging the two digits is the sum of the digits multiplied by
(a) $9 - q$ (b) $10 - q$ (c) $11 - q$ (d) None of these

31. The line containing the points $(2, a)$ and $(4, b)$ has slope (gradient) equal to –2. The slope of the line containing points $(2, -a)$ and $(4, -b)$ equals
(a) 2 (b) –1 (c) 0 (d) None of these

32. A dice is thrown twice. The first throw determines the tens digit and the second throw the ones digit of a two digit number. The probability that this two-digit number is a perfect square equals.
(a) $\frac{1}{12}$ (b) $\frac{1}{36}$ (c) $\frac{1}{9}$ (d) None of these

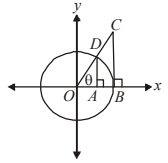
33. The mean of five numbers is 27. If one of the number is excluded, the mean is reduced by 2. Then the excluded number is
(a) 135 (b) 100 (c) 35 (d) None of these

34. If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$ then the value of $\cos\theta - \sin\theta$ is
(a) $-\sqrt{2}\cos\theta$ (b) $\sqrt{2}\sin\theta$
(c) $\sqrt{2}\sin\theta\cos\theta$ (d) None of these

35. If $\frac{\cos\alpha}{\cos\beta} = m$ and $\frac{\cos\alpha}{\sin\beta} = n$ then $(m^2 + n^2)\cos^2\beta$ is
(a) n (b) m^2 (c) n^2 (d) None of these

36. A box contains 6 nails and 10 nuts. Half of the nails and half of the nuts are rusted. If one item is chosen at random, what is the probability that it is rusted or is a nail?
(a) $\frac{3}{16}$ (b) $\frac{11}{16}$ (c) $\frac{14}{16}$ (d) None of these

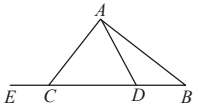
37. The accompanying diagram shows unit circle O, with radius $OD = 1$.



Which line segment has a length equivalent to $\tan\theta$?
(a) $\overline{AD}$ (b) $\overline{OA}$ (c) $\overline{BC}$ (d) None of these

38. If $m\angle A = 28° 10$, $a = 20$, and $b = 25$, what is the maximum number of distinct triangles that can be constructed?
(a) 3 (b) infinity (c) 0 (d) None of these

39. In ΔABC, $\overline{BC}$ is extended to E, and D is a point on $\overline{BC}$,



Which statement must always be true?
(a) $m\angle ADE > m\angle ABC$ (b) $m\angle ADE = m\angle ACB$

(c) $m\angle ACB = m\angle ABC$ (d) None of these

40. When drawn on the same set of axes, which pair of equation will result in two points of intersection?
(a) $y = x$ and $y = x$ (b) $y = 3$ and $x = -3$
(c) $y = x$ and $x^2 + y^2 = 1$ (d) None of these

41. In the accompanying diagram, point T is the midpoint of $\overline{SD}$ and $\overline{YU}$, $\overline{SY}$ and $\overline{UD}$ are drawn.

Which statement can be used to prove $\Delta STY \cong \Delta DTU$?
(a) SSS $\cong$ SSS (b) ASA $\cong$ ASA
(c) SAS $\cong$ SAS (d) None of these

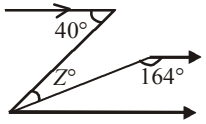
42. If 1 is added to both the numerator and the denominator of a given fraction, it becomes $\left(\frac{4}{5}\right)$. If however, 5 is substracted from both the numerator and the denominator, the fraction becomes $\frac{1}{2}$. Find the fraction.
(a) $\frac{7}{9}$ (b) $\frac{2}{7}$ (c) $\frac{3}{8}$ (d) None of these

43. Shadow of person X, when angle of elevation of the sun is θ, is equal in length to the shadow of a person Y, when angle of elevation of the sun is $(\theta/2)$. Which one of the following is correct?
(a) Person X is shorter than person Y.
(b) Person X is twice as tall as Y
(c) Person X is taller than person Y but is not twice as tall as Y
(d) None of these

44. If $x = \sqrt{12 + \sqrt{12 + \sqrt{12 + ...}}}$ infinity. Find x.
(a) $2\sqrt{3}$ (b) infinity (c) 4 (d) None of these

45. In the equation $20x^2 - 39xy - 18y^2 = 0$, the value of $x : y$ is
(a) $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{5}{6}$ (d) None of these

46. The value of Z is
(a) 40°
(b) 164°
(c) 24°
(d) None of these

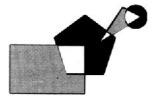


SECTION - C
INTERACTIVE SECTION

47. The letters M, A, T, H, S denote positive real numbers such that M×A = 12, T×H = 30, A × H = 24, A×T = 20 and H×S = 42 then the value of M × A×T×H×S is
(a) 2501 (b) 2520 (c) 2540 (d) None of these

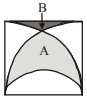
48. Hitesh and Raj went out for a cycle and were 16 km from home when Hitesh ran into a tree damaging his bicycle beyond repair. They decide to return home and that Hitesh will start on foot and Raj will start on his bicycle. After some time, Raj will leave his bicycle beside the road and continue on foot, so that when Hitesh reaches the Bicycle he can mount it and cycle the rest of the distance. Hitesh walks at 4 km per hour and cycles at 10 km per hour, while Raj walks at 5 km per hour and cycles at 12 km per hour. For what length of time should Raj ride the bicycle, if they are both to arrive home at the same time?
(a) 30 hr. (b) 40hr. (c) 50 hr. (d) None of these

49. The diagram shows a rectangle, pentagon, triangle and circle with respective areas 121, 81, 49 and 25. The difference between the lightly shaded area and the black area is



(a) 25 (b) 36 (c) 64 (d) None of these

50. The diagram shows a semicircle and two quarter circles inscribed in a square of side length 2. The difference between the area of the shaded region A and the area of the shaded region B equals



(a) $\frac{3}{2}\pi - 4$ (b) $\frac{1}{3}\pi - \frac{1}{3}$ (c) $\frac{3}{2} - \frac{1}{4}\pi$ (d) None of these

☺ END OF THE EXAM ☺

ANSWERS

1.	(c)	**2.**	(b)	**3.**	(c)	**4.**	(c)	**5.**	(b)
6.	(b)	**7.**	(a)	**8.**	(c)	9.	(c)	**10.**	(c)
11.	(c)	**12.**	(b)	**13.**	(b)	**14.**	(a)	**15.**	(c)
16.	(a)	**17.**	(b)	**18.**	(b)	**19.**	(a)	**20.**	(b)
21.	(c)	**22.**	(c)	**23.**	(a)	**24.**	(b)	**25.**	(b)
26.	(b)	**27.**	(b)	**28.**	(a)	**29.**	(c)	**30.**	(c)
31.	(a)	**32.**	(c)	**33.**	(c)	**34.**	(a)	**35.**	(c)
36.	(b)	**37.**	(c)	**38.**	(d)	**39.**	(a)	**40.**	(c)
41.	(b)	**42.**	(a)	**43.**	(c)	**44.**	(c)	**45.**	(a)
46.	(c)	**47.**	(b)	**48.**	(a)	**49.**	(c)	**50.**	(a)

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