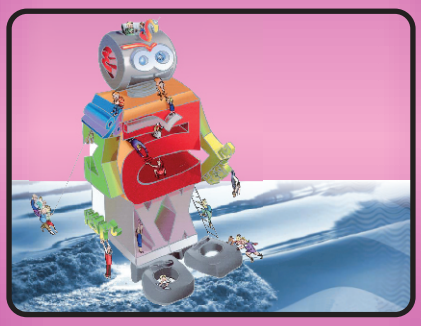
E&G

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 9

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 - IX

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

UNIT I: NUMBER SYSTEMS

REAL NUMBERS

Review of representation of natural numbers, integers, rational numbers on the number line. Representation of terminating/ non-terminating recurring decimals, on the number line through successive magnification. Rational numbers as recurring/terminating decimals. Examples of non-recurring / non terminating decimals such as $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ etc.

Existence of non-rational numbers (irrational numbers) such as $\sqrt{2}$, $\sqrt{3}$, and their representation on the number line. Explaining that every real number is represented by a unique point on the number line, and conversely, every point on the number line represents a unique real number.

Existence of $\sqrt{x}$ for a given positive real number x (visual proof to be emphasized). Definition of n^{th} root of a real number.

Recall of laws of exponents with integral powers.

Rational exponents with positive real bases (to be done by particular cases, allowing learner to arrive at the general laws).

Rationalization (with precise meaning) of real numbers of the type (& their combinations) $\frac{1}{a+b\sqrt{x}}$ & $\frac{1}{\sqrt{x}+\sqrt{y}}$ where x and y are natural numbers and a, b are integers.

UNIT II: ALGEBRA

1. POLYNOMIALS

Definition of a polynomial in one variable, its coefficients, with examples and counter examples, its terms, zero polynomial. Degree of a polynomial. Constant, linear, quadratic, cubic polynomials; monomials, binomials, trinomials. Factors and multiples. Zeros/roots of a polynomial/equation.

Remainder Theorem with examples and analogy to integers. Statement and proof of the Factor Theorem.

Factorization of $ax^2 + bx + c$, $a \neq 0$ where a, b, c are real numbers, and of cubic polynomials using the Factor Theorem.

Recall of algebraic expressions and identities. Further identities of the type

$(x + y + z)^2$

$= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$, $(x \pm y)^3$

$= x^3 \pm y^3 \pm 2xy\,(x \pm y)$,

$x^3 + y^3 + z^3 - 3xyz = (x + y + z)$

$(x^2 + y^2 + z^2 - xy - yz - zx)$ and their use in factorization of polynomials. Simple expressions reducible to these polynomials.

2. LINEAR EQUATIONS IN TWO VARIABLES

Recall of linear equations in one variable. Introduction to the equation in two variables. Prove that a linear equation in two variables has infinitely many solutions, and justify their being written as ordered pairs of real numbers, plotting them and showing that they seem to lie on a line. Examples, problems from real life, including problems on ratio and proportion and with algebraic and graphical solutions being done simultaneously.

UNIT III: COORDINATE GEOMETRY

1. COORDINATE GEOMETRY

The Cartesian plane, coordinates of a point, names and terms associated with the coordinate plane, notations, plotting points in the plane, graph of linear equations as examples; focus on linear equations of the type $ax + by + c = 0$ by writing it as $y = mx + c$ and linking with the chapter on linear equations in two variables.

UNIT IV: GEOMETRY

1. INTRODUCTION TO EUCLID'S GEOMETRY

History – Euclid and geometry in India. Euclid's method of formalizing observed phenomenon into rigorous mathematics with definitions, common/obvious notions, axioms/ postulates, and theorems. The five postulates of Euclid.

Equivalent versions of the fifth postulate. Showing the relationship between axiom and theorem.

1. Given two distinct points, there exists one and only one line through them.
2. Two distinct lines cannot have more than one point in common.

2. LINES AND ANGLES

1. If a ray stands on a line, then the sum of the two adjacent angles so formed is 180° and the converse.
2. If two lines intersect, the vertically opposite angles are equal.
3. Results on corresponding angles, alternate angles, interior angles when a transversal intersects two parallel lines.
4. Lines, which are parallel to a given line, are parallel.
5. The sum of the angles of a triangle is 180°.
6. If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interiors opposite angles.

3. TRIANGLES

1. Two triangles are congruent if any two sides and the included angle of one triangle is equal to any two sides and the included angle of the other triangle (SAS Congruence).
2. Two triangles are congruent if any two angles and the included side of one triangle is equal to any two angles and the included side of the other triangle (ASA Congruence).
3. Two triangles are congruent if the three sides of one triangle are equal to three sides of the other triangle (SSS Congruence).
4. Two right triangles are congruent if the hypotenuse and a side of one triangle are equal (respectively) to the hypotenuse and a side of the other triangle.
5. The angles opposite to equal sides of a triangle are equal.
6. The sides opposite to equal angles of a triangle are equal.
7. Triangle inequalities and relation between 'angle and facing side' inequalities in triangles.

4. QUADRILATERALS

1. The diagonal divides a parallelogram into two congruent triangles.
2. In a parallelogram opposite sides are equal, and conversely.
3. In a parallelogram opposite angles are equal and conversely.
4. A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and equal.
5. In a parallelogram, the diagonals bisect each other and conversely.
6. In a triangle, the line segment joining the mid points of any two sides is parallel to the third side and its converse.

5. AREA

Review concept of area, recall area of a rectangle.

1. Parallelograms on the same base

and between the same parallels have the same area.
2. Triangles on the same base and between the same parallels are equal in area and its converse.

6. CIRCLES

Through examples, arrive at definitions of circle related concepts, radius, circumference, diameter, chord, arc, subtended angle.

1. Equal chords of a circle subtended equal angles at the center and its converse.
2. The perpendicular from the center of a circle to a chord bisects the chord and conversely, the line drawn through the center of a circle to bisect a chord is perpendicular to the chord.
3. There is one and only one circle passing through three given non-collinear points.
4. Equal chords of a circle (or of congruent circles) are equidistant from the center(s) and conversely.
5. The angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle.
6. Angles in the same segment of a circle are equal.
7. If a line segment joining two points subtends equal angle at two other points lying on the same side of the line containing the segment, the four points lie on a circle.
8. The sum of the either pair of the opposite angles of a cyclic quadrilateral is 180° and its converse.

7. CONSTRUCTIONS

1. Construction of bisectors of line segments & angles, 60°, 90°, 45° angles etc, equilateral triangles.
2. Construction of a triangle given its base, sum/difference of the other two sides and one base angle.
3. Construction of a triangle of given perimeter and base angles.

UNIT V: MENSURATION

1. **AREAS**

Area of a triangle using Hero's formula (without proof) and its application in finding the area of a quadrilateral.

2. **SURFACE AREAS AND VOLUMES**

Surface areas and volumes of cubes, cuboids, spheres (including hemispheres) and right circular cylinders/ cones.

UNIT VI: STATISTICS & PROBABILITY

1. **STATISTICS**

Introduction to Statistics: Collection of data, presentation of data – tabular form, ungrouped/grouped, bar graphs, histograms (with varying base lengths), frequency polygons, qualitative analysis of data to choose the correct form of presentation for the collected data. Mean, median, mode of ungrouped data.

2. **PROBABILITY**

History, Repeated experiments and observed frequency approach to probability. Focus is on empirical probability. (A large amount of time to be devoted to group and to individual activities to motivate the concept; the experiments to be drawn from real - life situations, and from examples used in the chapter on statistics).

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CHAPTER 1 Number Systems

Q.1. What is the decimal expansion of the fraction $\frac{40}{9}$?

(a) $4.\overline{14}$ (b) $4.\overline{4}$

(c) $4.\overline{93}$ (d) None of these

Q.2. If $\left(3\sqrt{3}+2\sqrt{11}\right)-\left(3\sqrt{11}-\sqrt{3}\right)=4\sqrt{3}+A\sqrt{11}$, then what is the value of *A*?

(a) 1 (b) –1

(c) 2 (d) 3

Q.3. If the expression $\frac{1}{5\sqrt{3}-4}$ can be simplified in the form $X\sqrt{3}+\frac{4}{59}$, then what is the value of *X*?

(a) $\frac{11}{59}$ (b) $\frac{5}{59}$

(c) $\frac{13}{59}$ (d) $\frac{17}{59}$

Q.4. What is the value of the expression $\left[\left(\sqrt{5}-\sqrt{3}\right)^2\div\left(4-\sqrt{15}\right)\right]$?

(a) 5 (b) 4

(c) 3 (d) 2

Q.5. What is the value of the expression $\frac{3^{\frac{9}{4}}\cdot 3^{\frac{3}{4}}}{3^3}$?

(a) 3 (b) 4

(c) 1 (d) 5

Q.6. If the expression $\frac{\left(8\sqrt{2}-\sqrt{12}\right)\left(8\sqrt{2}+\sqrt{12}\right)}{\sqrt{11}+\sqrt{7}}$ can be simplified in the form $X\sqrt{11}+Y\sqrt{7}$, then what is the value of $(X + Y)$?

(a) 50 (b) 55

(c) 0 (d) 5

Q.7. Which of the following fractions has its decimal equivalent as 0.678678678...?

(a) $\frac{121}{347}$ (b) $\frac{226}{333}$

(c) $\frac{154}{723}$ (d) None of these

Q.8. Which of the following numbers is irrational?
(a) 0.07340734... (b) 0.8342831583...
(c) 0.123123123... (d) None of these

Q.9. Which of the following numbers is rational?
(a) $3\sqrt{11}$ (b) $\frac{\sqrt{18}}{\sqrt{3}}$
(c) $\pi - 7$ (d) $\frac{\sqrt{32}}{\sqrt{2}}$

Q.10. Which of the following numbers is an irrational number that lies between the fractions $\frac{2}{7}$ and $\frac{3}{7}$?
(a) 0.150151152... (b) 0.286286...
(c) 0.35363738... (d) 0.42714271...

Q.11. Which of the following fractions has its decimal equivalent as 0.4656565...?
(a) $\frac{469}{990}$ (b) $\frac{461}{990}$
(c) $\frac{471}{999}$ (d) $\frac{481}{999}$

Q.12. If $p = 9 + 4\sqrt{5}$ and $pq = 1$, then $\frac{1}{p^2} + \frac{1}{q^2}$ is
(a) 100 (b) 322
(c) 110 (d) 125

Q.13. The fraction $\frac{2\left(\sqrt{2}+\sqrt{6}\right)}{3\left(\sqrt{2+\sqrt{3}}\right)}$ is equal to
(a) $\frac{2}{5}$ (b) $\frac{7}{18}$
(c) $\frac{3}{4}$ (d) $\frac{4}{3}$

Q.14. If $a \geq 0$ then $\sqrt{a\sqrt{a\sqrt{a}}}$ =
(a) $\sqrt[8]{a^2}$ (b) $\sqrt[4]{a^3}$
(c) $\sqrt[8]{a^2}$ (d) $\sqrt[8]{a^7}$

Q.15. If 'x' and 'y' are rational numbers and $\frac{2+\sqrt{3}}{2-\sqrt{3}} = x + y\sqrt{3}$, then y = ...
(a) 4 (b) 5
(c) 7 (d) 9

Q.16. If $a = \frac{\sqrt{3}+1}{2}$, then the value of $4a^3 + 2a^2 - 8a + 7$ is
(a) 10 (b) 12
(c) 14 (d) 16

Q.17. Which of the given relations are ***correct***?
(i) $2^{\frac{1}{2}} \cdot 2^{\frac{1}{3}} = 2^{\frac{5}{6}}$ (ii) $2^{\frac{1}{2}} \cdot 2^{\frac{1}{3}} = 2^{\frac{1}{6}}$
(iii) $\left(2^{\frac{1}{2}}\right)^{\frac{1}{3}} = 2^{\frac{1}{6}}$ (iv) $\left(2^{\frac{1}{2}}\right)^{\frac{1}{3}} = 2^{\frac{5}{6}}$
(a) (i) and (iv) (b) (ii) and (iii)
(c) (i) and (iii) (d) (ii) and (iv)

Q.18. The expression $\frac{8}{5\sqrt{2}-7}$ can be rationalised as
(a) $5\sqrt{2}+7$ (b) $3\sqrt{2}$
(c) $8\left(5\sqrt{2}+7\right)$ (d) None of these

Q.19. What is the value of the expression $\left[\left(\sqrt{2}+\sqrt{3}\right)^2\left(5-2\sqrt{6}\right)\right]$?
(a) $7\sqrt{3}$ (b) 1
(c) $3\sqrt{2}$ (d) None of these

Q.20. What is the value of the expression $\frac{2^{\frac{2}{3}} \cdot 2^{\frac{1}{3}}}{2}$?
(a) 0 (b) 1
(c) 2 (d) 3

Q.21. If a is a rational number and b is an irrational number, then the value of which of the following expressions can be a rational number?
(a) $a + b$ (b) $a - b$
(c) ab (d) $\frac{a}{b}(b \neq 0)$

Q.22. Which of the following expressions is equivalent to the expression $\frac{\left[\left(3^2\times 9^2\right)^{\frac{1}{3}}\right]^{\frac{1}{2}}}{\left(27^{\frac{1}{3}}\right)^4}$?

(a) 3^{-6} (b) 3^{-5}
(c) 3^{-4} (d) 3^{-3}

Q.23. What is the simplified form of the expression $\frac{\left(3^{\frac{1}{5}}\right)^4}{12^{\frac{1}{5}}\cdot 2^{\frac{1}{5}}}$?

(a) $\left(\frac{3}{2}\right)^{\frac{4}{3}}$ (b) $\left(\frac{3}{2}\right)^{\frac{3}{5}}$
(c) $\left(\frac{3}{2}\right)^{\frac{1}{2}}$ (d) None of these

Q.24. What is the value of the expression $(9)^{\frac{3}{2}}\times\left(\frac{1}{6}\right)^{-\frac{1}{2}}\times\left(\frac{1}{24}\right)^{-\frac{1}{2}}$?

(a) 310 (b) 315
(c) 320 (d) 324

Q.25. The value of $\left(\sqrt[6]{27}-\sqrt{6\frac{3}{4}}\right)^2$ equals

(a) $\frac{3}{7}$ (b) $\frac{3}{5}$
(c) $\frac{3}{8}$ (d) $\frac{3}{4}$

Q.26. On simplifying $\frac{999813\times 999815+1}{(999814)^2}$, we get

(a) 1 (b) 3
(c) 5 (d) 7

Q.27. If $a=4+\sqrt{15}$, then $a^3+\frac{1}{a^3}=$

(a) 534 (b) 488
(c) 450 (d) None of these

Q.28. If both 'x' and 'y' are rational numbers, then 'x' and 'y' from $\frac{3-\sqrt{5}}{3+2\sqrt{5}}=x\sqrt{5}-y$, are

(a) $x=\frac{9}{11}, y=\frac{19}{11}$ (b) $x=\frac{19}{11}, y=\frac{9}{11}$
(c) $x=\frac{2}{11}, y=\frac{8}{11}$ (d) $x=\frac{10}{11}, y=\frac{21}{11}$

Q.29. If $25^{a-1}=5^{2a-1}-100$, then the value of a is

(a) 1 (b) 2
(c) 3 (d) 4

Q.30. If $4^{44}+4^{44}+4^{44}+4^{44}=4^p$ then p is

(a) 45 (b) 46
(c) 47 (d) 48

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ANSWERS

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

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CHAPTER 2 Polynomials

Q.1. The product of all the solutions of $p^4 - 16 = 0$ is
(a) –5 (b) –4
(c) –3 (d) 2

Q.2. Which of the following algebraic expressions is not a polynomial?
(a) $x^2 + x + 3$ (b) $x^2 + x^{\frac{2}{3}} + 3$
(c) 9 (d) 1

Q.3. $x - 8xy^3 =$
(a) $x(1 - 2y)(1 + 2y + 4y^2)$ (b) $x(1 + 2y)(1 + 2y + 4y^2)$
(c) $x(1 - 2y)(1 - 2y + 4y^2)$ (d) $x(1 + 2y)(1 - 2y + 4y^2)$

Q.4. The value of k for which $(x + 2)$ is a factor of $(x + 1)^7 + (3x + k)^3$ is
(a) 1 (b) 7
(c) 2 (d) 3

Q.5. The remainder when the polynomial $p(x) = x^{100} - x^{97} + x^3$ is divided by $x + 1$ is
(a) 1 (b) 22
(c) 3 (d) 4

Q.6. If $p = (2 - a)$, then $a^2 + 6ap + p^3 - 8$, is
(a) 0 (b) 2
(c) 3 (d) 4

Q.7. If $x + \frac{1}{x} = a + b$ and $x - \frac{1}{x} = a - b$, then
(a) $ab = 1$ (b) $ab = 3$
(c) $ab = 5$ (d) None of these

Q.8. Given that $a = 2$ is a solution of $a^3 - 7a + 6 = 0$. The other solutions are
(a) 1, 3 (b) 1, –3
(c) –3, –1 (d) None of these

Q.9. The number of positive integers k for which the equation $kx - 12 = 3k$ has an integer solution for x is
(a) 2 (b) 3
(c) 5 (d) 7

Q.10. If $\left(a + \frac{1}{a}\right)^2 = b$, then $a^3 + \frac{1}{a^3}$ is equal to
(a) a^3 (b) b^3
(c) $b^{\frac{3}{2}} - 3b^{\frac{1}{2}}$ (c) a^3b^3

Q.11. If $a + b = 5$ and $a^2 + b^2 = 111$, then the value of $a^3 + b^3$ is
(a) 770 (b) 775
(c) 715 (d) None of these

Q.12. If $a + b + c = 0$, then $\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab}$
(a) 0 (b) 1
(c) 3 (d) 2

Q.13. Value of x, if $\sqrt{(x+8)} + \sqrt{(2x+2)} = 1$, is
(a) {1} (b) {1, 17}
(c) {17} (d) ϕ

Q.14. If $x^{\frac{1}{3}} + y^{\frac{1}{3}} + z^{\frac{1}{3}} = 0$, then
(a) $x^3 + y^3 + z^3 = 0$ (b) $x + y + z = 27xyz$
(c) $(x + y + z)^3 = 27xyz$ (d) $x^3 + y^3 + z^3 = 27xyz$

Q.15. If $a + b + c = 0$, then $a^3 + b^3 + c^3$ is
(a) abc (b) $4abc$
(c) $3abc$ (d) $2abc$

Q.16. If $x + 1/x = 15$, then $x^2 + 1/x^2$ is equal to
(a) 223 (b) 210
(c) 225 (d) 225 + 1/225

Q.17. $1 - x + x^2 - x^3 =$
(a) $(1 + x)(1 - x^2)$ (b) $(1 - x)(1 + x^2)$
(c) $(1 - x)(1 - x^2)$ (d) $(1 + x)(1 + x^2)$

Q.18. Factorise $a^2 + b^2 + 2(ab + bc + ca)$
(a) $(a + b)(a + b + 2c)$ (b) $(b + c)(c + a + 2b)$
(c) $(c + a)(a + b + 2c)$ (d) $(b + a)(b + c + 2a)$

Q.19. Factorise $x^2 + 3\sqrt{2}x + 4$
(a) $\left(x + 2\sqrt{2}\right)\left(x + \sqrt{2}\right)$ (b) $\left(x + 2\sqrt{2}\right)\left(x - \sqrt{2}\right)$
(c) $\left(x - 2\sqrt{2}\right)\left(x + \sqrt{2}\right)$ (d) $\left(x + 2\sqrt{2}\right)\left(x - \sqrt{2}\right)$

Q.20. Factorise $x^2 - 1 - 2a - a^2$
(a) $(x - a - 1)(x + a - 1)$ (b) $(x + a + 1)(x - a - 1)$
(c) $(x + a + 1)(x - a + 1)$ (d) $(x - a + 1)(x + a - 1)$

Q.21. If $a^{\frac{1}{2}} + b^{\frac{1}{2}} - c^{\frac{1}{2}} = 0$, then the value of $(a + b - c)^2$ is

(a) $2ab$ (b) $2bc$
(c) $4ab$ (d) $4ac$

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ANSWERS

1.	(b)	2.	(b)	3.	(a)	4.	(b)	5.	(a)	6.	(a)	7.	(a)	8.	(b)
9.	(c)	10.	(c)	11.	(a)	12.	(c)	13.	(d)	14.	(c)	15.	(c)	16.	(a)
17.	(b)	18.	(a)	19.	(a)	20.	(b)	21.	(c)						

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CHAPTER 3 Co-ordinate Geometry

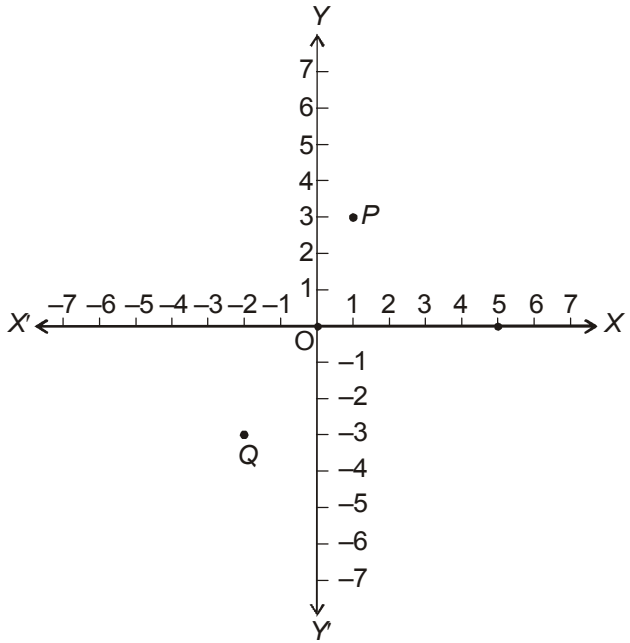
Q.1. What is the difference between the ordinates of the points (–2, 3) and (5, 8)?
(a) 4 (b) 5 (c) 6 (d) 7

Q.2. Which of the following statements is ***incorrect***?
(a) The point (1, 2) lies in the 1st quadrant.
(b) The point (–1, –2) lies in the 4th quadrant.
(c) The point (–1, 2) lies in the 2nd quadrant.
(d) The point (–2, –2) lies in the 3rd quadrant.

Q.3. The horizontal and the vertical lines drawn for determining the position of any point in the Cartesian plane are respectively called.
(a) *y*-axis and *x*-axis (b) *x*-axis and *y*-axis
(c) Origin and quadrant (d) Abscissa and ordinate

Q.4. If the respective coordinates of points *A*, *B*, *C* and *D* are (6, 0), (0, 8), (3, 0), and (–4, 0), then which of the following statements is correct?
(a) Point *A* lies on the *y*-axis (b) Point *B* lies on the *x*-axis
(c) Point *C* lies on the *y*-axis (d) Point *D* lies on the *x*-axis

Q.5. *Use the following graph to answer the following question.*



What are the respective coordinates of points *P* and *Q* in the given graph?

(a) (–2, 1) and (–3, –2) (b) (2,1) and (3, –2)
(c) (1, 3) and (–2, –3) (d) None of these

Q.6. Some statements are given as

(i) The perpendicular distance of a point from the *y*-axis, measured along the *x*-axis, is called its ordinate.
(ii) The perpendicular distance of a point from the *y*-axis, measured along the *x*-axis, is called its abscissa.
(iii) The perpendicular distance of a point from the *x*-axis, measured along the *y*-axis, is called its ordinate.
(iv) The perpendicular distance of a point from the *x*-axis, measured along the *y*-axis, is called its abscissa.

Which two given statements are ***correct***?

(a) (iv) and (i) (b) (iii) and (iv)
(c) (ii) and (iii) (d) (i) and (ii)

Q.7. The *x*-coordinate of a point is called as its ___(i)___ whereas its *y*-coordinate is called its ____(ii)____ .
The blank spaces in the given statement can be filled as

(a) (i) $\rightarrow$ axis, (ii) $\rightarrow$ origin
(b) (i) $\rightarrow$ abscissa, (ii) $\rightarrow$ ordinate
(c) (i) $\rightarrow$ origin, (ii) $\rightarrow$ axis
(d) (i) $\rightarrow$ ordinate, (ii) $\rightarrow$ abscissa

Q.8. The axis on which the point (0, –4) lies

(a) Positive *x*-axis (b) Negative *x*-axis
(c) Positive *y*-axis (d) Negative *y*-axis

Q.9. In the coordinate plane $(\alpha, \beta) = (\beta, \alpha)$ for some numbers α and β. Then the relation between α and β is

(a) $\alpha = 2\beta$ (a) $\alpha < \beta$
(c) $\alpha = \beta$ (d) $\alpha > \beta$

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ANSWERS

1. (b) 2. (b) 3. (b) 4. (d) 5. (c) 6. (c) 7. (b) 8. (d) 9. (c)

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NATIONWIDE INTERACTIVE MATHS OLYMPIAD (NIMO) SAMPLE PAPER

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

SECTION - A

MENTAL ABILITY

1. Write the missing term.

97, 86, 73, 58, 45, (.....)

(a) 34 (b) 54 (c) 55 (d) None of these

2. If in a code language, COULD is written as BNTKC and MARGIN is written as LZQFHM, how will MOULDING be written in that code?

(a) CHMFINTK (b) LNKTCHMF
(c) LNTKCHMF (d) None of these

3. In a certain code, RIPPLE is written as 613382 and LIFE is written as 8192. How is PILLER written in that code?

(a) 318826 (b) 318286 (c) 618826 (d) None of these

4. In a certain code, '*nee tim see'* means '*how are you*' '*ble nee see*' means '*where are you*', what is the code for '*where'*?

(a) nee (b) tim (c) see (d) None of these

5. Rajan is the brother of Sachin and Manick is the father of Rajan. Jagat is the brother of Priya and Priya is the daughter of Sachin. Who is the uncle of Jagat?

(a) Rajan (b) Sachin (c) Manick (d) None of these

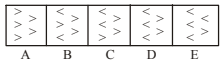
6. Kashish goes 30 metres North, then turns right and walks 40 metres, then again turns right and walks 20 metres, then again turns right and walks 40 metres. How many metres is he from his original position?

(a) 0 (b) 10 (c) 20 (d) None of these

7. If the first and third letters in the word NECESSARY were interchanged, also the fourth and the sixth letters and the seventh and the ninth letters which of the following would be the seventh letter from the left?

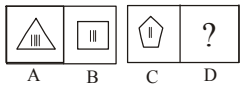
(a) A (b) Y (c) R (d) None of these

8. **Directions :** ***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 give Problem Figures***



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

9. **Direction :** ***In the given question figures A, B, C and D constitute the problem set while figures (a), (b) and (c) constitute the answer set. There is definite relationship between figures A and B. Establish a similar relationship between figures C and D by choosing a suitable figure (D) from the Answer set.***



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

10. **Directions :** ***In the following question, you are given a combination of letters and numbers followed by three alternatives (a), (b) and (c). Choose the alternative which most closely resembles the mirror-image of the given combination.***

QUANTITATIVE

(a) ƎVITATITИAUQ (b) EVITATITNAUQ

(c) QUAИTITATIVƎ (d) None of these

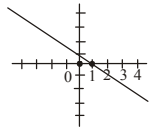
11. In a class of 50 students, 28 students studies mathematics and rest students studies sanskrit. The probability of sanskrit students is

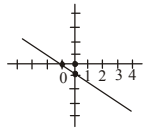
(a) $\frac{11}{250}$ (b) $\frac{28}{50}$ (c) $\frac{11}{25}$ (d) None of these

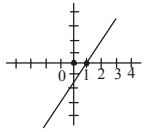
12. If

x	1	−1	−3
y	0	1	2

then the graph shown by this is

(a) 

(b) 

(c) 

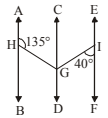
(d) None of these

13. If $\frac{x^3+3x}{3x^2+1}=\frac{35}{19}$ then the value of x is

(a) 2 (b) 4 (c) 5 (d) None of these

14. In a bag of 25 oranges, 17 were rotten. One orange is chosen at random. Then the probability of getting a fresh orange is

(a) $\frac{15}{25}$ (b) $\frac{17}{25}$ (c) $\frac{8}{25}$ (d) None of these

15. 

In figure, AB || CD || EF, then the value of $\angle HGI$ is

(a) 175° (b) 85° (c) 95° (d) none of these

16. The mean of numbers 6, y, 7, x and 14 is 8. Then the value of y in terms of x is

(a) $2y = 13 - x$ (b) $2y = 14 - 5x$

(c) $y = 13 - x$ (d) None of these

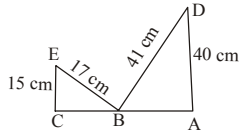
17. In the given figure, $\angle A = \angle C = 90°$. Then the value of AC is

(a) 8 cm

(b) 17 cm

(c) 41 cm

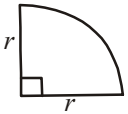
(d) None of these



18. The figure shows a quarter circle of perimeter 22.5cm. If r be radius of the circle then r is

(a) 7 cm (b) 6.3 cm

(c) 6 cm (d) None of these



19. In $\Delta ADE, BC$ is parallel to DE. Area of ΔABC is 25 cm^2, area of trapezium BCED is 24 cm^2 and DE = 21 cm. Then the length of BC is

(a) 10 cm (b) 12 cm (c) 15 cm (d)None of these

20. An exhibition tent is in the form of a cylinder surmounted by a cone. The height of the tent above the ground is 67 m and height of cylinderical part is 37 m. If the diameter of the base is 144 m and 10% extra for folds and for stitching.

Then the quantity of canvas required to make the tent is $\left(\pi=\frac{22}{7}\right)$

(a) 3783 m^2 (b) 3738 m^2

(c) 3439 m^2 (d) None of these

21. A tank that is in the form of an inverted cone contains a liquid. The height h, in meters of the space above the liquid is given by the formula $h = 21 - \frac{7}{2}r$ where r is the radius of the liquid surface.

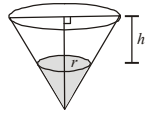
The circumference of the top of the tank, in metres is

(a) 15π

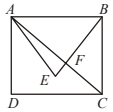
(b) 18 π

(c) 12 π

(d) None of these

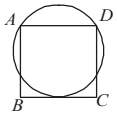


22. If ABCD is a square and ABE is an equilateral triangle, then angle BFC, measured in degrees, equals



(a) 105 (b) 120
(c) 135 (d) None of these

23. A circle passes through vertices A and D and touches side BC of a square. If the square has side length 2, then the radius of the circle is

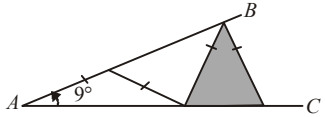


(a) $\frac{5}{4}$ (b) $\frac{4}{5}$
(c) 1 (d) None of these

24. If a and b are nonzero numbers such that a and b are the two roots of $x^2 + a.x + b = 0$, then b equals
(a) -2 (b) -1 (c) 1 (d) None of these

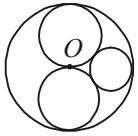
25. Consider a square with area S and side length s, and an equilateral triangle with area D and side length d. If $\frac{D}{S} = \sqrt{3}$, then $\frac{d}{s}$ equals
(a) 3 (b) 2 (c) $\sqrt{2}$ (d) None of these

26. Isosceles triangles have been drawn between AB and AC with $\angle BAC = 9°$.



What is the largest angle in the shaded triangle?
(a) 72 ° (b) 126° (c) 90° (d) None of these

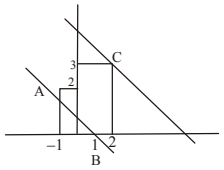
27. A circles radius 2cm with centre$O$, contains three smaller circles as shown in the diagram; two of them touch the outer circle, and touch each other at O, and the third touches each of the other circles. Then the radius of the third circle, in centimeters is



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

28. Let A = 200420042004 × 2005200520052005
and B = 200520052005 ×20042004
Then the value of $\frac{A}{B}$ is
(a) 100 000 001 (b) 100 00 001
(c) 100 0001 (d) None of these

29.



In the given figure co-ordinates of points A, B, C are
(a) (–1, 2), (2, 0), (3, 2) (b) (–1, 2), (1, 0), (2, 3)
(c) (2, – 1), (0, 2) (2, 3) (d) None of these

30. In ΔABC, $m\angle A = 30$, $a = 14$, and $b = 20$. Which type of angles is $\angle B$?
(a) It must be an acute angle
(b) It must be an obtuse angle.
(c) It may be either an acute angle or an obtuse angle.
(d) None of these

31. If $x = 1 + 2^p$ and $y = 1 + 2^{-p}$ then y equals
(a) $\frac{x+1}{x-1}$ (b) $\frac{x+2}{x+1}$ (c) $\frac{x}{x-1}$ (d) None of these

32. Raj simplified the expression

$$15\left(\frac{1}{3}+\frac{2}{5}\right)$$

to

$$(5 + 6)$$

Which of the following properties of the real numbers did Raj use?
(a) associative property of multiplication
(b) commutative property of multiplication
(c) distributive property (d) None of these

33. ($2^3 = 2 \times 2 \times 2$ and $2^5 = 2 \times 2 \times 2 \times 2 \times 2$)
If $2^x + 3^y = 41$, where x and y are natural numbers, then the value of $x + y$ is
(a) 9 (b) 8 (c) 7 (d) None of these

34. A cylindrical container holds three tennis balls so that the balls are touching the sides and ends of the container. The ratio of the length of the container to its circumference is approximately.

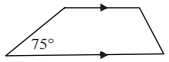
(a) 1 : 1 (b) 3 : 2 (c) 2 : 1 (d) None of these

35. If the product of the digit of a four-digit number is 75, then the sum of the digits is
(a) 10 (b) 14
(c) 15 (d) impossible to determine

36. If $a + b = -3$ and $ab = 4$, then $a^3 + b^3$ equals
(a) 9 (b) $3\sqrt{2}$ (c) $-3+2\sqrt{2}$ (d) None of these

37. $\sqrt{2+\sqrt{3}} - \sqrt{2-\sqrt{3}}$ equals
(a) 1 (b) $\sqrt{2}$ (c) $\frac{3}{2}$ (d) $\sqrt{3}$

38. The four angles of a trapezium have the same constant difference between them. If the smallest angle is 75° then the second largest angle (in degrees) is

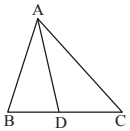


(a) 85 (b) 100 (c) 95 (d) None of these

39. The average of three numbers is 18. If the largest number is replaced by the number 38, then the average of the three numbers is 23. The original number that was replaced, is

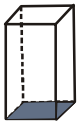
(a) 38 (b) 23 (c) 15 (d) None of these

40. In the given figure, ABD is an equilateral triangle. If the area of triangle ABC is twice the area of triangle ADC, then $\angle BAC$ is equal to



(a) 90° (b) 120° (c) 60° (d) None of these

41. A solid right prism has a square base. The height is twice the length of the side of the base. The surface area of this prism is 160 cm^2. If 1 cm^3 of the prism has a volume of 250 grams, then the volume of the prism in kilograms is



(a) 28 (b) 32 (c) 36 (d) None of these

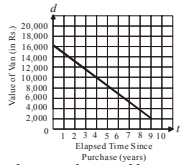
42. If $y = x + \left(\frac{1}{x}\right)$, then $x^4 + x^3 - 4x^2 + x + 1 = 0$ becomes

(a) $x^2 (y^2 + y - 2) = 0$ (b) $x^2 (y^2 + y - 3) = 0$
(c) $x^2 (y^2 + y - 6) = 0$ (d) None of these

43. Simplify $\frac{\left(2x^2 + x - 3\right)}{\left(x - 1\right)} + \frac{\left(2x^2 + 5x + 3\right)}{\left(x^2 - 1\right)}$

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

44. A small business purchased a van to handle its delivery orders. The graph below shows the value of this van over a period of time.



Which of the following best describes this situation?

(a) The van was purchased for Rs. 1,600
(b) The van decrease in value by Rs.1,600 per years
(c) The van increases in value by Rs. 1,600 per year
(d) None of these

45. If $l + m + n$ be real numbers such that $l + n \neq m$, what is the quotient on dividing $l^3 - m^3 + n^3 + 3\,lmn$ by $l - m + n$?

(a) $l^2 + m^2 + n^2 - lm - mn - ln$
(b) $l^2 + m^2 + n^2 + lm + mn - ln$
(c) $l^2 - m^2 + n^2 + lm - mn - ln$
(d) None of these

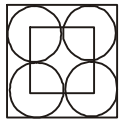
46. The locus of a point equidistant from the three sides of a triangle is

(a) Excircle (b) Circumcircle
(c) Incircle (d) None of these

SECTION - C

INTERACTIVE SECTION

47. In the diagram, four equal circles fit perfectly inside a square; their centres are the vertices of the smaller square. The area of the smaller square is 4.



The area of the larger square is

(a) 4 (b) 8
(c) 16 (d) None of these

48. Vishnu has displayed his technology project as a mobile and hung it from the classroom ceiling. It is perfectly balanced (figure 1).

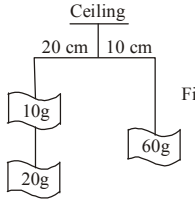


Figure 1

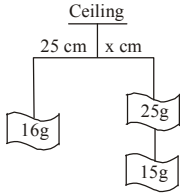
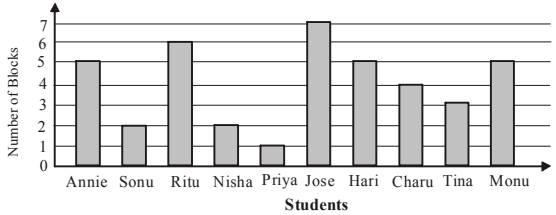


Figure 2

Manjeet wants to display his project in the same way (figure2). What must the length (x) of the wire be for his mobile to be perfectly balanced? Ignore the mass of the wire

(a) 5 (b) 10 (c) 15 (d) None of these

49. The bargraph shown below represents the number of blocks each of 10 students walks to school each day.

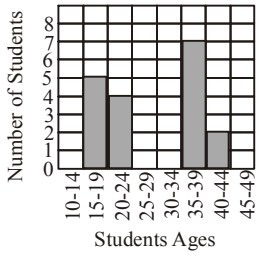


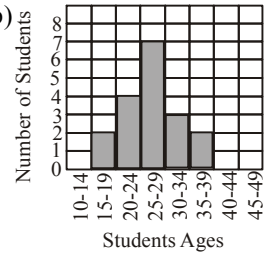
Based on the graph what is the medium number of blocks that these students walk to school each day.

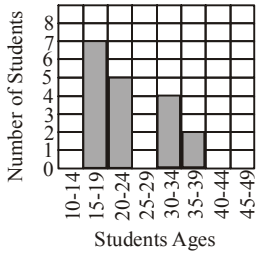
(a) 3.5 (b) 4 (c) 5 (d) None of these

50. The adjoining chart shows a random sample of student's ages at a community college. Administrators at the college constructed a histogram of the student's ages. Which of the following histograms **best** represents the distribution of student's ages?

22	18	35	43	44	19
18	38	36	20	19	37
37	20	19	38	38	21

(a) 

(b) 

(c) 

(d) None of these

☺ **END OF THE EXAM** ☺

ANSWERS

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

☺☺☺