MATHS BASE MAKER

Class 9 CBSE Mathematics | Ganita Manjari

Chapter 3: The World of Numbers

STUDENT PRACTICE WORKSHEET (concept + questions)

PART 1: MASTER CONCEPTS & RULES AT A GLANCE

Number Systems & Origin	• Natural Numbers (N): {1, 2, 3, 4, ...} - Closed under addition and multiplication; not closed under subtraction. • Whole Numbers (W): {0, 1, 2, 3, ...} includes zero. • Integers (Z): {..., -3, -2, -1, 0, 1, 2, 3, ...} from German 'Zahlen'.
Brahmagupta's Rules (628 CE)	• $a + 0 = a$, $a - 0 = a$, $a \times 0 = 0$, $a - a = 0$ • $a \div 0$ = Undefined (Since $a \div b = c$ implies $b \times c = a$; but $0 \times c$ cannot equal non-zero a). • $0 \div a = 0$ (for $a \neq 0$).
Ancient Arithmetic of Integers	• Fortune + Fortune = Fortune (+ + = +) • Debt + Debt = Debt (– + – = –) • Fortune × Fortune = Fortune (+ × + = +) • Debt × Debt = Fortune (– × – = +) • Debt × Fortune = Debt (– × + = –)
Rational Numbers (Q)	• Any number expressed in the form p/q, where p and q are integers and $q \neq 0$. • Negative signs can sit on numerator or denominator: $-p/q = p/(-q) = -(p/q)$.
Absolute Value	• The absolute value $\|x\|$ represents the geometric distance of x from 0 on the number line. • $\|x\| \geq 0$ for all real numbers (always non-negative).
Decimal Representation	• Terminating: Remainder becomes 0. In simplest form p/q, prime factors of q are strictly of form $2^m \cdot 5^n$. • Non-Terminating Repeating: Remainder never becomes 0, digits repeat periodically (Rational).

	• Non-Terminating Non-Repeating: Never ends, never repeats (Irrational numbers like $\sqrt{2}$, $\sqrt{3}$, π).
Real Numbers (R)	The union of all rational and irrational numbers forms the entire continuous real number line. The square root of a negative number (e.g., $\sqrt{(-1)}$) is not a real number.

PART 2: PRACTICE QUESTIONS (WITH FINAL ANSWERS)

Watch the Complete Chapter 3 Video Solutions on YouTube PART 1

https://youtu.be/jmpLvh023cQ

contd...watch part 2 on youtube

Question 1: Grain Storage in Jute Sacks

A farmer can store 25 kilograms of grain in every 4 jute sacks. If the farmer harvests a total crop weighing 375 kilograms, how many jute sacks will be required to store all the grain?

Final Answer: 60 sacks [375 × (4 / 25) = 15 × 4 = 60 sacks]

Question 2: Hand-Woven Cloth and Beads Exchange

A trader exchanges 4 hand-woven cotton cloths for 18 beads. If he brings 14 cotton cloths to the marketplace, how many beads will he receive in return?

Final Answer: 63 beads [14 × (18 / 4) = 14 × 4.5 = 63 beads]

Question 3: Division by Zero and Brahmagupta's Law

Why can we NOT divide any number by zero? Give a clear mathematical reason using Brahmagupta's definition (if a ÷ b = c, then b × c = a). Also explain: Is 0 ÷ 5 the same as 5 ÷ 0? Justify.

Final Answer: They are NOT the same.
0 ÷ 5 = 0 (valid, since 5 × 0 = 0).
5 ÷ 0 is Undefined (since 0 × c = 5 has no solution for any real number c).

Question 4: Merchant Financial Standing

A merchant starts his business day owing a loan of ₹1,400. In the morning, he makes a profit of ₹2,150. In the afternoon, he spends ₹950 to buy silk. What is his final financial standing at the end of the day?

Final Answer: Debt of ₹200 (or –₹200) [2150 – (1400 + 950) = 2150 – 2350 = –200]

Question 5: Mountain Base Camp Temperature Changes

The temperature at a mountain base camp is +2°C at sunset. By midnight, a cold wave causes the temperature to drop by 9°C. By dawn, the temperature drops again by another 5°C. What is the final temperature at dawn?

Final Answer: –12°C [+2°C – 9°C – 5°C = –12°C]

Question 6: Integer Arithmetic using Brahmagupta's Laws

Calculate the following products using Brahmagupta's rules of signs:
(i) (–15) × 4
(ii) (–9) × (–6)

Final Answer: (i) –60 [Product of debt and fortune is debt]
(ii) +54 [Product of two debts is a fortune]

Question 7: Rational Fraction Addition

Simplify the rational expression: (–2/3) + (7/12)

Final Answer: –1/12 [(–8 + 7) / 12 = –1/12]

Question 8: Multigrain Atta Laddoo Boxes

A homemaker has 11¼ kilograms of multigrain flour (atta). For preparing one box of special laddoos, she needs 1⅞ kilograms of multigrain atta. Exactly how many full boxes of laddoos can she prepare?

Final Answer: 6 full boxes [(45/4) ÷ (15/8) = (45/4) × (8/15) = 3 × 2 = 6 boxes]

Question 9: Identifying Rational Numbers

Which of the following numbers is a rational number?
(a) $\sqrt{7}$ (b) π (c) 0.333... (d) $\sqrt{20}$

Final Answer: (c) 0.333... [Since 0.333... = 1/3, which is written in the form p/q with integers p, q and q ≠ 0]

Question 10: Terminating vs. Repeating Decimals Without Division

Without actual division, determine whether each of the following rational numbers has a terminating or repeating decimal expansion:
(i) 3/125
(ii) 7/8
(iii) 9/40

Final Answer: All three are Terminating Decimals.
[Prime factors of denominators: $125 = 5^3$; $8 = 2^3$; $40 = 2^3 \times 5^1$. All denominators have only 2 and/or 5 as prime factors.]

Question 11: Converting Decimals into p/q Form

Express the following numbers in the form p/q wherever possible. If not possible, state the reason:

(a) 8.3623673332

(b) 7.01001000100001...

(c) 4.1252525...

(d) 2.918 (with 8 repeating, i.e., 2.91888...)

Final Answer: (a) 83623673332 / 10^{10} (Terminating rational decimal)

(b) Not possible (Non-terminating non-repeating, hence an irrational number)

(c) 2042 / 495 [Let x = 4.12525..., 1000x – 10x = 4125.25... – 41.25... => 990x = 4084 => x = 4084/990 = 2042/495]

(d) 2627 / 900 [Let x = 2.91888..., 1000x – 100x = 2918.88... – 291.88... => 900x = 2627 => x = 2627/900]

Question 12: Cyclic Properties of Rational Number 1/7

The decimal expansion of 1/7 is given as 0.142857142857...

(i) Write the repeating block of digits.

(ii) Find the decimal expansions of 2/7 and 3/7 without long division.

(iii) What pattern do you observe in the repeating blocks?

(iv) Is 1/7 a rational number? Give a reason.

Final Answer: (i) Repeating block is 142857 (length of 6 digits)

(ii) 2/7 = 0.285714... and 3/7 = 0.428571...

(iii) The repeating blocks contain the exact same six digits cyclically shifted.

(iv) Yes, 1/7 is a rational number because it is in the form p/q with integers p, q and q ≠ 0, producing a periodic repeating decimal.

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https://youtu.be/jmpLvh023cQ