CLASS 7

MATHEMATICS

Olympiad
Prepguide & PYQs

+

Workbook
After School Practice

- Concept Maps
- Olympiad Specific Concepts
- Topicwise Solved Examples
- Achievers MCQs
- Olympiad Exam PYQs
- Everyday Curiosity Qns

IMO, iOM, Hindustan Olympiad, NSTSE, SEAMO, ISTSE and others

Overview of Major Olympiad Exams

International Mathematics Olympiad (IMO)

Exam Details

Feature	Information
Frequency of conduct	Once a year
Exam Mode	Offline
Medium	English
Exam Duration	60 Minutes
Type of Questions	Multiple Choice Questions (Objective Type)

Syllabus

Section–1: Verbal and Non-Verbal Reasoning.

Section–2: Integers, Fractions and Decimals, Exponents and Powers, Algebraic Expressions, Simple Equations, Lines and Angles, Comparing Quantities, The Triangle and its Properties, Symmetry, Rational Numbers, Perimeter and Area, Data Handling, Visualising Solid Shapes.

Section–3 : Syllabus as per Section–2.

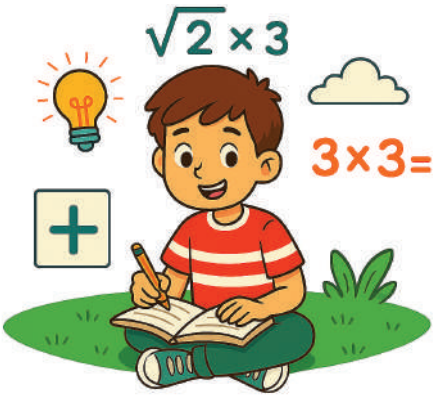
Section–4: Higher Order Thinking Questions - Syllabus as per Section–2.

Exam Structure

Levels	Details
Level 1	All students are eligible
Level 2	Top 5% of the participating students in Level 1 exam

Note:

- **Level 1 Questions:** 60% from class 7 syllabus + 40% from class 6 syllabus.
- **Level 2 Questions:** From class 7 syllabus only.
- **Achievers Section Questions:** From class 7 syllabus only.



Exam Pattern

Levels	Sections	Questions	Marks/ Question	Total Marks
Level 1	1: Logical Reasoning	15	1	15
	2: Mathematical Reasoning	20	1	20
	3: Everyday Mathematics	10	1	10
	4: Achievers Section	5	3	15
	Total	**50**		**60**
Level 2	1: Mathematics	45	1	45
	2: Achievers Section	5	3	15
	Total	**50**		**60**

Silverzone Olympiad (iOM)

Exam Details

Feature	Information
Exam Frequency	Conducted annually, two dates to choose from
Exam Mode	Offline, conducted in schools during school hours
Medium	English
Exam Duration	40 minutes
Type of Questions	Multiple Choice Questions (Objective Type)

Syllabus

Section 1:

- **Numbers and Their Operations:** Integers, Simplifying Arithmetic Expressions, Fractions and Decimals, Rational Numbers, Exponents
- **Algebra:** Algebraic Expressions, Simple Equations
- **Ratio and its Applications:** Ratio and Proportion, Percentage, Profit and Loss, Simple Interest
- **Geometry and Mensuration:** Lines and Angles, Triangles, Quadrilaterals, Solid Shapes, Perimeter, Area of Closed Figures
- **Data Handling:** Arithmetic Mean, Median, Mode, Bar graphs

Exam Structure

Levels	Details
Level 1	All students are eligible
Level 2	Top 1000 rank holders (Minimum 50% marks & Above)
Level 3	1st rank holders at Level 2

Exam Pattern

Sections	Questions	Marks/ Question	Total Marks
Section 1: Mathematics	20	2.5	50
Section 2: Reasoning and Aptitude	10	3	30
Section 3: Scholar's Zone	5	4	20
Total	35		100

Note: There is no negative marking for wrong answers.

Hindustan Olympiad

Exam Details

Detail	Information
Exam Frequency	Once a year
Exam Mode	Online
Duration	120 minutes
Medium	Hindi or English
Type of Questions	Multiple Choice Questions (Objective Type)

Note: An additional 10 minutes is provided for reading the instructions and filling the OMR sheet.

Exam Structure

Levels	Details
Level 1	All students are eligible (open-book exam)
Level 2	Top 10% of participants (proctored exam)

Exam Pattern

Sections	Ques-tions	Marks/ Ques-tion	Total Marks
Section A: Mathematics	20	1	20
Section B: English	20	1	20
Section C: Science	20	1	20
Section D: General Knowledge	20	1	20
Section E: Logical Reasoning	20	1	20
Total	100		100

Note: There is no negative marking.

National Level Science Talent Search Examination (NSTSE)

Exam Details

Feature	Details
Exam Frequency	Once a year
Exam Mode	Online & Offline
Duration	60 minutes
Medium	English
Type of Questions	Multiple Choice Questions

Syllabus

Sections:

- **Section A (Mathematics):** Integers, Fractions and Decimals, Data Handling, Simple Equations, Lines and Angles, Triangle and its Properties, Comparing Quantities, Rational Numbers, Perimeter and Area, Algebraic Expressions, Exponents and Powers, Symmetry

- **Section B (Physics):** Motion and time, Heat, Electric Current and its Effects
- **Section C (Chemistry):** Physical and chemical changes, Acids bases and salts, Water - A precious resource
- **Section D (Biology):** Nutrition in plants, nutrition in animals, Organization in living beings, Respiration in organisms, Transportation in living beings, Reproduction and growth in plants.
- **Critical Thinking:** This section includes a combination of skills like conscious application in real life, Logical & Inductive Reasoning, Tactics & Strategies in decision making, higher order thinking

Exam Pattern

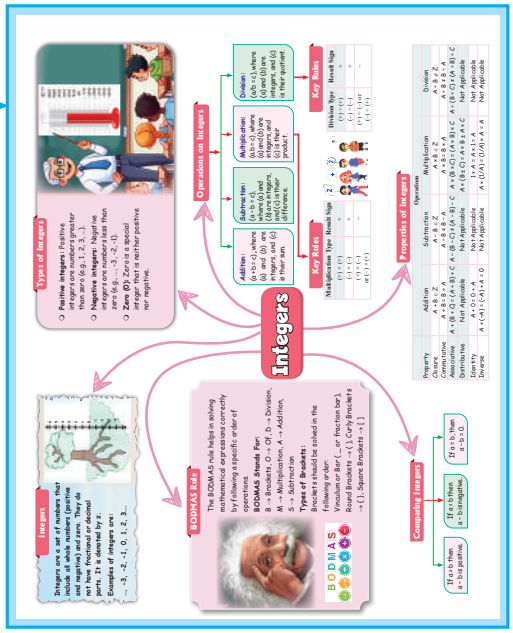
Sections	Questions	Marks/ Question	Total Marks
Section A: Mathematics	25	1	25
Section B: Physics	10	1	10
Section C: Chemistry	10	1	10
Section D: Biology	10	1	10
Section E: Critical Thinking	5	1	5
Total	60		60

How to Use this Book

This book is structured to support your learning journey of preparing for your olympiad exams through a variety of engaging and informative elements. Here's how to make the most of it:

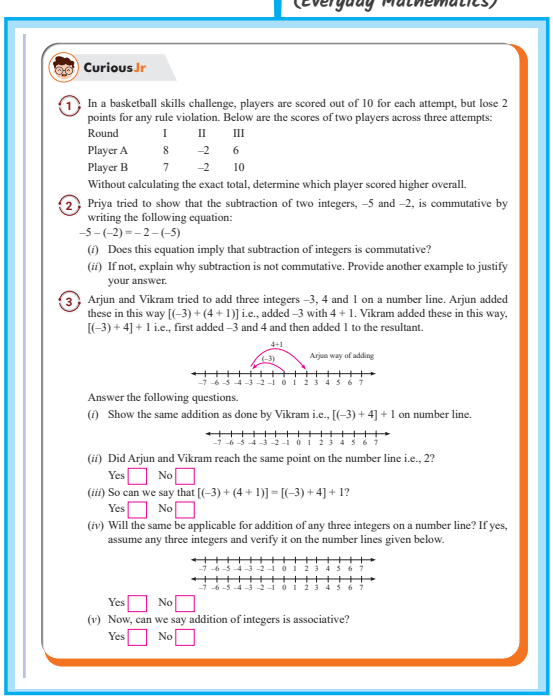
The concept map appears to be a comprehensive study aid that outlines key concepts in a structured format. Use it to understand the chapter's concepts and as a quick reference to recall important highlights.

Concept Map



CuriousJr brings real-life questions that make you think and wonder. These questions help you see how what you learn connects to the world around you.

CuriousJr
(Everyday Mathematics)



CuriousJr

1. In a basketball skills challenge, players are scored out of 10 for each attempt, but lose 2 points for any rule violation. Below are the scores of two players across three attempts:

Round	I	II	III
Player A	8	–2	6
Player B	7	–2	10

Without calculating the exact total, determine which player scored higher overall.

2. Priya tried to show that the subtraction of two integers, –5 and –2, is commutative by writing the following equation:

–5 – (–2) = – 2 – (–5)

(*i*) Does this equation imply that subtraction of integers is commutative?

(*ii*) If not, explain why subtraction is not commutative. Provide another example to justify your answer.

3. Arjun and Vikram tried to add three integers –3, 4 and 1 on a number line. Arjun added these in this way [(–3) + (4 + 1)] i.e., added –3 with 4 + 1. Vikram added these in this way, [(–3) + 4] + 1 i.e., first added –3 and 4 and then added 1 to the resultant.

Answer the following questions.

(*i*) Show the same addition as done by Vikram i.e., [(–3) + 4] + 1 on number line.

(*ii*) Did Arjun and Vikram reach the same point on the number line i.e., 2?

Yes ☐ No ☐

(*iii*) So can we say that [(–3) + (4 + 1)] = [(–3) + 4] + 1?

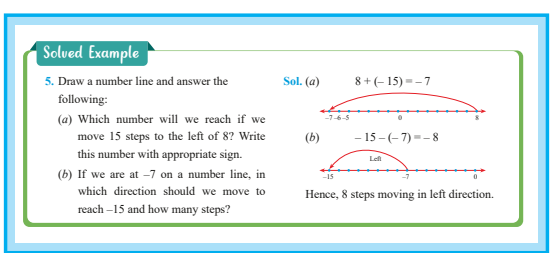
Yes ☐ No ☐

(*iv*) Will the same be applicable for addition of any three integers on a number line? If yes, assume any three integers and verify it on the number lines given below.

Yes ☐ No ☐

(*v*) Now, can we say addition of integers is associative?

Yes ☐ No ☐



Solved Example

5. Draw a number line and answer the following:

(*a*) Which number will we reach if we move 15 steps to the left of 8? Write this number with appropriate sign.

(*b*) If we are at –7 on a number line, in which direction should we move to reach –15 and how many steps?

Sol. (*a*) 8 + (– 15) = – 7

(*b*) – 15 – (– 7) = – 8

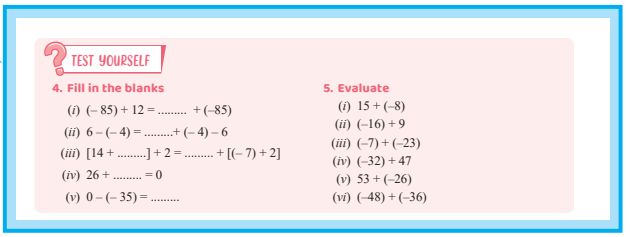
Hence, 8 steps moving in left direction.

Solved Example

Solved Example contains solved questions for each topic. These examples show how to solve problems step by step, making it easier for you to understand the method and apply it on your own. It helps you build strong problem-solving skills.

This section gives you practice questions based on each concept. Solving these will show how well you have learned and help you find areas where you need more practice.

Test Yourself



TEST YOURSELF

4. Fill in the blanks

(*i*) (– 85) + 12 = ... + (–85)

(*ii*) 6 – (– 4) = ...+ (– 4) – 6

(*iii*) [14 + ...] + 2 = ... + [(– 7) + 2]

(*iv*) 26 + ... = 0

(*v*) 0 – (– 35) = ...

5. Evaluate

(*i*) 15 + (–8)

(*ii*) (–16) + 9

(*iii*) (–7) + (–23)

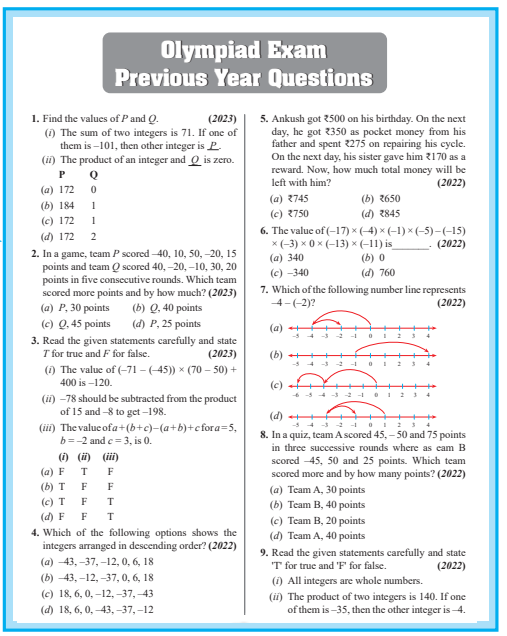
(*iv*) (–32) + 47

(*v*) 53 + (–26)

(*vi*) (–48) + (–36)

This section includes questions that were asked in past exams. Solving these helps you understand questions pattern, difficulty level, & most important topics. It's a great way to prepare for the actual exam with full confidence.

Olympiad Exam Previous Year Questions



Olympiad Exam Previous Year Questions

1. Find the values of *P* and *Q*. **(2023)**

(*i*) The sum of two integers is 71. If one of them is –101, then other integer is *P*.

(*ii*) The product of an integer and *Q* is zero.

	P	Q
(*a*)	172	0
(*b*)	184	1
(*c*)	172	1
(*d*)	172	2

2. In a game, team *P* scored –40, 10, 50, –20, 15 points and team *Q* scored 40, –20, –10, 30, 20 points in five consecutive rounds. Which team scored more points and by how much? **(2023)**

(*a*) *P*, 30 points (*b*) *Q*, 40 points

(*c*) *Q*, 45 points (*d*) *P*, 25 points

3. Read the given statements carefully and state *T* for true and *F* for false. **(2023)**

(*i*) The value of (–71 – (–45)) × (70 – 50) + 400 is –120.

(*ii*) –78 should be subtracted from the product of 15 and –8 to get –198.

(*iii*) The value of $a+(b+c)-(a+b)+c$ for $a=5$, $b=-2$ and $c=3$, is 0.

	(*i*)	(*ii*)	(*iii*)
(*a*)	F	T	F
(*b*)	T	F	F
(*c*)	T	F	T
(*d*)	F	F	T

4. Which of the following options shows the integers arranged in descending order? **(2023)**

(*a*) –43, –37, –12, 0, 6, 18

(*b*) –43, –12, –37, 0, 6, 18

(*c*) 18, 6, 0, –12, –37, –43

(*d*) 18, 6, 0, –43, –37, –12

5. Ankush got ₹500 on his birthday. On the next day, he got ₹350 as pocket money from his father and spent ₹275 on repairing his cycle. On the next day, his sister gave him ₹170 as a reward. Now, how much total money will be left with him? **(2022)**

(*a*) ₹745 (*b*) ₹650

(*c*) ₹750 (*d*) ₹845

6. The value of (–17) × (–4) × (–1) × (–5) – (–15) × (–3) × 0 × (–13) × (–11) is_____. **(2022)**

(*a*) 340 (*b*) 0

(*c*) –340 (*d*) 760

7. Which of the following number line represents –4 – (–2)? **(2022)**

(*a*)

(*b*)

(*c*)

(*d*)

8. In a quiz, team A scored 45, – 50 and 75 points in three successive rounds where as eam B scored –45, 50 and 25 points. Which team scored more and by how many points? **(2022)**

(*a*) Team A, 30 points

(*b*) Team B, 40 points

(*c*) Team B, 20 points

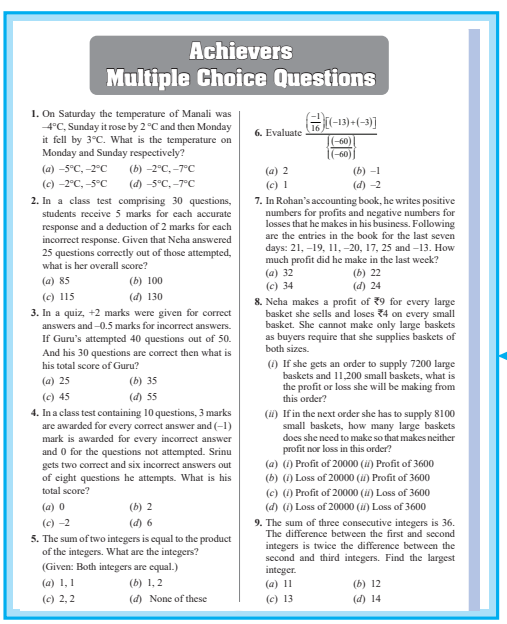
(*d*) Team A, 40 points

9. Read the given statements carefully and state 'T' for true and 'F' for false. **(2022)**

(*i*) All integers are whole numbers.

(*ii*) The product of two integers is 140. If one of them is –35, then the other integer is –4.

Achievers Multiple Choice Questions



Achievers Multiple Choice Questions

1. On Saturday the temperature of Manali was –4°C, Sunday it rose by 2 °C and then Monday it fell by 3°C. What is the temperature on Monday and Sunday respectively?

(*a*) –5°C, –2°C (*b*) –2°C, –7°C

(*c*) –2°C, –5°C (*d*) –5°C, –7°C

2. In a class test comprising 30 questions, students receive 5 marks for each accurate response and a deduction of 2 marks for each incorrect response. Given that Neha answered 25 questions correctly out of those attempted, what is her overall score?

(*a*) 85 (*b*) 100

(*c*) 115 (*d*) 130

3. In a quiz, +2 marks were given for correct answers and –0.5 marks for incorrect answers. If Guru's attempted 40 questions out of 50. And his 30 questions are correct then what is his total score of Guru?

(*a*) 25 (*b*) 35

(*c*) 45 (*d*) 55

4. In a class test containing 10 questions, 3 marks are awarded for every correct answer and (–1) mark is awarded for every incorrect answer and 0 for the questions not attempted. Srinu gets two correct and six incorrect answers out of eight questions he attempts. What is his total score?

(*a*) 0 (*b*) 2

(*c*) –2 (*d*) 6

5. The sum of two integers is equal to the product of the integers. What are the integers? (Given: Both integers are equal.)

(*a*) 1, 1 (*b*) 1, 2

(*c*) 2, 2 (*d*) None of these

6. Evaluate $\frac{\left(\frac{-1}{16}\right)[(-13)+(-3)]}{[(-60)]+[(-60)]}$

(*a*) 2 (*b*) –1

(*c*) 1 (*d*) –2

7. In Rohan's accounting book, he writes positive numbers for profits and negative numbers for losses that he makes in his business. Following are the entries in the book for the last seven days: 21, –19, 11, –20, 17, 25 and –13. How much profit did he make in the last week?

(*a*) 32 (*b*) 22

(*c*) 34 (*d*) 24

8. Neha makes a profit of ₹9 for every large basket she sells and loses ₹4 on every small basket. She cannot make only large baskets as buyers require that she supplies baskets of both sizes.

(*i*) If she gets an order to supply 7200 large baskets and 11,200 small baskets, what is the profit or loss she will be making from this order?

(*ii*) If in the next order she has to supply 8100 small baskets, how many large baskets does she need to make so that makes neither profit nor loss in this order?

(*a*) (*i*) Profit of 20000 (*ii*) Profit of 3600

(*b*) (*i*) Loss of 20000 (*ii*) Profit of 3600

(*c*) (*i*) Profit of 20000 (*ii*) Loss of 3600

(*d*) (*i*) Loss of 20000 (*ii*) Loss of 3600

9. The sum of three consecutive integers is 36. The difference between the first and second integers is twice the difference between the second and third integers. Find the largest integer.

(*a*) 11 (*b*) 12

(*c*) 13 (*d*) 14

Achievers Multiple Choice Questions

In this section, you'll get multiple-choice questions (MCQs) to strengthen your preparation. These questions help you practice in a way that is useful for exams.

CONTENTS

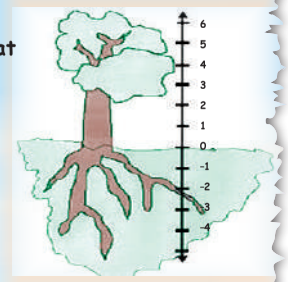
Integers

Integers

Integers are a set of numbers that include all whole numbers (positive and negative) and zero. They do not have fractional or decimal parts. It is denoted by z.

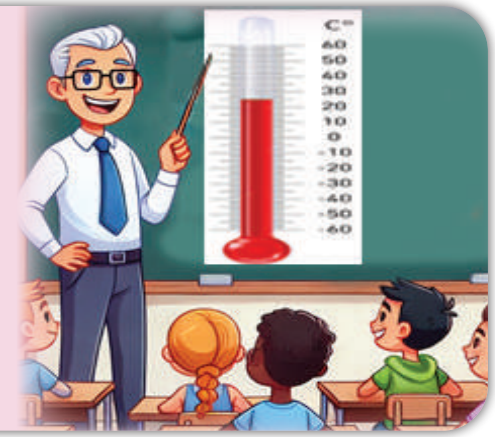
Examples of integers are:

…, -3, -2, -1, 0, 1, 2, 3….

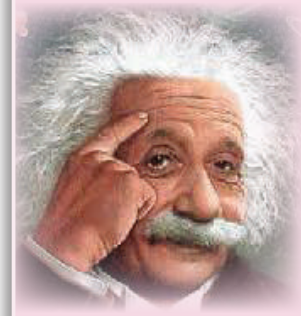


Types of Integers

- **Positive integers:** Positive integers are numbers greater than zero (e.g., 1, 2, 3, …).
- **Negative integers:** Negative integers are numbers less than zero (e.g., …, -3, -2, -1).
- **Zero (0):** Zero is a special integer that is neither positive nor negative.



BODMAS Rule



The BODMAS rule helps in solving mathematical expressions correctly by following a specific order of operations.

BODMAS Stands For:

B → Brackets, O → Of, D → Division, M → Multiplication, A → Addition, S → Subtraction

Types of Brackets:

Brackets should be solved in the following order:

Vinculum or Bar (_ or fraction bar), Round Brackets → ( ), Curly Brackets → { }, Square Brackets → [ ]

Integers

Operations on Integers

Addition: (a + b = c),, where (a) and (b) are integers, and (c) is their sum.

Subtraction: (a – b = c), where (a) and (b) are integers, and (c) is their difference.

Multiplication: (a.b = c), where (a) and (b) are integers, and (c) is their product.

Division: (a/b = c), where (a) and (b) are integers, and (c) is their quotient.

Key Rules

Multiplication Type	Result Sign
(+) × (+)	+
(–) × (–)	+
(+) × (–) or (–) × (+)	–

Key Rules

Division Type	Result Sign
(+) ÷ (+)	+
(–) ÷ (–)	+
(+) ÷ (–) or (–) ÷ (+)	–

Comparing Integers

- If a > b then a – b is positive.
- If a < b then a – b is negative.
- If a = b, then a – b = 0.

Properties of Integers

	Operations			
Property	Addition	Subtraction	Multiplication	Division
Closure	$A + B \in Z$	$A - B \in Z$	$A \times B \in Z$	$A \div B \notin Z$
Commutative	$A + B = B + A$	$A - B \neq B - A$	$A \times B = B \times A$	$A \div B \neq B \div A$
Associative	$A + (B + C) = (A + B) + C$	$A - (B - C) \neq (A - B) - C$	$A \times (B \times C) = (A \times B) \times C$	$A \div (B \div C) \neq (A \div B) \div C$
Distributive	Not Applicable	Not Applicable	$A \times (B \pm C) = A \times B \pm A \times C$	Not Applicable
Identity	$A + 0 = 0 + A$	Not Applicable	$1 \times A = A \times 1 = A$	Not Applicable
Inverse	$A + (-A) = (-A) + A = 0$	Not Applicable	$A \times (1/A) = (1/A) \times A = A$	Not Applicable

CHAPTER-1

Integers

OLYMP-PICKS

Introduction

Integers are whole numbers that can be either positive, negative, or zero. We use integers in everyday life when we talk about things like temperature or altitude. In this chapter, you will learn how to add, subtract, multiply, and divide integers, as well as how to represent them on a number line.

Integers

Integers are a set of numbers that include all positive whole numbers (1, 2, 3, ...), negative whole numbers (... –3, –2, –1) and zero (0). It is denoted by Z

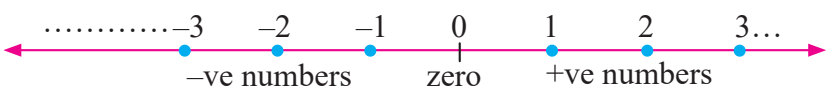
$Z = \{... -3, -2, -1, 0, 1, 2, 3, ...\}$

- Positive integers are numbers greater than zero e.g., (1, 2, 3, ...).
- Negative integers are numbers less than zero e.g., (... – 3, –2, –1).
- Zero (0) is a special integer that is neither positive nor negative.

Integers do not include fractions or decimals. They form an essential part of arithmetic and algebra.

Understanding the Number Line of Integers

- Integers are arranged on a number line with zero (0) at the center.
- Positive integers (1, 2, 3, ...) are always on the right side of zero.
- Negative integers (... –3, –2, –1) are always on the left side of zero.
- As we move right, the numbers increase (ascending order).
- As we move left, the numbers decrease (descending order).
- Zero is neither positive nor negative, but it acts as the dividing point between positive and negative numbers.

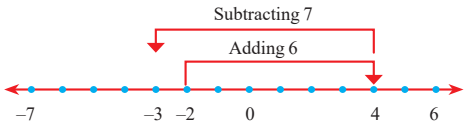


Solved Example

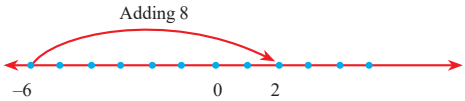
1. Draw a number line and represent each of the following:

$(a) -2 + 6 + (-7)$ $(b) -6 + 8$

Sol. $(a) -2 + 6 + (-7) = -3$



$(b) -6 + 8 = 2$



TEST YOURSELF

1. Draw a number line and represent each of the following on it:

$(i) -2 + 8 + (-9)$ $(ii) -2 + (-3) + (-5)$

2. What value of x on number line which makes the following statement true?

$(-20) + x = (-35) + (-5)$

Key Properties of Integers on a Number Line

1. No Largest or Smallest Integer

- The set of integers is infinite in both directions.
- There is no largest integer because we can always find a greater number by adding 1.
- There is no smallest integer because we can always find a smaller number by subtracting 1.

2. Comparison of Integers

- Any integer is greater than all the integers to its left on the number line.
- Any integer is less than all the integers to its right on the number line.

3. Spacing Between Integers

- No number exists between two consecutive integers. For example, there is no integer between 2 and 3 or between –1 and 0.
- At least one integer exists between two non-consecutive integers. For example, between 1 and 4, the integers 2 and 3 exist.

Absolute Value of an Integer

The absolute value of an integer is its numerical value without considering its sign. It is represented by $|x|$, where x is any integer. The absolute value always results in a non-negative number.

Solved Example

2. $|5| = 5$ (Absolute value of positive 5 is 5.)

3. $|-2| = 2$ (Absolute value of negative 2 is 2.)

4. $|0| = 0$ (Absolute value of zero is zero.)

Key Concept:

- The absolute value represents the distance of a number from zero on the number line, regardless of direction.
- Distance cannot be negative, so the absolute value is always positive or zero.

Addition and Subtraction of Integers Using a Number Line

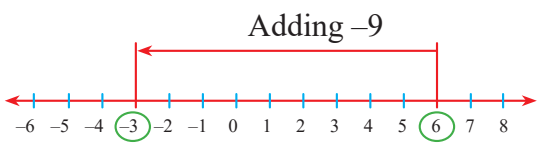
A number line is a visual tool that helps in understanding the addition and subtraction of integers by moving left or right.

Addition of Integers

1. To add a positive integer (+) → Move right on the number line.
2. To add a negative integer (–) → Move left on the number line.
3. The final position represents the sum of the two integers.

Example: 6 + (− 9)

- Start at 6.
- Move 9 steps left (since 9 is negative).
- The result is –3.



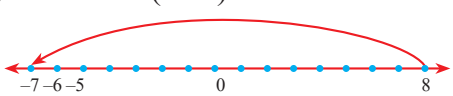
Solved Example

5. Draw a number line and answer the following:

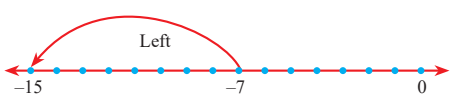
(*a*) Which number will we reach if we move 15 steps to the left of 8? Write this number with appropriate sign.

(*b*) If we are at –7 on a number line, in which direction should we move to reach –15 and how many steps?

Sol. (*a*) 8 + (– 15) = – 7



(*b*) – 15 – (– 7) = – 8



Hence, 8 steps moving in left direction.

TEST YOURSELF

3. Draw a number line and answer the following:

(*i*) Which number will we reach if we move 12 steps to the left of 5? Write this number with appropriate sign.

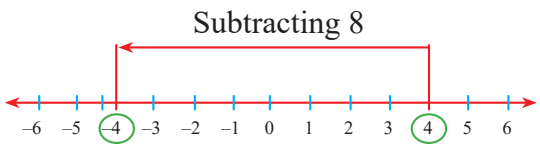
(*ii*) If we are at –4 on a number line, in which direction should we move to reach –12, and how many steps?

Subtraction of Integers

1. Subtracting a positive integer (+) → Move left on the number line.
2. Subtracting a negative integer (–) → Move right on the number line (since subtracting a negative is the same as adding the positive).
3. The final position represents the difference of the two integers.

Example: 4 – 8

- ⇨ Start at 4,
- ⇨ Move 8 steps left.(since subtracting)
- ⇨ Result: 4 – 8 = –4



Key Concept:

- ❑ Subtracting a negative integer is the same as adding its positive counterpart.
- ❑ Example: 6 – (– 2) = 6 + 2 = 8.

Solved Example

6. The sum of two integers is –11. If one of them is 9. Find the other.

Sol. Let the other integer be a. Then

$9 + a = -11 \Rightarrow a = (-11) - 9 = -11 - 9 = -20$.

Hence, the other integer is –20.

TEST YOURSELF

4. Fill in the blanks

(*i*) (– 85) + 12 = ... + (–85)

(*ii*) 6 – (– 4) = ...+ (– 4) – 6

(*iii*) [14 + ...] + 2 = ... + [(– 7) + 2]

(*iv*) 26 + ... = 0

(*v*) 0 – (– 35) = ...

5. Evaluate

(*i*) 15 + (–8)

(*ii*) (–16) + 9

(*iii*) (–7) + (–23)

(*iv*) (–32) + 47

(*v*) 53 + (–26)

(*vi*) (–48) + (–36)

Properties of Addition and Subtraction of Integers

Properties of Addition

Closure Property: The sum of any two integers is always an integer.
e.g., 5 + (– 3) = 2 (which is also an integer).

Commutative Property: The order of addition does not change the sum. i.e., $x + y = y + x$.
e.g. (– 4) + 7 = 7 + (– 4)

Associative Property: The way numbers are grouped does not change the sum. i.e., $x + (y + z) = (x + y) + z$ e.g., $(-2) + (3 + 5) = ((-2) + 3) + 5$

Additive Identity: Adding of zero to any integer does not change its value, so 0 is additive identity. i.e., $x + 0 = x$. e.g., $(-6) + 0 = -6$

Additive Inverse: The additive inverse of any integer is 'a' is '$-a$' i.e., $a + (-a) = (-a) + a = 0$

Solved Example

7. If $a = -8$, $b = -7$, $c = 6$. Verify that $(a + b) + c = a + (b + c)$

Sol. $a + b = -8 + (-7) = -8 - 7 = -15$

$(a + b) + c = -15 + (6) = -9$ ...(*i*)

$b + c = -7 + (6) = -1$

$a + (b + c) = -8 + (-1) = -9$ ...(*ii*)

from (*i*) and (*ii*)

$(a + b) + c = a + (b + c)$

TEST YOURSELF

6. Given the integers p = –6, q = 9 and r = –2, solve the following:

(*i*) Verify the associative property of addition by computing both $(p + q) + r$ and $p + (q + r)$.

(*ii*) Demonstrate the commutative property of addition by showing $p + q = q + p$.

Properties of Subtraction

Closure Property: The difference of any two integers is always an integer. i.e., If x and y are integers, then $x - y$ is also an integer.

Commutative Property: Subtraction is not commutative, meaning changing the order changes the result. i.e., $x - y \neq y - x$

Associative Property: Subtraction is not associative, meaning changing the grouping of numbers changes the result. i.e., $x - (y - z) \neq (x - y) - z$.

e.g., $10 - (5 - 2) = 10 - 3 = 7$ and $(10 - 5) - 2 = 5 - 2 = 3$. Since $7 \neq 3$, subtraction is not associative.

Subtractive Identity: Subtracting zero to any integer does not change its value. i.e., $x - 0 = x$, but $0 - x \neq x$.

e.g, $9 - 0 = 9$ and $0 - 9 = -9$ (which is NOT equal to 9)

Solved Example

8. On a particular day, the temperature of Delhi at 10 a.m. was 13°C, but by midnight, it fell to 6°C. The temperature of Chennai at 10 a.m. the same day was 18°C but fell to 10°C by midnight. Which temperature drop is greater?

Sol. We have, fall in Delhi's temperature = 13°C – 6°C = 7°C

Also, fall in Chennai's temperature = 18°C – 10°C = 8°C

So, 8°C > 7°C

Hence, the fall in temperature of Chennai is greater.

Dividing Integers with the Same Sign: When dividing two positive integers or two negative integers, divide their absolute values and assign a positive sign to the quotient. i.e., $x \div y = x \div y$ or $(-x) \div (-y) = x \div y$

e.g., $16 \div 4 = 4$ or $(-18) \div (-6) = 3$

Key Rules for Division of Integers

Division Type	Result Sign	Example
$(+) \div (+)$	+	$12 \div 4 = 3$
$(-) \div (-)$	+	$(-16) \div (-4) = 4$
$(+) \div (-)$ or $(-) \div (+)$	–	$20 \div (-5) = -4$ or $(-20) \div 5 = -4$

Solved Example

11. Evaluate:

(*i*) $98 \div 14$

(*ii*) $(-48) \div (-16)$

Sol. (*i*) $98 \div 14 = \frac{98}{14} = 7$

(*ii*) $(-48) \div (-16) = \frac{-48}{-16} = 3$

TEST YOURSELF

10. Evaluate

(*i*) $(-133) \div 19$

(*ii*) $168 \div (-14)$

Properties of Division of Integers

Closure Property: The result of dividing two integers may or may not be an integer.

e.g., $10 \div 2 = 5$ (integer) and $7 \div 2 = 3.5$ (not an integer)

Since division does not always result in an integer, it does not satisfy the closure property.

Commutative Property: Changing the order of division changes the result. i.e., $x \div y \neq y \div x$

e.g., $12 \div 4 = 3$ and $4 \div 12 = 1/3$ (not the same as 3)

Hence, division is not commutative.

Associative Property: Changing the grouping of numbers changes the result. i.e., $x \div (y \div z) \neq (x \div y) \div z$

e.g., $20 \div (10 \div 2) = 20 \div 5 = 4$ and $(20 \div 10) \div 2 = 2 \div 2 = 1$

Since $4 \neq 1$, division is not associative.

Solved Example

12. Simplify the expression $(-24)/(6)$ and verify your answer.

Sol. Identify the signs:

⇨ Dividend: –24 (negative)

⇨ Divisor: 6 (positive)

⇨ Since the signs are opposite, the quotient will be negative.

Assign the correct sign: $(-24)/6 = -4$

Verification: Multiply the quotient by the divisor to check: $-4 \times 6 = -24$ matches the original dividend).

1 In a basketball skills challenge, players are scored out of 10 for each attempt, but lose 2 points for any rule violation. Below are the scores of two players across three attempts:

Round	I	II	III
Player A	8	–2	6
Player B	7	–2	10

Without calculating the exact total, determine which player scored higher overall.

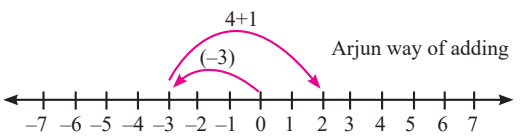
2 Priya tried to show that the subtraction of two integers, –5 and –2, is commutative by writing the following equation:

$-5 - (-2) = -2 - (-5)$

(*i*) Does this equation imply that subtraction of integers is commutative?

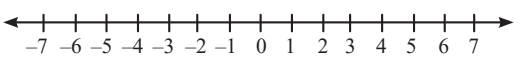
(*ii*) If not, explain why subtraction is not commutative. Provide another example to justify your answer.

3 Arjun and Vikram tried to add three integers –3, 4 and 1 on a number line. Arjun added these in this way [(–3) + (4 + 1)] i.e., added –3 with 4 + 1. Vikram added these in this way, [(–3) + 4] + 1 i.e., first added –3 and 4 and then added 1 to the resultant.



Answer the following questions.

(*i*) Show the same addition as done by Vikram i.e., [(–3) + 4] + 1 on number line.



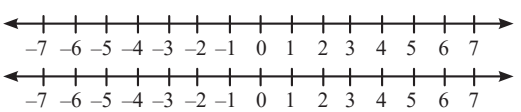
(*ii*) Did Arjun and Vikram reach the same point on the number line i.e., 2?

Yes ☐ No ☐

(*iii*) So can we say that [(–3) + (4 + 1)] = [(–3) + 4] + 1?

Yes ☐ No ☐

(*iv*) Will the same be applicable for addition of any three integers on a number line? If yes, assume any three integers and verify it on the number lines given below.



Yes ☐ No ☐

(*v*) Now, can we say addition of integers is associative?

Yes ☐ No ☐

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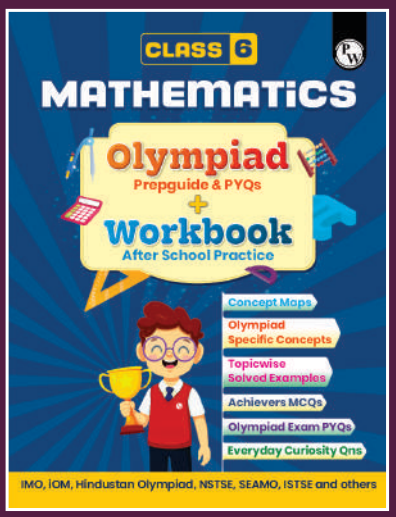

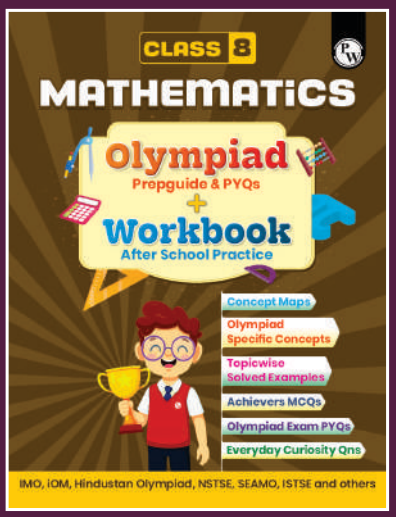

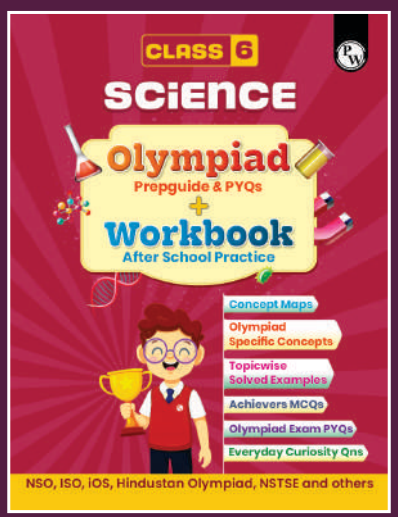

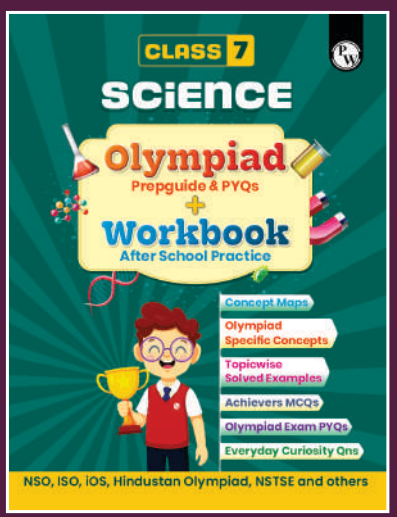

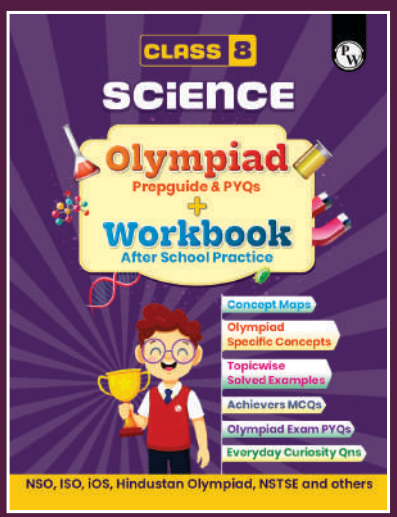

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