Introduction to Numbers

Counting objects and representing them through numerals is a fundamental skill. Historically, humans started with small numbers and gradually developed methods to express larger numbers using symbols. Numbers help us count, compare, and order collections of objects.

Concept Explanation

Numbers are used to count concrete objects and to arrange them in order, such as first, second, etc. Understanding numbers and their properties is essential for mathematical progress.

Worked Illustration

Consider the numbers 92, 392, 4456, and 89742. The greatest among these is 89742 because it has the highest number of digits and the largest value.

Practice Set

- Find the greatest and smallest numbers in the following sets:
  - 382, 4972, 18, 59785, 750
  - 1473, 89423, 100, 5000, 310

- 1834, 75284, 111, 2333, 450
- 2853, 7691, 9999, 12002, 124

Answer Key

- Greatest: 59785, Smallest: 18
- Greatest: 89423, Smallest: 100
- Greatest: 75284, Smallest: 111
- Greatest: 12002, Smallest: 124

Quick Reference

The number with more digits is always greater. If digits are equal, compare from left to right.

Glossary

- **Numeral:** Symbol or group of symbols used to represent a number.
- **Digit:** Single numerical symbol (0-9).
- **Greatest Number:** The number with the highest value in a set.

Comparing Numbers

To compare two numbers, first compare the number of digits. The number with more digits is greater. If the number of digits is the same, compare digits from left to right.

Concept Explanation

For example, to compare 4875 and 3542, both have 4 digits. Compare the thousands place: 4 > 3, so 4875 > 3542. If thousands place digits are equal, compare hundreds place, and so on.

Worked Illustration

Compare 4875 and 4542:

- Thousands place: 4 = 4
- Hundreds place: 8 > 5
- Therefore, 4875 > 4542

Practice Set

- Find the greatest and smallest numbers:
  - 4536, 4892, 4370, 4452
  - 15623, 15073, 15189, 15800
  - 25286, 25245, 25270, 25210
  - 6895, 23787, 24569, 24659

Answer Key

- Greatest: 4892, Smallest: 4370
- Greatest: 15800, Smallest: 15073
- Greatest: 25286, Smallest: 25210
- Greatest: 24659, Smallest: 6895

Quick Reference

Compare digits from left to right when numbers have equal digits.

Glossary

- **Place Value:** The value of a digit depending on its position in a number.
- **Thousands Place:** The fourth digit from the right in a number.

Forming Numbers from Digits

Using given digits without repetition, we can form different numbers. The greatest number is formed by arranging digits in descending order, and the smallest by arranging in ascending order, ensuring the leftmost digit is not zero.

Concept Explanation

For digits 7, 8, 3, 5, the greatest 4-digit number without repetition is 8753, and the smallest is 3578.

Worked Illustration

Arrange digits 2, 8, 7, 4:

- Greatest number: 8764
- Smallest number: 2478

Practice Set

- Make greatest and smallest 4-digit numbers using digits:
  - 9, 7, 4, 1
  - 4, 7, 5, 0 (Note: 0 cannot be the first digit)
  - 1, 7, 6, 2
  - 5, 4, 0, 3
- Make greatest and smallest 4-digit numbers using any one digit twice:
  - 3, 8, 7
  - 9, 0, 5
  - 0, 4, 9
  - 8, 5, 1

Answer Key

- Greatest and smallest numbers vary based on digit arrangement and repetition rules.

Quick Reference

Digits arranged in descending order form the greatest number; ascending order forms the smallest, with the first digit non-zero.

Glossary

- **Repetition:** Using the same digit more than once in a number.
- **Digit Arrangement:** Ordering digits to form numbers.

Place Value and Expanded Form

Each digit in a number has a place value depending on its position. Numbers can be expanded as sums of digits multiplied by their place values.

Concept Explanation

For example, 5278 can be expanded as:

$$5278 = 5 \times 1000 + 2 \times 100 + 7 \times 10 + 8 \times 1$$

Worked Illustration

Expand 45278:

$$45278 = 4 \times 10000 + 5 \times 1000 + 2 \times 100 + 7 \times 10 + 8 \times 1$$

Practice Set

- Read and expand the following numbers:
  - 50000
  - 41000
  - 47300
  - 57630
  - 29485
  - 29085
  - 20085
  - 20005

Answer Key

- Example: 50000 = 5 × 10000
- Example: 29485 = 2 × 10000 + 9 × 1000 + 4 × 100 + 8 × 10 + 5 × 1

Quick Reference

Place values increase by powers of 10 from right to left: ones, tens, hundreds, thousands, ten thousands, etc.

Glossary

- **Expanded Form:** Writing a number as the sum of each digit multiplied by its place value.
- **Place Value:** The value of a digit based on its position.

Large Numbers and Numeration Systems

Numbers beyond thousands are expressed using lakhs and crores in the Indian system, and millions and billions in the International system. Commas are used to separate place values for easier reading.

Concept Explanation

For example, 1,00,000 is one lakh, and 1,00,00,000 is one crore in the Indian system.

Worked Illustration

Number: 2,57,34,543

Expanded form:

$$2 \times 10000000 + 5 \times 1000000 + 7 \times 100000 + 3 \times 10000 + 4 \times 1000 + 5 \times 100 + 4 \times 10 + 3 \times 1$$

Practice Set

- Write the number names and expanded forms for:
  - 3,00,000
  - 3,50,000
  - 3,53,500
  - 4,57,928
  - 4,07,928
  - 4,00,829
  - 4,00,029

Answer Key

- 3,00,000: Three lakh = 3×100000
- 3,50,000: Three lakh fifty thousand = $3 \times 100000 + 5 \times 10000$
- 4,57,928: Four lakh fifty seven thousand nine hundred twenty eight = $4 \times 100000 + 5 \times 10000 + 7 \times 1000 + 9 \times 100 + 2 \times 10 + 8$

Quick Reference

Indian system uses commas after 3 digits from right, then every 2 digits; International system uses commas every 3 digits.

Glossary

- **Lakh:** 100,000
- **Crore:** 10,000,000
- **Comma:** Punctuation mark used to separate digits in large numbers.

Measurement Units and Large Numbers in Practice

Units of length, weight, and capacity vary in scale. For small measurements, millimetres and milligrams are used; for large measurements, kilometres and kilograms are used.

Concept Explanation

- 10 millimetres = 1 centimetre
- 1 metre = 100 centimetres = 1000 millimetres
- 1 kilometre = 1000 metres = 1,000,000 millimetres
- 1 kilogram = 1000 grams
- 1 gram = 1000 milligrams
- 1 litre = 1000 millilitres

Worked Illustration

Calculate how many millimetres make 1 kilometre:

$$1\ \text{km} = 1000\ \text{m} = 1000 \times 1000\ \text{mm} = 1,000,000\ \text{mm}$$

Practice Set

- How many milligrams make one kilogram?
- A box contains 200,000 tablets each weighing 20 mg. Find total weight in grams and kilograms.

Answer Key

- 1 kilogram = 1,000,000 milligrams
- Total weight = 200,000 × 20 mg = 4,000,000 mg = 4000 g = 4 kg

Quick Reference

Kilo means 1000 times greater; milli means 1000 times smaller; centi means 100 times smaller.

Glossary

- **Kilo:** Prefix meaning 1000 times greater.

- **Milli:** Prefix meaning 1000 times smaller.
- **Centi:** Prefix meaning 100 times smaller.

Application of Large Numbers in Real Life

Large numbers are used in measuring distances, populations, and quantities in daily life.

Worked Illustration

Bus route distances (in km):

- A to B: 4170
- B to C: 3410
- C to D: 2160
- D to E: 8140
- E to F: 4830
- F to G: 2550
- G to A: 1290

Total distance covered in the loop:

$$4170 + 3410 + 2160 + 8140 + 4830 + 2550 + 1290 = 26550 \text{ km}$$

Practice Set

- Calculate total distance from A to D.
- Calculate total distance from D to G.
- Calculate total distance for the entire loop.
- Find difference between distances C to D and D to E.
- Calculate time taken for various segments at 60 km/h.

Answer Key

- A to D: 4170 + 3410 + 2160 = 9740 km
- D to G: 8140 + 4830 + 2550 = 15520 km
- Total loop: 26550 km
- Difference C-D and D-E: 8140 - 2160 = 5980 km
- Time = Distance / Speed; e.g., A to B: 4170 / 60 = 69.5 hours

Quick Reference

Distance and time calculations use the formula: $\text{Time} = \frac{\text{Distance}}{\text{Speed}}$.

Glossary

- **Distance:** The length between two points.
- **Speed:** The rate of movement.
- **Time:** Duration taken to cover a distance.

Practical Problems with Large Numbers

Solving real-life problems involving large numbers using addition, subtraction, multiplication, and division.

Worked Examples

Example 1: Population of Sundarnagar in 1991 was 235,471. It increased by 72,958 by 2001. Find the population in 2001.

Solution:

$$\text{Population in } 2001 = 235471 + 72958 = 308429$$

Example 2: Bicycles sold in 2002-03: 743,000; in 2003-04: 800,100. Find which year had more sales and by how many.

Solution:

$$800100 - 743000 = 57100$$

More bicycles sold in 2003-04 by 57,100.

Example 3: Newspaper has 12 pages per copy; 11,980 copies printed daily. Find total pages printed daily.

Solution:

$$12 \times 11980 = 143760$$

Example 4: 75,000 sheets of paper; each sheet makes 8 pages; each notebook has 200 pages. Find number of notebooks made.

Solution:

$$\text{Total pages} = 75000 \times 8 = 600000$$

$$\text{Notebooks} = \frac{600000}{200} = 3000$$

Practice Set

- Calculate total sales money for Raman's shop items given quantities and prices.
- Arrange prices in ascending and descending order.
- Make similar problems involving large number operations.

Answer Key

- Refer to worked examples for methods.

Quick Reference

Use addition, subtraction, multiplication, and division carefully with large numbers, breaking them into place values if needed.

Glossary

- **Population:** Number of people in a place.
- **Notebook:** Collection of pages bound together.
- **Sheet:** Single piece of paper.