

CLASS 8 · HOTS · OLYMPIAD PREPARATION · SHORT NOTES

Chapter 2: HOTS: A Story of Numbers (Class 8)

Topic-wise short notes with solved examples

Higher order thinking questions on number systems for Class 8: place value and zero, other bases, grouping and landmark numbers and the Indian number system, each with a full solution.

1 Solved HOTS questions

- In the decimal (base 10) system each place is worth 10 times the place to its right. In base b the places are worth $1, b, b^2, b^3, \dots$. Writing a number in a new base is repeated division by the base, reading the remainders from the last to the first.

Example 1.1 Write 1000 in base 5.

SOLUTION

$1000 \div 5 = 200$ remainder 0; $200 \div 5 = 40$ remainder 0; $40 \div 5 = 8$ remainder 0; $8 \div 5 = 1$ remainder 3; $1 \div 5 = 0$ remainder 1.

Reading the remainders from the last to the first: 1 3 0 0 0.

13000₅

Example 1.2 Find the value of 2314_5 in base 10.

SOLUTION

$2 \times 5^3 + 3 \times 5^2 + 1 \times 5 + 4 = 250 + 75 + 5 + 4.$

334

Example 1.3 Write the number 40 506 070 in words in the Indian system, and give the place value of the digit 5.

SOLUTION

In the Indian system the digits are grouped as 4,05,06,070 (the last three digits, then groups of two).

So the number is 4 crore, 5 lakh, 6 thousand and 70. The digit 5 is in the lakh place, so its value is 5 lakh = 500 000.

Four crore five lakh six thousand seventy; the digit 5 stands for 500 000

Example 1.4 A number in base 2 is 1011. Write it in base 10 and add 1 to it in base 2.

SOLUTION

$$1 \times 8 + 0 \times 4 + 1 \times 2 + 1 = 11.$$

Adding 1 in base 2: $1011 + 1 = 1100$, which is 12.

11, and 1100_2

Example 1.5 Why is zero important in a place-value system?

SOLUTION

Zero holds an empty place. Without it 105 and 15 could not be told apart, and 100 would look like 1. It also lets a few digits write any number.

Zero marks an empty place, so the position of every digit has a clear meaning