NCERT Solutions For Class 8 Maths

Chapter 3 - A Story of Numbers

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1. Suppose you are using the number system that uses sticks to represent numbers, as in Method 1. Without using either the number names or the numerals of the Hindu number system, give a method for adding, subtracting, multiplying and dividing two numbers or two collections of sticks.

Answer :

Method 1: Addition (Putting Together)

- Take one set of sticks to represent the first number.
- Take another set to represent the second number.
- Combine both sets into a single group.
- The total number of sticks in the group shows the **sum**.

Example:

Group A: |||| (4 sticks)

Group B: ||| (3 sticks)
Total: ||||||| → **7 sticks**

Method 2: Subtraction (Taking Away)

- Begin with the group of sticks representing the **larger quantity**.
- Remove or take away the number of sticks representing the **smaller quantity**.
- The sticks that remain show the **difference**.

Example:
Start with: ||||||| (7 sticks)
Take away: ||| (3 sticks)
Remaining: |||| → **4 sticks**

Method 3: Multiplication (Repeated Addition)

- Create several groups of sticks, each having the **same number** of sticks.
- Count the total number of sticks across all groups.

- The total represents the **product**.

Example:

3 groups of ||| (3 sticks each):

Group 1: |||

Group 2: |||

Group 3: |||

Total: |||||||||| → **9 sticks**

Method 4: Division (Equal Sharing or Grouping)

- Take a total collection of sticks.

- Either:
  • **Share equally** into a fixed number of groups (to find how many in each group), or
  • **Group repeatedly** by a set size (to find how many groups can be made).

Example (Equal Sharing):

Total: |||||| (6 sticks) ÷ 2 → ||| and ||| (3 sticks in each group)

Example (Grouping):

How many groups of || (2 sticks) can be made from |||||| (6 sticks)?

Answer: **3 groups**

In short:

Addition means combining sticks,

Subtraction means taking away,

Multiplication means making equal groups repeatedly,

Division means sharing or grouping equally.

2. One way of extending the number system in Method 2 is by using strings with more than one letter — for example, we could use 'aa' for 27. How can you extend this system to represent all the numbers? There are many ways of doing it!

Answer : Treat the strings like a base-26 place-value system with letters as digits: a=1, b=2, …, z=26. After z, continue as two-letter "digits": aa=27, ab=28, …, az=52, ba=53, …, zz=676, aaa=677, and so on. Other workable ideas exist, but the base-26 place-value approach is systematic and scales to any size.

3. Try making your own number system.

Answer: *Example "ABC Number System" (base-5)*: Use five symbols A,B,C,D,E for 0–4. Positions follow powers of 5 (ones, fives, twenty-fives, …). Example: BD means 1×5 + 3 = 8. This shows how place value lets us write any whole number with just five symbols.

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1. Represent the following numbers in the Roman system. (i) 1222 (ii) 2999 (iii) 302 (iv) 715

Answer :

(i) 1222 → **MCCXXII** (1000 + 200 + 20 + 2)

(ii) 2999 → **MMCMXCIX** (2000 + 900 + 90 + 9)

(iii) 302 → **CCCII** (300 + 2)

(iv) 715 → **DCCXV** (700 + 10 + 5)

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1. A group of indigenous people in a Pacific island use different sequences of number names to count different objects. Why do you think they do this?

Answer: Because counting is tied to culture and use. Different objects (like fish, coconuts, people, days) may be grouped or valued differently, so special number words help classify, remember, or count in pairs/sets. Using separate sequences keeps meaning clear in daily life.

2. Consider the extension of the Gumulgal number system beyond 6 in the same way of counting by 2s. Come up with ways of performing the different arithmetic operations (+, −, ×, ÷) for numbers occurring in this system, without using Hindu numerals. Use this to evaluate the following:

(i)(ukasar-ukasar-ukasar-ukasar-urapon)+(ukasar-ukasar-ukasar-urapon)

(ii) (ukasar-ukasar-ukasar-ukasar-urapon) – (ukasar-ukasar-ukasar)
(iii) (ukasar-ukasar-ukasar-ukasar-urapon) × (ukasar-ukasar)
(iv)(ukasar-ukasar-ukasar-ukasar-ukasar-ukasar-ukasar-ukasar) ÷ (ukasar-ukasar)

Answer: In Gumulgal, ukasar = 2 and urapon = 1. Add by joining 2s and 1s; subtract by removing; multiply by repeated joining; divide by making equal groups of ukasar.

(i) (2+2+2+2+1) + (2+2+2+1) = 9 + 7 = 16 → eight ukasar (i.e., *ukasar* repeated 8 times).
(ii) 9 - 6 = 3 → *ukasar-urapon* (2 + 1).
(iii) 9 × 4 = 36 → 18 copies of ukasar (since 36 is 18 twos).
(iv) 16 ÷ 4 = 4 → *ukasar-ukasar* (two twos).

3. Identify the features of the Hindu number system that make it efficient when compared to the Roman number system.

Answer: Place value, the use of zero, and just 10 symbols (0–9) allow compact writing and easy calculation. Large numbers stay short and operations like +, -, ×, ÷ follow simple rules—unlike Roman numerals, which are longer and harder to compute with.

4. Using the ideas discussed in this section, try refining the number system you might have made earlier.

Answer: Upgrade the system to a clear place-value base (e.g., base-5 with symbols A=0,...,E=4), make each position a power of the base, and

include a zero symbol. This keeps numbers short, readable, and easy to calculate—similar to the Hindu system.

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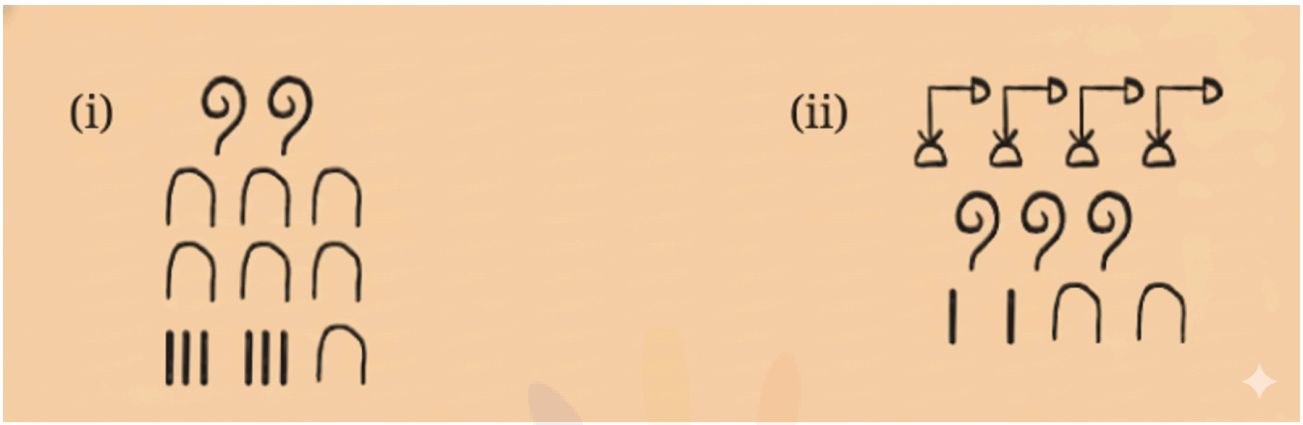
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1. Represent the following numbers in the Egyptian system: 10458, 1023, 2660, 784, 1111, 70707.

Answer :



2. What numbers do these numerals stand for?



Answer

(i) 100 + 100 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 1 + 1 + 1 + 1 + 1 + 1

= 200 + 70 + 6

= 276

(ii) 1000 + 1000 + 1000 + 1000 + 100 + 100 + 100 + 10 + 10 + 1 + 1

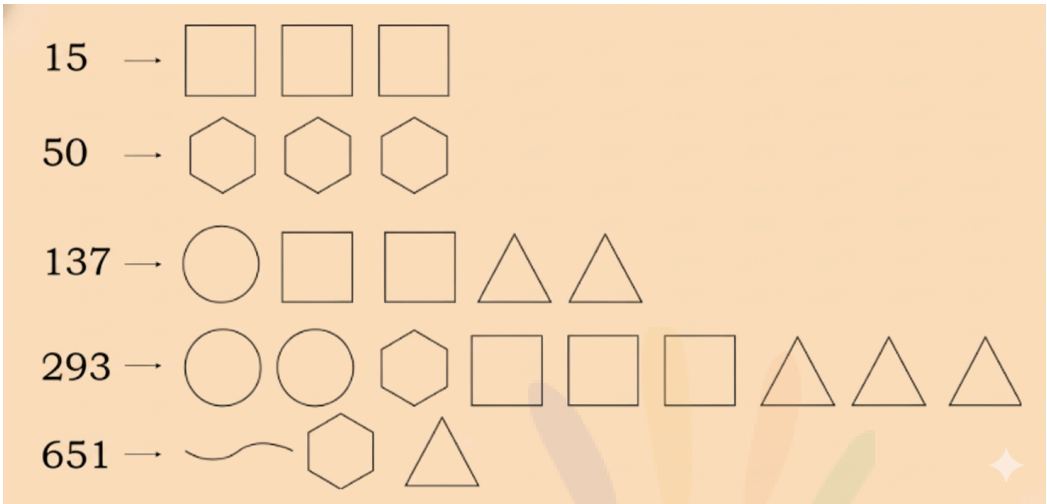
= 4000 + 300 + 20 + 2

= 4322

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1. Write the following numbers in the above base-5 system using the symbols in Table 2: 15, 50, 137, 293, 651.

Answer :



2. Is there a number that cannot be represented in our base-5 system above? Why or why not?

Answer :

No, every number can be represented in the base-5 system.

This is because:

- The base-5 system uses five symbols (A, B, C, D, E) that represent the digits 0 to 4.
- Any number can be expressed as a combination of these digits multiplied by powers of 5 (1, 5, 25, 125, and so on).
- Since there is no limit to how many digits we can use, all whole numbers can be written in base-5.

3. Compute the landmark numbers of a base-7 system. In general, what are the landmark numbers of a base-n system?

Answer:

The landmark numbers in a base-7 system are the powers of 7:

$7^0 = 1$

$7^1 = 7$

$7^2 = 49$

$7^3 = 343$

$7^4 = 2401$

$7^5 = 16807$

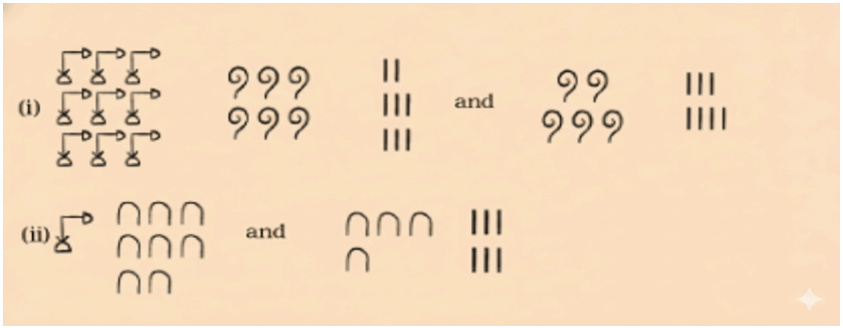
...and so on.

In general, for a base-n number system, the landmark numbers are all powers of n — that is, n^0, n^1, n^2, n^3, and so forth. Each power represents a new place value in that number system.

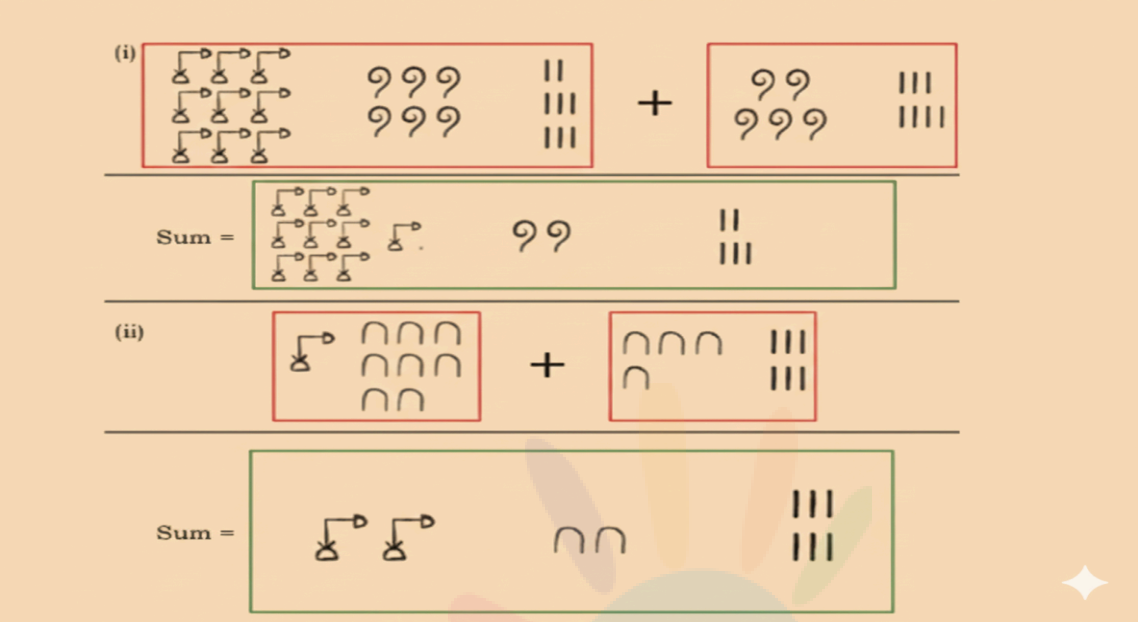
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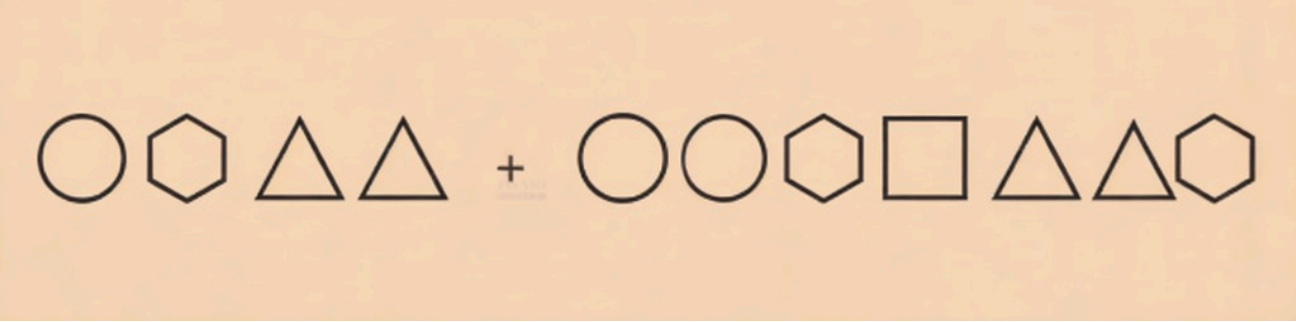
1. Add the following Egyptian numerals:



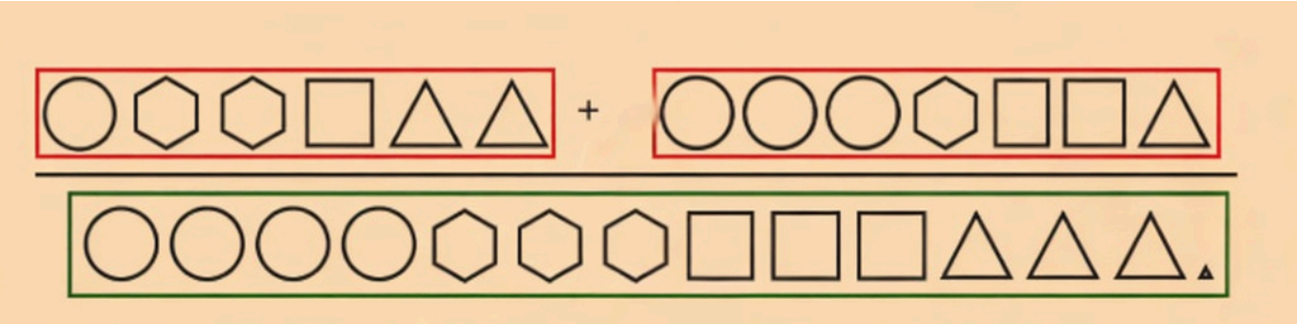
Answer:



2. Add the following numerals that are in the base-5 system that we created:



Answer:



1. Can there be a number whose representation in Egyptian numerals has one of the symbols occurring 10 or more times? Why not?

Answer: No. The Egyptian system is additive and replaces ten of any symbol by a single symbol of the next higher value. So a symbol never needs to appear 10 or more times in a correct final writing.

2. Create your own number system of base 4 and represent numbers from 1 to 16.

Answer: *Sample "Quad-Code" (base-4)*: A=0, B=1, C=2, D=3. Numbers 1→16: B, C, D, BA, BB, BC, BD, CA, CB, CC, CD, DA, DB, DC, DD, ABA. (Positions are powers of 4: 1, 4, 16, …)

3. Give a simple rule to multiply a given number by 5 in the base-5 system that we created.

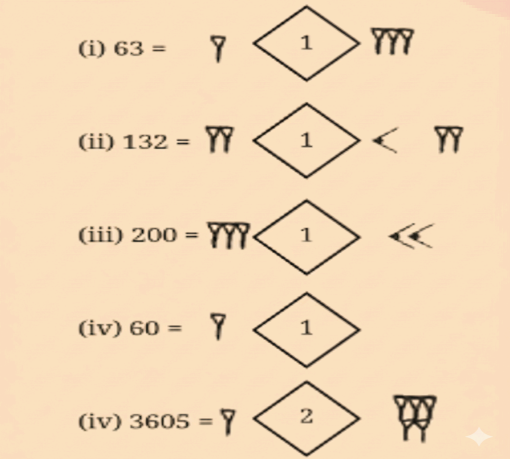
Answer : Just append an **A** (zero) at the right end. In base-5 this shifts the number one place left, which multiplies it by 5. *Example*: BC (7) → BCA (7×5 = 35).

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1. Represent the following numbers in the Mesopotamian system — (i) 63 (ii) 132 (iii) 200 (iv) 60 (v) 3605

Answer :



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1. Why do you think the Chinese alternated between the Zong and Heng symbols? If only the Zong symbols were to be used, how would 41 be

represented? Could this numeral be interpreted in any other way if there is no significant space between two successive positions?

Answer :

Why the Chinese alternated between Zong and Heng symbols:

- The ancient Chinese numeral system used **Zong (vertical)** and **Heng (horizontal)** strokes to represent digits.

- They **alternated** these two forms for each successive place value (units, tens, hundreds, etc.) so that the reader could easily distinguish one place from another.

- This alternation made it visually clear where one number ended and the next began, especially when numbers were written close together on bamboo slips or narrow surfaces.

If only Zong symbols were used for 41:

- 41 = 4 tens + 1 unit.

- Using only Zong (vertical) symbols:
  → Four Zongs for 4 tens and one Zong for 1 unit: **IIII I**

Problem with this representation:

- Without alternating directions or leaving a visible space, **IIII I** could be mistaken for **five Zongs**, which equals **5**, not **41**.

- Hence, **the alternation of Zong and Heng was crucial** for maintaining clear place value distinction.

In summary:

The Chinese alternated between Zong and Heng symbols to **prevent confusion between different place values**.
Without alternation or spacing, a number like **41** could easily be **misinterpreted as 5**.

2. Form a base-2 place value system using 'ukasar' and 'urapon' as the digits. Compare this system with that of the Gumulgal's.

Answer :
Forming a Base-2 Place Value System using 'ukasar' and 'urapon':
To build a base-2 (binary) system, we assign the values:

- **'ukasar' = 0**

- **'urapon' = 1**

In this system, each position represents a power of 2, starting from the right:

- 1st place → $2^0 = 1$
- 2nd place → $2^1 = 2$
- 3rd place → $2^2 = 4$, and so on.

Examples:

- 1 → **urapon**
- 2 → **urapon ukasar**
- 3 → **urapon urapon**
- 4 → **urapon ukasar ukasar**

Each position tells how many of that power of 2 are used, with **'ukasar'** marking a zero and **'urapon'** marking a one.

Comparison with the Gumulgal System:

The Gumulgal number system is **not a place value system**. It works by **adding groups of 2s and 1s** — for example, to make 7, they might express it as **ukasar-ukasar-ukasar-urapon** (2 + 2 + 2 + 1).

In contrast, the base-2 system using 'ukasar' and 'urapon' is **positional**, meaning the value of each symbol depends on its place.

→ This makes it **more efficient and systematic** for representing larger

numbers, while the Gumulgal additive method is **simpler but limited** to small values.

3. Where in your daily lives and in which professions, do the Hindu numerals and 0, play an important role? How might our lives have been different if our number system and 0 hadn't been invented or conceived of?

Answer : We rely on Hindu numerals and zero for prices, time, phone numbers, banking, science, engineering, computers—almost everything. Without zero and place value, calculations would be slow and clumsy, large numbers hard to write, and modern technology would not have developed as it did.

4. The ancient Indians likely used base 10 for the Hindu number system because humans have 10 fingers and so we can use our fingers to count. But what if we had only 8 fingers? How would we be writing numbers then? What would the Hindu numerals look like if we were using base 8 instead? Base 5? Try writing the base-10 Hindu numeral 25 as base-8 and base-5 Hindu numerals, respectively. Can you write it in base-2?

Answer :

If humans had only 8 fingers:

We would most likely have developed a **base-8 (octal)** number system instead of base-10. In such a system, counting would go from **0 to 7**, and all calculations would be based on **powers of 8**. Our numerals and arithmetic

methods would have evolved accordingly, just as today's Hindu numerals are built around base-10.

Converting the base-10 number 25 into other bases:

► Base-8 (Octal):

25 ÷ 8 = 3 remainder 1

3 ÷ 8 = 0 remainder 3

So, $\mathbf{25}_{10} = \mathbf{31}_{8}$

► Base-5 (Quinary):

25 ÷ 5 = 5 remainder 0

5 ÷ 5 = 1 remainder 0

1 ÷ 5 = 0 remainder 1

So, $\mathbf{25}_{10} = \mathbf{100}_{5}$

► Base-2 (Binary):

25 ÷ 2 = 12 remainder 1

12 ÷ 2 = 6 remainder 0

6 ÷ 2 = 3 remainder 0

3 ÷ 2 = 1 remainder 1

1 ÷ 2 = 0 remainder 1

So, $\mathbf{25}_{10} = \mathbf{11001}_{2}$

Summary:

If we had 8 fingers, our everyday number system would likely use **base 8**, with digits 0–7. For the number 25 (in base 10):

- In **base-8**, it's **31**
- In **base-5**, it's **100**
- In **base-2**, it's **11001**