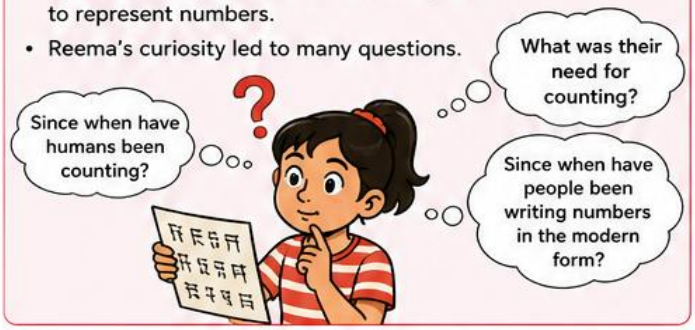
3 A STORY OF NUMBERS

From ancient symbols to modern numbers – a journey through time!

1. REEMA'S CURIOSITY

- Reema found a paper with strange symbols.
- Her father explained that around 4000 years ago, the Mesopotamians used such symbols to represent numbers.
- Reema's curiosity led to many questions.



2. WHY DID HUMANS COUNT?

- Even in the Stone Age, humans needed to count.
- They counted food, animals, goods in trade, offerings in rituals, and the passing of days.
- They wanted to predict events like new moon, full moon, and seasons.
- But their ways of writing numbers were different from what we use today.

3. ORIGIN OF OUR MODERN NUMBER SYSTEM

Origin in India

- Ancient Indian texts like the *Yajurrveda Samhita* used names of numbers based on powers of 10.
- Example: *eka* (1), *dasha* (10), *shata* (100), *sahasra* (1,000), *āyuta* (10,000)... up to 10^{12} and beyond.

Early use of 0 and ten digits

- The first known use of numbers with ten digits (including 0 as a dot) is in the Bakhshali manuscript (c. 3rd century CE).
- Aryabhata (c. 499 CE) explained and used this system in his works.

Spread to the Arab world

- Around 800 CE, the Indian system reached the Arab world.
- Popularised by Al-Khwārizmī in *On the Calculation with Hindu Numerals* (c. 825) and Al-Kindi in *On the Use of the Hindu Numerals* (c. 830).

Reach to Europe and the world

- Reached Europe and parts of Africa by around 1100 CE.
- Fibonacci (c. 1200) encouraged Europe to adopt Indian numerals.
- Widely accepted in Europe by the 17th century.
- Now used in every corner of the world!

Why 'Arabic' or 'Hindu' numerals?

- Europeans called them 'Arabic numerals' as they learned them from the Arab world.
- Arabs called them 'Hindu numerals'.
- Today we use terms like 'Hindu numerals', 'Indian numerals', or 'Hindu-Arabic numerals'.

KEY TAKEAWAY

Our modern number system has its root in India and travelled across the world to become the most efficient way to write and work with numbers.

4. EVOLUTION OF DIGITS (0 TO 9)

Stage/Period	0	1	2	3	4	5	6	7	8	9
Brahmi (c. 3rd century BCE)	•	𑁒	𑁓	𑁔	𑁕	𑁖	𑁗	𑁘	𑁙	𑁚
Hindu (Gwalior) (c. 6th century)	०	१	२	३	४	५	६	७	८	९
Sanskrit–Devanagari (c. 8th–10th century)	०	१	२	३	४	५	६	७	८	९
West Arabic (Gubar) (c. 10th century)	•	١	٢	٣	٤	٥	٦	٧	٨	٩
East Arabic (c. 10th century)	٠	١	٢	٣	٤	٥	٦	٧	٨	٩
11th century (Apices)	٠	١	٢	٣	٤	٥	٦	٧	٨	٩
15th century	o	1	2	3	4	5	6	7	8	9
16th century (Dürer)	0	1	2	3	4	5	6	7	8	9

Over centuries, these shapes evolved into the digits we use today.

5. IMPORTANCE

- The Indian numeral system made calculations simpler and faster.
- It laid the foundation for mathematics, science and technology.
- Its global adoption shows the power of human knowledge and sharing.

6. QUICK FACTS

- Counting began: Stone Age
- Mesopotamian symbols used: Around 4000 years ago
- First use of 0 in Bakhshali manuscript: c. 3rd century CE
- Indian system reached Arabs: Around 800 CE
- Reached Europe: Around 1100 CE (Popularised by Fibonacci c. 1200)
- Widely accepted in Europe: By the 17th century

Numbers tell the story of human thinking, curiosity and innovation across time and civilisations!

STORY OF NUMBERS

WORKSHEET-1

PART –I Section A: MCQs (10 × 1 = 10 marks)

1. Which of the following is the Hindu-Arabic numeral for the Roman numeral 'XLIV'?

(A)44 (B)46 (C)54 (D)64

2. The Egyptian numeral system was based on which number as its base?

(A)12 (B)20 (C)10 (D)60

3. In the Roman numeral system, the symbol 'M' represents:

(A)100 (B)500 (C)1000 (D)5000

4. Which ancient number system used a base-60 (sexagesimal) system?

(A) Egyptian (B) Mayan (C) Roman (D) Mesopotamian

5. The number zero (0) as a placeholder was first formally developed by which civilisation?

(A) Egyptian (B) Roman (C) Indian (Hindu) (D) Mayan

6. In the Roman system, 'IV' means:

(A)4 (B)6 (C)4 (D)1

7. Which of the following number systems is additive (values are simply added)?

(A) Hindu-Arabic (B) Egyptian hieroglyphic

(C) Mayan (D) Mesopotamian cuneiform

8. The Mayan number system was based on which number as its primary base?

(A)10 (B)12 (C)20 (D)60

9. The place value system (positional notation) is a key feature of which number systems?

(A) Roman and Egyptian (B) Hindu-Arabic and Mesopotamian

(C) Roman and Mayan (D) Egyptian and Chinese

10. How is the number 2024 written in Roman numerals?

(A) MMXXIV (B) MMXXVI (C) MCMXXIV (D) MMCDXXIV

MCQs (PART-2) (10 × 1 = 10 marks)

11. In the Mesopotamian system, which two symbols were used to write all numbers?

(A) | and < (B) | and Y (C) O and X (D) | and —

12. Which number system used shells (zero), dots (ones), and bars (fives) as its symbols?

(A) Chinese (B) Egyptian (C) Mayan (D) Roman

13. In the traditional Chinese rod numeral system, numbers are written:

(A) Left to right only (B) Bottom to top only

(C) In vertical columns, top to bottom (D) As hieroglyphs

14. The Egyptian numeral for 1,000 was represented by:

(A) A lotus flower (B) A coiled rope (C) A pointing finger (D) A tadpole

15. In the Mesopotamian base-60 system, how would 70 be written?

(A) As 1 group of 60 + 10 (B) As 7 tens

(C) As 14 fives (D) As 3 groups of 20 + 10

16. Which of the following correctly expresses the Mayan number for 33?

(A) One bar + three dots in the ones place

(B) One dot (top row) + one bar + three dots (bottom row)

(C) Three bars + three dots

(D) One bar + three dots across two rows

17. The Hindu-Arabic numeral system uses how many symbols (digits)?

(A)8 (B)9 (C)10 (D)12

18. What is special about the number system developed in ancient India that changed mathematics worldwide?

(A) It used symbols for only odd numbers

(B) It introduced place value and the digit zero

(C) It was based on 60

(D) It used only addition

19. In the Roman numeral system, which rule applies when a smaller numeral appears BEFORE a larger one?

(A) It is added (B) It is multiplied (C) It is subtracted (D) It is ignored

20. An archaeologist finds a tablet with the symbol 'III IIII' in Babylonian. In our numeral system this represents 3 × 60 + 4 = ?

(A)34 (B)180 (C)184 (D)204

WORKSHEET-1

Section B: Short Answer (10 × 2 = 20 marks)

1. Convert the Roman numeral MCMXCIX into Hindu-Arabic numerals. Show each step.

2. Write the number 487 in Egyptian hieroglyphic notation. Describe each symbol used.

3. In the Mayan number system, represent the number 38. Draw and label each symbol.

4. The Mesopotamians used base-60. Write 125 in Mesopotamian notation (as groups of 60s, 10s, and 1s). What would it look like in cuneiform symbols?

5. Why is the Hindu-Arabic number system considered superior to the Roman numeral system? Give TWO specific reasons.

6. Convert the number MMMDCCXLVIII (Roman) to Hindu-Arabic. Show each symbol's value.

7. The Chinese counting rod system alternates vertical and horizontal rods. Write the number 352 using rod numerals description (vertical for hundreds, horizontal for tens, vertical for ones).

8. An Egyptian scribe writes a number using: one 'finger' (10,000), three 'lotus flowers' (1,000 each), and four 'coiled ropes' (100 each). What is this number?

9. In the Mayan system, what is the place value of the THIRD row (counting from bottom)? What number does one dot in that position represent?

10. State ONE key difference between the Egyptian number system and the Hindu-Arabic number system with a suitable example.

Section C: Short Answer (6 × 3 = 18 marks)

11. Compare the Roman and Egyptian number systems under the following heads:

(a) Base used (b) Presence of zero (c) Use of place value (d) Ease of arithmetic.

Which system do you think was more practical for trade? Give a reason.

12. Ravi has ₹3,749 in his piggy bank. He wants to write this amount in FOUR different ancient number systems.

(a) Roman numerals (b) Egyptian hieroglyphics (describe symbols)

(c) Mayan system (rows and symbols) (d) Explain why this would be easier in Hindu-Arabic.

13. The Babylonians used base-60. Our modern system of measuring time (60 seconds = 1 minute, 60 minutes = 1 hour) is inherited from them.

(a) How many seconds are in 2 hours 35 minutes using Babylonian logic?

(b) Express 9,345 seconds as hours, minutes and seconds.

(c) Why do you think base-60 was convenient for this purpose?

14. Examine the Mayan number system:

(a) Draw and identify all three Mayan symbols and their values.

(b) Represent the number 97 in the Mayan system (show row-wise).

(c) Add the Mayan numbers for 18 and 25 and express the result in both Mayan and Hindu-Arabic.

15. The concept of ZERO is one of India's greatest gifts to the world.

(a) Which ancient Indian mathematician formally introduced the rules of zero?

(b) Why was the introduction of zero as a number (not just a placeholder) a revolutionary idea?

(c) Give TWO examples to show how arithmetic would be difficult without zero.

16. Investigate the Chinese number system:

(a) How does the traditional Chinese written numeral system express the number 2,356?

(b) Compare the Chinese number system with the Hindu-Arabic system — which uses place value?

(c) Write 45,678 in Chinese numeral system notation (describe each component).

Section D: Long Answer (3 × 5 = 15 marks)

17. A historian finds an ancient Roman inscription on a monument:
"Anno Domini MCMLXXXIX" (meaning 'In the Year of the Lord...')

(a) Convert MCMLXXXIX to Hindu-Arabic numerals. Show each numeral's value.

(b) What year does this represent? What significant event could this year mark?

(c) Write the current year (2025) in Roman numerals.

(d) How many years have passed between these two dates? Write this difference in Roman numerals.

(e) Explain TWO limitations of the Roman numeral system that make such calculations difficult.

18. A museum exhibit compares five ancient number systems by representing ONE number — 365 (days in a year).

(a) Express 365 in the Roman numeral system.

(b) Express 365 in the Egyptian hieroglyphic system (describe each symbol).

(c) Express 365 in the Mesopotamian (base-60) system. Show: 365 = ? × 60 + ? × 1.

(d) Express 365 in the Mayan vigesimal (base-20) system. Show: 365 = ? × 20 + ?.

(e) Which system do you think makes it easiest to represent 365? Justify.

19. Investigate how the development of the Hindu number system changed the world:

(a) Name the key contributions: the digits 0-9, place value, decimal point.

(b) Show how addition of 4,567 + 3,894 is performed in Hindu-Arabic vs. how complex it would be in Roman numerals.

(c) Explain the concept of place value with an example: Why does the digit '3' in 3,000 represent a different value from '3' in 30?

(d) How did Indian mathematicians (Brahmagupta, Aryabhata) influence world mathematics?

(e) Name TWO modern technologies or fields that would NOT be possible without the Hindu number system.

SECTION-E Case Study Based Questions (2 × 4 = 8 marks)

20. The Museum of Ancient Civilisations

Class VIII students visit a Museum of Ancient Civilisations. They see a timeline wall that shows how different cultures wrote numbers. One exhibit features an Egyptian papyrus (c. 1650 BCE) showing the number 4,352 written as: four lotus flowers (1,000 each), three coiled ropes (100 each), five heel bones (10 each), and two strokes (1 each). Another display shows the same number 4,352 in Roman numerals on a stone inscription. The guide explains: 'The Egyptians and Romans both lacked a symbol for zero and did not use place value. This made multiplication and division very hard for these civilisations!' A student asks: 'How would the Mesopotamians or the Hindus have written 4,352?'

20(i). Verify: does the Egyptian papyrus correctly represent 4,352? Show the calculation. Also write 4,352 in Roman numerals and identify any challenge in doing so.

20(ii). How would the Hindus (using the Hindu-Arabic system) write 4,352? Explain the role of EACH digit's place value. Why is the Hindu system easier for multiplication than the Egyptian or Roman system?

21. **Decoding an Ancient Mayan Calendar**

An archaeologist uncovers a Mayan stone tablet. It records two dates: Date A is written as two rows — top row: one dot; bottom row: three bars and two dots. Date B is written as three rows — top row: two dots; middle row: one bar; bottom row: three dots. The Mayan calendar uses a base-20 system where the bottom row represents ones (0–19), the second row represents 20s, and the third row represents 360s (not 400s, because of how their calendar works — one row = 360 for time purposes). Each dot = 1, each bar = 5, a shell = 0. The archaeologist needs to decode these date numbers into our Hindu-Arabic system to identify the time gap between them

Q31(i). Decode Date A and Date B from Mayan notation into Hindu-Arabic numerals. Show full working for each. (Use: Row 1 value × 360 + Row 2 value × 20 + Row 3 value.)

Q31(ii). Find the difference between Date B and Date A (in Hindu-Arabic). What does this number of days roughly equal in years (use 1 year ≈ 365 days)? Why do you think the Mayans developed such a sophisticated calendar system?

Self Assessment:

I understood all concepts: ☐ Yes ☐ No

I need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Parent's Assessment:

My ward understood the all the concepts ☐ Yes ☐ No

He/She need more practice ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Signature of Parent:

Teacher's Assessment

Answer of Worksheet-1

Q.NO.	1	2	3	4	5	6	7	8	9	10
ANS.	A	C	C	D	C	A	B	C	B	A
Q.NO.	11	12	13	14	15	16	17	18	19	20
ANS.	A	C	C	A	A	B	C	B	C	C

Answer of Worksheet-2

Q.NO.	1	2
ANS.	1999	4 'lotus flowers' + 8 'heel bones' + 7 'strokes'
Q.NO.	3	4
ANS.	Row 2 (top) = 1 dot (×20=20); Row 1 (bottom) = 3 bars + 3 dots (=18). Total = 20+18 = 38	2 groups of 60 + 5 ones → '2, 5' in base-60
Q.NO.	5	6
ANS.	Any Two reasons	3748
Q.NO.	7	8
ANS.	3 vertical rods (hundreds) | 5 horizontal rods (tens) | 2 vertical rods (ones)	13,400

Q.NO.	9	10
ANS.	360 (for calendar) or 400 (for pure base-20)	Egyptian is additive (no place value); Hindu-Arabic is positional (place value).
Q.NO.	11	12
ANS.	Comparison in own words	₹3,749 in four systems
Q.NO.	13	14
ANS.	Babylonian base-60 and time	a) Three Mayan symbols: Shell (•) = 0; Dot (•) = 1; Bar (—) = 5. (b) 97 in Mayan: 97 = 4×20 + 17. Top row (20s): 4 dots. Bottom row (1s): 3 bars(=15) + 2 dots(=2) = 17. Total: 80+17=97 ✓ (c) 18 Mayan: 0 in top, 1 bar+3 dots (=18) bottom. 25 Mayan: 1 dot top (=20), 1 bar (=5) bottom. Sum = 18+25=43. 43=2×20+3: top row=2 dots, bottom=3 dots. Roman: XLIII.
Q.NO.	15	16
ANS.	(a) Brahmagupta. (b) Zero as a NUMBER (not just a space) enabled: place value systems to work correctly; algebra; calculus; the concept of negative numbers; and modern computing (binary 0 and 1).	(a) 2,356 in Chinese: 二千三百五十六 (er qian san bai wu shi liu): 2×1000 + 3×100 + 5×10 + 6×1. The Chinese system names each digit with its place value word. (b) Chinese vs Hindu-Arabic: Both use a form of place value (multiplier × place). Hindu-Arabic is purely positional (position alone gives value); Chinese uses explicit place-name words (thousand, hundred, ten). (c) 45,678: 四万五千六百七十八 = 4×10,000 + 5×1,000 + 6×100 + 7×10 + 8×1
Q.NO.	17	18
ANS.	(a) M=1000, CM=900, L=50, XXX=30, IX=9. Total: 1000+900+50+30+9 = 1989. (b) 1989 = the year the Berlin Wall fell (a historic event). (c) 2025 in Roman: MM=2000, XX=20, V=5 → MMXXV. (d) 2025−1989 = 36 years. 36 in Roman = XXXVI.	(a) Roman: CCCLXV (C=100×3=300, L=50, X=10, V=5 → 300+50+10+5=365). (b) Egyptian: 3 coiled ropes (3×100=300) + 6 heel bones (6×10=60) + 5 strokes (5×1=5) = 365. (8 individual symbols.) (c) Mesopotamian base-60: 365 = 6×60 + 5×1 = 360+5. Written as '6 5' in cuneiform (six tens-wedge groups + five unit-wedges). (d) Mayan base-20: 365 = 18×20 + 5. Bottom row (ones): 1 bar (=5). Top row (20s): 18 = 3 bars + 3 dots. (Note: this is pure base-20; calendar uses 360 base.)
Q.NO.	19	20
ANS.	(a) Key contributions: 10 digits (0–9), place value (positional notation), decimal fractions, concept of zero as a number and placeholder. (b) Addition: 4567+3894 = 8461 (carried out in seconds). In Roman: MMMMDLXVII + MMMDCCCXCIV — no standard algorithm; must convert! Roman multiplication requires lengthy lookup tables (like the Salamis tablet).	i) Egyptian papyrus is correct: 4×1000+3×100+5×10+2 = 4352 ✓. Roman: MMMMCCCLII Egyptian verification: 4 lotus flowers=4×1000=4000; 3 coiled ropes=3×100=300; 5 heel bones=5×10=50; 2 strokes=2. Total=4000+300+50+2=4352 Roman: 4352 = MMMMCCCLII (four M's, three C's, L=50, two I's). Challenge: Roman has no standard single numeral for 4000 — writing four M's (MMMM)

	(c) Place value: 3,000 — the digit 3 is in the THOUSANDS place, so it represents 3×1000=3000. 30 — the digit 3 is in the TENS place, representing 3×10=30. Same symbol, different position = completely different value. This is the power of the Hindu system. (d) Brahmagupta (628 CE): defined rules for +,-,×,÷ with zero and negative numbers. Aryabhata (499 CE): used zero implicitly in astronomical calculations. Their work spread to the Arab world (Al-Khwarizmi) → Europe	is cumbersome; in some traditions 4000=MV̄ (bar notation). This shows Roman's limitation with large numbers. (ii).Hindu-Arabic: 4,352 — digit 4 (thousands)=4000, digit 3 (hundreds)=300, digit 5 (tens)=50, digit 2 (ones)=2 Place value breakdown: 4352 = 4×1000 + 3×100 + 5×10 + 2×1.
Q.NO.	21	
ANS.	**(i).** Date A: Top row (×360): 1 dot = 1×360 = 360? NO — given system: Row1×360 + Row2×20 + Row3×1. top row = one dot = 1; second row = three bars+two dots = 15+2=17. No third row given. Date A = 1×20 + (3 bars+2 dots) = 20 + 17 = 37? Let's use the case's own rule: 2 rows given for Date A. Actually: Top row = 1 dot (=1×360? or ×20). Case says Row1=360s. If 2 rows: row1=20s, row2=ones (simpler). Date A (2 rows): Row 1 (×20)=1 dot=20. Row 2 (×1)=3 bars+2 dots=17. Date A=20+17=37. Date B (3 rows): Row 1 (×360)=2 dots=720. Row 2 (×20)=1 bar=5×20=100. Row 3 (×1)=3 dots=3. Date B=720+100+3=823. **(ii)**Using above: 823 − 37 = 786 days difference. 786 ÷ 365 ≈ 2.15 years (approximately 2 years and 56 days). The Mayans developed a sophisticated calendar because: they were expert astronomers who tracked Venus, the Moon and the Sun with remarkable accuracy; their agricultural society depended on knowing planting and harvest seasons precisely; and their religious ceremonies were tied to celestial cycles.	