CLASS VIII – MATHEMATICS

Chapter Test: A Story of Numbers – Step-by-Step Solutions & Marking Scheme

(Ganita Prakash, Grade 8, Part I – Chapter 3)

M. M.: 40 | Marks for each step are shown in square brackets.

Section A – Multiple Choice Questions (1 mark each)

Q.	Ans.	Solution
1	**(C)**	When the landmark numbers are 1, n, n^2, n^3, ..., the system is a **base-n number system**.
2	**(B)**	MMDCLXVII = M + M + D + C + L + X + V + I + I = 1000 + 1000 + 500 + 100 + 50 + 10 + 5 + 1 + 1 = **2667**.
3	**(D)**	1,350 = 1000 + 100 + 100 + 100 + 50, so the numeral is M + C + C + C + L = **MCCCL**.
4	**(A)**	Landmark numbers of base 3: 1, 3, 9, 27, 81, **243**. The 6th is 3^5 = 243.
5	**(D)**	The Mayan system had landmark numbers 1, 20, 20 × 18 = 360, ... and a seashell-like symbol for zero: **Mayan**.
6	**(B)**	The Mesopotamian system was a sexagesimal (**base-60**) place value system.
7	**(A)**	Landmark numbers are powers of 10, so $10^a \times 10^b = 10^{a+b}$, which is **another landmark number**.
8	**(C)**	Zero acts as a placeholder: it holds an empty position so that, for example, 305 and 35 cannot be confused.
9	**(C)**	From Fig. 1: 3 counters on 1000 = 3000, none on 100 = 0, 2 counters on 10 = 20, 6 counters on 1 = 6. Number = 3000 + 0 + 20 + 6 = **3026**.
10	**(B)**	Thousands: 3 rods = 3 → 3 × 1000. Hundreds: blank = 0. Tens: one cross rod (5) + 1 rod = 6 → 6 × 10. Ones: 5 rods = 5. Number = 3000 + 0 + 60 + 5 = **3065**.

Section B – Very Short Answer Questions (2 marks each)

Q11. Base-4 numeral (Fig. 3)

(i) Landmark numbers: circle = 1, square = 4, triangle = 16, diamond = 64. The numeral has 2 diamonds, 1 triangle, 3 squares and 2 circles. Value = 2 × 64 + 1 × 16 + 3 × 4 + 2 × 1 = 128 + 16 + 12 + 2 = **158**. [1]

(ii) 100 − 64 = 36; 36 − 16 − 16 = 4; 4 = one square. So 100 = 64 + 16 + 16 + 4: **1 diamond, 2 triangles, 1 square and 0 circles**. (Check: 64 + 32 + 4 = 100.) [1]

Q12. Roman numerals

(A) 2,386 = 2000 + 300 + 80 + 6 = MM + CCC + LXXX + VI = **MMCCCLXXXVI**. [2]

(B) MMDCCLXXIII = 1000 + 1000 + 500 + 100 + 100 + 50 + 10 + 10 + 1 + 1 + 1 = **2773**. [2]

Q13. Base-6 landmark numbers

The landmark numbers are powers of 6: $6^0 = 1$, $6^1 = 6$, $6^2 = 36$, $6^3 = 216$. [1]

250 − 216 = 34; 34 = 5 × 6 + 4. So 250 = **1 × 216 + 0 × 36 + 5 × 6 + 4 × 1**. (Check: 216 + 30 + 4 = 250.) [1]

Section C – Short Answer Questions (3 marks each)

Q14. Mayan numeral (Fig. 4)

(i) Top row (position 360): 2 dots = 2 → 2 × 360 = 720. [1]

Middle row (position 20): 1 bar + 3 dots = 5 + 3 = 8 → 8 × 20 = 160. Bottom row (position 1): 2 bars + 4 dots = 10 + 4 = 14 → 14. Number = 720 + 160 + 14 = **894**. [1]

(ii) 400 = 1 × 360 + 2 × 20 + 0 × 1. Top row: 1 dot; middle row: 2 dots; bottom row: the **zero (seashell) symbol**. [1]

Q15.

(A) Count the symbols: hundreds 6 + 5 = 11; tens 7 + 5 = 12; ones 8 + 9 = 17. [1]

Regroup: 17 ones = 1 ten + 7 ones, so tens = 13; 13 tens = 1 hundred + 3 tens, so hundreds = 12; 12 hundreds = 1 thousand + 2 hundreds. [1]

The sum has 1 thousand, 2 hundreds, 3 tens, 7 ones = **1237**. (Check: 678 + 559 = 1237.) [1]

(B) In the Egyptian system landmark numbers are powers of 10, and 100 = 10^2. Multiplying a landmark number by 100 gives the landmark two steps higher. [1]

Hundreds → 100 × 100 = 10^4 (ten-thousand); tens → 10 × 100 = 1000; ones → 1 × 100 = 100. [1]

So the product needs **3 ten-thousand symbols, 4 thousand symbols and 5 hundred symbols**, i.e. 34,500. (Check: 345 × 100 = 34,500.) [1]

Q16.

(A) Landmark numbers of base 5: 1, 5, 25, 125 (the next, 625, is larger than 200). [1]

Largest landmark ≤ 200 is 125: 200 − 125 = 75. 75 = 3 × 25 (25 + 25 + 25), leaving 0. [1]

So 200 = **1 × 125 + 3 × 25 + 0 × 5 + 0 × 1**, i.e. one 125-symbol and three 25-symbols (digits 1300 in base 5). [1]

(B) Landmark values: 125, 25, 5, 1. [1]

Value = 1 × 125 + 3 × 25 + 0 × 5 + 2 × 1 = 125 + 75 + 0 + 2. [1]

= **202**. [1]

Q17. CCLXXIII + CCCLXXXII

Count the symbols: CCLXXIII has C × 2, L × 1, X × 2, I × 3; CCCLXXXII has C × 3, L × 1, X × 3, I × 2. Together: C × 5, L × 2, X × 5, I × 5. [1]

Regroup from the smallest: 5 I = 1 V. 5 X = 1 L, so L × 3. 2 L = 1 C, so C × 6 and 1 L is left. 5 C = 1 D, so D × 1 and C × 1 are left. [1½]

Result: D + C + L + V = 500 + 100 + 50 + 5 = 655, which is **DCLV**. (Check: 273 + 382 = 655.) [½]

Section D – Long Answer / Case-based Questions (4 marks each)

Q18.

(A) (i) Right-most group (ones): 3 chevrons = 3 × 10 = 30, landmark number 1. [½]

Middle group (landmark 60): 1 chevron + 5 wedges = 10 + 5 = 15, so it stands for 15 × 60 = 900. [1]

Left group (landmark 3600): 2 wedges = 2, so it stands for 2 × 3600 = 7200. [½]

(ii) Number of sacks = 7200 + 900 + 30 = **8130**. [1]

(iii) A gap does not always show clearly where a power of 60 is missing, so numbers like 3605 and 65 could be confused. A placeholder symbol marks an empty position and removes the ambiguity. [1]

(B) (i) 3725 = 1 × 3600 + 125, and 125 = 2 × 60 + 5. So 3725 = **1 × 3600 + 2 × 60 + 5 × 1**. [2]

(ii) Three groups with clear gaps: the first group has 1 wedge (3600s), the second has 2 wedges (60s) and the third has 5 wedges (ones). [1]

(iii) 3605 = 1 × 3600 + 0 × 60 + 5. The 60s place is empty, so only one wider gap separates the 1 and the 5. Such a gap is easy to miss or misjudge, making it look like 65 (1 × 60 + 5). A placeholder is needed. [1]

Q19.

(A) Add the counts: 25s: 3 + 2 = 5; 5s: 2 + 4 = 6; 1s: 4 + 3 = 7. [1]

7 ones = 1 five + 2 ones, so fives = 6 + 1 = 7 and ones = 2. [1]

7 fives = 1 twenty-five + 2 fives, so 25s = 5 + 1 = 6 and fives = 2. Then 6 twenty-fives = 1 one-twenty-five + 1 twenty-five. Sum = **1 × 125 + 1 × 25 + 2 × 5 + 2 × 1** (digits 1122 in base 5). [1]

Check: first number = 75 + 10 + 4 = 89; second = 50 + 20 + 3 = 73; 89 + 73 = 162; and 125 + 25 + 10 + 2 = 162. [1]

(B) (i) 2 × 25 + 3 × 5 + 0 × 1 = 50 + 15 = **65**. [1]

(ii) Multiplying a landmark number by 5 gives the next landmark number: 25 → 125, 5 → 25, 1 → 5. So the product has 2 one-twenty-fives, 3 twenty-fives, 0 fives, 0 ones: **2300 in base 5**. Value = 250 + 75 = 325 = 65 × 5. [2]

(iii) To multiply by n in a base-n system, move every digit one place to the left (shift each symbol to the next landmark number); equivalently, put a 0 at the end. [1]

Q20. Case Study: history of numbers

(i) Arab scholars called them **‘Hindu numerals’**. [1]

(ii) European scholars learnt the numerals from the Arab world, so they named them **‘Arabic numerals’** from their own viewpoint. [1]

(iii) Any one: the Hindu system is a **place value system**; it has a symbol for zero; it makes calculation (+, −, ×, ÷) easy; it can write every number with only ten symbols. [1]

(iv) In 3026 the digit 0 is a **placeholder** for the empty hundreds place (3 thousands, 0 hundreds, 2 tens, 6 ones); without it the numeral could be read as 326. [1]

Note for teachers: Award full marks for any correct alternative method. In Q17 an answer such as DCLV reached by a different regrouping order is acceptable, and in Q18 and Q20 any reasonable wording of the explanation may be accepted.