Chapter 1: Large Numbers Around Us

CONTENTS 10 exercises · 44 questions

1.1	A Lakh Varieties! (Page 3)	3 Q
1.2	Land of Tens — Thoughtful Thousands, Tedious Tens, Handy H...	3 Q
1.3	Creative Chitti — Different Ways to Express Numbers (Page 6)	2 Q
1.4	Systematic Sippy — Minimum Button Clicks (Page 7)	2 Q
1.5	Of Crores and Crores! — Indian and American Number Systems ...	3 Q
1.6	Exact and Approximate Values — Nearest Neighbours (Page 11)	3 Q
1.7	Populations of Cities (Page 12–13)	6 Q
1.8	Patterns in Products — Quick Multiplication (Page 14)	2 Q
1.9	Fascinating Facts about Large Numbers (Page 16–17)	6 Q
1.10	Did You Ever Wonder…? — Large Number Puzzles (Page 19–21)	14 Q

Exercise 1.1 — A Lakh Varieties! (Page 3)

Q1 According to the 2011 Census, the population of the town of Chintamani was about 75,000. How much less than one lakh is 75,000?

SOLUTION

One lakh = 1,00,000

Difference = 1,00,000 – 75,000 = 25,000

Answer: 75,000 is 25,000 less than one lakh.

Q2 The estimated population of Chintamani in the year 2024 is 1,06,000. How much more than one lakh is 1,06,000?

SOLUTION

Difference = 1,06,000 – 1,00,000 = 6,000

Answer: 1,06,000 is 6,000 more than one lakh.

Q3 By how much did the population of Chintamani increase from 2011 to 2024?

SOLUTION

Population in 2011 ≈ 75,000

Population in 2024 = 1,06,000

Increase = 1,06,000 – 75,000 = 31,000

Answer: The population increased by 31,000 from 2011 to 2024.

Exercise 1.2 — Land of Tens — Thoughtful Thousands, Tedious Tens, Handy Hundreds

Q1 The Thoughtful Thousands only has a +1000 button. How many times should it be pressed to show: (a) Three thousand? (b) 10,000? (c) Fifty three thousand? (d) 90,000? (e) One Lakh? (f) _____? 153 times (g) How many thousands are required to make one lakh?

SOLUTION

(a) Three thousand = 3 × 1000 → press 3 times.
(b) 10,000 = 10 × 1000 → press 10 times.
(c) Fifty three thousand = 53 × 1000 → press 53 times.
(d) 90,000 = 90 × 1000 → press 90 times.
(e) One lakh = 1,00,000 = 100 × 1000 → press 100 times.
(f) 153 × 1000 = 1,53,000 → the number shown is 1,53,000.
(g) 1,00,000 ÷ 1000 = 100 → 100 thousands make one lakh.

Answer: (a) 3 times (b) 10 times (c) 53 times (d) 90 times (e) 100 times (f) 1,53,000 (g) 100 thousands

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Q2 The Tedious Tens only has a +10 button. How many times should it be pressed to show: (a) Five hundred? (b) 780? (c) 1000? (d) 3700? (e) 10,000? (f) One lakh? (g) _____? 435 times

SOLUTION

(a) 500 = 50 × 10 → press 50 times.
(b) 780 = 78 × 10 → press 78 times.
(c) 1000 = 100 × 10 → press 100 times.
(d) 3700 = 370 × 10 → press 370 times.
(e) 10,000 = 1000 × 10 → press 1000 times.
(f) 1,00,000 = 10,000 × 10 → press 10,000 times.
(g) 435 × 10 = 4,350 → the number shown is 4,350.

Answer: (a) 50 (b) 78 (c) 100 (d) 370 (e) 1000 (f) 10,000 (g) 4,350

Q3 The Handy Hundreds only has a +100 button. How many times should it be pressed to show: (a) Four hundred? (b) 3,700? (c) 10,000? (d) Fifty three thousand? (e) 90,000? (f) 97,600? (g) 1,00,000? (h) _____? 582 times (i) How many hundreds are required to make ten thousand? (j) How many hundreds are required to make one lakh? (k) Handy Hundreds says 'There are some numbers which Tedious Tens and Thoughtful Thousands can't show but I can.' Is this statement true?

SOLUTION

(a) 400 = 4 × 100 → press 4 times.
(b) 3,700 = 37 × 100 → press 37 times.
(c) 10,000 = 100 × 100 → press 100 times.
(d) 53,000 = 530 × 100 → press 530 times.
(e) 90,000 = 900 × 100 → press 900 times.
(f) 97,600 = 976 × 100 → press 976 times.
(g) 1,00,000 = 1000 × 100 → press 1000 times.
(h) 582 × 100 = 58,200 → the number shown is 58,200.
(i) 10,000 = 100 × 100 → 100 hundreds make ten thousand.
(j) 1,00,000 = 1000 × 100 → 1000 hundreds make one lakh.
(k) The statement is false. Handy Hundreds can only show multiples of 100. Tedious Tens can show any multiple of 10, including numbers like 10, 20, 30, …, 90 that are NOT multiples of 100. Similarly, Thoughtful Thousands shows multiples of 1000. So Handy Hundreds cannot show numbers like 200 (which Tedious Tens can show by pressing +10 twenty times) — but every multiple of 100 IS also reachable by Tedious Tens (press 10 times for 1000, etc.). In fact any number Handy Hundreds shows is also reachable by Tedious Tens and Thoughtful Thousands (multiples of 100 are also multiples of 10 and of 100). The statement is not true.

Answer: (a) 4 (b) 37 (c) 100 (d) 530 (e) 900 (f) 976 (g) 1000 (h) 58,200 (i) 100 (j) 1000 (k) No, the statement is false.

Exercise 1.3 — Creative Chitti — Different Ways to Express Numbers (Page 6)

Q1 For each number given below, write expressions for at least two different ways to obtain the number through button clicks. Think like Chitti and be creative. (a) 8300 (b) 40629 (c) 56354 (d) 66666 (e) 367813

SOLUTION

(a) 8300:
Way 1: (8 × 1000) + (3 × 100) = 8000 + 300 = 8300
Way 2: (5 × 1000) + (33 × 100) = 5000 + 3300 = 8300

(b) 40629:
Way 1: (40 × 1000) + (6 × 100) + (2 × 10) + (9 × 1) = 40000 + 600 + 20 + 9 = 40629
Way 2: (30 × 1000) + (106 × 100) + (29 × 1) = 30000 + 10600 + 29 = 40629

(c) 56354:
Way 1: (56 × 1000) + (3 × 100) + (5 × 10) + (4 × 1) = 56000 + 300 + 50 + 4 = 56354
Way 2: (46 × 1000) + (103 × 100) + (54 × 1) = 46000 + 10300 + 54 = 56354

(d) 66666:
Way 1: (6 × 10000) + (6 × 1000) + (6 × 100) + (6 × 10) + (6 × 1) = 66666
Way 2: (66 × 1000) + (6 × 100) + (66 × 1) = 66000 + 600 + 66 = 66666

(e) 367813:
Way 1: (3 × 100000) + (6 × 10000) + (7 × 1000) + (8 × 100) + (1 × 10) + (3 × 1) = 367813
Way 2: (36 × 10000) + (7 × 1000) + (8 × 100) + (13 × 1) = 360000 + 7000 + 800 + 13 = 367813

Answer: Many valid expressions exist. Standard place value notation gives one way; non-standard groupings (e.g. using 33 hundreds instead of 3 hundreds + 3 thousands) give other ways.

Q2 Creative Chitti questions: (a) You have to make exactly 30 button presses. What is the largest 3-digit number you can make? What is the smallest 3-digit number you can make? (b) 997 can be made using 25 clicks. Can you make 997 with a different number of clicks?

SOLUTION

(a) Largest 3-digit with exactly 30 button presses:
Use +100, +10, and +1 buttons only (higher buttons give 4+ digit numbers).
Press +100 eight times, +10 nineteen times, +1 three times:
(8 × 100) + (19 × 10) + (3 × 1) = 800 + 190 + 3 = 993
Total presses = 8 + 19 + 3 = 30. ✓ Largest 3-digit number = 993.

Smallest 3-digit with exactly 30 button presses:
To stay as small as possible, use +100 just once (to ensure a 3-digit result) and spend the remaining presses on +1:
(1 × 100) + (29 × 1) = 100 + 29 = 129
Total presses = 1 + 29 = 30. ✓ Smallest 3-digit number = 129.
(The textbook key's 102 cannot be made with exactly 30 presses — reaching 102 needs at least 3 presses and the value can't be padded up to 30 presses without exceeding 102, so 129 is the true smallest.)

(b) 997 with 25 clicks (standard): (9 × 100) + (9 × 10) + (7 × 1) = 997; clicks = 9 + 9 + 7 = 25.
Alternative with 34 clicks: (8 × 100) + (19 × 10) + (7 × 1) = 800 + 190 + 7 = 997; clicks = 8 + 19 + 7 = 34.
Many other ways are possible by swapping between button types.

Answer: (a) Largest 3-digit = 993; Smallest 3-digit = 129 (b) Yes, e.g. (8×100)+(19×10)+(7×1) uses 34 clicks.

Exercise 1.4 — Systematic Sippy — Minimum Button Clicks (Page 7)

Q1 For the numbers in the previous exercise, find out how to get each number by making the smallest number of button clicks and write the expression.

SOLUTION

The minimum clicks equals the sum of the digits of the number (place-value representation).

(a) 8300 = (8 × 1000) + (3 × 100); minimum clicks = 8 + 3 = 11
(b) 40629 = (4 × 10000) + (6 × 100) + (2 × 10) + (9 × 1); minimum clicks = 4 + 6 + 2 + 9 = 21
(c) 56354 = (5 × 10000) + (6 × 1000) + (3 × 100) + (5 × 10) + (4 × 1); minimum clicks = 5 + 6 + 3 + 5 + 4 = 23
(d) 66666 = (6 × 10000) + (6 × 1000) + (6 × 100) + (6 × 10) + (6 × 1); minimum clicks = 6 + 6 + 6 + 6 + 6 = 30
(e) 367813 = (3 × 100000) + (6 × 10000) + (7 × 1000) + (8 × 100) + (1 × 10) + (3 × 1); minimum clicks = 3 + 6 + 7 + 8 + 1 + 3 = 28

Answer: (a) 11 clicks (b) 21 clicks (c) 23 clicks (d) 30 clicks (e) 28 clicks

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Q2 Do you see any connection between each number and the corresponding smallest number of button clicks?

SOLUTION

Yes. The minimum number of button clicks to make a number equals the sum of its digits.

For example, 8300 has digits 8, 3, 0, 0. Sum = 8 + 3 + 0 + 0 = 11 = minimum clicks.

Each digit tells how many times we press the button for that place value.

Answer: The minimum clicks = sum of the digits of the number.

Exercise 1.5 — Of Crores and Crores! — Indian and American Number Systems (Page 9

Q1 Read the following numbers in Indian place value notation and write their number names in both the Indian and American systems: (a) 4050678 (b) 48121620 (c) 20022002 (d) 246813579 (e) 345000543 (f) 1020304050

SOLUTION

(a) 4050678 → Indian: 40,50,678
Indian name: Forty lakh fifty thousand six hundred seventy-eight
American: 4,050,678 → Four million fifty thousand six hundred seventy-eight

(b) 48121620 → Indian: 4,81,21,620
Indian name: Four crore eighty-one lakh twenty-one thousand six hundred twenty
American: 48,121,620 → Forty-eight million one hundred twenty-one thousand six hundred twenty

(c) 20022002 → Indian: 2,00,22,002
Indian name: Two crore twenty-two thousand two
American: 20,022,002 → Twenty million twenty-two thousand two

(d) 246813579 → Indian: 24,68,13,579
Indian name: Twenty-four crore sixty-eight lakh thirteen thousand five hundred seventy-nine
American: 246,813,579 → Two hundred forty-six million eight hundred thirteen thousand five hundred seventy-nine

(e) 345000543 → Indian: 34,50,00,543
Indian name: Thirty-four crore fifty lakh five hundred forty-three
American: 345,000,543 → Three hundred forty-five million five hundred forty-three

(f) 1020304050 → Indian: 1,02,03,04,050
Indian name: One arab two crore three lakh four thousand fifty
American: 1,020,304,050 → One billion twenty million three hundred four thousand fifty

Answer: See solution above for Indian and American names of each number.

Q2 Write the following numbers in Indian place value notation: (a) One crore one lakh one thousand ten (b) One billion one million one thousand one (c) Ten crore twenty lakh thirty thousand forty (d) Nine billion eighty million seven hundred thousand six hundred

SOLUTION

(a) One crore one lakh one thousand ten
= 1,00,00,000 + 1,00,000 + 1,000 + 10 = 1,01,01,010

(b) One billion one million one thousand one
1 billion = 1,00,00,00,000; 1 million = 10,00,000; 1 thousand = 1,000
= 1,00,00,00,000 + 10,00,000 + 1,000 + 1 = 1,00,10,01,001

(c) Ten crore twenty lakh thirty thousand forty
= 10,00,00,000 + 20,00,000 + 30,000 + 40 = 10,20,30,040

(d) Nine billion eighty million seven hundred thousand six hundred
9 billion = 9,00,00,00,000; 80 million = 8,00,00,000; 700 thousand = 7,00,000; 600 = 600
= 9,00,00,00,000 + 8,00,00,000 + 7,00,000 + 600 = 9,08,07,00,600

Answer: (a) 1,01,01,010 (b) 1,00,10,01,001 (c) 10,20,30,040 (d) 9,08,07,00,600

Q3 Compare and write '<', '>' or '=': (a) 30 thousand ___ 3 lakhs (b) 500 lakhs ___ 5 million (c) 800 thousand ___ 8 million (d) 640 crore ___ 60 billion

SOLUTION

(a) 30 thousand = 30,000; 3 lakhs = 3,00,000
30,000 < 3,00,000 → 30 thousand < 3 lakhs

(b) 500 lakhs = 500 × 1,00,000 = 5,00,00,000; 5 million = 50,00,000
5,00,00,000 > 50,00,000 → 500 lakhs > 5 million

(c) 800 thousand = 8,00,000; 8 million = 80,00,000
8,00,000 < 80,00,000 → 800 thousand < 8 million

(d) 640 crore = 640 × 1,00,00,000 = 64,00,00,00,000; 60 billion = 60 × 1,00,00,00,000 = 6,00,00,00,00,000
64,00,00,00,000 < 6,00,00,00,00,000 → 640 crore < 60 billion

Answer: (a) < (b) > (c) < (d) <

Exercise 1.6 — Exact and Approximate Values — Nearest Neighbours (Page 11)

Q1 Similarly, write the five nearest neighbours for these numbers: (a) 3,87,69,957 (b) 29,05,32,481

SOLUTION

(a) 3,87,69,957:
Nearest thousand: the hundreds-tens-ones part is 957 ≥ 500, round up → 3,87,70,000
Nearest ten thousand: the last 4 digits = 9,957 ≥ 5,000, round up → 3,87,70,000
Nearest lakh: last 5 digits = 69,957 ≥ 50,000, round up → 3,88,00,000
Nearest ten lakh: last 6 digits = 7,69,957 ≥ 5,00,000, round up → 3,90,00,000
Nearest crore: last 7 digits = 87,69,957 ≥ 50,00,000, round up → 4,00,00,000

(b) 29,05,32,481:
Nearest thousand: last 3 digits = 481 < 500, round down → 29,05,32,000
Nearest ten thousand: last 4 digits = 2,481 < 5,000, round down → 29,05,30,000
Nearest lakh: last 5 digits = 32,481 < 50,000, round down → 29,05,00,000
Nearest ten lakh: last 6 digits = 5,32,481 ≥ 5,00,000, round up → 29,10,00,000
Nearest crore: last 7 digits = 5,32,481 < 50,00,000 (i.e. 1,05,32,481 vs 50,00,000), look at last 7: 05,32,481 < 50,00,000, round down → 29,00,00,000

Answer: (a) Nearest thousand: 3,87,70,000; Ten thousand: 3,87,70,000; Lakh: 3,88,00,000; Ten lakh: 3,90,00,000; Crore: 4,00,00,000 || (b) Nearest thousand: 29,05,32,000; Ten thousand: 29,05,30,000; Lakh: 29,05,00,000; Ten lakh: 29,10,00,000; Crore: 29,00,00,000

Q2 Roxie and Estu are estimating: 4,63,128 + 4,19,682. Roxie says: 'The sum is near 8,00,000 and is more than 8,00,000.' Estu says: 'The sum is near 9,00,000 and is less than 9,00,000.' (a) Are these estimates correct? Whose is closer? (b) Will the sum be greater than 8,50,000 or less? (c) Will the sum be greater than 8,83,128 or less? (d) Exact value of 4,63,128 + 4,19,682 = ?

SOLUTION

Exact value: 4,63,128 + 4,19,682 = 8,82,810

(a) Roxie says sum ≈ 8,00,000 and sum > 8,00,000.
8,82,810 > 8,00,000 ✓ — Roxie is correct.
Estu says sum ≈ 9,00,000 and sum < 9,00,000.
8,82,810 < 9,00,000 ✓ — Estu is correct.

Roxie's estimate (8,00,000) is farther from 8,82,810 (difference 82,810); Estu's estimate (9,00,000) is closer (difference 17,190). Estu's estimate is closer.

(b) Sum = 8,82,810 > 8,50,000, so the sum is greater than 8,50,000.
Reason: both numbers together exceed 8,50,000 since 4,63,128 alone is more than 4,25,000 (half of 8,50,000).

(c) Sum = 8,82,810 > 8,83,128? No — 8,82,810 < 8,83,128.
The sum is less than 8,83,128.
Reason: 4,63,128 + 4,19,682 = 8,82,810, which is 318 less than 8,83,128.

(d) Exact value = 8,82,810

Answer: (a) Both correct; Estu's estimate is closer (b) Greater than 8,50,000 (c) Less than 8,83,128 (d) 8,82,810

Q3 Estimating: 14,63,128 – 4,90,020. Roxie says: 'The difference is near 10,00,000 and is less than 10,00,000.' Estu says: 'The difference is near 9,00,000 and is more than 9,00,000.' (a) Are these estimates correct? Whose is closer? (b) Will the difference be greater than 9,50,000 or less? (c) Will the difference be greater than 9,63,128 or less? (d) Exact value of 14,63,128 – 4,90,020 = ?

SOLUTION

Exact value: 14,63,128 – 4,90,020 = 9,73,108

(a) Roxie says difference ≈ 10,00,000 and < 10,00,000.
9,73,108 < 10,00,000 ✓ — Roxie is correct.
Estu says difference ≈ 9,00,000 and > 9,00,000.
9,73,108 > 9,00,000 ✓ — Estu is correct.

Roxie's estimate distance:	10,00,000 – 9,73,108	= 26,892.
Estu's estimate distance:	9,00,000 – 9,73,108	= 73,108.

Roxie's estimate is closer.

(b) 9,73,108 > 9,50,000, so the difference is greater than 9,50,000.
Reason: subtracting just under 5 lakh from 14,63,128 leaves well above 9,50,000.

(c) 9,73,108 > 9,63,128, so the difference is greater than 9,63,128.
Reason: 14,63,128 – 4,90,020 = 9,73,108; and 9,73,108 > 9,63,128 by 9,980.

(d) Exact value = 9,73,108

Answer: (a) Both correct; Roxie's estimate is closer (b) Greater than 9,50,000 (c) Greater than 9,63,128 (d) 9,73,108

Exercise 1.7 — Populations of Cities (Page 12–13)

Q1 What is your general observation about the population data of Indian cities (2001 and 2011)? Share it with the class.

SOLUTION

Observing the table: most cities in the list show a significant increase in population from 2001 to 2011.

Cities like Bengaluru, Hyderabad, Surat and Vadodara have nearly doubled in population.

Only Kolkata shows a slight decrease from 2001 to 2011.

Mumbai remains the most populous city in both years.

Answer: Most cities saw significant population growth from 2001 to 2011. Some cities nearly doubled while Kolkata saw a slight decrease.

Q2 What is an appropriate title for the above table?

SOLUTION

The table shows populations of major Indian cities in two census years.

An appropriate title: 'Population of Some Major Indian Cities in 2001 and 2011'

Answer: Population of Some Major Indian Cities in 2001 and 2011

Q3 How much is the population of Pune in 2011? Approximately, by how much has it increased compared to 2001?

SOLUTION

Population of Pune in 2011 = 31,15,431

Population of Pune in 2001 = 25,38,473

Increase = 31,15,431 – 25,38,473 = 5,76,958 ≈ 6 lakh

Answer: Pune's 2011 population is 31,15,431; it increased by approximately 6 lakh since 2001.

Q4 Which city's population increased the most between 2001 and 2011?

SOLUTION

Increase in population (2001→2011):
Bengaluru: 84,25,970 – 43,01,326 = 41,24,644
Mumbai: 1,24,42,373 – 1,19,78,450 = 4,63,923
Delhi: 1,10,07,835 – 98,79,172 = 11,28,663
Bengaluru has the largest increase of 41,24,644.

Answer: Bengaluru's population increased the most — by about 41,24,644 between 2001 and 2011.

Q5 Are there cities whose population has almost doubled? Which are they?

SOLUTION

A population 'almost doubles' means the 2011 population is roughly 2× the 2001 population (ratio ≈ 2).
Bengaluru: 84,25,970 ÷ 43,01,326 ≈ 1.96 (nearly doubled)
Hyderabad: 68,09,970 ÷ 36,37,483 ≈ 1.87 (nearly doubled)
Surat: 44,67,797 ÷ 24,33,835 ≈ 1.84 (nearly doubled)
Vadodara: 35,52,371 ÷ 16,90,000 ≈ 2.10 (more than doubled)

Answer: Bengaluru, Hyderabad, Surat and Vadodara have populations that nearly doubled (or more) between 2001 and 2011.

Q6 By what number should we multiply Patna's population to get a number/population close to that of Mumbai?

SOLUTION

Patna's 2011 population = 16,84,222
Mumbai's 2011 population = 1,24,42,373
Ratio = 1,24,42,373 ÷ 16,84,222 ≈ 7.39
Check: 16,84,222 × 7 = 1,17,89,554 (slightly less than Mumbai)
16,84,222 × 8 = 1,34,73,776 (slightly more than Mumbai)
So multiplying by approximately 7 to 8 gives a number close to Mumbai's population.

Answer: Multiply Patna's population by approximately 7 (or 7.4) to get close to Mumbai's population.

Exercise 1.8 — Patterns in Products — Quick Multiplication (Page 14)

Q1 Find quick ways to calculate these products: (a) 2 × 1768 × 50 (b) 72 × 125 [Hint: 125 = 1000/8] (c) 125 × 40 × 8 × 25

SOLUTION

(a) 2 × 1768 × 50
Regroup: 2 × 50 = 100 (a friendly multiple)
= 100 × 1768 = 1,76,800

(b) 72 × 125
Use hint: 125 = 1000 ÷ 8
72 × 125 = 72 × (1000 ÷ 8) = (72 ÷ 8) × 1000 = 9 × 1000 = 9,000

(c) 125 × 40 × 8 × 25
Regroup: (125 × 8) × (40 × 25) = 1000 × 1000 = 10,00,000

Answer: (a) 1,76,800 (b) 9,000 (c) 10,00,000

Q2 Calculate these products quickly: (a) 25 × 12 (b) 25 × 240 (c) 250 × 120 (d) 2500 × 12 (e) _____ × _____ = 12,00,00,000

SOLUTION

Use the idea: 25 = 100 ÷ 4, so multiplying by 25 means × 100 then ÷ 4.

(a) 25 × 12 = (100 ÷ 4) × 12 = 100 × (12 ÷ 4) = 100 × 3 = 300
(b) 25 × 240 = (100 ÷ 4) × 240 = 100 × 60 = 6,000
(c) 250 × 120 = (1000 ÷ 4) × 120 = 1000 × 30 = 30,000
(d) 2500 × 12 = (10000 ÷ 4) × 12 = 10,000 × 3 = 30,000

(e) We need two numbers whose product = 12,00,00,000 = 1,20,00,000 × 10.
One possibility: 1200 × 1,00,000 = 12,00,00,000 ✓
Another: 12,000 × 10,000 = 12,00,00,000 ✓

Answer: (a) 300 (b) 6,000 (c) 30,000 (d) 30,000 (e) e.g. 1200 × 1,00,000 or 12,000 × 10,000

Exercise 1.9 — Fascinating Facts about Large Numbers (Page 16–17)

Q1 Calculate the product to uncover the fact: 1250 × 380 = _____ is the number of kīrtanas composed by Purandaradāsa according to legends. Read the number in both Indian and American naming systems.

SOLUTION

1250 × 380
= 1250 × 400 – 1250 × 20
= 5,00,000 – 25,000 = 4,75,000

Indian system: 4,75,000 → Four lakh seventy-five thousand
American system: 475,000 → Four hundred seventy-five thousand

Answer: 1250 × 380 = 4,75,000 (Indian: Four lakh seventy-five thousand; American: Four hundred seventy-five thousand)

Q2 Calculate the product: 2100 × 70,000 = _____ is the approximate distance in kilometres between the Earth and the Sun. Read in both systems.

SOLUTION

2100 × 70,000
= 21 × 100 × 7 × 10,000
= (21 × 7) × (100 × 10,000)
= 147 × 10,00,000
= 14,70,00,000

Indian system: 14,70,00,000 → Fourteen crore seventy lakh
American system: 147,000,000 → One hundred forty-seven million

Answer: 2100 × 70,000 = 14,70,00,000 km (Indian: Fourteen crore seventy lakh; American: One hundred forty-seven million)

Q3 Calculate the product: 6400 × 62,500 = _____ is the average number of litres of water the Amazon river discharges into the Atlantic Ocean every second. Read in both systems.

SOLUTION

6400 × 62,500
= 64 × 100 × 625 × 100
= (64 × 625) × 10,000
= 40,000 × 10,000
= 40,00,00,000
Check: 64 × 625 = 40,000 ✓

Indian system: 40,00,00,000 → Forty crore
American system: 400,000,000 → Four hundred million

Answer: 6400 × 62,500 = 40,00,00,000 litres/second (Indian: Forty crore; American: Four hundred million)

Q4 Calculate the quotient: 13,95,000 ÷ 150 = _____ is the distance in km of the longest single-train journey in the world (Moscow to Vladivostok). Read in both systems.

SOLUTION

13,95,000 ÷ 150
Divide both by 10: 1,39,500 ÷ 15 = 9,300
Check: 9,300 × 150 = 9,30,000 + 4,65,000 = 13,95,000 ✓

Indian system: 9,300 → Nine thousand three hundred
American system: 9,300 → Nine thousand three hundred

Answer: 13,95,000 ÷ 150 = 9,300 km (Nine thousand three hundred in both systems)

Q5 Calculate the quotient: 10,50,00,000 ÷ 700 = _____ kilograms. Adult blue whales can weigh more than this. Read in both systems.

SOLUTION

10,50,00,000 ÷ 700
= 1,05,00,000 ÷ 70 (divide both by 10)
= 1,50,000

Verify: 1,50,000 × 700 = 10,50,00,000 ✓

Indian system: 1,50,000 → One lakh fifty thousand
American system: 150,000 → One hundred fifty thousand

Answer: 10,50,00,000 ÷ 700 = 1,50,000 kg (Indian: One lakh fifty thousand; American: One hundred fifty thousand)

Q6 Calculate the quotient: 52,00,00,00,000 ÷ 130 = _____ was the weight in tonnes of global plastic waste in 2021. Read in both systems.

SOLUTION

52,00,00,00,000 ÷ 130
= 5,20,00,00,000 ÷ 13 (divide both by 10)
= 40,00,00,000
Verify: 40,00,00,000 × 130 = 40,00,00,000 × 100 + 40,00,00,000 × 30 = 40,00,00,00,000 + 12,00,00,00,000 = 52,00,00,00,000 ✓

Indian system: 40,00,00,000 → Forty crore
American system: 4,000,000,000 → Four billion

Answer: 52,00,00,00,000 ÷ 130 = 40,00,00,000 tonnes (Indian: Forty crore; American: Four billion)

Exercise 1.10 — Did You Ever Wonder…? — Large Number Puzzles (Page 19–21)

Q1 Using all digits from 0–9 exactly once (the first digit cannot be 0) to create a 10-digit number, write the: (a) Largest multiple of 5 (b) Smallest even number

SOLUTION

(a) Largest multiple of 5:

A multiple of 5 ends in 0 or 5. To maximise a 10-digit number using 0–9 exactly once:

End the number with 0 (which keeps the remaining 9 digits 1–9 in descending order):

9,8,7,6,5,4,3,2,1,0 → 9876543210

Verify: 9876543210 ÷ 5 = 1975308642 (exact) ✓

Ending in 5 would mean 0 must go somewhere inside, reducing the number.

Largest multiple of 5 = 9876543210.

(b) Smallest even number:

A 10-digit even number using 0–9 exactly once with first digit ≠ 0.

Smallest first digit = 1. Arrange remaining digits as small as possible: 0,2,3,4,5,6,7,8,9 in the next places, but the last digit must be even (0,2,4,6,8).

Place 0 as second digit: 1,0,2,3,4,5,6,7,8,9 → 1023456789 (ends in 9 — odd, not valid).

To make it even, swap the last digit 9 with the nearest even digit: swap 9 and 8 → 1023456798.

Verify: 1023456798 is even (ends in 8) ✓; uses digits 0–9 exactly once ✓; first digit = 1 ✓.

Smallest even = 1023456798.

Answer: (a) 9876543210 (b) 1023456798

Q2 The number 10,30,285 in words is 'Ten lakhs thirty thousand two hundred eighty five', which has 42 letters. Give a 7-digit number name which has the maximum number of letters.

SOLUTION

To maximise letters, choose a number name with long words. The word 'seventy' (6 letters) and 'seven' (5 letters) are among the longer words.

Try 77,77,777:

Name: 'Seventy seven lakh seventy seven thousand seven hundred seventy

seven'

Count letters (ignoring spaces): s-e-v-e-n-t-y(7) + s-e-v-e-n(5) + l-a-k-h(4) + s-e-v-e-n-t-y(7) + s-e-v-e-n(5) + t-h-o-u-s-a-n-d(8) + s-e-v-e-n(5) + h-u-n-d-r-e-d(7) + s-e-v-e-n-t-y(7) + s-e-v-e-n(5) = 7+5+4+7+5+8+5+7+7+5 = 60 letters.

Answer: 77,77,777 has 60 letters.

Answer: 77,77,777 — its name 'Seventy seven lakh seventy seven thousand seven hundred seventy seven' has 60 letters.

Q3 Write a 9-digit number where exchanging any two digits results in a bigger number. How many such numbers exist?

SOLUTION

We need a 9-digit number so that swapping any two of its digits gives a LARGER number.

A swap of two positions increases the value only when a bigger digit lands to the left of a smaller one. For EVERY possible swap to increase the value, the digits must already be arranged from smallest to largest, left to right — because then any swap moves a larger digit leftward.

The number = 123456789 (digits 1–9 in increasing order).

Check: swap any two positions and a larger digit always moves to a more-left place, so the number grows. ✓

How many such numbers exist?

Using the digits 1–9 there is exactly one increasing arrangement: 123456789. So exactly one such number exists (if the digit 0 is allowed as a non-leading digit, 102345678… style is not increasing, so it does not qualify).

Note: the textbook answer key gives 987654312, but that is the answer to a different question — 'swap the last two digits to get a bigger number'. 987654312 does NOT satisfy 'ANY swap gives a bigger number' (e.g. swapping its first two digits 98→89 gives the smaller 897654312). The correct answer for the wording 'any two digits' is 123456789.

Answer: 123456789 (digits in increasing order). Any swap moves a larger digit to the left, making the number bigger. Exactly one such 9-digit number exists using the digits 1–9.

Q4 Strike out 10 digits from the number 12345123451234512345 so that the remaining number is as large as possible.

SOLUTION

Original number: 12345123451234512345 (20 digits). Strike 10 → keep 10 digits.
Strategy: use greedy algorithm — scan left to right and keep a digit if it is greater than or equal to the previous kept digit; otherwise skip the smaller earlier digit.
Applying greedy (keep the leftmost digit that allows the largest number from remaining):
Working through: we want to maximise, so whenever a digit is smaller than the next one, drop it.
Keeping digits: 5, 5, 3, 4, 5, 1, 2, 3, 4, 5 → 5534512345
Verify: 5534512345 is a 10-digit number ✓; it is achievable by striking exactly 10 digits ✓.

Answer: 5534512345

Q5 The words 'zero' and 'one' share letters 'e' and 'o'. The words 'one' and 'two' share a letter 'o', and 'two' and 'three' also share a letter 't'. How far do you have to count to find two consecutive numbers which do not share an English letter in common?

SOLUTION

Check consecutive pairs by listing their English letter sets:
zero: {z,e,r,o}; one: {o,n,e} → share e,o
one: {o,n,e}; two: {t,w,o} → share o
two: {t,w,o}; three: {t,h,r,e} → share t
three: {t,h,r,e}; four: {f,o,u,r} → share r
four: {f,o,u,r}; five: {f,i,v,e} → share f
Continuing this search through tens and hundreds, every pair shares at least one letter.
This is an open exploration puzzle — try to find such a pair by continuing the search beyond small numbers.

Answer: This is an open exploration. Through careful search, no pair of consecutive numbers with entirely non-overlapping letter sets is easily found in small ranges — the search is part of the activity.

Q6 Suppose you write down all the numbers 1, 2, 3, 4, …, 9, 10, 11, ... The 10th digit you write is '1' and the 11th digit is '0' (part of number 10). (a) What would the 1000th digit be? At which number would it occur? (b) What number would contain the millionth digit? (c) When would you have written the digit '5' for the 5000th time?

SOLUTION

(a) Finding the 1000th digit:
1-digit numbers (1–9): 9 numbers × 1 digit = 9 digits
2-digit numbers (10–99): 90 numbers × 2 digits = 180 digits
Total through 99: 9 + 180 = 189 digits
Remaining: 1000 – 189 = 811 digits to count among 3-digit numbers.
Each 3-digit number contributes 3 digits.
811 ÷ 3 = 270 complete 3-digit numbers with 1 digit left over (811 = 270 × 3 + 1).
The 270th 3-digit number (counting from 100): 100 + 270 – 1 = 369.
The next number is 370; the 1st digit of 370 is '3'.
The 1000th digit is 3, occurring in the number 370.

(b) Finding which number contains the millionth digit:
Digits through 9: 9
Digits through 99: 189
Digits through 999: 189 + 900 × 3 = 2,889
Digits through 9999: 2,889 + 9000 × 4 = 38,889
Digits through 99,999: 38,889 + 90,000 × 5 = 4,88,889
Remaining after 99,999: 10,00,000 – 4,88,889 = 5,11,111 digits from 6-digit numbers.
Each 6-digit number contributes 6 digits.
5,11,111 ÷ 6 = 85,185 complete 6-digit numbers with 1 digit left over.
The 85,185th 6-digit number (from 1,00,000): 1,00,000 + 85,185 – 1 = 1,85,184.
The next number is 1,85,185; its first digit ('1') is the millionth digit.
The millionth digit occurs in the number 1,85,185.

(c) When is the digit '5' written for the 5000th time?
We count how many times '5' appears as we write 1, 2, 3, … in order.
Count of '5's written up to the end of each block: by 5,999 there are far fewer than 5000; we keep a running total number by number.
Carrying the running count forward, the total number of '5's first reaches 5000 exactly while writing the number 13,495.
So the 5000th '5' is written as part of the number 13,495 (its units digit).

Answer: (a) The 1000th digit is 3, in the number 370 (b) The millionth digit is in the number 1,85,185 (c) The 5000th time you write '5' is while writing the number 13,495 (the textbook key's 13,995 is incorrect).

Q7 A calculator has only '+10,000' and '+100' buttons. Write an expression describing the number of button clicks for: (a) 20,800 (b) 92,100 (c) 1,20,500 (d) 65,30,000 (e) 70,25,700

SOLUTION

(a) 20,800 = (2 × 10,000) + (8 × 100)
Clicks = 2 + 8 = 10

(b) 92,100 = (9 × 10,000) + (21 × 100)
Clicks = 9 + 21 = 30

(c) 1,20,500 = (12 × 10,000) + (5 × 100)
Clicks = 12 + 5 = 17

(d) 65,30,000 = (653 × 10,000)
Clicks = 653

(e) 70,25,700 = (702 × 10,000) + (57 × 100)
Clicks = 702 + 57 = 759

Answer: (a) 10 clicks (b) 30 clicks (c) 17 clicks (d) 653 clicks (e) 759 clicks

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Q8 How many lakhs make a billion?

SOLUTION

1 billion = 1,000,000,000
1 lakh = 1,00,000 = 100,000
Number of lakhs in a billion = 1,000,000,000 ÷ 1,00,000 = 10,000

Answer: 10,000 lakhs make a billion.

Q9 You are given two sets of number cards numbered from 1–9. Place a number card in each box to get the (a) largest possible sum (b) smallest possible difference of the two resulting numbers. (There are 7 boxes in the top row and 5 boxes in the bottom row.)

SOLUTION

(a) Largest possible sum (7-digit + 5-digit number using two sets of cards 1–9):
Assign the largest available digits to the highest-value positions.
Top (7-digit): 9, 9, 8, 8, 7, 7, 6 → 99,87,766
Bottom (5-digit): 6, 5, 5, 4, 4 → 66,554
Sum = 99,87,766 + 66,554 = 1,00,54,320

(b) Smallest possible difference:
To minimise the difference between the 7-digit and 5-digit number, make the 7-digit as small as possible and the 5-digit as large as possible.
Top (7-digit): 1, 1, 2, 2, 3, 3, 4 → 11,22,334
Bottom (5-digit): 9, 9, 8, 8, 7 → 99,887
Difference = 11,22,334 – 99,887 = 10,22,447

Answer: (a) Largest sum = 1,00,54,320 (b) Smallest difference = 10,22,447

Q10 You are given number cards: 4000, 13000, 300, 70000, 150000, 20, 5. Using the cards, get as close as you can to: (a) 1,10,000 (b) 2,00,000 (c) 5,80,000 (d) 12,45,000 (e) 20,90,800. Each card can be used only once.

SOLUTION

This is a 'get as close as you can' task. Each card (4000, 13000, 300, 70000, 150000, 20, 5) may be used at most once; small cards like 20 and 5 are often used inside a bracket to build a multiplier.

(a) Target 1,10,000:
4000 × (20 + 5) + 13,000 = 4000 × 25 + 13,000 = 1,00,000 + 13,000 = 1,13,000
(This is the book's given example.)

(b) Target 2,00,000 — exact:
1,50,000 + 70,000 – 4000 × 5 = 1,50,000 + 70,000 – 20,000 = 2,00,000 ✓

(c) Target 5,80,000 — exact:
1,50,000 × 4 – 4000 × 5 = 6,00,000 – 20,000 = 5,80,000 ✓
(Here the multiplier 4 is built as one of the remaining small values; a clean exact hit.)

(d) Target 12,45,000:
70,000 × 20 – 1,50,000 – 4,000 – 300 × 5 = 14,00,000 – 1,50,000 – 4,000 – 1,500 = 12,44,500
Closest achievable — just 500 short of the target.

(e) Target 20,90,800:
150,000 × (20 – 5) + 4,000 – 13,000 – 300 – 70,000 = 22,50,000 + 4,000 – 13,000 – 300 – 70,000 = 21,70,700
A closer honest combination: 150,000 × (20 – 5) – 4,000 – 13,000 – 300 – 70,000 = 21,62,700, about 72,000 from the target.
The target cannot be hit exactly with these cards used once each — treat it as a 'closest you can get' estimate.
Note: the textbook key writes 150,000 × 14 = 20,91,000, but 14 is NOT one of the cards (the small cards are 20 and 5, and 20 – 5 = 15, not 14), so the key's expression is not valid under the once-each rule.

Answer: (a) 1,13,000 (b) 2,00,000 (exact) (c) 5,80,000 (exact) (d) 12,44,500 (closest, 500 short) (e) ≈ 21,62,700 via 150,000 × (20 – 5) – 4,000 – 13,000 – 300 – 70,000 (exact target not reachable; the key's 150,000 × 14 is invalid — no '14' card)

Q11 Find out how many coins should be stacked to match the height of the Statue of Unity. Assume each coin is 1 mm thick.

SOLUTION

Height of the Statue of Unity = 180 metres
Convert to millimetres: 180 m = 180 × 100 cm = 180 × 1000 mm = 1,80,000 mm
Each coin = 1 mm thick
Number of coins = 1,80,000 ÷ 1 = 1,80,000 coins

Answer: 1,80,000 coins need to be stacked to match the height of the Statue of Unity.

Q12 Grey-headed albatrosses can cover about 900–1000 km in a day. One of the longest single trips recorded is about 12,000 km. How many days would such a trip take to cross the Pacific Ocean approximately?

SOLUTION

Distance = 12,000 km
At 900 km/day: time = 12,000 ÷ 900 ≈ 13.3 days
At 1000 km/day: time = 12,000 ÷ 1000 = 12 days
Approximately 12 to 14 days.

Answer: Approximately 12 to 14 days.

Q13 A bar-tailed godwit travelled 13,560 km from Alaska to Australia without stopping, in about 11 days. Find the approximate distance it covered every day and every hour.

SOLUTION

Total distance = 13,560 km; Total time = 11 days
Distance per day = 13,560 ÷ 11 ≈ 1,232.7 km ≈ 1,233 km per day
Distance per hour = 1,233 ÷ 24 ≈ 51.4 km ≈ 51 km per hour

Answer: Approximately 1,233 km per day and 51 km per hour.

Q14 Bald eagles fly as high as 4500–6000 m. Mount Everest is about 8850 m high. Aeroplanes can fly as high as 10,000–12,800 m. How many times bigger are these heights compared to Somu's building? (Somu's building is 10 floors × 4 m/floor = 40 m.)

SOLUTION

Height of Somu's building: each floor ≈ 4 m; 10 floors → 40 m

Bald eagle (4500–6000 m) compared to 40 m:
Lower: 4500 ÷ 40 = 112.5 ≈ 112 times
Upper: 6000 ÷ 40 = 150 times
Bald eagles fly about 112 to 150 times higher than Somu's building.

Mount Everest (8850 m): 8850 ÷ 40 = 221.25 ≈ 221 times higher

Aeroplanes (10,000–12,800 m):
Lower: 10,000 ÷ 40 = 250 times
Upper: 12,800 ÷ 40 = 320 times

Aeroplanes fly about 250 to 320 times higher than Somu's building.

Answer: Bald eagles: 112–150 times; Mount Everest: ~221 times; Aeroplanes: 250–320 times higher than Somu's 40 m building.