Grade 4 Unit 1 test: Place value to a million and rounding (answer key)

12 questions, 39 points

ANSWERS AT A GLANCE

1. (a) 69 (b) LXX
2. (a) 400,000 + 70,000 + 300 + 8 (b) four hundred seventy thousand, three hundred eight (c) the hundred thousands place
3. (a) Mill Bridge 1909, Oak Bridge 1994, Stone Bridge 1894 (b) Stone Bridge, Mill Bridge, Oak Bridge
4. (a) 3,915 stacks (b) 392,500 trays
5. (a) Malik (b) Ben's ones period has only two digits; Zoe dropped a zero from the thousands period.
6. (a) Rounding up must give a number greater than 297,220, but 200,000 is less; Sofia forgot to trade the ten for one more hundred thousand. (b) 297,220 ≈ 300,000.
7. No. A number that rounds to 13,800 to the nearest hundred is from 13,750 to 13,849, and every one of those rounds to 14,000 to the nearest thousand, not 13,000.
8. (a) Aquarium 27 votes, science center 17 votes. (b) 18 votes: 3 bundles of five and 3 single marks.
9. (a) XXXVIII = 38 and XLII = 42. (b) 42 is more than 38, so page XLII comes later. Each Roman symbol has its own value, and one big symbol such as L can stand for as much as many small ones, so more symbols does not mean a bigger number.
10. (a) 917,530 (b) 105,379
11. (a) Both round to 150,000. (b) 148,620 ≈ 100,000 and 151,380 ≈ 200,000. (c) The two numbers are the same to the nearest ten thousand but different to the nearest hundred thousand, because the halfway mark 150,000 for hundred thousands falls between them.
12. Least 25,000; greatest 25,499.

WORKED SOLUTIONS

1. In a storybook kingdom there have been many queens named Isabel. They are told apart by Roman numerals. The newest one is Queen Isabel LXIX. (2 points)

(a) Which Queen Isabel is she? Write her number in our digits.

(b) The next queen named Isabel will get the next number. Write that number in Roman numerals.

ANSWER

(a) 69 (b) LXX

SOLUTION

(a) Look for a smaller symbol just before a larger one, then add the parts:
LXIX = LX + IX = 60 + 9 = 69. She is the 69th Queen Isabel.

(b) The next queen is number 69 + 1 = 70. Write it by places: 70 is 7 tens and 0 ones. Seven tens are LXX, and the ones write nothing. She will be Queen Isabel LXX.

SCORING

1 point for (a) 69; 1 point for (b) LXX.

2. A baseball stadium's attendance for the whole season was 470,308. (3 points)

(a) Write the number in expanded form.

(b) Write the number in word form.

(c) In which place would a 3 be worth 1,000 times as much as the 3 in this number?

ANSWER

(a) 400,000 + 70,000 + 300 + 8 (b) four hundred seventy thousand, three hundred eight (c) the hundred thousands place

SOLUTION

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(a) The places from the right hold 8 ones, 0 tens, 3 hundreds, 0 thousands, 7 ten thousands, 4 hundred thousands. The zeros add no term: 400,000 + 70,000 + 300 + 8.

(b) The thousands period is 470, four hundred seventy; the ones period is 308, three hundred eight. So four hundred seventy thousand, three hundred eight.

(c) The 3 is in the hundreds place, so it is worth 300. Each step to the left is ten times as much: 300, then 3,000, then 30,000, then 300,000. Three steps make 10 × 10 × 10 = 1,000 times as much, and three places to the left of the hundreds place is the hundred thousands place. Check: a 3 there is worth 300,000, and 300,000 is 1,000 times 300.

SCORING

1 point for each part. (a) must leave out the zero places or show them as 0; (b) must not use "and"; (c) needs the hundred thousands place.

3. Three old bridges cross the river in Priya's town. Each bridge has a plaque that shows the year it was built.

Mill Bridge: MCMIX

Oak Bridge: MCMXCIV

Stone Bridge: MDCCCXCIV (4 points)

(a) Write each year in our digits.

(b) List the three bridges from oldest to newest.

ANSWER

(a) Mill Bridge 1909, Oak Bridge 1994, Stone Bridge 1894 (b) Stone Bridge, Mill Bridge, Oak Bridge

SOLUTION

(a) Split each numeral into its place parts, watching for a smaller symbol just before a larger one.

Mill Bridge: MCMIX = M + CM + IX = 1,000 + 900 + 9 = 1909.

Oak Bridge: MCMXCIV = M + CM + XC + IV = 1,000 + 900 + 90 + 4 = 1994.

Stone Bridge: MDCCCXCIV = M + DCCC + XC + IV = 1,000 + 800 + 90 + 4 = 1894.

(b) All three years have 1 thousand. Stone Bridge has 8 hundreds and the other two have 9, so Stone Bridge is the oldest. In the tens place, Mill Bridge has a 0 and Oak Bridge has a 9, so Mill Bridge is older than Oak Bridge. From oldest to newest: Stone Bridge (1894), Mill Bridge (1909), Oak Bridge (1994).

SCORING

1 point for each correct year: Mill Bridge 1909, Oak Bridge 1994, Stone Bridge 1894 (3 points); 1 point for the order Stone Bridge, Mill Bridge, Oak Bridge (follow through from the student's own years).

4. A school district serves lunch on trays that come in stacks of 100. This year its kitchens used 391,500 trays, all in full stacks. (3 points)

(a) How many stacks of 100 trays is that? Explain how the places of 391,500 show it.

(b) Suppose the kitchens had used 10 more stacks. How many trays would that have been in all?

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ANSWER

(a) 3,915 stacks (b) 392,500 trays

SOLUTION

(a) Each stack is one hundred, so count the hundreds in 391,500. Its tens and ones are 0. Each place is ten times the place to its right, so a thousand is 10 hundreds, a ten thousand is 100 hundreds and a hundred thousand is 1,000 hundreds. The digits from the hundred thousands place down to the hundreds place, read together, count hundreds: 3,915 hundreds. That is 3,915 stacks.

(b) Ten stacks are 10 hundreds, which is one thousand trays. Adding one thousand raises the thousands digit from 1 to 2: 392,500 trays.

SCORING

(a) 2 points: 1 for 3,915 stacks, 1 for explaining that the digits down to the hundreds place count hundreds (or that each thousand is ten hundreds). (b) 1 point for 392,500.

5. A newspaper says that four hundred thousand, sixty people came to a summer concert series. Three students write the number in standard form.

Ben writes 400, 60. Zoe writes 40,060. Malik writes 400,060. (3 points)

(a) Who is right?

(b) Explain the mistake each of the other two students made.

ANSWER

(a) Malik (b) Ben's ones period has only two digits; Zoe dropped a zero from the thousands period.

SOLUTION

(a) The thousands period is four hundred, 400. The ones period is sixty, which must fill three places: 060. So the number is 400,060, and Malik is right.

(b) Ben wrote sixty as 60 after the comma. Every period after the first must have exactly three digits, so sixty needs a 0 in the hundreds place: 060. Without it the comma sits in the wrong spot.

Zoe wrote the thousands period as 40, which is forty thousand, not four hundred thousand. She left out a zero, so her 4 slid from the hundred thousands place into the ten thousands place. Her number, 40,060, is forty thousand, sixty.

SCORING

1 point for Malik. 1 point for Ben's mistake (the ones period needs three digits). 1 point for Zoe's mistake (a missing zero moves the 4 to the ten thousands place).

6. Sofia rounds 297,220 to the nearest ten thousand. The thousands digit is 7, so Sofia knows the number rounds up. Sofia changes the ten thousands digit from 9 to 0, puts zeros after it, and writes 200,000. (3 points)

(a) Explain why 200,000 cannot be right.

(b) What is the correct rounding?

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ANSWER

(a) Rounding up must give a number greater than 297,220, but 200,000 is less; Sofia forgot to trade the ten for one more hundred thousand. (b) 297,220 ≈ 300,000.

SOLUTION

(a) Rounding up gives the upper neighbor, which is greater than the number itself. But 200,000 is less than 297,220, so it cannot be the result of rounding up. The mistake: 9 ten thousands plus one more is ten ten thousands, which is one hundred thousand. The ten thousands digit does become 0, but the hundred thousands digit must go up from 2 to 3.

(b) The neighbors are 290,000 and 300,000, and the thousands digit 7 puts the number past the halfway mark, so

$$297{,}220 \approx 300{,}000$$

SCORING

1 point for explaining that rounding up cannot give a smaller number (or that the neighbors are 290,000 and 300,000, and 200,000 is neither); 1 point for naming the missing trade into the hundred thousands; 1 point for 300,000.

7. Samir runs a bookshop. He says, "Last year we sold about 13,800 books, to the nearest hundred. To the nearest thousand, that is about 13,000 books." Can both roundings be right? Explain how you know. (3 points)

ANSWER

No. A number that rounds to 13,800 to the nearest hundred is from 13,750 to 13,849, and every one of those rounds to 14,000 to the nearest thousand, not 13,000.

SOLUTION

To the nearest hundred, 13,800 is fenced in by two halfway marks, 13,750 and 13,850. So the real number of books is somewhere from 13,750 to 13,849.

Every one of those numbers has hundreds digit 7 or 8. To the nearest thousand that is the deciding digit, and it is 5 or more, so each one rounds up to 14,000.

So the books sold rounds to 14,000 to the nearest thousand, never 13,000. Both roundings cannot be right.

SCORING

1 point for the range 13,750 to 13,849 (or for noting the hundreds digit must be 7 or 8); 1 point for showing these round to 14,000 to the nearest thousand; 1 point for the answer no.

8. The 62 fourth graders at Omar's school vote on a field trip. Each student votes once. Omar keeps a tally of the votes for each place.

The aquarium tally has 5 bundles of five and 2 single marks. The science center tally has 3 bundles of five and 2 single marks. All the other votes are for the apple orchard. (3 points)

(a) How many votes did the aquarium get? How many did the science center get?

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(b) How many votes did the apple orchard get? Describe its tally: how many bundles of five and how many single marks?

ANSWER

(a) Aquarium 27 votes, science center 17 votes. (b) 18 votes: 3 bundles of five and 3 single marks.

SOLUTION

(a) Count the bundles by fives, then the single marks by ones.

Aquarium: 5 × 5 + 2 = 25 + 2 = 27 votes.

Science center: 3 × 5 + 2 = 15 + 2 = 17 votes.

(b) The aquarium and the science center got 27 + 17 = 44 votes together. Every student voted once, so the orchard got 62 − 44 = 18 votes.

Split 18 into fives: 18 = 3 × 5 + 3. The orchard tally has 3 bundles of five and 3 single marks.

SCORING

1 point for (a), both 27 and 17; 1 point for 18 orchard votes; 1 point for 3 bundles of five and 3 single marks.

9. The preface of a thick old atlas has its pages numbered in Roman numerals. Isaac looks at two of its pages: page XXXVIII and page XLII. (3 points)

(a) Write both page numbers in our digits.

(b) Isaac says page XXXVIII must come later in the book, because its numeral has more symbols. Explain why he is wrong.

ANSWER

(a) XXXVIII = 38 and XLII = 42. (b) 42 is more than 38, so page XLII comes later. Each Roman symbol has its own value, and one big symbol such as L can stand for as much as many small ones, so more symbols does not mean a bigger number.

SOLUTION

(a) In XXXVIII every symbol is added: 10 + 10 + 10 + 5 + 1 + 1 + 1 = 38.

In XLII, X comes just before the larger L, so they form the pair XL = 50 − 10 = 40. Then XLII = 40 + 1 + 1 = 42.

(b) 42 is more than 38, so page XLII comes after page XXXVIII. Counting symbols does not tell which number is bigger, because each Roman symbol has its own value wherever it sits. L alone is worth 50, so XLII reaches 42 with only 4 symbols, while XXXVIII needs 7 small symbols to reach 38.

SCORING

1 point for 38; 1 point for 42; 1 point for saying page XLII comes later with a reason that a symbol's value, not the number of symbols, decides the size (for example, L alone is worth 50).

10. The fourth grade sells raffle tickets at the spring fair. Every ticket number is a six-digit number that uses each of the digits 0, 1, 3, 5, 7 and 9 exactly once. (4 points)

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(a) The first prize goes to the greatest ticket number in which the 1 is worth 10,000. What is that ticket number?

(b) The second prize goes to the least ticket number in which the 5 is worth 5,000. What is that ticket number?

ANSWER

(a) 917,530 (b) 105,379

SOLUTION

(a) For the 1 to be worth 10,000 it must be in the ten thousands place. The leftmost place is worth the most, so it gets the largest digit left, 9. The other digits fill the places that are left, largest first: 7, 5, 3, 0. The number is 917,530.

(b) For the 5 to be worth 5,000 it must be in the thousands place. For the least number, the hundred thousands place gets the smallest digit that can lead. The 0 cannot go first, or the number would have only five digits, so 1 goes first. Then the smallest digit left, 0, goes in the ten thousands place. After the 5 come 3, 7, 9. The number is 105,379.

SCORING

2 points for each part: 1 for putting the named digit in the place that gives it that value, 1 for placing the other digits correctly (in (b), 1 first and not 0).

11. (4 points)

(a) Round 148,620 and 151,380 to the nearest ten thousand.

(b) Round 148,620 and 151,380 to the nearest hundred thousand.

(c) Owen says, "If two numbers round to the same number at one place, they must round to the same number at a bigger place too, because the bigger place drops even more digits." Use your answers to explain why Owen is wrong.

ANSWER

(a) Both round to 150,000. (b) 148,620 ≈ 100,000 and 151,380 ≈ 200,000. (c) The two numbers are the same to the nearest ten thousand but different to the nearest hundred thousand, because the halfway mark 150,000 for hundred thousands falls between them.

SOLUTION

(a) For 148,620 the thousands digit is 8, so it rounds up to 150,000. For 151,380 the thousands digit is 1, so it rounds down to 150,000.

(b) Both numbers have neighbors 100,000 and 200,000, with halfway mark 150,000. For 148,620 the ten thousands digit is 4, so it rounds down to 100,000. For 151,380 the ten thousands digit is 5, so it rounds up to 200,000.

(c) Parts (a) and (b) show two numbers that are the same to the nearest ten thousand and different to the nearest hundred thousand, so Owen is wrong. Each rounding starts from the number itself, not from a rounded number. The halfway mark 150,000 lies between 148,620 and 151,380, so to the nearest hundred thousand they go to different neighbors.

SCORING

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1 point for (a), both 150,000; 1 point for (b), 100,000 and 200,000; 2 points for (c): 1 for saying the answers are a counterexample, 1 for explaining that the halfway mark 150,000 lies between the two numbers (or that each rounding starts from the original number).

12. A whole number rounds to 25,000 to the nearest thousand and to 30,000 to the nearest ten thousand. What is the least the number could be, and what is the greatest? (4 points)

ANSWER

Least 25,000; greatest 25,499.

SOLUTION

To the nearest thousand, 25,000 is fenced in by the halfway marks 24,500 and 25,500. A halfway number rounds up, so the whole numbers that round to 25,000 are 24,500 to 25,499.

To the nearest ten thousand, 30,000 is fenced in by the halfway marks 25,000 and 35,000, so the whole numbers that round to 30,000 are 25,000 to 34,999.

The number must be in both lists. The first list ends at 25,499 and the second starts at 25,000, so the number is from 25,000 to 25,499. The least is 25,000 and the greatest is 25,499.

Check: 25,000 is exactly halfway between 20,000 and 30,000 and rounds up to 30,000, while 24,999 rounds down to 20,000. And 25,499 has hundreds digit 4, so it rounds to 25,000, while 25,500 rounds to 26,000.

SCORING

1 point for the numbers that round to 25,000 (24,500 to 25,499); 1 point for the numbers that round to 30,000 (25,000 to 34,999); 1 point for the least, 25,000; 1 point for the greatest, 25,499.

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