NVACS: Number and Operations Base Ten

Concept Overview for 3rd Graders

NBT. 1,2,3

Use place value understanding and properties of operations to perform multi-digit arithmetic using a range of strategies and algorithms. Grade 3 expectations in this domain are limited to whole numbers less than or equal to 1,000.

- Students use place value understanding to round whole numbers to the nearest 10 or 100.
- They fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.
- Students should multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.

Base Ten System Structure

The value of each place is 10 times the value of the place to the immediate right. Because of this, multiplying by 10 yields a product in which each digit of the multiplicand is shifted one place to the left.

Rounding

Students need to understand that when moving to the right across the places in a number (e.g., 456), the digits represent smaller units. When rounding to the nearest 10 or 100, the goal is to approximate the number by the closest number with no ones or no tens and ones (e.g., so 456 to the nearest ten is 460; and to the nearest hundred is 500). Rounding to the unit represented by the leftmost place is typically the sort of estimate that is easiest for students. Rounding to the unit represented by a place in the middle of a number may be more difficult for students (the surrounding digits are sometimes distracting). Rounding as an estimate helps students maintain their sense of reasonableness of their answers in computation.

Expanded Form

Students should have flexibility with the different number forms. Traditional expanded form is 285 = 200 + 8 + 5, but students should also know that 285 can be written as 28 tens and 5 ones or 1 hundred and 18 tens and 5 ones. This flexibility is linked to regrouping that is performed when adding and/or subtracting multi-digit numbers.

Concept Overview for 3rd Graders

Multiplying by multiples of 10

Some examples of how 3rd grade students might explain "15 tens is 150"

• Skip-counting by 50. 5 tens is 50, 100, 150.
• Counting on by 5 tens. 5 tens is 50, 5 more tens is 100, 5 more tens is 150.
Decomposing 15 tens:
- 15 tens is 10 tens and 5 tens.
- 10 tens is 100.
- 5 tens is 50.
- So 15 tens is 100 and 50, or 150.

• Decomposing 15.

$$\begin{aligned} 15 \times 10 &= (10 + 5) \times 10 \\ &= (10 \times 10) + (5 + 10) \\ &= 100 + 50 \\ &= 150 \end{aligned}$$

All of these explanations are correct. However, skip-counting and counting on become more difficult to use accurately as numbers become larger, e.g., in computing 5 90 or explaining why 45 tens is 450, and needs modification for products such as 4 x 90. The first does not indicate any place value understanding.

Addition and Subtraction Strategies and Algorithms

- **Breaking Apart (Place Value), also known as "Separating" or "Decomposing"**

  Break both numbers down to place value and add each, starting with the largest:

  46 + 25 =
  46 breaks into 40 plus 6 (40 + 6), 25 breaks into 20 plus 5 (20 + 5)
  40 + 20 = 60
  6 + 5 = 11
  60 + 11 = 71

$$\begin{array}{r} 40 + 6 \\ +\ \ 20 + 5 \\ \hline 60+11 = 71 \end{array}$$

Concept Overview for 3rd Graders

- **Compensation**

Round one or more of the numbers to numbers that are easier to work with, then compensate:

256 + 487
+13 (487 + 13) (13 is added to get an easier number to work with)
500

256 + 500 = 756

756 - 13 = (Here the student adjusts. Since 13 was added to 487, we now subtract 13 from 256)
756 - 10 = 746
746 - 3 = 743
So, 256 + 487 = 743

Subtraction using place value

Breaking numbers into their place values (moving towards the algorithm)

378 – 59

378 = 300 + 70 + 8 -59 = - 50 + 9	300 + 60 + 18 - 50 + 9	200 + 60 + 18 - 50 + 9 200 + 10 + 9 Answer: 219