## Vertical Progression:

| | |
|---|---|
| **3rd Grade** | **3.OA.B Understand properties of multiplication and the relationship between multiplication and division.**<br>   ○  **3.OA.B.5** Apply properties of operations as strategies to multiply and divide.<br>**3.OA.C Multiply and divide within 100.**<br>   ○  **3.OA.C.7** Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division**.**<br>**3.NBT.A Use place value understanding and properties of operations to perform multi-digit arithmetic.**<br>   ○  **3.NBT.A.2** 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.<br>   ○  **3.NBT.A.3** 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. |
| **4th Grade** | **4.NBT.B Use place value understanding and properties of operations to perform multi-digit arithmetic.**<br>   ○  **4.NBT.B.4** Fluently add and subtract multi-digit whole numbers using the standard algorithm.<br>   ○  **4.NBT.B.5** Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.<br>   ○  **4.NBT.B.6** Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. |
| **5th Grade** | **5.NBT.B Perform operations with multi-digit whole numbers and with decimals to hundredths.**<br>   ○  **5.NBT.B.5** Fluently multiply multi-digit whole numbers using the standard algorithm.<br>   ○  **5.NBT.B.6** Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.<br>   ○  **5.NBT.B.7** Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. |
| **6th Grade** | **6.NS.A Compute fluently with multi-digit numbers and find common factors and multiples.**<br>   ○  **6.NS.A.2** Fluently divide multi-digit numbers using the standard algorithm.<br>   ○  **6.NS.A.3** Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. |

## Students will demonstrate command of the ELG by:

- Multiplying multi-digit numbers fluently using the standard algorithm.
- Solving word problems using multiplication.
- Understanding the relationship between division and multiplication.
- Using multiplication to check division (inverse operations).
- Finding whole number quotients with multi-digit dividends and 2-digit divisors.
- Explaining strategies used to find quotients.
- Illustrating and explaining division by using equations, rectangular arrays, or area models.
- Using models, drawings, graph paper, and other strategies to add, subtract, multiply, and divide decimals.
- Communicating what strategy was used in the expression or equation and justifying why that strategy was appropriate.
- Reading numbers with decimal points.

## Vocabulary:

- algorithm
- area models
- equations
- factor

- multi-digit
- multiplication
- multiply
- products

- rectangular arrays
- whole number

## Sample Instructional/Assessment Tasks:

1) **Standard(s):** 5.NBT.5    https://www.illustrativemathematics.org/content-standards/5/NBT/B/5/tasks/1812

**Item Prompt:** 5.NBT Elmer's Multiplication Error

This is Elmer's work on a multiplication problem:



**a.** Use estimation to explain why Elmer's answer is not reasonable.
**b.** What error do you think Elmer made? Why do you think he made that error?
**c.** Find 179×64 using a correct version of Elmer's method. Then show another way of doing it to help Elmer see why your answer is correct.

**Solution**

**a.** 179 is greater than 100 and 64 is greater than 60, and 100×60=6,000. Since 179×64 is greater than 100×60, we can see that Elmer's answer of 1,790 is much too small.

**b.** The standard algorithm breaks 64×179 into 60×179+4×179. Elmer's work for 4×179 is correct (4×179=716). However, on the next line, he wrote 6×179 instead of 60×179. This is why his answer is much too small.

**c.** Here is the correct calculation using Elmer's method:

```
  45
  33
 179
x 64
 716
+10,740
11,456
```

Here is the answer using the partial products algorithm:

```
      179
    x  64
9 × 4 =      36
70 × 4 =    280
100 × 4 =   400
9 × 60 =    540
70 × 60 =  4200
100 × 60 = +6000
         11,456
```

Here is a rectangle with side lengths 100+70+9 and 60+4 that shows all of the partial products as the area of part of the rectangle:

|  | 100 | 70 | 9 |
|---|---|---|---|
| 60 | 60 x 100 = 6,000 | 60 x 70= 4,200 | 60 x 9 = 540 |
| 4 | 4 x 100= 400 | 4 x 70= 280 | 4 x 9 = 36 |

```
  6,000
  4,200
    540
    400
    280
+    36
 11,456
```

**2) 5.MD.A.1, 5.NBT.B. 6**

**Source:** Illustrative Mathematics
https://www.illustrativemathematics.org/content-standards/5/NBT/B/6/tasks/878

**Item Prompt:** What time was it 2011 minutes after the beginning of January 1, 2011?

**Solution:** So 2011 minutes after the beginning of 2011 it is January 2 and it is 9:31 AM.

**3) 5.NBT.7**

**Source:** Illustrative Mathematics
https://www.illustrativemathematics.org/content-standards/5/NBT/B/7/tasks/1293

**Item Prompt The Value of Education**

The table shows four people who earn the typical amount for their education level.

| Name | Level of Education | Weekly Income |
|---|---|---|
| Miley | High School Dropout | $440.50 |
| Niko | High School Graduate | $650.35 |
| Taylor | 2-Year College Graduate | $771.25 |
| Pinky | 4-Year College Graduate | $1,099.20 |

a. How much more does Niko earn than Miley in one week?
b. If Taylor and Miley both work for 2 weeks, how much more will Taylor earn?
c. How much money will Pinky earn in a month? About how long will Miley have to work to earn the same amount?

**Solution**

a. Niko makes $650.35 per week and Miley makes $440.50 per week. Niko makes $209.85 more per week than Miley.
b. Taylor will make $661.50 more than Miley in two weeks.
c. Pinky will make $4396.80 in a month. Miley will have to work about 10 weeks, or two and a half months, to earn the same amount that Pinky will make in one month. Students can also calculate a more exact answer to this question if they need some practice dividing decimals.