HPISD Grade 4 Mathematics

UNIT NAME	ESTIMATED DURATION	9 WEEKS			
UNIT 2: NUMBERS AND OPERATIONS/ALGEBRAIC REASONING: MULTIPLICATION AND DIVISION, PATTERNS AND EXPRESSIONS	5 WEEKS	1	2	3	4

Unit Overview

Connections between operations, the properties and patterns of multiplication and division, proficiency with the basic facts and the development of strategies to solve problems involving multiplication and division with multi-digit whole numbers.

Enduring Understandings

The student will understand that:	• A numeric or algebraic expression represents a quantity. • Proficiency with basic facts aids in estimation and computation with larger and smaller numbers. • Multiplication and division can be accomplished through the addition and subtraction of partial products.

Concepts

Operation Meanings and Relationships Properties Patterns Numbers Base Ten Number System	• The same number sentence (e.g. 12-4=8) can be associated with different concrete or real-world situations, different number sentences can be associated with the same concrete or real- world situation. • For a given set of numbers there are relationships that are always true, and these are the rules that govern arithmetic and algebra. • Relationships can be described and generalizations made for mathematical situations that have numbers or objects that repeat in predictable ways. • The set of real numbers is infinite, and each real number can be associated with a unique point on the number line. • The base ten numeration system is a scheme for recording numbers using digits 0-9 groups and place value.

Guiding/Essential Questions

1. When are algebraic and numeric expressions used?
2. How are real world problems identified that can be solved with multiplication and division?
3. What strategies aid in mastering multiplication and division facts?
4. How can multiples be used to solve problems?

Learning Targets	Learning Progressions
<u>Prerequisites:</u> • The student will multiply a two-digit number by one-digit number using mental math, properties, & partial products <u>Learning Targets:</u> • The student will use patterns in multiplication and division with strategies such as commutative, associative, and distributive properties, mental math and partial products along with standard algorithms,	• Estimate to determine reasonable results • Apply strategies to multiply a 2-digit number by a 1 digit number • Identify each multiplication property 1. Commutative property 4 x 3 = 3 x 4 (two numbers can be multiplied in any way to arrive at the same product) 2. Associative property 4 x (3 x 1) = (4 x 3) x 1 3. Distributive property 4 (3 x 1) = (4 x 3) + (4 x 1) • See Resources **

students will multiply up to a 4-digit number by a 1-digit number and 2-digit numbers by 2-digit numbers.

5th Grade Connection:

- The student will multiply with fluency a three-digit number by a two-digit number using the standard algorithm

---

Prerequisites:

- The student will determine the total number of objects when equally sized groups are combined or arranged in arrays
- The student will represent multiplication facts by using arrays, area models, strip diagrams, and equations

Learning Target:

- The student will model factors and products using arrays, area models and equations, including perfect squares up to 15 by 15

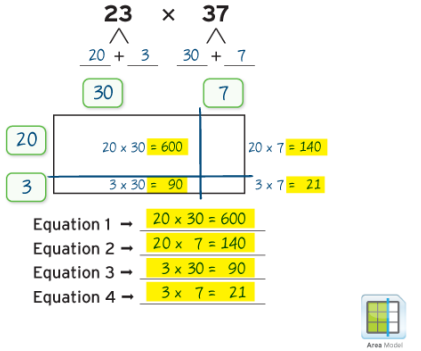
5th Grade Connection:

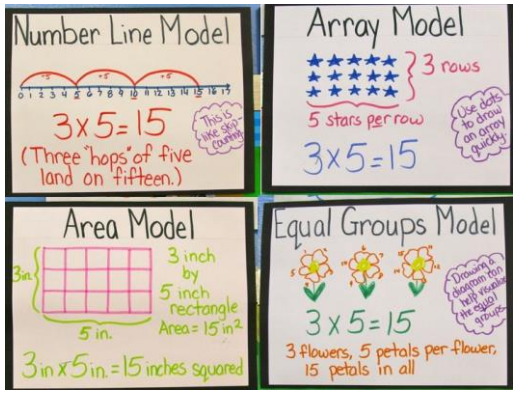
- The student will multiply with fluency a three-digit number by a two-digit number using the standard algorithm

---

- Define what a factor is and how factors are used to create products.
- Recognize what an array represents and use it to solve a multiplication problem
- Construct arrays based on the factors and products to model area
- Distinguish the difference between an area model and an array
- Show how an array or area model can be used to represent an equation

Partial Products / Area Models





Prerequisite:

- The student will understand the relationship between place value and numerical value

Learning Target:

- The student will use patterns to multiply by 10 and 100

5th Grade Connection:

- The student will multiply with fluency a three-digit number by a two-digit number using the standard algorithm

- Recognize place value patterns to find products when one factor is 10 or 100.
- Relate the number of zeros in a product to the location in a place value system.

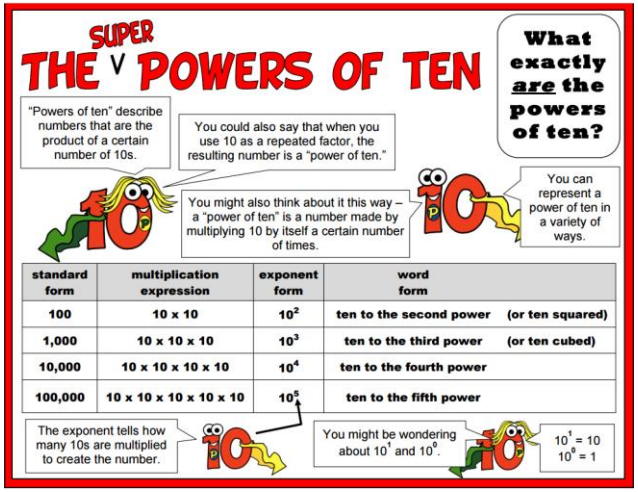
Example:

$$\begin{aligned} 36 \times 94 &= (30+6) \times (90+4) \\ &= (30+6) \times 90 + (30+6) \times 4 \\ &= 30 \times 90 + 6 \times 90 + 30 \times 4 + 6 \times 4. \end{aligned}$$

Patterns of 10 and 100

Example:

Multiplying by 104 is multiplying by 10 four times. Multiplying by 10 once shifts every digit of the multiplicand one place to the left in the product (the product is ten times as large) because in the base-ten system the value of each place is 10 times the value of the place to its right. So multiplying by 10 four times shifts every digit 4 places to the left.



Although this references exponents, you may teach children that when we look at multiples of 10, the pattern is that the number of zeros in the product will directly correlate to the factor of 10 or 100

Prerequisites:

- The student will determine a quotient using the relationship between multiplication and division

Learning Target:

- The student will find whole-number quotients and remainders using a variety of strategies.

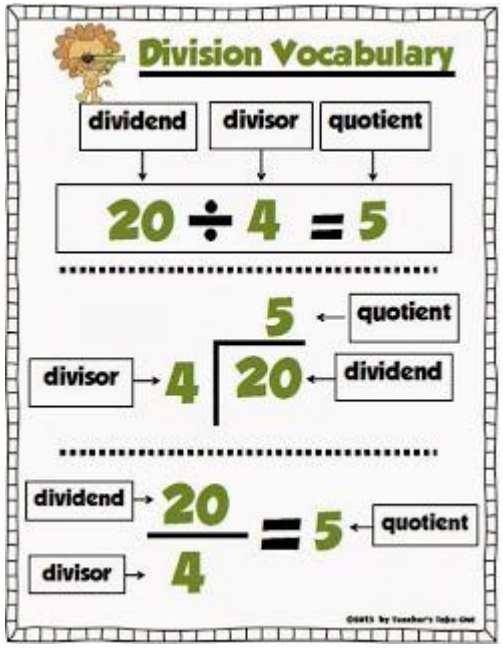
5th Grade Connection:

- The student will solve with proficiency for quotients of up to a four-digit dividend by a two-digit divisor using strategies and the standard algorithm

- Arrange a division equation in a variety of ways
- Label the different pieces to a division equation
- Define the purpose of each (quotient, divisor, dividend, remainder)
- Represent the quotient of up to a 3- digit number divided by a 1 digit number with NO remainders
- Identify the remainder in a division equation and that it represents the "leftover"

Example:
There are 592 students participating in Field Day. They are put into teams of 8 for the competition. How many teams get created?

Student 1	Student 2			Student 3
592 divided by 8 There are 70 8's in 560 592 - 560 = 32 There are 4 8's in 32 70 + 4 = 74	592 divided by 8 I know that 10 8's is 80 If I take out 50 8's that is 400 592 - 400 = 192 I can take out 20 more 8's which is 160 192 - 160 = 32 8 goes into 32 4 times I have none left I took out 50, then 20 more, then 4 more That's 74	592 -400 192 -160 32 -32 0	50 20 4 	I want to get to 592 8 x 25 = 200 8 x 25 = 200 8 x 25 = 200 200 + 200 + 200 = 600 600 - 8 = 592 I had 75 groups of 8 and took one away, so there are 74 teams



Prerequisites:

- Define what a variable is and how it is used in an equation

<table>
<tr><td>

- The students will determine the unknown whole number in a multiplication or division equation

Learning Targets:

- The students will represent problems using an input-output table and numerical expression to generate a number pattern

5th Grade Connections:

- The students will recognize the difference between additive and multiplicative numerical patterns given a table or graph

</td><td>

- Construct an input output table and use it to solve an equation

Complete the table.

Rule: multiply by 2

In	Out
0	
2	
3	6
4	

https://www.brainpop.com/math/algebra/equationswithvariables/preview.weml

</td></tr>
<tr><td>Formative Assessments</td><td>Summative Assessments</td></tr>
<tr><td></td><td></td></tr>
<tr><td>TEKS: Readiness Standards</td><td>TEKS: Supporting Standards</td></tr>
<tr><td>

- Solve with fluency one- and two-step problems involving multiplication and division, including interpreting remainders. **4.4H**
- Represent multi-step problems involving the four operations with whole numbers using strip diagrams and equations with a letter standing for the unknown quantity. **4.5A**
- Represent problems using an input-output table and numerical expressions to generate a number pattern that follows a given rule representing the relationship of the values in the resulting sequence and their position in the sequence. **4.5B**

</td><td>

- Represent the product of 2 two-digit numbers using arrays, area models, or equations, including perfect squares through 15 by 15. **4.4C**
- Use strategies and algorithms, including the standard algorithm, to multiply up to a four-digit number by a one-digit number and to multiply a two-digit number by a two-digit number. Strategies may include mental math, partial products, and the commutative, associative, and distributive properties. **4.4D**
- Represent the quotient of up to a four-digit whole number divided by a one-digit whole number using arrays, area models, or equations. **4.4E**
- Use strategies and algorithms, including the standard algorithm, to divide up to a four-digit dividend by a one-digit divisor. **4.4F**

</td></tr>
<tr><td colspan="2">TEKS Process Standards</td></tr>
<tr><td colspan="2">**See listed in Unit 1</td></tr>
<tr><td>Processes and Skills:</td><td>Facts:</td></tr>
<tr><td></td><td></td></tr>
</table>

Topics	
Multiplication concepts and strategies Division concepts and strategies	Solve problems related to perimeter and area of rectangles

Language of Instruction	
algorithms area arrays arrays associative property commutative property distributive property dividend dividend divisor divisor	equations factors factors models multiple numerical expressions perimeter product product quotient standard algorithms strategies strip diagrams

State Assessment Connections	National Assessment Connections

Resources

Commutative Property

The order of the factors does not change the product.

Factors Product

$7 \times 4 = 28$

$4 \times 7 = 28$

Associative Property

The way factors are grouped does not change the product. (Always complete the work in parentheses first.)

$5 \times (2 \times 4) = 5 \times 8 = 40$

$(5 \times 2) \times 4 = 10 \times 4 = 40$

Identity Property

When 1 is one of two factors, then the product is the other factor.

$23 \times 1 = 23$

$1 \times 23 = 23$

Zero Property

When zero is a factor, the product is zero.

$243 \times 0 = 0$

$0 \times 243 = 0$

The distributive property combines multiplication and addition.

Distributive Property

Think of one factor as the sum of two addends. Then multiply each addend by the other factor and add the product.

$3 \times 11 = 3 \times (8 + 3)$

$= (3 \times 8) + (3 \times 3)$

$= 24 + 9$

$= 33$

PARTIAL QUOTIENT DIVISION

One method of solving division problems is called partial quotient division. In this method, you figure out the quotient in parts. Let's see how it's done:

> Jason has $537 in his savings account. He is going to use it to buy presents for the 8 people in his family. If he wants to spend an equal amount on each person, how much will he be spending per person?

You can find the amount Jason can spend by solving 547 ÷ 8.

	partial quotients	
$8\overline{)547}$	40	1. Think of an amount you could definitely make groups of. It's helpful to use round or easily multiplied #s, e.g., 10, 20, 25, 30…
$-\ 320$		2. Figure out how much would be "used" if you made groups of that #.
227		3. Subtract that amount to find out how much is still left to divide.
$-\ 160$	20	4. Think of an amount you still could definitely still make groups of, figure out how much would be "used", and subtract that amount.
67		
$-\ 64$	8	5. Repeat until you can't make any more complete groups.
3		6. Add the partial quotients, check if you have a reminder, and you have your final answer!

547 ÷ 8 = 68 r 3 ← 68 = 40 + 20 + 8

Jason can spend $68 on each person, leaving $3 left over.

Envision 2.0
Topic 3: Number Sense: Multiplying by 1-digit Numbers
Topic 4: Developing Proficiency: Multiplying by 1-digit Numbers
Topic 5: Number Sense: Multiplying by 2-digit Numbers

Topic 6: Developing Proficiency: Multiplying by 2-digit Numbers
Topic 7: Number Sense: Dividing by 1-digit Divisors
Topic 8: Developing Proficiency: Dividing by 1-digit Divisors
Topic 9: Patterns and Equations