

These connections are to be used as a resource to integrate and connect related concepts and skills that support and enrich the content standards.



Core Standard

4.2 **Number and Operations and Algebra: Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.**

Content Standards

- 4.2.1 Apply with fluency multiplication facts to 10 times 10 and related division facts.
- 4.2.2 Apply understanding of models for multiplication (e.g., equal-sized groups, arrays, area models, equal intervals on the number line), place value, and properties of operations (commutative, associative, and distributive).
- 4.2.3 Select and use appropriate estimation strategies for multiplication (e.g., use benchmarks, overestimate, underestimate, round) to calculate mentally based on the problem situation when computing with whole numbers.
- 4.2.4 Develop and use accurate, efficient, and generalizable methods to multiply multi-digit whole numbers.
- 4.2.5 Develop fluency with efficient procedures for multiplying multi-digit whole numbers and justify why the procedures work on the basis of place value and number properties.

Connections to the Standard

Key Connections to Prior Math Knowledge:

- In third grade, students explored the concepts of multiplication as repeated addition and division as repeated subtraction through various models and representations (equal groups, arrays, area models, number lines, hundreds charts, etc). They solved multiplication and division problems involving basic facts. (3.2.1, 3.2.2, 3.2.3)
- Develop understandings of multiplication and division, and strategies for basic multiplication facts and related division facts. Students work with models to develop an understanding of the concepts/meanings of multiplication and division and how they are related. (3.2.1, 3.2.2, 3.2.3)
- Third grade students also generated strategies related to number properties. (3.2.4)
- Second grade uses take away models that are expanded to the idea of models of sharing equally (division) as repeated subtraction in 3rd grade. (2.2.2, 2.2.3, 3.2.2, and 3.2.3)
- Third grade compared the inverse relationship between multiplication and division (3.2.5)

Key Connections to Future Math Knowledge

- In grade five, students will apply models of division to develop fluency with efficient procedures for dividing whole numbers. (5.2)
- In 4th grade multiplying multi-digit numbers fosters conceptual understanding and lays the foundation for work in fifth grade where students will develop fluency with efficient procedures for dividing whole numbers. (5.2)

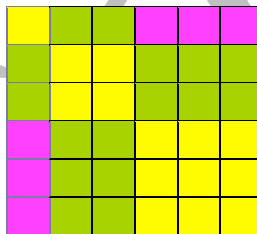
Key Connection(s) to Current Grade Level Math Standards:

- Give students repeated and varied opportunities to work with basic multiplication and division facts using games and activities. (4.2.1)

- Give students repeated opportunities to estimate products and quotients in varied situations. (Example: There are 24 students in our class. If each person gets 3 pieces of candy, about how many pieces of candy will we need?) (4.2.3)
- Explore various methods for multiplication (building a model, making a sketch, partial products, rectangular arrays, strategies from other countries or cultures, etc.) (4.2.2, 4.2.4)
- Additionally, demonstrating fluency in multiplication includes being able to explain the effect on the product when one of the factors is changed. For example, changing the second factor in 22×7 to 22×6 and posing the question, “What happens to the product when the second factor is changed from a 7 to a 6?” Students should be able to explain that the product is smaller and instead of having 7 groups of 22, there are 6 groups of 22. Or the product of $22 \times 7 = 154$ so to find one less group of 22 you could subtract $154 - 22 = 132$ so 22×6 is 132. (4.2.5)
- As with any operation, students should be able to estimate and determine the reasonableness of the product of whole numbers (one factor with two digits or less and the other factor with three digits or less). They should be able to refine their estimates using terms such as closer to, between, and a little more than. (4.2.3)

Key Connection(s) to Other Content Areas

- Science
 - School Garden Problems
 - Planting the garden
 - Trees in the park
- Social Studies
 - Oregon history (Example: supplies for the wagons)
- Arts
 - Grid art. See example below.



- Beaded bracelet patterns. (e.g. Each bracelet uses two red beads for every six yellow beads. How many of each color are needed to make up to 10 bracelets.
- Songs that teach the facts (www.school-house-rock.com)
- Language Arts
 - Anno's Mysterious Multiplying Jar
 - Seventeen Kings and 42 Elephants
- PE
 - Multiply students by number of laps/push-ups/jumping jacks/baskets/etc.

Key Connection(s) to Real World:

- Cooking
 - Calculate number of cookies needed for... (27 students each get 3 cookies, etc.)
- Sewing
 - Quilting – How many squares on a quilt that measures 12 squares by 12 squares?
 - 27 students each need 23 inches of ribbon
- Building
 - Cost to purchase materials, e.g. How much will 24 boards cost if they are \$8.00 each?
 - Find the area of the walls and floor of your tree house. The measurements are 6 feet by 8 feet by 8 feet.
- Money
 - Calculate how much you would earn walking a dog each day if you earn \$2.00 per day and walk the dog for a month.
 - If you put 75 cents into your piggy bank each week for a year, how much money will you have after one year?
- Sports
 - Bobby the basketball player scores 13 points per game. In 12 games, how many points will he score?
- Technology
 - Cell phone minutes and cost per minute
 - Computer and video games scoring systems
- Other
 - Things that come in rectangular array, e.g. trays of cookies, six-packs, egg cartons, cases of drinks

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Math Background for Teachers:

Vocabulary:

fluency	product	estimation	factors
quotient	rectangular arrays	equal intervals	commutative
associative	distributive	multiplication	rows
multiply	columns	dimensions	multiples

Language of Math:

- “And” means the decimal point.
- Read decimal numbers to show value, i.e., 0.15 is read *fifteen hundredths*, **not** zero point one five.
- Place a zero before the decimal point for numbers less than 1.

Common Mistakes and Associated Misconceptions:

- When multiplying multi-digit whole numbers students make errors in calculation related to place value concepts e.g., $303 \times 9 = 27027$ or they multiply digit in tens place like it was in ones place
Possible misconception: Students are taught the traditional algorithm without place value understandings in place.
- When asked to estimate a problem with a division context, students come up with an inaccurate answer. Possible Misconception: They haven't accounted for the remainder or have used it inappropriately.