Math 4 - Act. 03: Multi-Digit Multiplication

Summary

At the conclusion of this lesson, students will be able to successfully multiply multi-digit numbers using rectangular arrays, and a variety of mental math strategies.

Time Frame

5 class periods of 15 minutes each

Materials

base ten blocks
crayons
grid paper
- *One Hundred Hungry Ants*
, Pinczes, Elinor J., Houghton Mifflin Co.

Additional Resources
Lessons for Introducing Multiplication, by Marilyn Burns (Math Solutions Publications)
Lessons for Extending Multiplication, by Maryann Wickett and Marilyn Burns (Math Solutions Publications)

Background for Teachers

Multiplication instruction traditionally has focused on two objectives: memorizing the multiplication facts and using one consistent, standard algorithm to multiply multi-digit numbers. Knowing the multiplication facts and computing efficiently are very important goals, but a deeper conceptual view of multiplication is essential. These lessons offer concrete experiences to minimize the risk of students learning how to do procedures or learning facts without understanding why they make sense. The students will develop key mathematical understandings through building rectangular arrays to help them visualize that a problem like 4 x 27 can be considered (4 x 20) + (4 x 7). They will mentally multiply multiples of 10 or 100, and use the distributive property to calculate products. Students in third grade have developed the multiplication concepts with a variety of concrete methods and can relate the representation to an algorithm. Fourth grade will extend this foundation by multiplying multi-digit numbers using rectangular arrays, and a variety of mental math strategies. The students will be able to explain how multiplication relates to rectangular arrays, multiply mentally by multiples of 10, and use the distributive property to calculate products. These activities will take several weeks to complete. Allow ample time for students to build rectangular arrays and determine the area before making a connection to the algorithm.

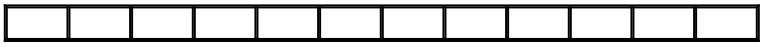
Intended Learning Outcomes

1. Demonstrate a positive learning attitude toward mathematics.
3. Reason mathematically.
4. Communicate mathematically.
5. Make mathematical connections.
6. Represent mathematical situations.

Instructional Procedures

Invitation to Learn
Read *One Hundred Hungry Ants*.
Instructional Procedures

Have student make an 8-fold book (see handout). Challenge them to draw all the different ways the 100 ants could travel, staying in equal rows.
Build various models of two digits x one digit (e.g., 4 x 13), draw on grid paper, and connect to the algorithm. Explore with the students ways to find the area of rectangles using base 10 blocks and making smaller rectangles with groups of 10's and 1's on grid paper.



$$\begin{array}{r} 13 \\ \times\ 4 \\ \hline 40 \\ +\ 12 \\ \hline 52 \end{array}$$

The above example shows 4 rows of 10 plus 3. There are 4 groups of 10 which is 40, and 12 ones altogether; 40 + 12 = 52. This activity uses the distributive property: 4 (10 + 3) = (4 x 10) + (4 x 3). The ability to break down a large problem into smaller, more manageable ones is vital to conceptual understanding.
Build various models of two digits x two digits, draw on grid paper, and connect to the algorithm. The example below shows the area representation of 13 x 12. This rectangle is composed of 4 smaller rectangles. A is composed of a hundred's board, B and C are composed of tens, and C is composed of singles. The area of the original rectangle is determined by adding the areas of rectangles A, B, C, and D. When moving to paper and pencil, have the students record the partial products to help illustrate the steps involved in the standard algorithm and bring meaning to this process. It may be helpful to have the students use base 10 grid paper. Have students practice the following problems: 15 x 14, 12 x 18, 16 x 16, 11 x 14.

Have the students build 12 x 24 with their base 10 blocks, sketch, and find the area using partial products. The example below shows 2 hundreds in the darker shaded region, 8 tens in the lighter shaded region, and 8 singles in the unshaded area. Therefore the total area of the rectangle is 288. Have students build rectangles to help find products to various problems (i.e., 16 x 23; 22 x 27; 21 x 19; etc.)

Curriculum Integration
Math/Science--Have students collect data on dinosaurs. They will need to record the height and length of each specific dinosaur. Determine the area that each dinosaur would take up. (e.g., a Tyrannosaurus is about 40 feet long and 20 feet high, 40' x 20' = 800 sq ft.). Use grid paper to show each rectangular array. Students will take their grid paper diagram outside and use chalk to roughly sketch the dinosaurs actual size using the dimension boundaries determined from research. As the groups finish their sketches, have them write the dinosaur's name and dimensions near the sketch. Have students write in their journal about what may have surprised them about the real-life size of the dinosaurs.

Extensions

Possible Extensions/Adaptations
Have the students mentally solve the problem 4 x 27, then as a group, share their strategies for finding the answer. Have the class solve 6 x 32 using each of the student’s methods.
Homework & Family Connections
Teach a member of your family how to multiply using partial products. Return a note indicating the shared mathematical experience between the family member and the student.

Assessment Plan

Have students multiply two-digit numbers through building, sketching, and showing the computation with partial products.

Authors

Utah LessonPlans