**Error Analysis**

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| In this lesson, students apply their knowledge of multiplication to analyze errors made in solving multiplication problems. |

**NC Mathematics Standards:**

**Number and Operations in Base Ten**

**NC.4.NBT.5** Multiply a whole number of up to three digits by a one-digit whole number, and multiply up to two two-digit numbers with place value understanding using area models, partial products, and the properties of operations. Use models to make connections and to develop the algorithm.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

**Student Outcomes:**

* I can analyze student work to find errors and correct student mistakes.

**Math Language:**

* multiplication
* open array

**Materials:**

* student handout – Error Analysis (1 per student)

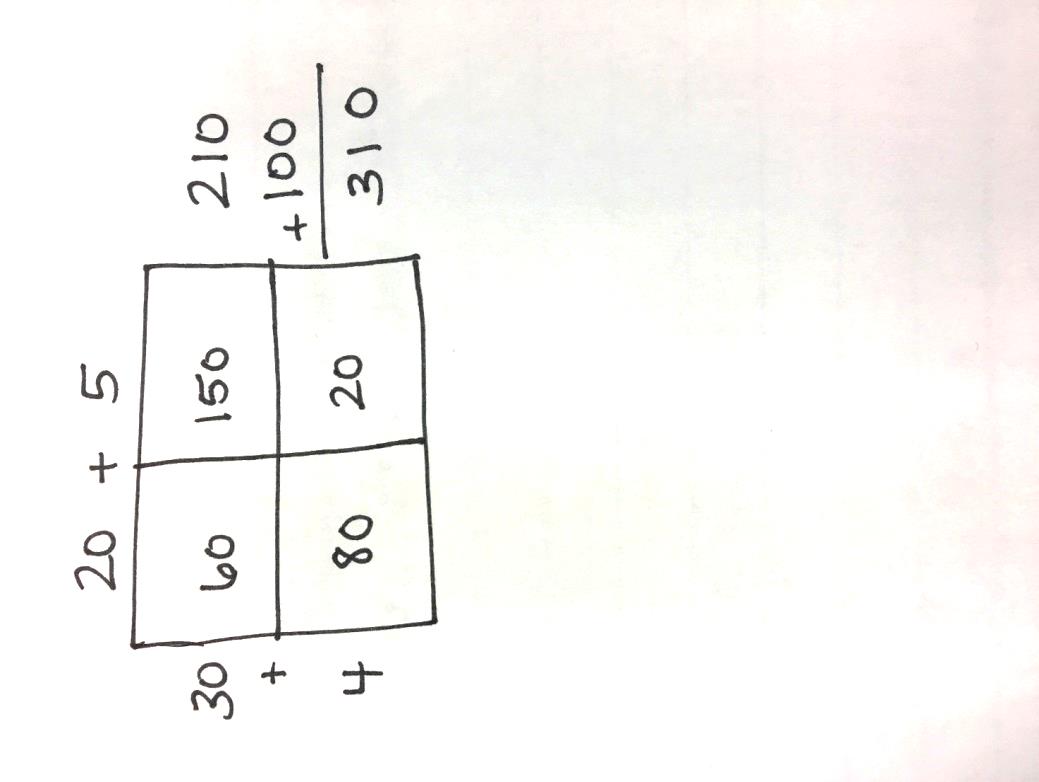
**Launch:**

1. Introduce Problem (5 – 10 minutes)

Ask students if they have ever made a mistake before. Have a few students share an example of a mistake they have made and what they learned from the mistake. Discuss how we can learn just as much from making mistakes as we can from getting correct answers. (Mistakes are opportunities for learning. This is important to establish within your classroom community so that students are comfortable talking about their mistakes and what they learn from their mistakes.)

Pass out the student handout and pose the following problem.

*Lauren solved the problem 25 x 34 and determined the product to be 310. Here is her work. Is the work correct? How do you know?*



**Explore:**

1. Analyze the Problem (10 – 15 minutes)

Allow students time to work individually and then with partners in order to solve the task. As students work, observe how they are trying to make sense of the error.

Observe:

* + Are they solving the problem on their own before or after analyzing Lauren’s work?
  + How are they using the sample to try and find the mistake?
  + Did they solve the problem using a different method?
  + Did they solve the problem using the same method?

Carefully select students to present to the class. Look for students that solved the problem correctly using the same method. Look for students who were able to determine what step made the mistake. Look for students who can describe the mistake.

**Discuss:**

1. Discussion of Error (15 – 25 minutes)

This is the most important part of the lesson. Students need to be able to generalize and verbalize the error that was made. In the sample, you are looking for students that understand that Lauren made an error with multiplying tens by tens. Although this may seem like a simple mental math error, this concept is difficult for many learners. It is important to understanding the distributive property and place value when multiplying multi-digit numbers. Pose the following questions:

* Is the student correct?
* How do you know?
* In what step did the student make the error?
* How would you help this student correct the error?
* Can you think of another way to explain how to correctly solve this problem?

\*Although these are sample questions to pose, be mindful of classroom discussion. Your students may need different questions and the conversation may lead you to ask additional questions. During this discussion, the teacher may need to connect the student work with place value blocks or suggest that students show each step with a model to reinforce what happens when tens are multiplied by tens. If students say to count the zeros, then press them to explain why this works using a manipulative or model. The discussion should be centered around reasoning that 60 couldn’t possibly be the answer for 20 groups of 30 when 2 groups of 30 is 60. Be sure students understand to always use reasoning when computing and not to blindly use tricks and short cuts – that is when simple errors occur!

Close the lesson by reminding students about the importance of learning from mistakes. Call on a few students to explain what the class can learn from Lauren’s mistake.

**Evaluation of Student Understanding:**

**Informal Evaluation:**

* Observe and monitor students as they are trying to figure out the problem.

**Formal Evaluation/Exit Ticket:**

* At the end of the lesson, ask students to correct their own problem where they have made a simple error. After they have made the error, ask them to show how they would teach another student how to correct the error.

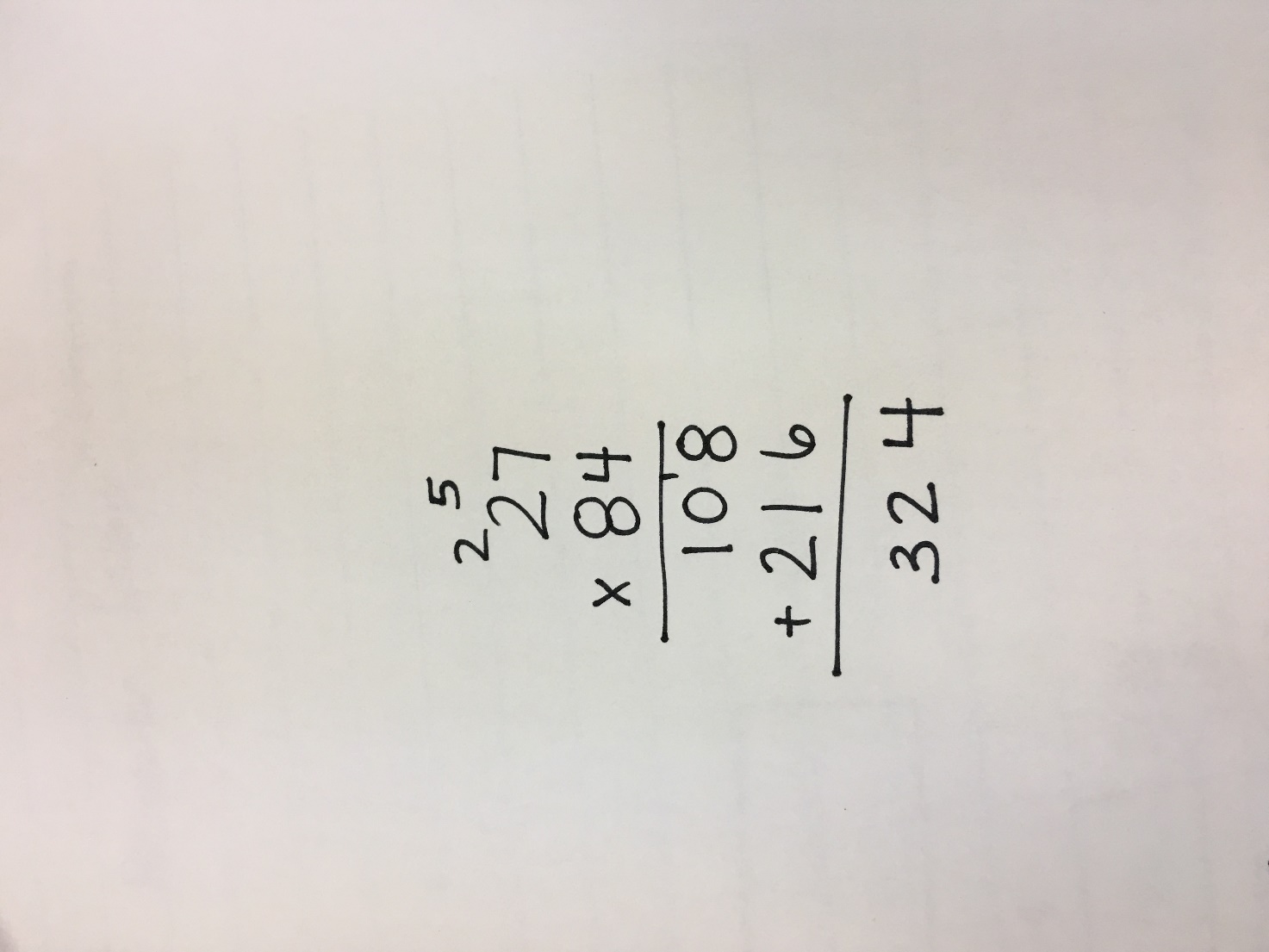
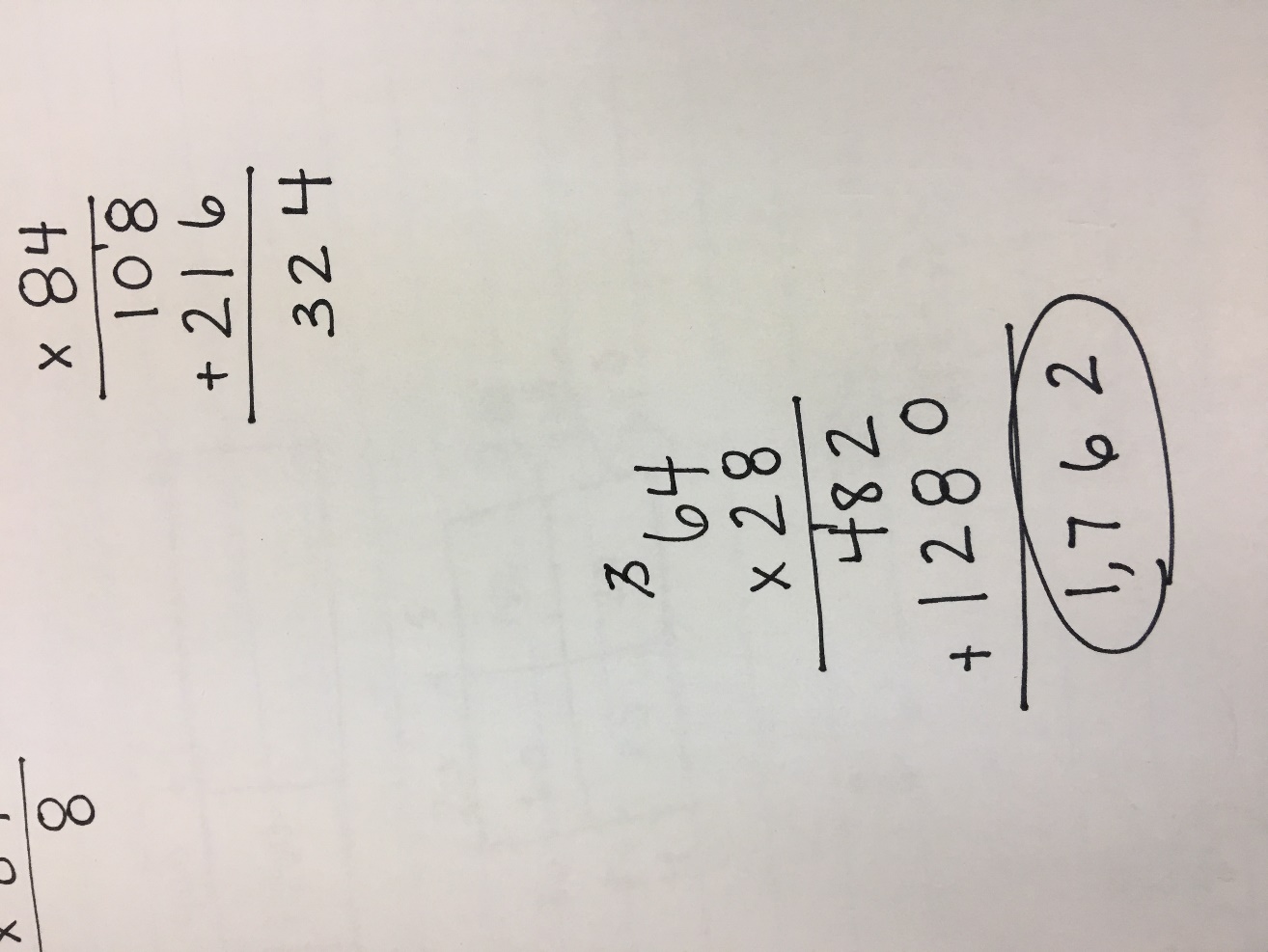
**Meeting the Needs of the Range of Learners:**

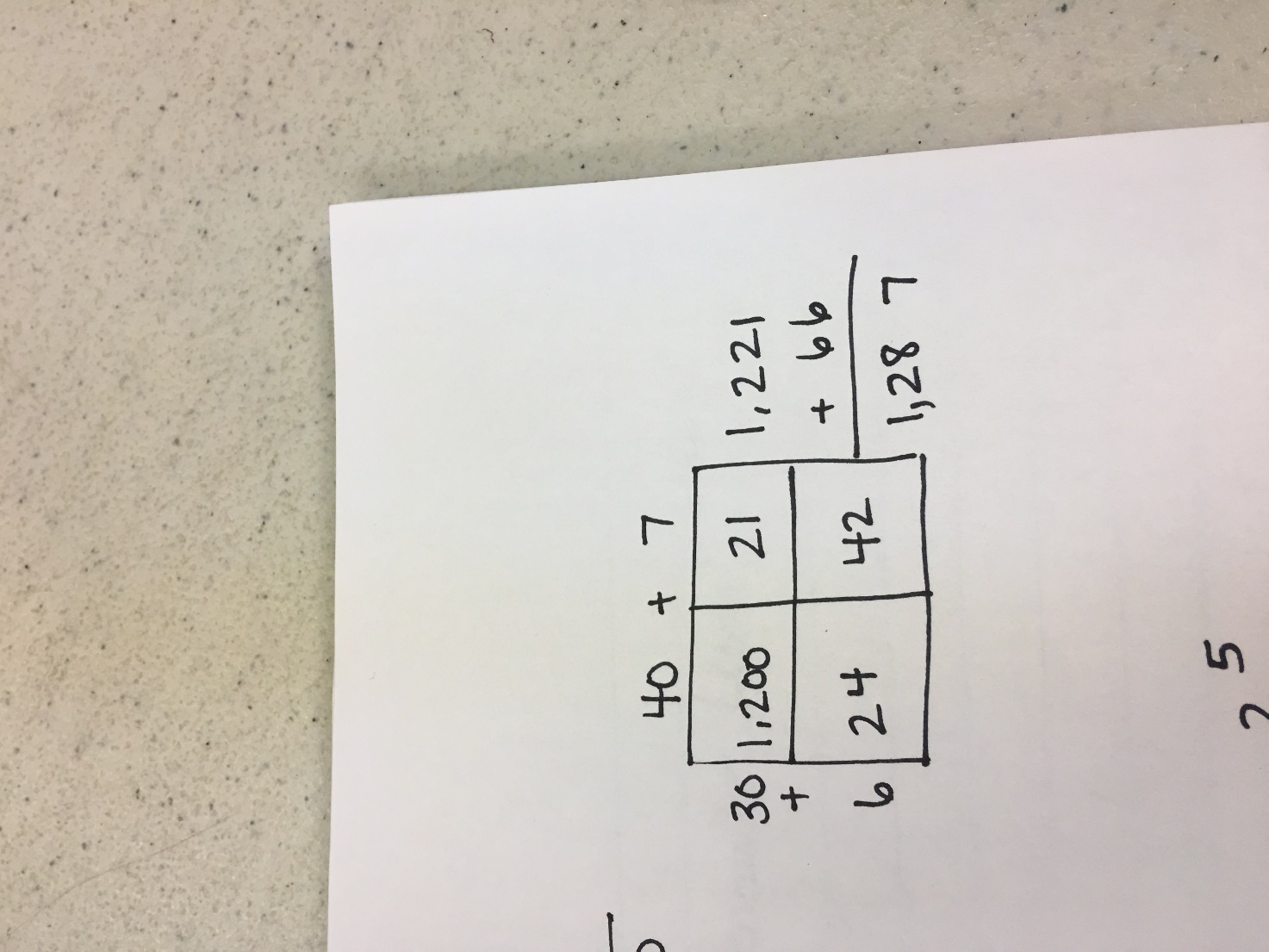
**Interventions:**

* Suggest that students first use their favorite method to solve the problem before trying to find the error. See if their answer is the same as the one provided.

**Extensions:**

* Use this as a model to analyze other errors in the classroom. You may choose your own common errors that you find from your current students or use some of the ones provided.

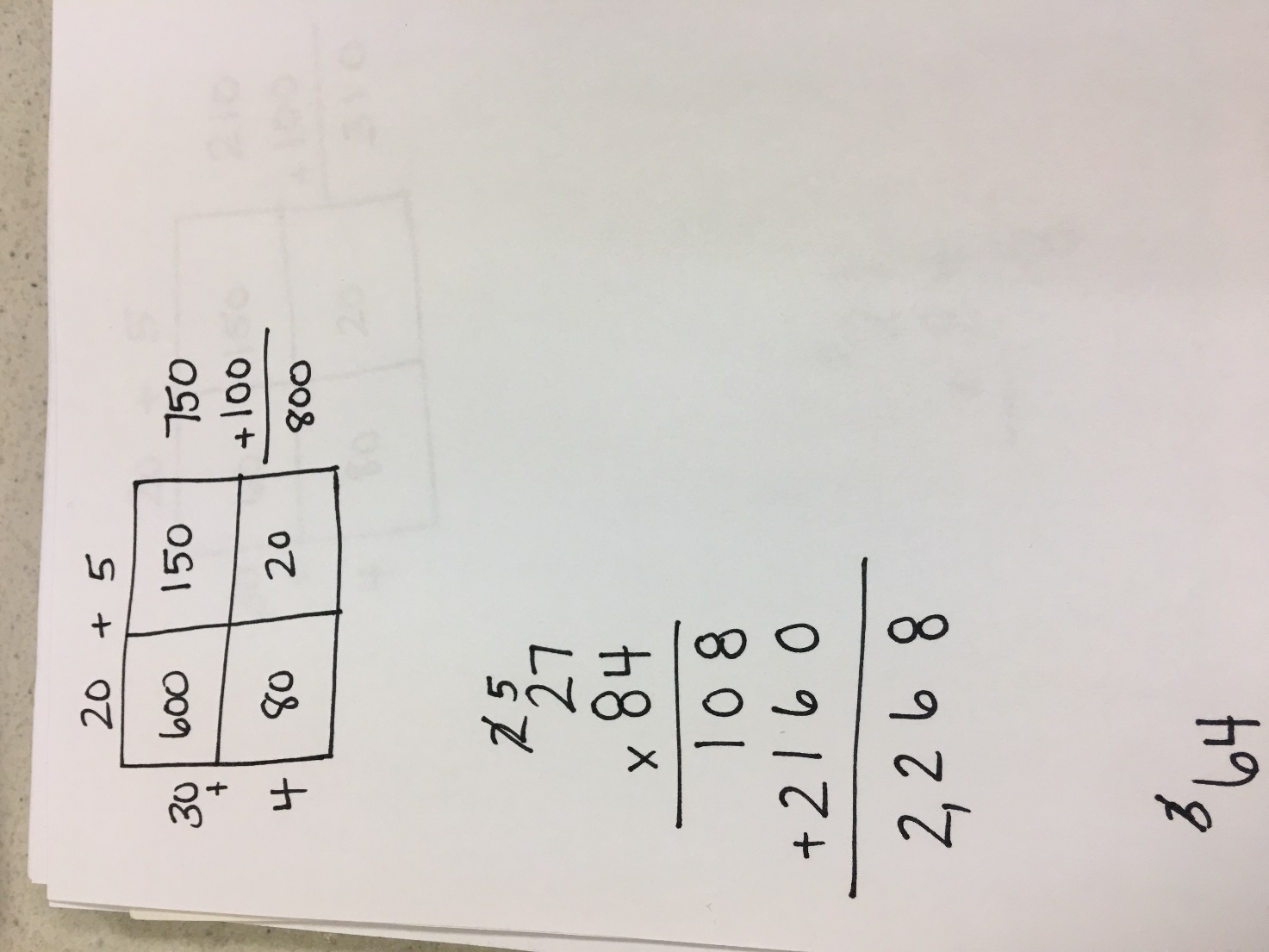
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**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| * Students may not be able to solve the problem correctly. | * Allow them to work with partners to first come up with the correct answer. |

**Possible Solutions:**



The student more than likely used the counting zeros method instead of reasoning about the solution. The student only added one zero when multiplying the tens place by the tens place. The students should realize that 60 couldn’t possibly be the answer for 20 groups of 30 when two groups of 30 is 60. This is a common mistake made when students simply add zeros without using sense making also.

Error Analysis

Lauren solved the problem 25 x 34 and determined the product to be 310. Below is her work.

Is the work correct? How do you know?

