Alex and Morgan were asked to simplify $3 + 2 \times 3$

**Alex’s “add first, then multiply” way**

The order of operations says to do operations from left to right.

So first I added 3 plus 2, and I got 5.

Then I multiplied 5 times 3, and I got 15.

**Morgan’s “multiply first, then add” way**

Multiplication comes before addition in the order of operations.

So first I multiplied 2 times 3, and I got 6.

Then I added 3 plus 6, and I got 9.

* How did Alex simplify the expression?
* How did Morgan simplify the expression?
* Whose answer is correct, Alex’s or Morgan’s? How do you know?
* What are some similarities and differences between Alex’s and Morgan’s ways?
* In thinking about the similarities and differences between Alex’s and Morgan’s ways, what conclusions can you draw about how to simplify this type of expression?
Alex and Morgan were asked to simplify $3 + 2 \times 3$

Alex’s “add first, then multiply” way

Morgan’s “multiply first, then add” way

The order of operations says to do operations from left to right.

So first I added 3 plus 2, and I got 5.

Hey Morgan, what did we learn from comparing these right and wrong ways?

Don’t just simplify from left to right. The “simplify from left to right” rule only applies within each part of the order of operations, not across the expression as a whole.

1. First, simplify expressions in parentheses.
2. Second, apply exponents.
3. Third, do all multiplication and division from left to right.
4. Fourth, do all addition and subtraction from left to right.

Hey Morgan, what did we learn from comparing these right and wrong ways?

1. First, simplify expressions in parentheses.
2. Second, apply exponents.
3. Third, do all multiplication and division from left to right.
4. Fourth, do all addition and subtraction from left to right.

* How did Alex simplify the expression?
* How did Morgan simplify the expression?
* Whose answer is correct, Alex’s or Morgan’s?
* What are some similarities and differences between Alex’s and Morgan’s ways?
* In thinking about the similarities and differences between Alex’s and Morgan’s ways, what conclusions can you draw about how to simplify this type of expression?
1a. How did Alex simplify the expression?

1b. How did Morgan simplify the expression?

2. Whose answer is correct, Alex’s or Morgan’s? How do you know?

3. What are some similarities and differences between Alex’s and Morgan’s ways?

4. In thinking about the similarities and differences between Alex’s and Morgan’s ways, what conclusions can you draw about how to simplify this type of expression?
Alex and Morgan were asked to simplify $3 + 2^2$

**Alex's “simplify expressions with exponents first” way**

First I simplified the expression with the exponent. I took 2 to the second power, and I got 4.

Then I added 3 plus 4, and I got 7.

**Morgan's “add first” way**

First I added 3 plus 2, and I got 5.

Then I simplified the expression with the exponent. I took 5 to the second power, and I got 25.

1. How did Alex simplify the expression?
2. How did Morgan simplify the expression?
3. Whose answer is correct, Alex's or Morgan's? How do you know?
4. What are some similarities and differences between Alex's and Morgan's ways?
5. If the problem were changed to $(3 + 2)^2$, then would you add the numbers first or apply the exponent first? Why?
6. Can you state a general rule that describes what you have learned from comparing Alex's and Morgan's ways of simplifying this expression?
Alex and Morgan were asked to simplify $3 + 2^2$

Alex's “simplify expressions with exponents first” way

First I simplified the expression with the exponent. I took 2 to the second power, and I got 4.

Then I added 3 plus 4, and I got 7.

Morgan's “add first” way

First I added 3 plus 2, and I got 5.

Then I simplified the expression with the exponent. I took 5 to the second power, and I got 25.

* How did Alex simplify the expression?
* How did Morgan simplify the expression?
* Whose answer is correct, Alex's or Morgan's? How do you know?
* What are some similarities and differences between Alex's and Morgan's ways?
* If the problem were changed to $(3 + 2)^2$, then would you add the numbers first or apply the exponent first? Why?
* Can you state a general rule that describes what you have learned from comparing Alex's and Morgan's ways of simplifying this expression?

When an expression contains lots of different operations, perform the operations according to the rules for the order of operations.

1. First, simplify expressions in parentheses.
2. Second, apply exponents.
3. Third, do all multiplication and division from left to right.
4. Fourth, do all addition and subtraction from left to right.
1a. How did Alex simplify the expression?

1b. How did Morgan simplify the expression?

2. Whose answer is correct, Alex’s or Morgan’s? How do you know?

3. What are some similarities and differences between Alex’s and Morgan’s ways?

4. If the problem were changed to \((3 + 2)^2\), then would you add the numbers first or apply the exponent first? Why?

5. Can you state a general rule that describes what you have learned from comparing Alex’s and Morgan’s ways of simplifying this expression?
Alex and Morgan were asked to simplify \( 8 ÷ 4 \times 2 \)

**Alex's “simplify from left to right” way**

I decided to simplify from left to right.

First I did 8 divided by 4, and I got 2.

Then I multiplied 2 times 2, and I got 4.

\[
8 ÷ 4 \times 2 \quad \rightarrow \quad (8 ÷ 4) \times 2 \quad \rightarrow \quad 2 \times 2 \quad \rightarrow \quad 4
\]

**Morgan's “multiplication before division” way**

I decided to do multiplication first.

First I multiplied 4 times 2, and I got 8.

Then I did 8 divided by 8, and I got 1.

\[
8 ÷ 4 \times 2 \quad \rightarrow \quad 8 ÷ (4 \times 2) \quad \rightarrow \quad 8 ÷ 8 \quad \rightarrow \quad 1
\]

* How did Alex simplify the expression?
* How did Morgan simplify the expression?
* Which answer is correct, Alex's or Morgan's? How do you know?
* What are some similarities and differences between Alex's and Morgan's ways?
* Why did Morgan get the wrong answer?
* Can you state a general rule that describes what you have learned from comparing Alex's and Morgan's ways of simplifying this expression?
Alex and Morgan were asked to simplify $8 \div 4 \times 2$

Alex’s “simplify from left to right” way

1. First, simplify expressions in parentheses.
2. Second, apply exponents.
3. Third, do all multiplication and division from left to right.
4. Fourth, do all addition and subtraction from left to right.

Morgan’s “multiplication before division” way

Hey Morgan, what did we learn from comparing these right and wrong ways?

* How did Alex simplify the expression? Why?
* How did Morgan simplify the expression? Why?
* Which answer is correct, Alex’s or Morgan’s? How do you know?
* What are some similarities and differences between Alex’s and Morgan’s ways?
* Why did Morgan get the wrong answer?
* Can you state a general rule that describes what you have learned from comparing Alex’s and Morgan’s ways of simplifying this expression?

Which is correct?
1a How did Alex simplify the expression?

1b How did Morgan simplify the expression?

2 Which answer is correct, Alex’s or Morgan’s? How do you know?

3 What are some similarities and differences between Alex’s and Morgan’s ways?

4 Why did Morgan get the wrong answer?

5 Can you state a general rule that describes what you have learned from comparing Alex’s and Morgan’s ways of simplifying this expression?
Which is correct?

Alex and Morgan were asked to simplify $3 \times 2^2$

Alex's “perform operations with exponents first” way

First I took 2 to the second power, and I got 4.

Then I multiplied 3 times 4, and I got 12.

Morgan's “left to right” way

First I multiplied 3 times 2, and I got 6.

Then I took 6 to the second power, and I got 36.

1.1.4

* How did Alex simplify the expression? How did Morgan simplify the expression? Which answer is correct, Alex's or Morgan's? How do you know?

* What are some similarities and differences between Alex's way and Morgan's way?

* In thinking about the similarities and differences between Alex's and Morgan's ways, what conclusions can you draw about how to simplify this type of expression?
**Alex and Morgan were asked to simplify** $3 \times 2^2$

**Alex’s “perform operations with exponents first” way**

- First I took 2 to the second power, and I got 4.

- Then I multiplied 3 times 4, and I got 12.

**Hey Alex, what did we learn from comparing these right and wrong ways?**

When an expression contains a mix of operations, perform the operations in accordance with the rules for the order of operations:

1. First, simplify expressions in parentheses.
2. Second, apply exponents.
3. Third, do all multiplication and division from left to right.
4. Fourth, do all addition and subtraction from left to right.

**Morgan’s “left to right” way**

- First I multiplied 3 times 2, and I got 6.

- Then I took 6 to the second power, and I got 36.

* Which is correct?* 

* How did Alex simplify the expression? How did Morgan simplify the expression? Which answer is correct, Alex's or Morgan's? How do you know?* 

* What are some similarities and differences between Alex's way and Morgan's way?* 

* In thinking about the similarities and differences between Alex's and Morgan's ways, what conclusions can you draw about how to simplify this type of expression?* 

1.1.4
1a How did Alex simplify the expression?

1b How did Morgan simplify the expression?

2 Which answer is correct, Alex’s or Morgan’s? How do you know?

3 What are some similarities and differences between Alex’s way and Morgan’s way?

4 In thinking about the similarities and differences between Alex’s and Morgan’s ways, what conclusions can you draw about how to simplify this type of expression?