Unit 6, Lesson 3

Reasoning about Equations with Tape Diagrams

Let's see how equations can describe tape diagrams.

3.1 Find Equivalent Expressions

Select **all** the expressions that are **equivalent** to $7(2 - 3n)$. Explain how you know each expression you select is equivalent.

A. $9 - 10n$

B. $14 - 3n$

C. $14 - 21n$

D. $(2 - 3n) \cdot 7$

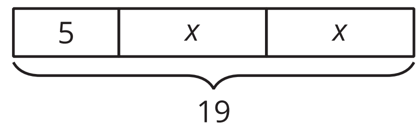
E. $7 \cdot 2 \cdot (-3n)$

3.2 Matching Equations to Tape Diagrams

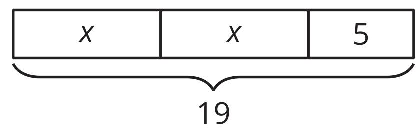
Match each equation to one of the tape diagrams. Be prepared to explain how the equation matches the diagram.

- $2x + 5 = 19$
- $2 + 5x = 19$
- $2(x + 5) = 19$
- $5(x + 2) = 19$
- $19 = 5 + 2x$
- $(x + 5) \cdot 2 = 19$
- $19 = (x + 2) \cdot 5$
- $19 \div 2 = x + 5$
- $19 - 2 = 5x$

A



B



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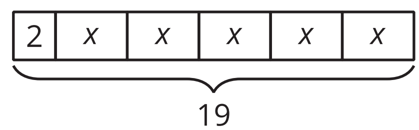

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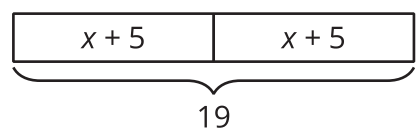
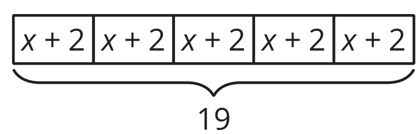


E



3.3 Drawing Tape Diagrams to Represent Equations

1. Draw a tape diagram to match each equation.

   $114 = 3x + 18$

   $114 = 3(y + 18)$

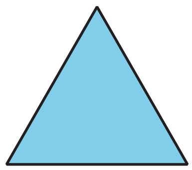
2. Use any method to find values for x and y that make the equations true. Explain your reasoning.

Are you ready for more?

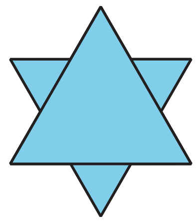
The Koch snowflake is a fractal—a special kind of repeating pattern. To make a Koch snowflake:

- Start with an equilateral triangle. This is Step 1.
- Divide each side into 3 equal pieces. Replace each middle third with a smaller equilateral triangle. This is Step 2.
- Repeat the process. This is Step 3.
- Keep repeating this process.

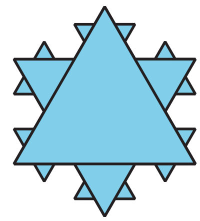
Step 1



Step 2



Step 3

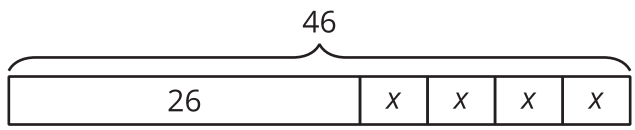


By what percentage does the perimeter increase from step 1 to step 2? From step 1 to step 3? From step 1 to step 10?

Lesson 3 Summary

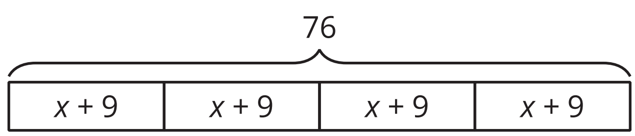
We have seen how tape diagrams represent relationships between quantities. Because of the meaning and properties of addition and multiplication, more than one equation can often be used to represent a single tape diagram.

Let’s take a look at two tape diagrams.



We can represent this diagram with several different equations. Here are some of them:

- $26 + 4x = 46$, because the parts add up to the whole.
- $4x + 26 = 46$, because addition is commutative.
- $46 = 4x + 26$, because if two quantities are equal, it doesn’t matter how we arrange them around the equal sign.
- $4x = 46 - 26$, because one part (the part made up of 4 x’s) is the difference between the whole and the other part.



Here are some equations that represent this diagram:

- $4(x + 9) = 76$, because multiplication means having multiple groups of the same size.
- $(x + 9) \cdot 4 = 76$, because multiplication is commutative.
- $76 \div 4 = x + 9$, because division tells us the size of each equal part.

