TOPIC 7

Expressions

TOPIC 7

LESSON 7.1a

Relationships Matter

6.EE.1

Objective Creating Numeric Expresssions

Warm-Up

Write each power of ten as a product of factors. Then calculate the product.

1. 10^2 = ______________________________ = _____________________

2. 10^5 = ______________________________ = ______________________

3. 10^3 = ______________________________ = _____________________

4. 10^4 = ______________________________ = _____________________

GETTING STARTED

Expression Challenge

Recall that an expression in mathematics is a number or a combination of numbers and operations. The number 8 is an expression, and $2 \times 2 + 4$ is also an expression. Both of these expressions are equal to 8.

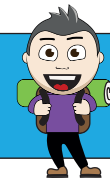
1. Write an expression that is equal to 10 using only four 2s and any number of math symbols.

2. Write an expression that is equal to 8 using only four 3s and any number of math symbols.

3. Write an expression that is equal to 20 using only one 2 and two 4s and any number of math symbols.

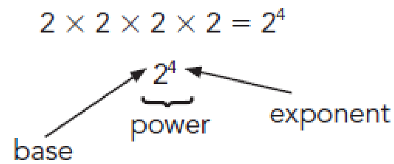
EXPLORE 1

Square and Cube Numbers



Just as repeated addition can be represented as a multiplication problem, repeated multiplication can be represented as a power.

A power has two elements: the base and the exponent.



The base of a power is the factor that is multiplied repeatedly in the power, and the exponent of the power is the number of times the base is used as a factor.

1. Identify the base and exponent in each power. Then, write each power in words.

a. 7^5

b. 4^8

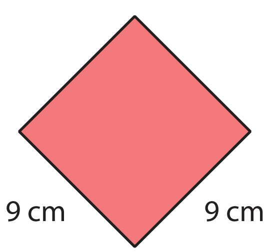
Remember that the area of a rectangle is calculated by multiplying its length by its width. Because all sides of a square have the same length, the area of a square, A, is calculated by multiplying the length of the side, s, by itself. The formula for the area of a square,

$A = s \times s$, can be written as $A = s^2$.

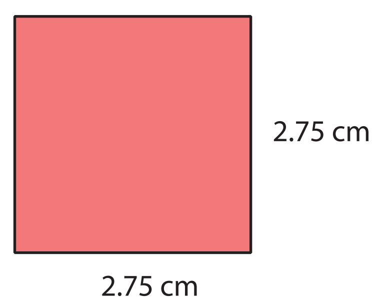
In the same way, to calculate the square of a number, you multiply the number by itself.

2. Write the area of each square as a repeated product, as a square number, and as an area in square units.

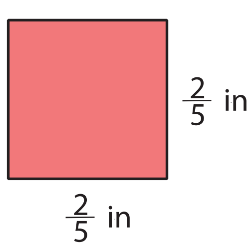
a.



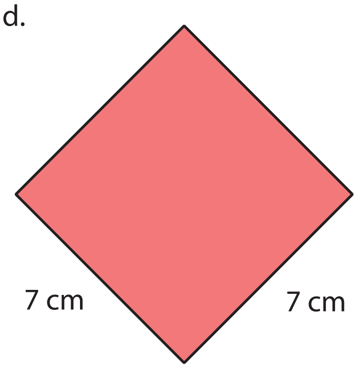
b.



c.



d.

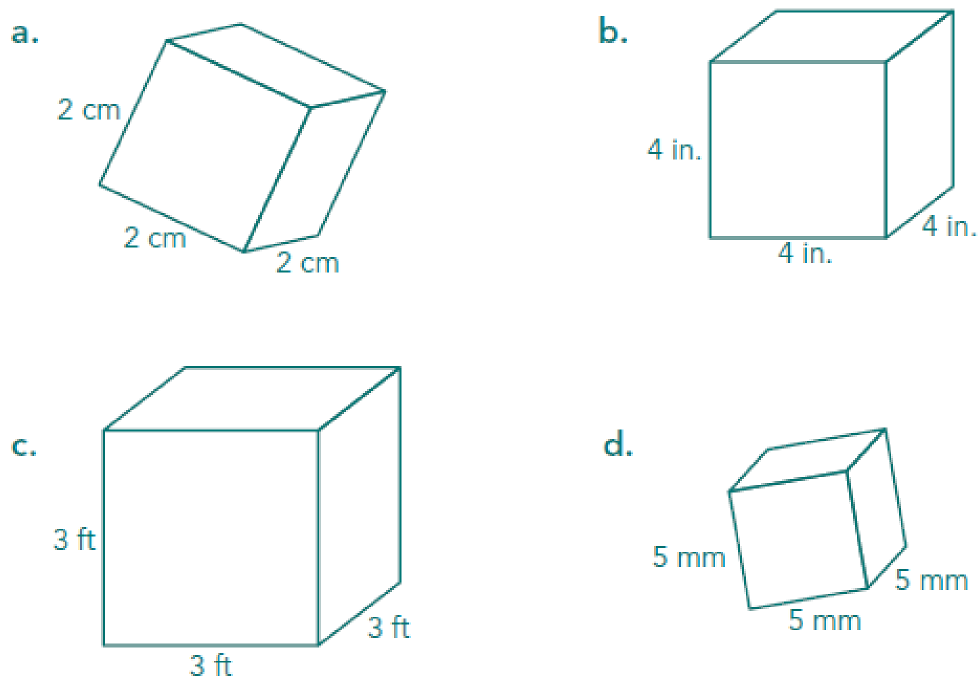


Some of the areas that you wrote in Question 1 are called perfect squares because they are squares of an integer. For example, 9 is a perfect square because $3 \times 3 = 9$. Another way you can write this
mathematical sentence is $3^2 = 9$.

Recall that the **volume** of a cube is calculated by multiplying its length by its width and its height. Since the length, width, and height of a cube are all the same, the formula for the volume, V, of a cube can be written as $V = s \times s \times s$, or $V = s^3$.

In the same way, to calculate the cube of a number, you use the number as a factor three times.

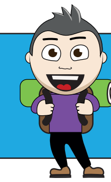
3. Write the volume of each cube as a repeated product, as the cube of a number, and as a volume in cubic units.



A **perfect cube** is the cube of an integer. For example, 216 is a perfect cube because 6 is a whole number and $6 \times 6 \times 6 = 216$.

EXPLORE 2

Modeling Expressions



Previously, you may have thought about expressions as recipes. For example, the expression 2 + 2 might have meant “start with 2 and add 2 more.” But as a relationship, 2 + 2 means “2 combined with 2.”

The Expression Cards at the end of this lesson contain a variety of numeric expressions and models that represent numeric expressions. Cut out the Expression Cards.

1. Consider the different structures of the expressions and the models.

a. Sort the models in a mathematically meaningful way.
b. Sort the expressions in a mathematically meaningful way.
c. Explain how you sorted the Expression Cards.

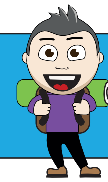
2. Match the numeric expressions with the models. Select two pairs of cards and explain why each expression matches the model.

Now it’s your turn!

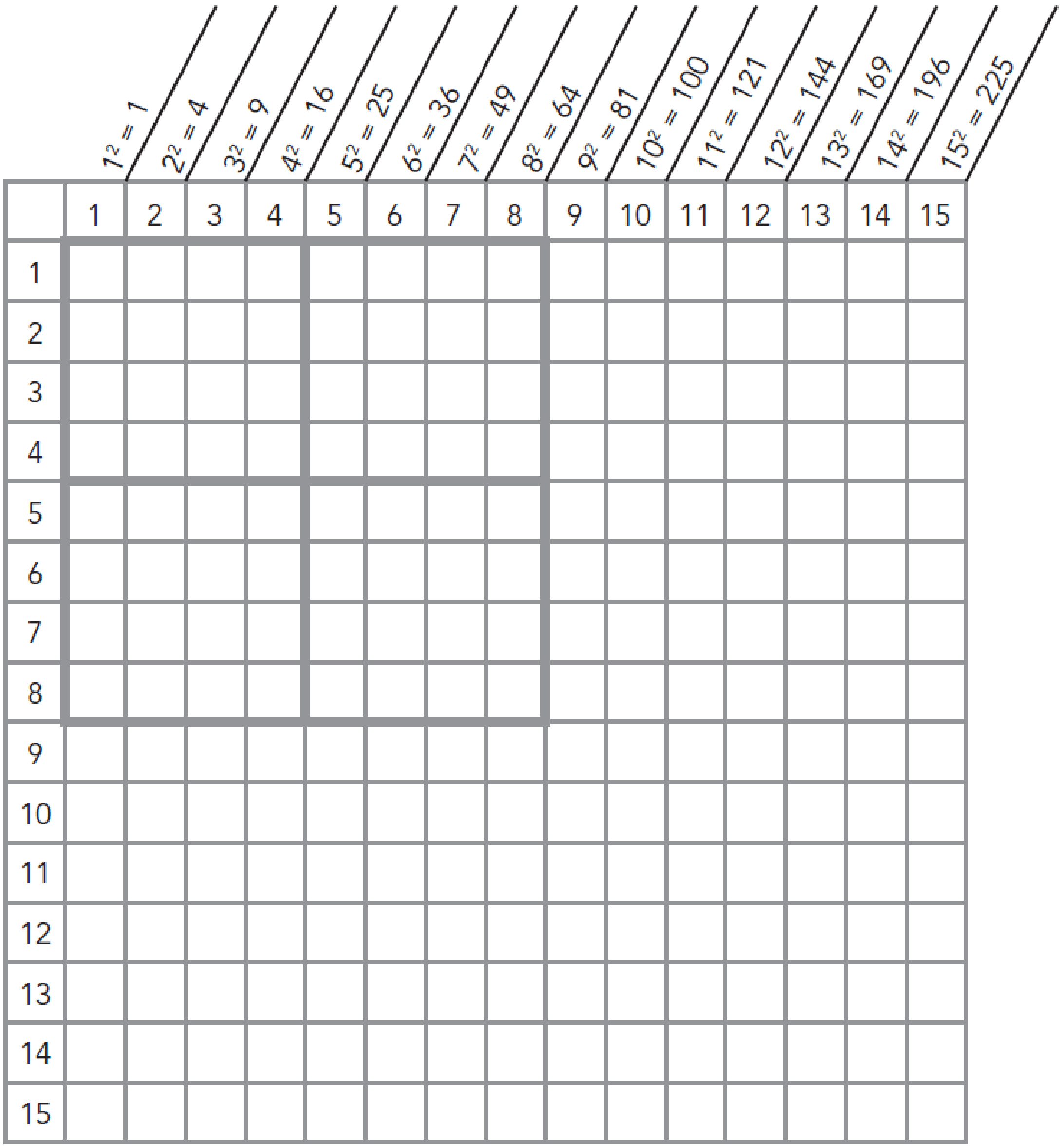
3. Think of a numeric expression. Draw a model to represent that expression. Trade your model with a classmate and write the numeric expression that represents their model. When you both have written your answers, trade back and check your work!

EXPLORE 3

Writing Equivalent Expressions



The diagram can be used to determine perfect squares. Daniel drew on the diagram to show that the expression $(4 + 4)^2$ is equivalent to 8^2.



1. Explain why $(4 + 4)^2$ is equivalent to 8^2 and not equivalent to $4^2 + 4^2$. Then use the diagram to write other expressions that are equivalent to 8^2.

2. Write an equivalent numeric expression for each perfect square.

a. 6^2

b. 12^2

To evaluate a numeric expression means to simplify the expression to a single numeric value.

3. Use the diagram to rewrite the expression $(7 - 3)^2 + (10 - 7)^2$ with fewer terms. Explain your work.

4. Use the diagram to write four numeric expressions.
Then explain how to evaluate each expression.

The table shows the cubes of the first 10 whole numbers.

$1^3 = 1$	$2^3 = 8$	$3^3 = 27$	$4^3 = 64$	$5^3 = 125$
$6^3 = 216$	$7^3 = 343$	$8^3 = 512$	$9^3 = 729$	$10^3 = 1000$

5. Write two more equivalent expressions for each. Show how to evaluate the expressions.

a. 5^3

b. 2^3

Name: ______________________ Date: ____________ Class: __________

Homework HW

LESSON 7.1a
Relationships Matter

Objective: Creating Numeric Expresssions

Review

Graph each rate in the given pair on a coordinate plane. Explain whether or not the rates are equivalent.

1. $\frac{15 \text{ cups flour}}{8.25 \text{ cups sugar}}, \frac{5 \text{ cups flour}}{2.75 \text{ cups sugar}}$
2. $\frac{245 \text{ mi}}{3.5 \text{ h}}, \frac{150 \text{ mi}}{2 \text{ h}}$

Calculate each conversion.

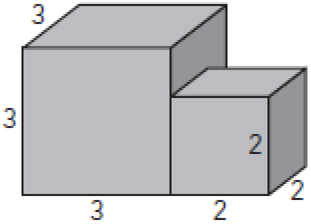
3. 4 grams = _____milligrams
4. 6400 ounces = _____pounds

Determine each sum.

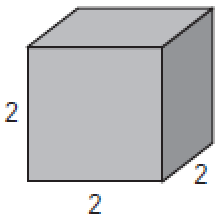
5. $\frac{6}{7} + 3\frac{1}{5}$
6. $1\frac{2}{3} + 4\frac{1}{4}$

3×2

$(3 \times 2)^2$

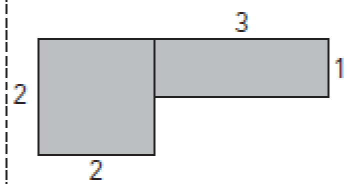


$(3 + 2)^3$

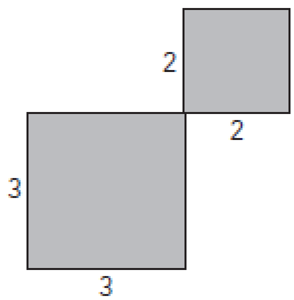


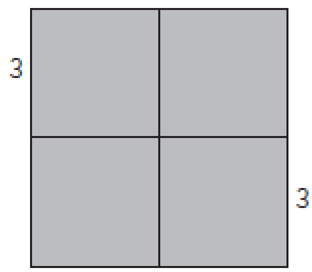
3^2

$3 \times (2 + 3)$



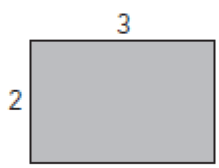
$3 + 2^2$

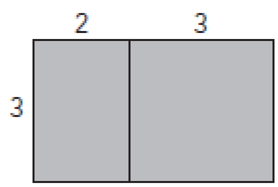


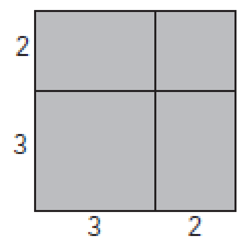


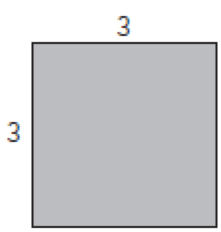
$(3 + 2)^2$

$3^3 + 2^3$



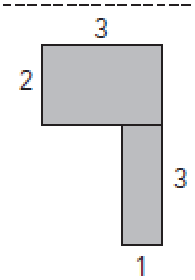






$3 \times 2 + 3$

$3^2 + 2^2$



2^3