# COMMON CORE COLLABORATIVE CARDS

EXPRESSIONS AND EQUATIONS

Grades 6–8

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# MEANINGFUL TASKS




*by* Kit Norris

# TEACHER'S PAGE

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| **GRADE LEVEL** | 6 |
| **TASK** | Generalizing Patterns |
| **COMMON CORE STATE STANDARDS ADDRESSED** | 6.EE.2, 6.EE.3, 6.G.1 |
| **STANDARDS FOR MATHEMATICAL PRACTICE** | 2. Reason abstractly and quantitatively.<br>3. Construct viable arguments and critique the thinking of others.<br>8. Look for and express regularity in repeated reasoning. |

**LAUNCH**

Review the meaning of *perimeter* of regular geometric shapes. Ask students to find the perimeter of a square whose sides measure 4 meters. Then give them a perimeter of a rectangle and ask what the measurements might be.

Say: *The perimeter of a rectangle is 16 inches. What is the length and width?*

There is more than one answer to this question. Look for students to say the measurements could be 4 × 4, as every square is also a rectangle. The measurements could also be 5 × 3, 6 × 2, or 1 × 7.

Students should work independently first and then work with a partner to share their thinking and compare their answers.

**TASK**

**1.** Have students begin by finding the perimeter of a triangle. Then ask them to find the perimeter of a regular hexagon and a regular pentagon. Then ask them to write an equation to represent the perimeter of each shape.

Look for students to reason that the perimeter of the hexagon can be represented by $P = 6s$. Some may add 6 units of $s$. For the pentagon, look for P = 5s. Ask students whether or not they think that $5s = P$ is the same as $P = 5s$.

**2.** Next, have students work on the perimeters of squares. Have them double the side length of a square and then compare the perimeter of the resulting square with the perimeter of the original square. Have them fill in the table on the student page to test their conjectures.

Look for students to see that if the side length of the first square is doubled, the perimeter of the new square will be double as well, or twice as big as the perimeter of the original square.

**3.** Students then explore what happens to the area of a square when the side length of the original square is doubled.

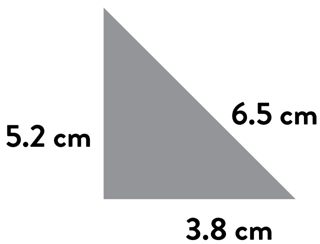
- Students make a conjecture and write an equation representing the new area in terms of the side length of the original square.
- Students then complete a table to compare their equation with values in the table.

**4.** Have students extend their thinking to tripling the side length of the first square and determining the impact on the area of the new square.

# GENERALIZING PATTERNS

**NAME** ______________________________

1. Find the perimeter of each shape.

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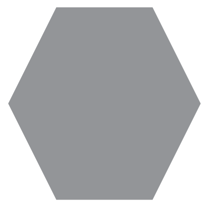

**All sides measure 8 inches**

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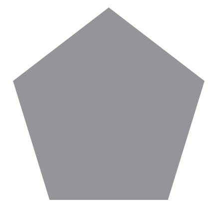

**All sides measure 6 cm**

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2. Represent the perimeters of the 2nd and 3rd figures in terms of a variable and an equation. Let *s* stand for the side length and *P* for the perimeter.

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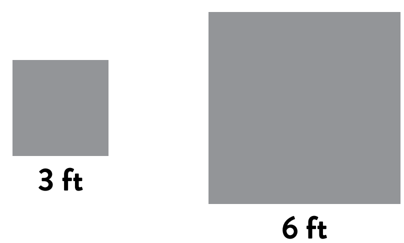
3. Look at the squares to the right. The side length of the second square measures twice as long as the side length of the first square. How many times greater than the perimeter of the first square is the perimeter of the second square?

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4. Do you think that the relationship you found in question 3 will always be true? Why or why not? Complete the table to test your conjecture.

| Side Length of First Square | Perimeter | Double the Side | New Perimeter |
|---|---|---|---|
| 8 | | | |
| 12 | | | |
| 25 | | | |
| 38 | | | |
| 50 | | | |

5. If *s* represents the side length of the square and *N* stands for the new perimeter, write an equation to express what happens to the new perimeter when the side length of the original square is doubled.

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# TEACHER'S PAGE

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| **GRADE LEVEL** | 7 |
| **TASK** | Do Not Add! |
| **COMMON CORE STATE STANDARDS ADDRESSED** | 7.EE.1, 7.EE.2 |
| **STANDARDS FOR MATHEMATICAL PRACTICE** | 1. Make sense of problems and persevere in solving them.<br>2. Reason abstractly and quantitatively.<br>7. Look for and make use of structure. |

**LAUNCH**

Launch this activity as a whole-group exercise. Tell the students that they will be investigating relationships among numbers. You will present three consecutive numbers to them and they will find the sum—but they are not to add! They are to find the sums using other operations.

After everyone understands the pattern represented by the three consecutive numbers, they will work towards writing an expression to verify why the pattern works.

Tell students that if they see the pattern, they can offer just the sum of the consecutive numbers. Ask them to tell you if they added or not. Students should only reply with a "yes" or "no." Students should not offer their method of solution until nearly everyone sees the pattern.

**TASK**

**1.** Listed below are some examples to present to the students. The pattern becomes more obvious as more examples are presented. Create a chart similar to this one. (Delay writing the sum until the students have provided it.)

| Values | Sum |
|---|---|
| 13, 14, 15 | 42 |
| 18, 19, 20 | 57 |
| 24, 25, 26 | 75 |
| 30, 31, 32 | 93 |

Some students may see that the sum is the same as three times the middle number. Present these students with a challenge to determine why this occurs.

Ask: *Can you verify the pattern? Does it work with any three numbers? Does the pattern hold true using decimals or fractions?*

**2.** Continue providing examples for the rest of the class, such as:

| Values | Sum |
|---|---|
| 99, 100, 101 | 300 |
| 19, 20, 21 | 60 |

You may need to offer a hint by asking: *How many numbers are there? What is the relationship between the number of values and the sum?*

**3.** Ask the students how they might prove that this pattern is true. Have them work in their groups of four to determine how they can verify the relationship.

As the students work, observe their process. If they are showing more examples as their proof, ask them how many they will need. Can they find a situation that is a counterexample, such as 9, 10, 12?

Suggest to the groups that they could use a variable to represent any number.

Ask:

*How could we represent one less than the number?*

*How could we represent one more than the number?*

**4.** When students are ready, work with them to come up with the proof:

$N =$ middle number

$N - 1 =$ smallest number

$N + 1 =$ largest number

Therefore,

$N - 1 + N + N + 1 = 3N$

Point out that no matter what value we use for $N$, the sum is always 3 times $N$.

**EXTENSION**

Ask students:

*Will a similar pattern hold for five consecutive values?*

*Does the pattern hold for an even number of values?*

*Can we represent this pattern for any number of values?*

# TEACHER'S PAGE

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| **GRADE LEVEL** | 8 |
| **TASK** | Expressing Expressions |
| **COMMON CORE STATE STANDARDS ADDRESSED** | 8.EE.1, 8.EE.2 |
| **STANDARDS FOR MATHEMATICAL PRACTICE** | 2. Reason abstractly and quantitatively.<br>3. Construct viable arguments and critique the reasoning of others. |

**LAUNCH**

Tell students they will be creating expressions given one clue card containing three or more elements to use in their expressions. They will then exchange the verbal expressions to see if their partner can write the same expression symbolically. Students will then exchange their expressions with another student in their group. The students will continue exchanging their expressions until everyone in the group has worked with each other's expressions.

**TASK**

Begin with the following example:

2, greater, opposite

Given these clues, a student's response might be "two greater than the opposite of a number" and $-n + 2$. The student then shares the expression in words with his or her partner. The partner writes the expression symbolically, and the two students compare their expressions.

Remind students that all of their expressions must use at least one variable.

Print and cut the clue cards on the facing page, and have the student groups work through these examples.

**EXTENSION**

Tell the students to include the word "equals" on their clue cards.

| | |
|---|---|
| 2, greater, $\sqrt{3}$ | $3^{-2}$ , subtract, four times |
| $3\sqrt{8}$ , minus, 1/2 | 1/3 of, $4^2$, 12 |
| multiply, cube root of 27, less than | times, $(\frac{2}{3})^{-1}$, ½ |
| sum, absolute value, $\sqrt{8}$ | divided, $(\frac{1}{2})^{-2}$, difference |
| 12, less than, cube root | –3, $(\frac{1}{4})^2$, times |
| greater than, 12, absolute value | sum, quantity, quotient |
| cube root of 16, times, less than | five times, more than, $3^3$ |