Mc Graw Hill

IGNITE!

Spark curiosity in your students.

Activities written by Dr. Raj Shah

Grades K–8

California Reveal MATH®

IGNITE!

IGNITE! activities launch every unit of *California Reveal Math* K–8. Use these samples with your students and IGNITE! math engagement!

"Let's bring curiosity, wonder, and joy back into the classroom and make math irresistible for kids."

- Raj Shah, Contributing Author

IGNITE! Activities help students:

Cultivate Curiosity — Mathematics is as much about asking questions as it is about finding solutions. Start wondering!

Accept the Challenge — Attitude is everything. Take on new challenges and see how far you can go. Don't give up!

Engage Trial and Error — You can't learn by watching. To make sense of math, you have to try things and see what happens.

Embrace "Struggle" — Learning new things is hard. Mistakes will happen. Allow yourself the freedom to make mistakes and learn from them.

Work Together — There is power in a community of learners working together to discover new things. Math doesn't have to be done alone.

Just Play — Explore, discover, conjecture... Solving problems is fun!

Name _____

IGNITE!

Broken Calculators

Part A: Your calculator can only add 2s and 5s.

1. How can you make numbers less than 100 with this calculator?

Part B: Your calculator can only add 3s and 7s.

2. What whole numbers less than 12 *cannot* be made with this calculator?

3. How can you make each of the whole numbers 12 through 16 with this calculator?

4. What is the quickest way to make 30 with this calculator? Explain.

5. Is there a number greater than 11 that *cannot* be made with this calculator? Explain.

Unit Opener

Ignite

Broken Calculators

Students think about adding combinations of 2s and 5s or 3s and 7s in a unique way to obtain particular numbers.

Part A

Have students imagine they have a broken calculator. All it can do is add 2s and 5s. The calculator always starts at 0.

- What are some whole number sums less than 100 that you can make using this calculator?
- What do you notice about the sums that you can make on this calculator?
- How can you get the sum of 92 with this calculator?
- How can you get the sum of 75 with this calculator?
- Describe two different ways to get a sum of 10 with this calculator.
- Describe different ways to get a sum of 14 with this calculator.
- When adding 5 and 2, does the order in which you enter the numbers into a calculator matter? Explain.

Listen to students' thinking about addition patterns.

- It is possible to make all even numbers because when adding two even numbers or adding two odd numbers, the sum will always be even.
- It is possible to make all numbers with a 0 or 5 in the ones place because when adding 5s, the sum will always have a 0 or 5 in the ones place.

Have students think about sums that cannot be made with this calculator.

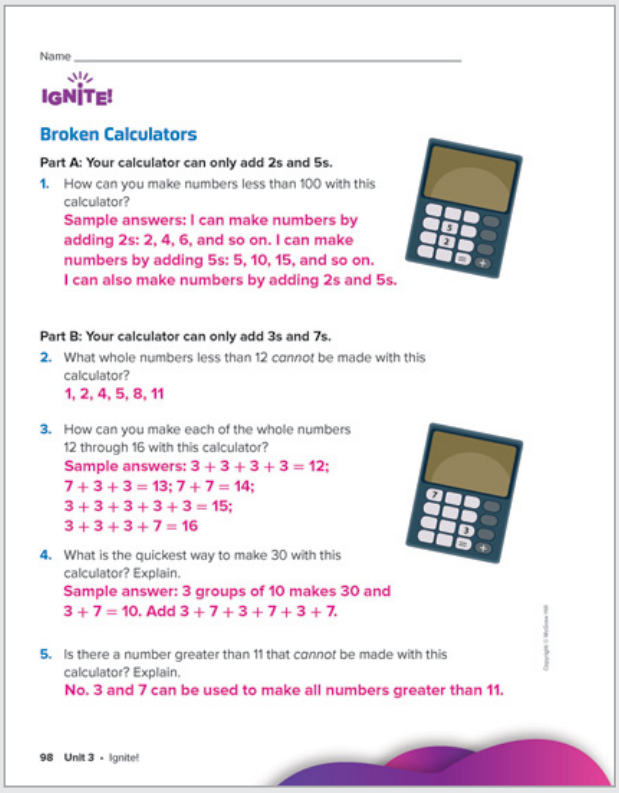
- What number sums less than 10 cannot be made using this calculator?
- What number sums greater than 10 cannot be made with this calculator? Explain.

Listen to students' thinking about repeated reasoning.

- You can make all even numbers by adding 2s.
- You can make all odd numbers greater than 5 by adding any number of 2s and only one 5.
- The only whole numbers that cannot be made with this calculator are 1 and 3.

Part B

Students extend addition patterns and reasoning used in Part A to explore possible sums with a calculator that can only add 3s and 7s.



Name _____

IGNITE!

Broken Calculators

Part A: Your calculator can only add 2s and 5s.

1. How can you make numbers less than 100 with this calculator?
   Sample answers: I can make numbers by adding 2s: 2, 4, 6, and so on. I can make numbers by adding 5s: 5, 10, 15, and so on. I can also make numbers by adding 2s and 5s.

Part B: Your calculator can only add 3s and 7s.

2. What whole numbers less than 12 *cannot* be made with this calculator?
   1, 2, 4, 5, 8, 11
3. How can you make each of the whole numbers 12 through 16 with this calculator?
   Sample answers: 3 + 3 + 3 + 3 = 12; 7 + 3 + 3 = 13; 7 + 7 = 14; 3 + 3 + 3 + 3 + 3 = 15; 3 + 3 + 3 + 7 = 16
4. What is the quickest way to make 30 with this calculator? Explain.
   Sample answer: 3 groups of 10 makes 30 and 3 + 7 = 10. Add 3 + 7 + 3 + 7 + 3 + 7.
5. Is there a number greater than 11 that *cannot* be made with this calculator? Explain.
   No. 3 and 7 can be used to make all numbers greater than 11.

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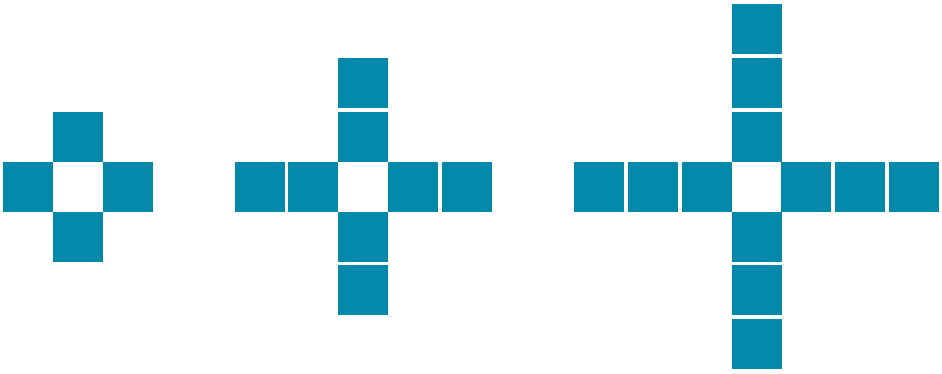
Name _____

IGNITE!

Pattern Puzzles

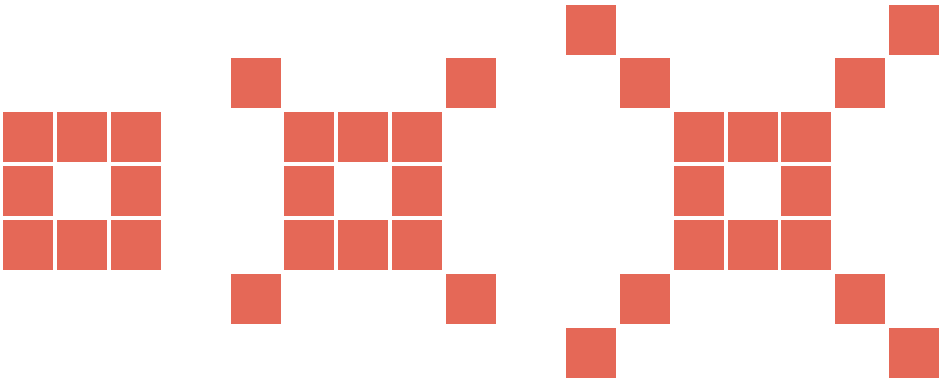
Describe the patterns you see.

Puzzle A



Step 1 Step 2 Step 3

Puzzle B



Step 1 Step 2 Step 3

Unit Opener

Ignite

Pattern Puzzles

Students discover patterns and use repeated addition or multiplication as a tool to solve more complex problems. You may want to revisit this Ignite! after Lesson 5-5. See below.

1. Direct students to Puzzle A. Allow them a few minutes to individually think about and write what they observe in the diagrams. Then have students share their observations with a partner. Challenge the partners to come up with one more thing that they notice.
   - How many small blue squares do you think will be in Step 4 of this pattern? Explain.

Listen to students thinking about the pattern.

- Each step adds 4 squares to the previous step in the pattern.
- Step 4 will have 4 more squares than Step 3 of the pattern.
- There will be 16 squares in Step 4.

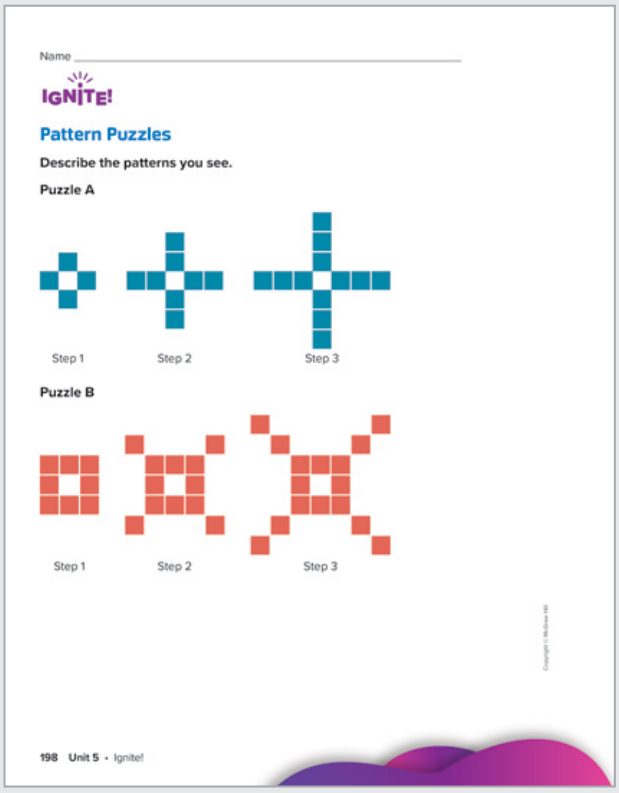
2. You may want to have students draw Step 4 of the pattern.
3. With their partner, have students estimate how many squares will be in Step 10. Record the estimates, organizing them from least to greatest. Then have students suggest which estimate(s) are closest to what they think is the actual number.
   - How many small blue squares are in Step 10 of this pattern? Explain.
4. Record the explanations for future consideration when this activity is revisited after Lesson 5-5.
5. Direct students to Puzzle B. Have students write a problem based on this pattern and provide the answer.

Revisiting the Ignite! (after Lesson 5-5)

6. Refer students again to Puzzle A, reviewing some of the strategies used to find the number of blue squares in Step 4.
   - What is an easier way to find the number of blue squares in Step 10?
   - How would you describe a general way to find the number of blue squares in any step?
   - In what step will there be 24 blue squares? Explain.
   - In what step will there be 36 blue squares? Explain.

Listen to students reasoning about efficient ways to think about the pattern.

- Each step of the patterns shows 4 equal groups of squares.
- The number of squares in each group is the same as the step number.
- We can multiply the step number by 4 to find the number of squares in any step.


Name _____

IGNITE!

Pattern Puzzles

Describe the patterns you see.

Puzzle A

Step 1 Step 2 Step 3

Puzzle B

Step 1 Step 2 Step 3

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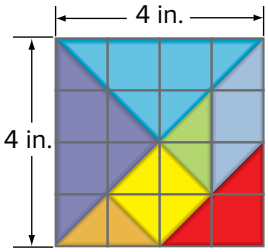
Name _____ Date _____ Period _____

IGNITE!

Which Pieces Are The Same Size?

For exercises 1–4, use the figure to answer the questions.



1. Without performing any calculations, which pieces do you think are the same size?

2. What tools or strategies would be useful to help you compare the sizes of the shapes?

3. Can you find the sizes of all the shapes? Which pieces are the same size?

4. What relationships do you notice between the heights, widths, and areas of the shapes?

Unit Opener

Ignite!

Purpose Spark students' curiosity and engage them in productive struggle.

Which Pieces Are The Same Size?

Students can work in pairs or groups of three to work on the *Ignite!* questions.

ETP Support Productive Struggle

- Not including the grid, how many different shapes to you see?
- Which shapes have the same dimensions?
- How could you compare the sizes of the different shapes?

ETP Facilitate Meaningful Discourse

As student-groups work through the activity, ask other students to think about how they would compare the figures and their sizes. Focus on students' rationales for each shape.

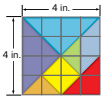
- How did you determine that these two shapes are the same size?

Name _____ Date _____ Period _____

IGNITE!

Which Pieces Are The Same Size?

For exercises 1–4, use the figure to answer the questions.



1. Without performing any calculations, which pieces do you think are the same size?

Students may see that the two larger triangles are the same size, and the two smaller right triangles are the same size.

2. What tools or strategies would be useful to help you compare the sizes of the shapes?

Students may suggest that the grid could help compare the sizes of the shapes.

3. Can you find the sizes of all the shapes? Which pieces are the same size?

Students can count the unit squares to determine the areas of the shapes. They may be surprised to discover various pairs of shapes that are the same size.

4. What relationships do you notice between the heights, widths, and areas of the shapes?

Students may notice how pieces can be cut into smaller triangles and then assembled back to cover other shapes in the picture.

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Name _____ Date _____ Period _____

IGNITE!

Which Would You Choose?

At a carnival, you can purchase one ticket to place in one of the three buckets described for a chance to win ride tokens. Each ticket costs $5.

Blue Bucket

- $\frac{1}{2}$ of all tickets win 10 tokens
- $\frac{1}{2}$ of all tickets win 0 tokens

Green Bucket

- $\frac{1}{3}$ of all tickets win 3 tokens
- $\frac{1}{3}$ of all tickets win 7 tokens
- $\frac{1}{3}$ of all tickets win 5 tokens

Orange Bucket

- $\frac{1}{10}$ of all tickets win 50 tokens
- $\frac{9}{10}$ of all tickets win 0 tokens

1. Which bucket would you choose? Explain your reasoning.

2. Imagine you have $100 to spend on tickets. Does this change how you play?

Unit Opener

Ignite!

Purpose Spark students' curiosity and engage them in productive struggle.

Which Would You Choose?

Students can work in pairs or groups of three to work on the *Ignite!* questions.

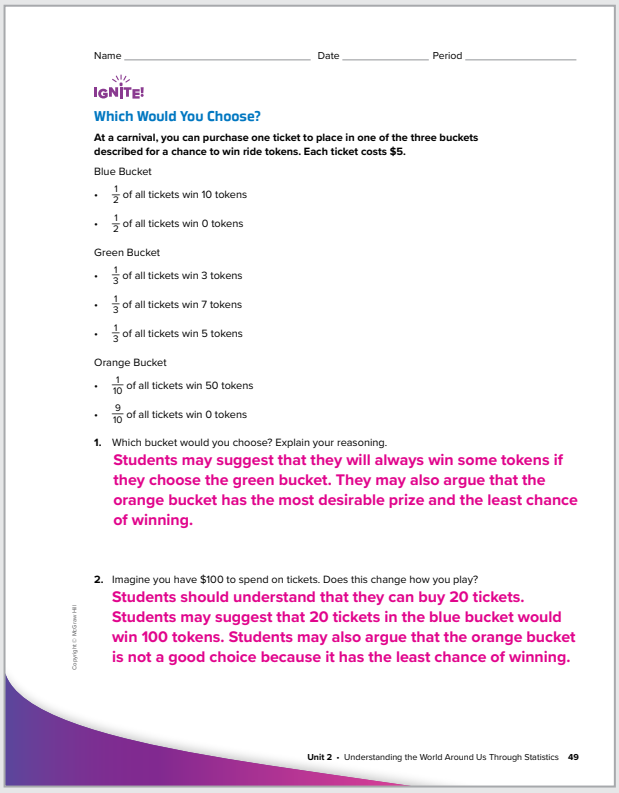
ETP Support Productive Struggle

- What information would you need to make a decision about which bucket you should choose?
- Think about methods you could use to evaluate the options. Which option is best for you?
- What are some reasons why you think it might be better to put your ticket in one bucket over another?

ETP Facilitate Meaningful Discourse

As student-groups share their ideas about which bucket to choose, guide students to form connections among how they could evaluate the different outcomes to determine the bucket in which they would place their ticket.

- Why might you choose one bucket over another?
- How could your choice affect your winnings?



Name _____ Date _____ Period _____

IGNITE!

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Orange Bucket

- $\frac{1}{10}$ of all tickets win 50 tokens
- $\frac{9}{10}$ of all tickets win 0 tokens

1. Which bucket would you choose? Explain your reasoning.

Students may suggest that they will always win some tokens if they choose the green bucket. They may also argue that the orange bucket has the most desirable prize and the least chance of winning.

2. Imagine you have $100 to spend on tickets. Does this change how you play?

Students should understand that they can buy 20 tickets. Students may suggest that 20 tickets in the blue bucket would win 100 tokens. Students may also argue that the orange bucket is not a good choice because it has the least chance of winning.

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California Reveal Math K–8 Contributing Author

Dr. Raj Shah has always had an affinity for math. Powered by his love of math, he earned a Ph.D. in Physics in 1999, which led to a career in R&D at Intel. In 2008, he left his job and founded Math Plus Academy, an after-school STEM enrichment program for students ages 5–14. His mission is to introduce students and adults to the wonders of mathematics. Dr. Shah also contributes his time to Math Teacher Circles, the Julia Robinson Math Festival, and is a founding member of The Global Math Project. He believes that everyone can enjoy math, develop strong number sense, and become a perseverant problem solver.

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