Activities written by Dr. Raj Shah engage students in math discovery.

Get your students hooked on math today!
Ignite! activities launch every module of *Reveal Math K–5*, an elementary core mathematics program. Enjoy these samples and use them in your classroom today.

Get Ready for Ignite!

**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!

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

**Embrace “Failure”** - 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!

Learning mathematics is like learning to play basketball. If you are right-handed, you must practice dribbling left-handed to get better—even if it’s uncomfortable. Practicing math that may be outside your comfort zone makes you stronger.

Dr. Raj Shah
Broken Calculators

Part A: Your calculator can only add 2s and 5s.
Show how you can make some numbers less than 100 with this calculator.

Part B: Your calculator can only add 3s and 7s.
What whole numbers less than 12 cannot be made with this calculator?
Show how you can make each of the whole numbers 12 through 16 with this calculator.
Show the quickest way to make 30 with this calculator.
Try to find a number greater than 11 that cannot be made with this calculator. Can you find one?
Hidden Squares

Figure 1

Figure 2
When adding 5 and 2, does the order in which you enter the numbers into a calculator matter? Explain. No. Sample explanations: 5 + 2 = 2 + 5. Addition is commutative.

2. Have students think about numbers that cannot be made with this calculator. What are the whole numbers less than 10 that cannot be made using this calculator? Can you make 92 with this calculator? Explain. Yes. Sample explanation: We can make all even numbers by adding 2s. Can you make 75 with this calculator? Explain. Yes. Sample explanation: Because this calculator adds 5s, we can make all of the 5s.

Describe two different ways to make 10 with this calculator. Enter 2 + 2 + 2 + 2 + 2 =. Enter 5 + 5 =.

Describe different ways to make 14 with this calculator. Sample answers: Make 10 and make 4: 5 + 5 + 2 + 2 = 14; Make 7 and make another 7: 5 + 2 + 5 + 2 = 14; Use 2 as an addend 7 times: 2 + 2 + 2 + 2 + 2 + 2 + 2 = 14

Extensions
3. Have students think about a calculator that can only add 3s and 7s. Have students use Part B when they do the following problems: List the whole numbers less than 12 that cannot be made using this calculator. Show how you can make each of the whole numbers 12 through 16 using this calculator. Show the quickest way to make 30 with this calculator. Try to find a number greater than 11 that cannot be made with this calculator. Can you find one? If students erroneously find a number greater than 11 that “cannot be made,” challenge the class to find a way to make that number.
Hidden Squares

Students count the number of squares and rectangles of various sizes that appear in puzzles.

1. Direct students to Figure 1.
   *How many small squares are in Figure 1? How did you count them?*
   *Sample answers: I saw 3 at the top, 2 in the middle, and 1 at the bottom. I imagined the bottom square moving into the "empty space" on the left to create a \( 2 \times 3 \) rectangle.*

2. Mention that someone told you that there are actually 7 squares in Figure 1.
   *Explain how someone might say there are 7 squares in Figure 1. There are 6 small squares and one large \( 2 \times 2 \) square. So there are 7 squares of different sizes in Figure 1.*

3. Divide students into groups of two or three.
   *Ask students to figure out how many squares of all sizes are in Figure 2. Advise them that they should count squares more than once when they appear in different squares.*

4. After students have had a few minutes counting, ask them to pause to think about how they could count the squares in an organized way.
   *How might you count the squares in a way that ensures that you do not miss any squares in your count? Sample answer: I could count all the \( 1 \times 1 \) squares. Then I could count all the \( 2 \times 2 \) squares, and so on.*

5. Allow students to continue counting squares.
   *What are the different sizes of squares that are in Figure 2? \( 1 \times 1, 2 \times 2, 3 \times 3, \text{ and } 4 \times 4 \)*
   *How many squares of each size did you find? \( 1 \times 1 \) squares: 21; \( 2 \times 2 \) squares: 12; \( 3 \times 3 \): 5; \( 4 \times 4 \) squares: 2.*
   *How many total squares did you find? 40*

Extension

6. Have students find the number rectangles of all sizes that are in Figure 1. You may want to discuss that all squares are rectangles, but not all rectangles are squares.
   *What are the different sizes of rectangles that are in Figure 1? \( 1 \times 1, 1 \times 2, 2 \times 1, 3 \times 3, \text{ and } 2 \times 2 \)*
   *How many rectangles of each size did you find? \( 1 \times 1 \) rectangles (squares): 6; \( 1 \times 2 \) rectangles: 3; \( 2 \times 1 \) rectangles: 3; \( 1 \times 3 \) rectangles: 1; \( 3 \times 1 \) rectangles: 1; \( 2 \times 2 \) rectangles (squares): 1.*
   *How many total rectangles did you find? 15*
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.
Reveal the Full Potential in Every Student.

*Reveal Math* empowers educators to uncover the mathematician in every student through powerful explorations, rich discourse, and timely and insightful differentiation opportunities.

Learn more at RevealMath.com