cartoon corner

Name ____________________

ONE BIG HAPPY by Rick Detorie

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RAPID-FIRE MATH

In questions 1–10, describe a "rapid-fire" way to find each result.

1. Evaluate: 1,000,000,000 – 3

2. Evaluate: (3,867 – 1,978) × (910 – 909 – 1)

3. Evaluate: 50,000 + 2,000 + 180 + 3 + 0.9 + 0.007

4. Solve for x: $87.895 + x = 750.9803 + 87.895$

5. Evaluate: $\frac{29}{47} \div \frac{29}{47}$

6. Find this result in standard notation without using a calculator: $90.4 \times 10{,}000 \times 10^5$

7. Solve for x: $(-7 + -9) + 22 = -7 + (x + 22)$

8. Evaluate: 15% of $604

9. How does knowing the answer to $x + 17 = 15$ help you quickly solve $10(x + 17) = 150$ for x?

10. Describe a quick way to tell which deal is better: (A) 6 cookies for $8 or (B) 8 cookies for $11.

from the September 2015 issue of mathematics teaching in the MIDDLE SCHOOL

Edited by **David B. Spangler**, McGraw-Hill Education, Chicago, Illinois; **Katie A. Hendrickson**, Code.org, Seattle, Washington; and **Hoyun Cho**, Capital University, Columbus, Ohio. Classroom teachers interested in field-testing or submitting a cartoon should contact Cartoon Corner at **mtms@nctm.org**. The cartoons must include the date and the newspaper syndicate that holds the copyright.

SOLUTIONS

1. Sample strategy: Simply count back 3: Counting back 1 yields 999,999,999; counting back 1 more yields 999,999,998; counting back 1 more yields 999,999,997. There is no need to repeatedly "borrow," crossing over 0s, to subtract.

2. Sample strategy: Because the second factor, 910 – 909 – 1, is equal to 0, the product is 0. There is no need to subtract in the first factor or apply the distributive property.

3. Sample strategy: The expression can be simplified to 52,183.907 by applying place value and expanded notation concepts. There is no need to attempt to add the terms one by one.

4. Sample strategy: By simply applying the Commutative Property of Addition, the missing addend is 750.9803. There is no need to try to solve the equation using inverse operations.

5. Sample strategy: Because dividing a nonzero number by itself is equal to 1,

$$\frac{29}{47} \div \frac{29}{47} = 1.$$

There is no need to invert the divisor and multiply.

6. Sample strategy: Applying the pattern of 0s and powers of 10, and the laws of exponents, the answer is 90,400,000,000.

7. Sample strategy: The problem is an illustration of the Associative Property of Addition. As such, the "missing term" can be easily identified as –9. There is no need to combine terms and formally solve for x.

8. Sample strategy: Mentally find 10% of \$604, which is \$60.40. Add half that amount, \$30.20, to \$60.40; 15% of \$604 = \$60.40 + \$30.20, or \$90.60.

9. Sample strategy: The solution to the first equation is $x = -2$. Both sides of the first equation were multiplied by 10 to produce the second equation. The solution to the second equation is also –2.

10. Sample strategies: You can use the least common multiple (LCM) of 6 and 8, which is 48, to compare the prices of the same number of cookies. For deal A, 48 cookies cost \$64. For deal B, 48 cookies cost \$66. Therefore, deal A is better. You can also use the LCM of \$8 and \$11, which is \$88, to compare the number of cookies for the same price. For deal A, \$88 will get you 66 cookies. For deal B, \$88 will get you 64 cookies. Therefore, deal A is better.

FIELD-TEST COMMENTS

My sixth-grade prealgebra students had a blast with Rapid-Fire Math. We completed these problems as a whole class while I projected one problem at a time. As soon as students had an answer, hands went up. The students were instructed to think about the strategy they used to solve the problem until called on. This allowed more students to solve the problem and gave time for the fastest problem solvers to organize their thinking and clearly articulate their strategy.

A billion minus 3 was solved by knowing that 10 – 3 = 7 and that 100 – 3 = 97, or as one student stated, "The rest of the digits are 9s, except the units, which is 7." One student actually explained crossing out and borrowing in his head. I asked whether that was truly what he did and the answer was an emphatic "Yes!"

Problem 5, which was 29/47 divided by itself, was solved by many students mentally, using the reciprocal. Only a few students recognized that dividing by the same nonzero number equals 1. It was evident that this procedure had been taught and reinforced, but that the understanding of the concept was lacking; we then discussed the concept.

Problems 6 and 8 were the most difficult for my students. The concepts of the laws of exponents and percentages were new to these students, and the answers were not as rapidly achieved. Problem 8 was overcomplicated when students attempted to multiply by 0.15 instead of calculating 10 percent and then adding one-half of that. This problem's solution provided a great conversation point about sales in stores and how to mentally calculate a percentage off.

Many strategies were used for problem 10. Some students looked at 6/8 and 8/11 and compared them using the common denominator of 88. Others simplified 6/8 to 3/4 and used 44 as the least common denominator.

Several students mentally divided the fractions and realized that 1 1/3 was less than 1 3/8. Students using this method were definitely comfortable with fractions and not necessarily ratios and rates. In the end, they concluded that 6 cookies for $8 was the better deal.

Judy Kraus
Hyde Park Middle School
Las Vegas, Nevada

Who hasn't heard, "What's the shortcut for doing this?" or, even worse, "What's the trick?" The student asking such a question often has forgotten how to do the problem and is looking for a reminder because of weak number-sense skills. "Rapid-Fire Math" is an activity that can address both needs.

My Chi Alpha Mu Math Club, with students in grades 5 through 8, tackled these problems in cross-grade-level small groups. After discussing the nature of idioms in the cartoon, each group worked through all ten questions. They were asked to find the answer in a more traditional way first and then come up with a second or third strategy. Groups shared their answers with the whole class. During each presentation, the students were required to use precise mathematics vocabulary to justify their methods.

Sometimes the fifth graders found the "Rapid-Fire" method first. They used the number-sense skills that were developed in elementary school, whereas the older students immediately started "showing steps" to solve the equations. The majority of the fifth graders had difficulty with some of the traditional methods because of lack of experience. Even the older students needed a refresher on scientific notation. We referenced tipping in a restaurant for the percentage problem and practiced calculating tips in our heads finding 10 percent, 15 percent, and 20 percent. The cookie problem stumped a few initially because they were trying to find a unit rate to compare. This lesson was a great opportunity to explore multiple strategies and to further develop number sense.

Pamela Haner
St. Catherine's School
Richmond, Virginia

I tested this cartoon with my sixth-, seventh-, and eighth-grade students. All grade levels were able to answer the questions. The ability to answer the questions was based more on how they looked at the problems rather than on their mathematical ability. Some of the students were able to find a "rapid-fire" way quickly, whereas others completed the actual calculations. It showed me where students were in their mathematical thinking.

These problems could be used to start a discussion with students about looking at mathematics as more than just a subject with lots of rules. They need to think about what is happening before they start calculating.

Machele Lynch
St. Patrick School
Carlisle, Pennsylvania

I used this cartoon as an extension activity with a combined fifth-grade and sixth-grade mathematics class. Students worked with partners. They enjoyed the activity, and there was some healthy competition among the pairs of students as to each group's solution strategies. Students shared and compared their answers when they completed the activity. Most of the students quickly solved problems 1–6 and 10. Although we had only used negative numbers for coordinate graphing when this cartoon was assigned, many students were able to solve problem 7 by eliminating like numbers. They had no idea how to solve the percentage problem or the distributive property problem.

After the students had solved problems on their own, I sat with them in a small group, and we discussed how to solve problems 8 and 9. A few of the students remembered seeing the distributive property but did not remember how to use it. Almost all wrote problem 10 as fractional values and then compared the fractions, probably because we were finishing up our fraction studies. We then looked at any alternate ways to solve the problems.

With problem 10, I found it interesting that some students simply stated that (A) was a better deal because it involved a smaller amount of money. We have not yet studied rate and ratio, so in their minds a lower price was better. None of them thought to figure out the cost per cookie in that problem. I will be interested to see how or if their thinking changes once we study rate and ratios.

Carol Fears
Landstuhl Elementary School/
Middle School
Armed Forces Post Office, Area Europe

OTHER IDEAS

Extend this month's Cartoon Corner task with these ideas:

- Have students describe other "rapid-fire" methods they can use to solve mental-math problems.
- Ask students to create problems for one another that look complex, but can be easily simplified using properties.
- Discuss how formulas, such as those for area and volume, provide shortcuts.
- Ask students to research the history behind the introduction of various mathematical symbols and how those symbols then facilitated the communication of mathematics.

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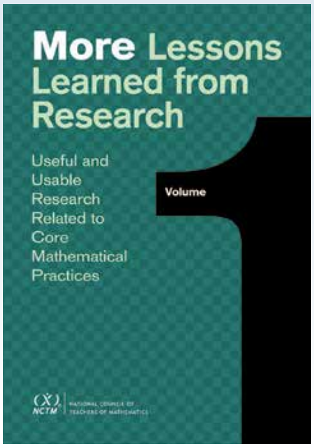

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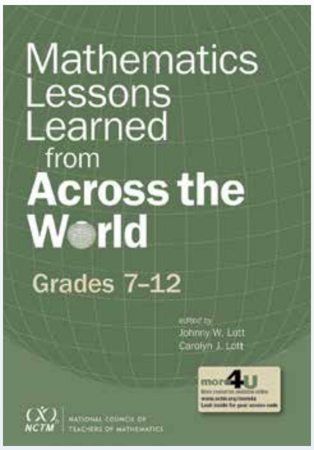

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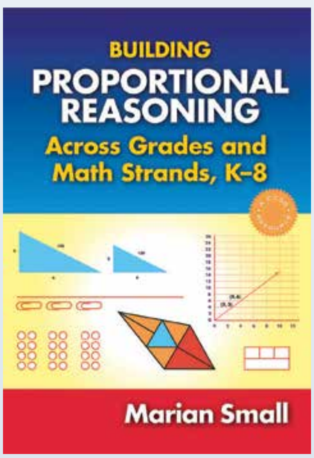

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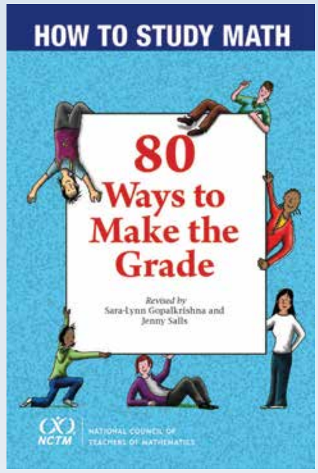

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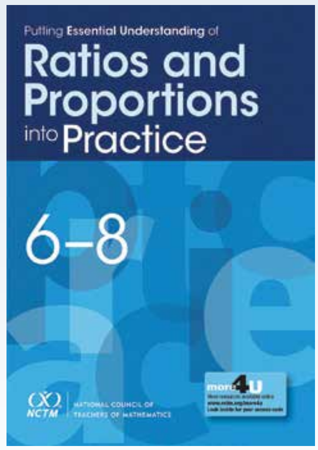

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