TAKE IT TO THE MAT

A NEWSLETTER ADDRESSING THE FINER POINTS OF MATHEMATICS INSTRUCTION

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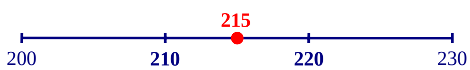
In last month's *Take It to the MAT*, we began a discussion of rounding—why we do it and how we do it. In this month's issue we will continue on the subject of rounding, its mechanics, and its connection to estimation.

We left off last time with the question: Consider 215 rounded to the nearest ten. Which multiple of ten is it closer to, 210 or 220? It is equally close to both 210 and 220, so we are left in a bit of a quandary. The standard rounding rule tells us to round "up" to 220. Why?



Well, this answer may be a little unsatisfying: *just because*. In mathematics, we have **conventions**—widely accepted techniques. The convention for rounding, at least as we teach it in elementary and middle grades, is to round numbers exactly halfway between two values "up." The primary purpose for this convention is so that we all agree to where we will round such numbers.

(Note: This convention fell out of favor with mathematicians and scientists a long time ago. The reasons why and the rule replacing it will not be discussed here, however.)

Let's return to the primary reason that we round—to estimate as it relates to computation. We want an answer that is *about* the actual sum, product, etc. There is not a need for an exact solution. We'll also take estimation a step beyond what we normally do, so as to deepen number sense. For now, we'll round so that only the first digit is not zero. Addition is up first.

Estimate: 121 + 694. Did you get 800? Well done. The number 121 rounds to 100, and 694 rounds to 700; 100 + 700 = 800. But, how good is your estimate? Is it too high or too low?

Here, it's very easy to see that when we rounded 121 to 100, we "lost" 21. When we rounded 694 to 700, we "gained" 6. Since we rounded down more than we rounded up, our estimate will be too low. So, our estimate of 800 would be better described as *a little more than 800*.

Note: This example is presented to begin the discussion. An estimate here is actually impractical. Students should be able to quickly add 121 and 694 in their heads, even in 3rd grade. Whether they find the sum by direct computation, or through the rounding process realize that their estimate of 800 is 15 too low, an exact answer of 815 should be expected. Estimation is better used when we need approximate answers to situations where exact answers will take more time.

Estimate: 19,487 + 62,646. In this case, we would round the addends to 20,000 and 60,000 respectively, and get 80,000. When we rounded 19,487 up, we gained a little more than 500. When we rounded 62,646, we lost 2,646. We lost far more than we gained, so our estimate is too small. Thus, we should say that our estimate is *more than 80,000*.

In both of the previous examples, one number was rounded up and one was rounded down. If both are rounded the same direction, it should be clear whether the estimate is too small or too large. Students can refine their estimate from a mere value to also stating if it's too low or too high.

Next month, we'll look at refining estimation with other arithmetic operations.