



TAKE IT TO THE MAT

A NEWSLETTER ADDRESSING THE FINER POINTS OF MATHEMATICS INSTRUCTION



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Estimation is a critical skill in an individual's mathematics repertoire. We probably use estimation in life more often than we use exact calculations. For this reason alone, students must develop good estimation skills. We continue our discussion of enhancing estimation skills that began with the October 2005 issue of *Take It to the MAT*.

To review, if we estimate the sum $694 + 121$, we might think of $700 + 100 = 800$. Since we rounded the first addend up less than we rounded the second one down, our estimate of 800 is too small. We know that the sum we seek is *more than* 800.

When estimating with subtraction, there are a few other things to consider. What if we estimate the difference $694 - 121$ as $700 - 100 = 600$? Just looking at the subtrahend 694, we have rounded it up to 700. We have made the initial quantity we are subtracting *from* larger, so our estimate will be too high.

Now, consider only the minuend 121. It was rounded down to 100, thus we are subtracting *less* than the actual value. That means our estimate will be too high. Thus, we get a double-whammy forcing our estimate above the actual difference. We know, therefore, that our estimate of 600 is too large. The difference $694 - 121$ is less than 600.

What if we estimate the difference $62,646 - 19,487$ as $60,000 - 20,000 = 40,000$? The subtrahend 62,646 is rounded down to 60,000. We have made the initial quantity we are subtracting *from* smaller, so our estimate will be too low. The minuend 19,487 is rounded up to 20,000. We are subtracting *more* than the actual value, so our estimate will be too low. The rounding of both numbers forces our estimate below the actual difference. We know, therefore, that our estimate of 40,000 is too small, and the difference $62,646 - 19,487$ is greater than 40,000.

In addition, rounding the addends in opposite directions meant that our estimate may be too large *or* too small, depending on which addend gained or lost more of its value when rounded. It was obvious whether our estimate would be too large or too small when rounding addends in the same direction.

In subtraction, the opposite is true. Rounding the subtrahend and minuend in opposite directions pushes our estimate too high or too low, with only the direction to be determined. Now, we will see, that rounding in the same direction will require us to examine which value was rounded further to refine our estimate as too low or too high.

Estimate: $8,092 - 2,215$. Our estimate would be $8,000 - 2,000 = 6,000$, having rounded both numbers down. When rounding 8,092 down to 8000, we made the initial number smaller, so our estimate would be too small. Rounding 2,215 to 2,000 would push our estimate higher than the actual difference—we are not subtracting as much. Since 2,215 was rounded “more” than 8,092, our estimate is pulled up more than down, so our estimate of 6,000 is too large. The actual difference is *less than* 6,000.

Next time, we'll look at estimation with multiplication. Before then, the reader is encouraged to think about how to refine such estimates as 50×20 for the product 47×22 .