Approximating Multiplying 3 Close Numbers:

A. Multiplying 3 close numbers is similar to *Multiplying 2 Large Numbers*.

B. In this problem we can change the outside numbers to be a multiple of ten (by adding or subtracting numbers) and change the middle number by adding/subtracting the difference of the other 2 numbers.

    1. This method can often times get you beyond the 5% window, so we have to compensate in some way.

    2. One way of correcting this is to add an additional number to the middle number for every 3 we had to add or subtract to get the other numbers to be a multiple of 10. (If the difference is less than 3, don't add anything. In other words round down.)

C. Here are some examples to help explain this better:

    Ex [1] 41 x 42 x 43 = _____.

        a. In this problem, we can change the first and the third numbers to be 40 and 40 if we subtract 1 from the first and 3 from the second.

        b. Now we should add 4 to the middle number (this is because we subtracted 1 and 3). According to step (2) above, we should add an additional 1, since $^4/_3 =$ 1.333... which, rounded down equals 1.

        c. So the new problem becomes 40 x 47 x 40. This is the same as 1600 x 47 which equals 75200. See *Multiplying by 12-19*.

        d. The actual answer can be between 70344 and 77748.

    Ex [2] 19 x 21 x 23 = _____.

        a. In this problem, you could just write $21^3 = 9261$, if you had it memorized. If not do the following:

        b. Change the first and third number to 20. If you do this you must add 1 to the first and subtract 3 from the third.

        c. Since we added 1 and subtracted 3, the difference that we need to add to the middle number is 2. To compensate we should add an additional 0 since $^2/_3$ rounded down equals 0.

        d. The new problem becomes 20 x 23 x 20 or 400 x 23 which equals 9200.

        e. The answer can be between 8719 and 9635.

Ex [3] 23 x 33 x 43 = _____.

    a. In this problem, we can change the first number to 20 and the third number to 40 by subtracting 3 from each number.

    b. We must add 6 to the middle number and add an additional 2, since $^6/_3 = 2$.

    c. Doing so gives 20 x 41 x 40 or 800 x 41 = 32800.

    d. The actual answer can be between 31006 and 34268.

D. Notice that in Ex [3], if we had not compensated the answer would have been outside the 5% window. So for problems where there is a large spread, the compensating will come in handy.