Mental Math Class Handout

** Numbers are not just collections of digits; they have properties, such as being near a number.

** PLEASE….Work LEFT-to-RIGHT!

** Try to use EASY numbers near the real ones, then fix it up at the end.

** Have confidence. Don't limit yourself by saying it's "too hard." Don't worry about speed.

ADDITION and SUBTRACTION:

1) Work LEFT-to-RIGHT. Keep a "running total" in your head.

   245 + 487 = 600 + 120 + 12 = 732

2) When subtracting, it is often easier to subtract a larger round number and add the rest back.

   236 – 185 = 236 - 200 + 15 = 51

MULTIPLICATION:

"Break-It-Up" Method: Easiest to understand but the toughest, so try other shortcut methods first.

7 x 35 = 7 x 30 + 7 x 5 = 245

6 x 24 = 6 x 20 + 6 x 4 = 144

24 x 32 = 20 x 32 + 4 x 32 = 768

"Good Neighbor" Method: Use a nice neighboring number to multiply by, then fix it up at the end.

9 x 44 = 10 x 44 - 44 = 396

11 x 44 = 10 x 44 + 44 = 484

19 x 34 = 20 x 34 - 34 = 646

41 x 56 = 40 x 56 + 56 = 2296

Useful "Trick": Squaring a 2-digit number near 50

Find how far the 2-digit number is from 50. Add it to 25. Square it and put it at the end.

54 x 54: 54 is 4 more than 50, so (25 + 4) = 29 End with 4x4=16, so we get 2916

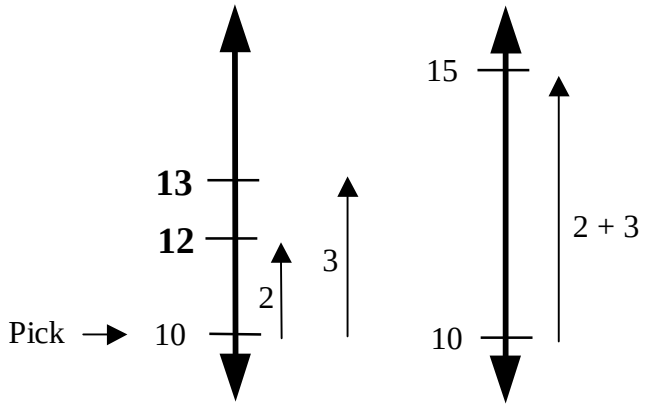
43 x 43: 43 is 7 less than 50, so (25 - 7) = 18 End with 7x7=49, so we get 1849

Multiplying by 25, 50, or 75

50 is the same as 100/2, so multiply by 100 and divide by 2: 34 x 50 = 3400 / 2 = 1700
You can also remember that 25 = 100/4 and 75 = 300/4.

"Lotto" Method: **Our really powerful method for close numbers (say, within 15 or 20)**

Pick a nearby number that is easy to multiply by and use this as a "Base" for the calculation.
To find the other number, add the differences from the original numbers. Multiply the differences and add.



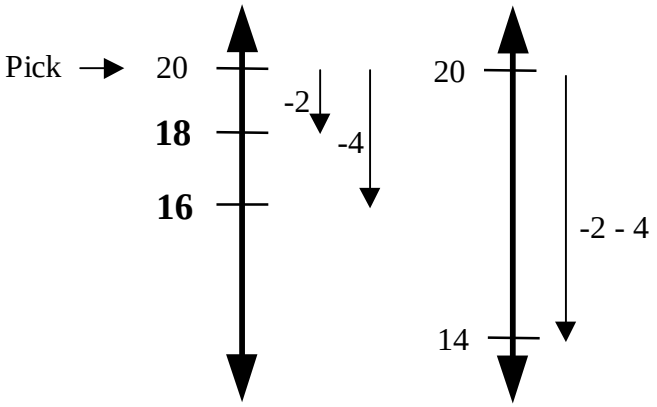
12 x 13 = 10 x 15 + 2 x 3 = 156

***Pick a Lower Number*:**

13 x 17 Pick 10, then 10 x 20 + 3 x 7 = 221

35 x 35 Pick 30, then 30 x 40 + 25 = 1225

23 x 32 Pick 20, then 20 x 35 + 3 x 12 = 736



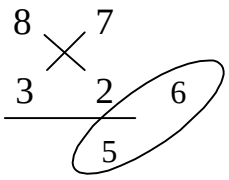
18 x 16 = 20 x 14 + 2 x 4 = 288

***Pick a Higher Number*:**

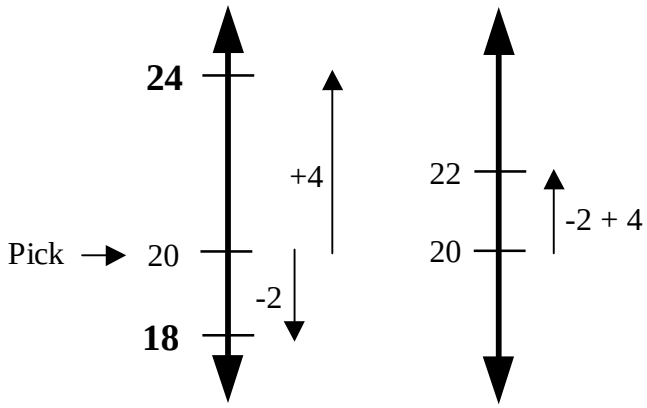
18 x 19 Pick 20: 20 x 17 + 1 x 2 = 342

35 x 38 Pick 40: 40 x 32 + 5 x 3 = 1295

An old way to avoid learning tables past 5x5:



Find 8 x 7:
3 and 2 are (10-7) and (10-8).
Then: 5 is (7-2) or (8-3)
and 6 is (3x2)
Answer: 56



18 x 24 = 20 x 22 - 2 x 4 = 432

***Pick a Between number* :**
(Subtract, Don't Add!)

27 x 35 Pick 30: 30 x 32 - 3 x 5 = 945

17 x 26 Pick 20: 20 x 23 - 3 x 6 = 442

Additional Material for Classes Familiar with Algebraic Notation

Multiplying two numbers far apart:

The biggest problem can be getting the two numbers close enough to each other to use the Lotto Method. Let's say you have 32 x 72 = ?. You can:

1) Subtract the larger number from 100:

$32 \times 72 = 32 \times (100 - 72) = 3200 - 32 \times 28$

2) Divide the larger number by 2 and then multiply it back at the end:

$32 \times 72 = 2 \times (32 \times 36)$

3) Break out 50 first, which is easy to multiply by since it equals 100/2:

$32 \times 72 = 32 \times 50 + 32 \times 22 = 3200/2 + 32 \times 22 = 1600 + 32 \times 22$

Multiplying two numbers ending in 5:

As seen in the example of 35 x 35 under the Lotto section in which a Lower number is picked, the square of a number ending in 5 (say, a5) is given by a(a+1) with 25 appended:

From Lotto section: 35 x 35 Pick 30, then $30 \times 40 + 25 = 1225$

or this way: $35 \times 35 = (3 \times 4) \mid 25 = 1225$

This is a special case of a more general method for multiplying two different numbers ending in 5:

$a5 \times b5 = [a \times b + (a+b)/2] \mid 25$

The third term in the brackets is the average of **a** and **b** . If the average ends in .5, drop the .5 but append 75 instead of 25:

$35 \times 55 = (3 \times 5 + 4) \mid 25 = 1925$

$55 \times 85 = (5 \times 8 + 6) \mid 75 = 4675$

$35 \times 35 = (3 \times 3 + 3) \mid 25 = (3 \times 4) \mid 25 = 1225$

Squaring a number one away from a round number:

$a^2 = (a-1)^2 + (a-1) + a$ so: $31^2 = 30^2 + 30 + 31 = 961$

$a^2 = (a+1)^2 - (a+1) - a$ so: $29^2 = 30^2 - 30 - 29 = 841$

Squaring a number ending in one:

$a1^2 = a^2 \parallel (2 \times a) \parallel 1$ where the middle section is one digit (add any upper digit to left section).

$21^2 = 4 \parallel 4 \parallel 1 = 441$

$71^2 = 49 \parallel 14 \parallel 1 = 5041$