Multiplication: Notes

What is multiplication?
- Important **order of operation**
- **Adding a number to itself a specific number of times**
- Multiplication Sentence: **Multiplicand (#) x Multiplicand (#) = Product (Answer)**
- Can be performed with **any number**, no matter how many digits it has
- Can multiply **horizontally** or **vertically**
- Symbols used to multiply: **x**, *****, **·**

How to multiply?
- You are **adding a number to itself a said number of times**
  - Example: Multiply **6 x 3**

    Or

    6

    x 3
  - Add 6 to itself 3 times
  - You would think in your head, "**6+6+6**"
  - The answer would be **18**
- The best way to perform multiplication in to **memorize the multiplication tables (SEE CHART BELOW)**
  - If you memorize the multiplication tables, when you get a question like 7 x 7, you won't need to think, "What is 7+7+7+7+7+7+7 ?"

Multiplying Numbers With More Than One Digit:
- You can also **multiply numbers that don't have the same number of digits**.
  1. Place the number with more digits above the number with less number of digits.
  2. Multiply the numbers in the ones place together, and write the answer under the bottom number's ones place.
  3. Multiply the bottom number's ones place with the top number's tens place, and write that answer to the left of your answer to Step 2 to get your final answer.
     a. Always remember to **solve from right to left**.

- Example: Multiply **21 x 4**

Or

21

x 4   (**Write the equation like this!**)

- You would first multiply 1 x 4 to get 4, and write that under the 4

21

x 4

4

- Then, you would multiply 4 x 2 to get 8, and write that next to the 4

21

x 4

84 (**Final Answer**)

- If the top number has 2 or more digits, you can use this strategy to solve those equations as well!

Carrying Over:

- In multiplication, sometimes you have to **carry over a number because the product is more than 9**.
- Similarly to addition you have to **carry over the tens digit to the next step of solving the equation and add it to the next product**.
- Follow the same steps as before, but if the product of a step is greater than 9, then add the tens digit to the next product in the line
- Example: Multiply **35 x 8**

Or

35

x 8   (**Write the equation like this!**)

- Multiply 5 x 8 to get 40, and write 0 under the 8 and add a +4 on top of the 3

+4

35

x 8

0

- Multiply 8 x 3 to get 24 and add 4 to it to get 28. Write 28 next to the 0.

+4

35

x 8

280 (**Final Answer**)

Double & Triple Digit Multiplication:
- Always make sure that you solve double and triple digit multiplication problems vertically!
- When multiplying double digit numbers, **make sure to follow these step by step rules**:
    1. Multiply the bottom ones place number with the top ones place number, and write the answer beneath the bottom ones place number.
    2. Multiply the bottom ones place number with the top tens place number, and write the answer beneath the bottom tens place number.
    3. Write a zero under the answer to Step 1. This is a placeholder: it will allow you to multiply the bottom tens number.
    4. Multiply the bottom tens number to the top ones number, and write the answer under your answer to Step 1.
    5. Multiply the bottom tens number to the top tens number, and write the answer to the left of your answer to Step 4. This will create a hundreds place in your answer.
    6. Finally, add your answers from Step 2 and Step 5 to get a final answer.
- Note: You can use these steps to solve 3 digit multiplication problems as well! You would just need to add another line of products from the bottom hundreds place under the products of the bottom tens place.
- Example: **Multiply 34 x 23**

  Or

  34

  x 23   **(Write the equation like this.)**
    - First you would multiply 4 x 3 to get 12. You would write 2 under the 3 and add a +1 on top of the 3.

      +1

      34

      x 23

      2
    - Then, you would multiply 3 x 3 to get 9 and add 1 to it to get 10. You would write 10 next to the 2.

      +1

      34

      x 23

      102

- You would add 0 under the 2 as a placeholder.

$$+1$$
$$34$$
$$\underline{\times\ 23}$$
$$102$$
$$\underline{\mathbf{0}}$$

- You can choose to get rid of the +1 since you don't need it anymore. You would multiply 2 x 4 to get 8, and write that next to the 0.

$$34$$
$$\underline{\times\ 23}$$
$$102$$
$$\underline{\mathbf{80}}$$

- You would multiply 3 x 2 to get 6, and write that next to 8.

$$34$$
$$\underline{\times\ 23}$$
$$102$$
$$\underline{\mathbf{680}}$$

- Finally you would add 102+680 to get 782 as a final answer!

$$34$$
$$\underline{\times\ 23}$$
$$102$$
$$\underline{+680}$$
$$\underline{\mathbf{782}}\ \textbf{(Final Answer)}$$

Multiplication chart

Directions: The dark grey part of the chart holds 1 multiplicand, the light gray part holds the other, and the white part holds the products. It is more important that you know your multiplication fast facts, and memorizing facts using this table is the best way to memorize!

x	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144