**College Guild**
PO Box 6448, Brunswick ME 04011

# THE NUMBERS GAME

## Unit 3 of 4

HELPS FOR MULTIPLYING

There is no great problem for multiplying as there is (in the palindromic number exercise) for addition, but there are a good many ways to learn multiplication facts. These facts are essential to working in math with ease. You have to practice them zillions of times to really know them. With this in mind, your first task is to fill in the three tables below. The first one is set up for you to use, and if need be, refer to. The next three are mixed up, and you will need to think carefully to complete them.

| X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **2** | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| **3** | 0 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| **4** | 0 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| **5** | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| **6** | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 |
| **7** | 0 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 |
| **8** | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 |
| **9** | 0 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 |

| X | 9 | 7 | 4 | 8 |
|---|---|---|---|---|
| **5** | | 35 | | |
| **3** | | | | 24 |
| **6** | | | | |
| **7** | 63 | | | |

**1. Table #1**

| X | 8 | 7 | 3 | 5 |
|---|---|---|---|---|
| **8** | | | | |
| **7** | | | | |
| **3** | | | | |
| **5** | | | | |

**2. Table #2**

| X | 2 | 7 | 0 | 6 |
|---|---|---|---|---|
| **5** | | | | |
| **9** | | | | |
| **8** | | | | |
| **3** | | | | |

**3. Table #3**

Consider a sheet of graph or quad ruled paper, one that is covered with a grid like this:  It may have four squares per inch or five, but that doesn't matter right now.

**4. How many squares are on the paper? Just guess…**

Is it more than 10? Obviously. More than 100? More than 1,000? More than 10,000? It is not so obvious when you get big numbers or many squares in the piece of graph paper. It's hard to get an answer without counting each square – and that would take a long time (and be very, very boring.) The best way to calculate the number of squares would be to multiply the number of squares going across the page horizontally by the number of squares going across it vertically.

If we wanted to figure out how many squares are on a paper 8.5 inches wide by 11 inches tall that has 4 squares per inch, we would have to use multiplication. First, we would have to figure out how many squares are going across the page horizontally by multiplying the number of inches across and the number of squares per inch:

*4 squares per inch X 8.5 inches across horizontally = 34 squares across the paper horizontally*

Next, we would use the same process to figure out how many squares are going across the paper vertically:

*4 squares per inch X 11 inches across vertically = 44 squares across the paper vertically*

Now, all we have to do is multiply the horizontal number and the vertical number to get the total number of squares:

*34 squares horizontally X 44 squares vertically = 1,496 total squares*

On graph paper, draw with a straight edge (like a ruler, the side of a book, or a heavy piece of paper) five rectangular boxes, each a different size. You can use the back of the last page of this unit if you don't have any graph paper.

**5. For each box:**
- **Count the number of squares down one side and across the bottom edge.**
- **Multiply these two numbers together to get the total number of squares inside the box.**
- **Write the total number inside the box.**

**6. If you had an 8.5" X 11" piece of paper with 5 squares per inch, how many squares would be on the paper?**

**7. Suppose you had an 11" X 14" piece of paper.**

**a. How many squares would it have if there are four squares to an inch?**

**b. How many if there are five squares to an inch?**

**Show your work in the space below.**

**8. If a section of a football stadium has 28 rows, and if there are 18 seats in each row, how many people can be seated in that section? Show your multiplication in the space below.**

**9. If an airplane flies at 390 miles per hour and travels for 6 hours, how far will it go? Show how you figured it.**

**10. If the cost of oil is $43 per barrel, and the Zlickow Petroleum Company imports 5,000 barrels, what is the total cost of the oil? Show how you calculated the answer.**

Questions 5 through 10 are examples of RATE. Rate means the *amount per unit*. A very commonly used rate is *miles per hour*, or distance per unit of time. To find the whole distance travelled, you multiply the rate in miles per hour by the number of hours. For example, *65 miles per hour X 2 hours = a total distance of 130 miles*. Another way to say the same thing is Distance = Rate X Time. The common formula is D = RT, sometimes abbreviated to just "Dirt".

Another example of rate is cost per unit. *Total cost = cost per unit X number of units*. In Question 10, the cost was in dollars and the units were barrels of oil. The one about seating in a football stadium can also be thought of as a rate problem. The number of seats per row times the number of rows gives the total seating capacity of the section.

**11. What other examples of rate can you think of? List three.**

_____

_____

_____

Rate is one of the most useful concepts we have, and it always involves either multiplication or division. Suppose a stadium section had a total of 520 seats, and there are 20 seats per row. How many rows are there in the section? You would divide 520 seats by 20 seats per row (520 ÷ 20) to get an answer of 26 rows. Here, you might call the rate *seats per row*.

Total seating, as we already know, would be the number of rows times the seats per row (26 rows X 20 seats per row = 520 total seats). We could make a formula, saying T = R X S.

**12. If a hall has a total seating capacity of 360, and there are 15 rows, how many seats per row are there?**

MATH MICE

The drawings which follow may not actually look much like mice, but they can be a neat way to practice multiplication. The square box in the middle is the face. Put in four simple numbers, one in each cell as shown (3, 5, 7, 8). The feet are the boxes below the face, the body is to the right of the face, and the ears are the circles above the face.

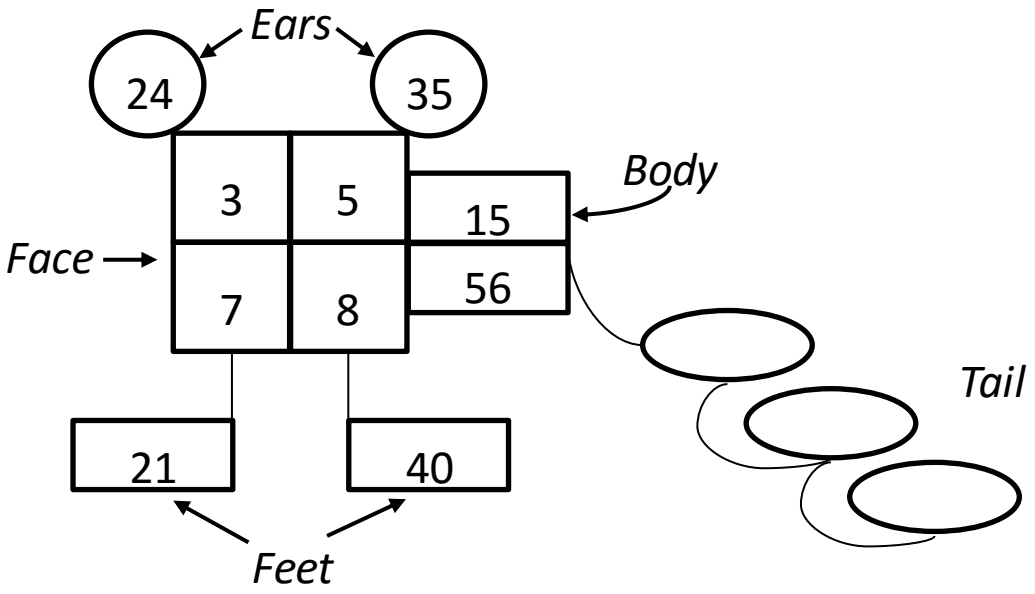
To get the left foot, multiply the two left hand numbers of the face (3 X 7 = 21). Multiply the two right hand numbers to get the right foot (5 X 8 = 40).

For the top of the body, multiply the top two numbers of the face (3 X 5 = 15). Multiply the bottom numbers of the face to get the bottom of the body (7 X 8 = 56).

To get the ears, multiply on the diagonal: 8 X 3 = 24 and 7 X 5 = 35.

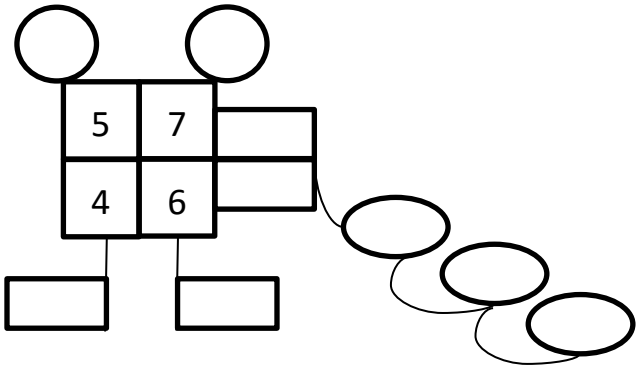
Now, multiply the two ears together (24 X 35), and put the answer in the first loop of the tail. Do the same for the feet (21 X 40), and put it in the second loop. Finally, do the same thing with the body (56 X 15) for the third loop. If you have done the calculations correctly, something quite neat happens…

**13. What do you notice about the tail?**



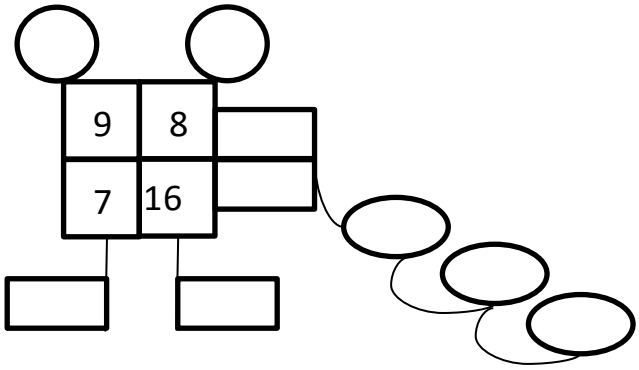

| Ears: | Feet: | Body: |
|---|---|---|
| 24 | 40 | 56 |
| x 35 | x 21 | x 15 |
| 120 | | |
| + 720 | | |
| 840 | | |

**14. Mouse #2**




Ears: Feet: Body:

**15. Mouse #3**



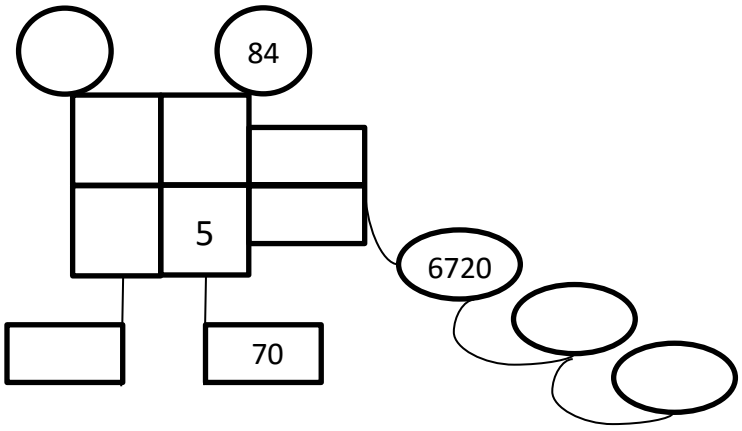

Ears: Feet: Body:

**16. Make up four different "multiplication mice" of your own and solve them. Show your work on the calculations you made for each part of the tail (not just the answers).**

Incidentally, mice work for addition, too. Just try it. They can also work for division and subtraction – just think about in the latter examples.

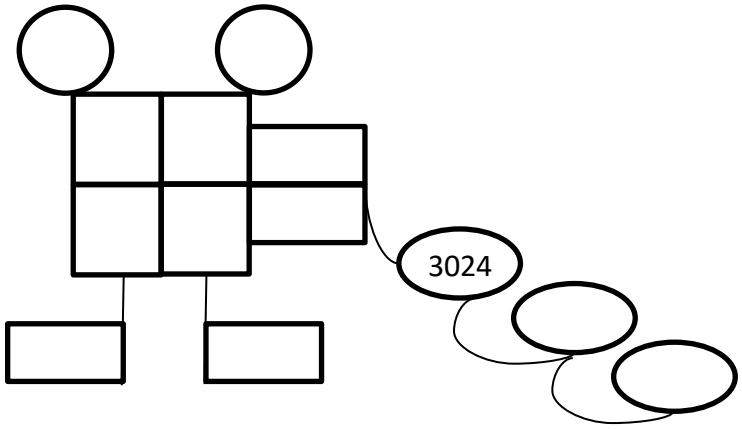
The following mice will require division. If an ear is filled, and you know one of the numbers below it, you must divide (or un-multiply) the ear number by the face number below it to get the missing part. The same applies if a foot or a body part is filled in.

**17. Keeping this in mind, fill in all the missing parts on this multiplication mouse. Make sure to show your work!**



It is possible to construct a mouse given only the tail number.

**18. Try it if the tail is 3024. There are several correct solutions. Find one!**




Now we can look at some notable products. (*Product* is just a fancy math term for the answer you get when multiplying two or more numbers together.) The products below require two-digit multiplication. You should get some special answers.

**19.** 12345679 x 9

**20.** 12345679 x 27

**21.** 12345679 x 63

**22.** 12345679 x 54

**23. What is the missing number in 12345679 x __??__ = 888,888,888?**

**24. And here are two final tables for you to fill in. Please show your work on a separate sheet.**

**9 x 7 = _____**

**99 x 77 = _____**

**999 x 777 = _____**

**9999 x 7777 = _____**

**99999 x 77777 = _____**

**8 x 1 + 1 = _____**

**8 x 12 + 2 = _____**

**8 x 123 + 3 = _____**

**8 x 1234 + 4 = _____**

**8 x 12345 + 5 = _____**

**8 x 123456 + 6 = _____**

**8 x 1234567 + 7 = _____**

**8 x 12345678 + 8 = _____**

**8 x 123456789 + 9 = _____**

Last page for super thinkers…

This is commonly known as "The Pancake Problem." Consider a large circle, or a pancake. If you make one cut across it, you will get 2 sections. If you make two cuts, you get 4 sections.

**25. Draw a pancake to show how many sections you get with three cuts.**

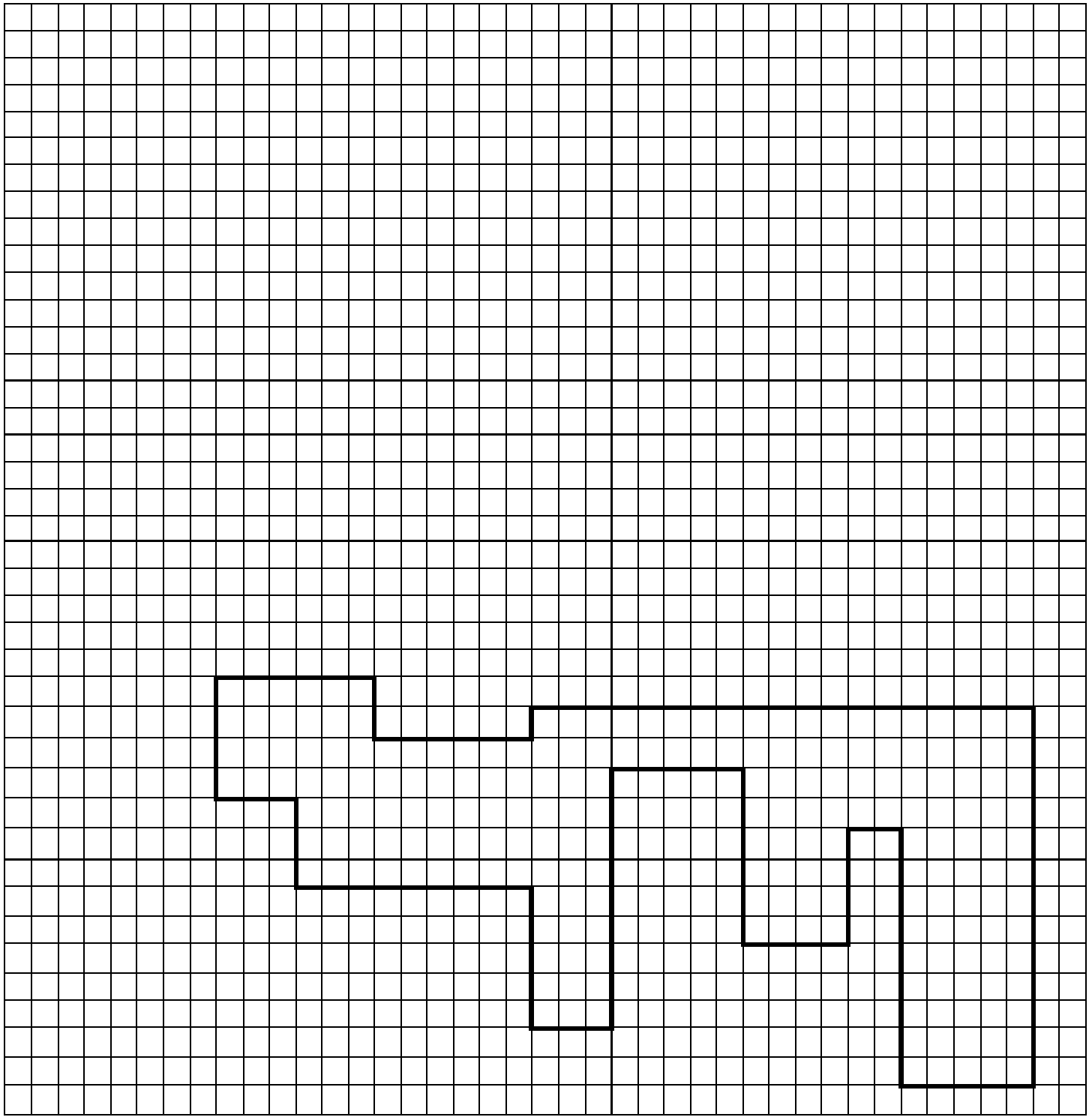
**26. Are there any special ways to make the cuts to change your answer to #25?**

**27. The cuts do NOT have to go through the center of the circle, nor do they have to be the same size. Use the space below to show more circles with different cuts.**

**28. How many sections can you get with 4 cuts? How many with 5 cuts?**

**29. Fill in the table below:**

| Number of Cuts | Number of Sections |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |



**30. Last question…The number of squares inside each of the boxes you drew is called the *area* of the box, or in math terms, the *area of the rectangle*. Can you find the area of the shape outlined above without counting all of the individual squares within it?**

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*Remember: First names only & please let us know if your address changes*