Graphical multiplication

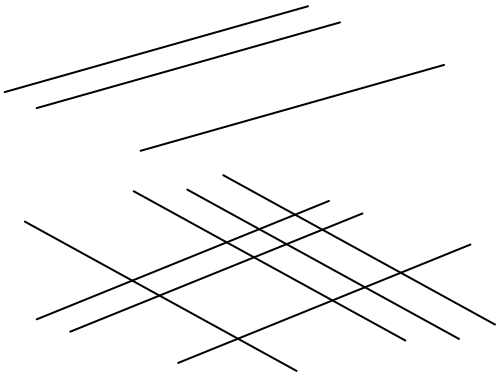
Overview: The trick looks impressive, so be prepared for jaw-drops when you show this to kids and adults. But can you figure out how it works? I'll give you a hint: Think about how to represent placeholders of powers of 10...

Materials

- Pencil
- Paper

Activity: This is a great method for kids who might have difficulty understanding multiplication, since it's graphical. Give it a try!

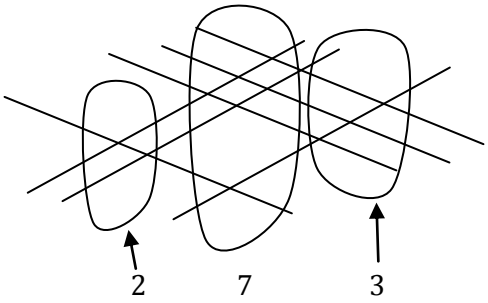
Let's multiply two numbers together: 21 x 13 =?



For 21, we draw two lines for the tens place and one line for the ones place:

Then draw the lines that represent 13. First, draw one line for the tens digit and three lines for the ones digit like this:

Now we count up the intersections. First, group them together vertically like this, and then count the number of intersections in each group.

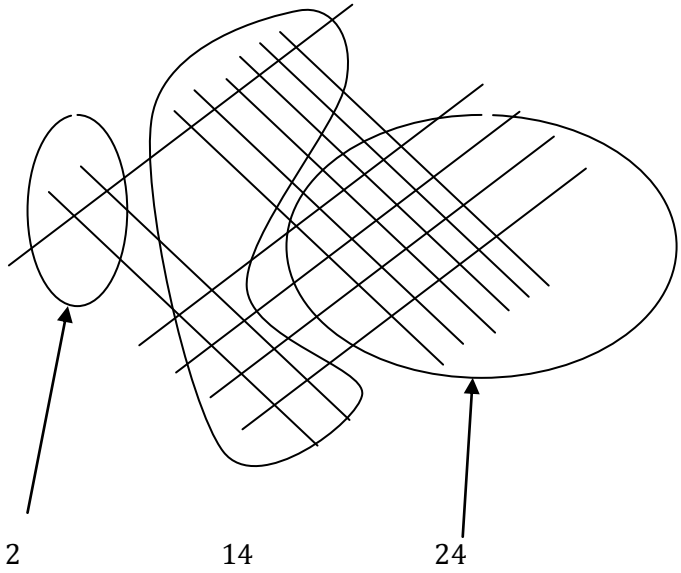


Put together the numbers that you counted up from the intersections (the 2, 7, and 3) to get the answer to the problem… 273.

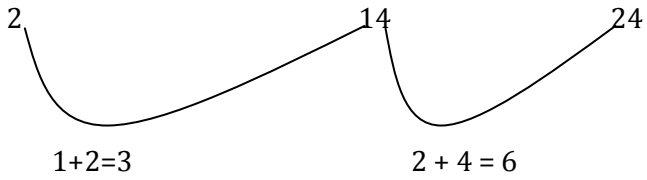
So 21 x 13 = 273!

Now you try this one before turning the page: 14 x 26 =?

First draw the lines for 14 and 26 as shown below, and then count the intersections.



The answer to 14 x 16 is not 21,424, since that's a five-digit answer, and we expect ours to be only three digits (as we've discussed before). So, since some of the numbers are more than 10, we have to perform a "carry" forward like this:

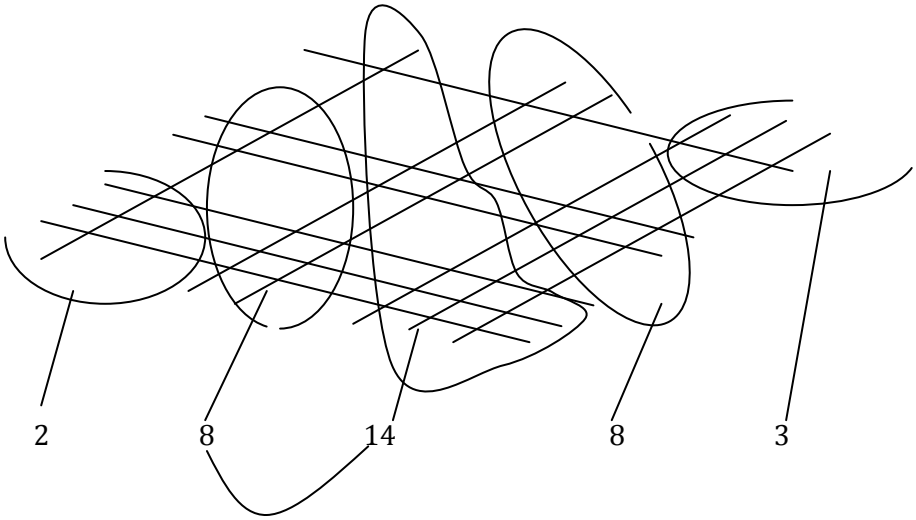


The answer becomes: 364.

So 14 x 26 = <u>364</u>!

What about multiplying three-digit numbers? Well, you really just need a larger sheet of paper.

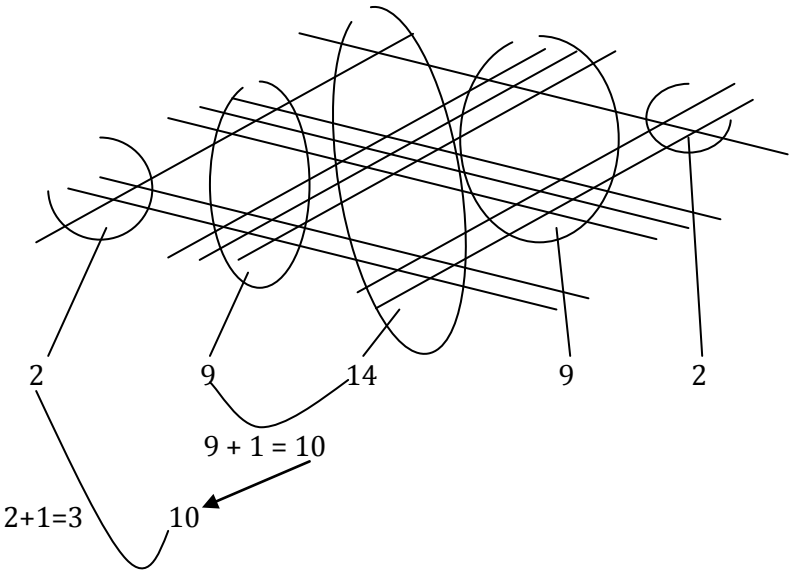
For example, let's figure out : 123 x 321 = ?



8 + 1 = 9

The solution is 123 x 321 =<u>29,483</u>!

Let's figure out: 132 x 231 = ?



The solution is: 132 x 231 = <u>30,492</u>!

How does this work? For the first example, we represented the number 21 with a set of two lines and then with one line. Then we turned 90 degrees and added the number 13 on top by drawing one line followed by a set of three lines.

But what do the lines really mean? Remember my hint about placeholders? Well, the lines are really placeholders for the following multiplication:

21 x 13 = (2×10 + 1)(1×10 + 3)

Instead of writing out the numbers like the problem above, we simply draw lines to mean the same thing. If you were to cross-multiply that problem, we get a scary thing that looks like this when we group it in powers of ten:

$(2\times10 + 1)(1\times10 + 3)= 2*10^2 + (2\times3 +1) \times 10 + 3 = 273$

The answer of 273 comes from figuring out there are 2 units of 100 (or 10^2), 7 units of 10, and 3 units of 1. Those are the intersection points of the lines we drew.

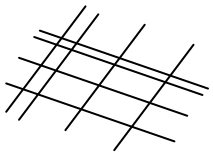
Now it's your turn! Work out the exercises below. (You'll find answers at the back of this book.)

Exercises

1. 23 x 45
2. 56 x 72
3. 52 x 26
4. 62 x 49
5. 67 x 92

For the following, write out the problems to solve and then solve them:

6.



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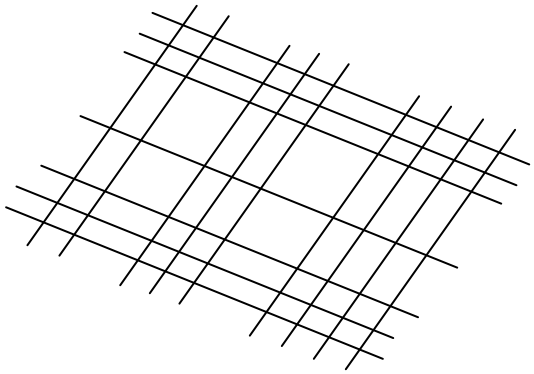

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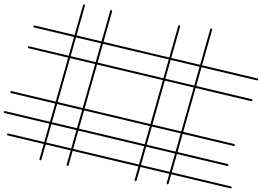

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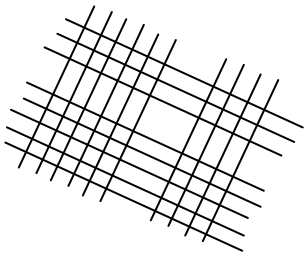

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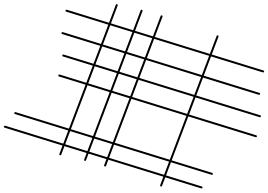

Answers to Exercises: Graphical Multiplication

1. 1035
2. 4032
3. 1352
4. 3038
5. 6164
6. 211 x 112 = 23 632
7. 234 x 313 = 73 242
8. 22 x 32 = 704
9. 64 x 53 = 3392
10. 24 x 31=744