

The Lattice Multiplication Method

The lattice method, sometimes called the Chinese method, is a multiplication method that uses a grid to organise the calculation.

Part 1: Multiplying two whole numbers

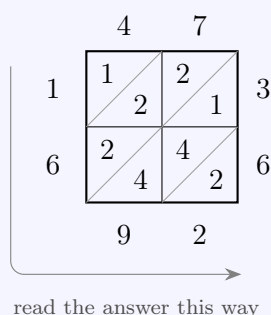
We draw a grid (sometimes called a lattice), the number of rows and columns should match the number of digits in the two numbers we are multiplying.

For example 47×36 is multiplying a 2 digit number by a 2 digit number, so our grid would have 2 columns and 2 rows.

Each cell of the grid is split diagonally, and we write the product of the digits in the cell, with the tens digit above the diagonal and the units digit below it.

Finally we add along the diagonals, starting from the bottom right corner. If a diagonal adds up to more than ten, we carry into the next diagonal.

Worked example: 47×36



$$4 \times 3 = 12, \quad 7 \times 3 = 21, \quad 4 \times 6 = 24, \quad 7 \times 6 = 42$$

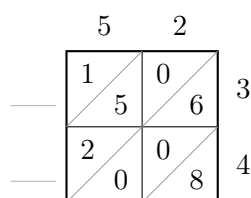
Adding the diagonals, starting from the bottom right corner:

$$\begin{array}{lll} \text{1st diagonal:} & 2 & = 2 \\ \text{2nd diagonal:} & 4 + 4 + 1 & = 9 \\ \text{3rd diagonal:} & 2 + 2 + 2 & = 6 \\ \text{4th diagonal:} & 1 & = 1 \end{array}$$

So $47 \times 36 = 1692$.

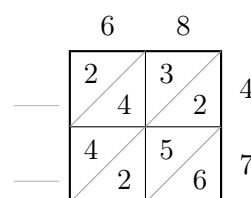
Q1. Both grids below are already filled in. Add along the diagonals and write the answer. One diagonal in part (b) adds up to more than ten, so you will need to carry.

(a) 52×34



$52 \times 34 = \underline{\hspace{2cm}}$

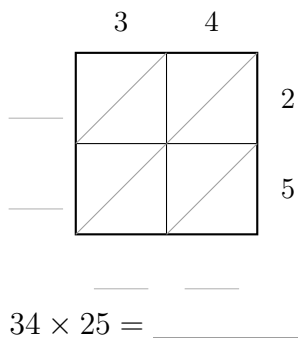
(b) 68×47



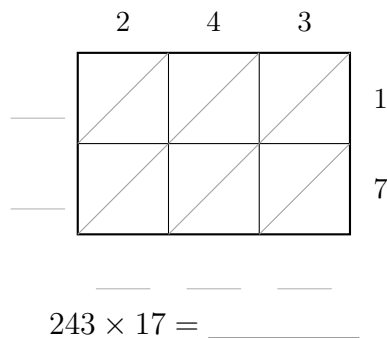
$68 \times 47 = \underline{\hspace{2cm}}$

Q2. These grids are drawn but empty. Fill in every cell, then add along the diagonals. Part (b) has a three-digit number, so its grid has three columns.

(a) 34×25



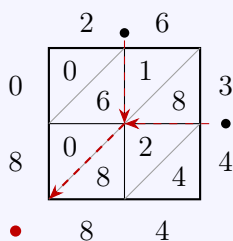
(b) 243×17



Part 2: Where the decimal point goes

The lattice method can also be used to multiply decimal numbers. The decimal point in the answer is located on the diagonal where the two decimal points in the numbers being multiplied meet, as seen below.

Worked example: 2.6×3.4



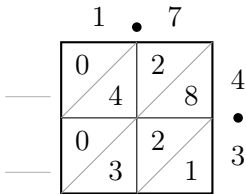
The digits along the top are 2 and 6, with the decimal point after the first of them. The digits down the side are 3 and 4, again with the decimal point after the first of them.

Adding the diagonals from the bottom right corner gives 4, then $2 + 8 + 8 = 18$, so we write 8 and carry 1, then $0 + 1 + 6 + 1 = 8$, then 0.

The two dashed lines meet in the middle of the grid, and the diagonal from there leaves the grid at the bottom left corner. So the digits 0884 become 08.84, which we write as 8.84.

Q3. This grid is already filled in. Add along the diagonals, then use the decimal points marked on the grid to work out where the decimal point goes in the answer.

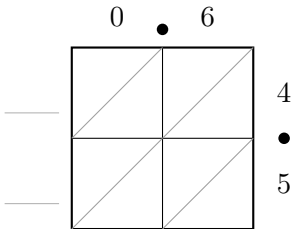
$$1.7 \times 4.3$$



$$1.7 \times 4.3 = \underline{\hspace{2cm}}$$

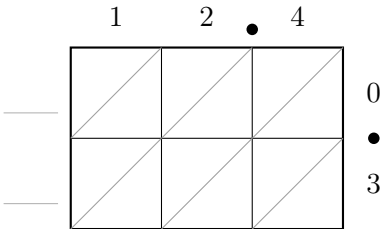
Q4. Fill in these grids, then find where the decimal point goes. In part (b) the decimal points are not in the same place in the two numbers, so the two lines will not meet in the middle of the grid.

(a) 0.6×4.5



$$0.6 \times 4.5 = \underline{\hspace{2cm}}$$

(b) 12.4×0.3



$$12.4 \times 0.3 = \underline{\hspace{2cm}}$$

Q5. Use your answer to Q4 part (a) to write down each of these without drawing a grid. Explain how you decided where to put the decimal point each time.

(a) $6 \times 45 = \underline{\hspace{2cm}}$

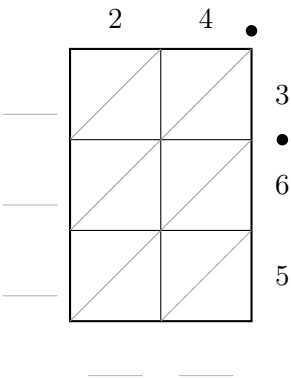
(b) $0.06 \times 4.5 = \underline{\hspace{2cm}}$

(c) $60 \times 0.45 = \underline{\hspace{2cm}}$

Part 3: Using the method

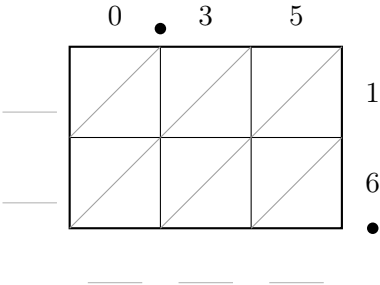
The decimal point of a whole number is at the end of its digits, so its mark goes on the corner of the grid. Everything else about the method stays the same.

Q6. (a) A school orders 24 packs of pencils. Each pack costs £3.65. Use the grid to work out the total cost of the order.



Total cost: £_____

(b) A dripping tap loses 0.35 litres of water every hour. Use the grid to work out how much water it loses in 16 hours.



Water lost: _____ litres

Q7. Draw your own grid for each of these. Mark the decimal points on the edges of the grid, and show the diagonal you followed to place the decimal point in the answer.

(a) Petrol costs £1.45 per litre. Kofi buys 38 litres. How much does he pay?

(b) A rectangular tile measures 4.8 cm by 2.5 cm. What is its area?

Q8. Practice. Use the Chinese multiplication method for each of these, drawing the grids yourself.

(a) 73×48

(c) 0.9×0.7

(e) 8.4×0.25

(b) 5.2×3.6

(d) 126×34

(f) 1.06×3.5

Part 4: Challenges

Q9. Why the diagonals work. In the grid for 47×36 , the cell holding 4×6 and the cell holding 7×3 lie on the same diagonal.

(a) Work out 40×6 and 7×30 . What do you notice about the two answers?

(b) Use part (a) to explain why the two cells on that diagonal are added together.

Q10. Sam uses the method on 0.48×0.25 . His digits come out as 001200, and he writes the answer 1200.

(a) Without working the multiplication out, explain how you know that 1200 cannot be right.

(b) Draw the grid, place the decimal point, and write down the correct answer.

- Q11.** How many single-digit multiplications does the method need to work out a three-digit number multiplied by a four-digit number? Explain how you know without drawing the grid.
- Q12.** Design a multiplication of two numbers, each written to one decimal place, whose answer is exactly 0.36. Show that your multiplication works using the Chinese multiplication method.
- Q13.** Zainab says: “The Chinese multiplication method is better than the column method, because you never have to carry.” Use one of your answers from this sheet to decide whether she is right.

Answers

Q1. (a) The diagonals give 8, then $0+0+6=6$, then $2+0+5=7$, then 1, so $52 \times 34 = 1768$. (b) The diagonals give 6, then $5+2+2=9$, then $4+3+4=11$, so write 1 and carry 1, then $2+1=3$, so $68 \times 47 = 3196$.

Q2. (a) The cells hold 06, 08, 15 and 20. The diagonals give 0, then $2+5+8=15$, so write 5 and carry 1, then $1+0+6+1=8$, then 0, so $34 \times 25 = 850$. (b) The cells hold 02, 04 and 03 along the top row, and 14, 28 and 21 along the bottom row. The diagonals give 1, then $2+8+3=13$, then $2+4+4+0+1=11$, then $1+0+2+1=4$, then 0, so $243 \times 17 = 4131$.

Q3. The digits are 0731. Both decimal points sit after the first digit of their number, so the two lines meet in the middle of the grid and the diagonal leaves the grid at the bottom left corner: 07.31, which is 7.31.

Q4. (a) The cells hold 00, 24, 00 and 30. The digits are 0270 and the diagonal leaves the grid at the bottom left corner, giving 02.70, so $0.6 \times 4.5 = 2.7$. (b) The cells hold 00, 00 and 00 along the top row, and 03, 06 and 12 along the bottom row. The digits are 00372. The line down from the top meets the line in from the side one column further to the right, so the diagonal leaves the grid through the bottom edge, between the third and fourth digits: 003.72, so $12.4 \times 0.3 = 3.72$.

Q5. (a) 270 (b) 0.27 (c) 27. The digits of the answer are 27 every time, because the digits being multiplied have not changed. Only the place value changes: in (a) both numbers have been multiplied by 10, so the answer is 100 times larger than 2.7; in (b) the first number has been divided by 10, so the answer is 10 times smaller; in (c) the first number has been multiplied by 100 and the second divided by 10, so the answer is 10 times larger.

Q6. (a) The digits are 08760. The decimal point of 24 is on the right-hand corner of the grid, and the diagonal from where the two lines meet leaves the grid at the bottom left corner, giving 087.60. The order costs £87.60. (b) The digits are 00560, and the decimal point goes between the third and fourth of them, giving 005.60. The tap loses 5.6 litres.

Q7. (a) $1.45 \times 38 = 55.10$, so Kofi pays £55.10. (b) $4.8 \times 2.5 = 12.00$, so the area is 12 cm^2 . The two zeros after the decimal point do not change the value, so they are not written.

Q8. (a) 3504 (b) 18.72 (c) 0.63 (d) 4284 (e) 2.1 (f) 3.71

Q9. (a) $40 \times 6 = 240$ and $7 \times 30 = 210$. Both answers are a whole number of tens, so the digit each one contributes lands in the tens column of the answer. (b) A cell does not really hold 4×6 ; it holds 40×6 , because the 4 is in the tens column. Every cell on the same diagonal stands for the same place value in the answer, which is why the digits on one diagonal are added together, and why a diagonal totalling ten or more carries into the next diagonal.

Q10. (a) 0.48 is less than 1 and 0.25 is less than 1, so the answer must be smaller than either of them, and certainly smaller than 1. Sam's answer is more than a thousand. (b) The digits are 001200. The decimal point of 0.48 is after its first column and the decimal point of 0.25 is after its first row, so the two lines meet one cell in from the top left corner. The diagonal from there leaves the grid through the left-hand side, between the second and third digits, giving 00.1200. So $0.48 \times 0.25 = 0.12$.

Q11. 12 multiplications. The grid has one column for each of the three digits and one row for each of the four digits, so it has $3 \times 4 = 12$ cells, and each cell holds one single-digit multiplication.

Q12. Many answers. For example 0.4×0.9 , 0.6×0.6 , 1.2×0.3 and 1.8×0.2 all give 0.36. The digits of the two numbers have to multiply to 36, and each number has one digit after the decimal point, so the answer has two.

Q13. She is partly right. No carrying happens while the grid is being filled in, because every cell holds a single-digit multiplication and its two digits have a triangle each. Carrying does still happen when the diagonals are added: in Q1 part (b) the third diagonal came to 11, so the 1 had to be carried into the next diagonal.