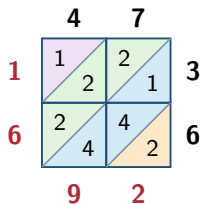
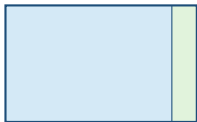


Lattice Multiplication



1. Area



Multiplying is finding the area of a rectangle.

2. Grid method

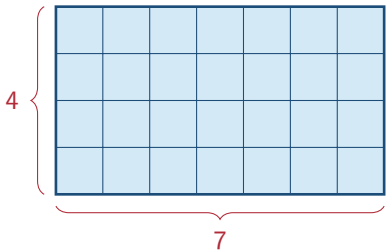
$\times$	20	3
10	200	30
4	80	12

The rectangle written as a table.
Every zero shown.

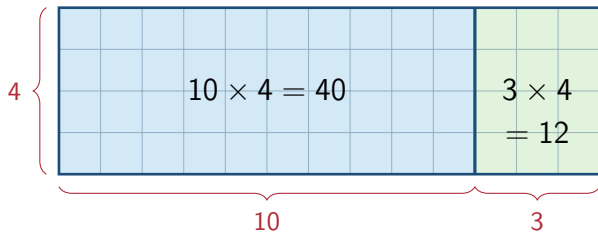
3. Lattice



The same products, with the
diagonals doing the place value.

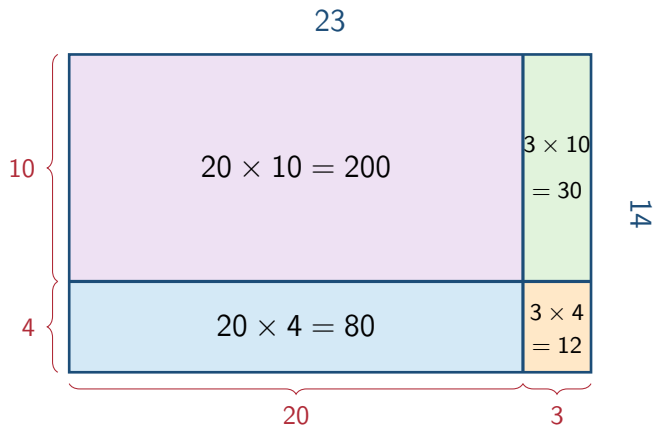


- A rectangle 7 wide and 4 tall.
- Count the squares: $7 \times 4 = 28$.
- **Every multiplication question can be represented as a rectangle.**

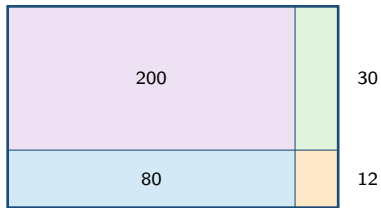


$$13 \times 4 = (10 \times 4) + (3 \times 4) = 40 + 12 = 52$$

We split 13 into the parts we can actually multiply in our heads: its *tens* and its *units*.



$$23 \times 14 = 200 + 30 + 80 + 12 = 322$$



×	20	3
10	200	30
4	80	12

$$200 + 30 + 80 + 12 = 322$$

- The grid is like the picture, but not drawn to scale.

$\times$	40	7
30	1200	210
6	240	42

$$4 \times 3 = 12 \quad \text{so } 40 \times 30 = 1200$$

$$4 \times 6 = 24 \quad \text{so } 40 \times 6 = 240$$

$$7 \times 3 = 21 \quad \text{so } 7 \times 30 = 210$$

$$7 \times 6 = 42 \quad \text{so } 7 \times 6 = 42$$

$$1200 + 240 + 210 + 42 = 1692, \quad \text{so } 47 \times 36 = 1692$$

(a) $34 \times 12 =$

(b) $26 \times 45 =$

(c) $53 \times 27 =$

(d) $18 \times 63 =$

(e) $72 \times 84 =$

(f) $95 \times 48 =$

$\times$		

Challenge. 124×36 . How many boxes does your grid need now, and why?

Answer:

(a) $34 \times 12 = 408$

(b) $26 \times 45 = 1170$

(c) $53 \times 27 = 1431$

(d) $18 \times 63 = 1134$

(e) $72 \times 84 = 6048$

(f) $95 \times 48 = 4560$

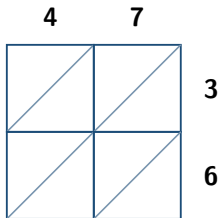
$\times$		

Challenge. 124×36 . How many boxes does your grid need now, and why?

Answer: $3 \times 2 = 6$ boxes, one for each pair of place values; $124 \times 36 = 4464$

×	300	40	7
600	180000	24000	4200
50	15000	2000	350
8	2400	320	56

- The method is fine for bigger numbers...
- But it is a lot of writing long numbers
- **The lattice keeps the same nine products but writes only the digits** — and uses *diagonals* instead of zeros to keep track of place value.



- 47×36 .
- One *column* for each digit of 47, written across the top.
- One *row* for each digit of 36, written down the right.
- Draw a diagonal in every cell, running from top-right down to bottom-left.

4	7	
1 / 2	2 / 1	3
2 / 4	4 / 2	6

- Multiply each of the combinations of digits in the relevant cell.
- **Tens** go in the upper-left triangle, **units** in the lower-right.

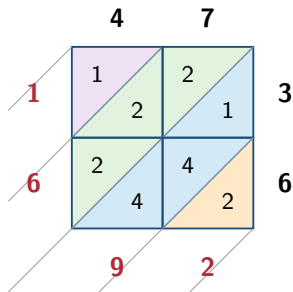
$$4 \times 3 = 12 \rightarrow \boxed{1} / \boxed{2}$$

$$7 \times 3 = 21 \rightarrow \boxed{2} / \boxed{1}$$

$$4 \times 6 = 24 \rightarrow \boxed{2} / \boxed{4}$$

$$7 \times 6 = 42 \rightarrow \boxed{4} / \boxed{2}$$

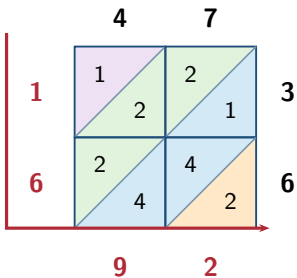
A one-digit answer such as $3 \times 2 = 6$ is written 0/6.



Start at the bottom right and work up the strips.

units	2	= 2
tens	$4 + 4 + 1$	= 9
hundreds	$2 + 2 + 2$	= 6
thousands	1	= 1

- Each shaded strip is one *place-value column*.
- Write each total just outside the lattice



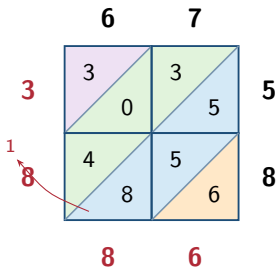
- Read **down the left-hand side**, then **along the bottom**.

- 1, 6, 9, 2

- $47 \times 36 = 1692$

Compare with the grid method:

$1200 + 240 + 210 + 42 = 1692$. its the same four products, the same answer — but no long addition.



$$67 \times 58$$

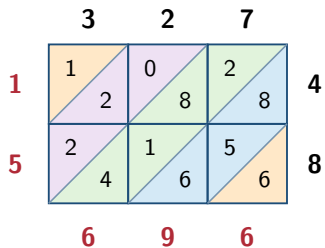
units	6	= 6
tens	$5 + 8 + 5$	= 18 write 8, carry 1
hundreds	$4 + 3 + 0 + 1$	= 8
thousands	3	= 3

- If a strip totals 10 or more, write down the units digit and **carry the tens into the next strip up-left.**
- Reading off: 3, 8, 8, 6 $\Rightarrow 67 \times 58 = 3886$

Estimate: $70 \times 60 = 4200$. ✓

		4	7		
Th	1	2	2	1	3
H	2	4	4	2	6
	T	U			

- The top-left cell really means $40 \times 30 = 1200$, i.e. **12 hundreds**.
- Its **2** sits on the hundreds diagonal and its **1** sits one diagonal further left — the thousands. Exactly right.
- Every step you move *left* or *up* in the lattice multiplies by 10; both moves shift you one diagonal along.
- **So a diagonal is a place-value column.** That is why the zeros are not needed: the geometry is doing the counting for us.



units	6	= 6
tens	5 + 6 + 8	= 19 → 9, carry 1
hundreds	1 + 4 + 2 + 8 + 1	= 16 → 6, carry 1
thousands	2 + 0 + 2 + 1	= 5
ten thous.	1	= 1

- Three digits by two digits $\Rightarrow$ a 3×2 lattice.
- Nothing else changes.
- $327 \times 48 = 15\,696$

(a) $38 \times 24 =$

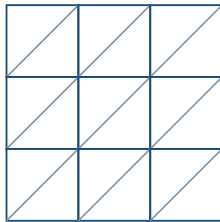
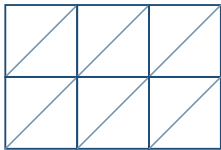
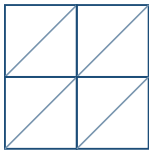
(b) $65 \times 43 =$

(c) $57 \times 89 =$

(d) $127 \times 36 =$

(e) $408 \times 57 =$

(f) $234 \times 156 =$



(a) $38 \times 24 = 912$

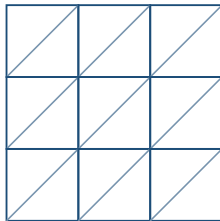
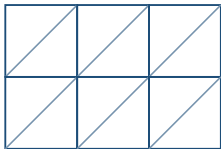
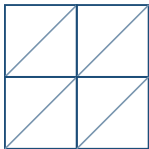
(b) $65 \times 43 = 2795$

(c) $57 \times 89 = 5073$

(d) $127 \times 36 = 4572$

(e) $408 \times 57 = 23256$

(f) $234 \times 156 = 36504$



And now the decimal point

$$4.7 \times 3.6$$

$4.7 \approx 5$ $3.6 \approx 4$ $\Rightarrow$ the answer is about 20

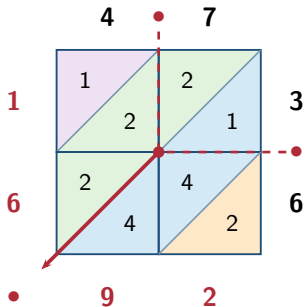
1.692

16.92

169.2

✓ the only one near 20

- The lattice will give the digits 1 6 9 2 whatever the decimal points are doing.
- We just need to work out where the decimal point goes.

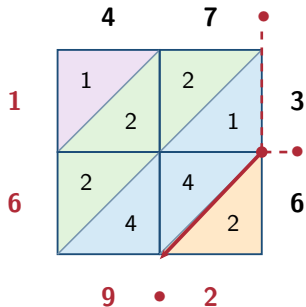


1. Ignore the decimal points and build the lattice from the **digits**: 47 and 36.
2. Mark the decimal point of the top number on the **top edge**, and of the side number on the **right edge**.
3. Slide one *down* and the other *across* until they **meet**.
4. From that meeting point, **follow the diagonal** down-left until you leave the lattice. That is where the decimal point goes in the answer.

$$4.7 \times 3.6 = 16.92$$

Estimate was 20. ✓

$$47 \times 3.6$$



- 47 has no decimal point written, so it sits at the **far right** of the top edge.
- 3.6 puts its point between the two rows, as before.
- They meet lower down, so the diagonal leaves the lattice one place further right.

$$47 \times 3.6 = 169.2$$

Estimate: $50 \times 4 = 200$. ✓

The lattice digits never changed: 1692. Only the point moved.

$$4.7 \times 3.6 \quad 1 + 1 = 2 \text{ places} \quad \Rightarrow 16.\dot{9}2$$

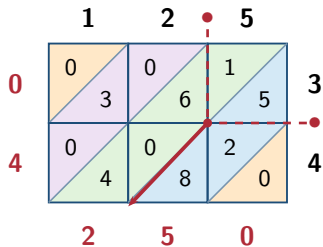
$$47 \times 3.6 \quad 0 + 1 = 1 \text{ place} \quad \Rightarrow 169.\dot{2}$$

$$0.47 \times 3.6 \quad 2 + 1 = 3 \text{ places} \quad \Rightarrow 1.\dot{6}92$$

$$0.47 \times 0.36 \quad 2 + 2 = 4 \text{ places} \quad \Rightarrow 0.\dot{1}692$$

- The digits 1692 come from the same lattice every single time.
- Total decimal places in the question = decimal places in the answer.
- The diagonal rule and the counting rule always agree — use whichever you prefer, and *check against your estimate*.

Careful with (d): after counting four places you need a leading zero to fill the gap.



units	0	= 0
tens	$2 + 8 + 5$	= 15 → 5, carry 1
hundreds	$0 + 4 + 1 + 6 + 1$	= 12 → 2, carry 1
thousands	$0 + 0 + 3 + 1$	= 4
ten thous.	0	= 0

- Digits: $125 \times 34 = 4250$.
- Points meet after the 2 on top and between the rows, so the diagonal exits one place from the right.
- $12.5 \times 3.4 = 42.50 = 42.5$

Estimate: $13 \times 3 \approx 39$. ✓ A trailing zero after the point can be dropped.

(a) $2.4 \times 3.7 =$

(b) $6.3 \times 0.8 =$

(c) $5.2 \times 4.6 =$

(d) $0.46 \times 2.3 =$

(e) $13.4 \times 2.5 =$

(f) $0.85 \times 0.64 =$

For each one, write your estimate before you start.

Challenge 1. 1.25×0.48 . Why does the answer need fewer digits than you expect?

Challenge 2. A lattice for $\square.\square \times 4.5$ gives the digits 2 7 9 0 and the answer 27.90. What was the first number?

Challenge 3. Explain to your partner why a diagonal is the same thing as a place-value column.

(a) $2.4 \times 3.7 = 8.88$

(b) $6.3 \times 0.8 = 5.04$

(c) $5.2 \times 4.6 = 23.92$

(d) $0.46 \times 2.3 = 1.058$

(e) $13.4 \times 2.5 = 33.5$

(f) $0.85 \times 0.64 = 0.544$

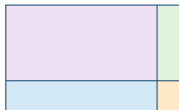
For each one, write your estimate before you start.

Challenge 1. 1.25×0.48 . Why does the answer need fewer digits than you expect?
 $= 0.6$; the lattice gives 6000 and the trailing zeros disappear.

Challenge 2. A lattice for $\square.\square \times 4.5$ gives the digits 2790 and the answer 27.90. What was the first number? 6.2

Challenge 3. Explain to your partner why a diagonal is the same thing as a place-value column.

Area



Split each number into place values;
the four areas are the four products.

Grid

×	40	7
30	1200	210
6	240	42

Every zero written out. Reliable, but a
long addition at the end.

Lattice

1	2	2	1
2	4	4	2

Digits only. The diagonals carry the
place value. Read down, then across.

- Tens in the upper-left triangle, units in the lower-right.
- Add down the diagonals from the bottom right, carrying up-left.
- **Decimals:** drop one point down, bring the other across, then follow the diagonal out. Or count the decimal places.
- **Always estimate first.**