Decimal places in a product

When both numbers have a decimal point, the digits are easy to multiply. But where does the point go in the answer?

WORDS TO KNOW

Decimal places: the digits after the point. 2.5 has one, 0.45 has two, 0.056 has three. A whole number has none.

Thousandth: one of 1000 equal parts of one whole, 0.001.

Estimate: a quick answer that is close, made with easy numbers.

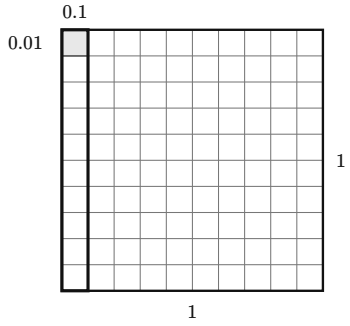
Hundredth: one of 100 equal parts of one whole, 0.01.

Area model: a rectangle split into parts, one part for each pair of pieces of the two numbers.

KEY IDEAS

1. A tenth of a tenth is a hundredth

Cut a square into 10 columns. Each column is 0.1. Cut one column into 10 pieces. Each piece is one small square of a 10 by 10 grid, so it is 0.01.



A rectangle 0.2 wide and 0.2 tall covers 2 × 2 = 4 small squares. So 0.2 × 0.2 = 0.04, four hundredths.

$$0.1 \times 0.1 = 0.01 \qquad 0.1 \times 0.01 = 0.001$$

Tenths times tenths give hundredths. Tenths times hundredths give thousandths.

2. Decimal places add

For bigger numbers, split each factor by place value and multiply every piece by every piece. Or, faster, multiply the digits as whole numbers and then count.

Multiply as if there were no points. The product has as many decimal places as the two factors have together.

Count before you drop any zero at the end.

3. Two ways to place the point

By the count: add the decimal places, then count that many digits in from the right. **By an estimate:** round the factors to easy numbers and see how big the product must be. Use each one to check the other.

If the digits run out, put zeros in front to hold the empty places. If the product ends in zeros, place the point first and only then drop them: 0.6 × 0.5 = 0.30 = 0.3.

WATCH OUT

- **Do not keep just one place.** Tenths times tenths are hundredths. 0.3 × 0.2 is 0.06, not 0.6.
- **A factor less than 1 takes only part.** 0.8 × 0.8 must be less than 0.8. Any answer bigger than that is wrong.
- **Do not lose a zero that holds a place.** 0.05 × 0.5 = 0.025. Writing 0.25 claims 2 tenths that are not there.
- **Ignoring the points is for multiplying only.** To add or subtract, line up tenths with tenths.

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WORKED EXAMPLES

Example 1. A square tile is 0.7 meter on each side. What is its area?

1. The area is 0.7 × 0.7 square meter. On a hundredths grid, that is 7 columns by 7 rows.
2. 7 × 7 = 49 small squares, and each small square is a hundredth.

Answer: 0.49 square meter. **Check:** the tile is smaller than a square meter, and 0.49 is less than 1.

Example 2. Use an area model to find 1.3 × 4.3.

	4	0.3
1	4	0.3
0.3	1.2	0.09

1. Split 1.3 = 1 + 0.3 and 4.3 = 4 + 0.3. Multiply each pair, as in the table. The new one is 0.3 × 0.3: 9 hundredths, 0.09.
2. Add the parts: 4 + 0.3 + 1.2 + 0.09 = 5.59.
3. Count to check: 13 × 43 = 559, and 1 + 1 = 2 decimal places make 5.59.

Answer: 5.59. **Check:** 1.3 is between 1 and 2, so the product is between 4.3 and 8.6. 5.59 is, and 55.9 and 0.559 are not.

Example 3. Find 0.08 × 0.8.

1. Multiply the digits: 8 × 8 = 64.
2. Count the places: 2 + 1 = 3. But 64 has only two digits.
3. Put a zero in front to fill the third place: 064. The point goes in front of all three.

Answer: 0.064. **Check:** 0.8 is less than 1, so the product must be less than 0.08. 0.064 is, and 0.64 is not.

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