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Answers

Use mental math to explore multiplying and dividing by powers of 10. Verify your thinking with a calculator.

1. Complete each chart. In part a), the first row is done for you.

a)

Number	Operation	Answer
34.912	× 10	349.12
34.912	× 100	3491.2
34.912	÷ 10	3.4912
34.912	÷ 100	0.349 12
34.912	÷ 1000	0.034 912

What do you notice?

The digits are the same. They change their place value depending on the power of 10 and whether I am multiplying or dividing.

b)

Number	Operation	Answer
0.8531	× 10	8.531
0.8531	× 100	85.31
0.8531	÷ 10	0.085 31
0.8531	÷ 100	0.008 531
0.8531	÷ 1000	0.000 853 1

What do you notice?

Even though this number was less than 1, the same patterns happened. Dividing made the number smaller and multiplying made the number greater but the digits didn't change.

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Answers (cont'd)

c)

Number	Operation	Answer
90.47	× 10	904.7
90.47	× 100	9047
90.47	÷ 10	9.047
90.47	÷ 100	0.9047
90.47	÷ 1000	0.090 47

What do you notice?
Again, the digits stayed the same. I am scaling the original number.

2. Pat wants to convert 453 m to kilometres.

Sam says to divide by 1000 while Chris says to multiply by $\frac{1}{1000}$.

a) Explain why they are both correct.

The fraction $\frac{1}{1000}$ means 1 ÷ 1000.

So, the strategies are the same.
Sam is saying: 453 ÷ 1000

Chris is saying: 453 × $\frac{1}{1000}$ which can also be thought of as 453 × 1 ÷ 1000 or 453 ÷ 1000

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Answers (cont'd)

b) How many kilometres is 453 m?

To convert metres to kilometres, I'll divide by 1000.
453 ÷ 1000 = 0.453
453 m is equal to 0.453 km.

c) To convert a distance measured in kilometres to metres, would you multiply or divide?
By what number? Explain your thinking.

I know 1 km = 1000 m.

So, I would multiply the distance by 1000 to convert it to metres.

Because I know multiplying by 1000 is the same as dividing by $\frac{1}{1000}$, I could also convert by dividing the distance by $\frac{1}{1000}$.

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Answers (cont'd)

3. Complete the following charts.

a)

Number Sentence	Expanded Form	Value
89×10^3	89×1000	89 000
89×10^2	89×100	8900
89×10^1	89×10	890
89×10^0	89×1	89
89×10^{-1}	$89 \times \frac{1}{10}$	8.9
89×10^{-2}	$89 \times \frac{1}{100}$	0.89
89×10^{-3}	$89 \times \frac{1}{1000}$	0.089

What do you notice?

The value gets smaller as the exponent decreases. Multiplying by a power of 10 with a negative exponent has the same effect as dividing by a power of 10 with a positive exponent.

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Answers (cont'd)

b)

Number Sentence	Expanded Form	Value
$89 \div 10^3$	$89 \div 1000$	0.089
$89 \div 10^2$	$89 \div 100$	0.89
$89 \div 10^1$	$89 \div 10$	8.9
$89 \div 10^0$	$89 \div 1$	89
$89 \div 10^{-1}$	$89 \div \frac{1}{10}$	890
$89 \div 10^{-2}$	$89 \div \frac{1}{100}$	8900
$89 \div 10^{-3}$	$89 \div \frac{1}{1000}$	89 000

What do you notice?

The number gets larger as the exponent decreases. Dividing by a power of 10 with a negative exponent has the same effect as multiplying by a power of 10 with a positive exponent.