# Unit 7, Lesson 4: Dividing Powers

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## 4.2: Dividing Powers

a) Complete the table to explore patterns in the exponents when dividing powers. Use the "expanded" column to show why the given expression is equal to the single power. You may skip a single box in the table, but if you do, be prepared to explain why you skipped it.

| Expression | Expanded Form | Single Power |
|---|---|---|
| $10^4 \div 10^2$ | $\frac{10 \cdot 10 \cdot 10 \cdot 10}{10 \cdot 10}$ $= \frac{10 \cdot 10}{10 \cdot 10} \cdot 10 \cdot 10$ $= 1 \cdot 10 \cdot 10$ | $10^2$ |
| $5^5 \div 5^2$ | $\frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5}$ $= \frac{5 \cdot 5}{5 \cdot 5} \cdot 5 \cdot 5 \cdot 5$ $= 1 \cdot 5 \cdot 5 \cdot 5$ | $5^3$ |
| $n^6 \div n^3$ | $\frac{n \cdot n \cdot n \cdot n \cdot n \cdot n}{n \cdot n \cdot n}$ | $n^3$ |
| $3^{43} \div 3^{17}$ | Skip | $3^{43-17} = 3^{26}$ |

b) If you chose to skip one entry in the table, which entry did you skip? Why?

Too long

c) Use the patterns you found in the table to rewrite $\frac{7^n}{7^m}$ as an equivalent expression of the form $7^{\square}$.

$7^{n-m}$

Subtract exponents

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d) It is predicted that by 2050, there will be $10^{10}$ people living on Earth. At that time, it is predicted there will be approximately $10^{12}$ trees. How many trees will there be for each person?

Trees per person → $\frac{\text{Trees}}{\text{person}}$ → $\frac{10^{12}}{10^{10}} = 10^2$

e) Complete the table below:

| expression | expanded | single power |
|---|---|---|
| $8^4 \div 8^6$ | $\frac{8 \cdot 8 \cdot 8 \cdot 8}{8 \cdot 8 \cdot 8 \cdot 8 \cdot 8 \cdot 8}$ ↑ On the bottom | $\frac{1}{8^2}$ |

$8^4 \div 8^6 = 8^{4-6} = 8^{-2} \rightarrow \frac{1}{8^2}$

*Negatives make fractions*

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### 4.3: Zero Exponent

So far we have looked at powers with exponents greater than 0. What would happen to our patterns if we included 0 as a possible exponent?

1. Write $9^{12} \cdot 9^0$ with a power of 9 with a single exponent using the appropriate exponent rule. Explain or show your reasoning.

$$9^{12} \cdot 9^0 = 9^{12+0} = 9^{12}$$

   a) What number could you multiply $9^{12}$ by to get this same answer?

$$9^{12} \cdot (1) = 9^{12}$$

2. Write $\frac{7^8}{7^0}$ with a single power of 7 using the appropriate exponent rule. Explain or show your reasoning.

$$\frac{7^8}{7^0} = 7^{8-0} = 7^8$$

   a) What number could you divide $7^8$ by to get this same answer?

$$\frac{7^8}{(1)} = 7^8$$

3. If we want the exponent rules we found to work even when the exponent is 0, then what does the value of $7^0$ have to be?

$$7^0 = 1$$

Anything with an exponent of 0 equals 1