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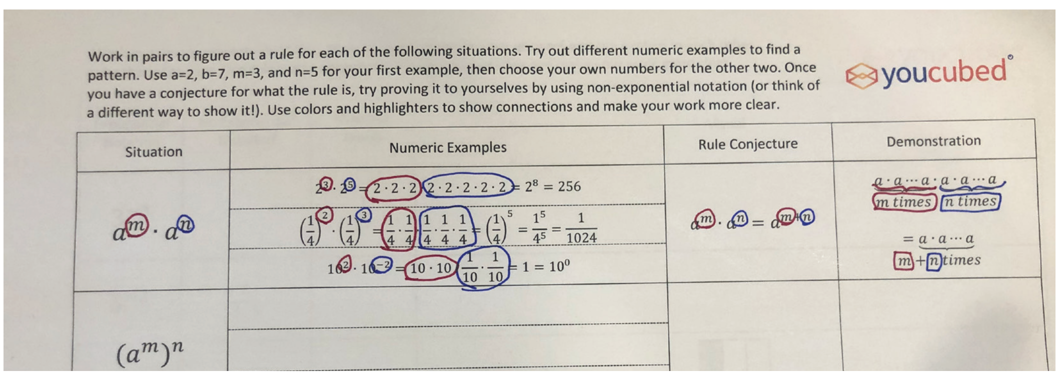
Exploring Exponents

This task is an opportunity for students to think about why the rules of exponents work, so they can use them with that understanding, rather than trying to remember rules. The handout has a table with some sections already completed so students can complete the rest by noticing patterns and discussing them.

The first page allows students to explore the relationship between positive and negative exponents, and the second one is about generating rules for operations on exponents.

An important part of this task is making sure that students share their reasoning with each other and are able to justify their thinking. Make sure the students have plenty of scratch paper so they can try out ideas before putting them down on the table. Encourage them to color code in order to show the connections in their thinking.


Work in pairs to figure out a rule for each of the following situations. Try out different numeric examples to find a pattern. Use a=2, b=7, m=3, and n=5 for your first example, then choose your own numbers for the other two. Once you have a conjecture for what the rule is, try proving it to yourselves by using non-exponential notation (or think of a different way to show it!). Use colors and highlighters to show connections and make your work more clear.

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Situation	Numeric Examples	Rule Conjecture	Demonstration
$a^m \cdot a^n$	$2^3 \cdot 2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^8 = 256$ $\left(\frac{1}{4}\right)^2 \cdot \left(\frac{1}{4}\right)^3 = \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \left(\frac{1}{4}\right)^5 = \frac{1^5}{4^5} = \frac{1}{1024}$ $10^2 \cdot 10^{-2} = 10 \cdot 10 \cdot \frac{1}{10} \cdot \frac{1}{10} = 1 = 10^0$	$a^m \cdot a^n = a^{m+n}$	$\underbrace{a \cdot a \cdots a}_{m \text{ times}} \cdot \underbrace{a \cdot a \cdots a}_{n \text{ times}}$ $= \underbrace{a \cdot a \cdots a}_{m+n \text{ times}}$
$(a^m)^n$			

Task Instructions:

Work in pairs to complete these tables. Make sure you agree on your answers and can explain to each other why that's the case. Use colors and highlighters to show connections and make your work more clear.

Work in pairs to complete this table. Make sure you agree on your answers and can explain to each other why that's the case. Use colors and highlighters to show connections and make your work more clear.

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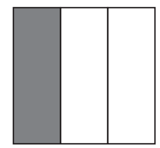
Exponential Notation	No Exponential Notation	Numeric Result	Visual	
3^{-3}		$\frac{1}{27}$		
3^{-2}	$\frac{1}{3 \cdot 3}$			
3^{-1}				
3^{0}				
3^{1}	3	3		Graph 3^x
3^{2}	$3 \cdot 3$	9		
3^{3}	$3 \cdot 3 \cdot 3$	27		

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$(a^m)^n$			
$(ab)^m$			
$\left(\frac{a}{b}\right)^m$			
$\frac{a^m}{a^n}$			