3 In-Class Resources for Lesson 3

The Power of One (and Zero)

Find all pairs of *a*, *b* such that $a^b = 1$.

Find all pairs of *a*, *b* such that $a^b = 0$.

FUN WITH POWERS

Find the solutions.

1.
$$\frac{5^{x^2}}{5^{4x}5^2} = 5^3$$

2. $2^{(a^2-9)} = 1$

3.
$$3^{(4^{(5^x-4)}-3)} = 3.$$

4. $a^{a(a^2-4)} = 1$.

ARE ALL NUMBERS POWERS OF A GIVEN NUMBER?

- 1. Using the calculator here, https://www.desmos.com/scientific, estimate x such that $5^x = 74$, so that you are within the first two decimal places of the exact value of x.
- 2. How do you know that the first 2 decimal digits are correct?
- 3. Let *P* be a random positive real number. Is it always possible to find an $x \in \mathbb{R}$ such that $5^x = P$? Why or why not?

Takeaway:

FINDING THE EXPONENT

Here are two approximations:

$$5^{1.37} = 9, \quad 5^{0.43} = 2$$

Using these values, we can make other approximations. For example:

Power 5^x	Exponent <i>x</i>	Reasoning
$5^{[2]} = 81$	$\boxed{?} = 2.74$	$81 = 9^2$
5 = 51	. – 2.74	$= 5^{1.37} \cdot 5^{1.37}$ (given)
		$= 5^{2.74}$ (product of power property)
		? = 2.74

Using the information below, and without a calculator, complete the following table.

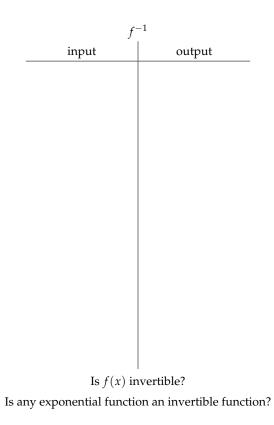
Power 5 ^{<i>x</i>}	Exponent <i>x</i>	Reasoning
$5^{x} = 8$		
$5^x = 18$		
$5^{x} = 45$		

Play with the numbers in the table below to complete the table. You can use what we have already done and these ideas: $5^{1.37} = 9$, $5^{0.43} = 2$, $5^{2.74} = 81$

Power 5 ^{<i>x</i>}	Exponent <i>x</i>	Reasoning
$5^{x} = 10$		
$5^x = 100$		
$5^{*} = 100$		
$5^x = 900$		
	2 + 0.42	
	3 + 0.43	
	$\frac{1}{4} \cdot 2.74$	
	2.04	
	-2.86	

EXPONENTIAL FUNCTIONS: INVERTIBLE?

Let $f(x) = 5^x$. Fill in sample entries of an input/output table to represent the inverse of f.



GENERALIZING HOW TO FIND LOGS

Let $L = \log_5 9$ and $M = \log_5 2$.

- 1. Complete the given rows as shown.
- 2. Then find as many other powers of 5 as you can that you can write in terms of L and M. Record your findings in the table.

Power P	Representation in terms of known powers of 5	Use the representation to express $\log_5 P$
9	-	$\log_5 9 = L$
2	-	$\log_5 2 = M$
81	92	$\log_5 9^2 = 2L$
93 5 ²⁰		
3∕2		
$\frac{1}{\sqrt[6]{50}}$		