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 x
$5^{\boxed{?}} = 81$	$\boxed{?} = 2.74$

			Reasoning
81	$=$	9^2	
	$=$	$5^{1.37} \cdot 5^{1.37}$	(given)
	$=$	$5^{2.74}$	(product of power property)
$\boxed{?}$	$=$	2.74	

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

Power 5^x	Exponent x	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:

$5^{1.37} = 9, \quad 5^{0.43} = 2, \quad 5^{2.74} = 81$

Power 5^x	Exponent x	Reasoning
$5^x = 10$		
$5^x = 100$		
$5^x = 900$		
	$3 + 0.43$	
	$\frac{1}{4} \cdot 2.74$	
	-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.

f^{-1}

input	output

Is $f(x)$ invertible?

Is any exponential function an invertible function?

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	9^2	$\log_5 9^2 = 2L$
$\frac{9^3}{5^{20}}$		
$900^{\frac{3}{4}}$		
$\sqrt[3]{2}$		
$\frac{1}{\sqrt[6]{50}}$		