Name:_____

Notesheet. Section 5.1: Exponential Functions

Math 1210

Definition 1. An exponential function f with base b and exponent x is the function

Theorem 2. If $a, b \in \mathbb{R}$, $a, b > 0$, and $x, y \in \mathbb{R}$, then

- $b^x \cdot b^y =$
- $\dfrac{b^x}{b^y} =$
- $(b^x)^y =$
- $(ab)^x =$
- $\left(\dfrac{a}{b}\right)^x =$

Challenge 3.

- Can you simplify $(81 \cdot 16)^{-\frac{1}{4}}$?
- Can you simplify $\dfrac{30^{-2/3}}{30^{1/3}}$?
- Can you simplify $\left(\dfrac{5^{1/6}}{5^{1/12}}\right)^6$?

Challenge 4. Can you sketch the graph of the function $f(x) = \left(\frac{1}{3}\right)^x$?

Theorem 5. The exponential function $f(x) = b^x$, $b > 0$, $b \neq 1$, has the following properties:

- Its domain is
- Its range is
- Its graph always passes through the point
- It is continuous on
- If $b > 1$, then it is increasing on . If $b < 1$, it is decreasing on .

Challenge 6. Can you sketch the graph of the function $f(x) = \left(\frac{1}{3}\right)^{-x}$?

Definition 7. e is a very magical number that is *approximately* equal to 2.7182818. e is *exactly* equal to $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$. e is also the ONLY number b (other than 0) such that $\frac{d}{dx}[b^x] = b^x$!!!

Challenge 8. Can you sketch the graph of the function $f(x) = e^x$?