

Your Name

Mrs. Theo

3/15/2021

Notes

6.1 Evaluating Exponential Expressions

Handwritten notes showing the evaluation of exponential expressions for base 4, illustrating the relationship between increasing and decreasing exponents.

increase exponent

$$4^3 = 4 \cdot 4 \cdot 4 = 64$$

$$4^2 = 4 \cdot 4 = 16$$

$$4^1 = 4$$

decrease exponent

$$4^0 = \frac{4}{4} = 1$$

$$4^{-1} = \frac{1}{4}$$

$$4^{-2} = \frac{1}{4 \cdot 4} = \frac{1}{4^2} = \frac{1}{16}$$

$$4^{-3} = \frac{1}{4 \cdot 4 \cdot 4} = \frac{1}{4^3} = \frac{1}{64}$$

Arrows indicate the relationship between adjacent powers of 4:

- From 4^3 to 4^2 : $\div 4$
- From 4^2 to 4^1 : $\div 4$
- From 4^1 to 4^0 : $\div 4$
- From 4^0 to 4^{-1} : $\div 4$
- From 4^{-1} to 4^{-2} : $\div 4$
- From 4^{-2} to 4^{-3} : $\div 4$

Additional calculations on the right side:

$$\frac{1}{4} \div 4 = \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16}$$

Exponents: # of times a number (base) is multiplied to itself X^m (exponent)

Negative Exponents: # of times a number (base) is divided (multiplied to itself under 1) $\frac{1}{\text{base}}$

Fraction Exponents: Radicals

Evaluate Without a calculator

2^3	3^2	4^{-1}	2^{-4}	$30^0 = 30^1 \div 30 = 30^0$	4^3
$2 \cdot 2 \cdot 2$	$3 \cdot 3$	$\frac{1}{4^1} = \frac{1}{4}$	$\frac{1}{2 \cdot 2 \cdot 2 \cdot 2}$	1	$4 \cdot 4 \cdot 4$
8	9		$\frac{1}{2^4} = \frac{1}{16}$		64
$(-4)^3$	$(-4)^{-3} = \frac{1}{64}$	$(-2)^4$	$(-2)^{-4}$	1^5	$(-1)^5$
$(-4)(-4)(-4)$	$\frac{1}{(-4)^3}$	$(-2)(-2)(-2)(-2)$	$\frac{1}{(-2)^4}$	1	-1
16	$\frac{1}{(-4)(-4)(-4)}$	16	$\frac{1}{16}$		$(-1)^6$
-64					1

Evaluate With a Calculator

$2^{-3.1}$	$2^{-\pi}$	$12^{5/7}$	$0.6^{3/2}$
0.117	0.113	$12 \wedge (5/7)$	
<u>0.1166</u>	<u>0.1133</u>	12.5	
		0.5	
		5.899	

Rational
Exponents

Radicals

numerator is exponent
denominator is index of radical

$$X^{m/n} = \sqrt[n]{X^m} \text{ or } (\sqrt[n]{X})^m$$

EX: Evaluate WITHOUT a calculator!

$$16^{\frac{3}{4}} \quad 625^{-\frac{1}{2}} \quad 64^{\frac{2}{3}} \quad 225^{-\frac{3}{2}} \quad \left(\frac{8}{27}\right)^{-\frac{4}{3}}$$

$$\begin{aligned} & (\sqrt[4]{16})^3 \\ & (2)^3 \\ & 8 \end{aligned}$$

$$\begin{aligned} & (\sqrt[3]{64})^2 \\ & (4)^2 \\ & 16 \end{aligned}$$

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Notes

6.1 Evaluating Exponential Functions

Exponential functions

Those in the form of

$$y = a \cdot b^x$$

, where $b > 0$ and x is a real number.

If the base was negative....

$$y = (-2)^x$$

plug in 1 $(-2)^1 = -2$
 plug in 2 $(-2)^2 = 4$ $\rightarrow (-2)^{\frac{1}{2}} = \sqrt[2]{-2}$ Imaginary

plug in 3 $(-2)^3 = -8$

plug in 4 $(-2)^4 = 16$

Evaluating Exponential Functions

Fractional a value

$$f(x) = 2(3)^x$$

$$g(x) = \frac{1}{2}(3)^x$$

Use function f
x is -2

$$f(-2)$$

$$\begin{aligned} f(-2) &= 2(3)^{-2} \\ &= 2 \cdot \frac{1}{3^2} \\ &= 2 \cdot \frac{1}{9} \\ &= \frac{2}{9} \\ &(-2, \frac{2}{9}) \end{aligned}$$

$$f(0)$$

$$\begin{aligned} f(0) &= 2(3)^0 \\ &= 2 \cdot 1 \\ &= 2 \\ &(0, 2) \end{aligned}$$

$$f(2)$$

$$\begin{aligned} f(2) &= 2(3)^2 \\ &= 2 \cdot 9 \\ &= 18 \\ &(2, 18) \end{aligned}$$

Use function g
plus in -2

$$g(-2)$$

$$\begin{aligned} g(-2) &= \frac{1}{2}(3)^{-2} \\ &= \frac{1}{2} \cdot \frac{1}{3^2} \\ &= \frac{1}{2} \cdot \frac{1}{9} \\ &= \frac{1}{18} \\ &(-2, \frac{1}{18}) \end{aligned}$$

$$g(0)$$

$$\begin{aligned} g(0) &= \frac{1}{2}(3)^0 \\ &= \frac{1}{2}(1) \\ &= \frac{1}{2} \\ &(0, \frac{1}{2}) \end{aligned}$$

$$g(2)$$

$$\begin{aligned} g(2) &= \frac{1}{2}(3)^2 \\ &= \frac{1}{2} \cdot 9 \\ &= \frac{9}{2} \\ &g(2) = 4.5 \\ &(2, 4.5) \end{aligned}$$

Evaluating
Exponential
Functions

Negative 'a' value

$$f(x) = -4(2)^x$$

Fractional b value

$$g(x) = -4\left(\frac{1}{2}\right)^x$$

Fractions to
negative powers
Flip Fraction

f(-2)

f(0)

f(2)

g(-2)

g(0)

g(2)

$$f(-2) = -4(2)^{-2}$$

$$= -4 \cdot \frac{1}{2^2}$$

$$= -4 \cdot \frac{1}{4}$$

$$= -\frac{4}{4} = -1$$

$$(-2, -1)$$

$$f(0) = -4(2)^0$$

$$= -4(1)$$

$$= -4$$

$$f(0) = -4$$

$$(0, -4)$$

$$f(2) = -4(2)^2$$

$$= -4 \cdot 4$$

$$f(2) = -16$$

$$(2, -16)$$

$$g(-2) = -4\left(\frac{1}{2}\right)^{-2}$$

$$= -4\left(\frac{2}{1}\right)^2$$

$$= -4 \cdot 4$$

$$= -16$$

$$(-2, -16)$$

$$g(0) = -4\left(\frac{1}{2}\right)^0$$

$$= -4(1)$$

$$g(0) = -4$$

$$(0, -4)$$

$$g(2) = -4\left(\frac{1}{2}\right)^2$$

$$= -4\left(\frac{1^2}{2^2}\right)$$

$$= -4\left(\frac{1}{4}\right)$$

$$g(2) = -1$$

$$(2, -1)$$

Evaluating
Exponential
Functions

Adding outside exponent

$$f(x) = (2)^x - 3$$

Adding in Exponent

$$g(x) = (2)^{x-3}$$

f(-2)

f(0)

f(2)

g(-2)

g(0)

g(2)

$$f(-2) = 2^{-2} - 3$$

$$= \frac{1}{2^2} - 3$$

$$= \frac{1}{4} - 3$$

$$= -2\frac{3}{4}$$

$$(-2, -2\frac{3}{4})$$

$$f(0) = 2^0 - 3$$

$$= 1 - 3$$

$$= -2$$

$$(0, -2)$$

$$f(2) = 2^2 - 3$$

$$= 4 - 3$$

$$f(2) = 1$$

$$(2, 1)$$

$$g(-2) = 2^{-2-3}$$

$$= 2^{-5}$$

$$= \frac{1}{2^5}$$

$$= \frac{1}{32}$$

$$(-2, \frac{1}{32})$$

$$g(0) = 2^{0-3}$$

$$= 2^{-3}$$

$$= \frac{1}{2^3}$$

$$g(0) = \frac{1}{8}$$

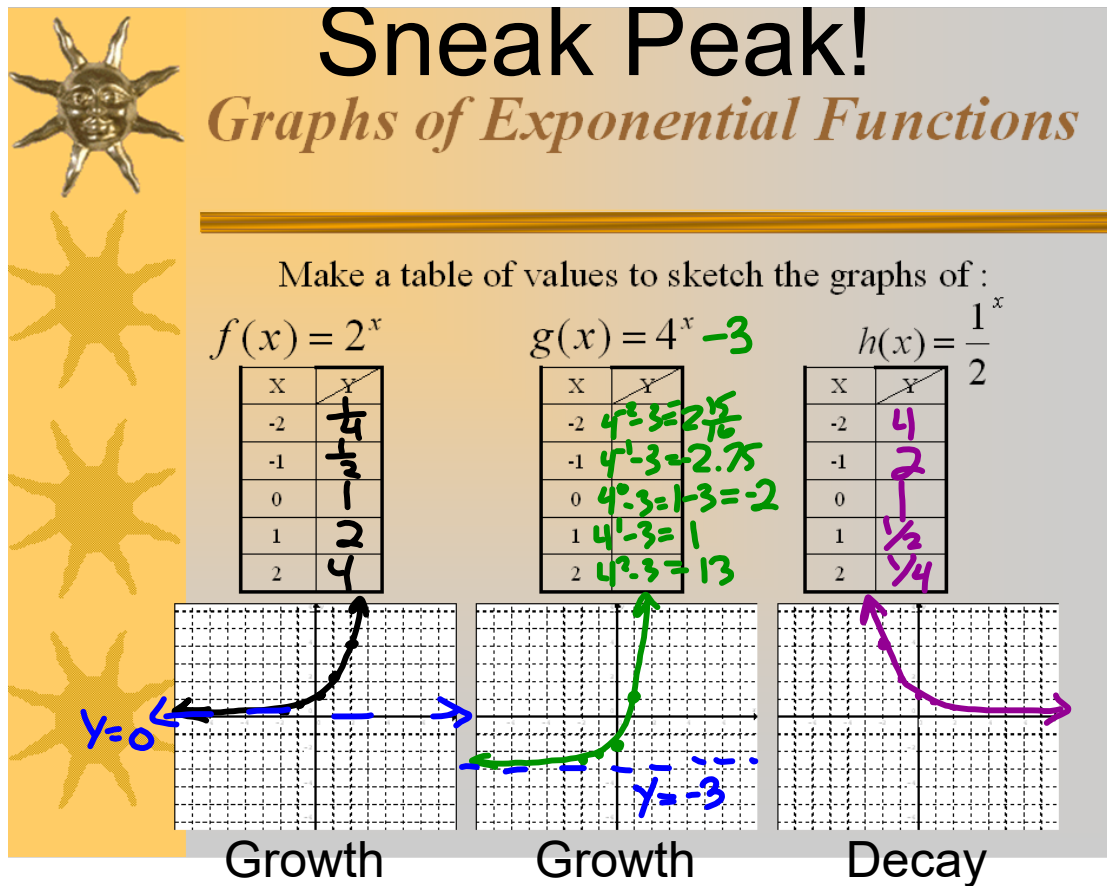
$$(0, \frac{1}{8})$$

$$g(2) = 2^{2-3}$$

$$g(2) = 2^{-1}$$

$$g(2) = \frac{1}{2}$$

$$(2, \frac{1}{2})$$



Assignment:

pg. 300 #3-8 and *Odd Only*

pg. 300 #9-18 evaluate the functions for

$f(-1)$, $f(0)$, $f(1)$ No need to determine Growth or decay yet

Assignment: **KEY**

pg. 300 #3-8 and

pg. 300 #9-18 evaluate the functions for

$f(-1)$, $f(0)$, $f(1)$ No need to determine
Growth or decay yet

3. a. $\frac{1}{4}$
b. 8

9) $f(x) = 6^x$

x	-1	0	1
f(x)	$\frac{1}{6}$	1	6

15) $f(x) = 1.2^x$

x	-1	0	1
f(x)	0.83	1	1.2

4. a. $\frac{1}{16}$
b. 64

11) $f(x) = \frac{1}{6}^x$

x	-1	0	1
f(x)	6	1	$\frac{1}{6}$

17) $f(x) = 0.6^x$

x	-1	0	1
f(x)	1.6	1	0.6

6. a. $\frac{3}{2}$
b. 48

13) $f(x) = \frac{4}{3}^x$

x	-1	0	1
f(x)	$\frac{3}{4}$	1	$\frac{4}{3}$

7. a. $\frac{46}{9}$
b. 32

8. a. $-\frac{7}{4}$
b. 6