Warm-up!

A) I am thinking of a geometric sequence with $g_2 = 5$ and $g_8 = 45$. Find g_{11}.

B) I am thinking of an exponential function $f(x) = a(b)^x$ with $b > 0$. If $f(10) = 13$ and $f(12) = 26$, find $f(16)$.

C) Same exponential function as part B. Find $f(10.5)$

Exponential Functions Day 3:

- Exponent Properties
- Transforming and manipulating exponential functions
- Writing end behavior with words

Homework: yes

Quiz on Day 5:

- Essentially Day 1-3
- See Canvas for further details

Review: Exponent Properties

Product of Powers: $a^m \cdot a^n =$

Power of a Power: $(a^m)^n =$

Power of a Product: $(ab)^m =$

Negative Exponent: $a^{-m} =$

Zero Exponent: $a^0 =$

Quotient of Powers: $\frac{a^m}{a^n} =$

Power of a Quotient: $\left(\frac{a}{b}\right)^m =$

Rational Exponents: $a^{\frac{m}{n}} =$

Evaluate without the use of a calculator

A) $\dfrac{9^{-\frac{5}{4}}}{\left(\frac{1}{3}\right)^{\frac{3}{2}}}$

B) $\left(8^{\frac{1}{3}} \cdot 8\right)^{\frac{1}{2}}$

Evaluate without the use of a calculator

C) $\frac{3^8 \cdot 3^4}{\left(9^{\frac{1}{4}}\right)^{20}}$

D) $2^{\frac{1}{2}} \cdot 18^{\frac{1}{2}}$

Let's just play with these and rewrite them in various ways using exponent properties

$$f(x) = 12(2)^{-3x}$$

$$g(x) = 5\left(\frac{1}{3}\right)^{x-2}$$

Which one of the following is equivalent to $g(x) = 10(2)^{3x+1}$

A) $g(x) = 20\left(\sqrt[3]{2}\right)^{x}$

B) $g(x) = (20)^{3x+1}$

C) $g(x) = 20(6)^{x}$

D) $g(x) = 20(8)^{x}$

Which one of the following is equivalent to $f(x) = 8(4)^{\frac{x}{2}}$

A) $f(x) = \frac{8}{4^x}$

B) $f(x) = 16(4)^x$

C) $f(x) = (2)^{x+3}$

D) $f(x) = 4(4)^x$

Rewrite the function in the form $a(b)^x$

$h(x) = 6(3)^{-x+1}$

Rewrite the function in the form $a(b)^x$

$$f(x) = -18\left(\frac{1}{9}\right)^{-\frac{x}{2}}$$

$$g(x) = 10(2)^{3x-2}$$

Let $f(x) = 3^x$

A) What sequence of transformations would map the graph of $f(x)$ to the graph of $g(x) = 3^{x+2}$

B) What sequence of transformations would map the graph of $f(x)$ to the graph of $h(x) = 3^x + 2$

C) What sequence of transformations would map the graph of $f(x)$ to the graph of $k(x) = 9(3)^x$

D) What sequence of transformations would map the graph of $f(x)$ to the graph of $m(x) = 3^{9x}$

Haha! I tricked you. Super sneaky. Example A and C were the same.

$$g(x) = 3^{x+2} \qquad k(x) = 9(3)^x$$

Determine the end behavior of each function. Express using limit notation.

$f(x) = 6(2)^x$

$g(x) = 6(2)^{3x}$

$h(x) = 6(2)^{x+3}$

$k(x) = 6(2)^x + 3$

Determine the end behavior. Express using limit notation.

$r(x) = -4(2)^x + 10$

(Review) When we want to express end behavior with words instead of limits

Instead of $\lim_{x\to-\infty} f(x)$, we can say: "As the input values of $f(x)$ decrease without bound…"

Instead of $\lim_{x\to\infty} f(x)$, we can say: "As the input values of $f(x)$ increase without bound…"

Instead of $= \infty$, we can say: "…the output values increase without bound."

Instead of $= -\infty$, we can say: "…the output values decrease without bound."

Example: Determine the end behavior of $f(x) = -4x^3 + x^2 - 5x - 6$

(Review) When the end behavior is a horizontal asymptote

Instead of saying $\lim_{x\to-\infty} f(x) = 5$, we say "As the input values of $f(x)$ decrease without bound, the output gets arbitrarily close to 5."

Example: Determine the end behavior of $f(x) = 4\left(\frac{1}{3}\right)^x$

Fill in the blanks to express the end behavior of each function

$f(x) = 12(3)^{-x+5}$

As the input values of $f(x)$ decrease without bound, the output values _____

As the input values of $f(x)$ increase without bound, the output values _____

$g(x) = -10(2)^{x} + 7$

As the input values of $g(x)$ decrease without bound, the output values _____

As the input values of $g(x)$ increase without bound, the output values _____

Determine the domain and range of each of the following functions

$$f(x) = 10\left(\frac{1}{2}\right)^{-x} + 3$$

$$g(x) = -5(10)^{x}$$

$$h(x) = -5(3)^{x} + 1$$