2.3 Exponential Functions
AP Precalculus

Solutions

2.3 Practice

Identify if the function is exponential growth or decay and justify your response.

1. $f(x) = 9(3.1)^x$ Exponential Growth or Decay **Because $a > 0$ and $b > 1$**	2. $f(x) = 6.8(0.4)^x$ Exponential Growth or Decay **Because $a > 0$ and $0 < b < 1$**	3. $f(x) = 2.1(0.06)^x$ Exponential Growth or Decay **Because $a > 0$ and $0 < b < 1$**	4. $f(x) = 8\left(\frac{11}{5}\right)^x$ Exponential Growth or Decay **Because $a > 0$ and $b > 1$**
5. $f(x) = 1.5\left(\frac{3}{4}\right)^x$ Exponential Growth or Decay **Because $a > 0$ and $0 < b < 1$**	6. $f(x) = \frac{7}{6}\left(\frac{6}{7}\right)^x$ Exponential Growth or Decay **Because $a > 0$ and $0 < b < 1$**	7. $f(x) = \frac{12}{17}\left(\frac{17}{12}\right)^x$ Exponential Growth or Decay **Because $a > 0$ and $b > 1$**	8. $f(x) = 18(5.6)^x$ Exponential Growth or Decay **Because $a > 0$ and $b > 1$**

The following values are output values of an exponential function of the form $f(x) = a \cdot b^x$, where a and b are constants. Write the function along with the input value that represents the output value.

9. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 7$ $f(x) = 7(3)^x$ where $x = 6$	10. $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot 6$ $f(x) = 6\left(\frac{1}{2}\right)^x$ where $x = 4$	11. $5 \cdot 5 \cdot 5$ $f(x) = 5^x$ where $x = 3$	12. $(-2) \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$ $f(x) = -2(4)^x$ where $x = 5$

Answer the questions for each exponential function.

13. $f(x) = 7(2)^x$

a. Is the function increasing or decreasing?

Increasing

b. Is the function concave up or concave down?

Concave up

c. Find $\lim_{x \to -\infty} f(x) = 0$

d. Find $\lim_{x \to \infty} f(x) = \infty$

14. $f(x) = -4(5)^x$

a. Is the function increasing or decreasing?

Decreasing

b. Is the function concave up or concave down?

Concave down

c. Find $\lim_{x \to -\infty} f(x) = 0$

d. Find $\lim_{x \to \infty} f(x) = -\infty$

15. $f(x) = (0.2)^x$

a. Is the function increasing or decreasing?

Decreasing

b. Is the function concave up or concave down?

Concave up

c. Find $\lim_{x \to -\infty} f(x) = \infty$

d. Find $\lim_{x \to \infty} f(x) = 0$

16. $f(x) = -6(0.8)^x$

a. Is the function increasing or decreasing?

Increasing

b. Is the function concave up or concave down?

Concave down

c. Find $\lim_{x \to -\infty} f(x) = -\infty$

d. Find $\lim_{x \to \infty} f(x) = 0$

17. $f(x) = 6\left(\frac{1}{9}\right)^x$

a. Is the function increasing or decreasing?

Decreasing

b. Is the function concave up or concave down?

Concave up

c. Find $\lim_{x\to-\infty} f(x) = \infty$

d. Find $\lim_{x\to\infty} f(x) = 0$

18. $f(x) = -(0.4)^x$

a. Is the function increasing or decreasing?

Increasing

b. Is the function concave up or concave down?

Concave down

c. Find $\lim_{x\to-\infty} f(x) = -\infty$

d. Find $\lim_{x\to\infty} f(x) = 0$

2.3 Exponential Functions

2.3 Test Prep

19.

$a=40$

x	0	1	2	3	4
$f(x)$	40	20	10	5	$\frac{5}{2}$

$\times \frac{1}{2}$ $\times \frac{1}{2}$ $\times \frac{1}{2}$ $\times \frac{1}{2}$

The exponential function f is defined by $f(x) = ab^x$, where a and b are positive constants. The table gives values of $f(x)$ at selected values of x. Which of the following statements is true?

A

(A) f demonstrates exponential decay because $a > 0$ and $0 < b < 1$.

(B) f demonstrates exponential decay because $a > 0$ and $b > 1$.

(C) f demonstrates exponential growth because $a > 0$ and $0 < b < 1$.

(D) f demonstrates exponential growth because $a > 0$ and $b > 1$.

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20. The function h is a function of the form $h(x) = a \cdot b^x$, where $a \neq 0$ and $b > 1$. The function h is also given by $h(x) = f(x) + 2$. Which of the following statements is true.

C

(A) The output values of both f and h are proportional over equal-length input-value intervals.

(B) The output values of f only, not h, are proportional over equal-length input-value intervals.

(C) The output values of h only, not f, are proportional over equal-length input-value intervals.

(D) The output values of neither f nor h are proportional over equal-length input-value intervals.

Explanation: Since $h(x) = a \cdot b^x$, this means h is proportional. h is also the **additive transformation** of the function f, therefore f must be exponential, but we don't know if f is proportional.