Notes

Period

9.1 Exponential Functions

Determine whether each table or rule represents a linear or an exponential function.

1)

x	1	2	3	4
y	3	9	27	81

×3 ×3 ×3

exponential

2)

x	1	2	3	4
y	3	9	15	21

+6 +6 +6

Linear.

3)

x	1	2	3	4	5	6
y	2	4	8	16	32	64

×2 ×2 ×2 ×2 ×2

exponential

4)

x	1	2	3	4	5	6
y	1	4	7	10	13	16

+3 +3 +3 +3 +3

Linear. $y = mx + b$

5) $y = 5 \cdot 2^x$

exponential $y = ab^x$

6) $y = 6 \cdot x^3$

neither

7) $y = 3x - 8$

$y = mx + b$

linear

8) $y = 4 \cdot 0.3^x$

$y = ab^x$

exponential.

9) $y = 3 \cdot 2^x$

exponential functions

10) $y = 4 \cdot 0.2^x$ $y = ab^x$

exponential function

11) $y = 5x - 8$

Linear function.

$y = mx + b$

12) $y = 5 \cdot 1.7^x$

$y = a \cdot b^x$

exponential function.

Evaluate each function for the given value.

13) $f(x) = 5^x$ for $x = 4$

$f(x) = 5^4$

$f(x) = 5 \cdot 5 \cdot 5 \cdot 5$

$f(x) = 25 \cdot 25$

$f(x) = 625$

14) $h(t) = 3 \cdot 4^t$ for $t = -3$

$h(t) = 3 \cdot 4^{-3}$

$h(t) = \frac{3}{64}$

$\frac{3 \cdot}{4^3}$

$\frac{3}{4 \cdot 4 \cdot 4}$

$\frac{3}{64}$

15) $y = 8 \cdot 0.7^x$ for $x = 3$

$y = 8 \cdot 0.7^3$

$y = 2.744$

16) $y = 4^x$ for $x = 3$

$y = 4^3$

$y = 4 \cdot 4 \cdot 4$

$y = 64$

17) $f(x) = 2 \cdot 3^x$ for $x = 5$

$f(x) = 2 \cdot 3^5$

$f(x) = 486$

18) $h(t) = 60 \cdot 1.07^t$ for $t = 8$

$h(t) = 60 \cdot 1.07^8$

$h(t) = 103.091$

19) $y = 5.7^x$ for $x = 0$

$y = 5.7^0$

$y = 5.1$

$y = 5$

Graph each exponential function. Identify the domain, range, y-intercept, and asymptote of each function.

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

domain: All real numbers.

Range: $y > 0$

y intercept: 1

asymptote: 0

21) $y = 0.25^x$

domain: All real numbers.

Range: $y > 0$

y intercept: 1

asymptote: 0

22) $y = 8 \cdot 1.2^x$

domain: All real numbers

Range: $y > 0$

y intercept: 8

asymptote: 0

23) What is the solution or solutions of $3^x = 5x$?

$-5x \quad -5x$

$3^x - 5x = 0$

$x \approx 0.269$ $x \approx 2.17$

24) A population of amoebas in a petri dish will triple in size every 20 minutes. At the start of an experiment the population is 800. The function $y = 800 \cdot 3^x$, where x is the number of 20 minute periods, models the population growth. How many amoebas are in the petri dish after 3 hours?

$y = 800 \cdot 3^x$

$y = 800 \cdot 3^9$

$y = 15,746,400$

$\frac{60}{20} = 3$ $\quad 3 \times 3 = 9$

$\frac{60}{20}\ 3$

$\frac{60}{2}\ 3$

9

25) A new car costs \$15,000 to build in 2010. The company's financial analysts expect cost to rise by 6% per year for the 10 years they are planning to build the car. The cost to build the car can be modeled by the function $f(t) = 15,000(1.06)^t$, where t is the number of years after 2010. How much will it cost the company to build the car in 2017?

$f(t) = 1500(1.06)^7$

$f(t) = 22,554.50$

Evaluate each function over the domain $\{-2, -1, 0, 1, 2, 3\}$

As the values of the domain increase, do the values of the range increase or decrease?

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

$0.1\bar{1}, 0.3\bar{3}, 1, 3, 9, 27$ Range increases.

27) $y = 4.2^x$

$0.0566, 0.2380, 1, 4.2, 17.64, 74.088$ Range increases.

28) $m(x) = 0.3^x$

$11.1\bar{1}, 3.3\bar{3}, 1, 0.3, 0.09, 0.027$

Range: decreases.

29) $g(t) = 4.3^x$

$0.4\bar{4}, 1.3\bar{3}, 4, 12, 36, 108$ Range increases.

30) $y = 50 \cdot 0.1^x$

$5000, 500, 50, 5, 0.5, 0.05$

Range decreases.

31) $f(x) = 2.4^x$

$0.1736, 0.4166\bar{6}, 1, 2.4, 5.76, 13.82$

Range increases.

Which function has a greater value for the given value of x?

32) $y = 5^x$ or $y = x^5$ for $x = 2$

$y = 5^2$ $\qquad$ $y = 2^5$

$y = 25$ $\qquad$ $y = 32$

$y = x^5$

33) $y = 300 \cdot x^3$ or $y = 100 \cdot 3^x$ $\quad x = 4$

$y = 300 \cdot 4^3$ $\qquad$ or $\qquad$ $y = 100 \cdot 3^4$

$y = 19,200$ $\qquad$ $y = 8,100$

$y = 300x^3$

Solve each equation.

35) $3^x = 81$

$x = 4$

36) $5 \cdot 2^x = 40$

$x = 3$

37) $4^x + 4 = 68$

$x = 3$

38) $3 \cdot 2^x - 16 = 80$

$x = 5$