6.2 Exponential Functions

Monday, September 23, 2019 7:46 AM

Warm Up

Determine whether the equation represents a linear function. Explain.

1. $y = \sqrt{2x + 3}$

x	y
0	1.732
1	2.236
2	2.646
3	3

not constant

2. $y = 2x^3 - 3x + 2$

x	y
0	2
1	1
2	12
3	45

not constant

3. $y = x + 1$ ← mx+b, yes, linear

4. $y = x^2 - 1$

x	y
0	-1
1	0
2	3
3	8

not constant

5. $y = 1 - \frac{1}{2}x$ ← mx+b, yes, linear

6. $y = \frac{1}{2}x - 3$ ← mx+b, yes, linear

Essential Question

What are the characteristics of exponential functions?

Needed Vocab:

- **Asymptote**
- **Constant Ratio**
- **Exponential Function**

Goal: "I can. . .

Describe and graph exponential functions."

Work with a partner. Copy and complete each table for the exponential function $f(x) = 2^x$. In each table, what do you notice about the values of x? What do you notice about the values of y?

x	$y = (2)^x$
1	2
2	4

+1 +1 ·2 ·2

x	$y = (2)^x$
2	4
4	16

+2 +2 ·4 ·4

for exponentials

- as the x's ↑ by 1 the y's ↑ or ↓ by multiplying by the base.
- as the x's ↑ by 2 the y's ↑ or ↓ by mult.

2	4
3	8
4	16
5	32

4	16
6	64
8	256
10	1024

as the x's ↑ by 2 the y's ↑ or ↓ by mult. by 2 the base.

Example 1

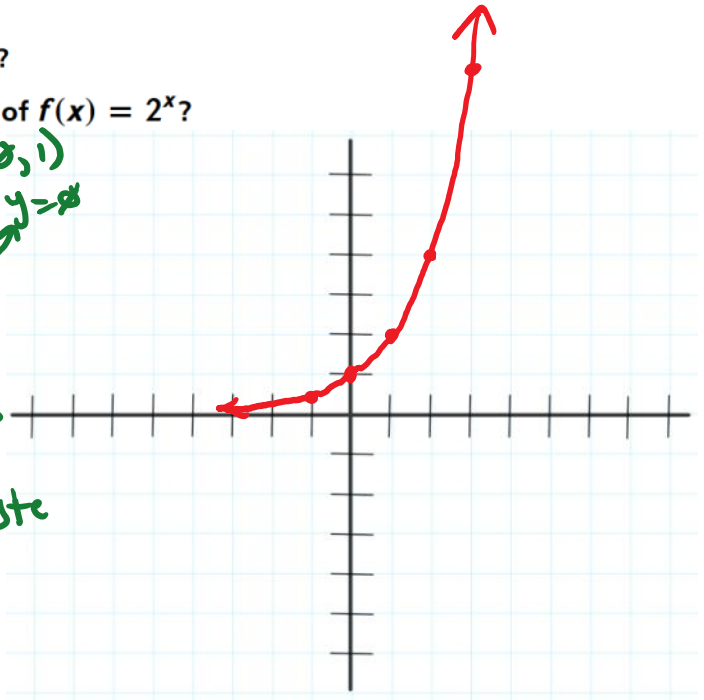
A. What does the graph of $f(x) = 2^x$ look like?

B. What are the characteristics of the graph of $f(x) = 2^x$?

x	y
-1	½
0	1
1	2
2	4
3	8

y-int: (0, 1)
Asympt.: y = 0
shape:

never hits x-axis
∴ Asymptote @ y = 0



What are the key features to the graph of $f(x) = \frac{1}{2}^x$?

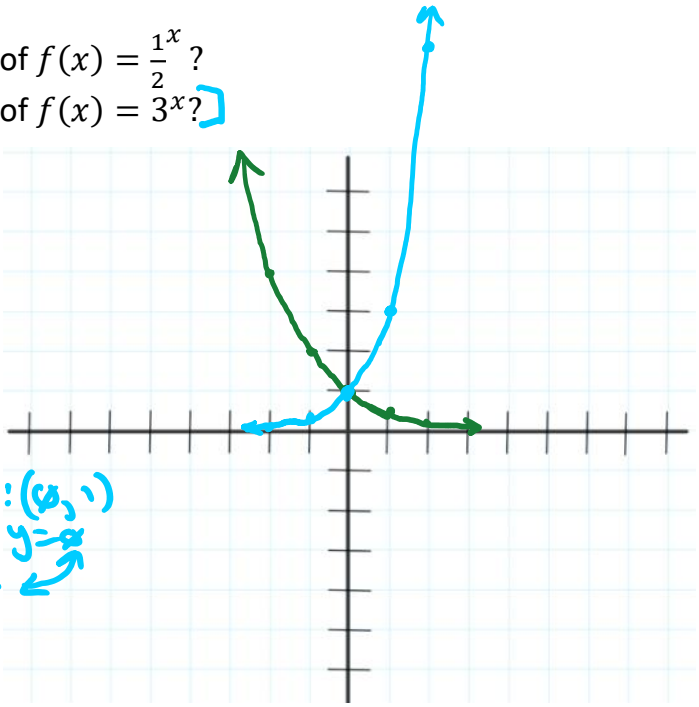
What are the key features to the graph of $f(x) = 3^x$?

x	y
-2	4
-1	2
0	1
1	½
2	¼

y-int: (0, 1)
asy.: y = 0
shape:

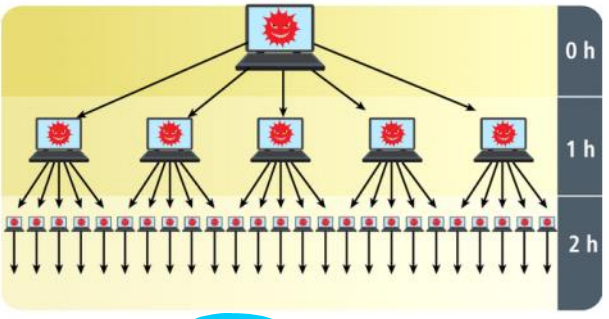
x	y
-2	1/9
-1	1/3
0	1
1	3
2	9

y-int: (0, 1)
asy: y = 0
shape:



Example 2

A network administrator uses the function $f(x) = 5^x$ to model the number of computers a virus spreads to after x hours. If there are 1,000 computers on the network, about how many hours will it take for the virus to spread to the entire network?



x	y
1	5
2	25
3	125
4	625
5	3125

> in between here. ≈ 4.3

How long would it take that same virus to spread to 50,000 computers?

x	y
1	5
2	25
3	125
4	625
5	3125
6	15,625
7	78,125

> $x \approx 6.72$

Exponential Functions

An **exponential function** is the product of an initial amount and a **constant ratio** raised to a power. Exponential functions are modeled using $f(x) = a \cdot b^x$, where a is a nonzero constant, $b > 0$, and $b \neq 1$.

$f(x) = a \cdot b^x$

a is the initial amount.

b is the constant ratio.

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

x	0	1	2	3	4
y	3	6	12	24	48

a = 3

·2 ·2 ·2 → b

Example 3

A. What is the written form of the function represented by the table?

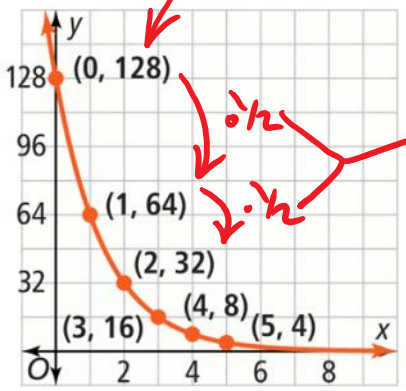
x	f(x)
0	4
1	12
2	36
3	108
4	324

a = 4

·3 ·3 → b = 3

$f(x) = 4 \cdot 3^x$

B. What is the written form of the function represented by the graph?



a = 128

·½ ·½ b = ½

$h(x) = 128 \cdot \frac{1}{2}^x$

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3. Write an exponential function for each set of points.

a. (0, 3), (1, 12), (2, 48), (3, 192), and (4, 768)

·4 ← b

a

$f(x) = 3 \cdot 4^x$

b. (0, 2,187), (1, 729), (2, 243), (3, 81), and (4, 27)

a ·⅓ b

$h(x) = 2{,}187 \cdot \frac{1}{3}^x$

Example 4

Talisha is offered two pledge options for donating to a charity. Which option will increase the pledge amount faster over time?

Option A: $100 for the first week, and each week after that the amount increases by $25

1 → $100
2 → $125
3 → $150

Option B: $1 for the first week, and each week after that the amount triples

1 → $1
2 → $3
3 → $9
4 → $27

2 → $125
3 → $150
4 → $175
5 → $200
6 → $225

2 → $3
3 → $9
4 → $27
5 → $81
6 → $243

option B increases faster

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4. Identify each function as linear or exponential. Explain.

a. $f(x)$ equals the number of branches at level x in a tree diagram, where at each level each branch extends into 4 branches.

Exponential

b. $f(x)$ equals the number of boxes in row x of a stack in which each row increases by 2 boxes.

Linear

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https://tinyurl.com/thhafou

Homework

Pg. 229
9, 15-25, 29, 30