Warm Up

Determine the constant ratio for each sequence.

1. 5, 5.25, 5.5125, 5.788125 . . .

2. 100, 20, 4, $\frac{4}{5}$ . . .

3. 1, $\frac{2}{3}$, $\frac{4}{9}$, $\frac{8}{27}$, . . .

Wakey, Wakey, Eggs and Bakey!

You have studied linear and exponential functions. You know that a linear function increases or decreases by a constant difference, whereas an exponential function increases or decreases by a common ratio.

Consider each function shown.

$f(x) = -3x - 1$ $g(x) = 2^x + 5$ $h(x) = 0.5^x$

$q(x) = 2 \cdot 1.5^{(x+1)}$ $r(x) = -3 \cdot 3^x$ $t(x) = -x + 2^3$

$a(x) = 10 \cdot 1^x$ $b(x) = 5(x - 1) + 4$ $c(x) = 2 \cdot (1 - 0.1)^x$

1. **Sort the functions into linear and exponential functions. Justify your choices.**

Linear Functions

Exponential Functions

What does the structure of each equation tell you about its corresponding function?

2. Sort the functions into increasing and decreasing functions. Justify your choices.

Increasing Functions

Decreasing Functions

What does the structure of each equation tell you about its corresponding function?

Let's consider which function type represents each situation.

Sanjay's family deposited $20,000 in an interest bearing account for his college fund. Sanjay's account earns simple interest each year.

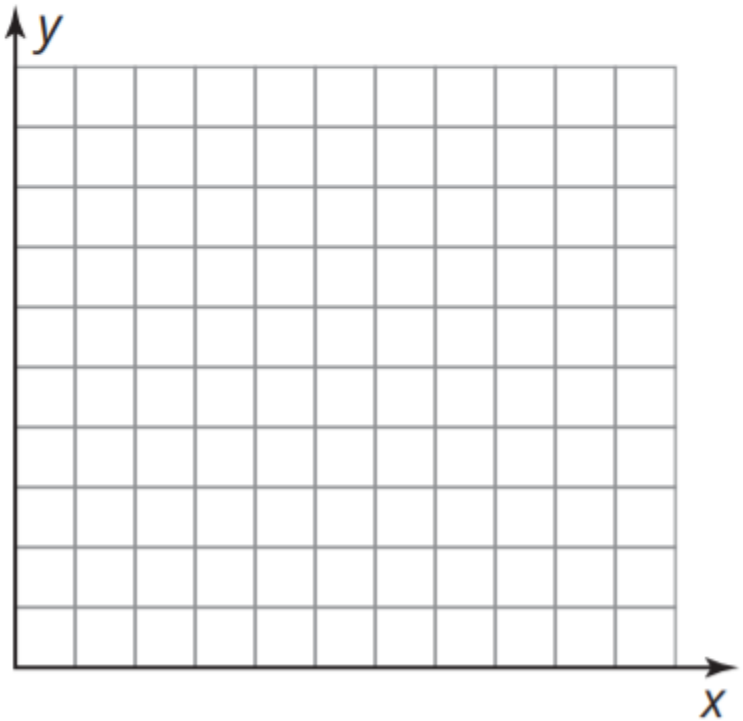
Chikonde's family deposited $20,000 in an interest bearing account for her college fund that earns compound interest each year.

Time (years)	Simple Interest Balance (dollars)	Compound Interest Balance (dollars)
0	20,000	20,000
1	20,800	20,800
2	21,600	21,632
3	22,400	22,497.28
10	28,000	29,604.89

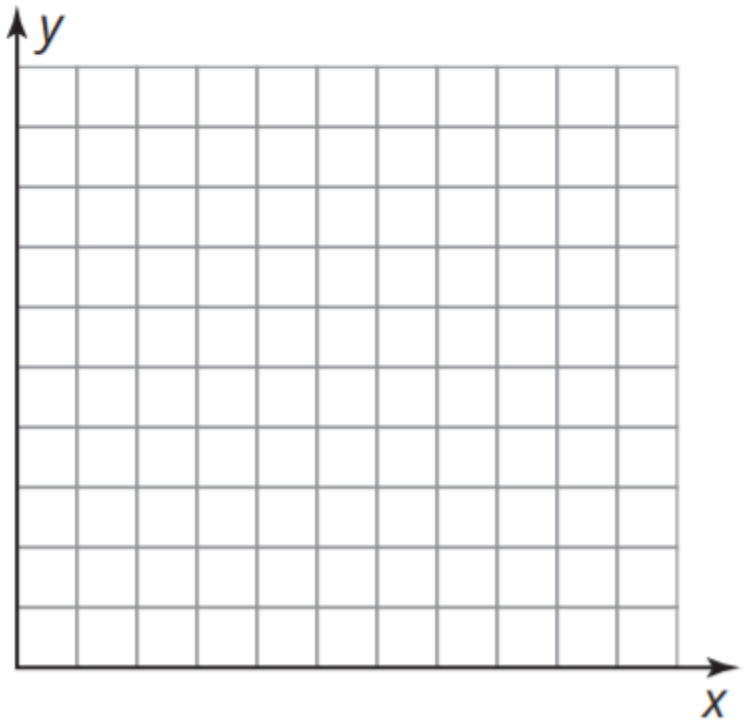
1. Study the table of values.

a. Sketch a graph of each account balance in dollars as a function of the time in years.

Simple Interest Balance



Compound Interest Balance



b. Write a function, $s(t)$, to represent the simple interest account and a function, $c(t)$, to represent the compound interest account.

2. Use the functions $s(t)$ and $c(t)$ to determine each value.

a. $s(6)$

b. $c(6)$

c. $c(5)$

d. $s(5)$

3. Determine the average rate of change between each pair of values given for each relationship.

Time Intervals (years)	Simple Interest Function (dollars)	Compound Interest Function (dollars)
Between $t = 0$ and $t = 1$		
Between $t = 1$ and $t = 2$		
Between $t = 2$ and $t = 6$		
Between $t = 6$ and $t = 10$		

4. **Compare the average rates of change for the simple and compound interest accounts. What does this tell you about linear and exponential functions?**

5. **Use technology to determine when each account will reach the given dollar amount.**

   a. **When does the simple interest account reach $100,000?**

   b. **Approximately when does the compound interest account reach one million dollars?**

6. **Takondwa says that given any increasing linear function and any exponential growth function, the output of the exponential function will eventually be greater than the output of the linear function. Is Takondwa correct? Use examples to justify your thinking.**