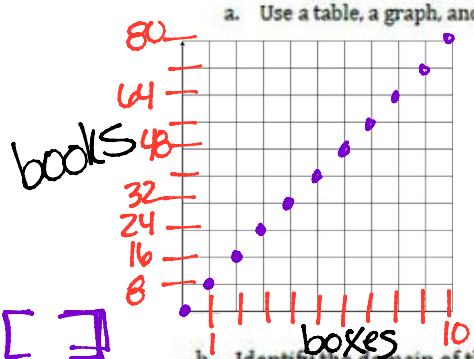
2.2 Shh! Please Be Discreet (Discrete)!

A Solidify Understanding Task

1. The Library of Congress in Washington D.C. is considered the largest library in the world. They often receive boxes of books to be added to their collection. Since books can be quite heavy, they aren't shipped in big boxes. If, on average, each box contains about 8 books, how many books are received by the library in 6 boxes, 10 boxes, or *n* boxes?

   a. Use a table, a graph, and an equation to model this situation.



Do not connect dots → no ½ books

Arithmetic → +8

Explicit $A_n = 0 + 8n$

$A_n = 8n$

Recursive: $A_1 = 8$

$A_n = A_{n-1} + 8$

boxes X	books Y	
0	0	>+8
1	8	>+8
2	16	>+8
3	24	>
4	32	>
5	40	>
6	48	>
7	56	>
8	64	>
9	72	>
10	80	

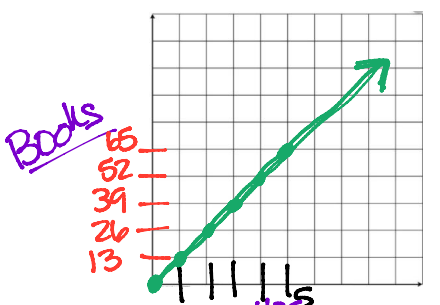
[ ] = Equal to

   b. Identify the domain of the function.

Boxes $[0, 1, 2, 3 \ldots \infty)$ → never touch ∞

2. Many of the books at the Library of Congress are electronic. If about 13 e-books can be downloaded onto the computer each hour, how many e-books can be added to the library in 3 hours, 5 hours, or *n* hours (assuming that the computer memory is not limited)?

   a. Use a table, a graph, and an equation to model this situation.



Continuous

Linear

Arithmetic

Exp → $A_n = 0 + 13n$

$A_n = 13n$

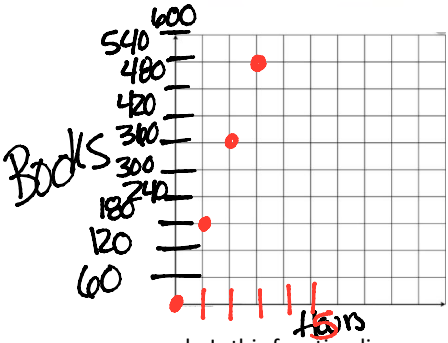
$f(n) = 13n$

Hrs X	Books Y	
0	0	>+13
1	13	>+13
2	26	
3	39	
4	52	
5	65	

   b. Identify the domain of the function.

Hours: $[0, \infty)$

3. The librarians work to keep the library orderly and put books back into their proper places after they have been used. If a librarian can sort and shelve 3 books in a minute, how many books does that librarian take care of in 3 hours, 5 hours, or n hours? Use a table, a graph, and an equation to model this situation.



3 books = 1 minute

Add 180 books = 1 hr

Arithmetic

Discrete

Eq: $A_n = 0 + 180n$

$A_n = 180n$

3x60= 180

Hours X	Books Y	
0	0	+180
1	180	+180
2	360	
3	540	
4	720	
5	900	

b. Is this function linear or exponential?

Linear

4. Would it make sense in any of these situations for there to be a time when 32.5 books had been shipped, downloaded into the computer or placed on the shelf?

Downloaded → lost internet connection

Ran out of room

5. Which of these situations (in problems 1-3) represent a discrete function and which represent a continuous function? Justify your answer.

1 and 3 discrete → whole #'s

2 → Continuous → have 1/2 a book downloaded

Warmup

Tell if the following are discrete or continuous.

1) Bacteria doubling every hour — Continuous

2) Mrs. Forrester's gray hairs tripling every day — Continuous

3) 4 more books read a day — Discrete

4) 7 times as many missing assignments as the day before — Discrete

Create the equation

5) You are chasing your dog and gathering 2 more treats every minute. You start with 1 treat. — Arithmetic

Explicit: $A_n = 1 + 2n$

6) Mrs. Forrester is giving you double the amount of candy from the day before. You start with 4 pieces of candy.

x2 Geometric

X	Y
0	4
1	8
2	16
3	32
4	64

(×2 ×2 ×2)

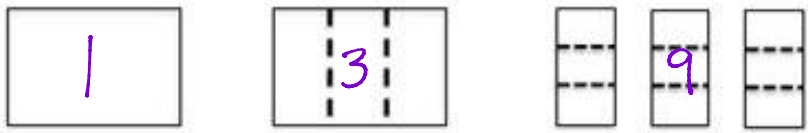
Exp

$A_n = 4(2)^n$

$A_n = 8(2)^{n-1}$ ← 1st term

$A_n = 64(2)^{n-4}$ $A_n = 32(2)^{n-3}$

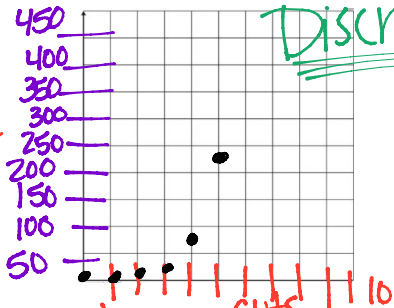
6. A giant piece of paper is cut into three equal pieces and then each of those is cut into three equal pieces and so forth. How many papers will there be after a round of 10 cuts? 20 cuts? *n* cuts?



Zero Cuts One Cut Two Cuts

X	Y	
0	1	×3
1	3	×3
2	9	×3
3	27	×3
4	81	×3
5	243	×3
6	729	×3
7	2187	×3
8	6561	
9	19683	
10	59049	

a. Use a table, a graph, and an equation to model this situation.



Discrete

Equation

Multiply → Geo

Explicit. $An = 3(3)^{n-1}$

Exponential

$An = 19683(3)^{n-9}$

$19683(3)^{9-9}$

b. Is this function linear or exponential?

Exponential

c. Identify the domain of the function. x-values

Cuts $[0, 1, 2, 3, \ldots \infty)$

d. Would it make sense to look for the number of pieces of paper at 5.2 cuts? Why or why not?

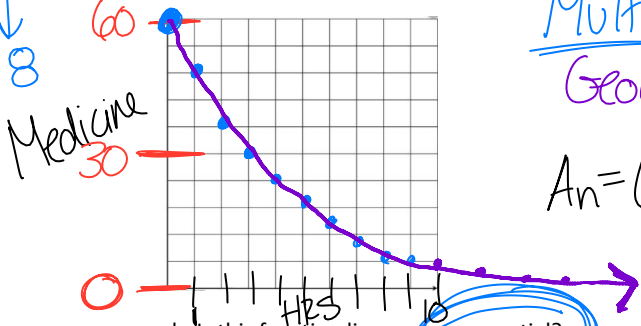
No decimal cuts, no ½ cuts only whole cuts

e. Would it make sense to look for the number of cuts it takes to make 53.6 papers? Why or why not?

Can't have a partial piece of paper

7. Medicine taken by a patient breaks down in the patient's blood stream and dissipates out of the patient's system. Suppose a dose of 60 milligrams of anti-parasite medicine is given to a dog and the medicine breaks down such that 20% of the medicine becomes ineffective every hour. How much of the 60 milligram dose is still active in the dog's bloodstream after 3 hours, after 4.25 hours, after n hours?

a. Use a table, a graph, and an equation to model this situation.



x	y
0	60
1	48
2	38.4
3	30.72
4	24.576
5	19.6608
6	15.72864
7	12.583
8	10.066
9	8.053
10	6.442

$A_n = 60(0.8)^n$

b. Is this function linear or exponential?

c. Identify the domain of the function.

Hrs $[0, \infty)$

d. Would it make sense to look for when there is 35 milligrams of medicine? Why or why not?

e. Would it make sense to look for an amount of active medicine at 3.8 hours? Why or why not?

8. Which of the functions modeled in #6 and #7 are discrete and which are continuous? Why?

9. What needs to be considered when looking at a situation or context and deciding if it fits best with a discrete or continuous model?

10. Describe the differences in each representation (table, graph, and equation) for discrete and continuous functions.