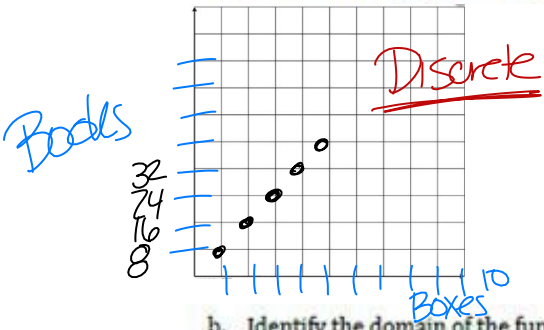
2.2 Shh! Please Be Discreet (Discrete)!

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.



$y = 8x$

$a_n = 8n$

$f(x) = 8x$

X	Y	
1	8	>+8
2	16	+8
3	24	>+8
4	32	

Set Not

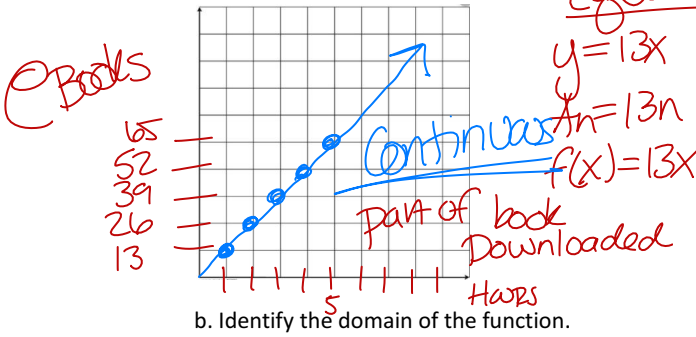
$\{0, 1, 2, 3 \ldots \infty\}$

   b. Identify the domain of the function.

Boxes → whole # → $[0, 1, 2 \ldots \infty)$

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.



Equation

$y = 13x$

$a_n = 13n$

$f(x) = 13x$

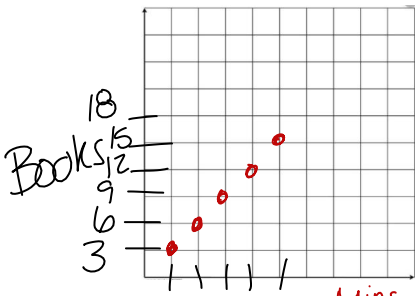
X	Y	
1	13	>+13
2	26	>+13
3	39	

   b. Identify the domain of the function.

Hours → no negative time

$[0, \infty)$

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.



x	y
1	3
2	6
3	9
4	12

Discrete

Eq

$y = 3x$

$a_n = 3n$

$f(x) = 3x$

Interval $[0, 1, 2, \ldots \infty)$

b. Is this function linear or exponential?

Domain x-values

Mins → no negatives

Set Notation $\{0, 1, 2 \ldots \infty\}$

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?

Download 32.5 books

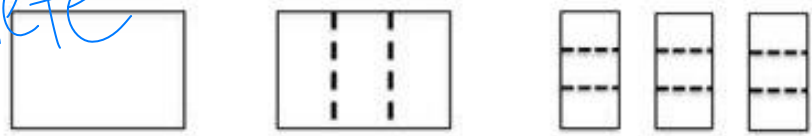
5. Which of these situations (in problems 1-3) represent a discrete function and which represent a continuous function? Justify your answer.

1 & 3 Discrete Whole #'s

2 Continuous downloading

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?

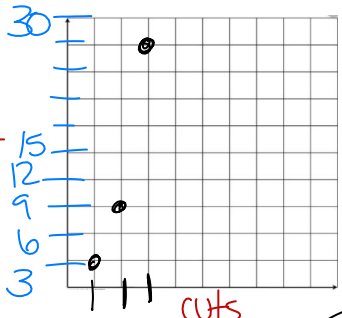
Discrete



Zero Cuts One Cut Two Cuts

X	Y
0	1
1	3
2	9
3	27

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



$y = 1(3)^x$

$3(3)^{x-1}$

$9(3)^{x-2}$

$27(3)^{x-3}$

b. Is this function linear or exponential?

c. Identify the domain of the function.

Cuts → Whole #

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

$\{0, 1, 2 \ldots \infty\}$

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

No → not whole #

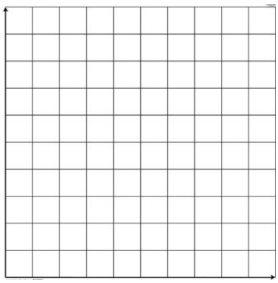
e. Would it make sense to look for the number of cuts it takes to make 53.6 papers? Why or why not?

No → not whole #

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.

Continuous



HRS X	Y mod
0	60
1	48

$\times 0.8$

80% effective $\frac{80}{100} = 0.8$

$48(0.8)^{x-1}$

b. Is this function linear or exponential?

c. Identify the domain of the function.

HRS → no negatives → $[0, \infty)$

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

Yes → continuous

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

Yes → continuous

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.