Name: ______________________________ Date: ______________

Discrete Functions
Common Core Algebra I

We have done a lot of modeling this year. Each time we used a function to describe the relationship between two quantities the input variable (typically x or t) was either **continuous** or **discrete**. A non-rigorous set of definitions for continuous and discrete is given below:

> **Continuous Versus Discrete Variables**
>
> A **continuous variable/function** takes on all real number values between its extremes.
>
> A **discrete variable/function** takes on isolated or unconnected values between its extremes.

In this lesson we will concentrate on **discrete functions** because most of the graphing we have done has been of **continuous functions.**

Exercise **#1:** Miranda has a lemonade stand where she is selling cups of lemonade for $0.50 per cup.

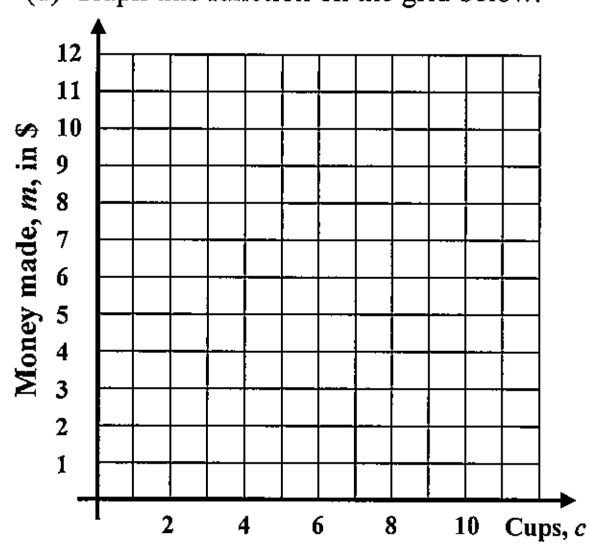
(a) Fill out the table below for the amount of money, m, that Miranda makes as a function of the number of cups, c, that she sells.

Cups, c	0	1	2	3	4
Money, m					

(c) Explain why this is an example of a **discrete function.**

(b) Create an equation that finds the money made, m, as a function of the number of cups, c, sold.

(d) Graph this function on the grid below.



(e) How many cups of lemonade would Miranda need to sell in order to make exactly $30?

(f) Explain why Miranda cannot make exactly $28.75.

So, **discrete functions** are **characterized** by **domains** (inputs) that **realistically** contain only certain types of numbers, typically **whole numbers**.

***Exercise* #2:** In each of the following cases, two variables are related by a function. In each situation, determine whether the function is **continuous** or **discrete**. Explain your thinking.

(a) A person who is driving at a constant speed of 62 miles per hour has a distance traveled, d, given as a function of time, t, in hours as $d = 62t$.

(b) Franklin is selling candy bars to raise money for the Drama Club. Each candy bar costs \$2.50. The money he raises, m, as a function of the number of candy bars, b, he sells is given by $m = 2.50b$.

(c) A teacher imposes a one-half multiplicative penalty each day that an assignment is turned in late. The total credit, c, that a student can earn based on the number of days it is late is given by $c = 100 \cdot \left(\frac{1}{2}\right)^d$.

(d) A bathtub is draining at a rate of 3.2 gallons per minute from an initial volume of 164 gallons. The volume, V, of water left in the bathtub after m minutes is given by $V = 164 - 3.2m$.

Phenomena that are discrete often have ramifications when it comes to realistic solutions to modeling problems. Consider an example that compares texting plans.

***Exercise* #3:** Malik is trying to compare texting plans for two cell phone companies. His options are given below.

Option A: A monthly charge of \$12.50 and each text costs \$0.02.

Option B: No monthly charge, but a charge of \$0.05 per text.

(a) Write equations that give the total monthly cost, c, based on the number of text's made, n, for both options.

Option A:

Option B:

(b) Why will Malik not be able to find a number of texts where the two plans charge an equal monthly amount?

(c) Even though the solution to (b) is not **viable**, it still might be helpful in thinking about the two cell phone plans. What information does it provide?