This power point can be used with Algebra 2 or Pre-Calculus students to introduce the idea of a limit or how to set up a math model .

What would happen if I had a Diet Coke every day at lunch?

I have to ask a few questions

* Should I look at the amount of sugar I would be drinking every day? *No, I am drinking Diet Coke*
* What about the Caffeine? How much caffeine does Diet Coke have in it?
* What would caffeine this do to me day after day?
* Is it bad for me?

Is this a math question?

* I am adding a given amount every day.
* My body will use a certain amount every day, so I am subtracting.
* So by just adding and subtracting what will happen over time?
* How much Caffeine would I still have from yesterday, before drinking another Diet Coke?

Let's guess on the equation

* My body will use 30% of the Diet Coke caffeine it is given. So I will have 70% left.

* I am guessing Diet Coke has 100mg of caffeine. I am think that Classic Coke would have more caffeine; so Diet Coke must be better for me.

* The equation would be 100mg - (.30*100mg) on the first day, thus 70mg at the end of the day.

* The next day it would be 70mg +100mg, giving the equation 170mg-(.30*170mg). The equation would follow the same the adding the remaining amount to 100mg.

* I am going to use Excel do run this equation for a few days. (This could be done by hand)

I rounded off my amounts to the nearest whole number.
I am starting to see a pattern. I will graph the end of the day remaining amount.

Start amount	Used every day	Left over at the end of the day
100	30	70
170	51	119
219	66	153
253	76	177
277	83	194
294	88	206
306	92	214
314	94	220
320	96	224
324	97	227
327	98	229
329	99	230
330	99	231
331	99	232
332	100	232
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Here is the graph to show what the data is doing

Left over at the end of the day

Legend: Left over at the end of the day
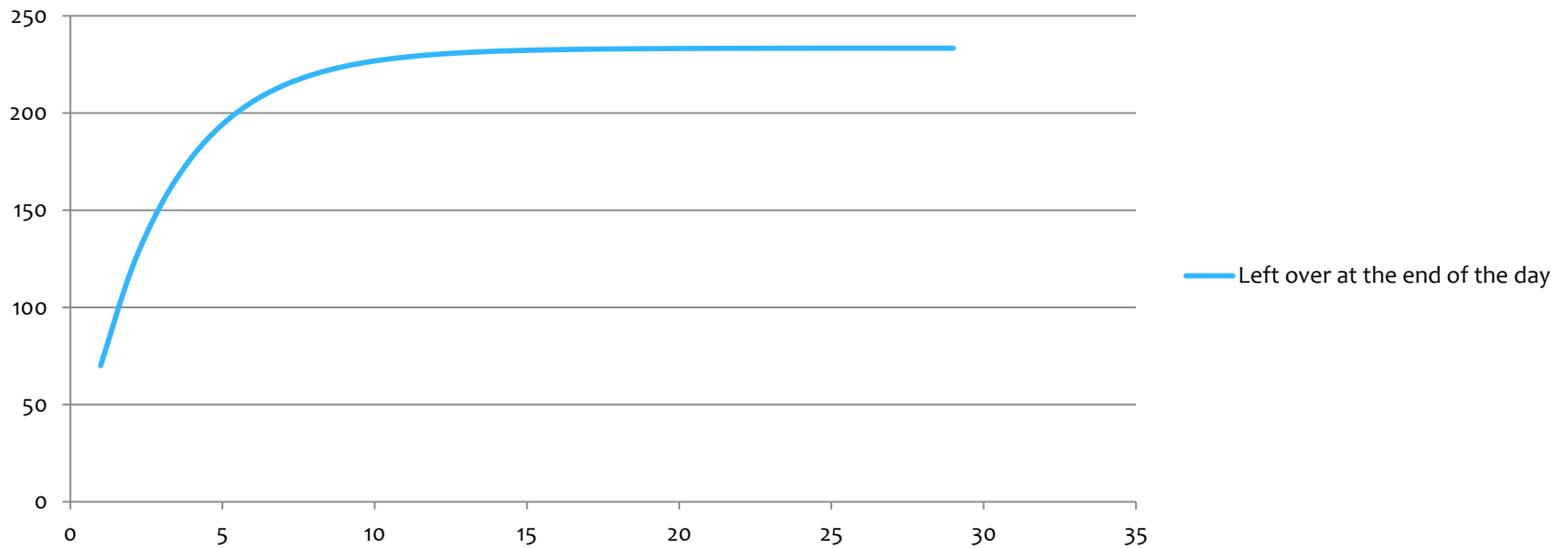
What do you see? Is this just because I have chosen the numbers?

* Ok those number were made up, let find some facts. *(To the BATCAVE, sorry I mean the web)*

* How much caffeine is in Diet Coke?

* How much caffeine does my body use each day?

Level of Caffeine of some drinks

* Lets pick a few

* Diet Coke	12 oz ,45 mg
* Coke-Cola Classics	12 oz, 35 mg
* Red Bull	8.46 oz, 80 mg
* Mountain Dew	12 oz, 54 mg
* Amp Energy Drink	12 oz, 80 mg
* Starbucks Grande Caffe Mocha	16oz, 175 mg

  Source:

   http://www.energyfiend.com/the-caffeine-database

  One of many websites, easy fact to find

How much does the body use?

* According to research (not a hard search)

* The mean serum caffeine half-life for healthy subjects is 5.7 hours. *(Based on normal body type, which not I am not)*

* Source:
* http://www.ncbi.nlm.nih.gov/pubmed/7361718?dopt=Abstract

* **Serum caffeine half-lives. Healthy subjects vs. patients having alcoholic hepatic disease.**
* Statland BE, Demas TJ.

So I need to change the equation

* *Starting amount* 45mg
* *Amount used* (Student will have an understand half life) $0.5^{(24/5.7)}$ times starting amount thus giving the remaining amount. The amount used has to be subtracted from the remaining amount.
* $(45-(45*0.5^{(24/5.7)}))$
* *Remaining amount*

    Starting amount times $(0.5^{(24/5.7)})$

Lets see what that does to the equation

The rate in which the body get rid of caffeine and the amount of caffeine in Diet Coke is lower then I thought. Graphing the new amounts seems to be leveling off but at lower levels.

Left over at the end of the day
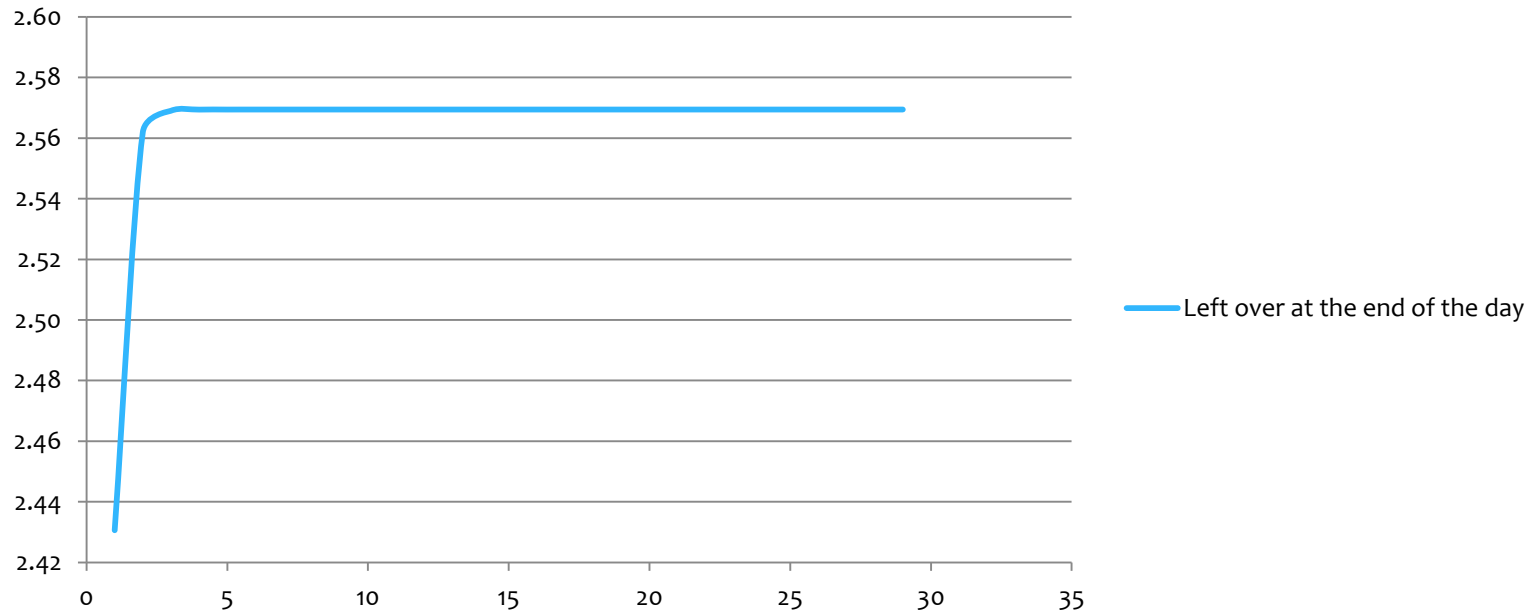
What are the definition level of caffeine?

* Here is the definition of what is considered low, moderate, high, and heavy amounts of caffeine intake:

* a low to moderate intake is 130 mg-300 mg per day

  a moderate is 200 mg-300 mg per day

  a high doses are above 400 mg per day
*
  heavy caffeine consumption is more than 6,000 mg/day.

* Source: http://www.medicinenet.com/caffeine/article.htm

Having what level of caffeine in my system is it bad?

* Chronic, heavy caffeine ingestion may cause or exacerbate anxiety and may be associated with depression and increased use of antianxiety drugs. Caffeine may cause anxiety and panic in panic disorder patients. Chronic users who are caffeine-sensitive may have symptoms of caffeinism at **relatively low doses**. Individuals who regularly consume moderate to heavy amounts of caffeine may develop caffeinism, or they may show signs of caffeine withdrawal syndrome after abstaining from the drug.

* Source: http://www.ncbi.nlm.nih.gov/pubmed/3284301

What is Caffeinism?

caf·fein·ism (k-fnzm, kf-) *n.* A toxic condition marked by diarrhea, elevated blood pressure, rapid breathing, heart palpitations, and insomnia, caused by excessive ingestion of coffee and other caffeine-containing substances.

Let's see what happen if I have a Diet Coke ever 4 hours.

Left over at the end of the day
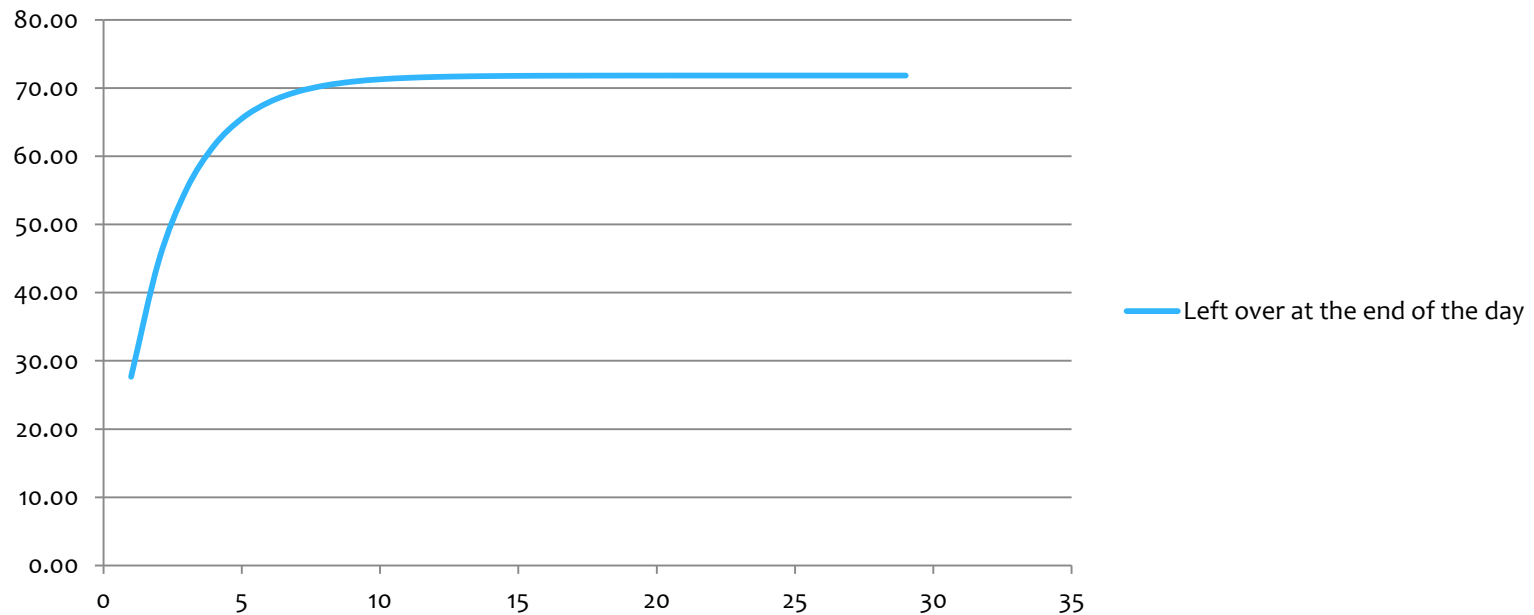
What are we seeing?

* Leveling off no matter the amount started with and the amount of time given?

* This model seem unreal. What are some of its problems?

* *One Answer ; Who gets out of bed to have a Diet Coke every 4 hours?*

So I would set my watch to remind me to drink a Diet Coke every 4 hour. Even if it was the middle of the night to drink my Diet Coke. Not going to happen.

* We would have to build a model that shows a long break between dinner or (drink before dinner) at 4pm and Breakfast at 8am.
* So the drinking would be 4 hour apart three times a day breakfast, lunch and dinner and a 16 hours break to not drink or maybe sleep.
* *Would we still get a graph that level off?*
* *For a high school student the question could be have you every seen something like this before?*
* Sounds like how often take my meds, hmm.

After the students work on the equation, there graph would be broken into some graph of after breakfast, lunch and dinner.
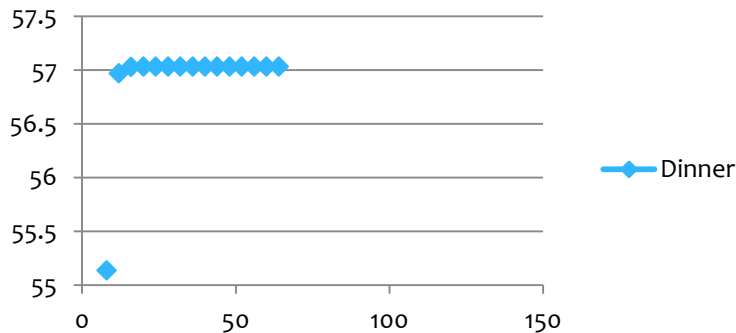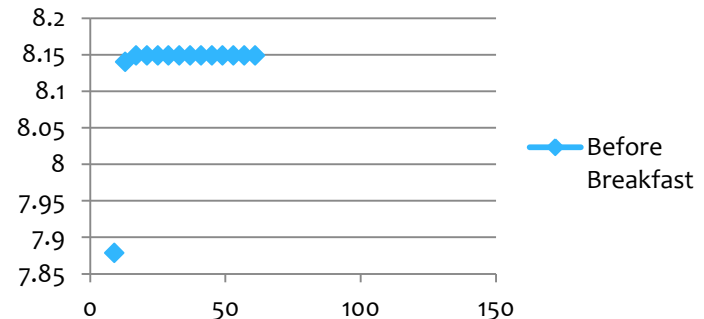

Breakfast left over after
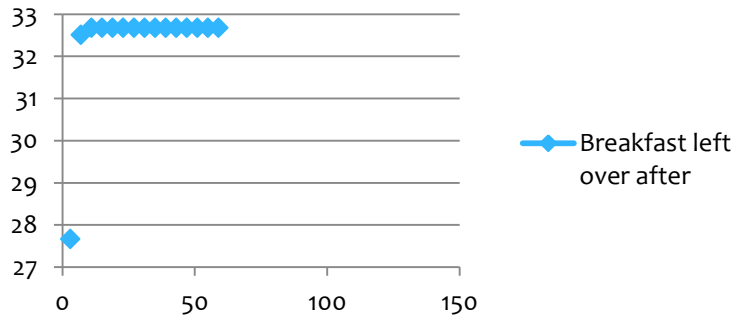
Lunch
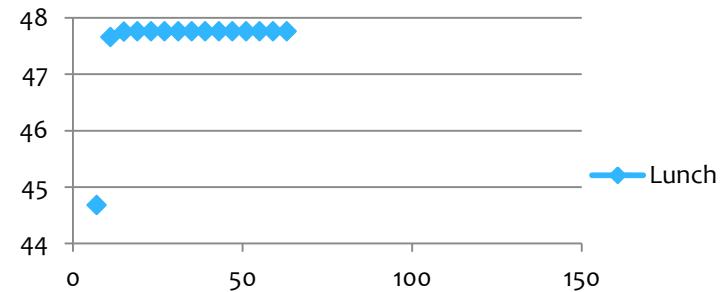
Dinner

Before Breakfast

Each graph shows that the amount level off every time.

* I would use this as way to start showing a limit.
* It also follows the idea of writing a model for an event. One off the top of head and the other with facts.
* Then it follows the state standard.

Indiana state standard for modeling

* **Mathematical Reasoning and Problem Solving**
    * A2.10.5
    * Understand that the logic of equation solving begins with the assumption that the variable is a number that satisfies the equation, and that the steps taken when solving equations create new equations that have, in most cases, the same solution set as the original. Understand that similar logic applies to solving systems of equations simultaneously.

To Answer my Question

* Caffeine does not seem to have any bad effect at this time to me.

* Ron Grosz