

**Math:** If you have 100 feet of fencing, what shape will make a garden with the largest area?

a) A circle   b) A rectangle   c) A square   d) It doesn't matter, they will all have the same area

**Science:** The speed of light is how many times faster than the speed of sound?

a) 10 times   b) 1000 times   c) 100,000 times   d) 1,000,000 times

**Analogies:** Rectangle : Parallelogram   Square : ?

**History:** What was the name of the machine that was used by Nazi Germany for the encryption and decryption of secret messages during World War II?

**Trivia:** The lowest possible temperature expressed in Fahrenheit is\_\_\_\_\_. (Closest)



**Math:** If you have 100 feet of fencing, what shape will make a garden with the largest area?

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**a) A circle**

**Science:** The speed of light is how many times faster than the speed of sound?

a) 10 times   b) 1000 times   c) 100,000 times   d) 1,000,000 times

**d) 1,000,000 times**

**Analogies:** Rectangle : Parallelogram   Square : ?

**Rhombus**



**History:** What was the name of the machine that was used by Nazi Germany for the encryption and decryption of secret messages during World War II?

**Enigma**

**Trivia:** The lowest possible temperature expressed in Fahrenheit is\_\_\_\_\_. (Closest)

**-459.67° F**

**Tie-breaker**

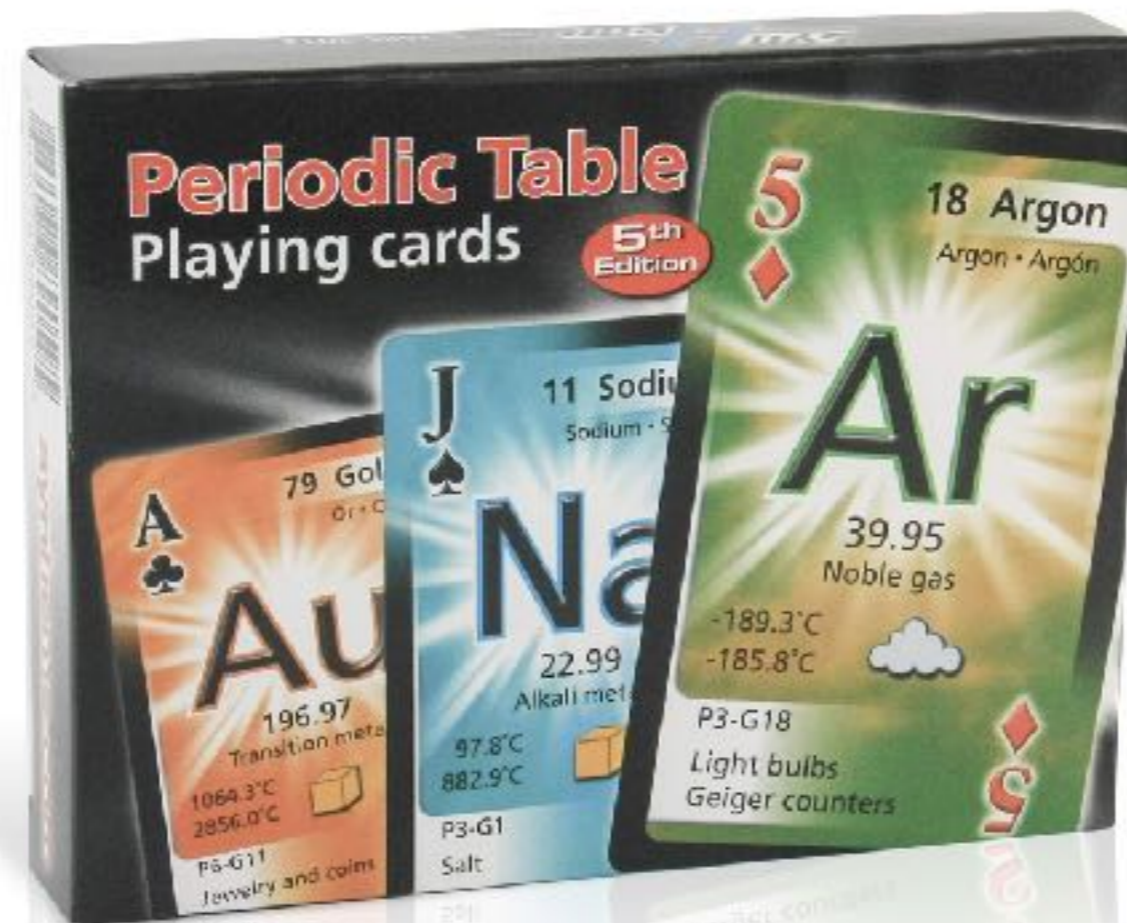
**Science:** What is the weight of a liter of water?

**1 Kilogram**

**2.20462262 pounds**



# Win Periodic Table Playing Cards





**3 pennies, 9, 27, 81, 243.....**



$$3^{64} \times \frac{1}{16} = \text{????}$$

**Up to the top of the Empire State Building**

**Through the atmosphere**

**Up to the moon**

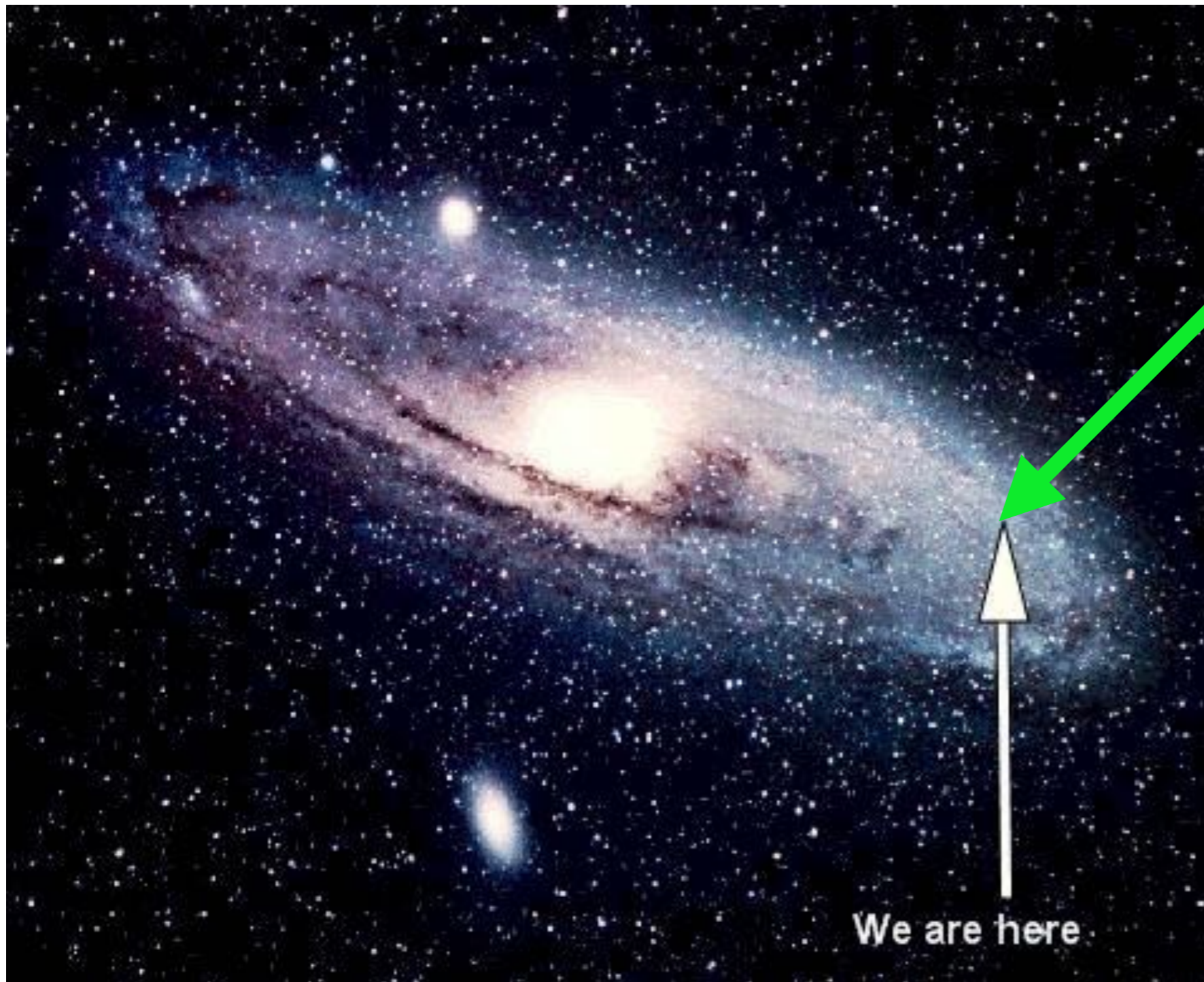
**To the sun**

**Out of our solar system to**

**Alpha Centauri (4 light years away)**



# The Milky Way Galaxy

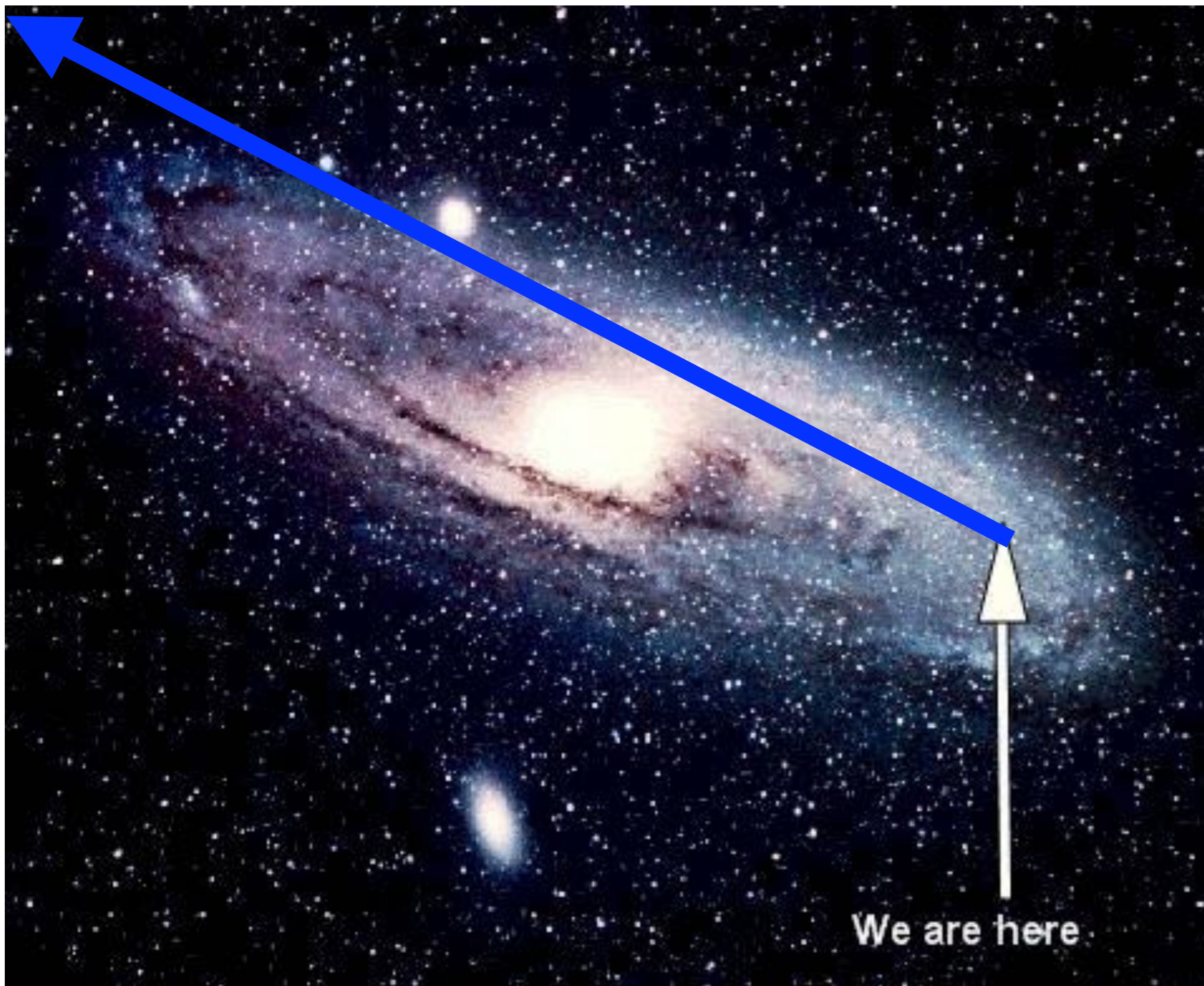


**Alpha Centauri**





# Then across the Milky Way Galaxy: (100,000 light-years across)



**Out to the next galaxy**

**Then across the entire Universe**

**And back --- three times!!**

$$3^{64} \times 1/16 = 600 \text{ billion light years}$$



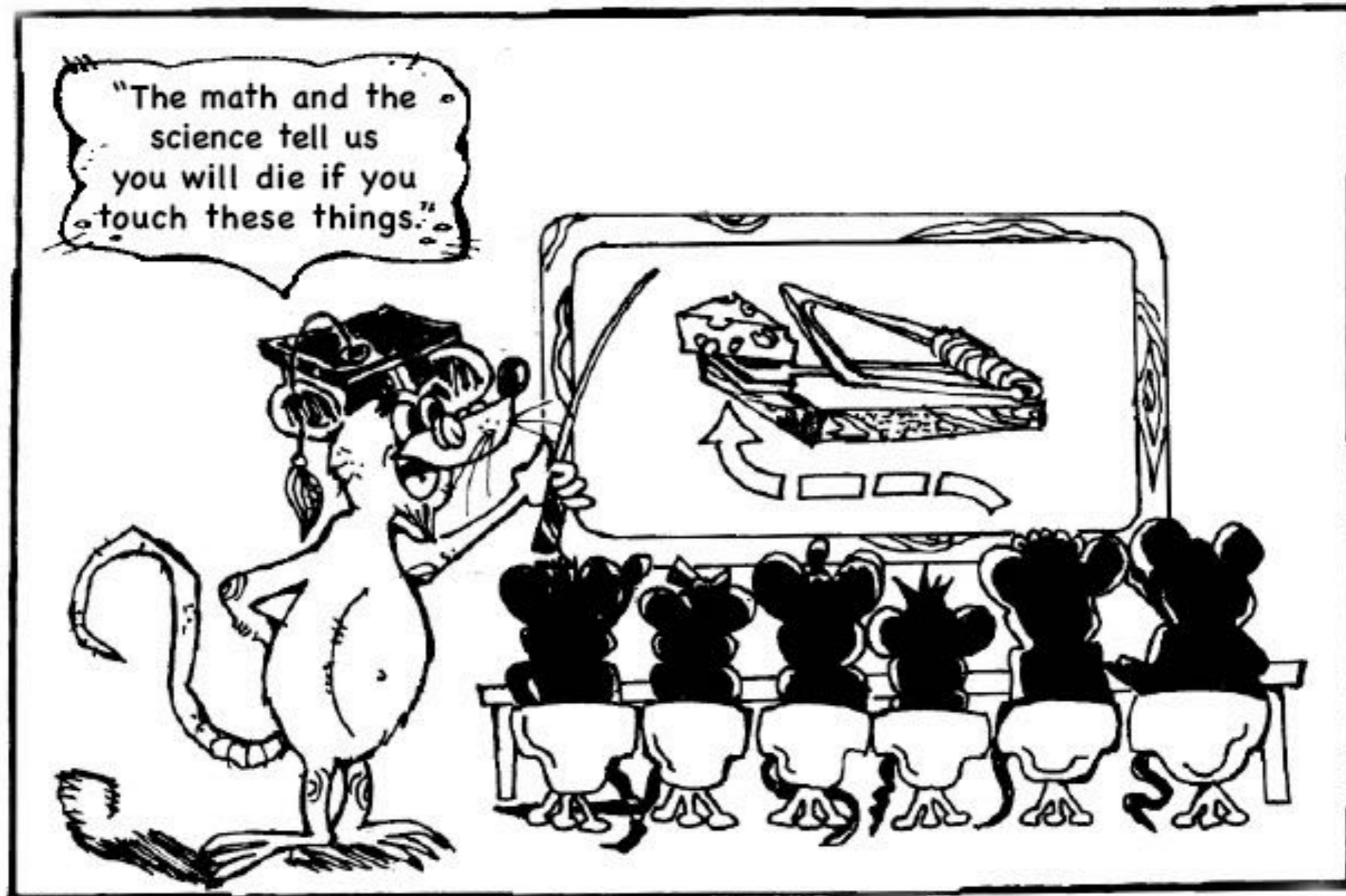


**~ 10 Things All Future  
Mathematicians and  
Scientists Must Know**

#1

**Math and science are not like referees and umpires that you can argue with if you don't like what they are telling you. The beauty of math and science is that they give you an objective look at a situation. It can be dangerous to ignore their message.**





**"The math and the science tell us you will die if you touch these things."**

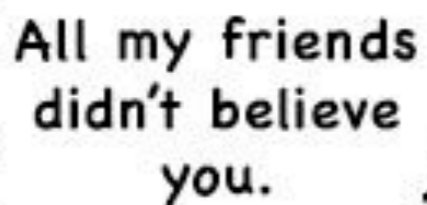
My favorite cheese is cheddar cheese. What if it's cheddar cheese?

What if I really, really want the cheese?

What if my kids are hungry?

What if I grab the cheese really fast?

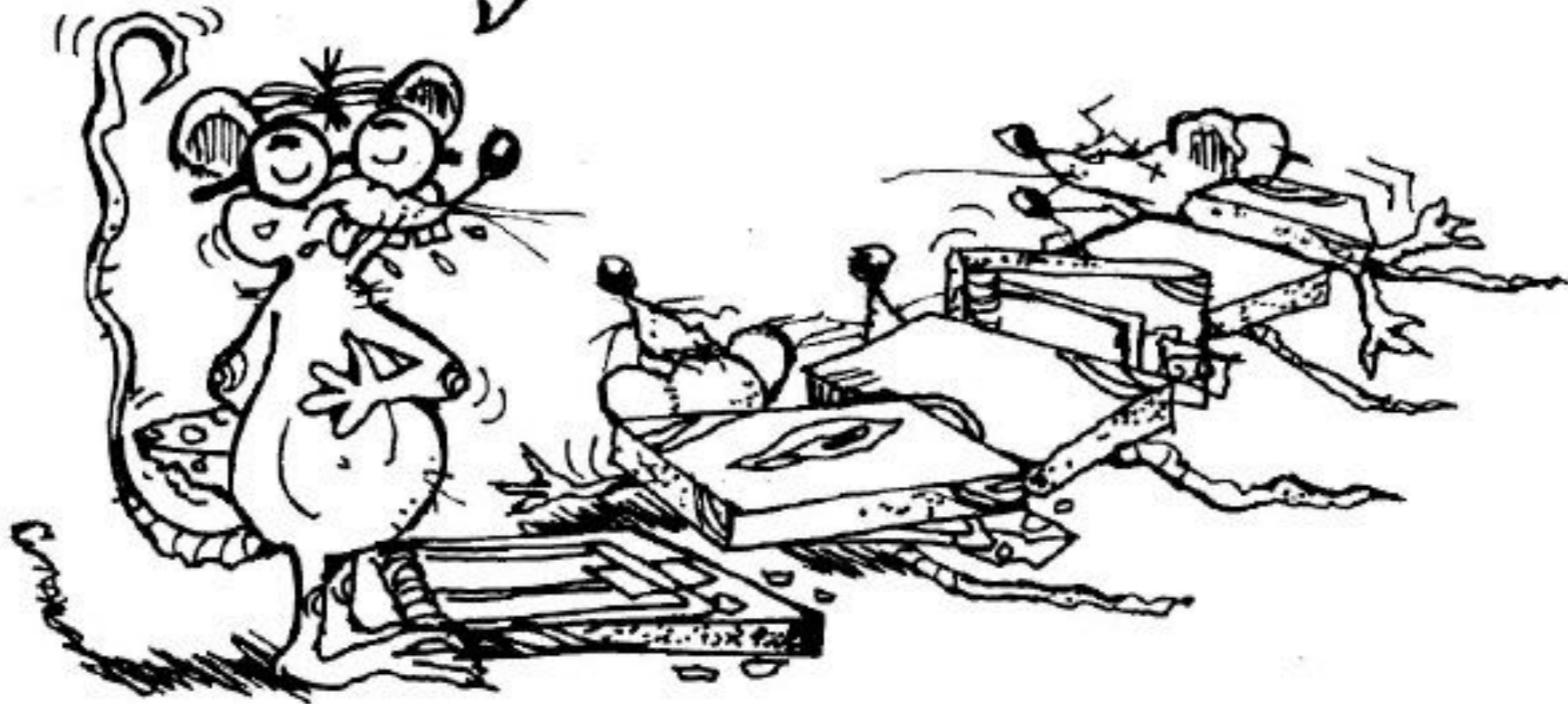




All my friends  
didn't believe  
you.

I hope nobody  
touched the  
cheese.

Oh I touched it , but I  
waited until everyone  
else touched it first!



**“My research shows that it is safe to touch the  
cheese after someone else touches it.”**



**Math can be interesting, challenging and important!**

**In 1956 leukemia was on the rise in young children - some were calling it an epidemic.**

**Ironically, higher rates were in countries with better medical care.**

**Dr. Alice Stewart interviewed mothers of children who had died of cancer about events from the time of conception (She also interviewed a control group).**

**An unexpected and dramatic revelation came from the data.**

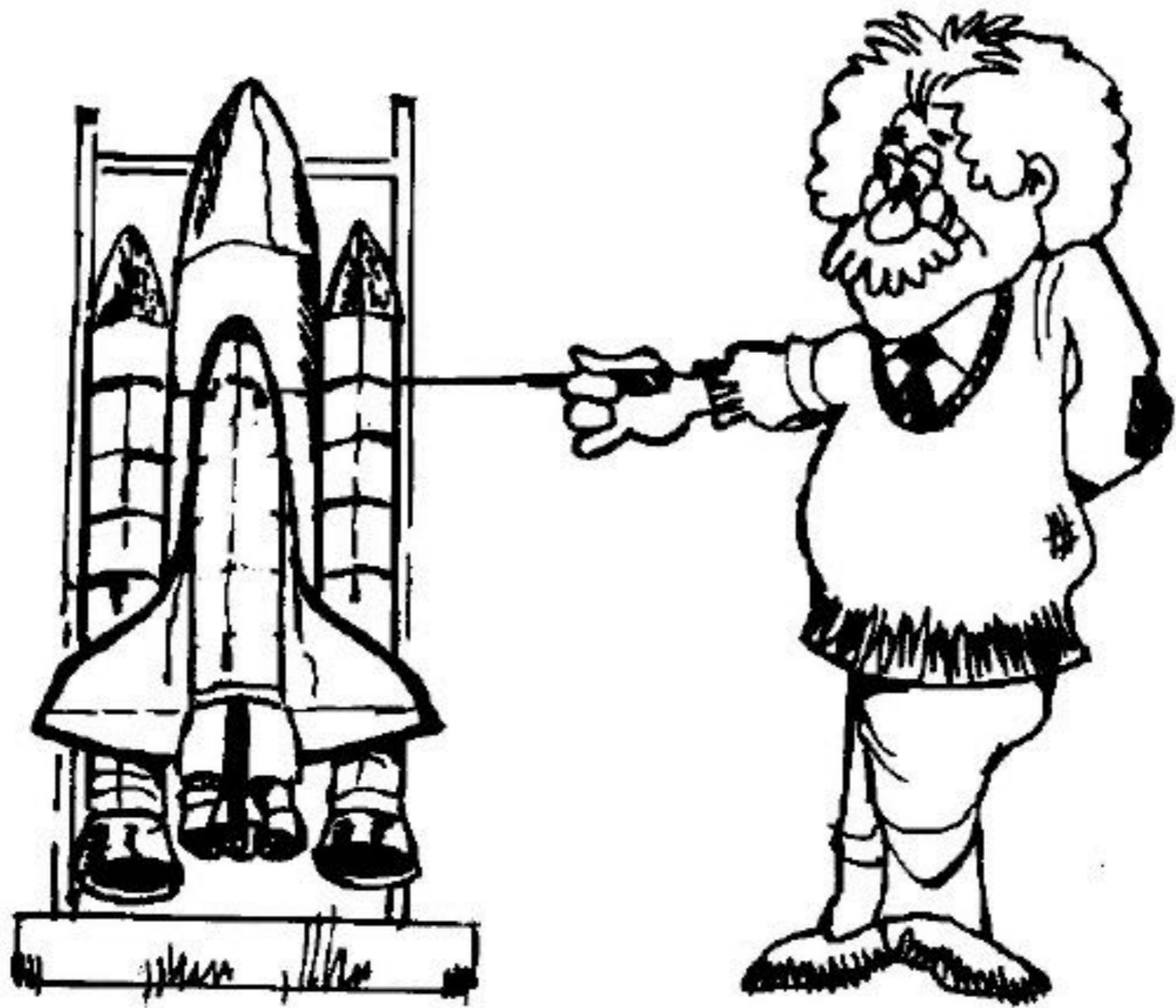
**Those children who died of cancer were more than twice as likely to have been x-rayed before birth.**

**It took until 1980 before the major American medical groups recommended that doctors not routinely x-ray pregnant women.**

**Dr. Stewart established link between x-rays and significant increase in childhood cancer in the mid 50s.**

**266,000 pregnant women were x-rayed in that year. Providers of X-ray equipment fought her.**

**Dr. Stewart believes that “it takes about 20 years...for an unpopular discovery to be digested and you’re lucky if it takes only that long.”**



# *“The Tragic Death of Aaliyah”*





**“Mathematics is cruelly indifferent to our hopes, dreams and beliefs.”**

**“Mathematics is how the universe talks to us and reveals its truths.”**

***-Galileo***

*“Math helps us sort out  
the real dangers from  
the imaginary dangers”*

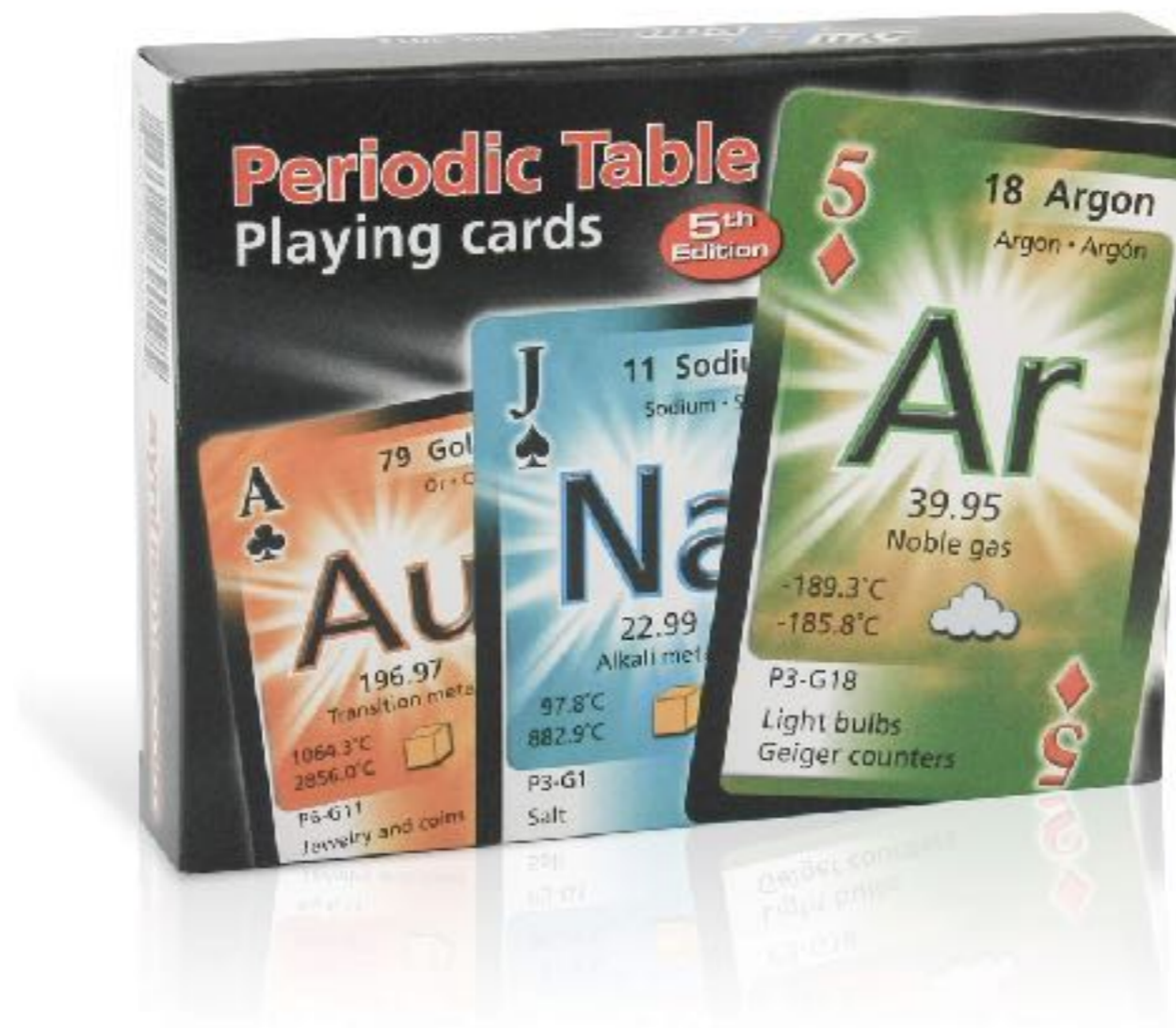


**Math warns you to  
avoid *Payday Loans***

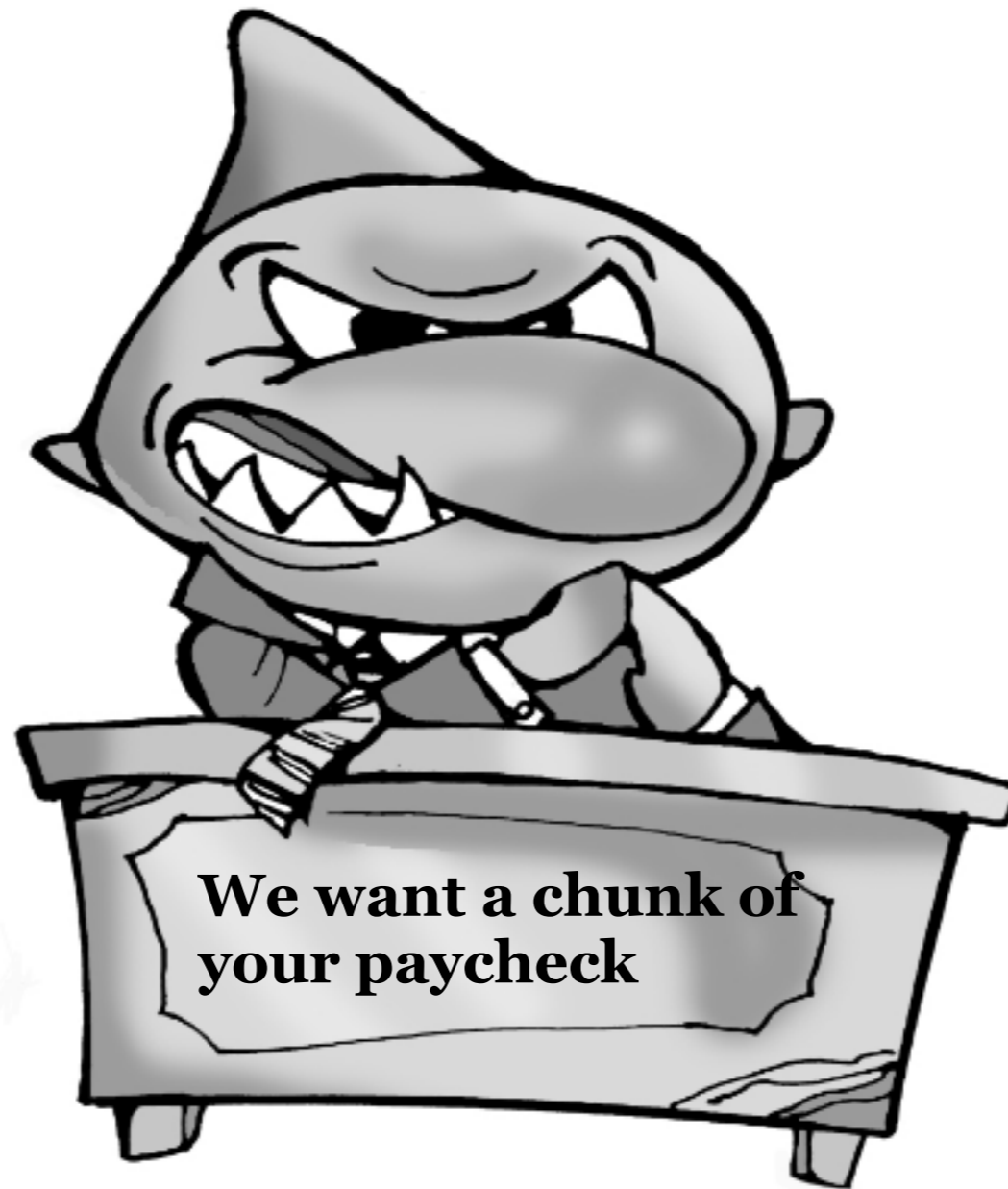




# Win Periodic Table Playing Cards



**I have a great deal for you.  
Only  $16\frac{2}{3}\%$  interest every two weeks.**



**Borrow \$100 for 6 years**



**Quick-Loan at 16.67% Interest  
Doubles Every 9 Weeks  
(Rounded to nearest whole dollar)**

<b>Week 9:</b>	<b>\$200</b>
<b>Week 18:</b>	<b>\$400</b>
<b>Week 27:</b>	<b>\$800</b>
<b>Week 36:</b>	<b>\$1600</b>
<b>Week 45:</b>	<b>\$3200</b>
<b>Week 54:</b>	<b>\$6400</b>
<b>Week 63:</b>	<b>\$12,800</b>

<b>Week 72:</b>	<b>\$25,600</b>
<b>Week 81:</b>	<b>\$51,200</b>
<b>Week 90:</b>	<b>\$102,400</b>
<b>Week 99:</b>	<b>\$204,800</b>
<b>Week 108:</b>	<b>\$409,600</b>
<b>Week 117:</b>	<b>\$819,200</b>
<b>Week 126:</b>	<b>\$1,638,400</b>

<b>Week 135:</b>	<b>\$3,276,800</b>
<b>Week 144:</b>	<b>\$6,553,600</b>
<b>Week 153:</b>	<b>\$13,107,200</b>
<b>Week 162:</b>	<b>\$26,214,400</b>
<b>Week 171:</b>	<b>\$52,428,800</b>
<b>Week 180:</b>	<b>\$104,857,600</b>

**Week 312: \$3,000,000,000,000**

**You should be ashamed of yourself !!**



**I am providing a service for the poor!!**



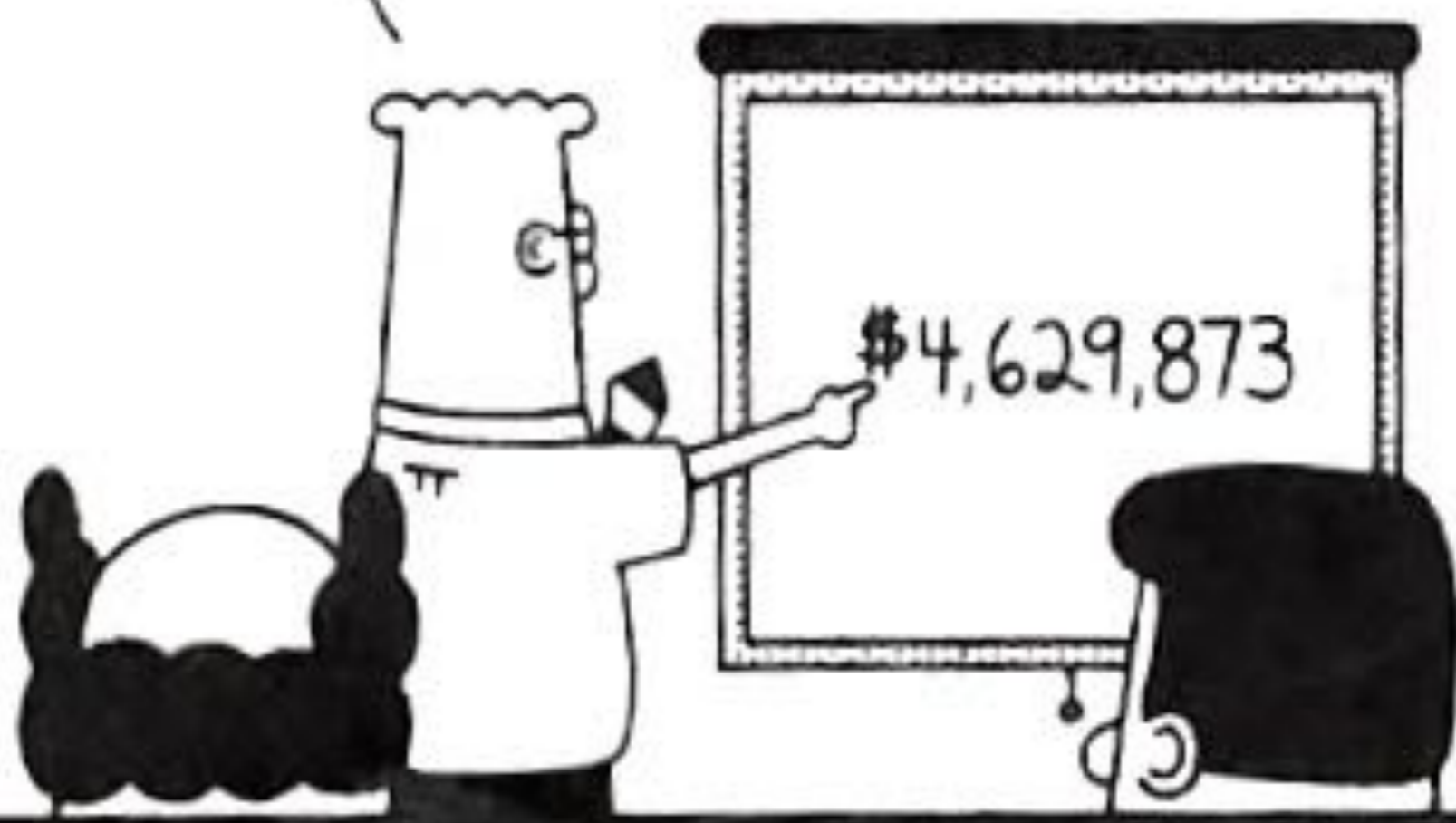


**#2**

**We are Lied to, Cheated  
and Manipulated by  
Statistics (And Why You  
Should Care)**



I DIDN'T HAVE ANY  
ACCURATE NUMBERS  
SO I JUST MADE UP  
THIS ONE.



STUDIES HAVE SHOWN  
THAT ACCURATE  
NUMBERS AREN'T ANY  
MORE USEFUL THAN THE  
ONES YOU MAKE UP.



HOW  
MANY  
STUDIES  
SHOWED  
THAT?

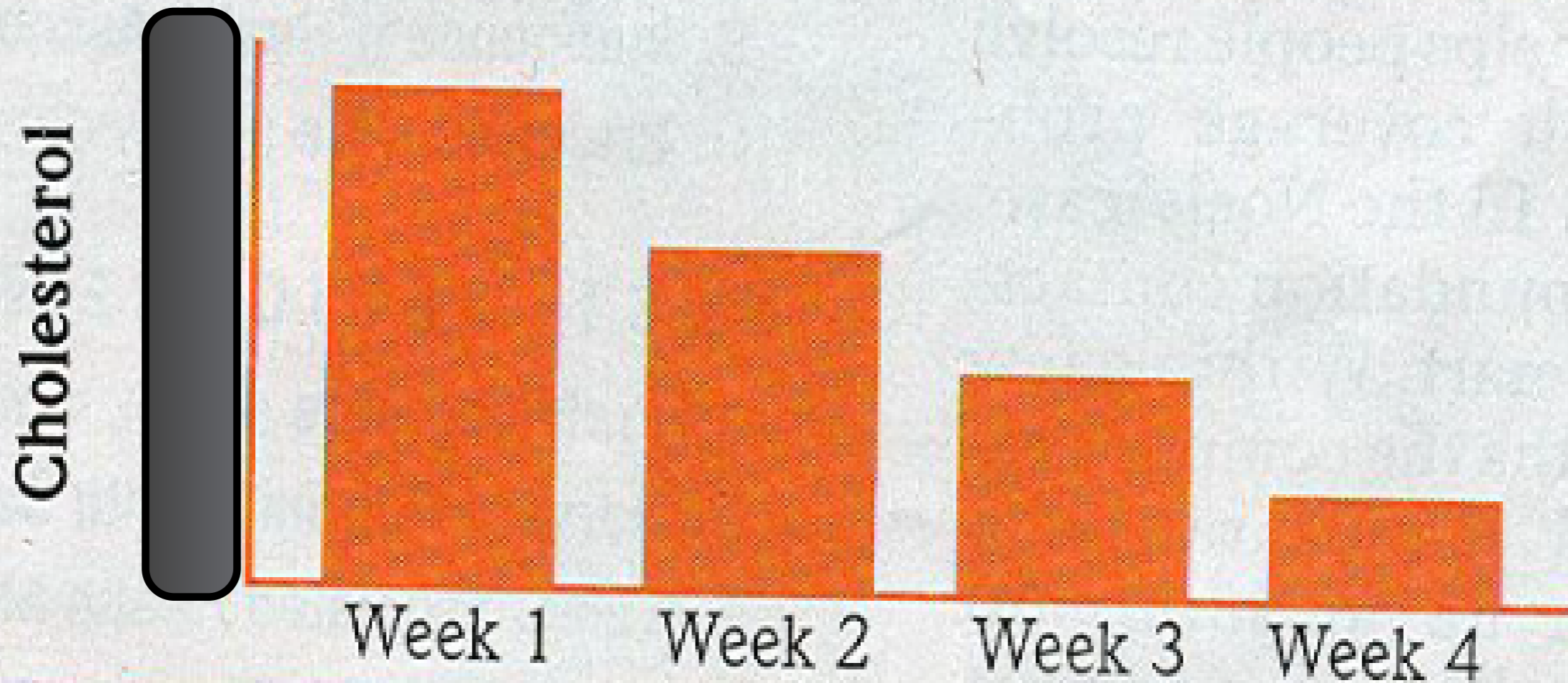
EIGHTY—  
SEVEN.



# Barely Believable Graphs

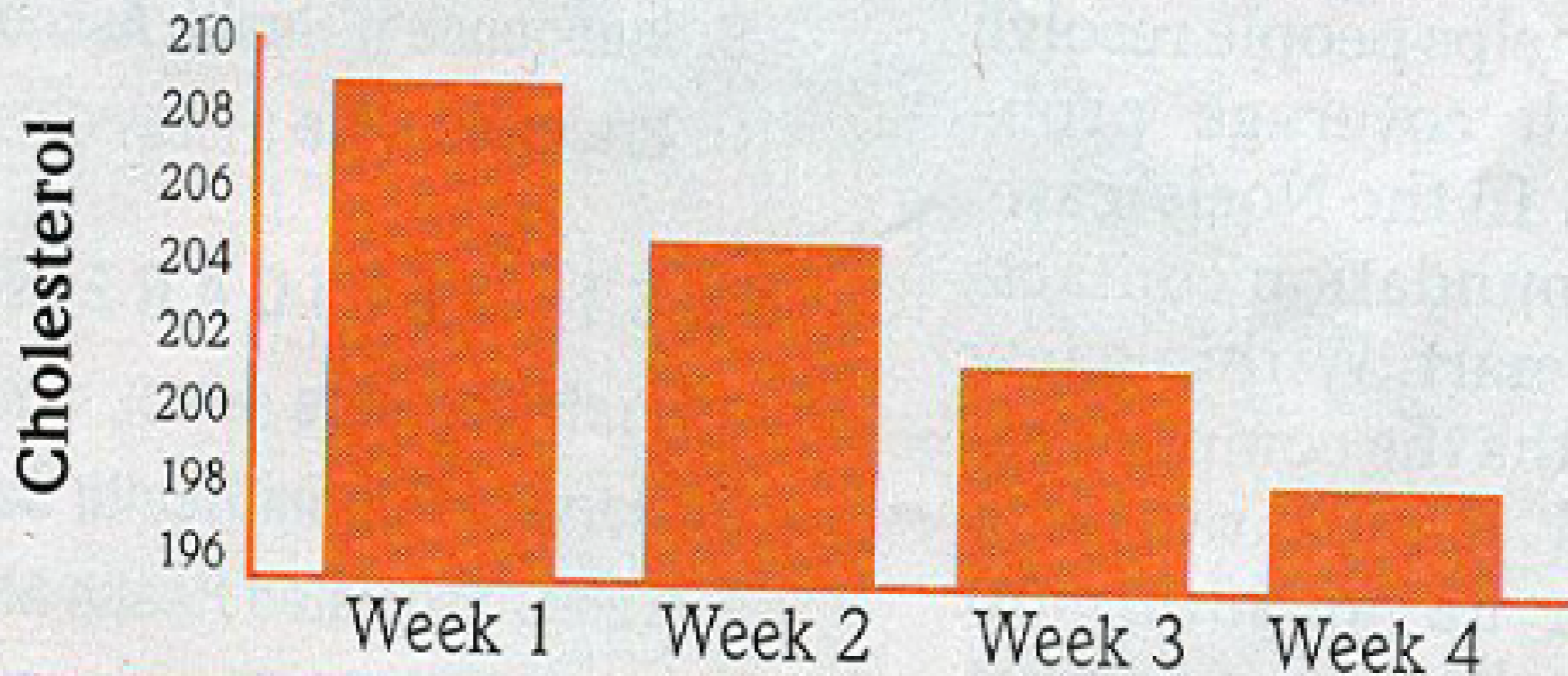


## *Representative Cholesterol Point Drop*



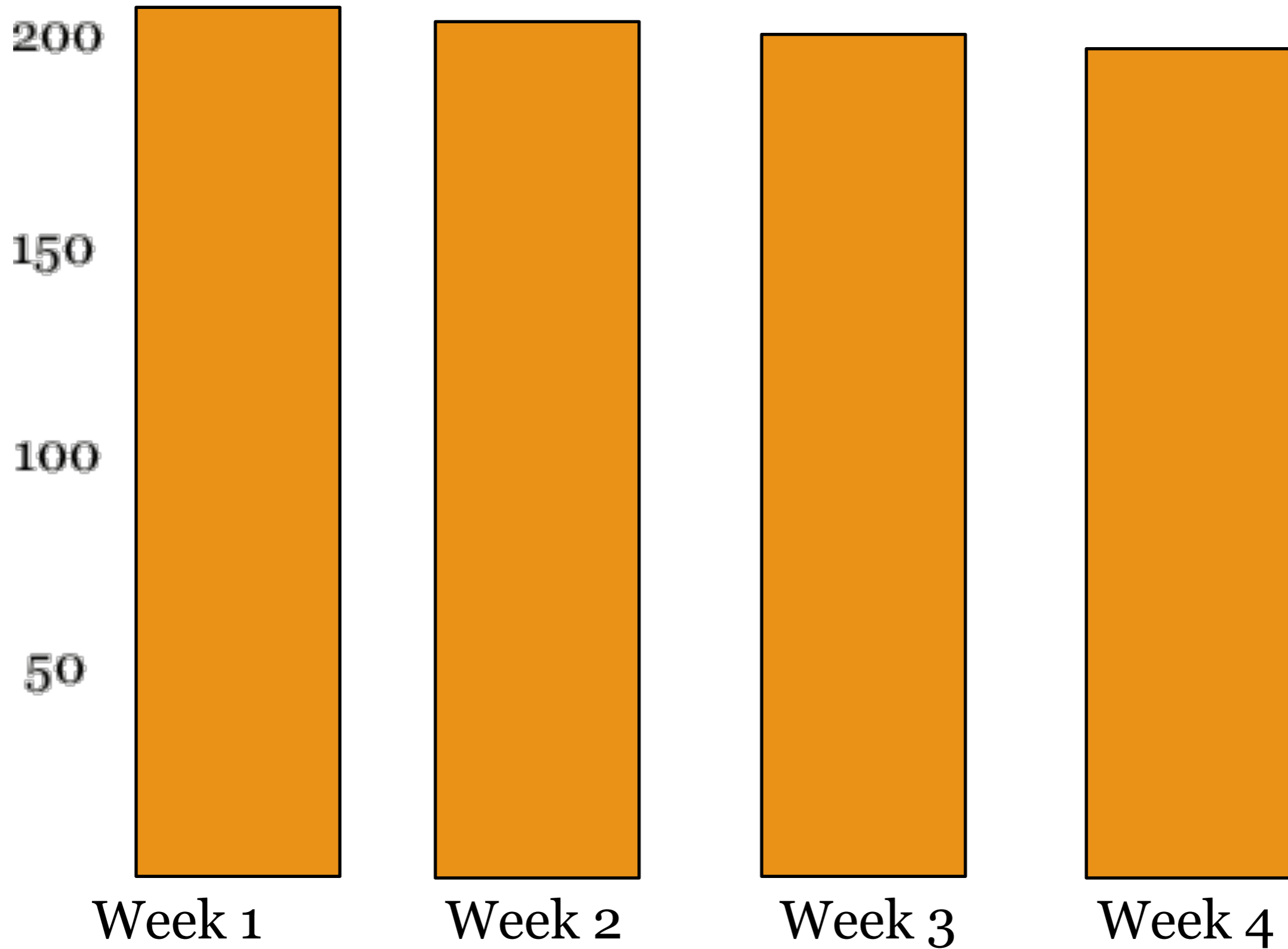
*Need more proof?*

## *Representative Cholesterol Point Drop*



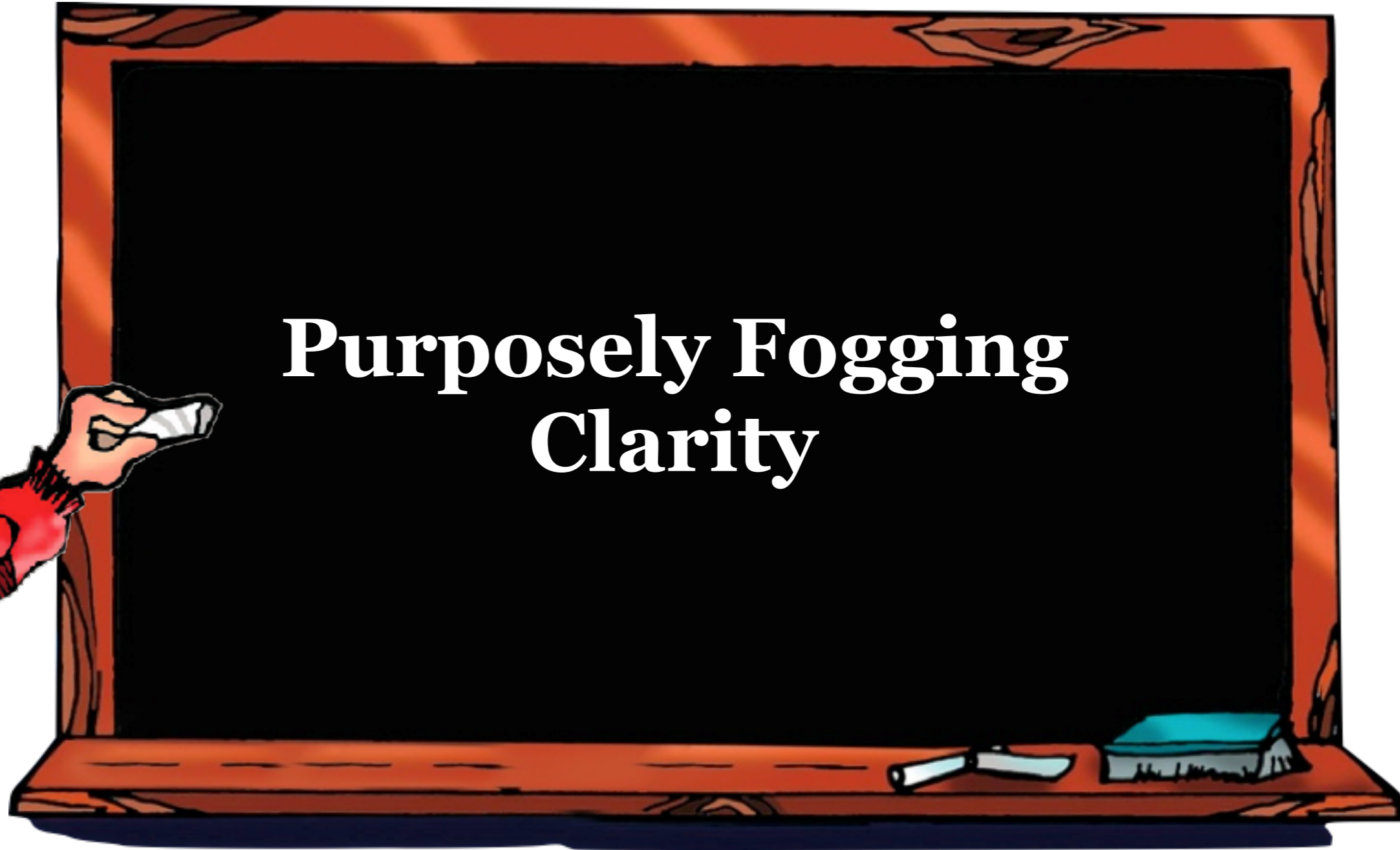
*Need more proof?*

# Cholesterol Point Drop





Purposely Fogging  
Clarity





**Men did not give up their lives for women during the sinking of the Titanic. Look at the statistics on deaths:**

**Men who survived: 332**

**Women who survived: 318**

**Men who died: 1360**

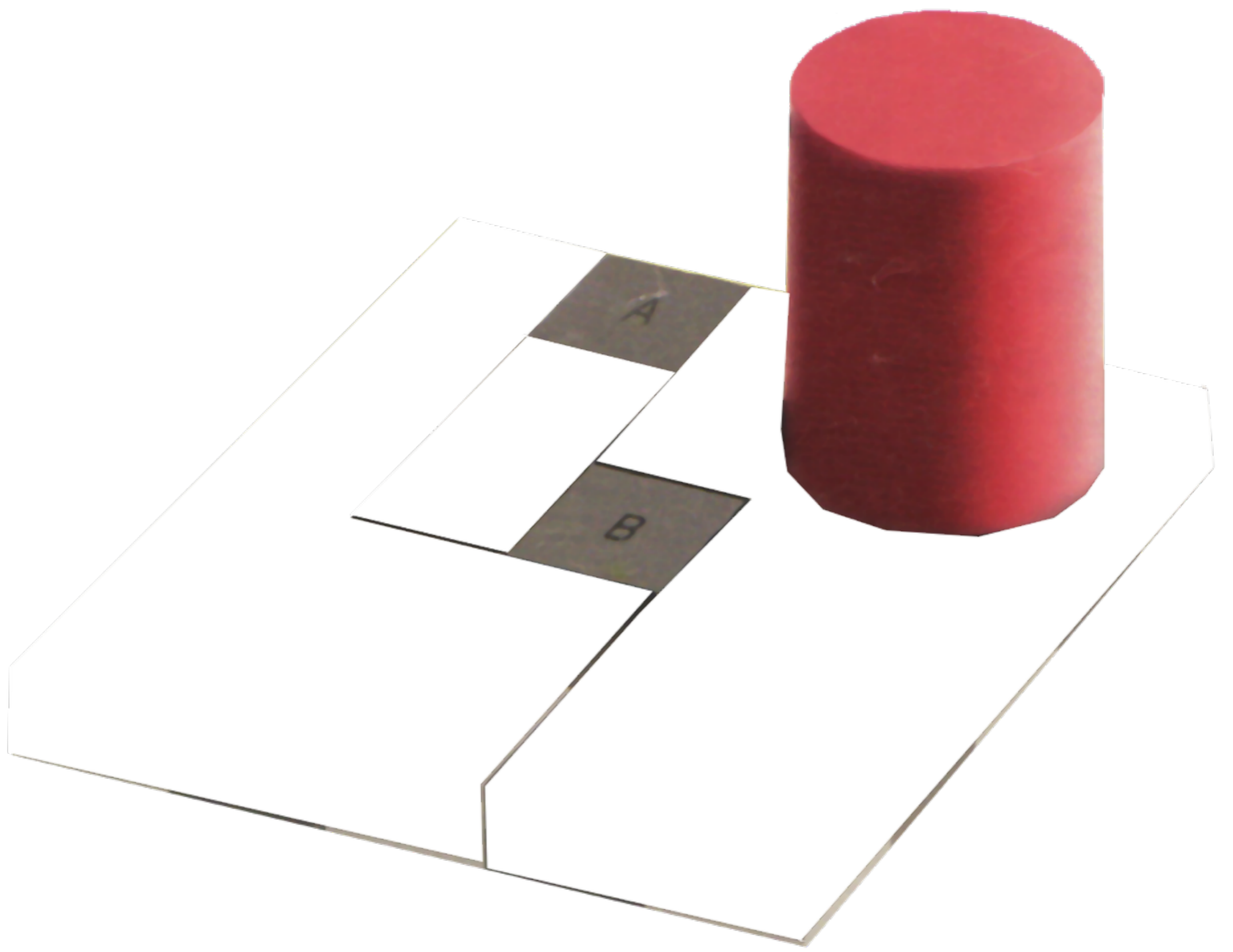
**Women who died: 104**

**If you were a man on the Titanic,  
your chance of dying was 80%.**

**1360 out of 1692**

**If you were a woman on the Titanic,  
your chance of dying was 25%.**

**104 out of 422**



GRAMPA, WILL YOU HELP ME WITH THIS PROBLEM?



OH, FRACTIONS. SORRY, I'M NO GOOD WITH FRACTIONS.



I'M NOT ASHAMED TO ADMIT IT, EITHER.



IN FACT, THEY SAY FIVE OUT OF FOUR PEOPLE HAVE TROUBLE WITH FRACTIONS



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**#3**

**During your career you will likely face situations where your ethics and your ability to maintain those ethics will influence the choices that you make.**



**Flawed thinking has led to millions of deaths**

**Ford Pinto - gas tank piercing bolts**

**Radium Girls - painting watch dials  
unprotected with radium**

**Dr. Kelsey**

# Dr. Frances Oldham Kelsey

## Thalidomide

- By 1960, Thalidomide approved in more than 20 countries, including Canada
- Used for various neurological treatments, and morning sickness in pregnant women
- Dr. Kelsey new to FDA, would not approve its use, and requested study resulted
- Faced enormous pressure from manufacturer and medical community

# Dr. Kelsey cont.

- Thalidomide concurrently found to cause horrible birth defects
- 10,000 cases of malformed limbs mostly in Europe
- Never approved in U.S. due to Kelsey, possibly saved thousand of similar defects
- Her strict requirement was against norms
- Led to much more rigorous drug evaluation, to today's safety regulations



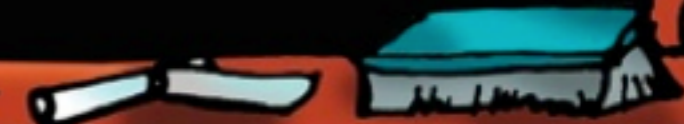
**#4**

**Gifted children are more susceptible to fearing mistakes and challenges because they are often foreign to them. They must understand that challenge and frustration are part of learning and life.**





# Math Mistakes in the Media and Government



# **Tiny typo, big effect on ballot!**

**Proposition 203 in Arizona was built around an 80-cent-per-pack tax increase on cigarettes to pay for the programs. But the ballot language calls for an ".80 cent/pack" tax increase.**



**Nooooooooooooo!**

**Nooooooooooooo!**



**Early-childhood-education and health programs on that ballot could lose millions of dollars if a misplaced decimal point is interpreted technically.**

**The Arizona will lose 186 million dollars a year.**

## **Reporter:**

**“In Arizona, a ballot measure approved by voters meant to tax each pack of cigarettes by 80 cents. Unfortunately, the ballot measure added a period in front of the 80 cents - .80 - actually making it only 0.8 cents per pack. Legislators are going to collect the tax anyway, it will just be 99% less than they expected.”**



**Just to make clear that the correct placement of decimal points is important!!!!**

**Sports science students Alex Rossetta and Luke Parkin volunteered for a study that was going to measure the effects of caffeine on exercise.**

**They were supposed to be given .3 grams of caffeine - the equivalent of 3 cups of coffee.**

**Because of a misplaced decimal point, they were given 30 grams.**

**They almost died!**

**A chance to experience  
challenge and frustration  
and  
possibly make your own  
mistakes.**



# Win Astronomy Playing Cards



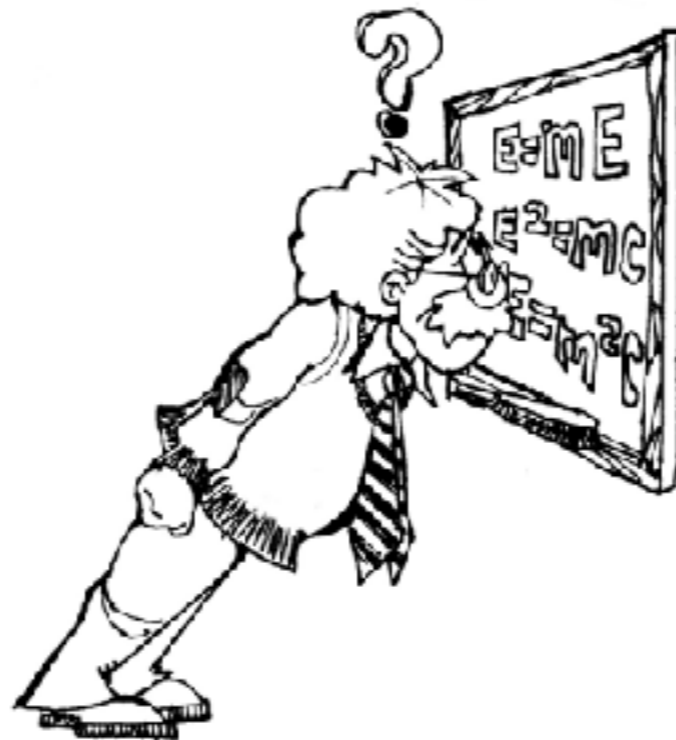


**How many cat legs are there?**



# Einstein Level

**Six farmers each have 6 barrels. In each barrel are 6 cats who each have 6 kittens - who are in the barrels. How many legs are there? (Don't forget the farmers' legs.)**



# Einstein Level

**Six farmers each have 6 barrels. In each barrel are 6 cats who each have 6 kittens. How many legs are there? (Don't forget the farmers' legs.)**



**Answer: 6060 legs**

# How many legs in one barrel?

**6 cats**

**36 kittens**

**42 total x 4 = 168 legs per barrel**

**How many barrels are in the problem?**

**36 barrels x 168 = 6048 legs**

**6048 legs plus 12 farmers' legs = 6060 legs**

**#5**

**The solution to many problems are counterintuitive. Your brain can easily be fooled into strongly believing in the correctness of an incorrect answer or solution.**



**There are three coins:**

**-- One has heads on both sides**

**-- One has tails on both sides**

**-- One has heads on one side and tails on the other side**





**#8**

**The failure to understand the difference between cause and correlation has led to an inability to differentiate what is true and what is not true in medicine, education and in many areas of our everyday lives.**





**I have discovered a  
shocking truth about  
where people die!!**



**I studied the golf skills of children who ride to school in new luxury cars and found that they were much better at golf than children who ride to school in older cars! If you want to improve your golf game, convince your parents to buy a luxury car.**



**(1) Children with bigger feet spell better.**

**(2) Countries that add fluoride to water have higher cancer rates than countries that do not add fluoride.**

**(3) Children are more successful at school when mothers stay home and do not work outside the home.**

**(4) Studies show that married people are happier than those who are not married.**

**(5) Those who buy flood insurance are more likely to have their house destroyed by a flood.**

**(6) Leaving a night-light on in a child's room leads to nearsightedness.**

**1) Parent-Teacher conferences**

**2) The governor and the prisoners**

**3) California - Algebra Study**

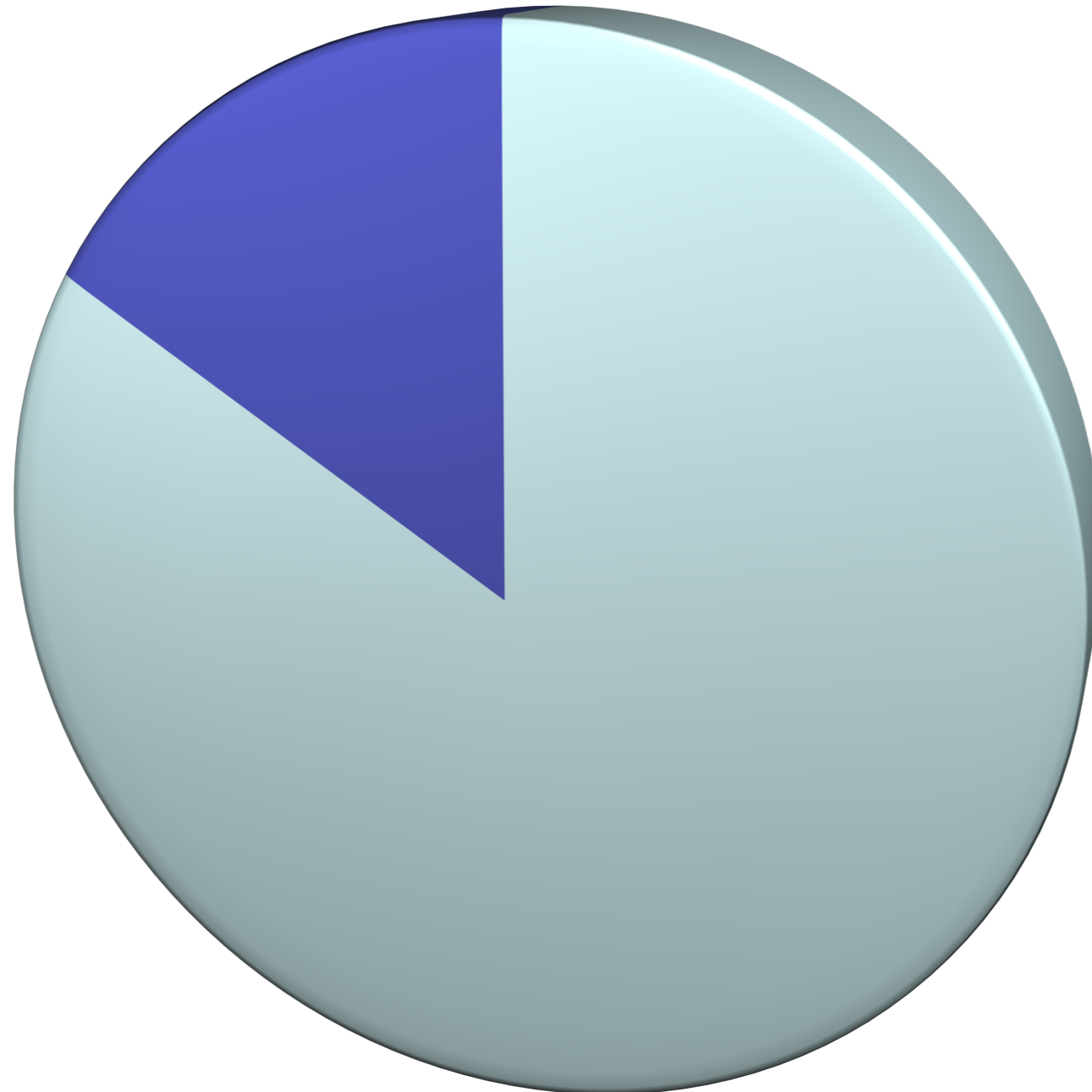
**The state of California noticed that the most successful college students took algebra in 7th grade. Because of this new information, they embarked on a program to have all students take algebra in 7th grade.**

**Restoring Voting Rights to Former  
Prisoners Will Lower the Crime Rate**

● Not arrested

● Arrested

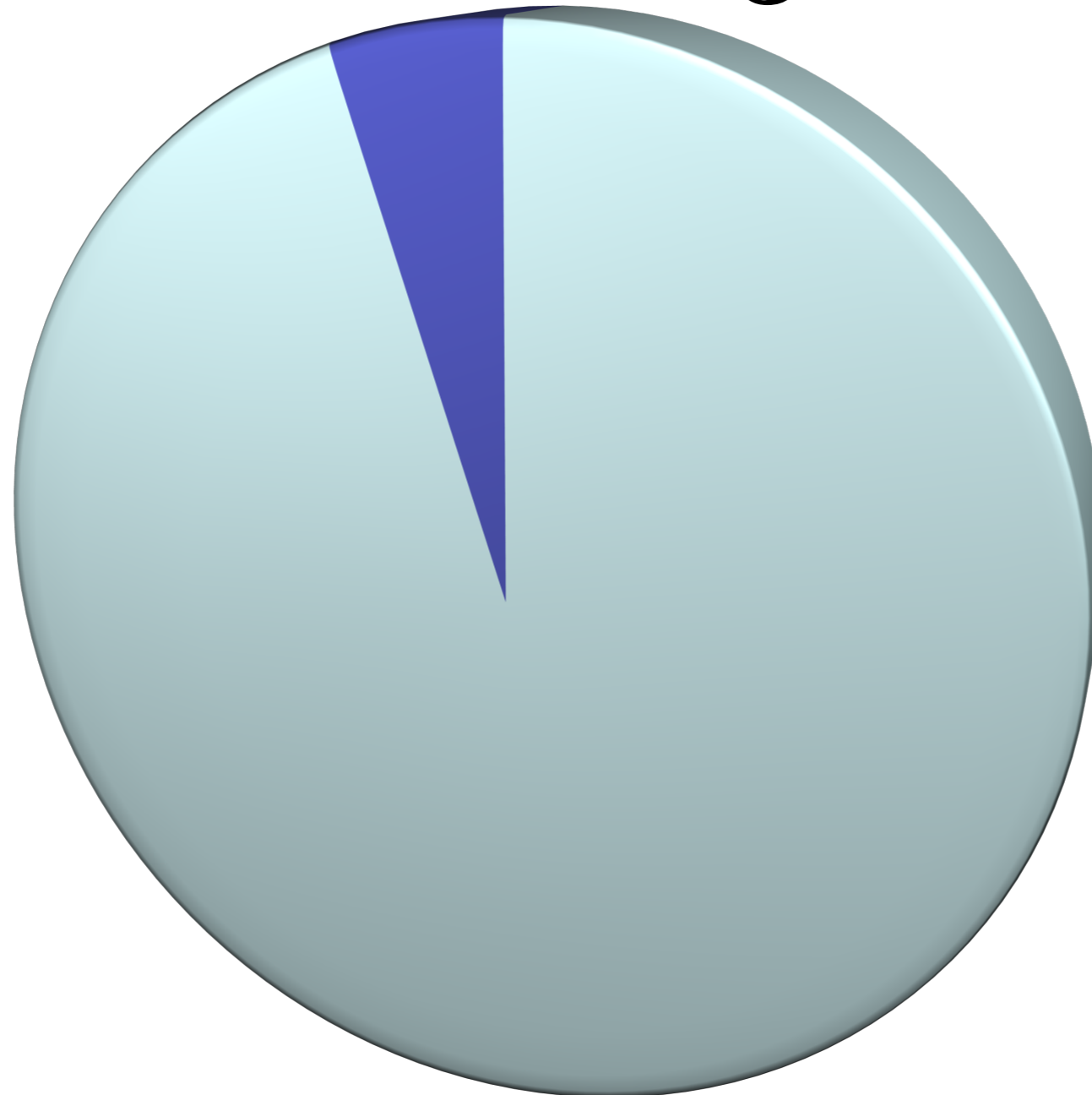
# Adults who did not vote -- 16% arrested



● Not arrested

● Arrested

# Adults who did vote -- 5% arrested

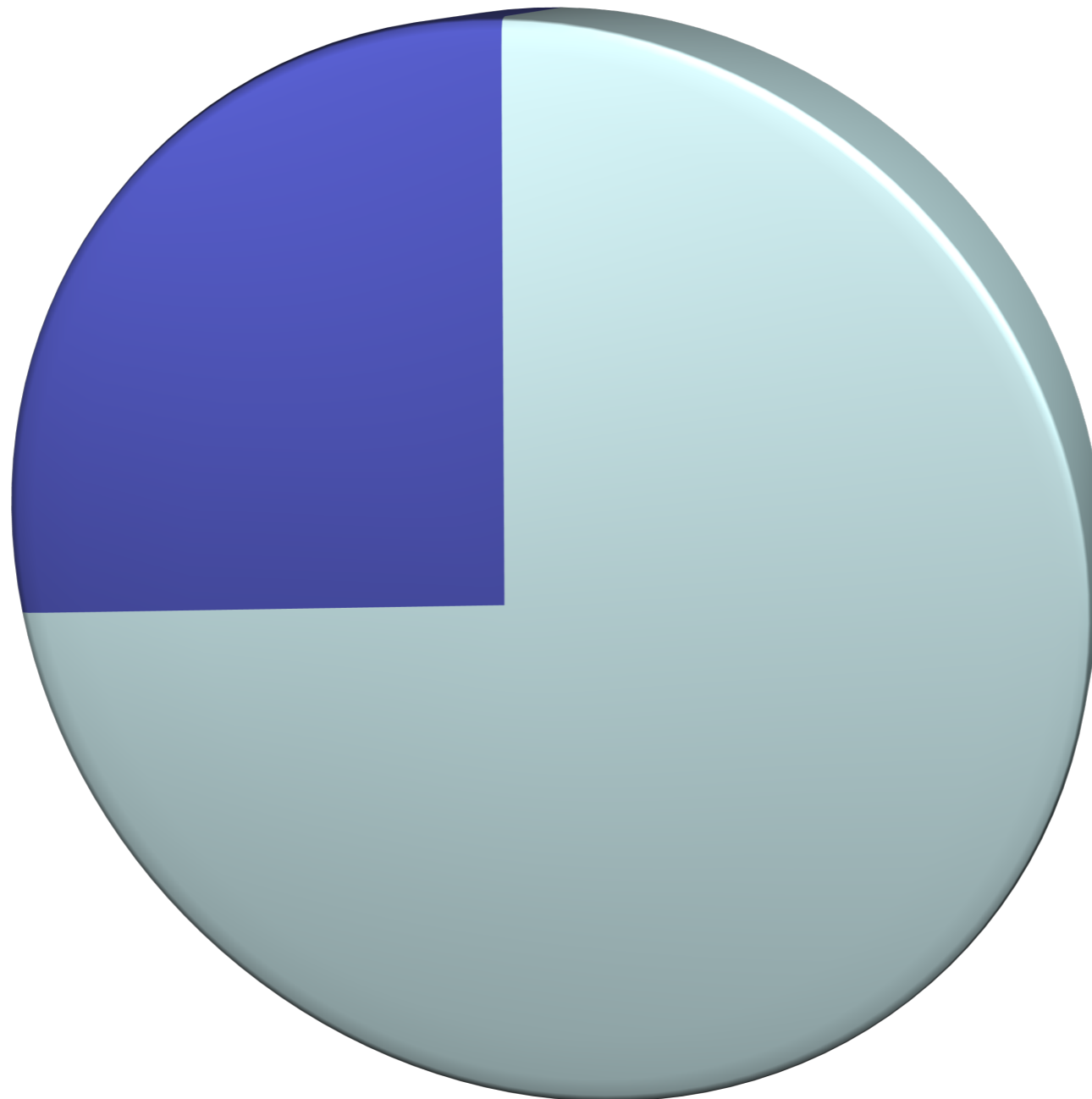




● Not arrested

● Arrested

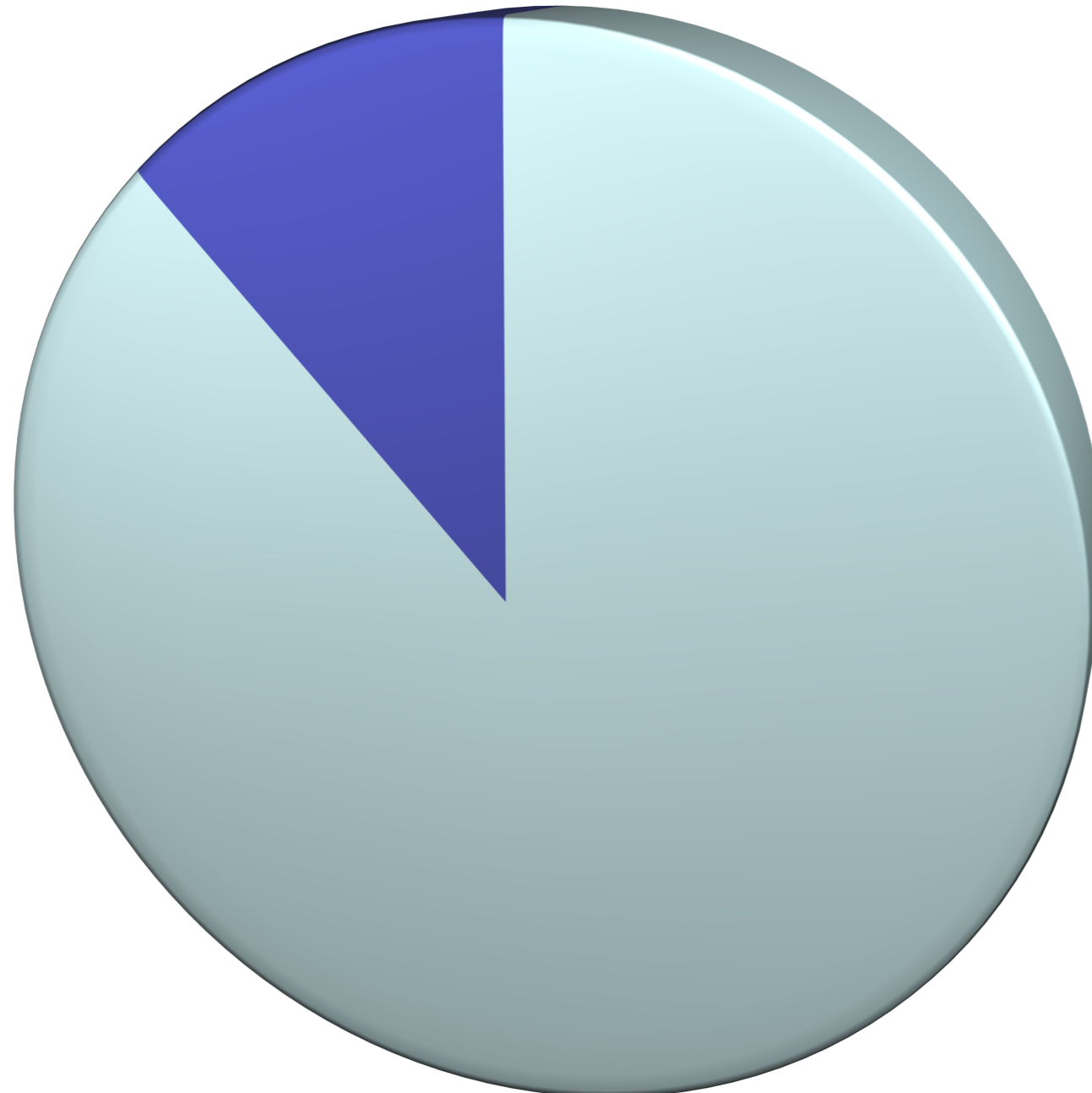
# **Nonvoting former prisoners-- 27% rearrested**



● Not arrested

● Arrested

## **Voting former prisoners -- 12% rearrested**



**Is voting an “effect” of a former prisoner who has decided to be a good citizen? So the desire to stop criminal behavior drives more voting. Or does voting result in good behavior?**



**#6**

**You must keep an open mind. Many of the greatest ideas and discoveries of the last 500 years were ridiculed and attacked when they were initially presented. The medical advances that were delayed are tragic examples of the implications of a failure to keep an open mind.**



**“Distinguishing a genius from a crank is not easy. Both take bold leaps of faith fueled by imagination and sustained by belief, yet the former is a visionary and the latter a fool.”**

***(New Scientist, August 13, 2004)***



**Dr. Semmelweis - childbed fever**

**Elizabeth Kenny - Polio**

**Dr. Warren and Dr. Marshall  
Cause of ulcers**



# **Dr. Ignaz Semmelweis - Puerperal Fever**

- In 1847 Puerperal Fever (childbed fever) killed up to 18% of new mothers
- Much higher in wards with doctors
- Lower in wards with only midwives 5% >
- Dr. Semmelweis investigated in detail and determined doctor did autopsies and delivered babies
- Decades before germ theory was accepted he proposed a contaminant, and washing hands

# Dr. Semmelweis

- He proposed washing hands with chlorine and lime based solution
- Immediately lowered deaths by 90%
- Hailed as a medical hero??
- Heck no!
- Largely ignored and even ridiculed by doctors (gentlemen don't need to wash hands) and even his wife
- Institutionalize and died shortly after<sub>80</sub>



# Dr. Semmelweis

- Lister, Pasteur and others confirmed germ theory later, vindicated his pioneering work, after his death.
- Dogma at the time was balancing the “four humors” for each patient, perhaps by blood letting
- Belief perseverance - clinging to old ideas long after they are discredited

# Elizabeth Kenny - Polio

- Early to mid 1900's polio was devastating disease especially for children (long before vaccine)
- Treatment was immobilization of affected limbs
- Kenny developed a series of exercises to strengthen limbs, with great success
- Established medical community ignore and condemned her for decades
- Belief perseverance

*Elizabeth Kenny:*

“Some minds remain open long enough for the truth not only to enter, but to pass on through by way of a ready exit without pausing anywhere along the route.”

# Drs. Barry Marshall and Robin Warren - *H. Pylori* and ulcers

- Ulcers are caused by stress, spicy food and acid, right?
- Drs. Marshall and Warren showed *Helicobacter Pylori* bacteria not only associated with but caused stomach ulcers
- Ignored and ridiculed, had papers rejected
- Marshall even tested himself by ingesting *H. Pylori*!!
- Now firmly established as a primary cause of gastric ulcers, treated with antibiotics

#7

**It is important to maintain a healthy skepticism. You must not have a mind that is so open that it is like a sieve.**



# Confirmation Bias



#10

**Bias is almost everywhere. It influences the results of surveys, scientific experiments, the beliefs that we hold and many of the decisions that we make.**



***“The moment a person forms a theory, his imagination sees in every object only the traits which favor that theory.”***

***- Thomas Jefferson -***

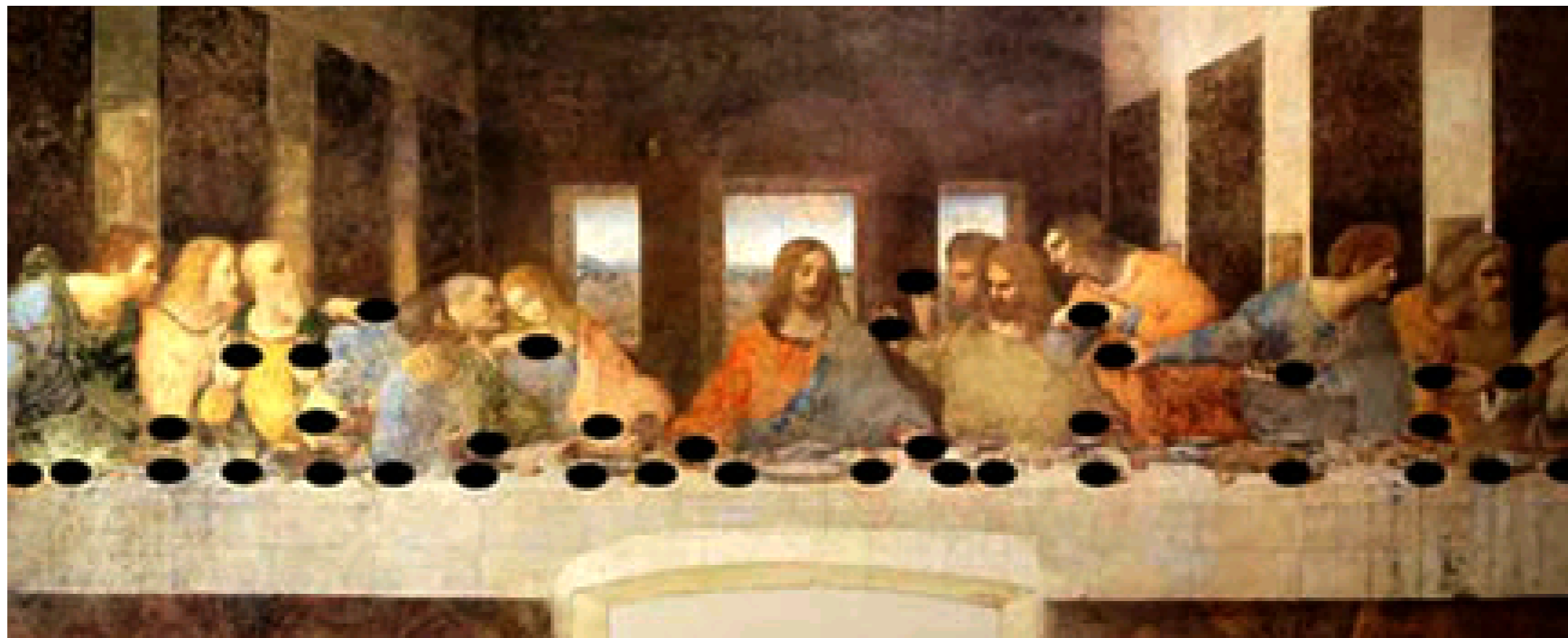




**You've heard the saying "Don't believe everything you hear".**

***"Don't believe everything you think."***

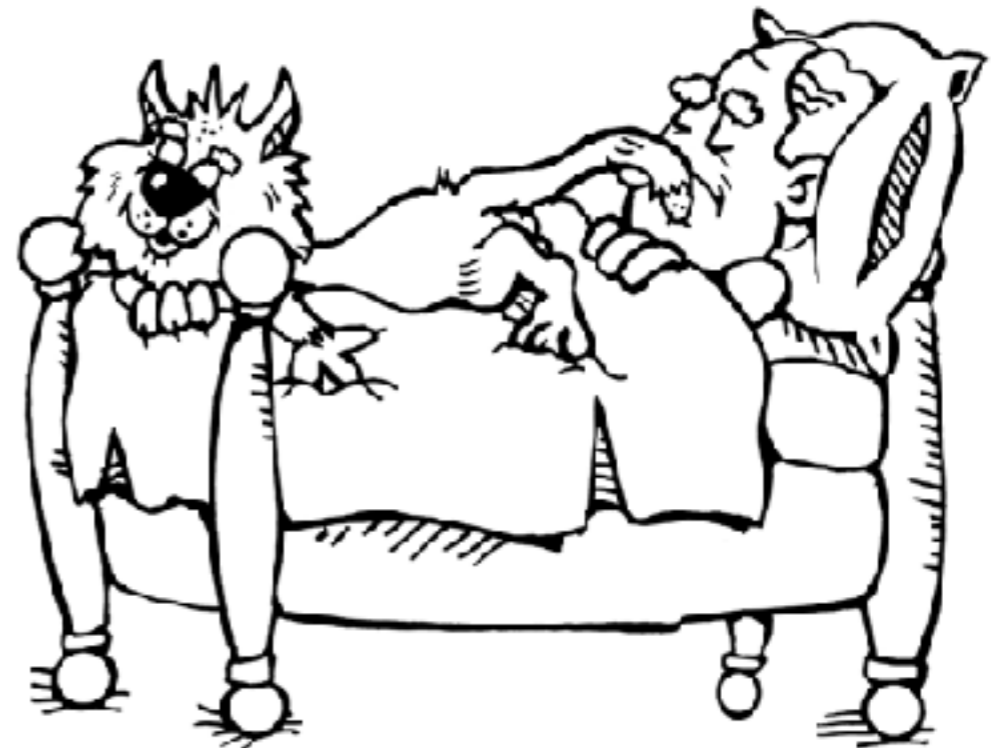






**“Oscar the cat has curled up in the bed of a nursing home patient named Ethel. The attendants at the home now know it is time to call Ethel's family because Oscar has the remarkable ability of predicting what patients will soon die.**

**I can think of three options to explain Oscar's apparent talent.**



**Option#1:**

**Oscar the cat really can predict who will die.**



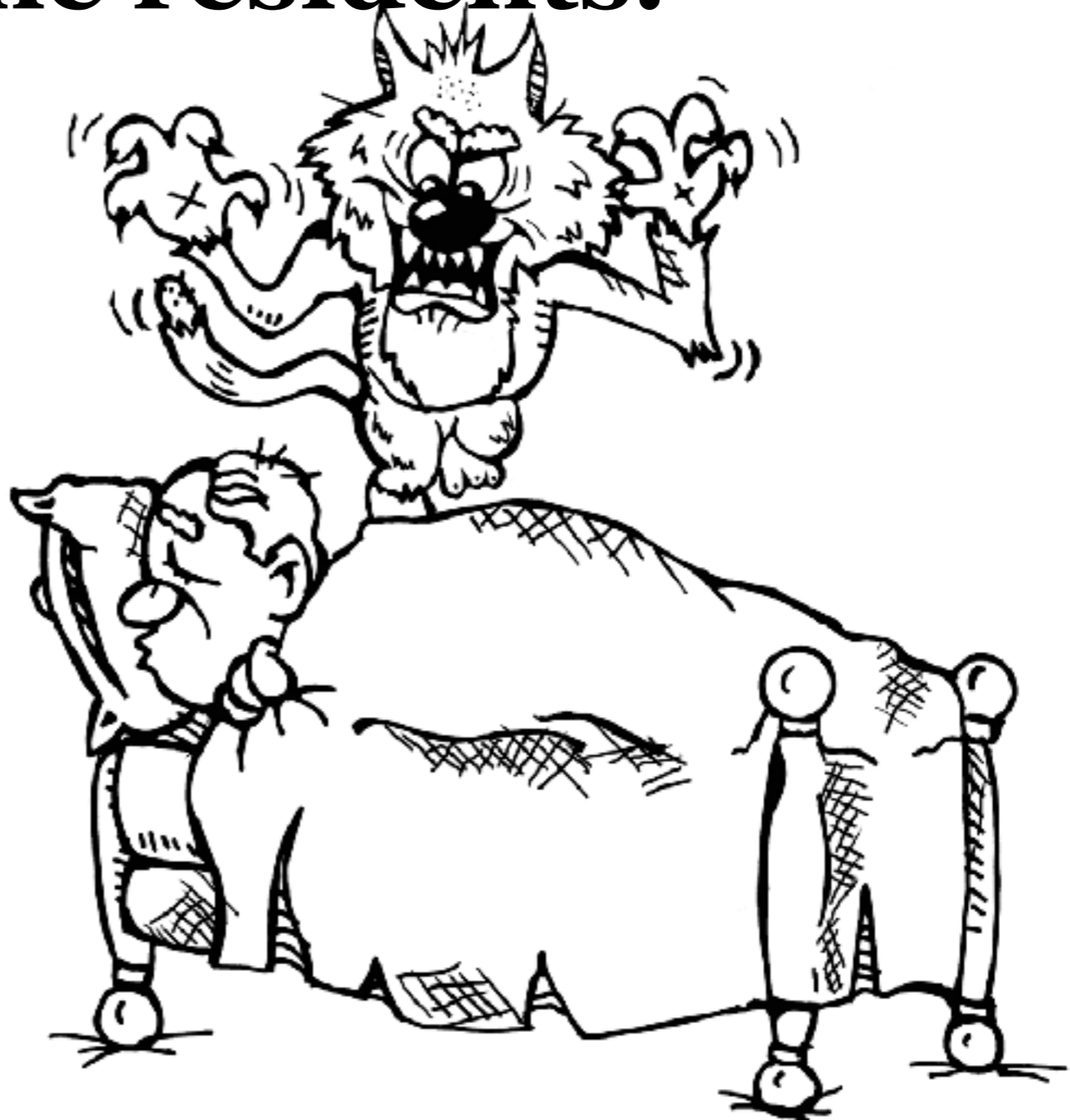
## **Option#2:**

**Oscar the cat was just relaxing in rooms that are quiet and someone came up with the idea that he could predict the impending death of patients.**



# Option#3:

**Oscar the cat was actively involved in the deaths of the residents.**



# Summary

- Real life examples, perhaps to begin or end classes
- Engage students better to understand importance and use of math, and critical thinking
- Encourage both analytical thinking and open mind to consider new data



# Confirmation Bias

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