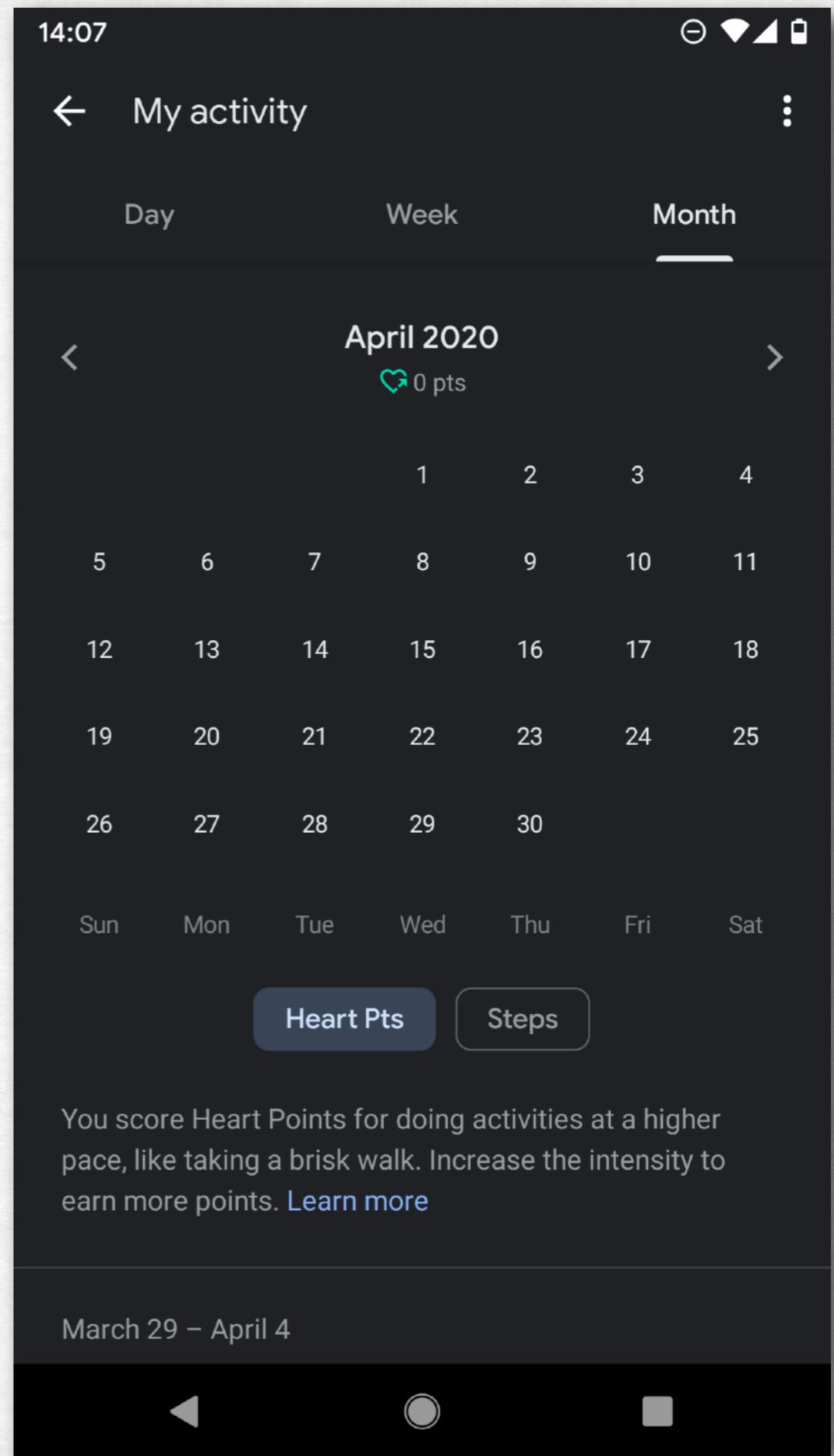
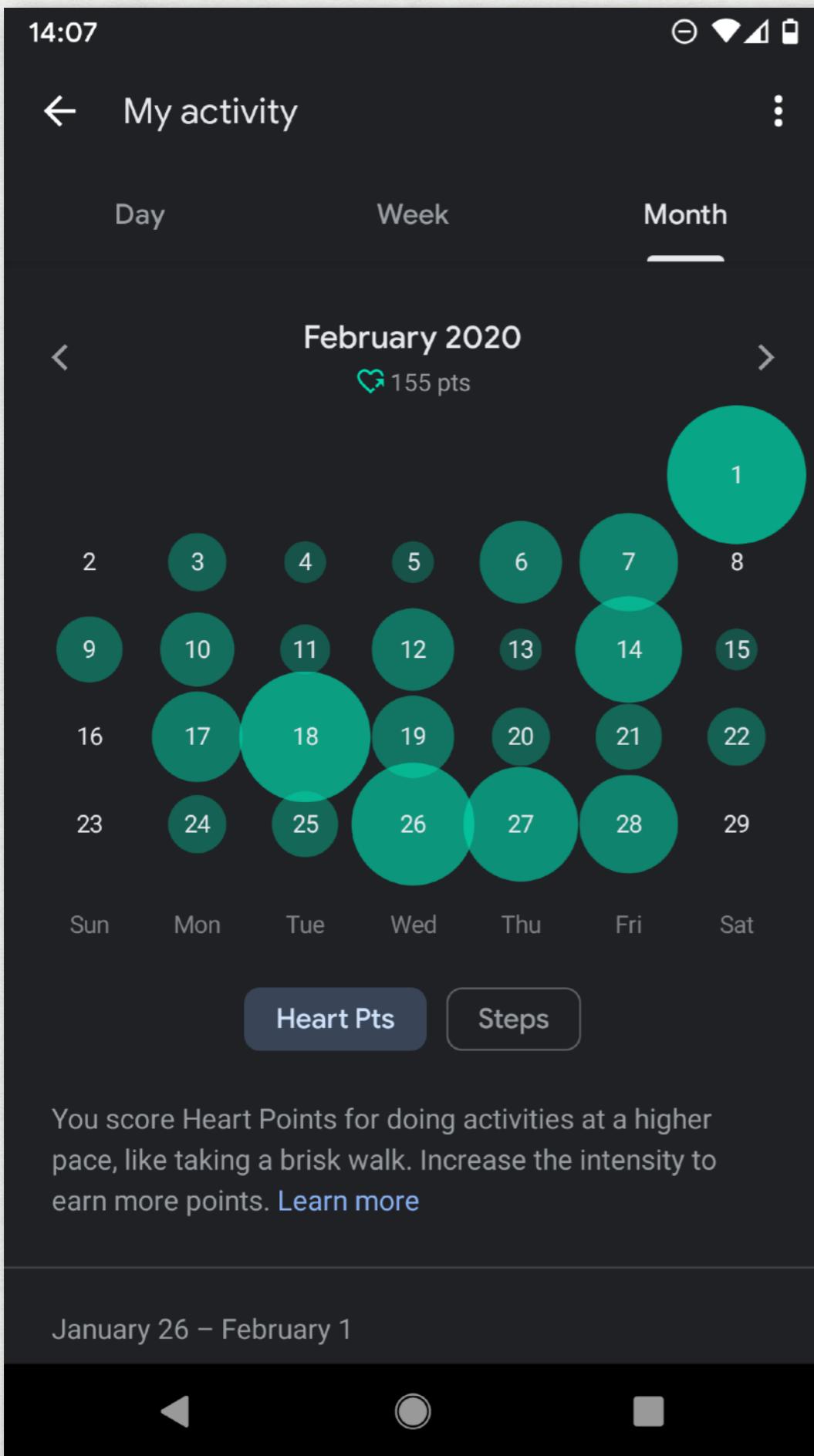


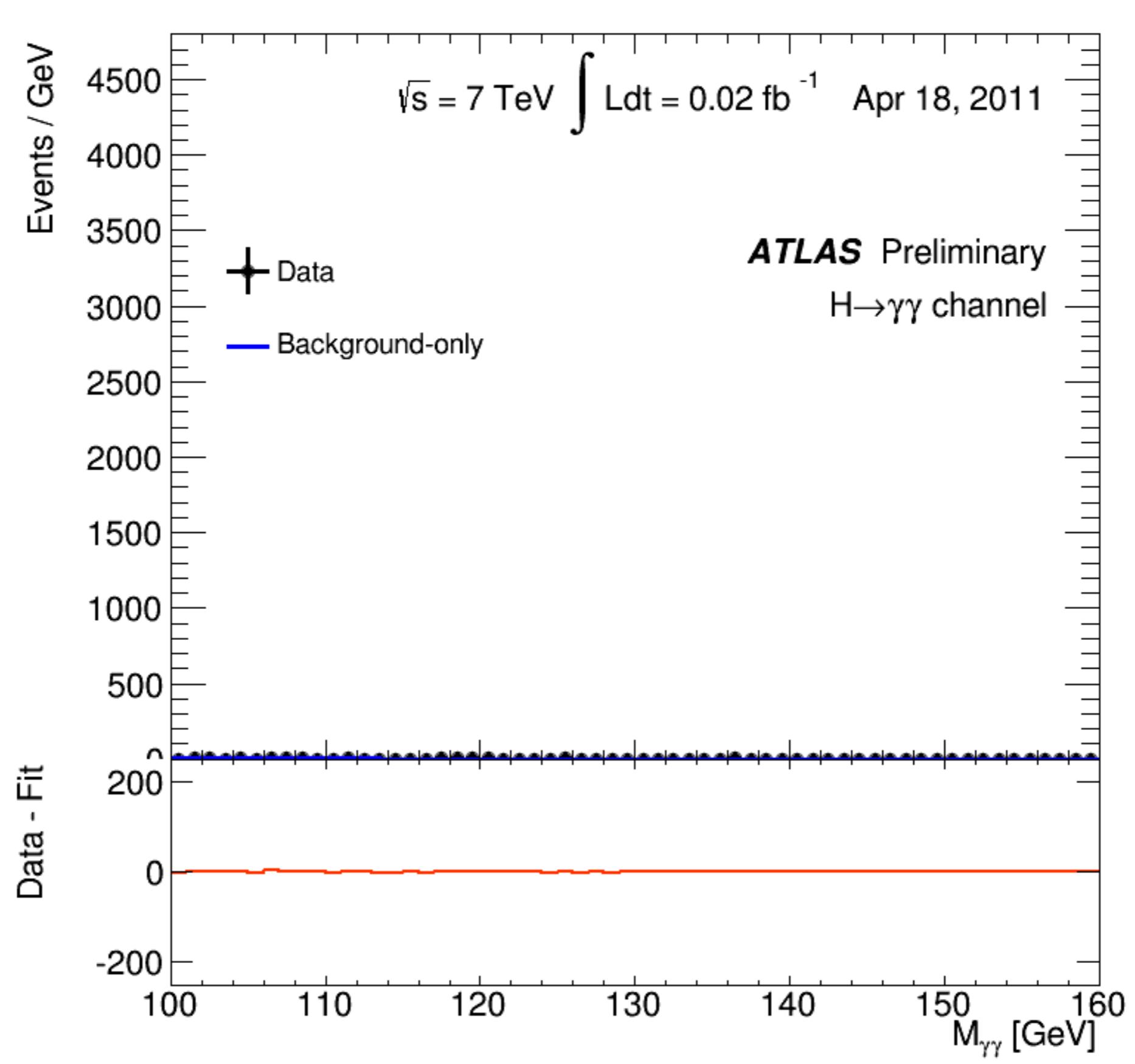
An Intro to  
**Data Visualizing**  
**with COVID-19**

**What is data  
visualization?**

# Example 1

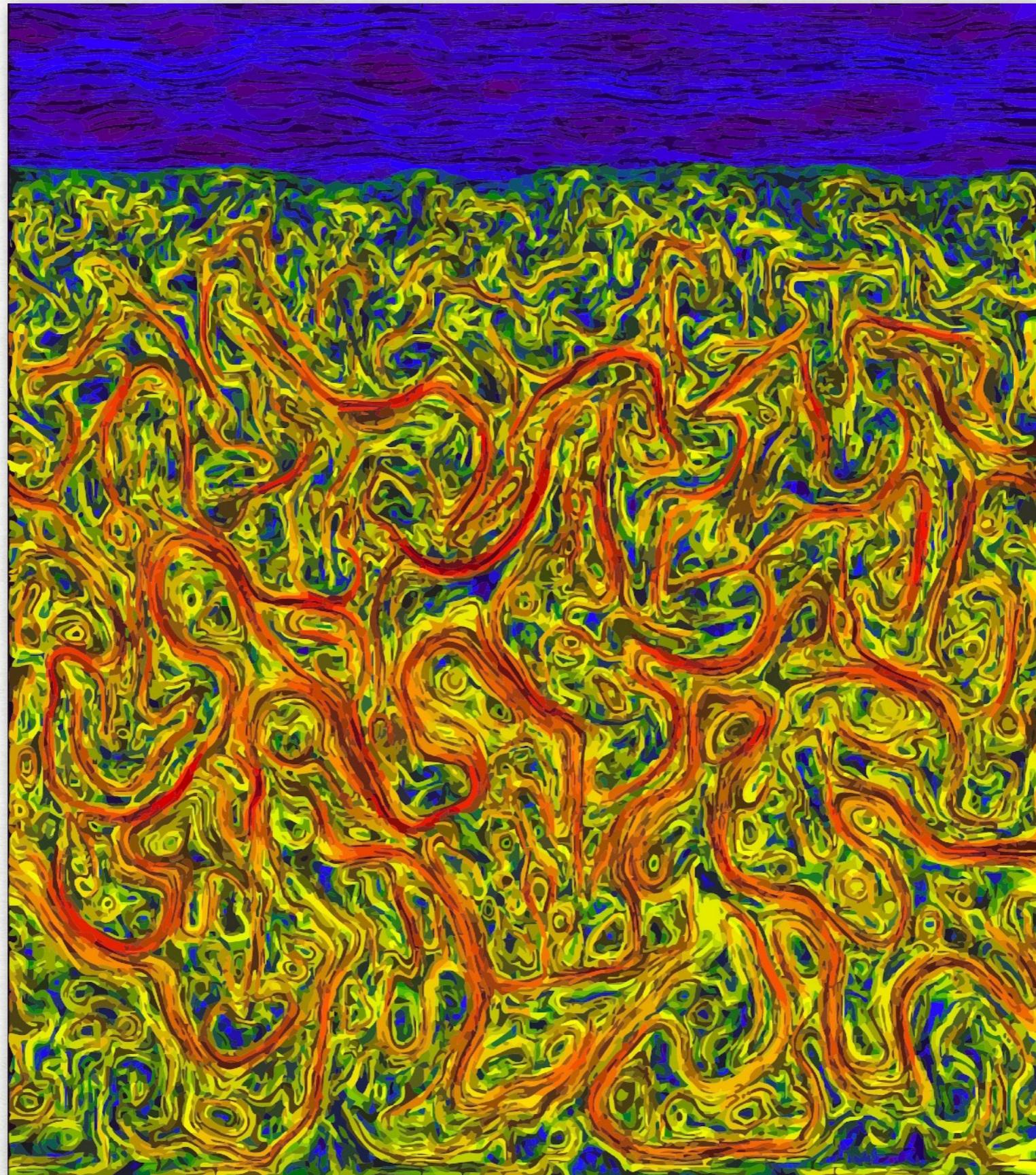


# Example 2



<https://cds.cern.ch/record/2230893?ln=en>

# Example 3



[http://art-csep.cnsi.ucsb.edu/gallery?field\\_year\\_value%5Bvalue%5D%5Byear%5D=2016](http://art-csep.cnsi.ucsb.edu/gallery?field_year_value%5Bvalue%5D%5Byear%5D=2016)

# Demonstration

# What is data visualization?

# Data are the records of observation or measurements

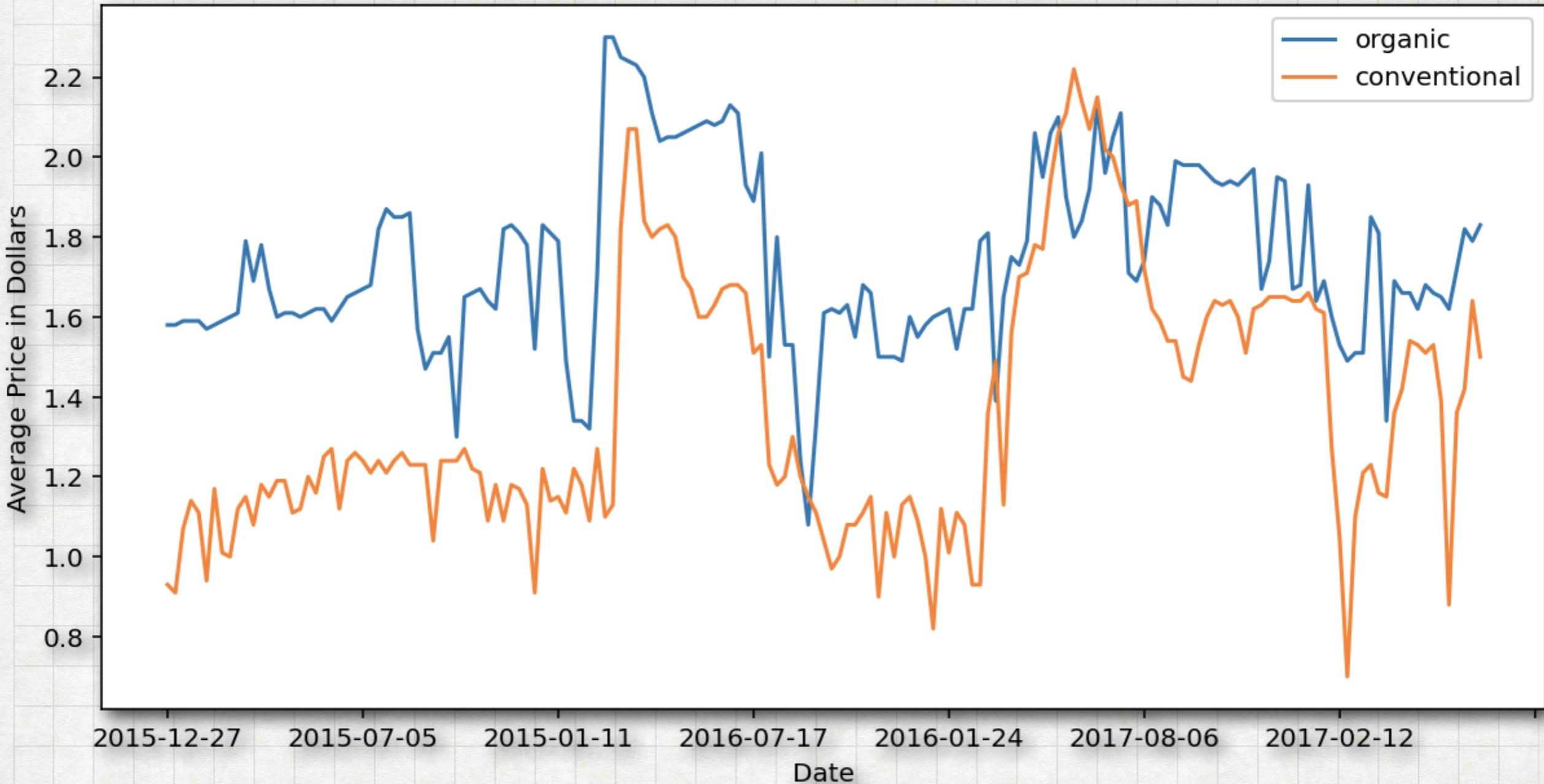
```
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1,2015-12-20,1.35,54876.98,674.28,44638.81,58.33,9505.56,9408.07,97.49,0.0,conventional,2015,Albany  
2,2015-12-13,0.93,118220.22,794.7,109149.67,130.5,8145.35,8042.21,103.14,0.0,conventional,2015,Albany  
3,2015-12-06,1.08,78992.15,1132.0,71976.41,72.58,5811.16,5677.4,133.76,0.0,conventional,2015,Albany  
4,2015-11-29,1.28,51039.6,941.48,43838.39,75.78,6183.95,5986.26,197.69,0.0,conventional,2015,Albany  
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24,2015-07-12,1.05,124055.31,672.25,94693.52,4257.64,24431.9,24290.08,108.49,33.33,conventional,2015,Albany  
25,2015-07-05,1.35,109252.12,869.45,72600.55,5883.16,29898.96,29663.19,235.77,0.0,conventional,2015,Albany  
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27,2015-06-21,1.27,104849.39,804.01,76688.55,5481.18,21875.65,21662.0,213.65,0.0,conventional,2015,Albany  
28,2015-06-14,1.32,89631.3,850.58,55400.94,4377.19,29002.59,28343.14,659.45,0.0,conventional,2015,Albany  
29,2015-06-07,1.07,122743.06,656.71,99220.82,90.32,22775.21,22314.99,460.22,0.0,conventional,2015,Albany  
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31,2015-05-24,1.19,101470.91,680.27,71376.81,58.7,29355.13,28761.81,593.32,0.0,conventional,2015,Albany  
32,2015-05-17,1.43,109857.47,1150.55,81955.16,94.32,26657.44,26285.43,372.01,0.0,conventional,2015,Albany  
33,2015-05-10,1.26,120427.91,1420.43,102000.52,185.66,16821.3,16535.55,285.75,0.0,conventional,2015,Albany  
34,2015-05-03,1.2,50107.67,818.87,45400.05,817.24,12570.51,12281.85,268.56,0.0,conventional,2015,Albany
```

Discrete(categorical)

Continuous

But numbers are hard to understand!

# The need for graphical representations



Data visualization is all  
about telling a good story  
from the data

# Data visualization rule of thumb

Understand the data

Know the audience

Clearly convey the messages

# Understand the data

What do the numbers mean?

What is the context?

Do they make sense?

,Date,AveragePrice,Total Volume,4046,4225,4770,Totals,Bags,Small Bags,Large Bags,XLarge Bags,type,year,region  
0,2015-12-27,1.33,64236.62,1036.74,54454.85,48.16,8696.87,8603.62,93.25,0.0,conventional,2015,Albany  
1,2015-12-20,1.35,54876.98,674.28,44638.81,58.33,9505.56,9408.07,97.49,0.0,conventional,2015,Albany  
2,2015-12-13,0.93,118220.22,794.7,109149.67,130.5,8145.35,8042.21,103.14,0.0,conventional,2015,Albany  
3,2015-12-06,1.08,78992.15,1132.0,71976.41,72.58,5811.16,5677.4,133.76,0.0,conventional,2015,Albany  
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17,2015-08-30,1.0<sup>1</sup>  
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22,2015-07-26,1.11,106757.1,648.75,91949.05,966.61,13192.69,13061.53,131.16,0.0,conventional,2015,Albany  
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34,2015-05-03,1.2,59197.67,910.97,45400.95,217.24,12570.51,12201.95,369.56,0.0,conventional,2015,Albany

# Most data have errors!

# Know the audience

Who are you present the visualization to?

Can they understand it?

# Clearly convey the messages

What is the best way to visualize the data?

Label what you are plotting!

Can I read it?

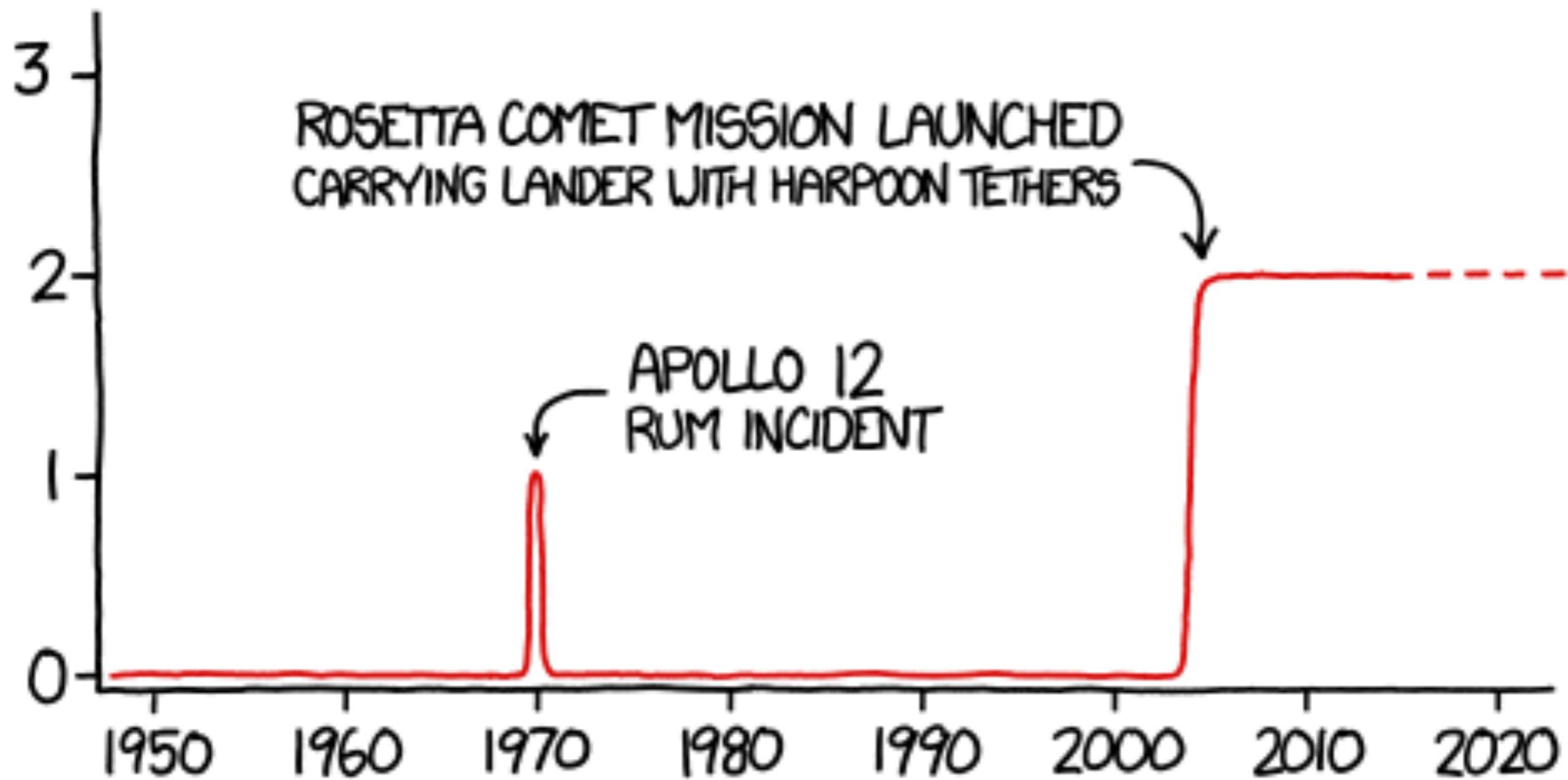
**Questions?**

Common ways to  
visualize data

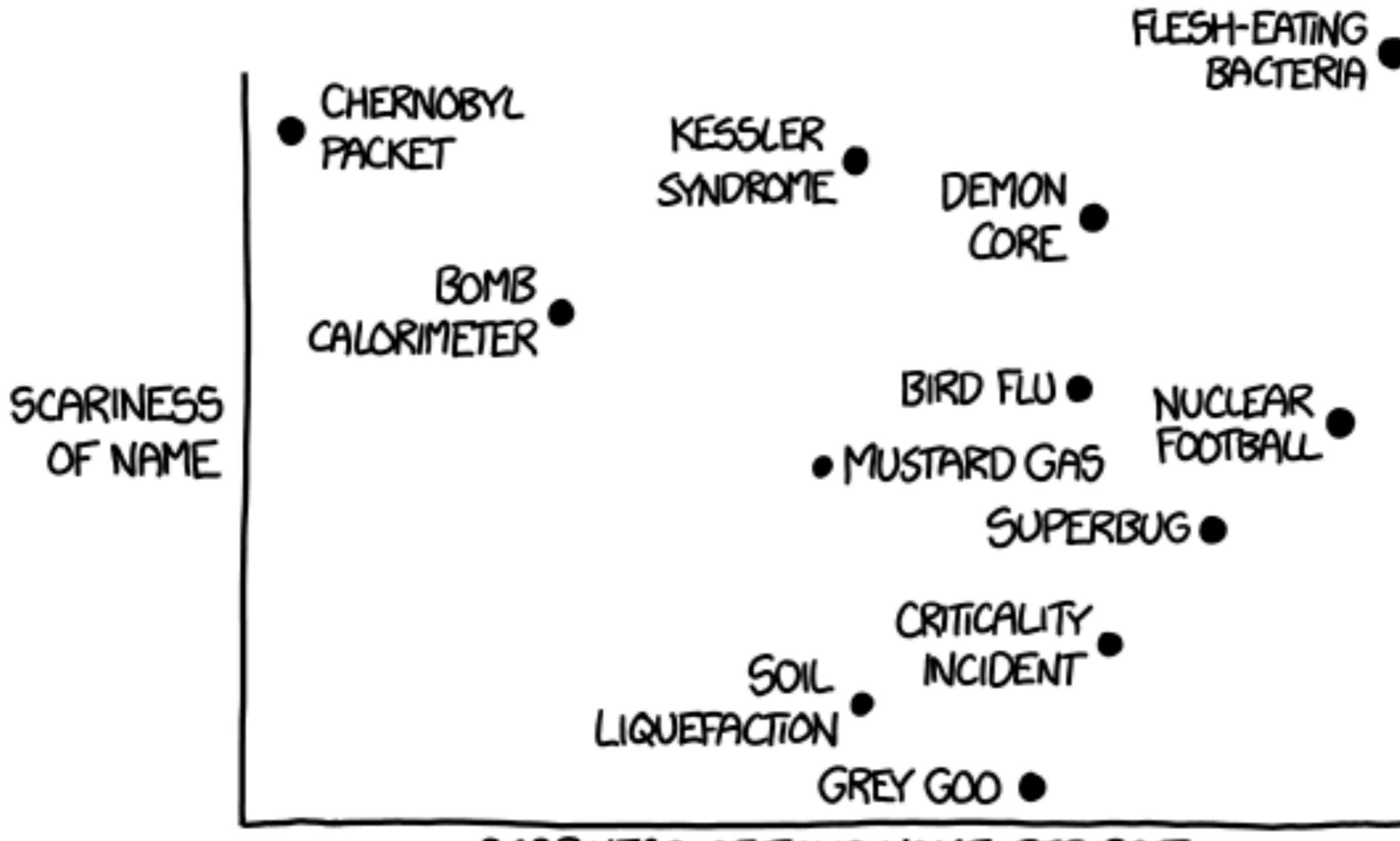
**Disclaimer**  
**I am not an artist!**

# Line graphs

# NUMBER OF HARPOONS IN SPACE BY YEAR



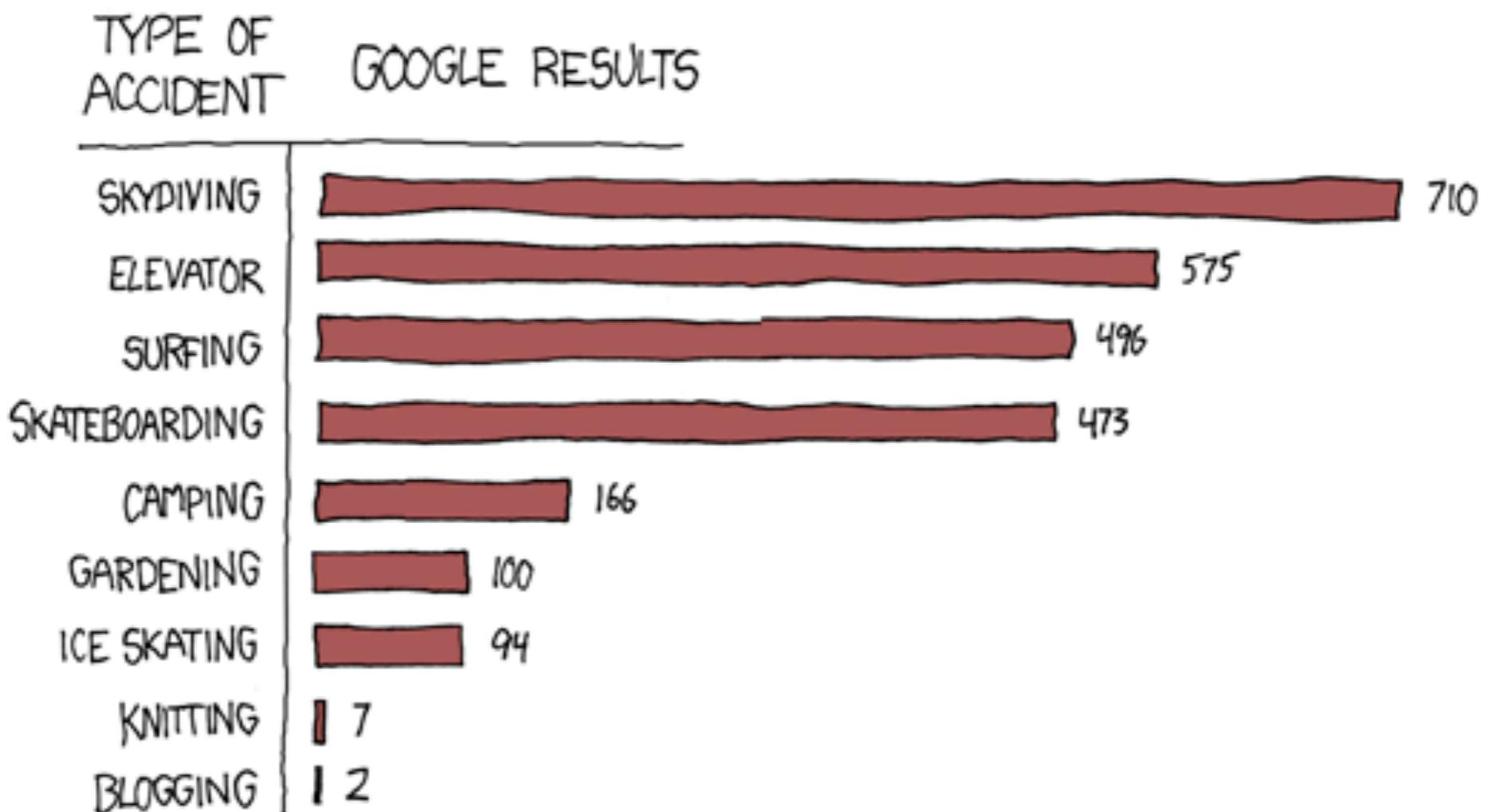
# Scatter plots



# Bar graphs

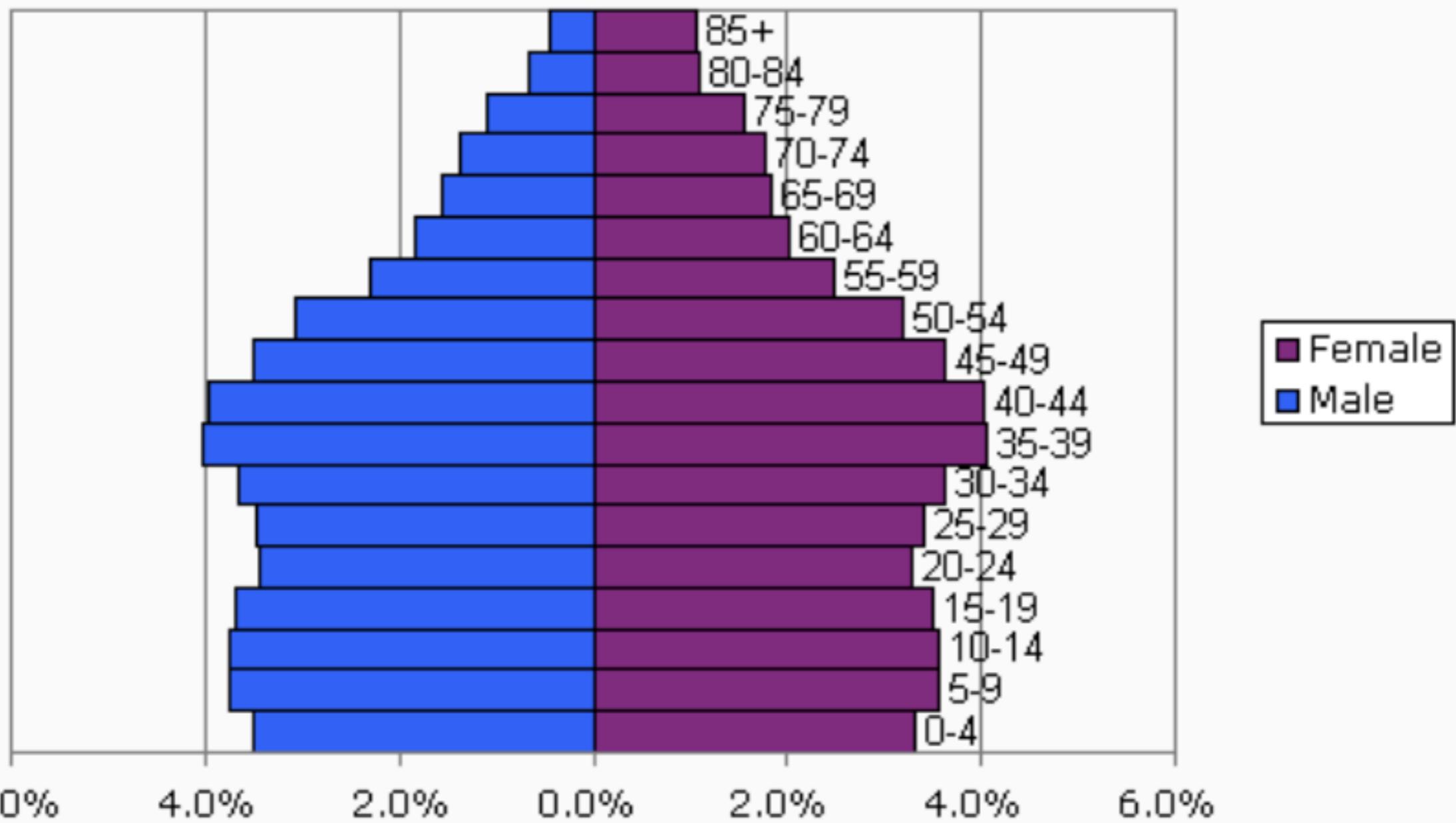
# DANGERS

INDEXED BY THE NUMBER OF GOOGLE RESULTS FOR  
"DIED IN A \_\_\_\_\_ ACCIDENT"



# Histogram

## Age Distribution, 2000



**Questions?**

# Linear vs Log

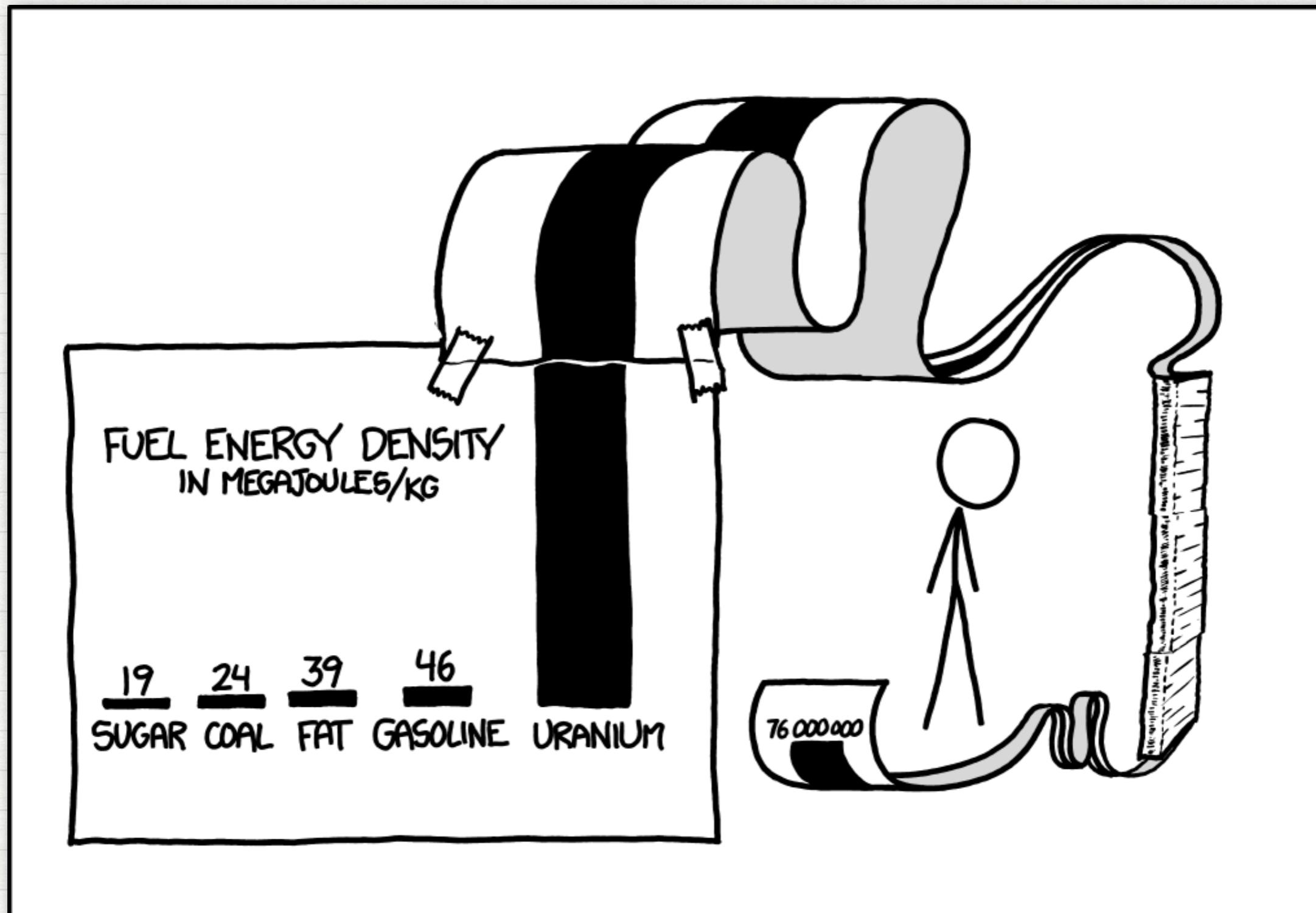
An order of magnitude is  
approximately 10x difference  
between two numbers

Human adults (about 170cm) are roughly an order magnitude taller than cats (about 15cm)

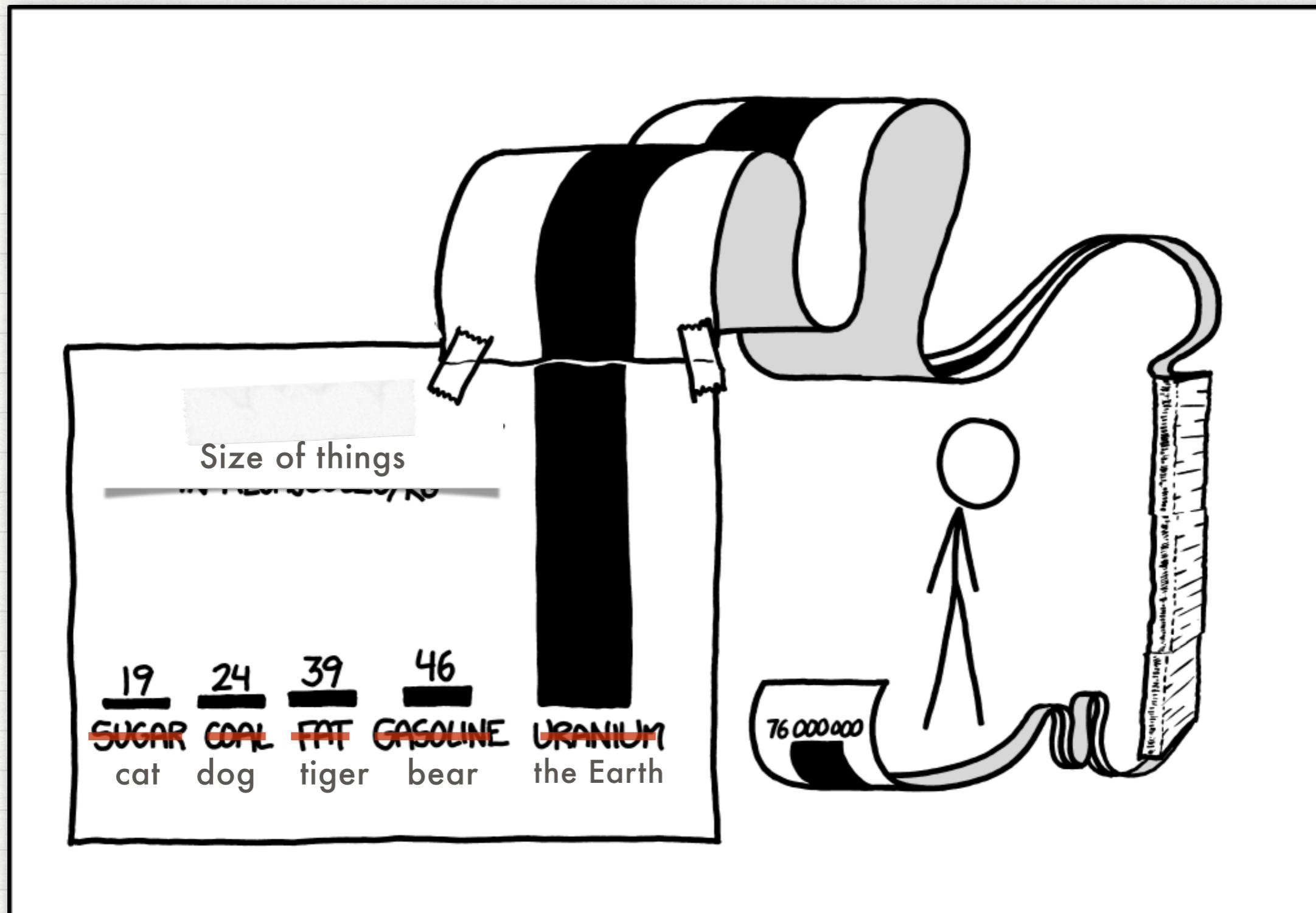
The Earth (about 10000 km in diameter) is about 7 orders of magnitude larger than a human (about 1m)

Let's say we want to plot the size  
of things in this Universe (galaxy,  
star, human, dog, ant, cell, atom)

**1st way**

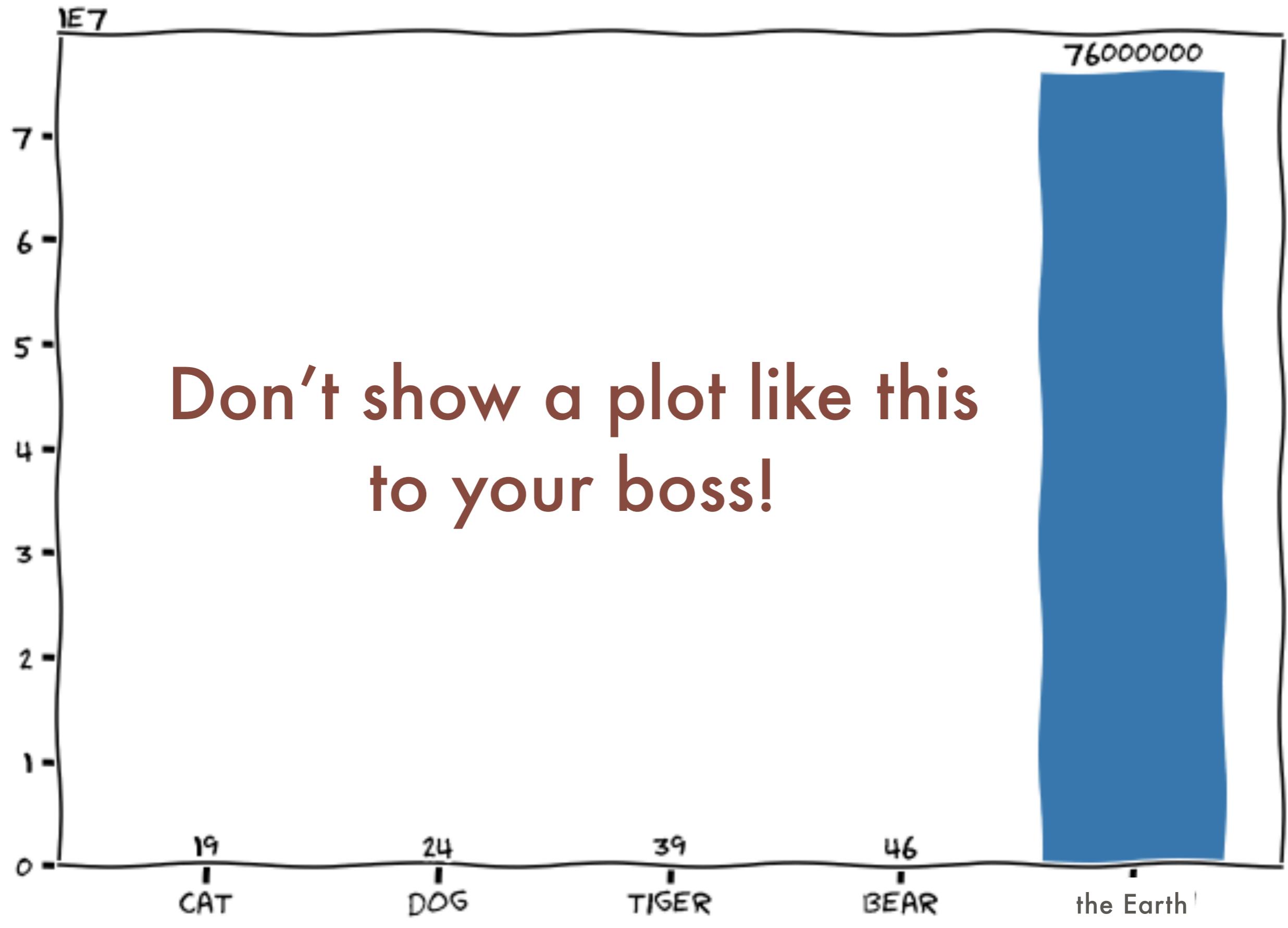


SCIENCE TIP: LOG SCALES ARE FOR QUITTERS WHO CAN'T FIND ENOUGH PAPER TO MAKE THEIR POINT PROPERLY.

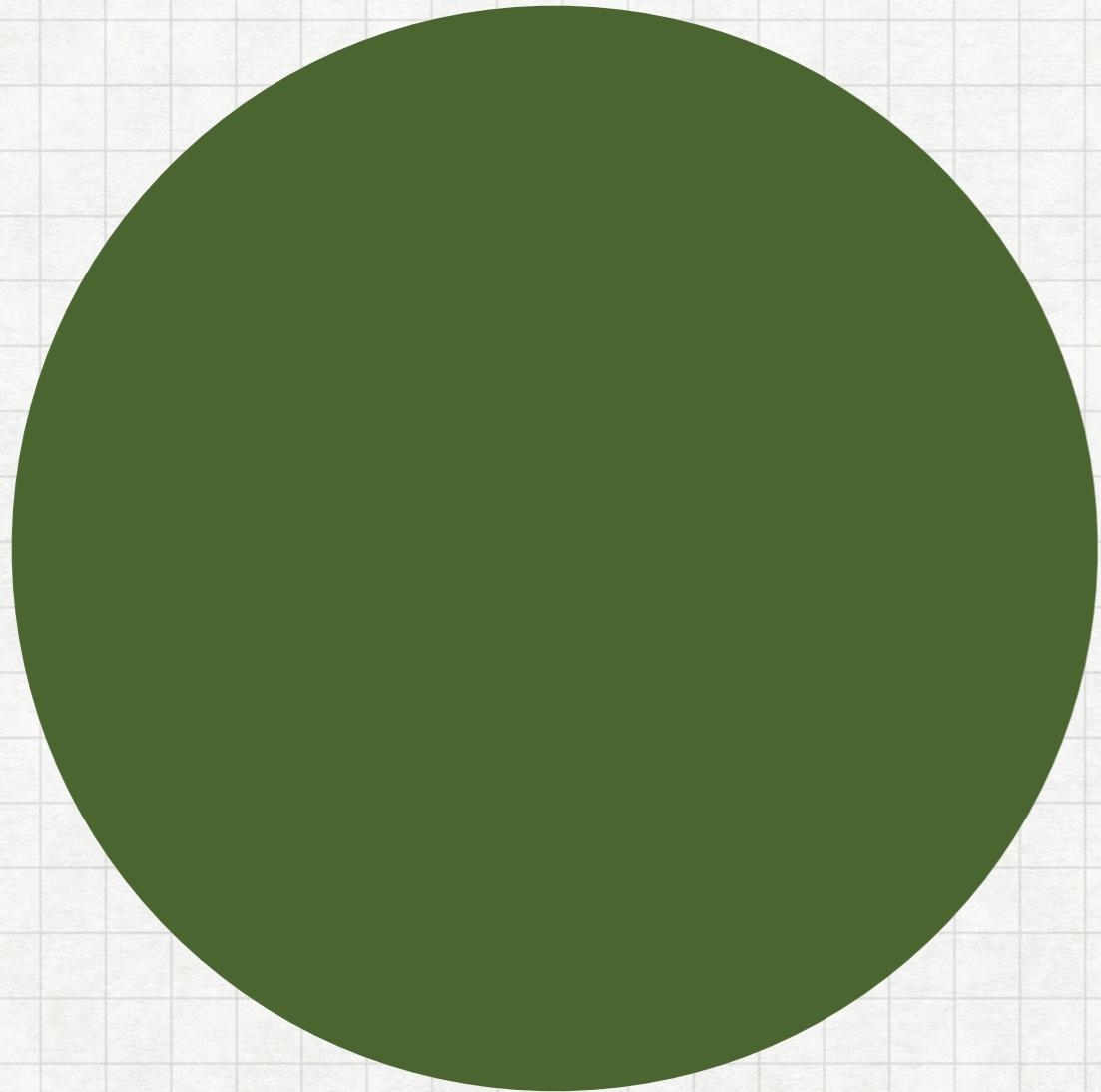


SCIENCE TIP: LOG SCALES ARE FOR QUITTERS WHO CAN'T FIND ENOUGH PAPER TO MAKE THEIR POINT PROPERLY.

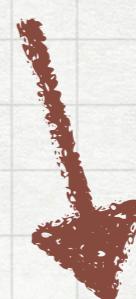
**2nd way**



the Earth

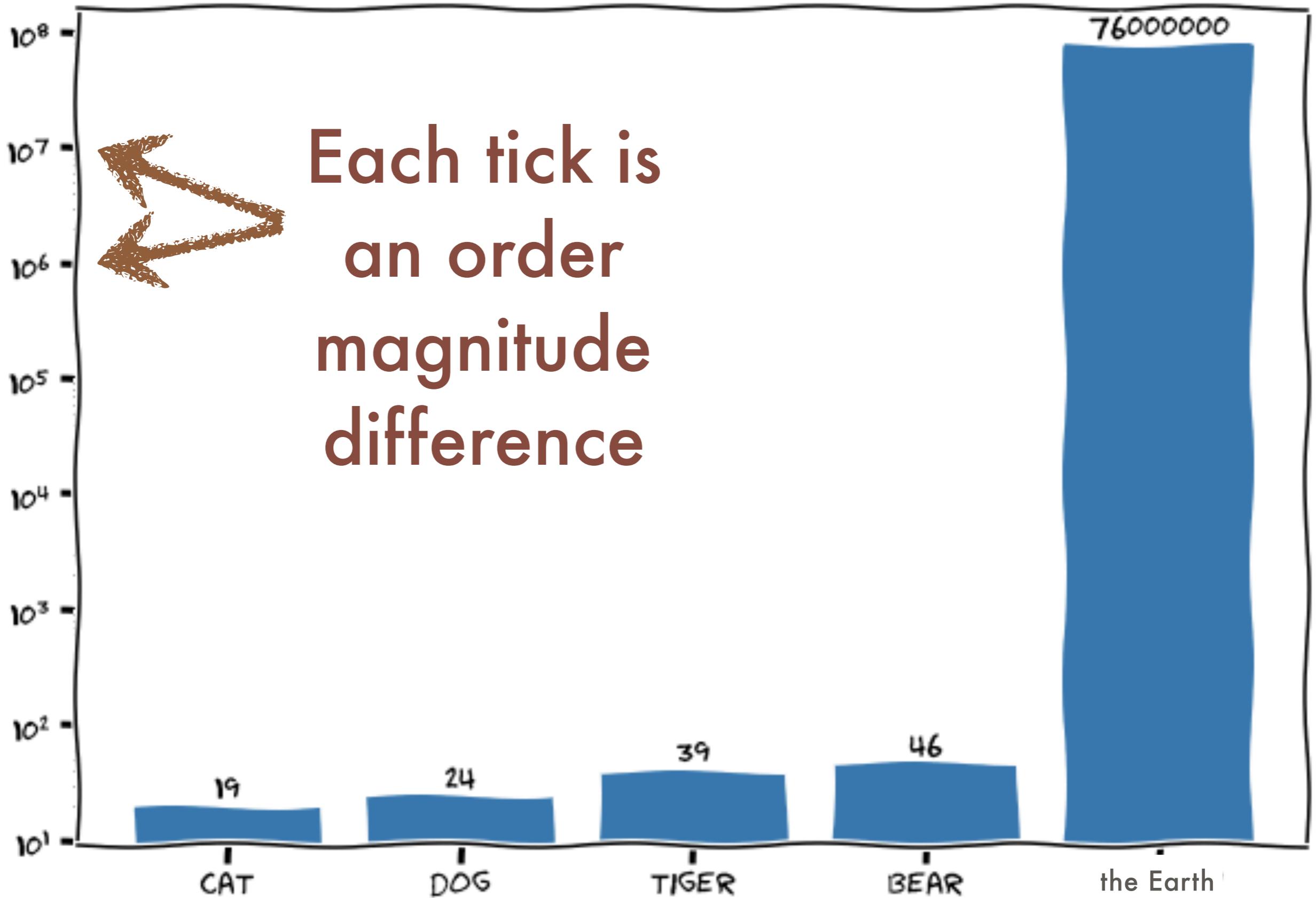


bear    human    cat

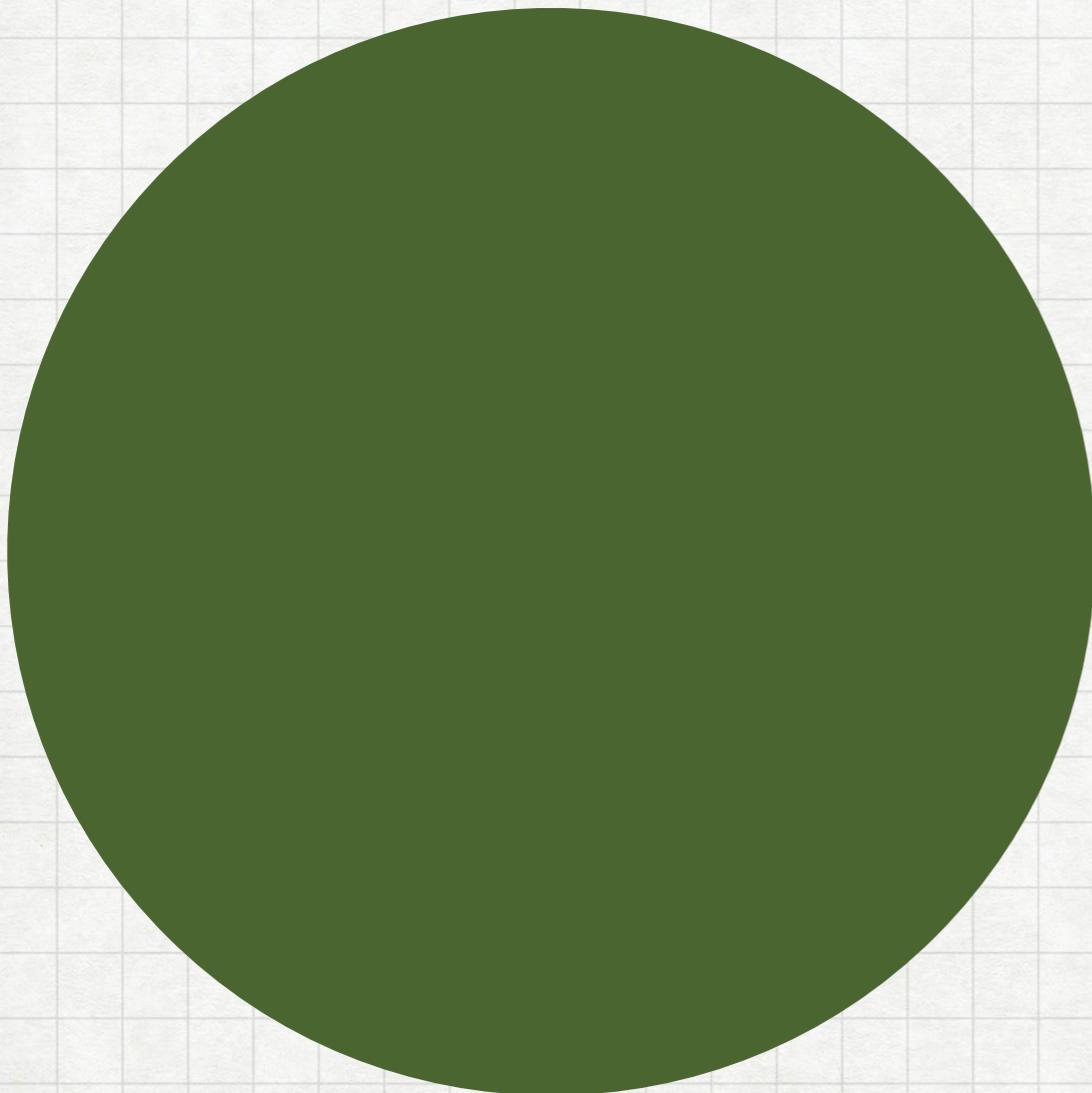


The only reasonable  
way...

Each tick is  
an order  
magnitude  
difference



the Earth



bear



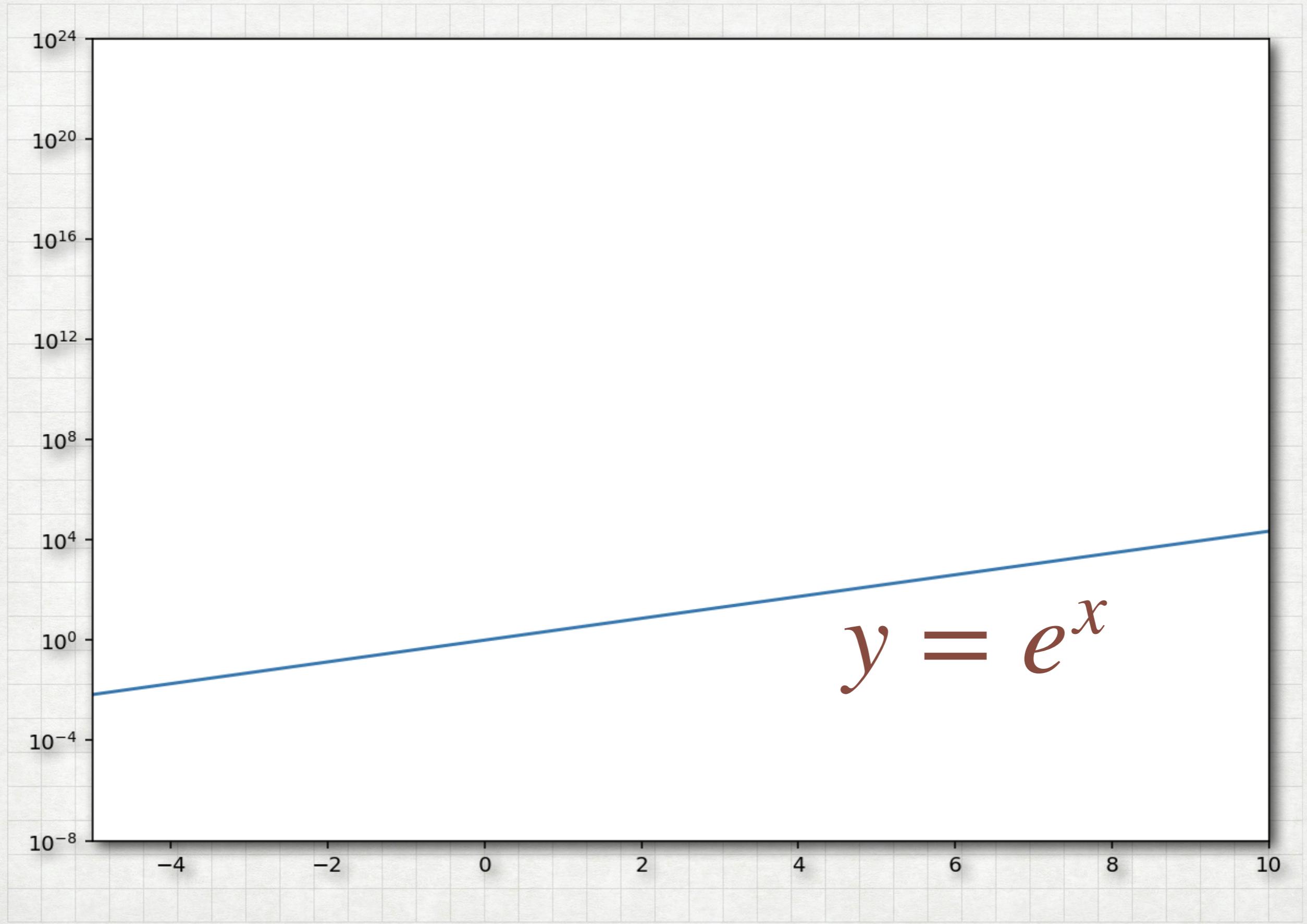
human

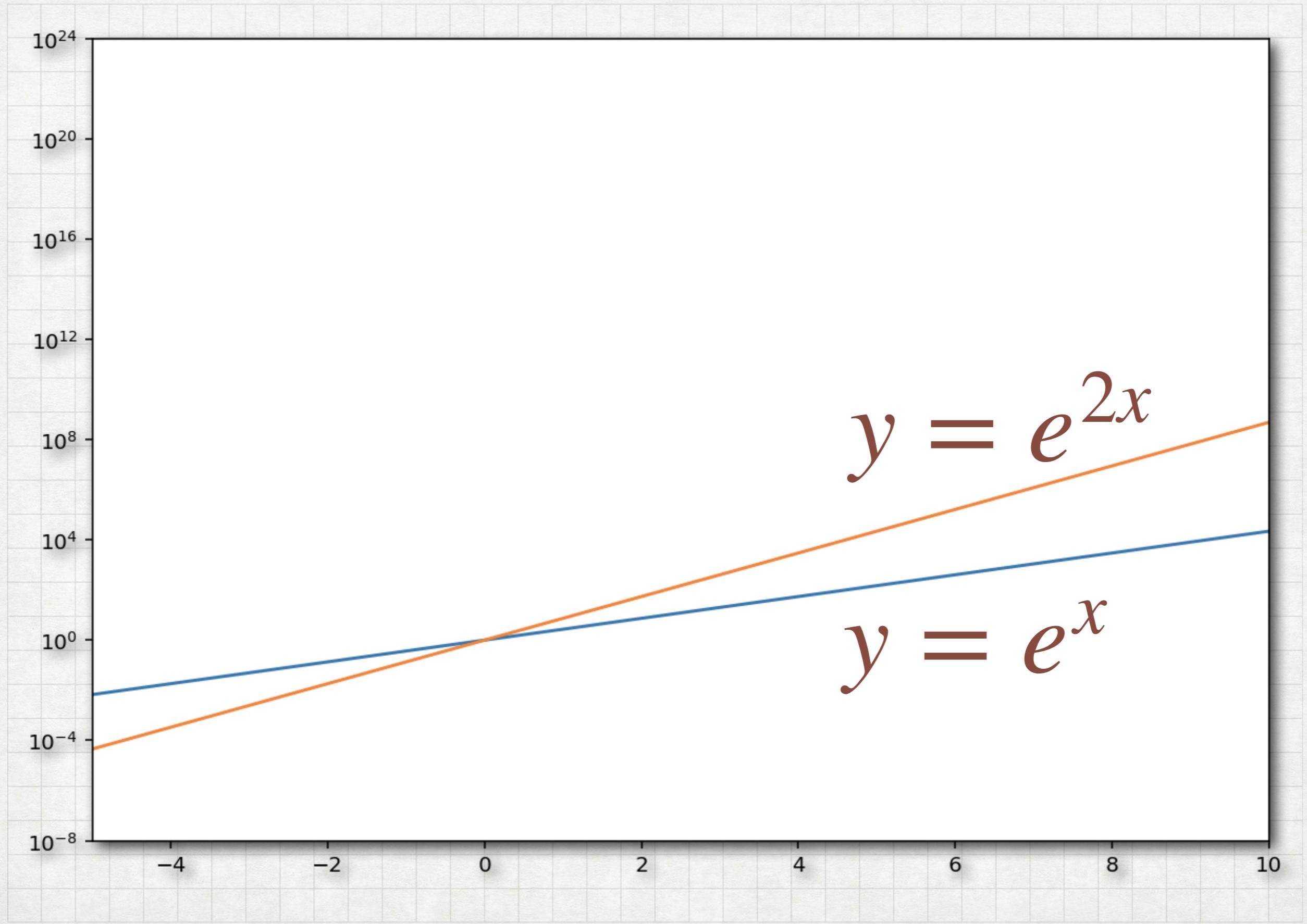


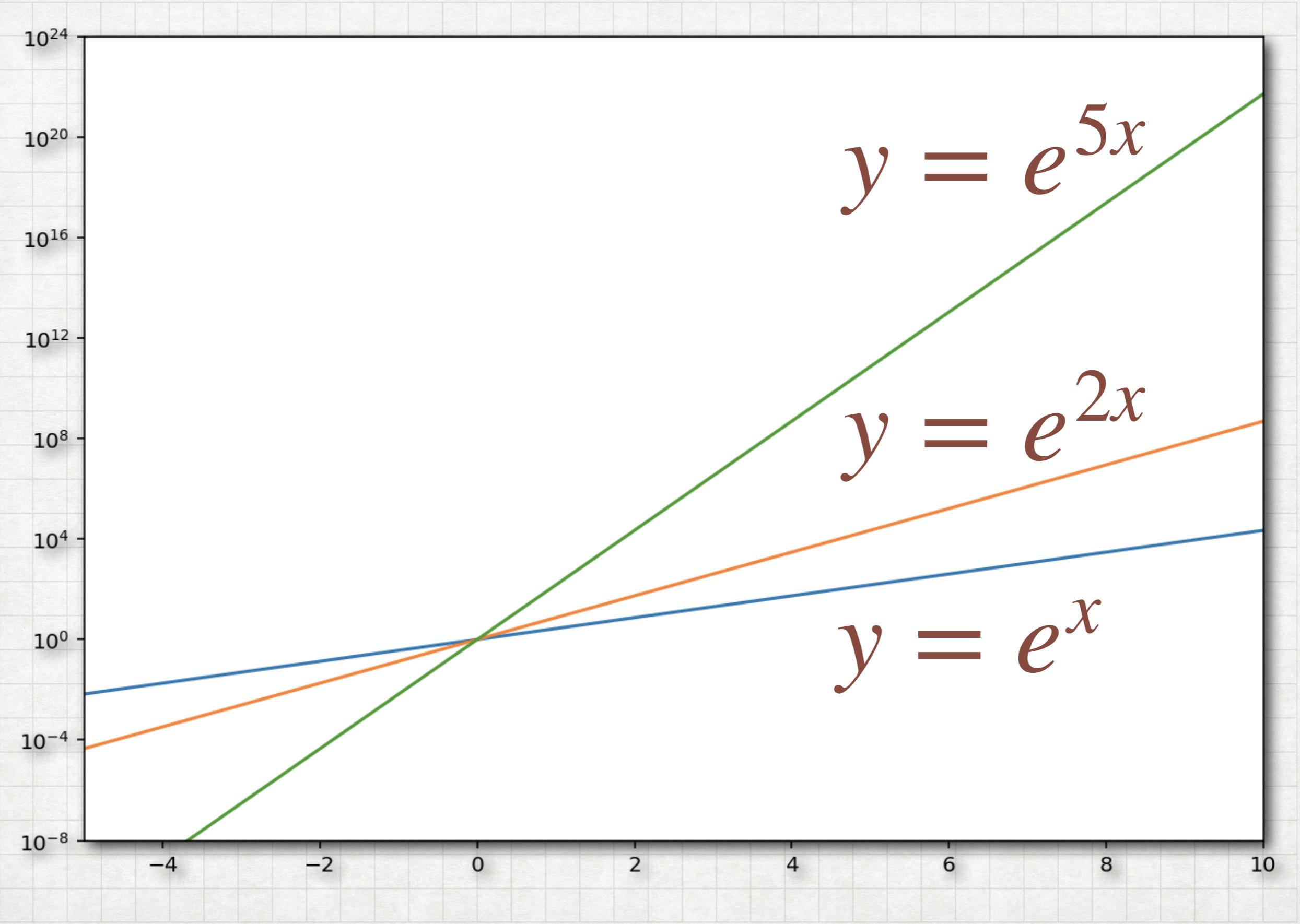
cat



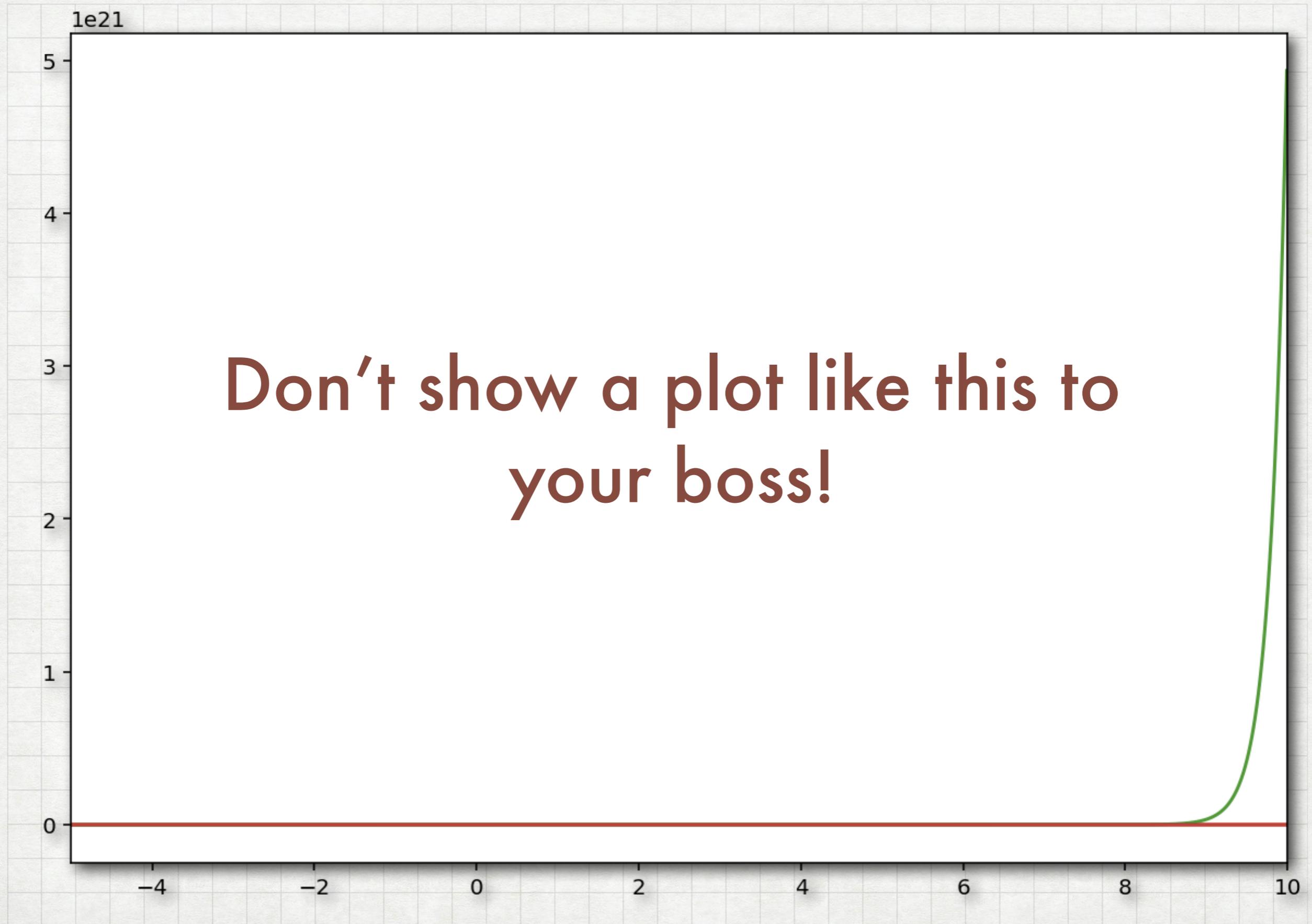
NOT to scale!







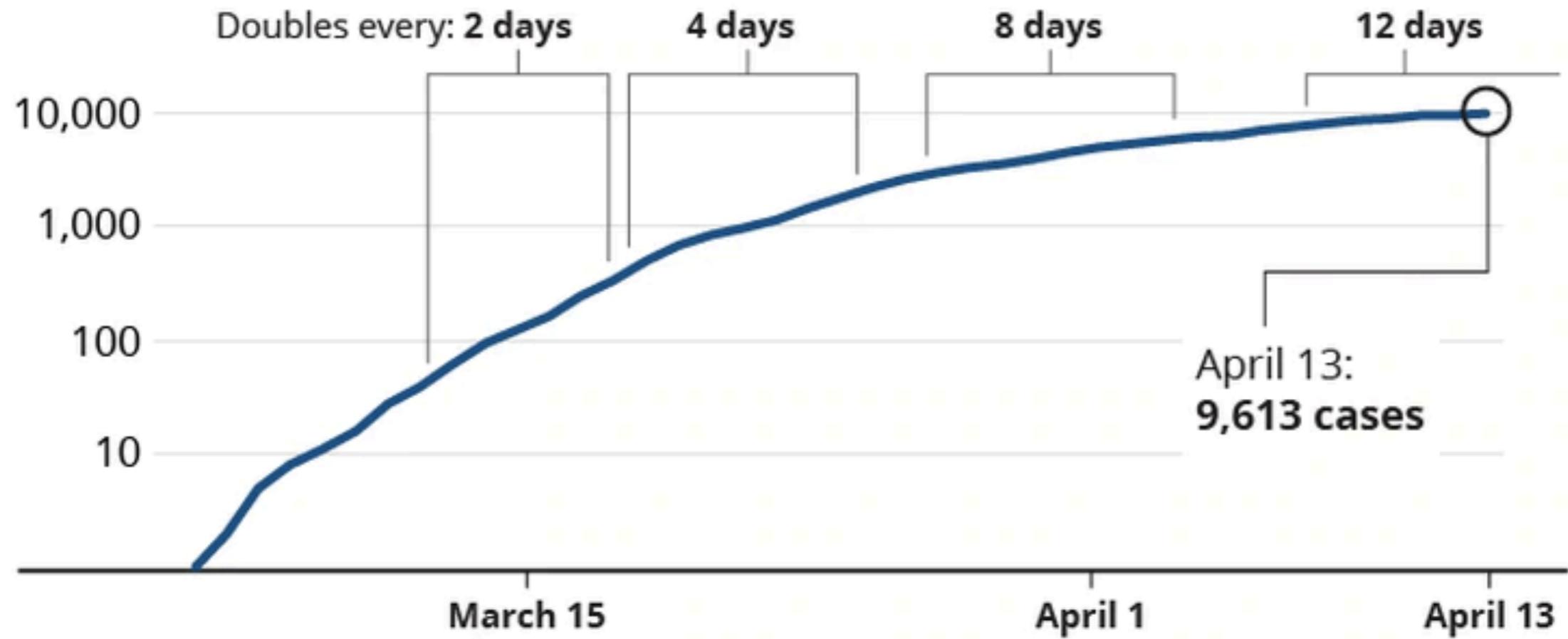
Again, what will happen if  
you plot them in linear  
scale?



# “Bending the curve”

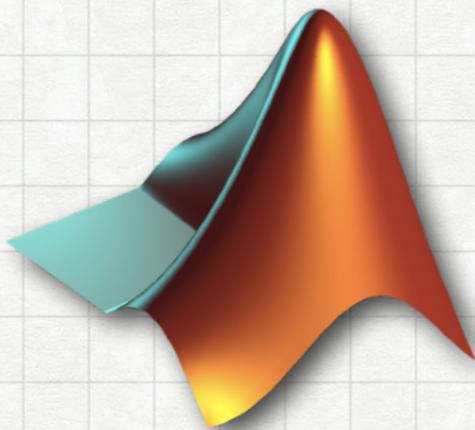
## Confirmed coronavirus cases: Log scale

*This chart shows cumulative Chicago cases by day on a log scale, that shows exponential growth in a compact way.*

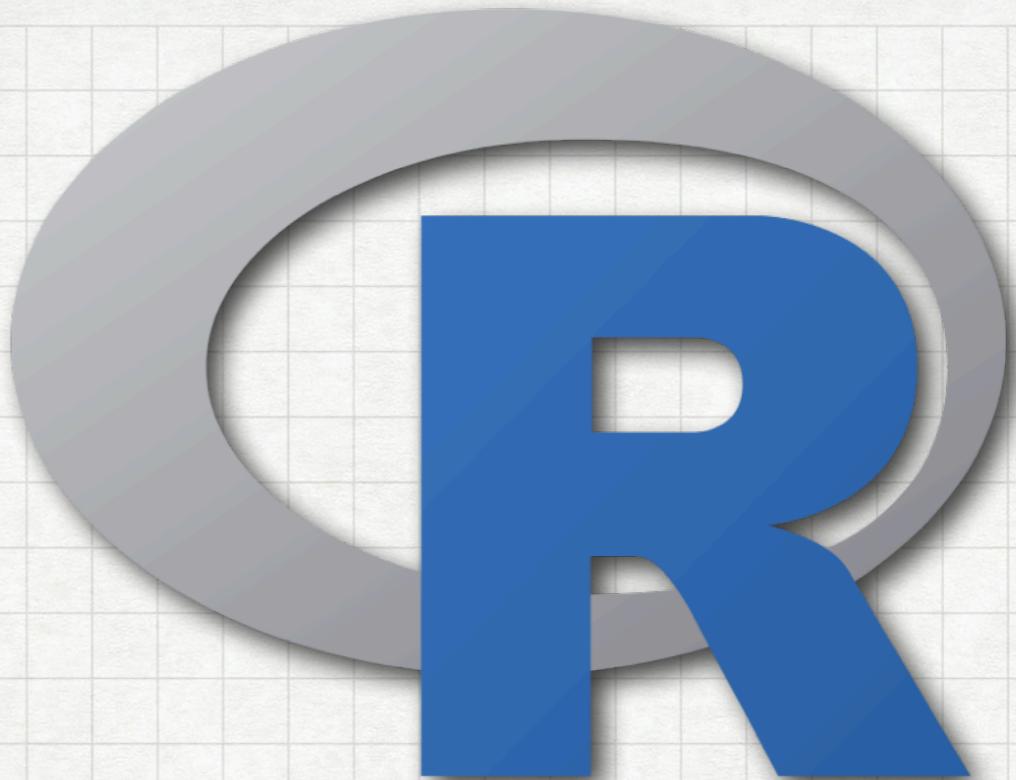


**Questions?**

# Tools



<https://www.mathworks.com/products/matlab.html>



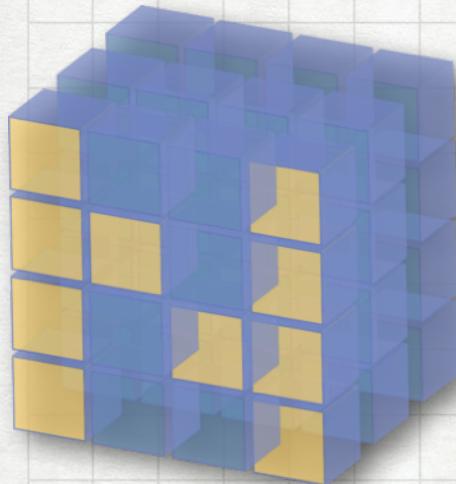
<https://www.r-project.org/>



python<sup>TM</sup>

<https://www.python.org/>

# Two (three) Essential Libraries

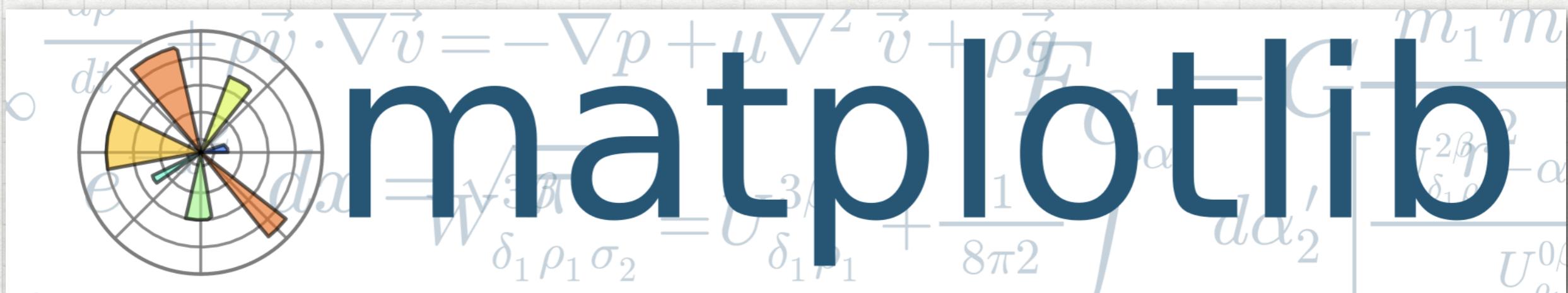


NumPy

<https://numpy.org/>

pandas

<https://pandas.pydata.org/>



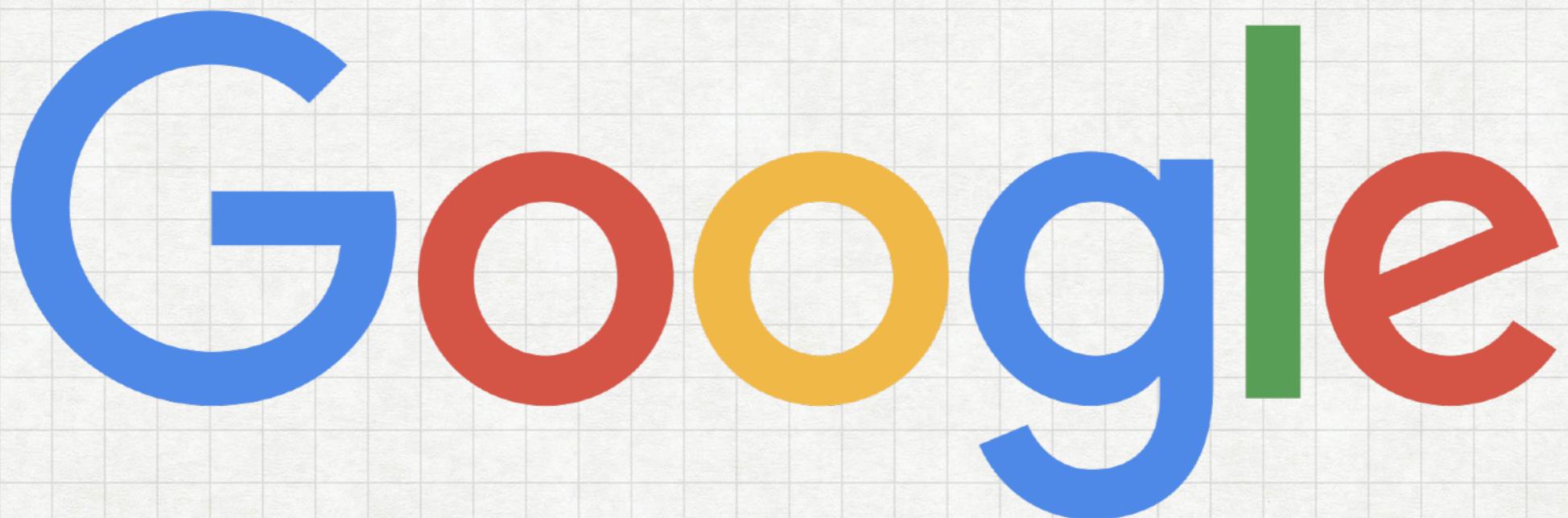
<https://matplotlib.org/>

# Honorary mention



<https://jupyter.org/>

# Honorary mention



“how to delete a column pandas”

“how to make a bar graph pandas”

“how to make y axis log scale matplotlib”