

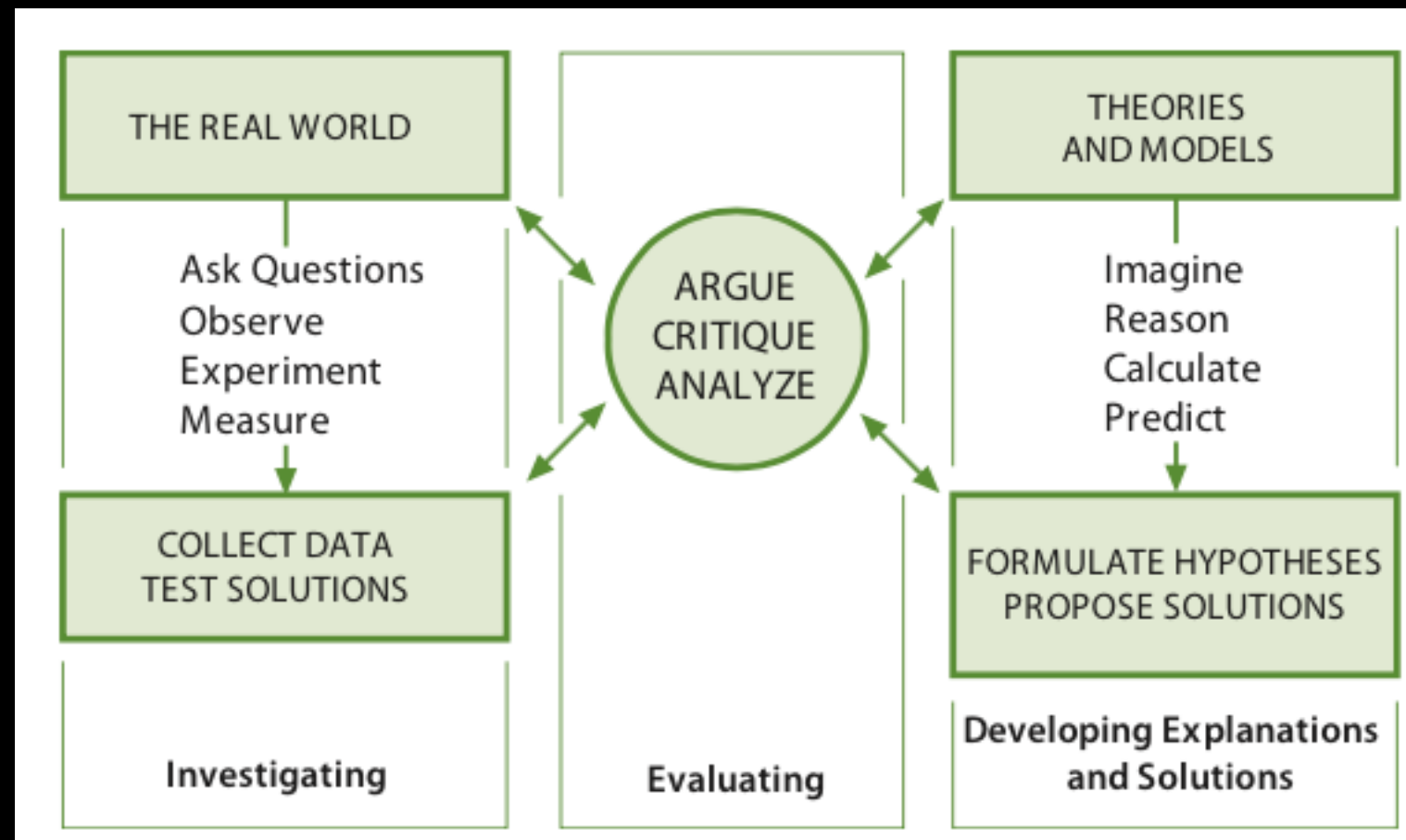
# Math Science Leadership Conference

4

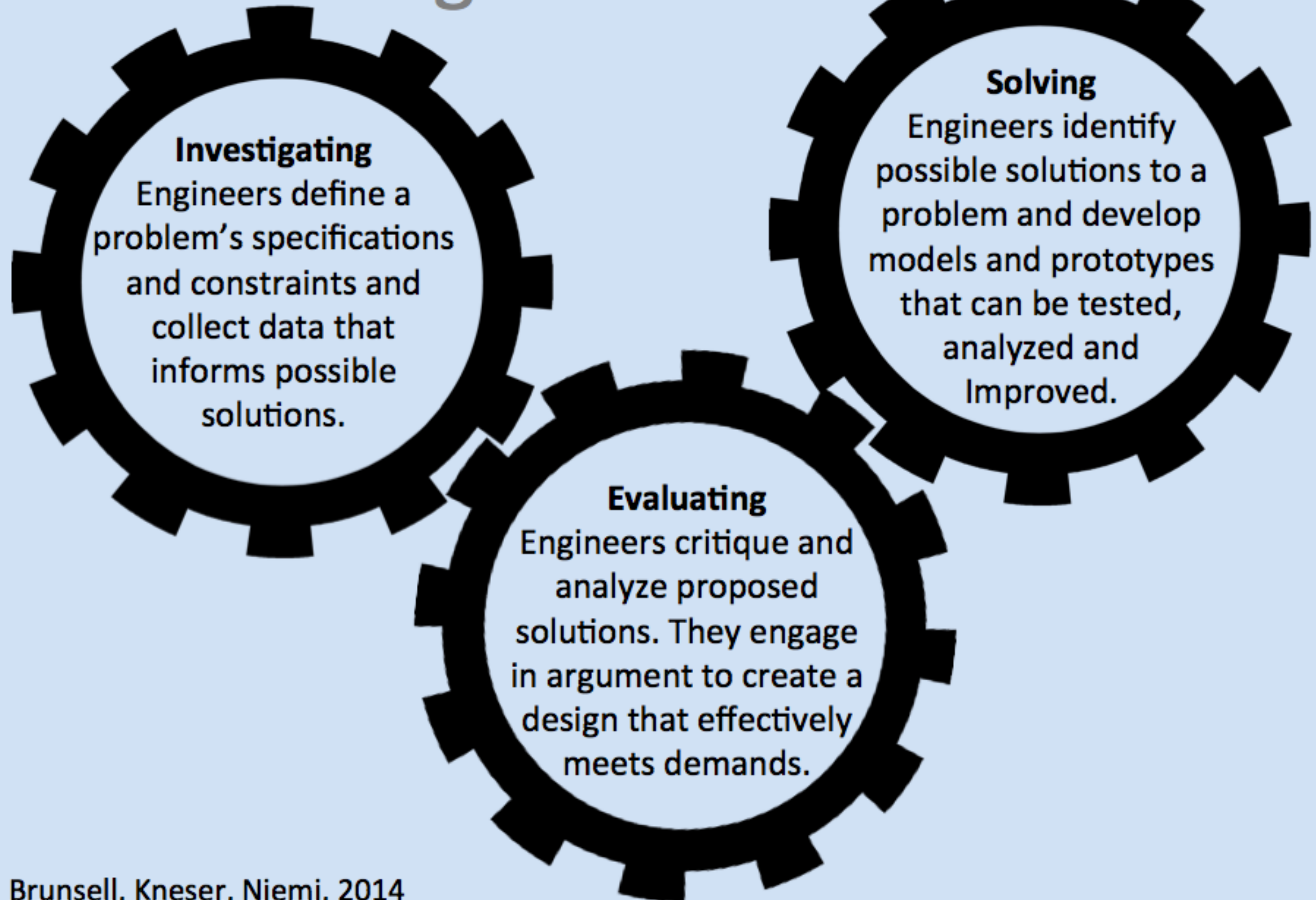
Analyzing and Interpreting Data

## Science and Engineering Practices

- 1 Asking Questions and Defining Problems
- 2 Developing and Using Models
- 3 Planning and Carrying Out Investigations
- 4 Analyzing and Interpreting Data
- 5 Using Mathematics and Computational Thinking
- 6 Constructing Explanations and Designing Solutions
- 7 Engaging in Argument from Evidence
- 8 Obtaining, Evaluating, and Communicating Information



# What do engineers do?



# What do scientists do?

## **Investigating**

Scientists ask questions, make observations, and collect data using a variety of methods.

## **Evaluating**

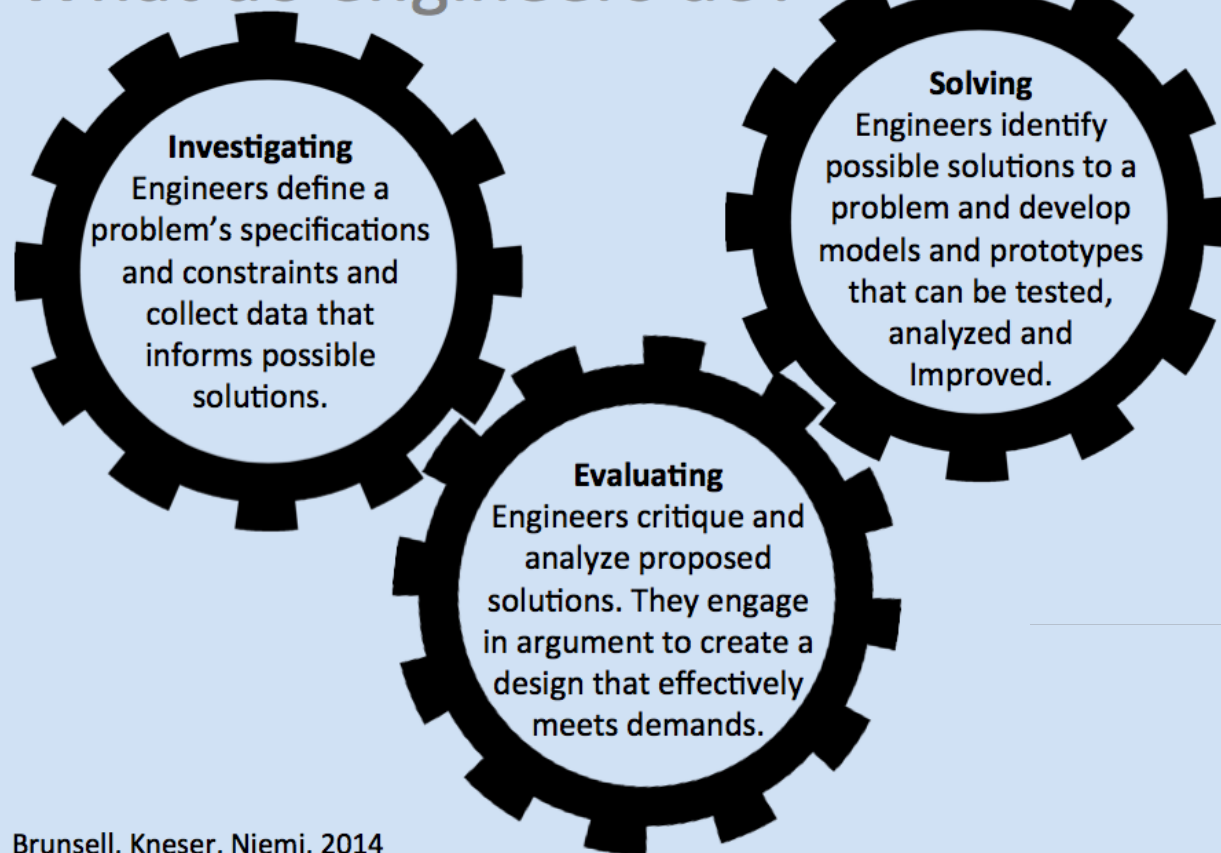
Scientists critique and analyze explanations and models. They engage in argumentation to test claims based on existing evidence

## **Explaining**

Scientists attempt to make sense of the world by using evidence or modify to create explanations and models



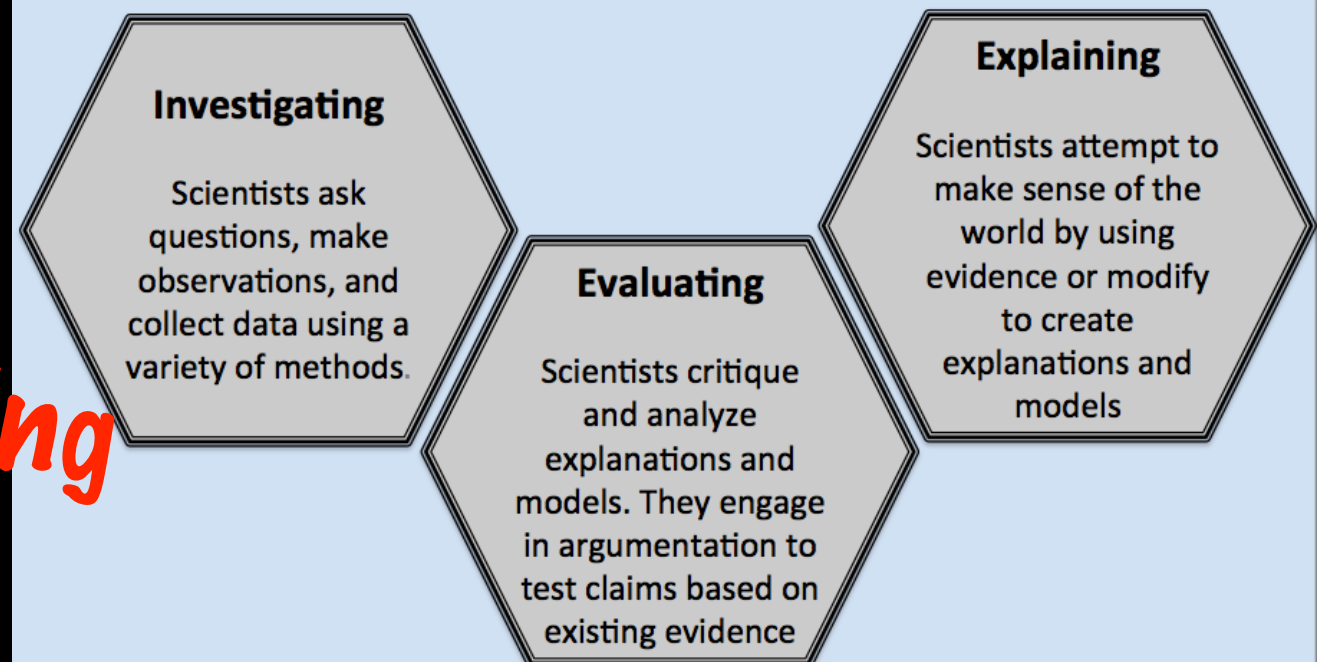
## What do engineers do?



Brunsell, Kneser, Niemi, 2014

*Analyzing & Interpreting Data*

## What do scientists do?



Brunsell, Kneser, Niemi, 2014

*Analyzing & Interpreting Data*

## Practice 4

### Analyzing and Interpreting Data

Once collected, data must be presented in a form that can reveal any patterns and relationships and that allows results to be communicated to others. Because raw data as such have little meaning, a major practice of scientists is to organize and interpret data through tabulating, graphing, or statistical analysis. Such analysis can bring out the meaning of data—and their relevance—so that they may be used as evidence.

skills

verbs

products

tools

Elementary

Middle

High School




Elementary	Middle	High School
record observations	standard techniques:	more complex analysis
engage in inquiry	display, analyze, interpret data	scatterplots
collect data	graphing	statistical analysis
make tables	outliers	computer simulations
make graphs	averaging	large data sets
computer simulations	measurement error	
	explain	

# Elementary Activity



# Middle School Activity

*data table*

*variables*

*trials*

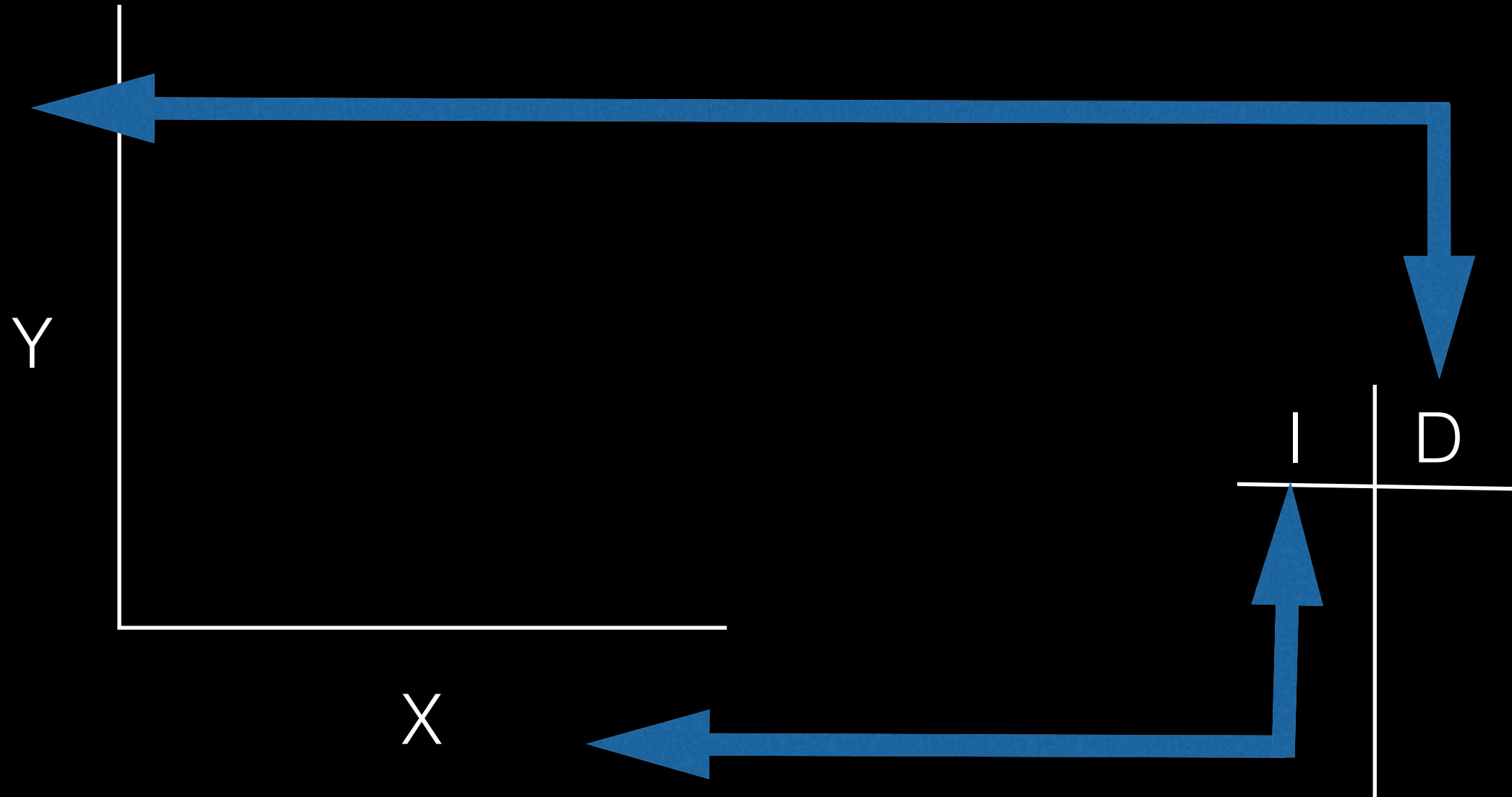
*averages*

## Independent/Manipulated

## Dependent/Responding

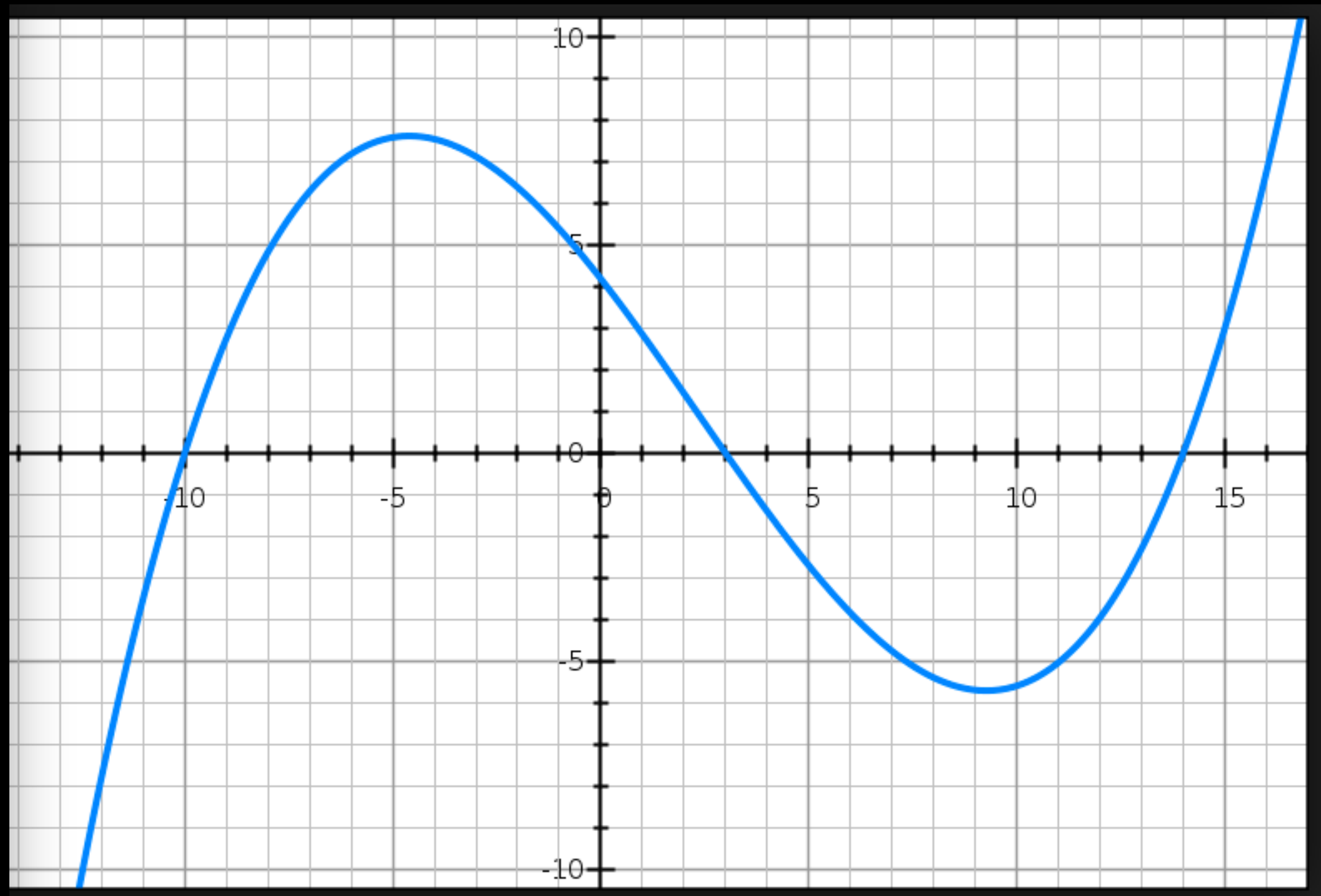
[illegible]

# From tables to graphs





# Graph It





<http://www.geysertimes.org/>

## Old Faithful Geyser

Recent Activity

Notes

Links

Attachments

Baselines

Last Known  
Eruption

1h 0m ago

### Latest Eruptions

Show 20 entries

Eruption	Duration	Interval
21 Jan 2015 @ 1451 wc		1h 31m
21 Jan 2015 @ 1320 wc		1h 37m
21 Jan 2015 @ 1143 wc		1h 3m
21 Jan 2015 @ 1040 wc		1h 44m
21 Jan 2015 @ 0856 wc long		1h 4m
21 Jan 2015 @ 0752 wc		1h 31m
21 Jan 2015 @ 0621 wc		13h 46m
20 Jan 2015 @ 1635 wc long		1h 25m
20 Jan 2015 @ 1510 wc long		1h 44m
20 Jan 2015 @ 1326 wc long		1h 30m
20 Jan 2015 @ 1156 wc long		1h 37m
20 Jan 2015 @ 1019 wc long		1h 0m
20 Jan 2015 @ 0919 wc short		1h 30m
20 Jan 2015 @ 0749 wc long		1h 26m
20 Jan 2015 @ 0623 ie		12h 35m
19 Jan 2015 @ 1748 wc		1h 33m
19 Jan 2015 @ 1615 wc long		1h 41m
19 Jan 2015 @ 1434 wc long		1h 32m
19 Jan 2015 @ 1302 wc long		1h 49m

### Interval Statistics

# of Intervals	100
Min	55m
Max	21h 20m
Mean	2h 33m
Median	1h 33m

2127

# OLD FAITHFUL ERUPTION DATA

	Time of Day	Duration (sec)	Interval (min)
9/1/99	9:03	253	83
9/1/99	10:31	247	88
9/1/99	11:57	255	86
9/1/99	13:25	276	88
9/1/99	14:55	256	90
9/1/99	16:29	251	94
9/1/99	17:59	260	90
9/1/99	19:27	242	88
9/3/99	9:02	250	83
9/3/99	10:22	244	80
9/3/99	11:55	239	93
9/3/99	13:22	240	87
9/3/99	14:52	253	90
9/3/99	16:17	238	85
9/3/99	17:51	248	94
9/3/99	19:19	264	88
9/7/99	9:22	262	92
9/7/99	10:50	250	88
9/7/99	12:22	249	92
9/7/99	13:50	252	88
9/7/99	15:15	245	87
9/7/99	16:42	252	51
9/7/99	17:33	107	86
9/7/99	18:59	271	86
9/9/99	11:05	274	104
9/9/99	12:25	254	80
9/9/99	13:52	254	87
9/9/99	15:10	239	78
9/9/99	16:39	247	89
9/9/99	17:58	224	79
9/9/99	19:25	249	87
9/11/99	14:12	248	82
9/11/99	15:32	233	80
9/11/99	17:09	260	97
9/11/99	18:42	243	93
9/12/99	10:57	235	96
9/12/99	12:15	267	78
9/12/99	14:59	243	85
9/12/99	16:30	235	91
9/12/99	17:47	207	77
9/12/99	19:25	248	98
9/13/99	11:00	230	82
9/13/99	12:23	257	83
9/13/99	13:45	194	82
9/13/99	15:13	189	88
9/13/99	16:34	236	81
9/13/99	17:37	110	63
9/13/99	19:11	259	94

TA	Time of day	Duration (sec)	Interval (min)
9/14/99	9:23	236	91
9/14/99	10:48	241	85
9/14/99	12:07	255	79
9/14/99	13:28	237	81
9/14/99	14:54	215	86
9/14/99	16:13	247	79
9/14/99	17:42	237	89
9/14/99	19:05	240	83
9/15/99	10:41	240	89
9/15/99	12:05	245	84
9/15/99	13:26	228	81
9/15/99	14:46	235	80
9/15/99	16:13	261	87
9/15/99	17:18	122	65
9/16/99	10:28	256	90
9/16/99	11:55	242	87
9/16/99	13:21	224	86
9/16/99	14:43	247	82
9/16/99	16:17	257	94
9/16/99	17:37	238	80
9/16/99	19:00	235	83
9/19/99	10:15	255	89
9/19/99	11:40	261	85
9/19/99	12:40	120	60
9/19/99	14:13	261	93
9/19/99	17:01	247	77
9/19/99	18:08	119	67
9/21/99	10:19	150	65
9/21/99	11:54	261	95
9/21/99	13:21	244	87
9/21/99	14:47	235	86
9/21/99	16:15	250	88
9/21/99	17:36	246	81
9/21/99	19:09	265	93
9/25/99	10:56	261	94
9/25/99	12:34	266	98
9/25/99	14:08	270	94
9/25/99	15:29	267	81
9/25/99	16:54	251	85
9/25/99	18:20	247	86
8/1/99	11:00	254	91
8/1/99	12:24	255	84
8/1/99	13:33	131	69
8/1/99	15:04	272	91
8/1/99	16:29	244	85
8/1/99	17:59	260	90
8/1/99	19:29	254	90
8/6/99	10:01	256	95
8/6/99	11:24	260	83





TEXAS INSTRUMENTS

TI-83 Plus



Y=

F1

TBLSET

F2

FORMAT

F3

CALC

F4

TABLE

Y=

WINDOW

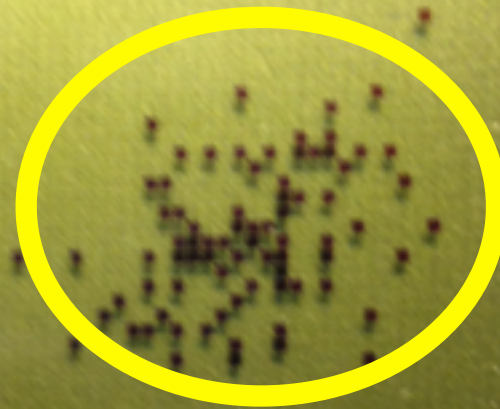
ZOOM

TRACE

GRAPH

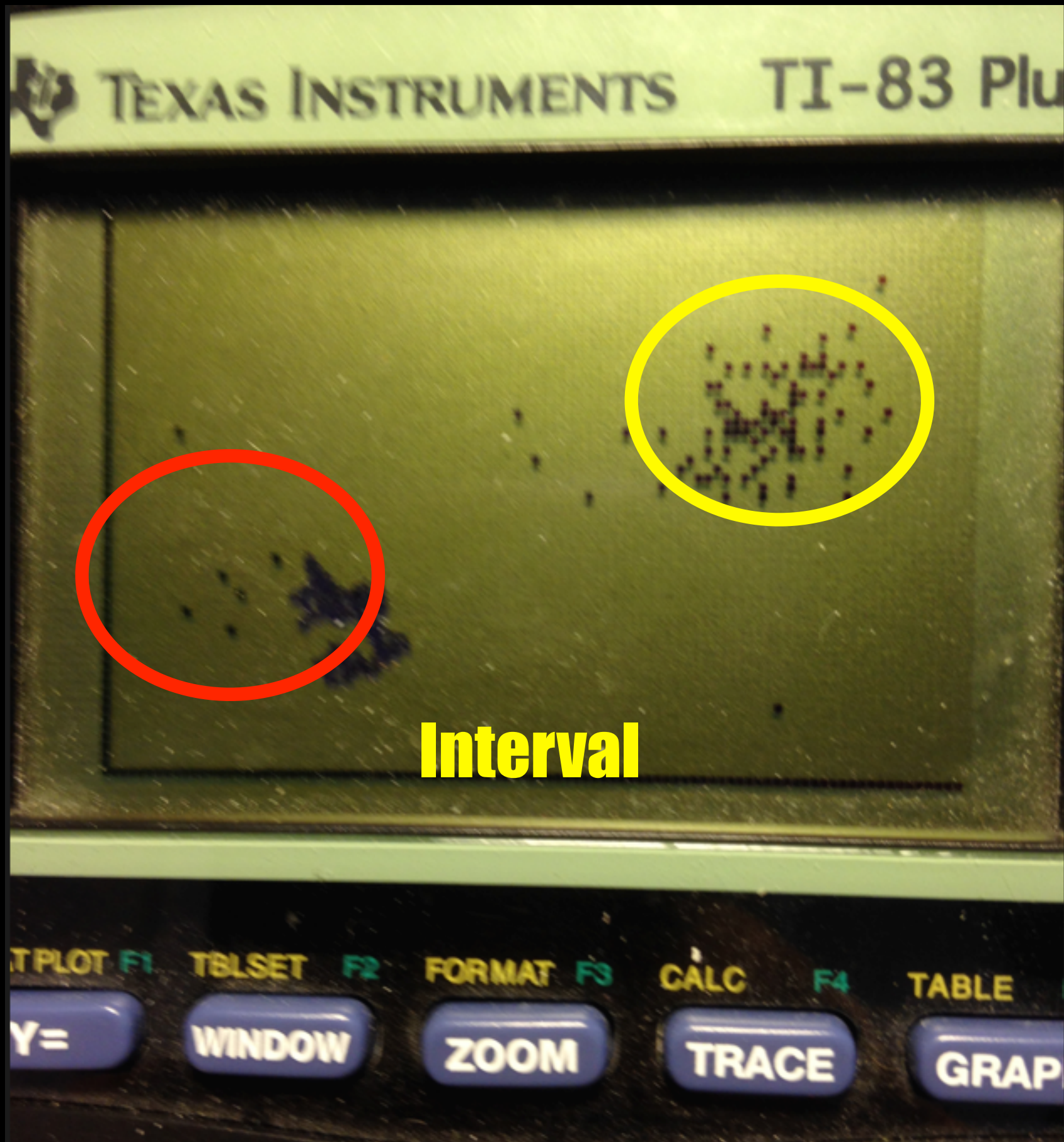


**Duration**



**Interval**

63

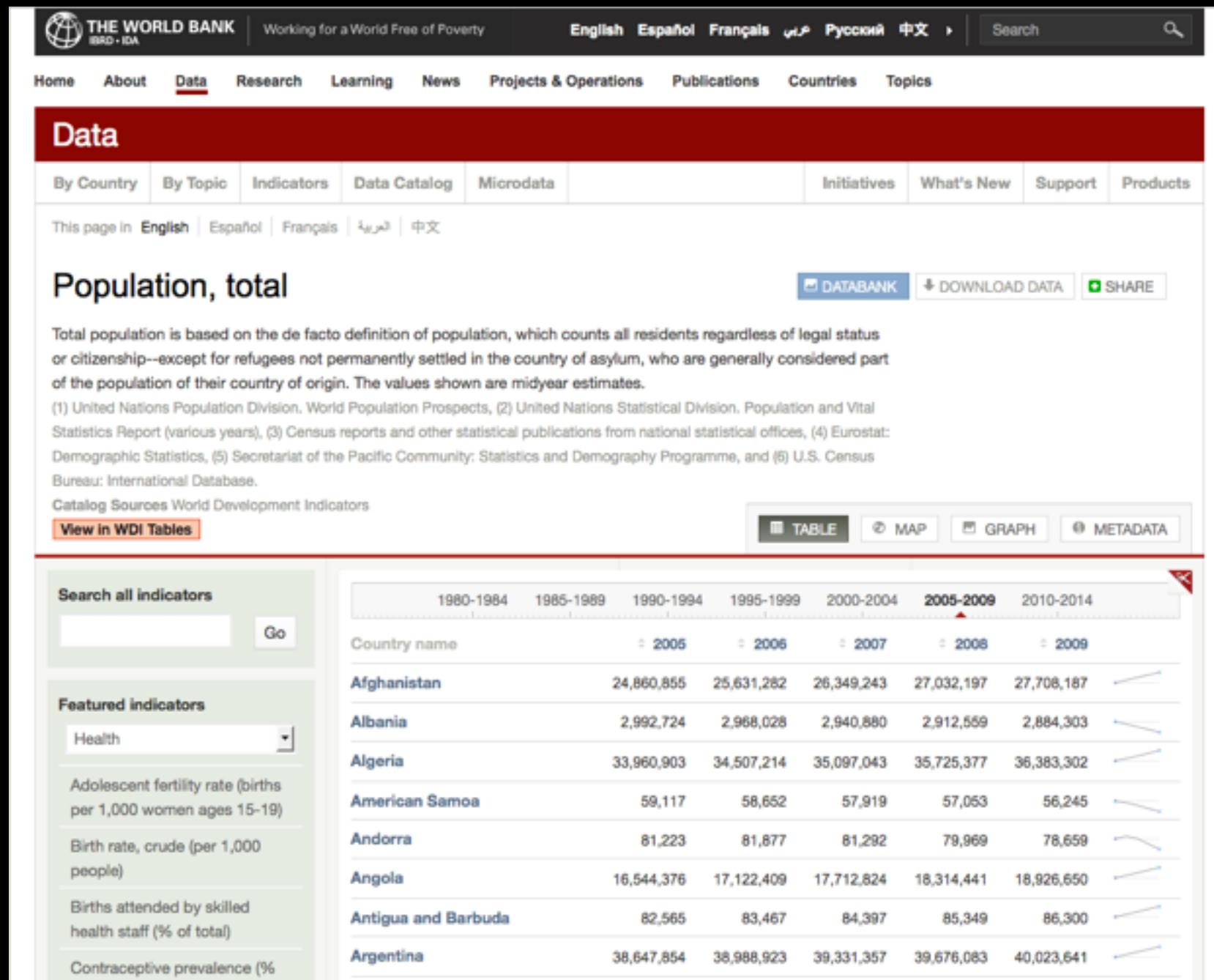


88



# High School Activity

<http://data.worldbank.org/indicator/SP.POP.TOTL?page=1>





**2014**  
People

## 2.1 World Development Indicators: Population dynamics

[Data](#) > [Data Catalog](#) > [World Development Indicators](#) > [Tables](#) > [2.1](#)

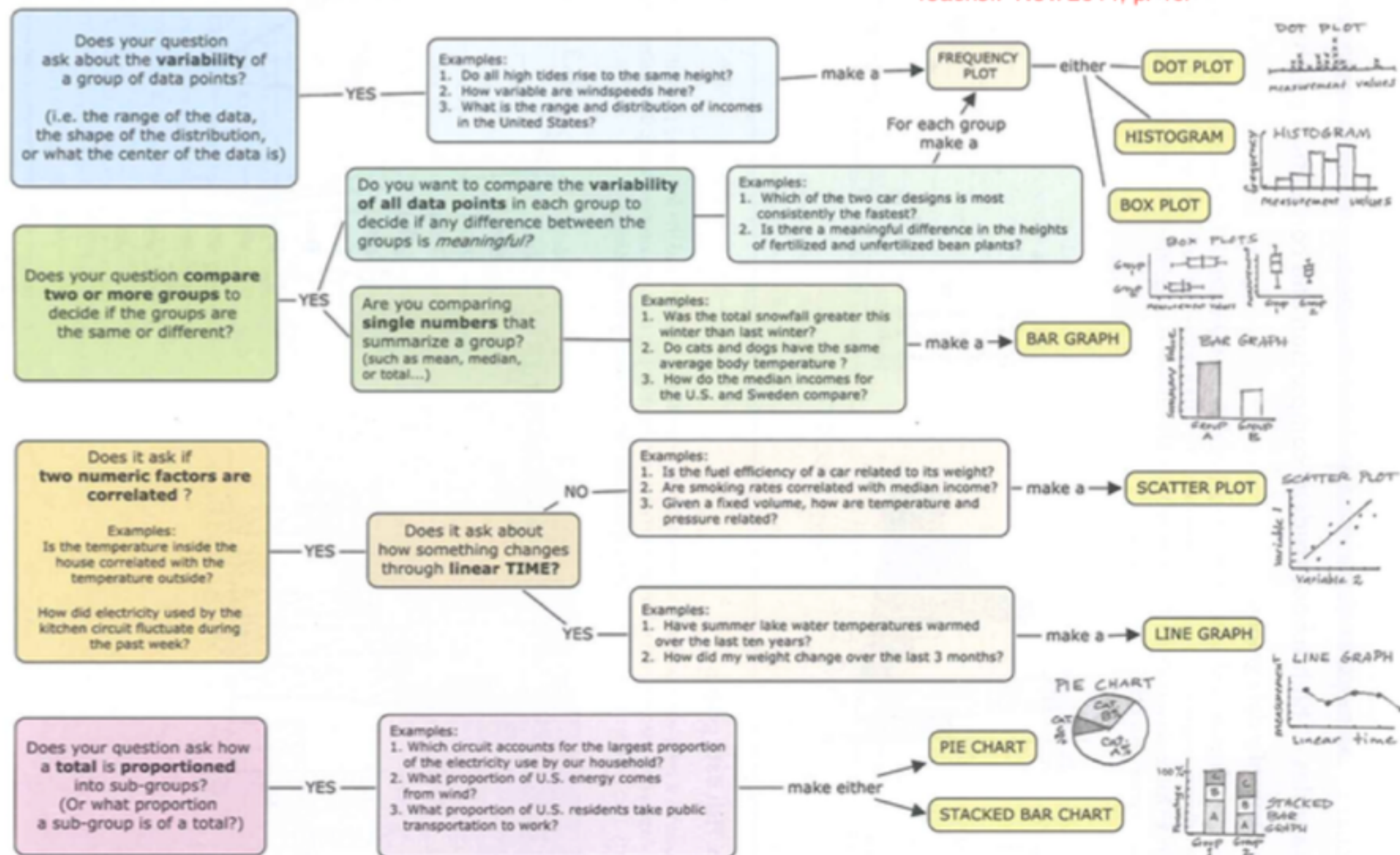
	Population			Average annual population growth %		Population age composition		
	millions					Ages 0-14	Ages 15-64	Ages 65+
	2000	2013	2025	2000-13	2013-25	% 2013	% 2013	% 2013
Afghanistan	20.6	30.6	39.6	3	2	47	51	2
Albania	3.1	2.8	3.0	-1	1	21	69	11
Algeria	31.7	39.2	46.5	2	1	28	68	5
American Samoa	0.1	0.1	0.1	0	1	..	..	..
Andorra	0.1	0.1	0.1	1	1	..	..	..
Angola	13.9	21.5	30.4	3	3	48	50	2
Antigua and Barbuda	0.1	0.1	0.1	1	1	25	68	7
Argentina	36.9	41.4	45.4	1	1	24	65	11
Armenia	3.1	3.0	3.0	0	0	20	69	10
Aruba	0.1	0.1	0.1	1	0	19	69	11
Australia	19.2	23.1	26.4	1	1	19	67	14
Austria	8.0	8.5	8.8	0	0	14	67	18
Azerbaijan	8.0	9.4	10.3	1	1	22	72	6
Bahamas, The	0.3	0.4	0.4	2	1	21	71	8
Bahrain	0.7	1.3	1.6	5	1	21	77	2
Bangladesh	132.4	156.6	177.9	1	1	30	65	5
Barbados	0.3	0.3	0.3	0	0	19	70	11
Belarus	10.0	9.5	8.8	0	-1	15	71	14
Belgium	10.3	11.2	11.5	1	0	17	65	18
Belize	0.2	0.3	0.4	3	2	34	62	4
Benin	6.9	10.3	13.9	3	2	43	54	3
Bermuda	0.1	0.1	..	0	..	..	..	..
Bhutan	0.6	0.8	0.9	2	1	28	67	5
Bolivia	8.5	10.7	12.8	2	2	35	60	5

FIGURE 2

# The Graph Choice Chart.

What question would you like to explore? Write your question as a complete sentence.

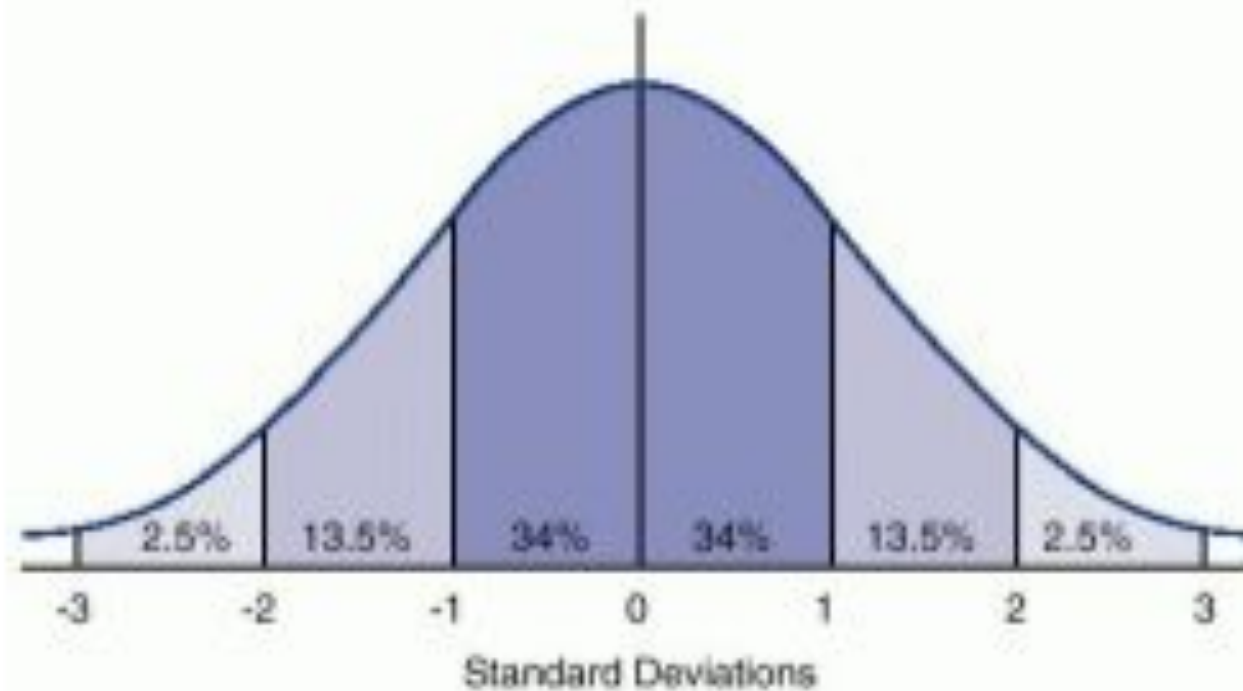
The Graph Choice. The Science Teacher. Nov. 2014, p. 40.





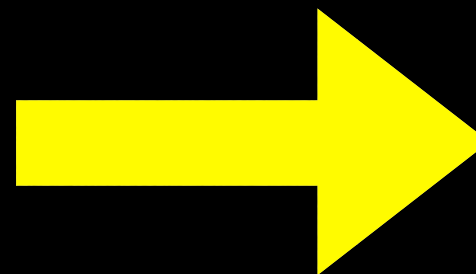
# Statistical Analysis



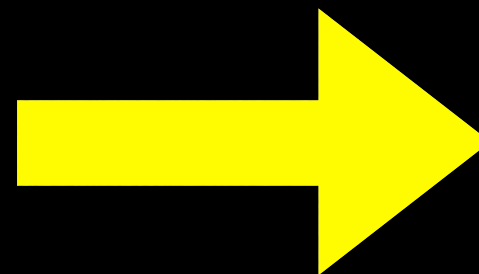


Normal distribution. The approximate percentage of the area (or frequency) lying under the curve between standard deviations is indicated.

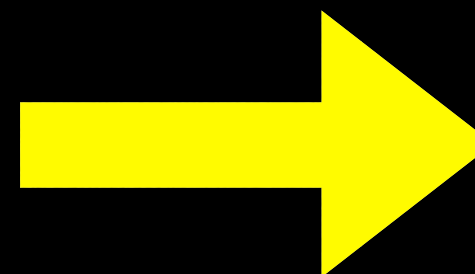




0 Heads

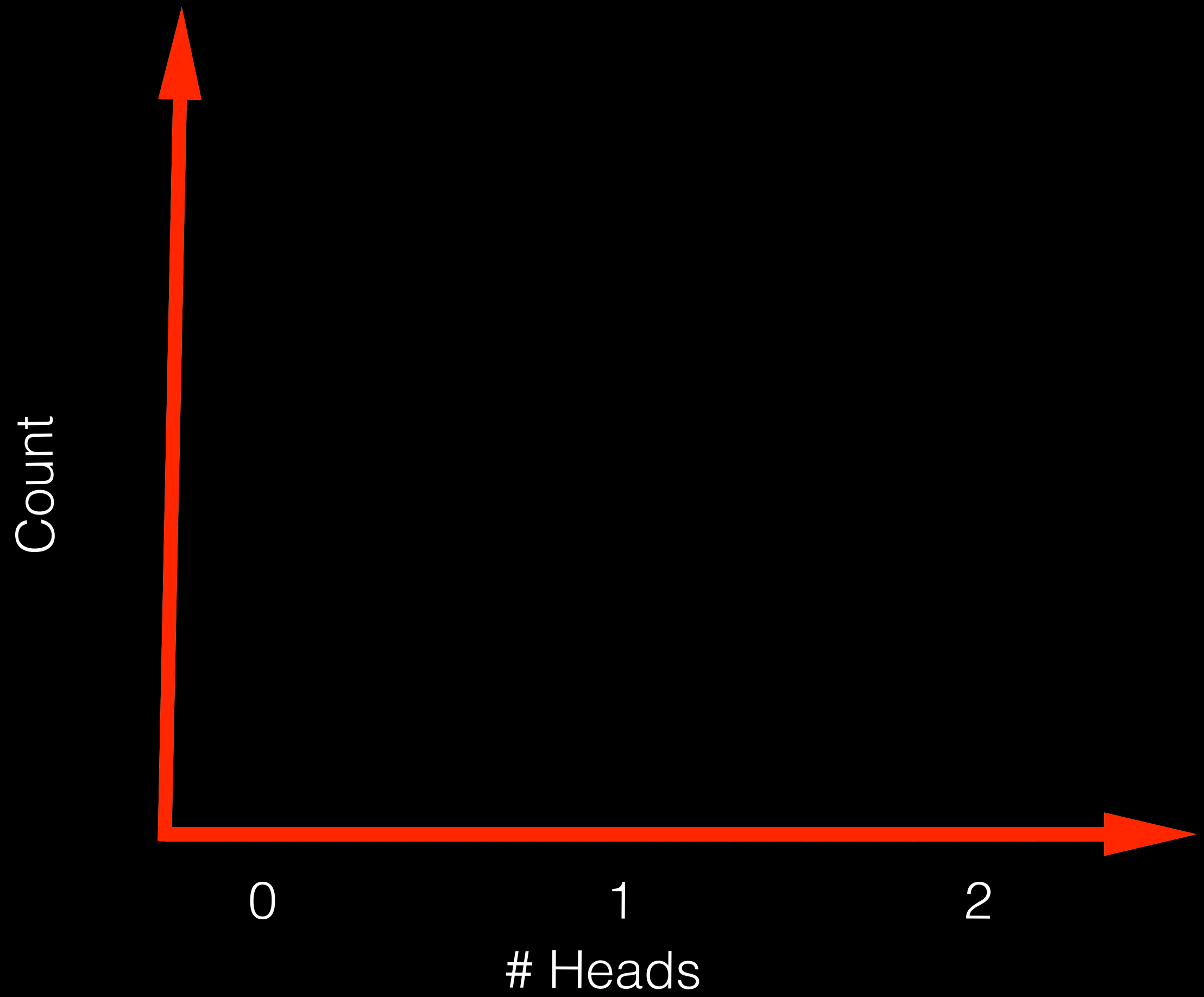


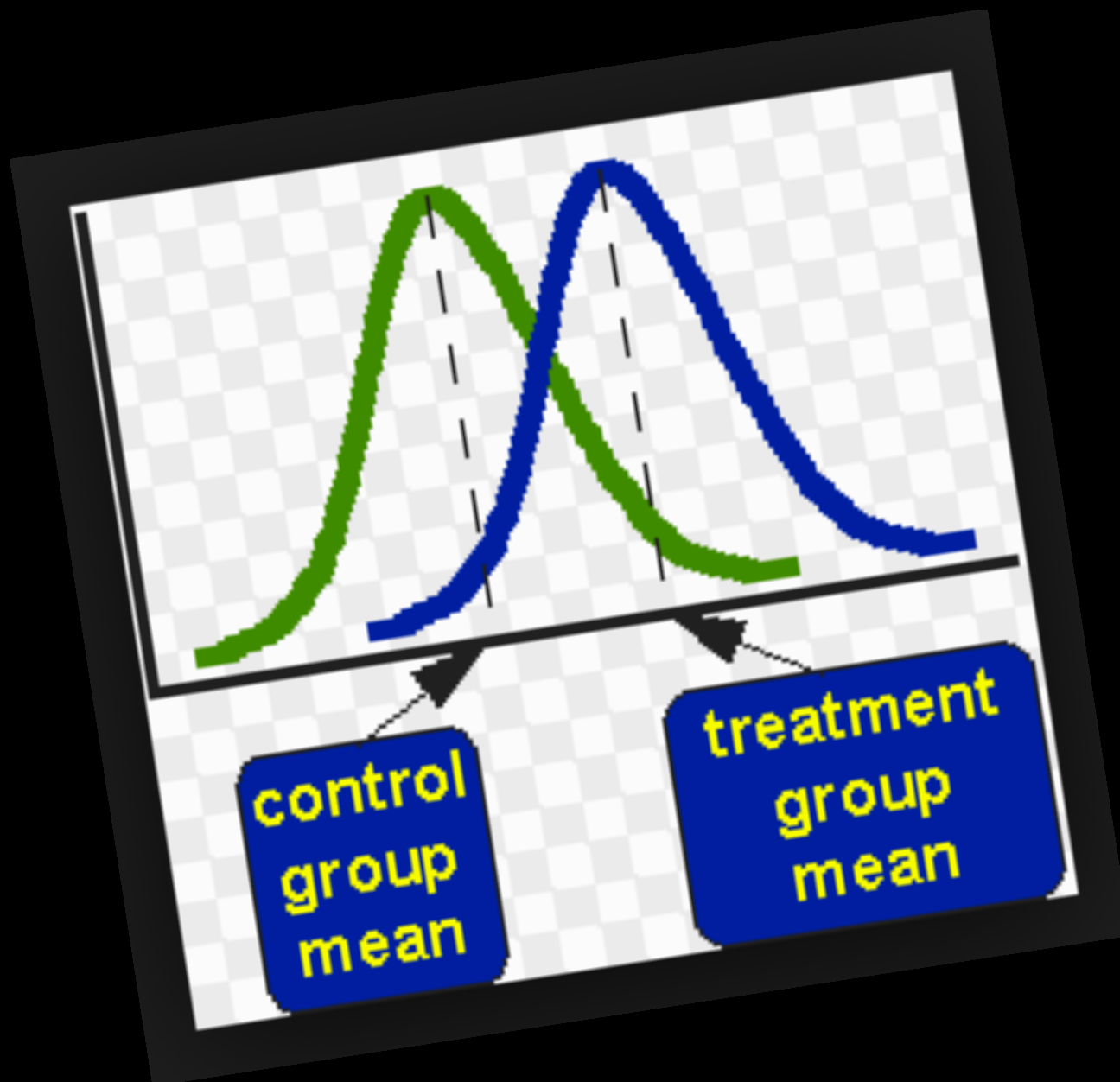
1 Head



2 Heads







t-test