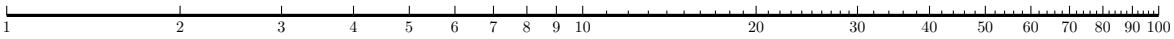
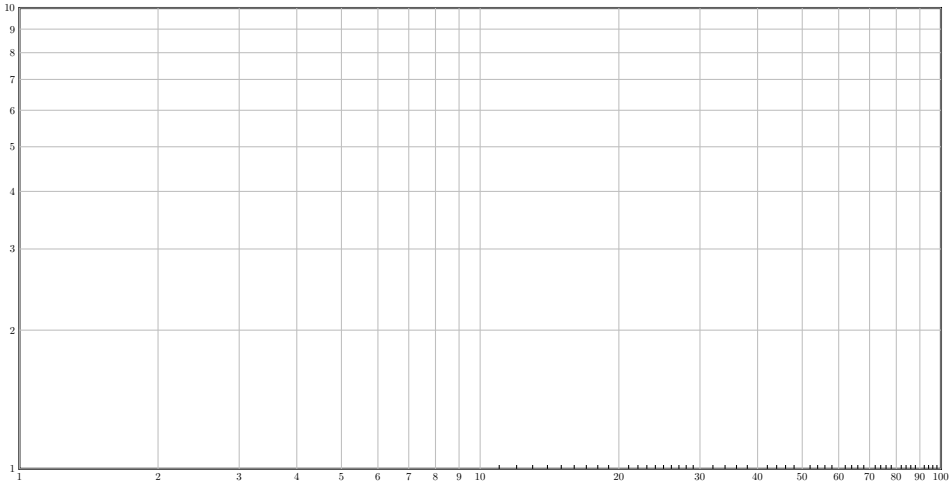
Logarithmic Scales 2 **Math 111 - Workshop**

1. **Benford's Law** asserts that in real world data, numbers beginning with a 1 (like 125, or 17, or 1903.72) are more common than numbers beginning with a 2 (like 28, or 207.4), which in turn are more common than numbers beginning with a 3, and so on. Look at the rule of proportion below from 1 to 100. Shade in the part of the rule that represents numbers beginning with a 1 (like 10, and 14.7, and 1.98, etc.). Then shade in the part of the ruler that corresponds to numbers beginning with a 9 (like 9.1, 9.7, 91.82, etc.). Can you think of a reason why Benford's Law might be true?



2. **Log-Log Scatterplots** A log-log plot is a plot where both the x and y-axes are log-scale. Use the axes below to plot the following data.

x	y
1	1
4	2
9	3
16	4
25	5
36	6
49	7
64	8
81	9



What do you think the correlation coefficient is for the scatter-plot above? How is it different from the correlation coefficient of the same data on a regular scatter-plot?

3. What is the log(89150)? Explain your reasoning.
   (a) 8.91
   (b) 4.95
   (c) 3.59
   (d) 5.19

4. Without a calculator, what is log(9750)? Explain your reasoning.
   (a) 3.99
   (b) 4.10
   (c) 3.15
   (d) 3.00

5. **Homework**. Make a scatter-plot in Excel showing this data.

Planet	Order	Orbital Radius (in AU)
Mercury	1	0.4
Venus	2	0.7
Earth	3	1
Mars	4	1.6
Asteroid Belt	5	2.8
Jupiter	6	5.2
Saturn	7	10
Uranus	8	19.6
Neptune	9	38.8

   (a) Right click on the y-axis (The axis with the orbital radius). Select `Format Axis` option and then select `Logarithmic Scale`.
   (b) Double click on the chart, and then right click on the data points and select `Insert Trend Line`. Under the options for the trend line, select `Exponential` and `Show Equation` and `Show R squared` (i.e., the coefficient of determination).
   (c) What do you notice about this graph? Is it a line (it should be)? If so, then you have just rediscovered the Titius-Bode law in astronomy.