

Optical Sensor (2C)

- Logarithmic Scale
- Photometric Unit

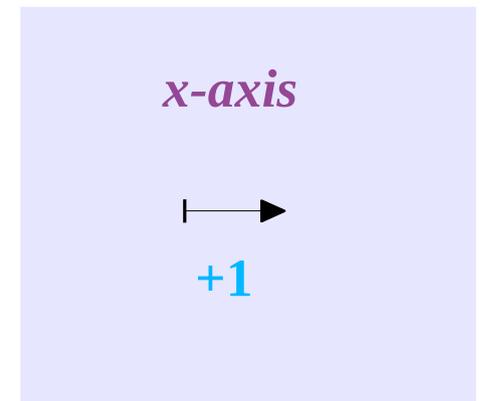
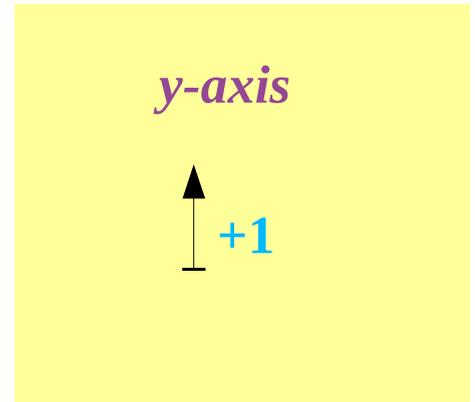
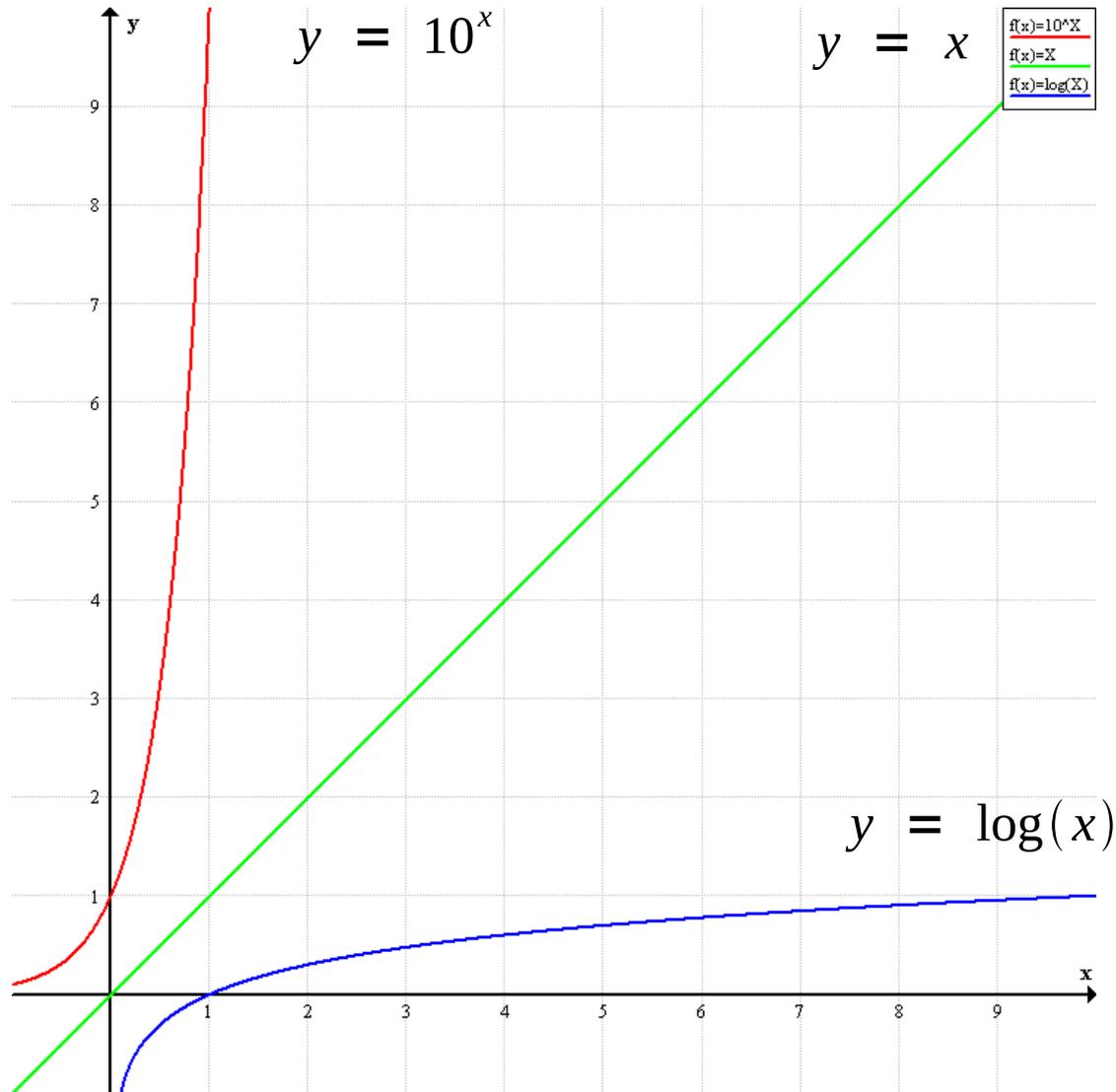
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Please send corrections (or suggestions) to youngwlim@hotmail.com.

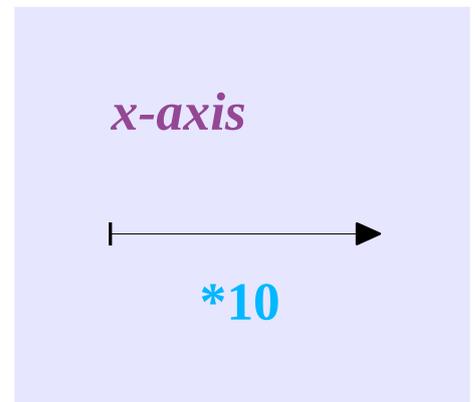
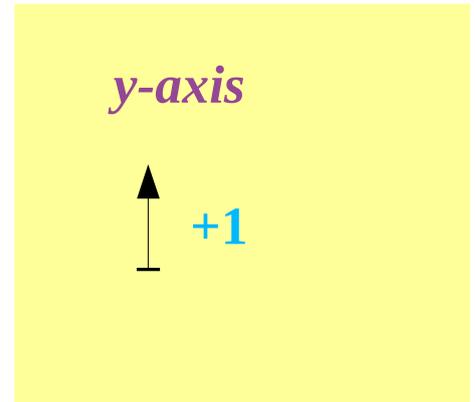
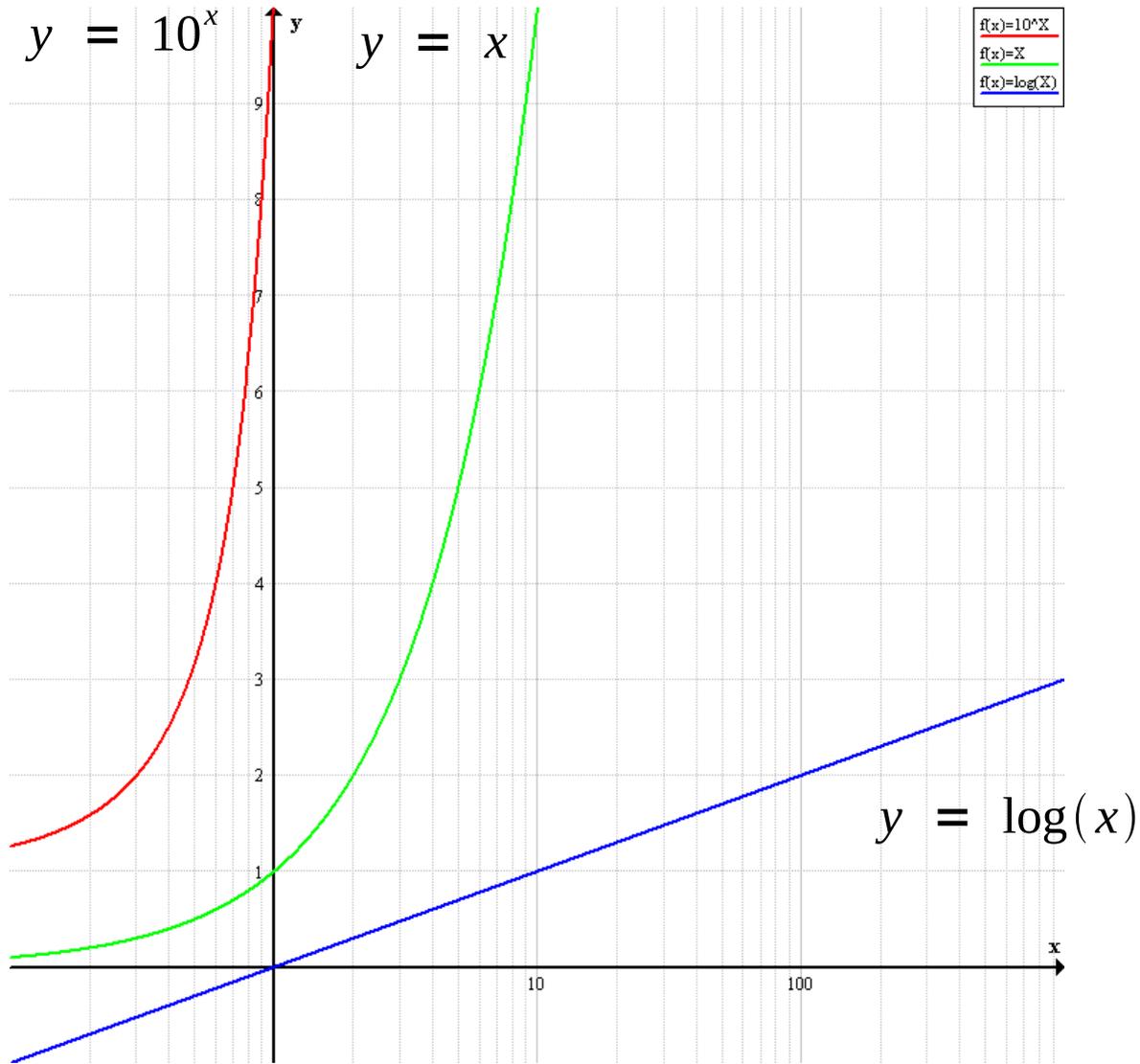
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Linear – Linear Scale



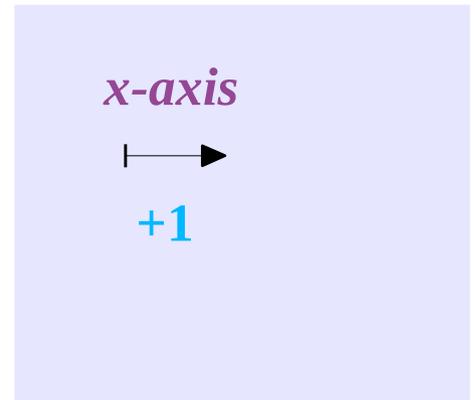
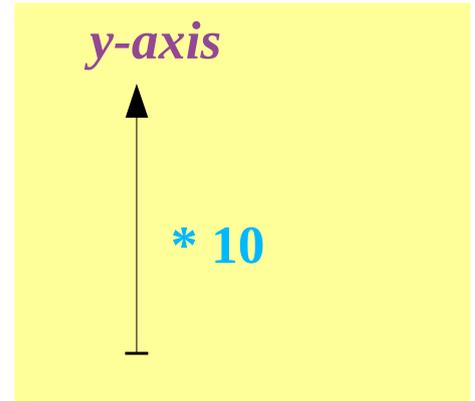
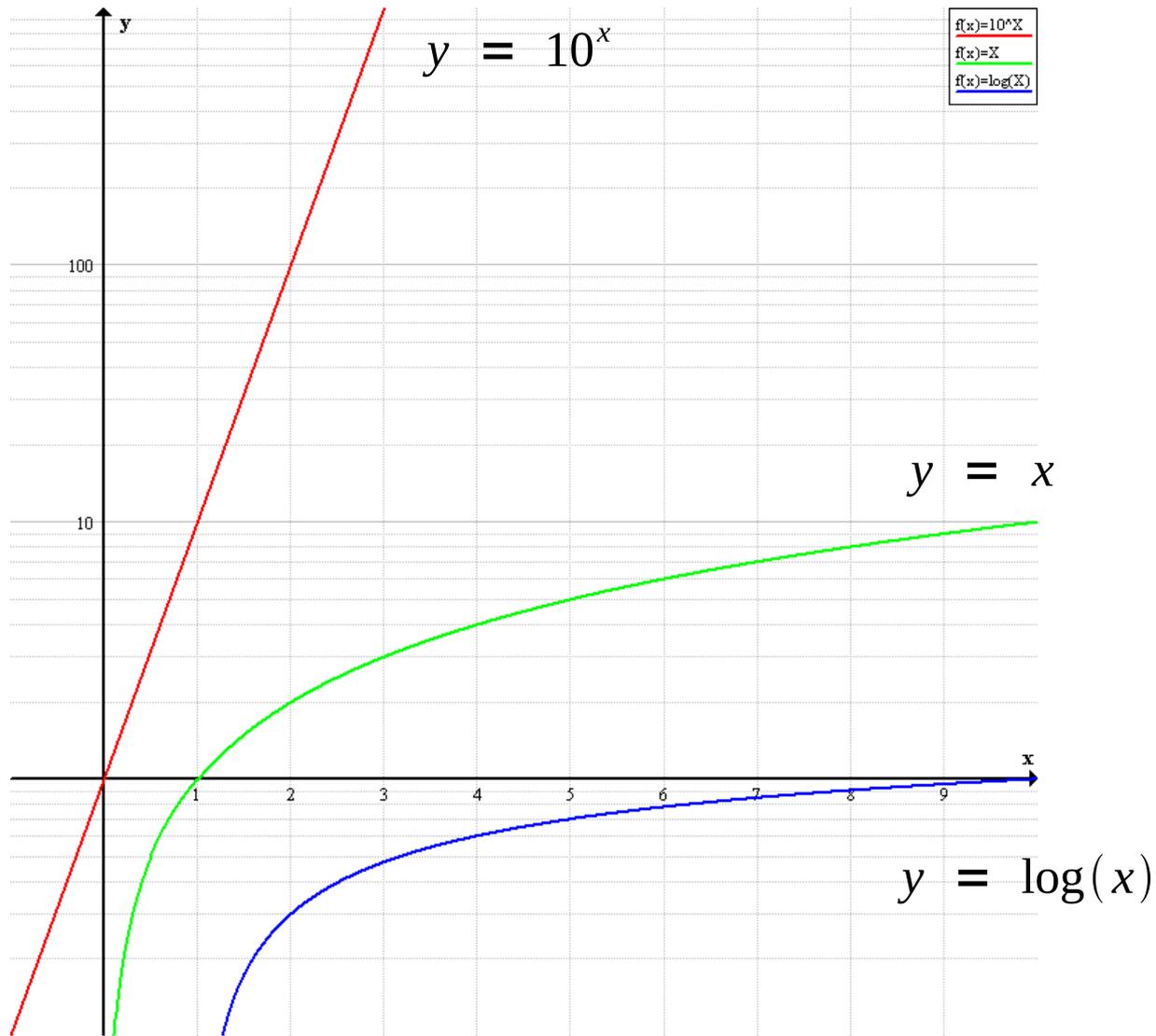
* A picture from Wikipedia

Linear – Log Scale



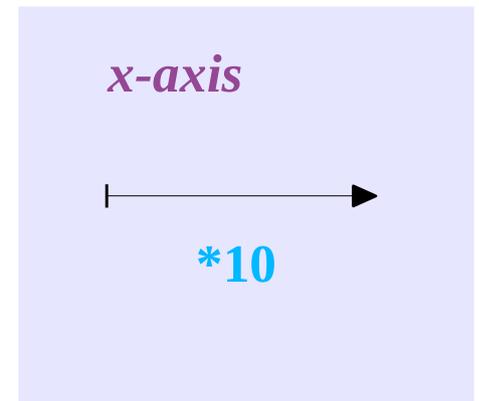
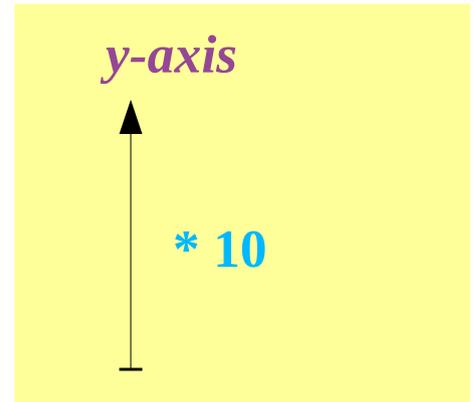
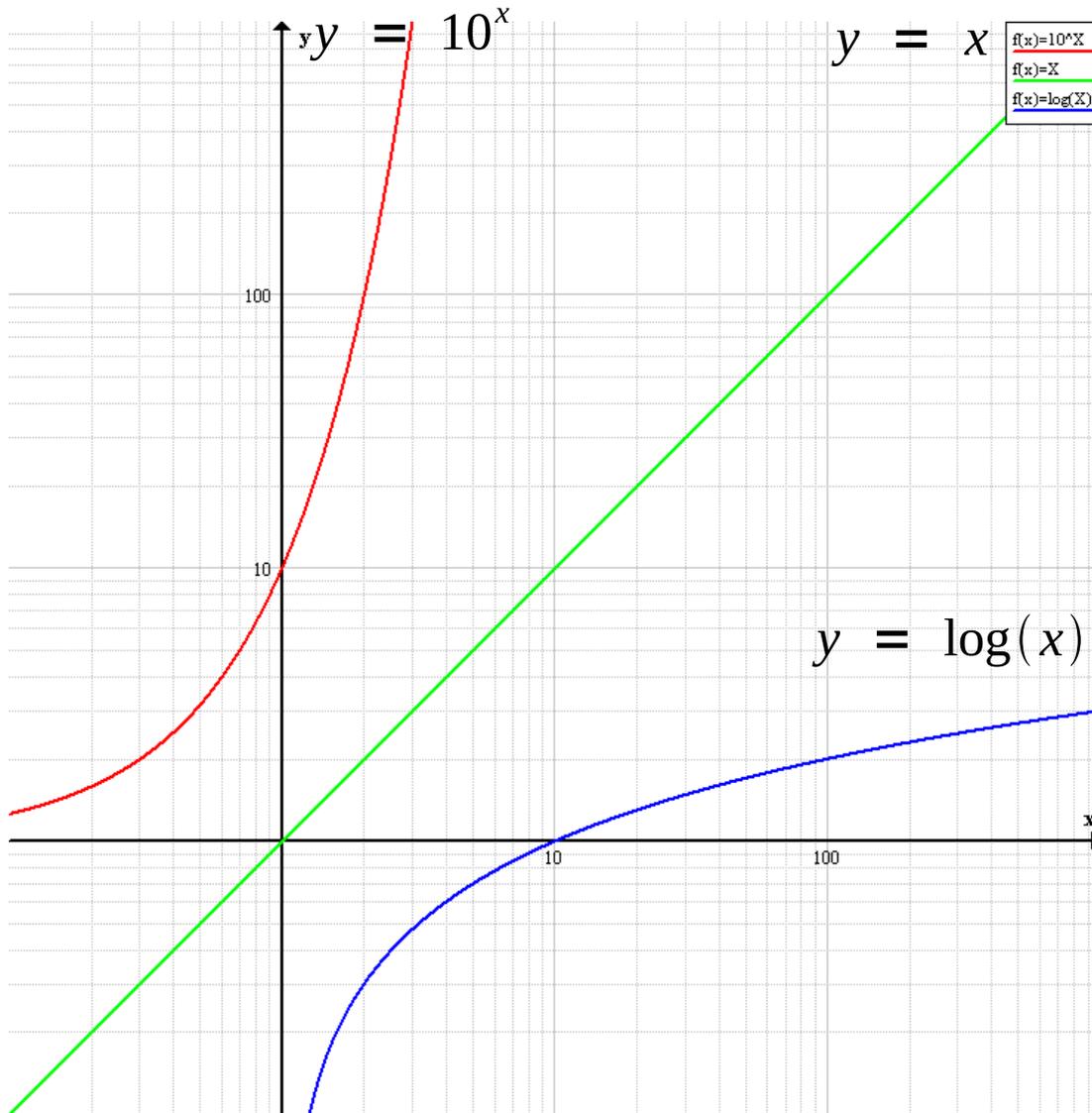
* A picture from Wikipedia

Log – Linear Scale



* A picture from Wikipedia

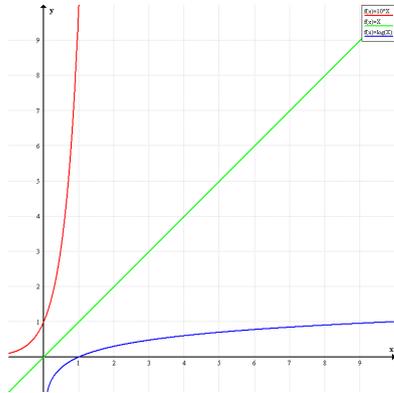
Log – Log Scale



* A picture from Wikipedia

Logarithmic and Semi-logarithmic Plots

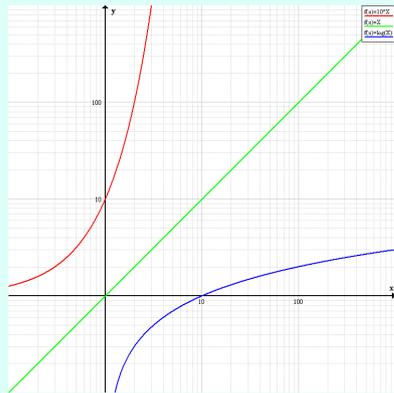
Linear



Linear

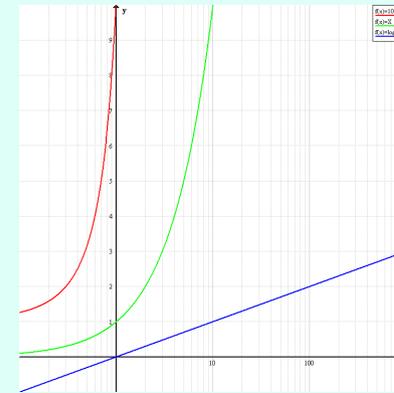
Logarithmic plots

Log



Log

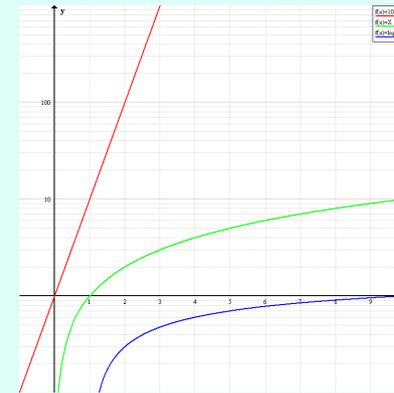
Linear



Log

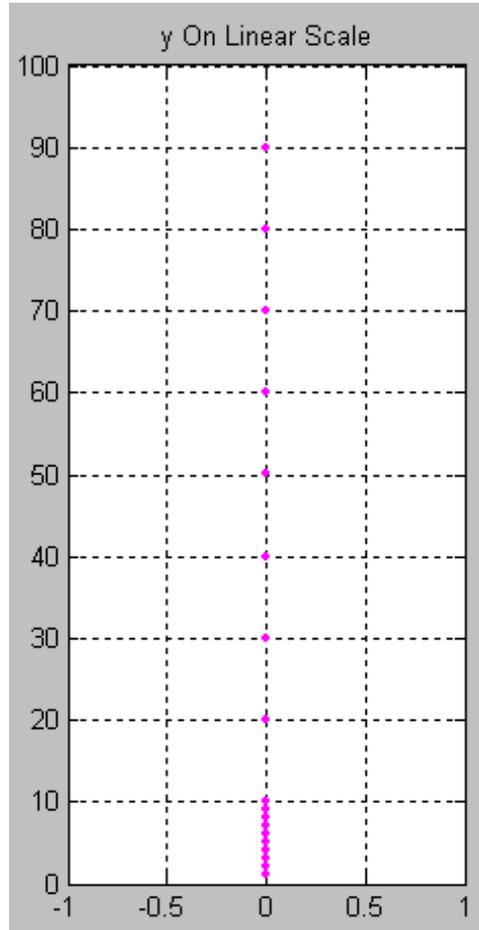
Semi-logarithmic plots

Log



Linear

Linear Scale Plot Example



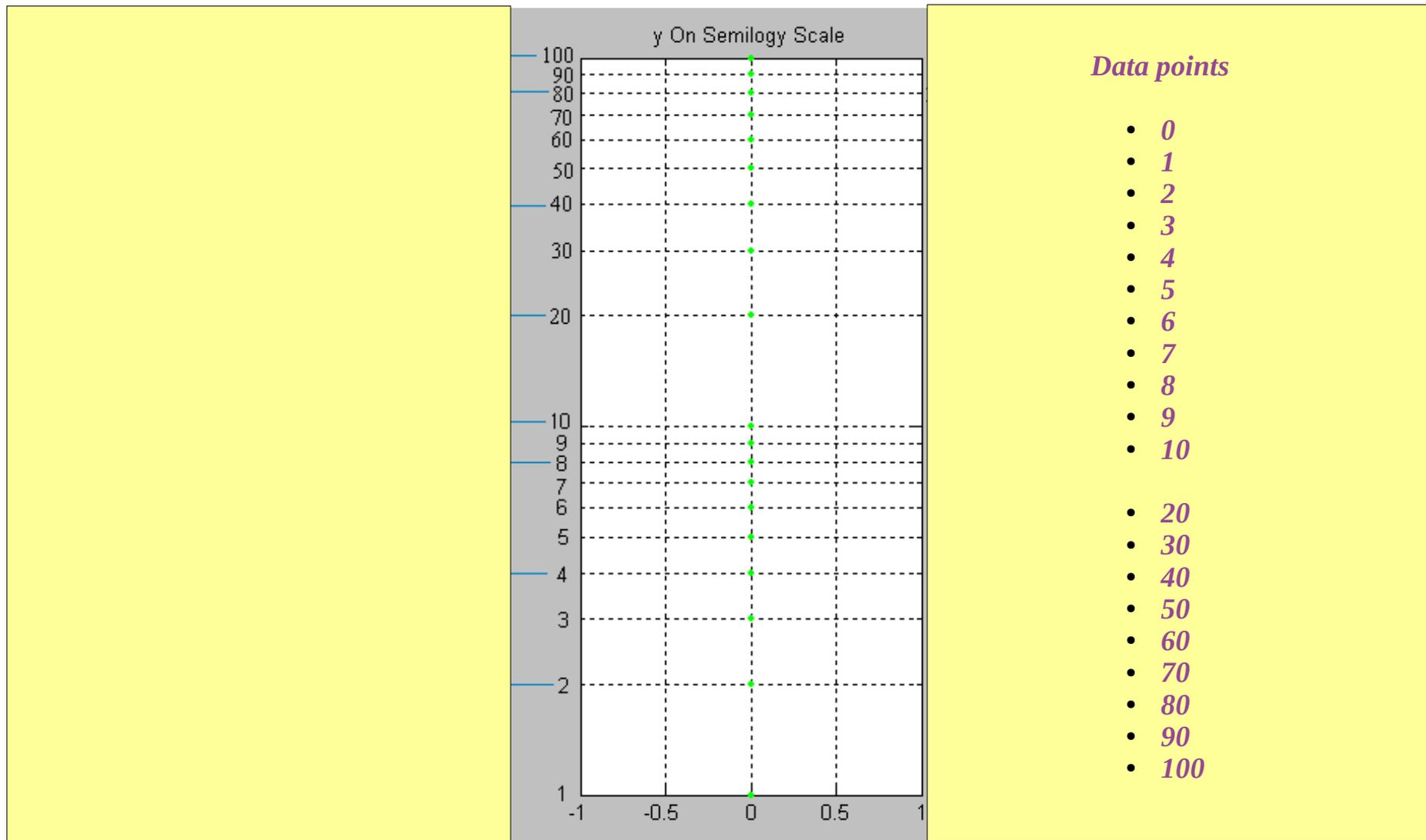
Data points

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

* A picture from Wikipedia

Semi-logarithmic Scale Plot Example (1)



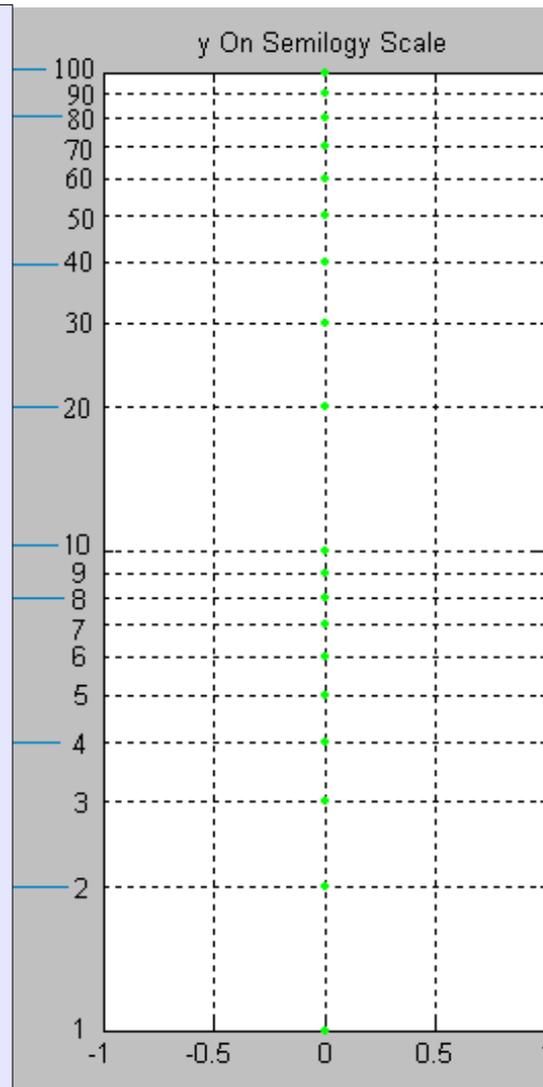
* A picture from Wikipedia

Semi-logarithmic Scale Plot Example (2)

Log values

-
- $\text{Log}(1) = 0.00$
- $\text{Log}(2) = 0.31$
- $\text{Log}(3) = 0.47$
- $\text{Log}(4) = 0.60$
- $\text{Log}(5) = 0.70$
- $\text{Log}(6) = 0.78$
- $\text{Log}(7) = 0.85$
- $\text{Log}(8) = 0.90$
- $\text{Log}(9) = 0.95$
- $\text{Log}(10) = 1.0$

- $\text{Log}(20) = 1.31$
- $\text{Log}(30) = 1.47$
- $\text{Log}(40) = 1.60$
- $\text{Log}(50) = 1.70$
- $\text{Log}(60) = 1.78$
- $\text{Log}(70) = 1.85$
- $\text{Log}(80) = 1.90$
- $\text{Log}(90) = 1.95$
- $\text{Log}(100) = 2.0$



Data points

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

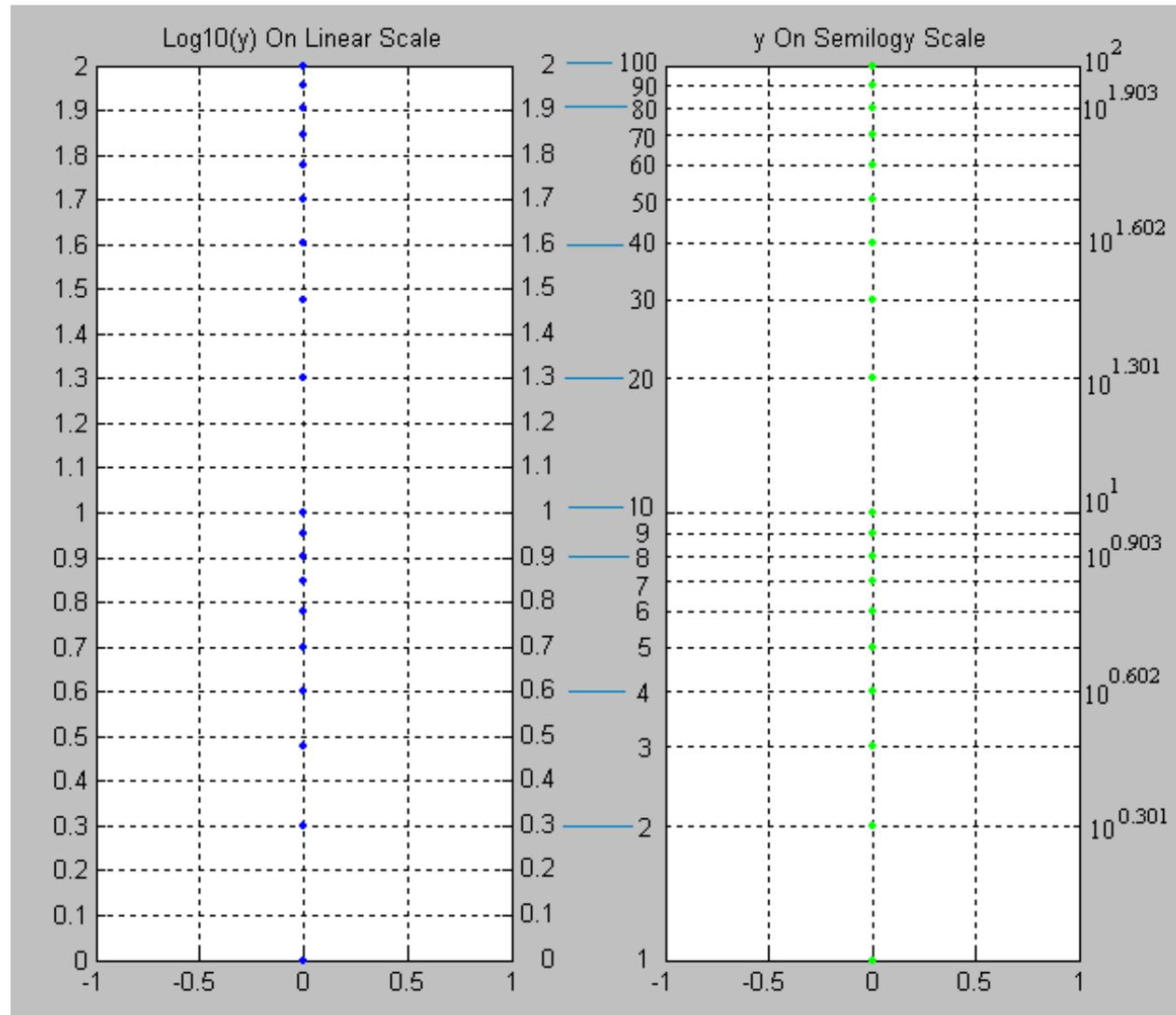
* A picture from Wikipedia

Semi-logarithmic Scale Plot Example (3)

Log values

- $\text{Log}(1) = 0.00$
- $\text{Log}(2) = 0.31$
- $\text{Log}(3) = 0.47$
- $\text{Log}(4) = 0.60$
- $\text{Log}(5) = 0.70$
- $\text{Log}(6) = 0.78$
- $\text{Log}(7) = 0.85$
- $\text{Log}(8) = 0.90$
- $\text{Log}(9) = 0.95$
- $\text{Log}(10) = 1.0$

- $\text{Log}(20) = 1.31$
- $\text{Log}(30) = 1.47$
- $\text{Log}(40) = 1.60$
- $\text{Log}(50) = 1.70$
- $\text{Log}(60) = 1.78$
- $\text{Log}(70) = 1.85$
- $\text{Log}(80) = 1.90$
- $\text{Log}(90) = 1.95$
- $\text{Log}(100) = 2.0$



$$\log(10^{1.903}) = 1.903$$

$$\log(10^{1.602}) = 1.602$$

$$\log(10^{1.301}) = 1.301$$

$$\log(10^1) = 1.0$$

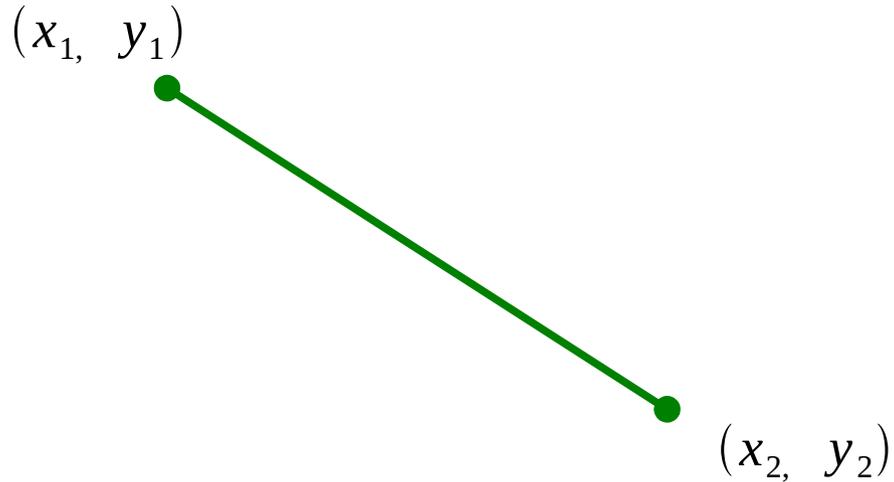
$$\log(10^{0.903}) = 0.903$$

$$\log(10^{0.602}) = 0.602$$

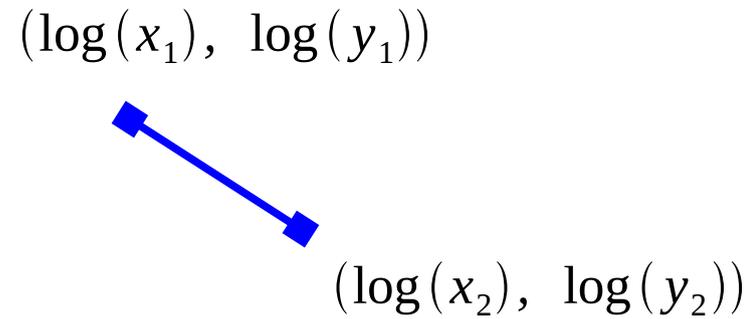
$$\log(10^{0.301}) = 0.301$$

* A picture from Wikipedia

Slope in a Logarithmic Plot (1)

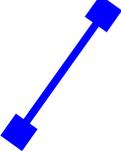


$$\text{slope } m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$



$$\begin{aligned} \text{slope} &= \frac{(\log(y_2) - \log(y_1))}{(\log(x_2) - \log(x_1))} \\ &= \frac{\log(y_2/y_1)}{\log(x_2/x_1)} \end{aligned}$$

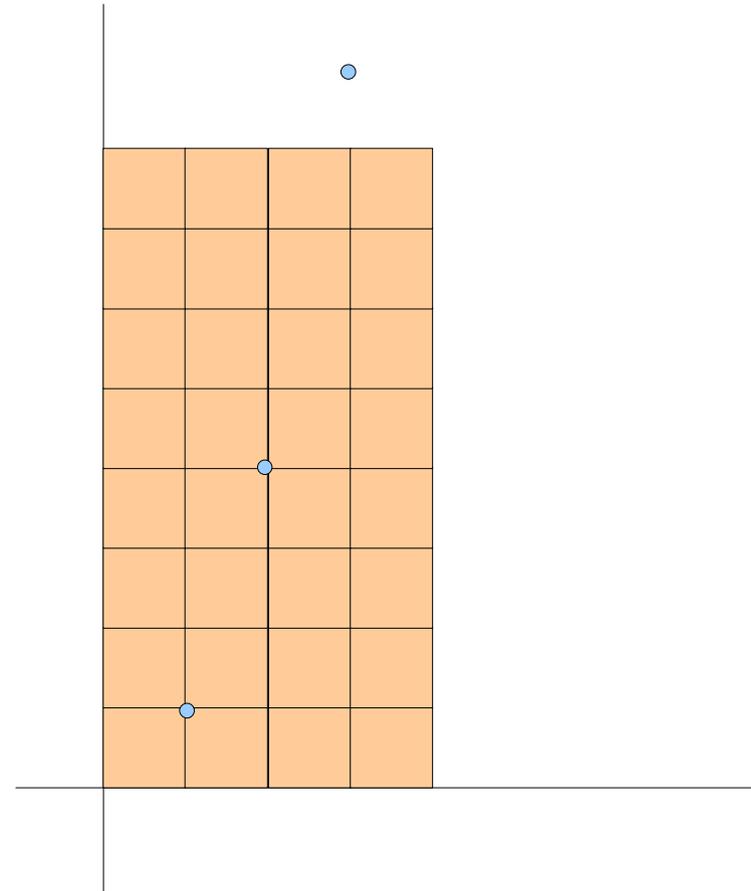
Slope in a Logarithmic Plot (2)

$(\log(x_2), \log(y_2))$

 $(\log(x_1), \log(y_1))$

$$\frac{\log(y_2/y_1)}{\log(x_2/x_1)} = 2$$

$$\log(y_2/y_1) = \log(x_2/x_1)^2$$

$$\left(\frac{y_2}{y_1}\right) = \left(\frac{x_2}{x_1}\right)^2$$



Photometric and Radiometric Units

Photometric Unit

- **Human eye's visual system**
- **More sensitive to some wavelengths than others**
- **Lux = lumen / meter²**

Radiometric Unit

- **Based on physical power**
- **All wavelengths are weighted equally**
- **Watt / meter²**

References

[1] <http://en.wikipedia.org/>