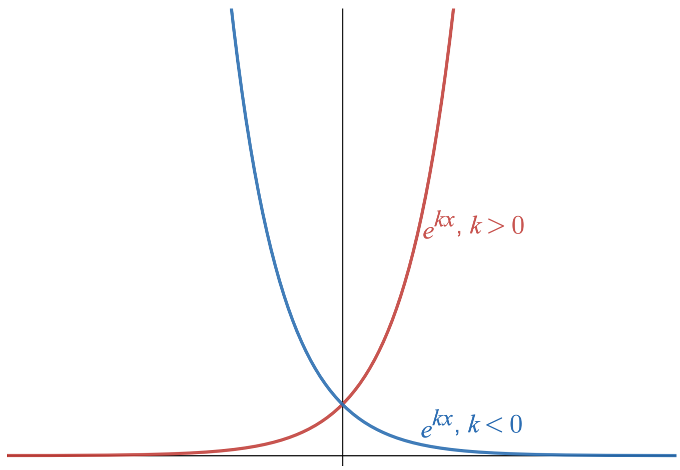
Semi-Log and Log-Log Plots

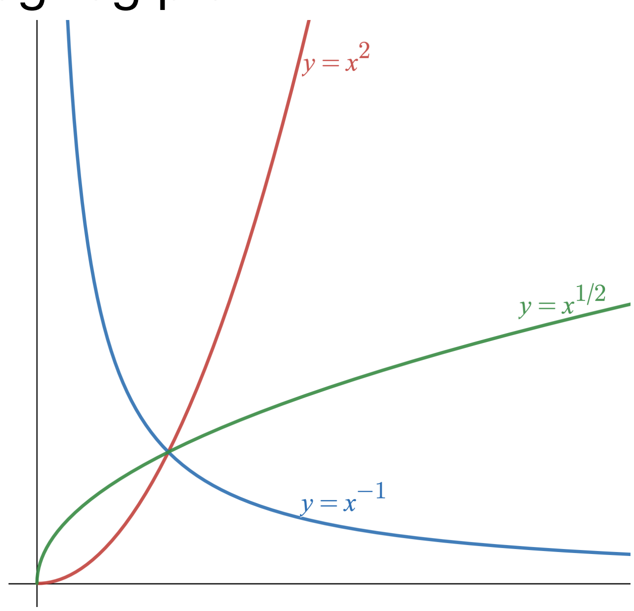
Exponential Functions

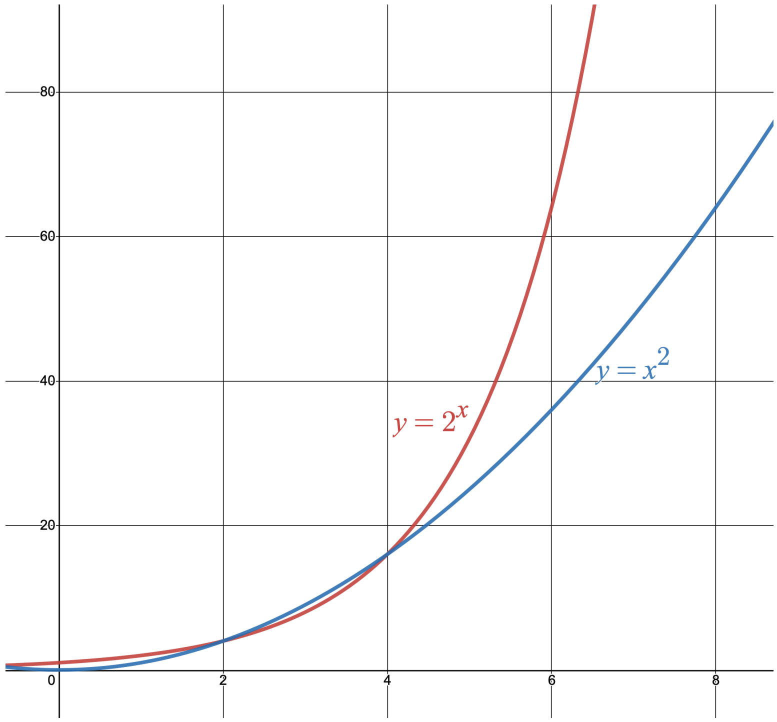
- Form: $y = Ae^{kx}$ where *A* and *k* are constants
- *y*-intercept is *A*
- Grows/decays faster than power function
- Linearized by semi-log plot



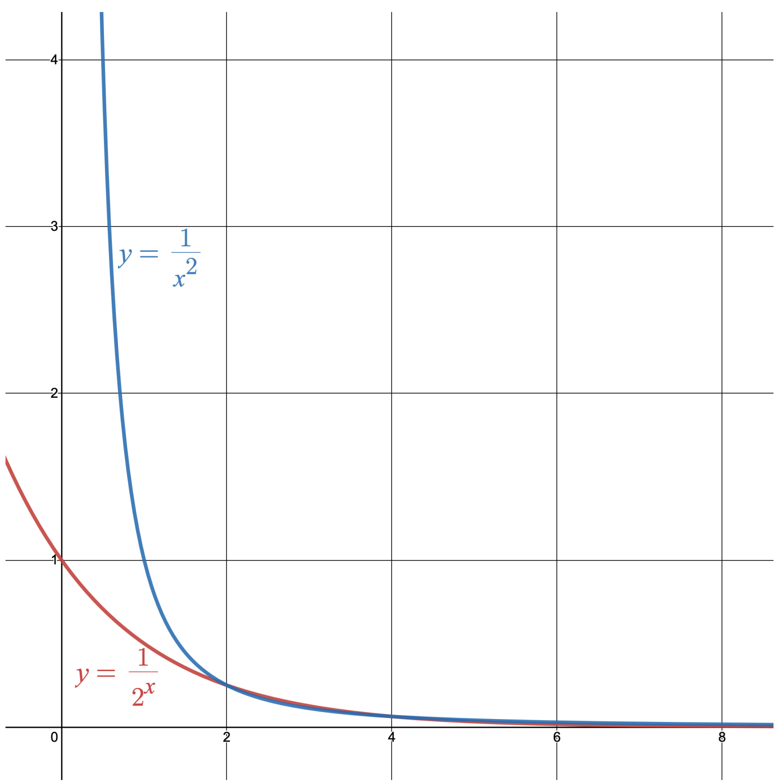
Power Functions

- Form: $y = kx^p$ where *k* and *p* are constants
- *p* can be +/- and is not necessarily an integer
- *y*-intercept is zero if *p* > 0, otherwise there is no *y*-intercept
- Linearized by log-log plot





exponential growth vs. a parabola



exponential decay vs. an inverse-square law

Semi-Log Plots

- One axis is on a logarithmic scale, the other on a linear scale
- Can be used to linearize exponential functions
- If ln(*y*) vs. *x* is linear
  - $y = Ae^{kx}$
  - slope = *k*
  - *y*-intercept = ln(*A*)

Log-Log Plots

- Both axes on logarithmic scales
- Can be used to linearize power functions
- If ln(*y*) vs. ln(*x*) is linear
  - $y = kx^p$
  - slope = *p*
  - *y*-intercept = ln(*k*)

Example: Radioactive Shielding

A Geiger counter is used to measure beta decay. The Geiger counter is placed a fixed distance away from the radioactive source and the counts (# of detected beta particles) in one minute is measured. Next, a layer of cardboard is inserted between the source and detector. The experiment is repeated for different numbers of layers.

Layers of Cardboard	0	1	2	3	4	5	6
Counts per minute	1840	1390	1038	785	592	430	323

Use an appropriate logarithmic transformation and a graph to determine an equation for the counts/min as a function of the number of layers of cardboard.

Example: Illuminance

A lux meter is used to determine the illuminance (luminous flux per area) at various distances from a light source.

Distance (m)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Illuminance (lx)	1457	330	136	73	45	30	22	18

Use an appropriate logarithmic transformation and a graph to determine the relationship between illuminance and distance.