Section 7.2: Inverse Functions

The essense of an inverse function is that it "undoes" what the function does: $f^{-1}(f(x)) = x$ (and $f(f^{-1}(x)) = x$, although we need to keep our eyes on domain and range). Let's take a look at a couple of the graphs we've been studying lately: **which functions can be inverted?**

Figure 1: http://upload.wikimedia.org/wikipedia/commons/d/de/Atmosphere_model.png; According to the National Center for Atmospheric Research, "The total mean mass of the atmosphere is 5.1480×10^{18} kg...." Notice the strange scale for the mass density.

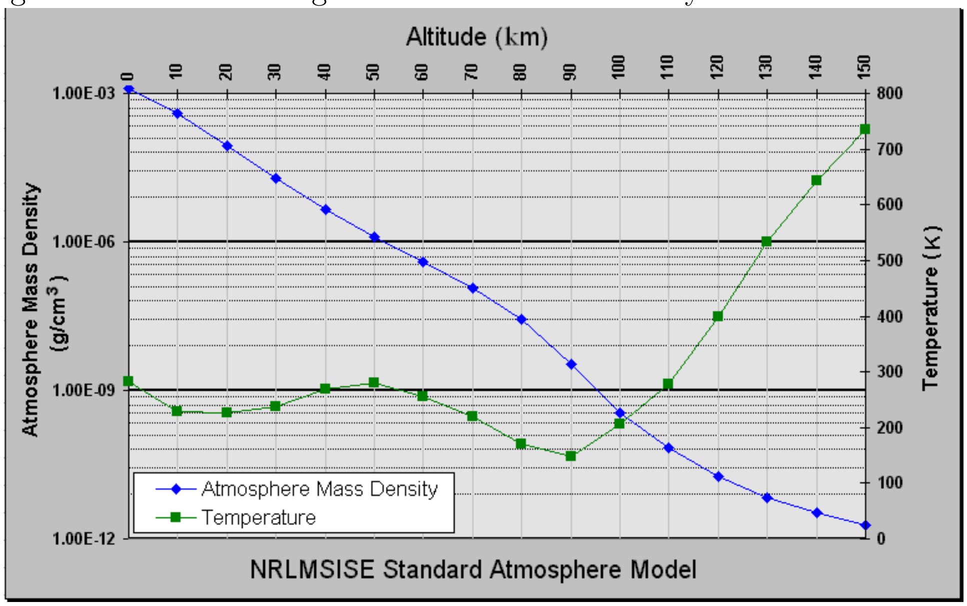
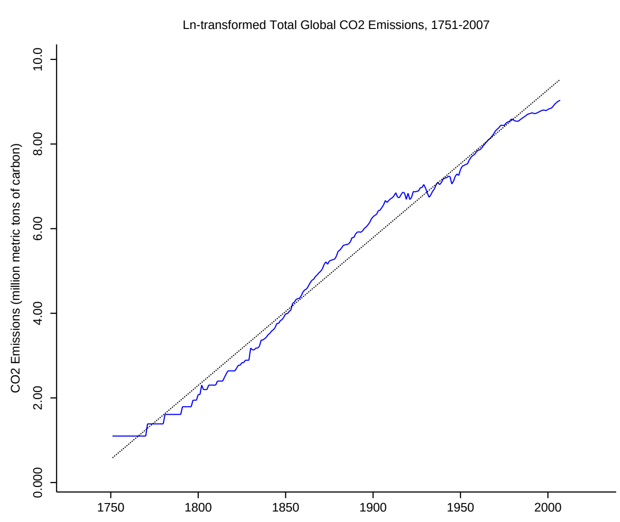
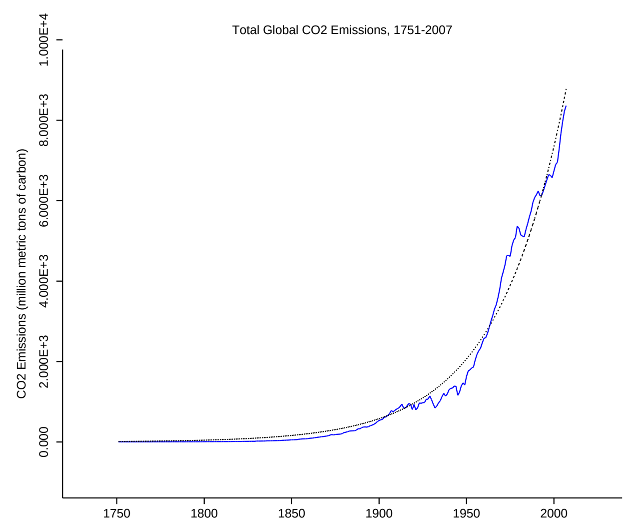


Figure 2: From http://cdiac.esd.ornl.gov/ftp/ndp030/global.1751_2007.ems. This data concerns Global CO2 Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring: 1751-2007. At left is the transformed data, with a linear fit. At right is the original data, and an exponential Emissions model given by $E(t) = e^{8.9+0.025(t-2000)}$, derived from non-linear regression.





1. In Figure 1, assume that the model functions for temperature and density are given by their graphs, the continuous curves connecting the data values.

(a) At what altitude is the temperature equal to 200^o K?

(b) At what altitude is the atmospheric mass density equal to 1e-6? 1e-7?

What important properties of these functions' derivatives relate to their invertibility?

2. In Figure 2, is the continuous function invertible that is obtained by connecting the raw data?

3. In Figure 2, is the continuous function invertible that is obtained by modeling the raw data?

4. In Figure 2, in what year did emissions hit 4e+3 million metric tons? [I hope that you're in something of a quandary on this one....]