Problem 2, Part b, c

The rule of 72 gives *annual* growth rates, so there is no need to divide by the number of years. I fumbled that part a bit.

Problem 2, Part d

To standardize a random variable, you subtract the mean and divide by the *standard deviation*. But the problem tells us to divide by the variance instead. The mean is

$$\begin{aligned} E[z] &= E\left[\frac{x-6}{4}\right] \\ &= E[x/4] - E[6/4] \\ &= \frac{1}{4}E[X] - \frac{6}{4} \\ &= \frac{6}{4} - \frac{6}{4} \\ &= 0. \end{aligned}$$

Then for variance,

$$\begin{aligned} Var(z) &= Var\left(\frac{x-6}{4}\right) \\ &= \frac{1}{4^2}\left[Var(x) + \underbrace{Var(6)}_{0}\right] \\ &= \frac{4}{16} \\ &= 1/4 \\ \implies \quad \sigma &= 1/2. \end{aligned}$$

The moral of the story is this: to find the new standard deviation, just take the old standard deviation (2) and divide it by whatever is in the denominator. For example,

$$SD\left(\frac{x-6}{4}\right) = \frac{2}{4},$$
$$SD\left(\frac{x-6}{2}\right) = \frac{2}{2},$$
$$SD\left(\frac{x-6}{7}\right) = \frac{2}{7}.$$

This problem asks for the top one. Therefore the standard deviation is $\sigma = 1/2$.

Question 3, part a

So freduse doesn't work for everyone. Here's how you can import it manually. First, download SPASTT01USM661 from at `https://fred.stlouisfed.org/series/SPASTT01USM661N` and import it into Stata (use the csv). Then type in the following:

```
generate date2 = date(date, "YMD")
generate months = mofd(date2)
tsset months, monthly
```

Now you should be able to do the time series stuff, e.g. `tsline spastt01usm661n`.

Question 3, part a

Remember how I repeated "the slope of `lnSPA` is the annual growth rate" like, six times? Yeah well, if we find the line of best fit, then that gives the approximate annual growth rate. So if you type `regress spastt01usm661n months`, the coefficient for months gives the average annual rate, which is the slope of `twoway line lnSPA months || lfit lnSPA months`