Tutorial Worksheet, 02/08/2016

Instructions: Please work in groups of 3 or 4 students. Please work with students who will attend the same recitation section. You do not turn this worksheet in at the end of class; instead, attendance will be recorded so that you get credit for participating in this activity.

02/08: Functions and Graphs

Exercise 2.2.2. For the following experiments, determine the independent variable and the dependent variable, and draw a simple graph or give a brief verbal description (your best guess) of the function relating the two.

(a) A rabbit population size is a function of the number of coyotes in the region.

(b) An agronomist, interested in the most economical rate of nitrogen application to corn, measures the corn yield in test plots using eight different levels of nitrogen application.

(c) An enzyme, E, catalyzes a reaction converting a substrate, S, to a product, P, according to

$$\mathrm{E} + \mathrm{S} \rightleftarrows \mathrm{ES} \rightleftarrows \mathrm{E} + \mathrm{P}.$$

Here's a reference for enzyme kinetics:

`https://en.wikipedia.org/wiki/Enzyme_kinetics`

Please solve the following exercise using RStudio (preferred) or a graphing calculator.

Exercise 2.4.2 Let $F(x) = \sqrt[3]{x}$. The polynomials

$$P_2(x) = \frac{5}{9} + \frac{5}{9}x - \frac{1}{9}x^2 \quad \text{and} \quad P_3(x) = P_2(x) + \frac{5}{81}(x-1)^3$$

closely approximate F near the point $(1, 1)$ of the graph of F.

(a) Draw the graphs of F and P_2 on the interval $[0, 3]$, meaning $0 \leq x \leq 3$.

(b) Compute the relative error in $P_2(2)$ as an approximation to $F(2) = \sqrt[3]{2}$.

(c) Draw the graphs of F and P_3 on the interval $[0, 3]$.

(d) Compute the relative error in $P_3(2)$ as an approximation to $F(2) = \sqrt[3]{2}$.

Solve the following problem by computing $f(g(x))$ and its domain algebraically, but then sketch the graph of $f(g(x))$ using RStudio (preferred) or a graphing calculator. Use the sketch to determine the range of $f(g(x))$.

Exercise 2.7.7 Compute the composition, $f(g(x))$, of each of the following pairs of functions. In each case, specify the domain and range of the composite function; and sketch its its graph.

(a) $f(z) = \dfrac{1}{1+z}$; $g(x) = x^2$

(b) $f(z) = \dfrac{z}{1+z}$; $g(x) = \dfrac{x}{1-x}$

(c) $F(x) = 5^z$; $g(x) = \ln x$

Please solve parts (d) through (i) of Exercise 2.7.7 as part of your self-study of Chapter 2.