MAT 201
Assignment 3

Thursday, February 12, 2015

For full credit on these problems, each must be submitted with a complete and clear solution, showing all of your work. You may work with other classmates on these problems, but please indicate on your assignment if you received help. Partial answers and incomplete solutions may be eligible for some partial credit, depending on the level of completeness and demonstrated understanding.

1. Consider the function $f(x) = (x-1)^3 + 7$.
   (a) Find the inverse $f^{-1}(x)$.
   (b) Graph both $f(x)$ and $f^{-1}(x)$ on the same set of axes.
   (c) Find $\left(f \circ f^{-1}\right)(x)$ and $\left(f^{-1} \circ f\right)(x)$.

2. Consider the function $f(x) = \sec x$, which is the reciprocal of the cosine function. That is $\sec x = 1/\cos x$.
   (a) Graph $f(x) = \sec x$.
   (b) Explain why $f(x)$ is not one-to-one.
   (c) Restrict the domain of $f(x)$ so that the function is now one-to-one.
   (d) Find the inverse function (the arcsecant) of the remaining function, and give the domain and range of this inverse.
   (e) Graph the function $g(x) = \operatorname{arcsec} x$.

3. Solve the following equations for x.
   (a) $4^{2x-1} = 64$
   (b) $\left(\frac{1}{3}\right)^x = 27$
   (c) $5 = e^{3x}$
   (d) $\ln(x+4) = 7$

4. Suppose that the population P of a city was 10000 in the year 2010, and grew to 11500 by the year 2015, and suppose that we want to model the population according to an exponential model,
$$P(t) = P_0 e^{r\,t},$$
where t represents the number of years since 2010.
   (a) Find approximate values for P_0, the initial population, and r, the growth rate.
   (b) According to this model, what will be the appproximate population in the year 2025?
   (c) According to this model, in what year will the population be approximately 23000?