1. Intro to limits at infinity:
   (a) What is $lim_{x\to\infty}\frac{1}{x}$? (Hint: picture the graph.)
   (b) What is $lim_{x\to\infty}\frac{1}{x^n}$ where $n \geq 1$?
   (c) Use the above facts and some algebra to evaluate $lim_{x\to\infty}\frac{x^3+3x+1}{5x^3-2x^2+17x-\pi}$
2. Fill in the boxes in the following definitions.
   (a) The line $\square$ is called a *vertical asymptote* of a function f if $\lim_{x\to\square} f(x) = \square$.
   (b) The line $\square$ is called a *horizontal asymptote* of a function f if $\lim_{x\to\square} f(x) = \square$ or $\lim_{x\to\square} f(x) = \square$.
3. Find the vertical and horizontal asymptotes of the following functions.
   (a) $h(x) = \frac{x^2-9}{x(x-3)}$
   (b) $f(x) = e^{1/x}$
   (c) $g(x) = \frac{\cos x + 2\sqrt{x}}{\sqrt{x}}$
4. Let $g(x) = x^{1/3}$.
   (a) Write the expression for the slope of the secant line that passes through $(0, 0)$ and $(h, g(h))$.
   (b) Calculate the limits of the slopes of the secant lines as as h approaches 0 from the left and the right.
   (c) What can you say about the line tangent to the graph of g at $(0, 0)$? Verify your answer by drawing the graph of the function.
5. Recall that a rational function is a ratio of two polynomial functions:

$$f(x) = \frac{a_m x^m + a_{m-1}x^{m-1} + \cdots + a_2x^2 + a_1x + a_0}{b_n x^n + b_{n-1}x^{n-1} + \cdots + b_2x^2 + b_1x + b_0}.$$

   (a) Prove that if $m = n$, then $\lim_{x\to\pm\infty} = \frac{a_m}{b_n}$. (Hint: think about generalizing what you did in number 1c.)
   (b) What happens if $m < n$?
   (c) What happens if $m > n$?