PRACTICE PROBLEMS

(1) Find the vertical and horizontal asymptotes of the following functions:
   (a) $f(x) = \dfrac{x^2 - x - 6}{x^2 - x - 20}$
   (b) $g(x) = \dfrac{x + 1}{(x + 3)(x + 5)}$
   (c) $h(x) = \dfrac{(x + 1)^2}{x^2 + 4x + 3}$

(2) On what intervals are the following functions continuous?
   (a) $\arctan\left(-x^2 + \dfrac{5}{x} - \sqrt{x + 1}\right)$
   (b) $\ln\left(\dfrac{\sqrt{x + 2}}{x}\right)$
   (c) $5x\sqrt{x^2 + x}$
   (d) $\dfrac{\sqrt{x + 1} - \sqrt{x - 1}}{3x}$

(3) In general, 4th degree polynomials don't have to have a root (e.g. $f(x) = x^4 + 1$). Show that $g(x) = 4x^4 - 10x^3 + 4x^2 - 6x - 10$ has a root.

(4) Find the following limits:
   (a) $\lim\limits_{x \to 5} \dfrac{x^2 - 2x - 15}{x - 5}$
   (b) $\lim\limits_{x \to 1} \dfrac{x^2 - 3}{x + 5}$
   (c) $\lim\limits_{x \to 0} \dfrac{\sqrt{9 + x} - 3}{x}$
   (d) $\lim\limits_{x \to \pi} \sin(x + \sin(x))$

(5) Do the following sequences converge? If so, to what?
   (a) $a_n = \dfrac{n}{n^3 + 1}$
   (b) $b_n = \dfrac{n^3 + 5}{n^2 + 3n + 4}$
   (c) $c_n = \dfrac{(-3)^n}{6^n}$
   (d) $d_n = \cos(n\pi/2)$