1. [10 pts. each] Evaluate each limit algebraically using limit laws, showing work.

   (a) $\displaystyle\lim_{x\to c}\frac{x^2-2cx+c^2}{x-c}$, c a constant

   (b) $\displaystyle\lim_{y\to 3}\frac{\sqrt{3y+16}-5}{y-3}$

   (c) $\displaystyle\lim_{\theta\to\pi/2}\frac{\sin^2\theta-5\sin\theta+4}{\sin^2\theta-1}$

   (d) $\displaystyle\lim_{r\to 2}\left(\frac{1}{r-2}-\frac{2}{r^2-2r}\right)$

2. [10 pts.] Suppose
$$q(x)=\begin{cases} x^2-5x, & x\le -1 \\ 2\ell x^3-7, & x>-1. \end{cases}$$
   Determine a value for ℓ (if any) for which the limit $\lim_{x\to-1}q(x)$ exists, and state the value of the limit if possible.

3. [3 pts. each] Determine the following limits as a real number or $\pm\infty$, or state the limit does not exist.
$$\lim_{t\to 0}\frac{t-2}{t^5-4t^3}, \qquad \lim_{t\to 2}\frac{t-2}{t^5-4t^3}, \qquad \lim_{t\to-2}\frac{t-2}{t^5-4t^3}.$$

4. [15 pts.] Determine $\lim_{x\to\infty}U(x)$ and $\lim_{x\to-\infty}U(x)$ for
$$U(x)=\frac{x+1}{\sqrt{9x^2+x}}.$$
   Then state the horizontal asymptotes of U, if any.

5. [10 pts.] Determine the intervals of continuity for the function F given by
$$F(x)=\begin{cases} x^3+4x+1, & \text{if } x\le 0 \\ 2x^3, & \text{if } x>0 \end{cases}$$

6. Let $f(x)=\dfrac{x-1}{x+2}$.

   (a) [10 pts.] Use the limit definition of a derivative to find $f'(1)$.

   (b) [5 pts.] Determine an equation for the tangent line to the graph of f at the point $(1, f(1))$.

7. [10 pts.] Use the limit definition of a derivative to find $v'(t)$ given that $v(t)=\sqrt{2-4t}$.