Mathematics I **Worksheet 9** Name:

1. Find the limit. Use L'Hospital's Rule where appropriate. If there is a more elementary method, consider using it. If L'Hospital's Rule doesn't apply, explain why.

   (a) $\lim_{x\to 1} \frac{x^2-1}{x^2-x}$
   (b) $\lim_{x\to 1} \frac{x^3-2x^2+1}{x^3-1}$
   (c) $\lim_{x\to 0} \frac{\sin 4x}{\tan 5x}$
   (d) $\lim_{x\to 0} \frac{e^{2x}-1}{\sin x}$
   (e) $\lim_{x\to \frac{\pi}{2}} \frac{1-\sin x}{1+\cos 2x}$
   (f) $\lim_{x\to\infty} \frac{\ln x}{\sqrt{x}}$
   (g) $\lim_{x\to\infty} \frac{\ln\sqrt{x}}{x^2}$
   (h) $\lim_{x\to 1} \frac{x^8-1}{x^5-1}$
   (i) $\lim_{x\to 0} \frac{8^x-5^x}{x}$
   (j) $\lim_{x\to\infty} \frac{e^{\frac{x}{10}}}{x^3}$
   (k) $\lim_{x\to 0} \frac{x(cos x-1)}{sin x-x}$
   (l) $\lim_{x\to 0^+}(\frac{1}{x}-\frac{1}{\sqrt{x}})$
   (m) $\lim_{x\to\infty} x tan\frac{1}{x}$
   (n) $\lim_{x\to\infty}(1+\frac{3}{x})^{2x}$

2. Use the guidelines you have learned to sketch the detailed graph of the following functions. Note that, when calculating the specifics of vertical and horizontal asymptotes you may need to use L'Hospital's rule.

   (a) $f(x) = xe^{-x^2}$
   (b) $f(x) = \frac{\ln x}{x^2}$
   (c) $f(x) = \frac{e^x}{x}$
   (d) $f(x) = (x^2-3)e^{-x}$