16 October 2014 **L'Hospital's Rule**

(1) Evaluating the following limits using L'Hospital's rule.

(a) $\lim_{x\to 0} \dfrac{x^2}{1-\cos x}$

(b) $\lim_{x\to 0} \dfrac{\ln\sqrt{x}}{x^2}$

(c) $\lim_{x\to 0} \dfrac{x}{\tan^{-1}(4x)}$

(2) Sometimes you have to use an algebraic "trick" to put the indeterminate form in $\frac{0}{0}$ form or $\frac{\infty}{\infty}$ form. Evaluate the following limits by manipulating them until they look like fractions of the form $\frac{0}{0}$ or $\frac{\infty}{\infty}$.

(a) $\lim_{x\to 0} \left(\cot x - \dfrac{1}{x}\right)$

(b) $\lim_{x\to 1^+} \left(\ln(x^7-1) - \ln(x^5-1)\right)$

(3) When you encounter the indeterminate forms involving powers $(1^\infty, 0^0, \infty^0)$ you should write the function as $y = f(x)$ and then take the natural log of both sides. Now take the limit of $\ln f(x)$ using L'Hospital's rule; when you finish, don't forget that you have found $\ln y$, not y.

(a) $\lim_{x\to 0^+} (\tan 2x)^x$.

(b) $\lim_{x\to\infty} x^{\ln 2/(1+\ln x)}$

(c) $\lim_{x\to\infty} \left(1 + \frac{2}{x}\right)^x$