Calculus I **Fall 2014**

Linear approximation and L'Hôpital

Discussion session 19 - 28 October 2014

---

1. Describe, in your own words, the following terms:

   (a) linear function $\alpha(x)$

   (b) linear term of a function $\beta(x)$

   (c) linearization of a function $\gamma(x)$

   (d) linear approximation of a function $\delta(x)$

2. Use L'Hôpital's rule to compute the following limits, if they exist:

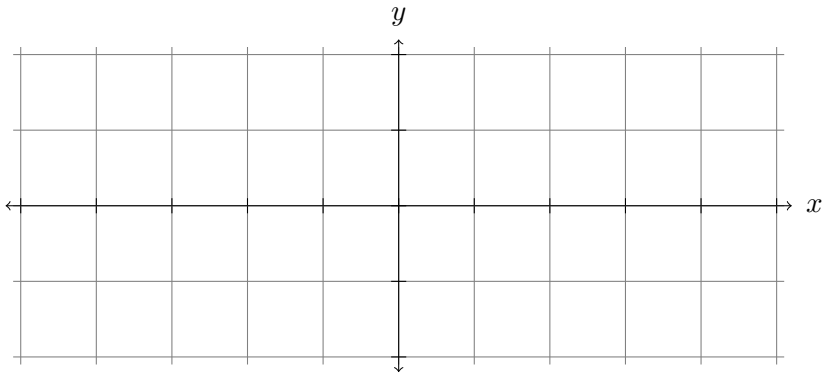
   (a) $\lim_{x\to 3}\left[\dfrac{\sqrt{x+1}-2}{\sqrt{x+6}-3}\right]$

   (b) $\lim_{x\to+\infty}\left[x^{1/x}\right]$

   (c) $\lim_{x\to 0}\left[\dfrac{e^{7x^2}-14x-1}{4e^{3x}-12x-4}\right]$

3. Let $f(x) = \dfrac{1}{1+x^3}$.

   (a) Sketch the graph of f on the axes below.



   (b) Compute the best linear approximation to f at the point $x = 1$.

   (c) Use this approximation to estimate $f(1.2)$.

   (d) What is the difference between the approximation and the actual value?

4. Let $p(t) = t^2$ and $a = 1/2$.

   (a) Compute the best linear approximation to p at the point a.

   (b) Use this approximation to estimate $p(t)$ for any t near a.

   (c) Express the difference of the approximation as an *error function* $r(t)$.

   (d) Sketch the graph of r on the axes below.