1. **Riemann sums.**

   (*) a. Evaluate
   $$\lim_{n\to\infty} \frac{1^5 + 2^5 + 3^5 + \ldots + n^5}{n^6}$$
   by showing that the limit is
   $$\int_0^1 x^5 dx$$
   and evaluating the integral.

   b. Evaluate
   $$\lim_{n\to\infty} \frac{1^3 + 2^3 + 3^3 + \ldots + n^3}{n^4} \ .$$

2. **L'Hôpital or not L'Hôpital?**

   Find the following limits:

   a. $\displaystyle\lim_{x\to 2} \frac{\sqrt{x^2 + 12} - 4}{x - 2}$ [2007 exam question]

   b. $\displaystyle\lim_{x\to 0} \frac{1 - \cos(6x)}{36x^2}$ [2008 exam question]

   c. $\displaystyle\lim_{x\to\infty} \frac{\sqrt{x + 5}}{\sqrt{x} + 5}$

3. **Finite sums.**

   Which formula is not equivalent to the other two?

   a. $\displaystyle\sum_{j=2}^{4} \frac{(-1)^{j-1}}{j - 1}$

   b. $\displaystyle\sum_{k=0}^{2} \frac{(-1)^k}{k + 1}$

   c. $\displaystyle\sum_{l=-1}^{1} \frac{(-1)^l}{l + 2}$

Extra: Let $f(x)$, $g(x)$ be two continuously differentiable functions satisfying the relationships $f'(x) = g(x)$ and $f''(x) = -f(x)$. Let $h(x) = f^2(x) + g^2(x)$. If $h(0) = 5$, find $h(10)$.