Evaluate the limit

① $\lim_{x \to -1} \frac{1 + \sqrt[3]{x}}{1 + \sqrt[5]{x}}$

② $\lim_{n \to \infty} \frac{1^2 + 2^2 + \ldots + n^2}{n^3}$

③ $\lim_{n \to \infty} \frac{1^2 + 3^2 + 5^2 + \ldots + (2n-1)^2}{n^3}$

④ $\lim_{x \to \infty} \left(\frac{x+1}{x-1} \right)^x$

⑤ $\lim_{x \to 0} \frac{\ln(\cos \alpha x)}{\ln(\cos \beta x)}$

By using summation by parts show that

(F_k is the k'th Fibonacci number, $F_0 = 0$, $F_1 = 1$)

⑥ $\sum_{k=1}^{n} k \cdot F_k = n F_{n+2} - F_{n+3} + 2$

⑦ $\sum_{k=1}^{n} \left(\frac{1}{2}\right)^k F_k = 2 - \left(\frac{1}{2}\right)^n F_{n+3}$

Evaluate

⑨ $\sum_{k=1}^{n} \frac{2k+1}{k^2 (k+1)^2}$

Find the derivative

(9) $f(x) = \arccos \frac{1}{x}$

(10) $f(x) = \sqrt{3 - \cos^3(\ln(x+\sqrt{x}))}$

(11) $f(x) = (\ln x)^{3x}$

(12) $f(x) = (x^2+1)^{\cos \frac{x}{2}}$