Some Sample Problems

1. Find the antiderivative: $\int \sqrt{\tan(x)}\,dx$

2. What is the sum of $1 + \frac{1}{2} + \frac{1}{3} - \frac{1}{4} - \frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8} + \frac{1}{9} - \frac{1}{10} - \frac{1}{11} - \frac{1}{12} + \cdots$

3. Find the total perimeter of $x^2 + y^2 = a^2$, where $a$ is a fixed positive number.

4. Let $f(x) = \int_1^x \frac{\ln(t)}{1+t}\,dt$ for $x > 0$. Find $f(x) + f\left(\frac{1}{x}\right)$.
   (As a check: $f(2) + f\left(\frac{1}{2}\right) = \frac{1}{2}(\ln2)^2$.)