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Explain your solution concisely but clearly. Include all derivation steps. Make sure a fellow student would be able to understand what you mean.

1. Use L'Hôpital's rule as many times as necessary to find the following limit. State *why* you can use L'Hôpital's rule. (What condition needs to be satisfied?)

$$L = \lim_{x \rightarrow 0} \frac{(x+1)e^{-x} - 1}{\sin^2 x}$$

**Solution:**

2. Consider the function

$$f(x) = \frac{x^2 + 2x + 1}{x^2 + 3x + 3}$$

1. Make a sketch of the function and observe where it reaches its smallest and largest value. Use GeoGebra or any other tool for plotting.
2. State what the value of  $f'(x)$  is at the points  $x$  where  $f(x)$  reaches its smallest and largest value (“bottom of the valley”, “peak of the mountain”).
3. Find a formula for  $f'(x)$ . Simplify it fully.
4. Solve the equation  $f'(x) = 0$ . This gives the location of the maximum and minimum.

**Solution:**