Method of Partial Fractions

Problem: compute $\mathscr{L}^{-1}\{Y(s)\}$, where

$$Y(s) = \frac{s}{(s+1)(s^2+1)}$$

We seek a, b, c, such that

$$Y(s) = \frac{a}{s+1} + \frac{bs+c}{s^2+1} \quad \text{(need } bs+c \text{ so that deg(num)} = \text{deg(den)} - 1)$$

- Find a: multiply by $s+1$ to isolate a

$$(s+1)Y(s) = \frac{s}{s^2+1} = a + \frac{(s+1)(as+b)}{(s^2+1)}$$

— now let $s = -1$ to "kill" the second term on the RHS:

$$a = (s+1)Y(s)\Big|_{s=-1} = -\frac{1}{2}$$