

# NETWORKS AND COMPLEXITY

## Solution 9-1

*This is an example solution from the forthcoming book *Networks and Complexity*.  
Find more exercises at <https://github.com/NC-Book/NCB>*

### Ex 9.1: Simple Taylor expansion [2]

Taylor expand the function

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

up to linear order around  $x = 0$ .

#### Solution

We consider

$$f(x) = \frac{1}{1+x}. \quad (1)$$

We will need the derivative

$$f'(x) = \partial_x \frac{1}{x+1} = -\frac{1}{(x+1)^2} \quad (2)$$

Using the equations from the chapter we can now compute the coefficients. The zeroth-order (constant) coefficient of the expansion is

$$c_0 = f(0) = 1. \quad (3)$$

The first-order (linear) is

$$c_1 = f'(0) = -1 \quad (4)$$

as well. Hence we can approximate

$$f(x) = \frac{1}{x+1} \approx 1 - x = g(x). \quad (5)$$

Let's plot this along with the function to see that it works,

