

1. Solve the following equations in $\mathbb{R}$ (note that $\mathbb{R}$ refers to the real numbers, not to the statistics software R):

(a) $x^2 + 3x + 2 = 0$

(b) $2x^2 + 5x = 3$

(c) $4(x - 1) = x^2$

(d) $(e^{12x})^x \cdot e^{x+1} = 1$

2. Write the following sums with/without sum sign ($\sum$), if possible simplify using formulas from the lecture and compute their values:

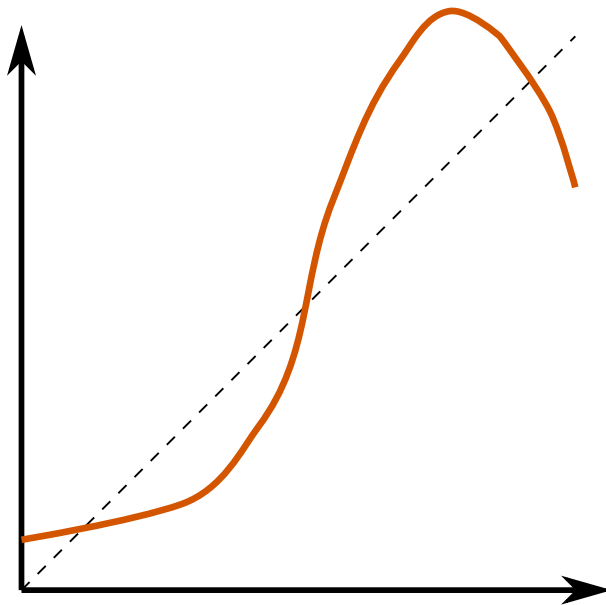
$$a = \sum_{n=1}^{10} 2 \cdot n$$

$$b = 1 + 4 + 9 + 16 + 25 + 36 + 49 + 64 + 81 + 100$$

$$c = \sum_{j=7}^{900} 3^{-j}$$

$$d = 49 + 56 + 63 + \dots + 6993 + 7000 + 7007$$

3.



If a certain population has a size x in the current generation, the size in the next population is modeled as $f(x)$, where f is the function whose graph is shown to the right. Apply cobwebbing to check which fixed points are unstable, locally stable or globally stable.

4. Assume a population whose size follows the reproductive rule

$$x_{n+1} = f(x_n) = m + (1 - d) \cdot x_n + r \cdot x_n^2$$

with $m \geq 0$, $0 \leq d$ and $r \geq 0$.

- (a) Describe a possible biological situation for which such a model could be appropriate. What is the meaning of the parameters m , d and r ?
- (b) Try to find combinations of parameter values for m , d and r such that
- (i) there are no fixed points,
 - (ii) there is exactly one fixed point,
 - (iii) there are two fixed points,
 - (iv) there is an unstable fixed points,
 - (v) there is a stable fixed point.