MATHS BASICS FOR EES — EXERCISE SHEET 1

---

1. Logarithms and Exponentials

(a) Calulate in $\mathbb{R}$ (note that $\mathbb{R}$ refers to the real numbers, not to the software R) :
$\log_3(10), \log_\pi(15)$

(b) Demonstrate the following equation for $x > 0$:
$\log_{a^n}(x) = \frac{1}{n} \log_a(x)$

(c) Resolve in $\mathbb{R}$ (do not forget to think about the domain of definition of the functions):
$\log_4(x) = -2$
$\ln(x - 2) + \ln(3) = \ln(18)$

2. Compute the derivatives of the following functions:

$$f(x) = 3x^2 - 4x + 3 \qquad\qquad g(x) = x^2 \cdot e^{-x^2}$$

$$h(x) = x^3 \cdot \log_3 x \qquad\qquad k(x) = \frac{x^2 - 5x + 3}{1 + 7x^2}$$

$$p(x) = (\cos(x))^2 + (\sin(x))^2 \qquad q(x) = x^x$$

3. Assume a population of a current size of 1000 indivduals. Each day, $\approx 10\%$ of the individuals produce one descendant (assume asexual reproduction) and $\approx 5\%$ of the individuals die. Predict the size of the population after one year.