

Livestock Breeding and Genomics - Exercise 1

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Problem 1: Vectors

Given are the following two vectors v and w . Compute

- the sum $v + w$,
- the difference $v - w$ and
- the dot product $v \cdot w$.

$$v = \begin{bmatrix} 3 \\ -5 \\ 1 \\ 9 \end{bmatrix}, \quad w = \begin{bmatrix} 1 \\ 9 \\ -12 \\ 27 \end{bmatrix}$$

Problem 2: Vectors in R

Verify your computations from Problem 1 in R. Start by assigning the vectors v and w with the components given in Problem 1. If you are not sure how to assign vectors in R, please have a look at <https://bookdown.org/rdpeng/rprogdatascience/r-nuts-and-bolts.html#creating-vectors> and its the corresponding video at https://youtu.be/w8_XdYI3reU

Problem 3: Angle between Vectors

Given are two vectors

$$a = \begin{bmatrix} 8 \\ 0 \\ 4 \end{bmatrix} \text{ and } b = \begin{bmatrix} 2 \\ 21 \\ x \end{bmatrix}$$

How do we have to choose x , such that the vectors are perpendicular? Verify your solution with R

Problem 4: Phenotypes and Genotypes

Farmer Frank Miller has two cows named `Delilah` and `Rosy`. `Delilah` has completed 8 lactations with the following results

Lactation	Milk.Yield
1	5852
2	6833
3	7984
4	7869
5	7322
6	8216
7	8622
8	7851

Rosy is a young cow and has completed just 2 lactation which is shown below.

Lactation	Milk.Yield
1	6249
2	7312

Your Tasks

- Compute for both cows the sum and the mean of all lactation results using R. **Hint:** Have a look at the functions `mean()` and `sum()` in R.
- Our farmer wants to know which of the two cows would be a better mother for his breeding herd when looking at the traits **milk yield** and **longevity**. The trait longevity is defined as the number of years a cow is able to produce milk. From the breeding association the farmer receives the following predicted breeding values for the two cows. Please explain which of the two cows is the better choice as a mother.

Cows	Milk.Yield	Longevity
Delilah	-1037	112
Rosy	471	122