

## Exercise 5

### Module 5: Vectors and Matrices

#### 1.

Complete each sentence with the correct word. Choose from: scalar · vector · matrix · index · dot product

- (a) A single number like temperature = 23.5 is called a \_\_\_\_\_.
- (b) A list of numbers like [12.4, 9.8, 14.1] is called a \_\_\_\_\_.
- (c) A grid of numbers with rows and columns is called a \_\_\_\_\_.
- (d) The position of an element in a list (starting at 0) is called its \_\_\_\_\_.
- (e) Multiplying matching pairs and adding the results is called the \_\_\_\_\_.

#### 2

Write the Python syntax for each task. Use NumPy (import numpy as np).

- 1. Create a vector called yields with values 4.2, 5.1, 3.8, 4.7  
syntax: \_\_\_\_\_
- 2. Get the second value from yields  
syntax: \_\_\_\_\_
- 3. Add 0.5 to every element of yields  
syntax: \_\_\_\_\_
- 4. Find the dot product of [1,2,3] and [4,5,6]  
syntax: \_\_\_\_\_

#### 3.

Calculate each result by hand. No Python needed, just work it out.

- $v = [3, 6, 9] \rightarrow v + 1 = ?$   
Answer: \_\_\_\_\_
- $v = [3, 6, 9] \rightarrow v * 2 = ?$   
Answer: \_\_\_\_\_
- $a = [1, 2, 3] \cdot b = [1, 1, 1] \rightarrow a + b = ?$   
Answer: \_\_\_\_\_
- $a = [5, 8, 3] \cdot b = [2, 4, 1] \rightarrow \text{np.dot}(a,b) = ?$   
Answer: \_\_\_\_\_

#### 4.

Look at this farm data matrix and answer the questions below.

```
# rows = fields, columns = soil pH on Monday and Tuesday
ph_data = np.array([
    [6.5, 6.8], # Field A
    [7.1, 7.0], # Field B
    [5.9, 6.1], # Field C
])
```

- (a) What is `ph_data.shape(rows,columns)`? \_\_\_\_\_
- (b) Which field has the lowest pH on Monday? \_\_\_\_\_
- (c) What is the pH of Field B on Tuesday? `ph_data[____][____]` = \_\_\_\_\_
- (d) What does `ph_data[0][1]` return? \_\_\_\_\_

#### 5.

Answer each question in one or two sentences. Keep it short and simple.

- (a) What is the difference between a vector and a scalar?  
\_\_\_\_\_
- (b) If you have a matrix with shape (4, 3), how many rows and how many columns does it have?  
\_\_\_\_\_
- (c) Give one real example from farming where you would store data as a vector.  
\_\_\_\_\_
- (d) Give one real example from farming where you would store data as a matrix.  
\_\_\_\_\_