Math 3 Scalars and Vectors

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Exercise 1

1. A temperature of 100°C is a quantity of . . .

2. An acceleration of 9.8 m/s^2 vertically downward is a quantity of . . .

3. The weight of a mass of 7 kg is a quantity of . . .

4. The amount of 500 pounds is a quantity of . . .

Answer

1. Temperature doesn't have a specific direction or orientation. It only measures the degree of heat or coldness of an object and is expressed as a scalar quantity.

2. Acceleration has both magnitude and direction. In this case, the direction is downward, indicating that the acceleration is occurring in a specific direction (towards the center of the Earth's gravity) and not just numerically. Therefore, it is a vector quantity.

3. Weight of a 7 kg mass is a vector quantity because weight also has magnitude and direction.

4. Money or currency is a scalar because, in the context of the amount of money, we only consider the numerical value without regard to direction or orientation.

Exercise 2

exercise 2

```python
import numpy as np
# 1-dimensional array:
x = np.array([1,2,3,4])
print("1d array\n", x)

# 2-dimensional array:
A = np.array([[1,2], [3,4], [5,6]])
print("2d array\n", A)

# Transpose
A_t = A.T
print("Transpose\n", A_t)

# We can see that A has 2 rows and 3 columns from A_t.
A_t.shape
```

```
1d array
 [1 2 3 4]
2d array
 [[1 2]
 [3 4]
 [5 6]]
Transpose
 [[1 3 5]
 [2 4 6]]
(2, 3)
```

- The code creates a 1D array 'x' and a 2D array 'A,' prints them, calculates the transpose of 'A,' and checks the shape of the transposed array. The output shows the arrays and their transposition, along with the shape of the transposed array.

Exercise 3

Exercise 3

```
# Load library
import numpy as np

# Create a vector as aa row

vector_row = np.array([1, 2, 3])

# Create a vector as a column
vector_column = np.array([[1],
                          [2],
                          [3]])


print(vector_row)
print(vector_column)
```

```
[1 2 3]
[[1]
 [2]
 [3]]
```

- The code defines a row vector and a column vector using the NumPy library and prints both vectors. The output will show the values of the row vector in a horizontal line and the values of the column vector in a vertical line.

Exercise 4

Exercise 4

```
# Load library
import numpy as np

# Create a vector as aa row

vector = np.array([1, 2, 3, 4, 5, 6])

# Create a vector as a column
matrix = np.array([[1, 2, 3],
                   [4, 5, 6],
                   [7, 8, 9],
                   ])

print(vector[2])
```

```
3
```

- The code defines a vector and a matrix using the NumPy library and prints the element at index 2 of the vector. The output will be the value at the 3rd position of the vector, which is '3'.

Exercise 4

```
# Load library
import numpy as np

# Create a vector as aa row

vector = np.array([1, 2, 3, 4, 5, 6])

# Create a vector as a column
matrix = np.array([[1, 2, 3],
                   [4, 5, 6],
                   [7, 8, 9],
                   ])

print(vector[2])

print(vector[:])

# select everything up to and including the third element
print(vector[:3])

# select everything after the third element
print(vector[3:])
```

```
3
[1 2 3 4 5 6]
[1 2 3]
[4 5 6]
```

- The code creates a vector and a matrix, prints a specific element from the vector, and demonstrates how to use slicing to select specific elements from the vector, including all elements, elements up to a certain index, and elements after a certain index.

Exercise 5

Exercise 5

```
# Load library
import numpy as np

# Create matrix
matrix = np.array([[1, 2, 3, 4],
                   [5, 6, 7, 8],
                   [9, 10, 11, 12]])

# View number of rows and columns
print(matrix.shape)

# View number of elements (rows * columns)
print(matrix.size)
```

```
(3, 4)
12
```

- The code creates a 2D matrix and then prints the number of rows and columns in the matrix (3 rows and 4 columns) and the total number of elements (12) in the matrix.

Exercise 6

6. Please review the application of vectors or scalars in daily life.

Scalars:

- Distance: When you measure how far you walk or drive from point A to point B, you are dealing with a scalar quantity.
- Volume: The volume of a container, such as a liter of water or a gallon of gasoline, is a scalar.
- Time: When you set your alarm clock for 7:00 AM, you are dealing with a scalar (time) that only has magnitude.

Vectors:

- Velocity: Your car's speed with a specified direction, like 60 mph north, is a vector.
- Force: When you push or pull an object with a certain strength and direction, you're dealing with a force vector.
- Displacement: Your movement from one point to another with direction (e.g., 10 meters south) is a vector.

- Wind Velocity: Wind speed and direction, such as 20 mph from the west, are vector quantities used in weather reports and aviation.