# MATRICES: CREATING 1D MATRICES

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# WHAT IS A MATRIX?

- Matrix structure: rows first, then columns (rows-by-columns)

$A = 1$ (scalar)

$B = [1\ 21\ 36\ 44\ 25]$ (row vector, which is also a 1-by-5 matrix)

$$C = \begin{bmatrix} 18 \\ 23 \\ 84 \\ 65 \\ 19 \end{bmatrix}$$ (column vector or 5-by-1 matrix)

$$D = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 4 & 5 & 6 & 7 \\ 7 & 8 & 9 & 10 \end{bmatrix}$$

(3-by-4 matrix)

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# CREATING 1D MATRICES (VECTORS)

- Use square brackets [ ] to create matrices

- Row vectors are horizontal

  Syntax: A = [1 2 3 4]   or   A = [1, 2, 3, 4]

- Column vectors are vertical

  Syntax: B = [5; 6; 7; 8]

- To convert row vectors to column vectors and *vice versa*
  - Use the transpose operator **'**   (apostrophe)
  - Or use the transpose function

# TYPING IT ALL OUT

- What if I require numbers from 1 to $10^6$?
  - We do not want to type it all out!
  - Remember, engineers are efficient

# THE COLON OPERATOR

- Colon operator :
  - Creates a vector with equally spaced values using a specified spacing step

- Syntax: start_value : step : end_value
  - Default step of 1 if step is omitted

- Examples:

  A = [6 7 8 9 10]        or       A = 6 : 1 : 10    or    A = 6 : 10

  B = [6 11 16 21 26]     or     B = 6 : 5 : 26

  C = [6 4 2 0 -2 -4]     or     C = 6 : -2 : -4

# THE COLON OPERATOR: LIMITATIONS

- How to create a vector with the following requirements?
  - First value is 3
  - Last value is less than or equal to 40
  - Step size of 5

- What if the value of 40 is needed?
  - Is the end value important?

- Colon operator to create column vectors?
  - Use round brackets with apostrophe:   A = (1 : 20)'

# WHAT IF …

- What if I require 7 equally spaced numbers between 3.851 and 7.84?
  - I can manually calculate the step size

    Step size = (end value – start value)/(number of points - 1)

    Step size = $\frac{7.84 - 3.851}{7 - 1} = 0.6648$

    →    A = 3.851 : 0.6648 : 7.84

- Is there an alternative?

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# THE LINSPACE FUNCTION

- The linspace function:
  - Create a vector with equally spaced values using a specified number of points

- Syntax: linspace(start_value, end_value, num_of_points)
  - Default of 100 points if num_of_points is not specified

- Examples:

    A = [1 2 3 4 5 6]        or        linspace(1, 6, 6)


    B = [3.8510   4.5158   5.1807   5.8455   6.5103   7.1752   7.84]
        or    B = linspace(3.851, 7.84, 7)

# SUMMARY

- Colon operator uses a specified step size
- Linspace function uses a specified number of values
- Use both appropriately throughout your coding in this unit

- What does "logspace" do?