Analysis and Visualization with Vectors

MATLAB® Fundamentals for Aerospace Applications

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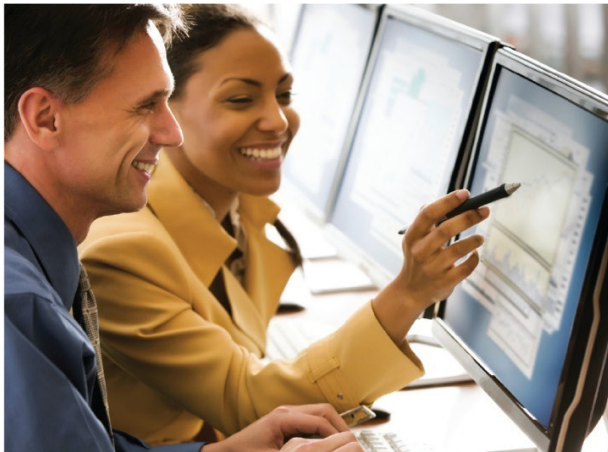
Outline

- Calculations with vectors

- Creating vector variables

- Accessing and manipulating elements of vectors

- Sharing live scripts

Vectors, Matrices, and Arrays

Array:
multiple values in one variable
(any size/dimensions)

Matrix:
numeric 2-D array (*m*-by-*n*)

Vector:
1-D array (1-by-*n* or *n*-by-1)

Scalar:
single value
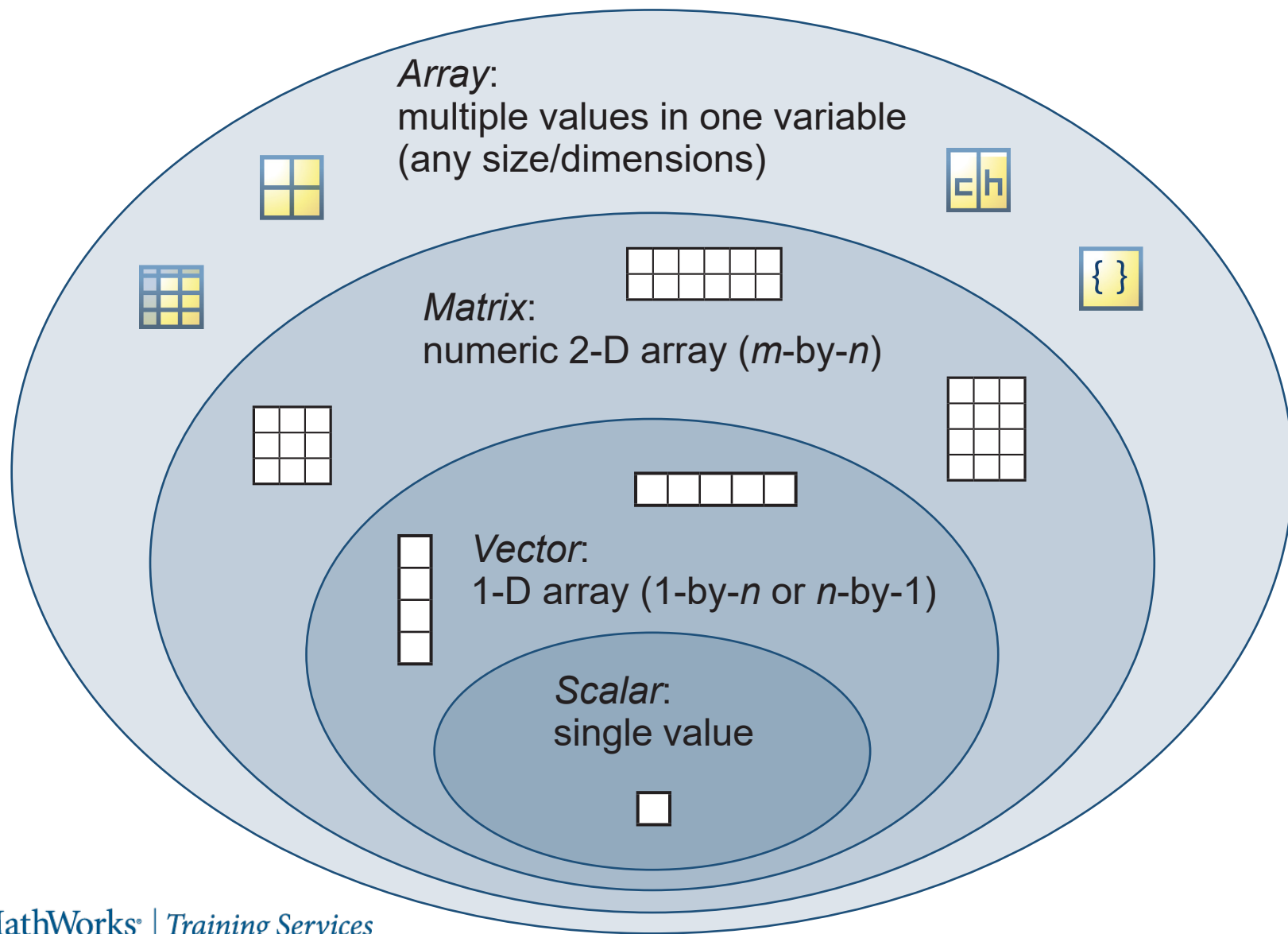
Course Example: Comparing Real Cost
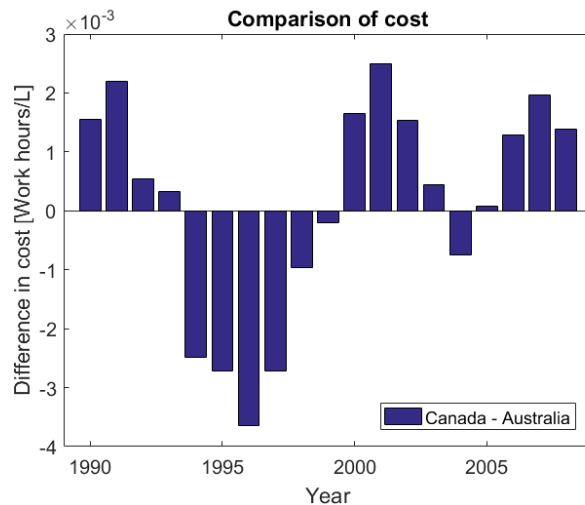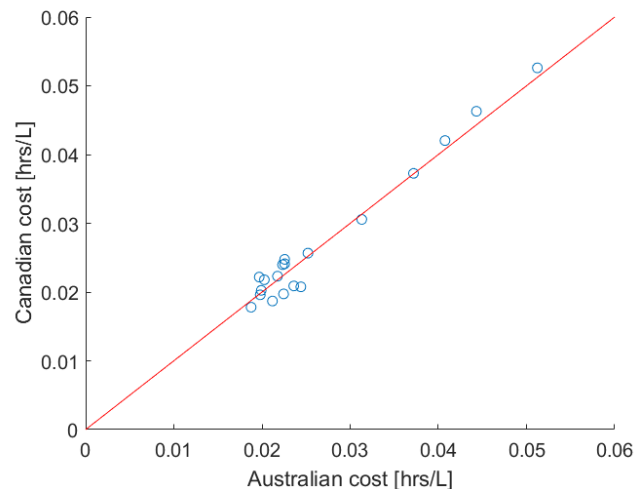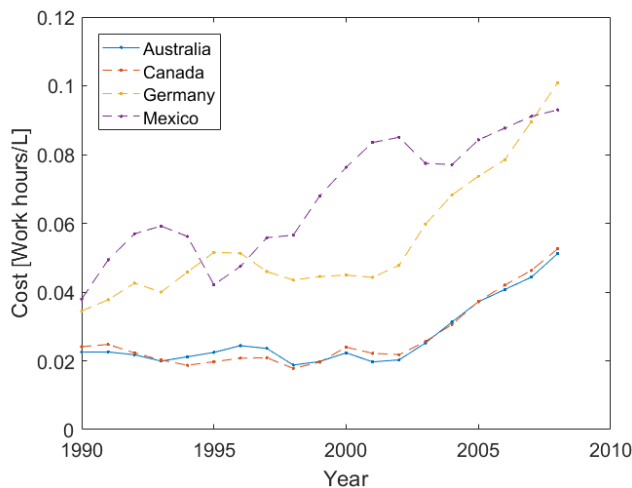
Array Operations

```
Mexico = gal2lit*Mexico
```
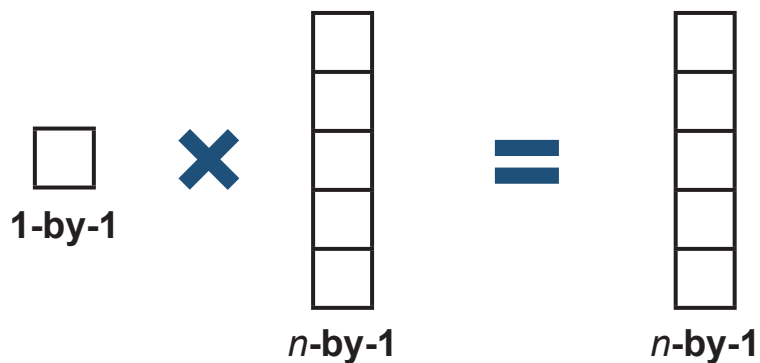
Mathematical Functions

```
absDiff = abs(AuCaDiff)
```


$$
\begin{bmatrix}
1.55 \\
2.19 \\
0.55 \\
0.33 \\
-2.49 \\
-2.72 \\
-3.65 \\
-2.71 \\
-0.97 \\
-0.20 \\
1.65 \\
2.49 \\
1.53 \\
0.45 \\
-0.75 \\
0.08 \\
1.28 \\
1.97 \\
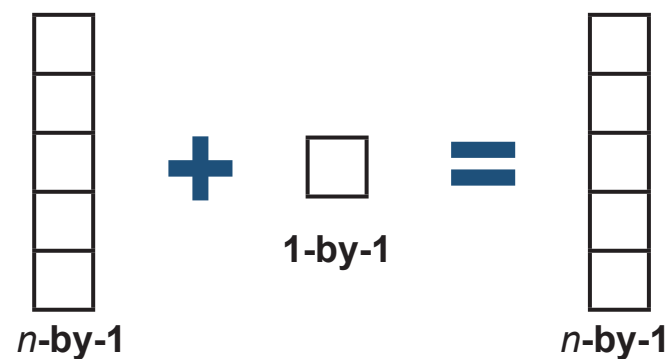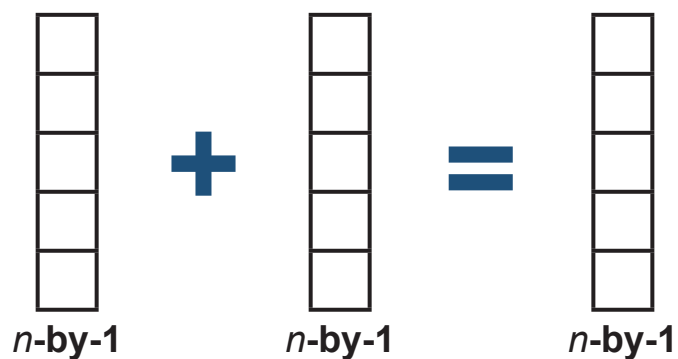1.38
\end{bmatrix}
$$

19-by-1

abs

19-by-1

"Vectorized"

$$
\begin{bmatrix}
1.55 \\
2.19 \\
0.55 \\
0.33 \\
2.49 \\
2.72 \\
3.65 \\
2.71 \\
0.97 \\
0.20 \\
1.65 \\
2.49 \\
1.53 \\
0.45 \\
0.75 \\
0.08 \\
1.28 \\
1.97 \\
1.38
\end{bmatrix}
$$

```
sin
sind
sinh
asin
exp
log
log2
log10
sqrt
nthroot
abs
angle
floor
ceil
round
mod
```

Statistical Functions

19-by-1

```
[maxDiff,idx] = max(absDiff)
```

1-by-1   **1-by-1**

1.55	1
2.19	2
0.55	3
0.33	4
2.49	5
2.72	6
3.65	7
2.71	8
0.97	9
0.20	10
1.65	11
2.49	12
1.53	13
0.45	14
0.75	15
0.08	16
1.28	17
1.97	18
1.38	19

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Indexing into Vectors

NaN
1.96
1.89
1.73
1.84
1.95
2.12
2.05
1.63
1.72
1.94
1.71
1.76
2.19
2.72
3.23
3.54
3.85
4.45

Aus90 = Australia(1)

1-by-1

1-by-1

Aus08 = Australia(end)

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Changing Values in a Vector

reference

19-by-1

NaN
1.96
1.89
1.73
1.84
...

Aus90 = Australia(1)

1-by-1

assignment

19-by-1

1.96
1.96
1.89
1.73
1.84
...

Australia(1) = 1.96

1-by-1

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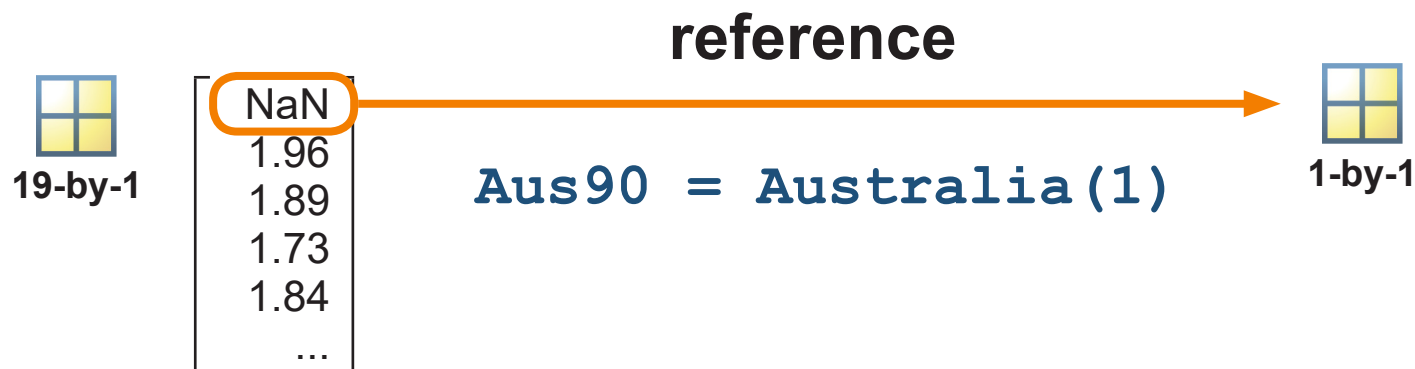
Entering Vectors Manually

`x = [19 13 7 11 2 17 5 3]`

19	13	7	11	2	17	5	3

`x = [19;13;7;11;2;17;5;3]`

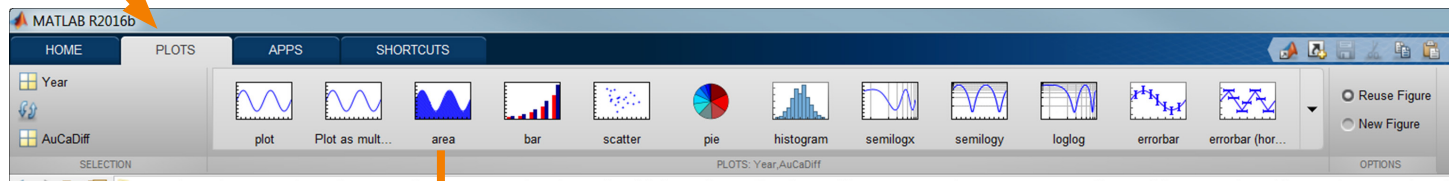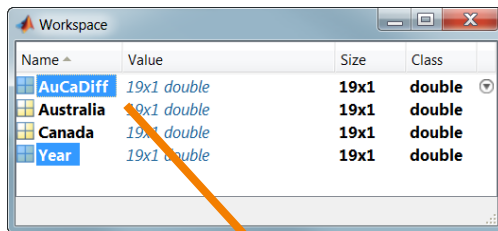| 19 |
|----|
| 13 |
| 7 |
| 11 |
| 2 |
| 17 |
| 5 |
| 3 |

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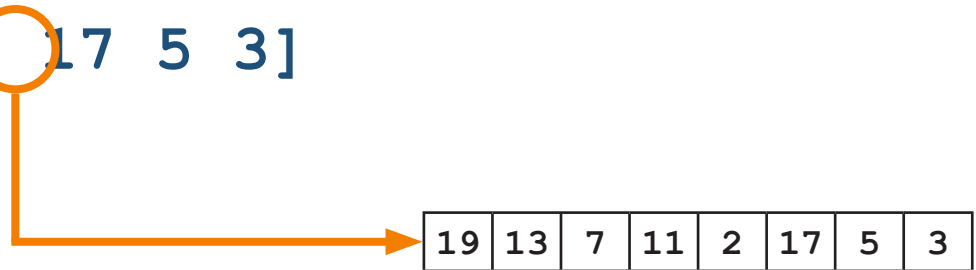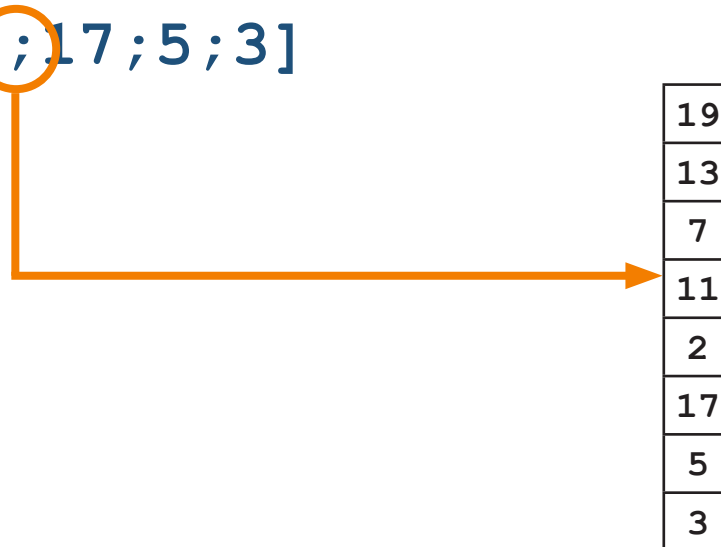
Creating Vectors of Equally Spaced Values


```
x = linspace(a,b,n);
```

n points
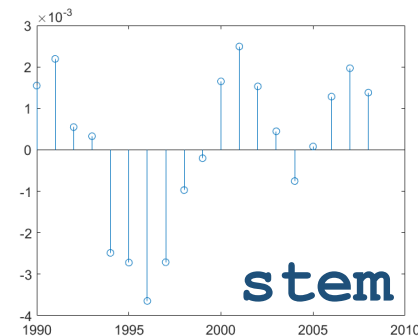
a   b

dx

```
x = a:dx:b;
```
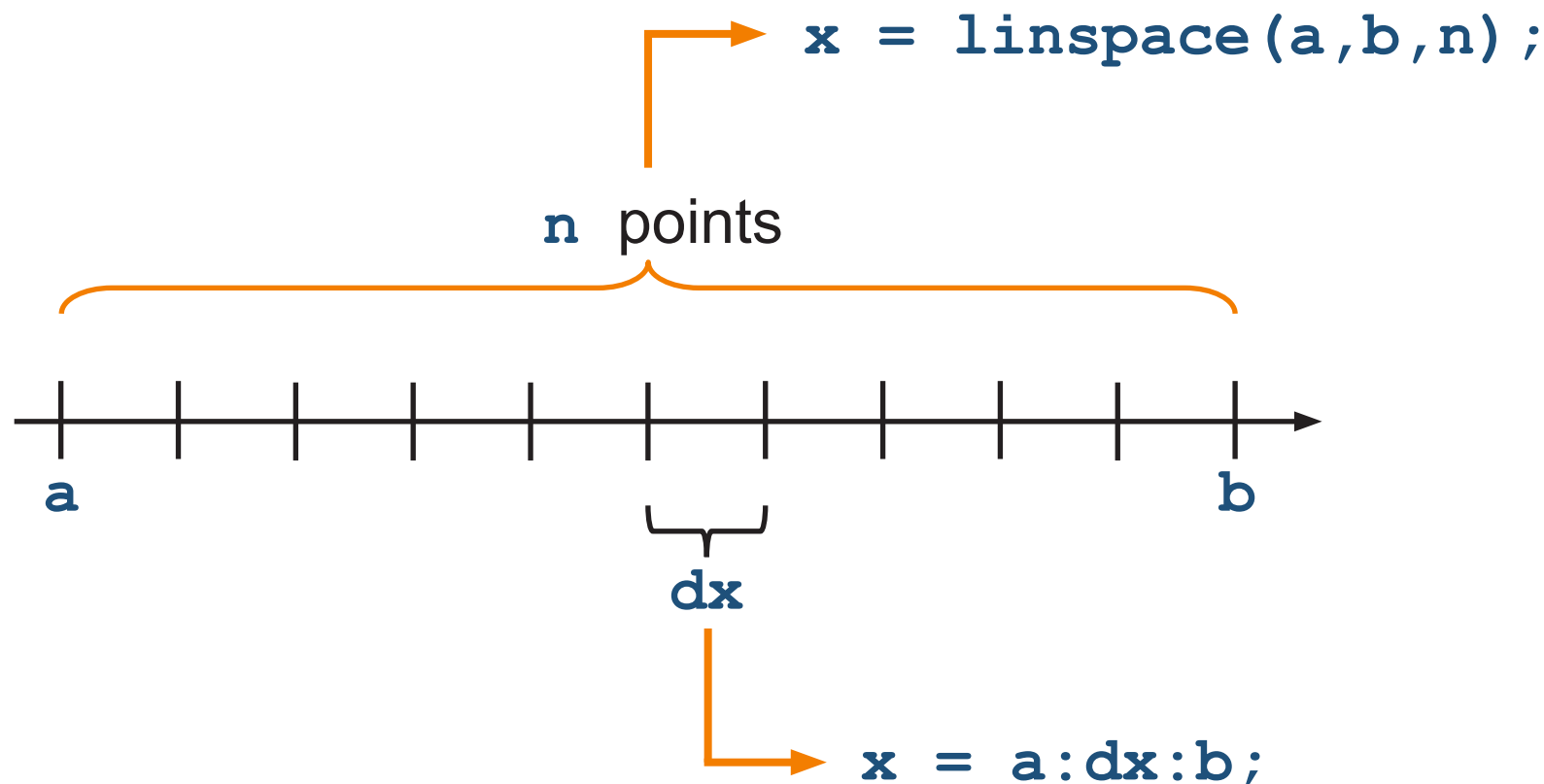
Accessing Data in Vectors

$$
\begin{bmatrix}
1.96 \\
1.96 \\
1.89 \\
1.73 \\
1.84 \\
1.95 \\
2.12 \\
2.05 \\
1.63 \\
1.72 \\
1.94 \\
1.71 \\
1.76 \\
2.19 \\
2.72 \\
3.23 \\
3.54 \\
3.85 \\
4.45
\end{bmatrix}
$$

Aus90s = Australia(1:10)

10-by-1

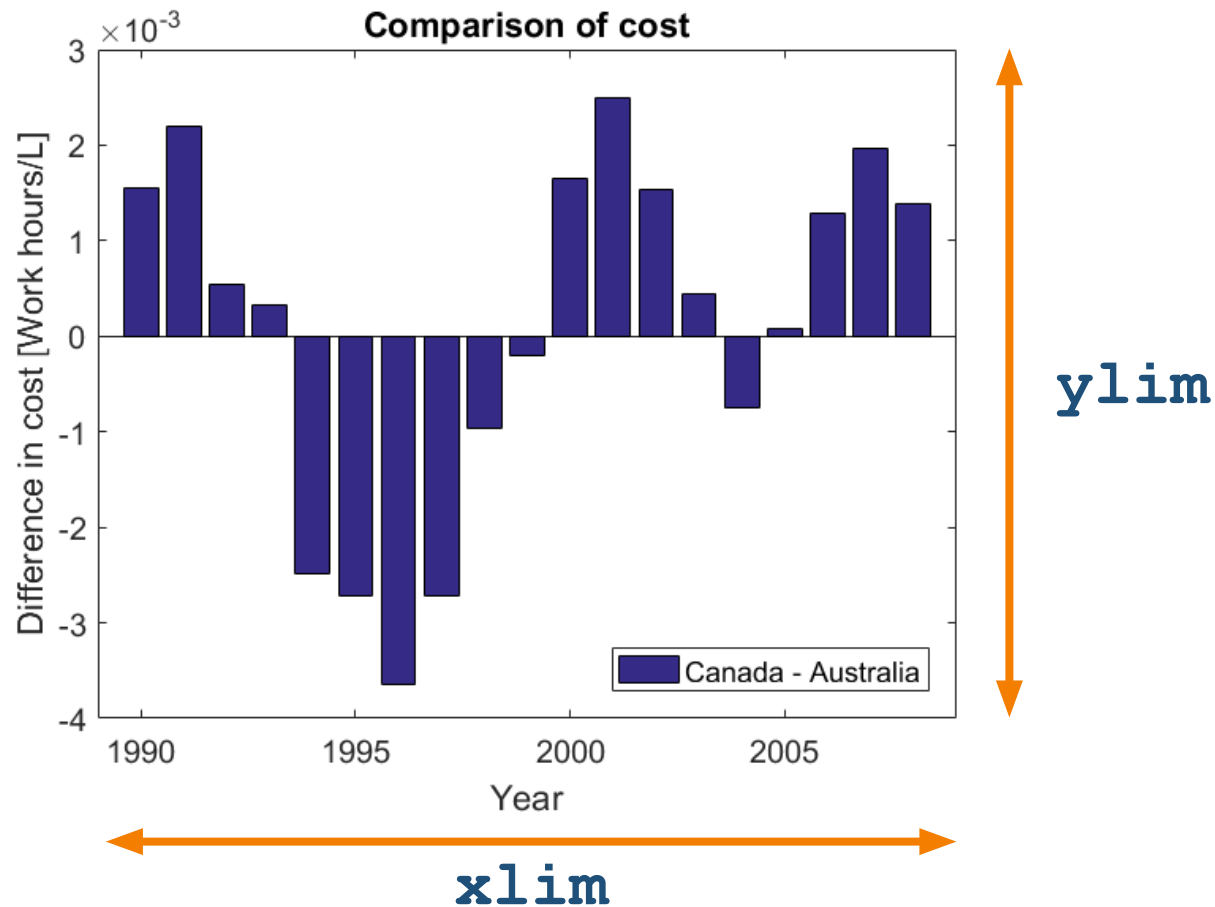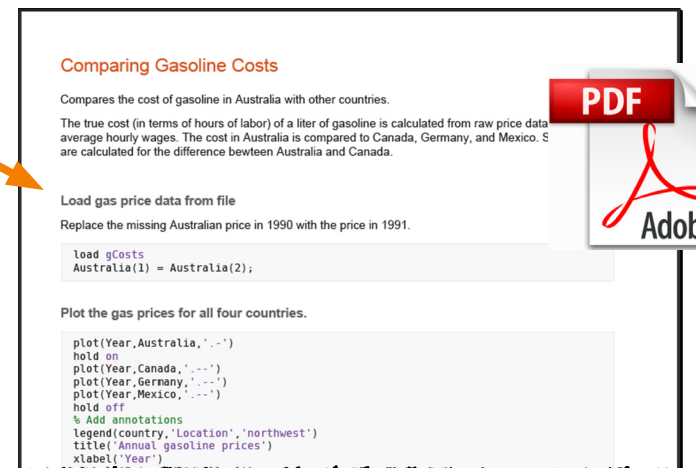**Aus00s = Australia(11:end)**

9-by-1

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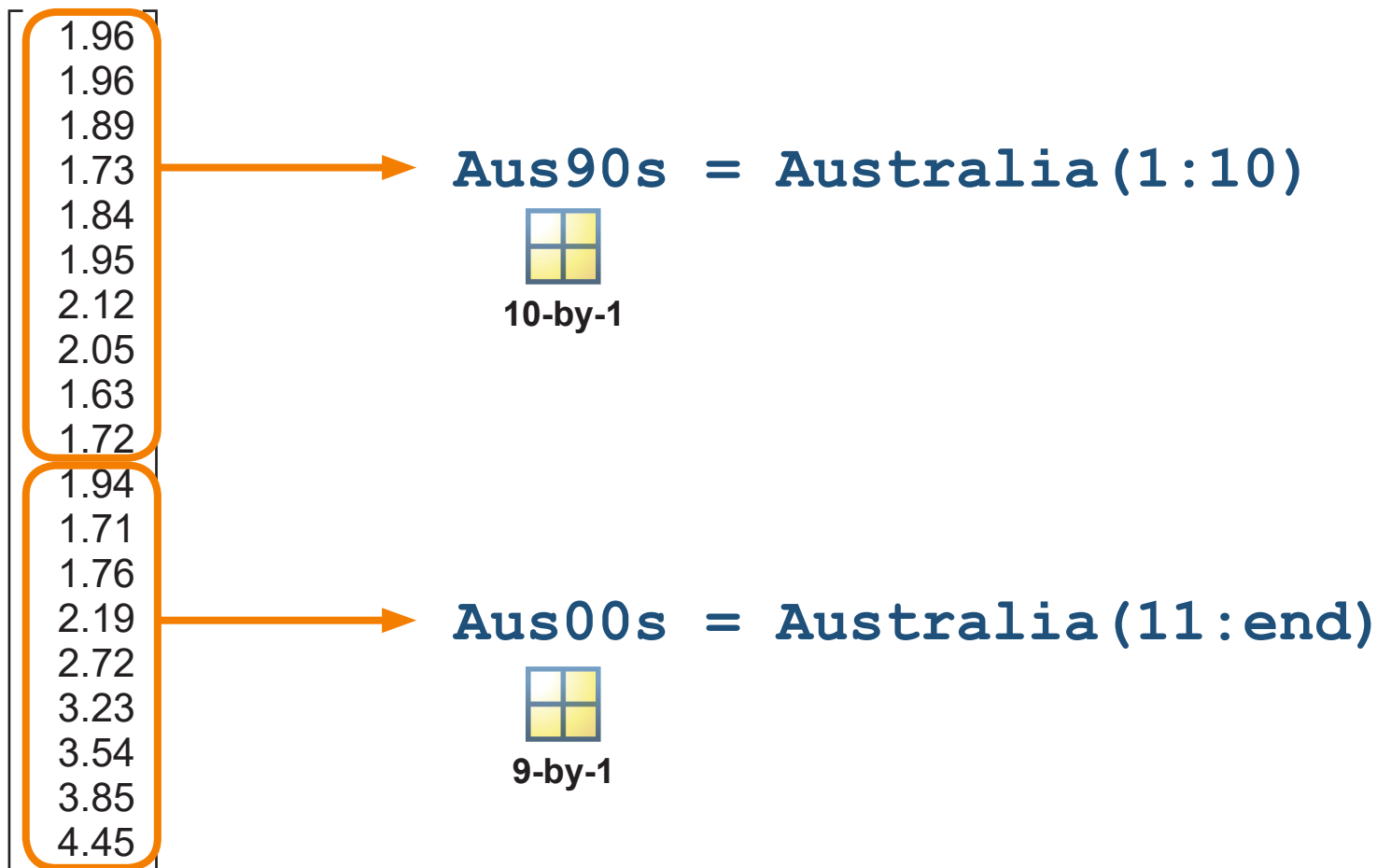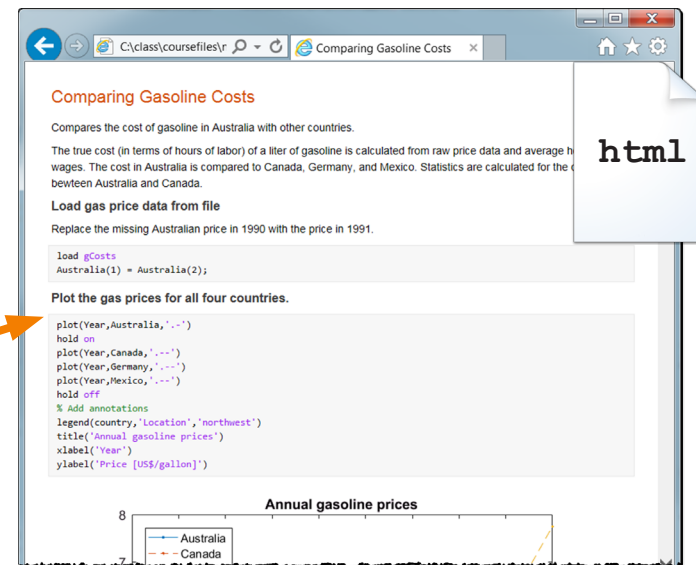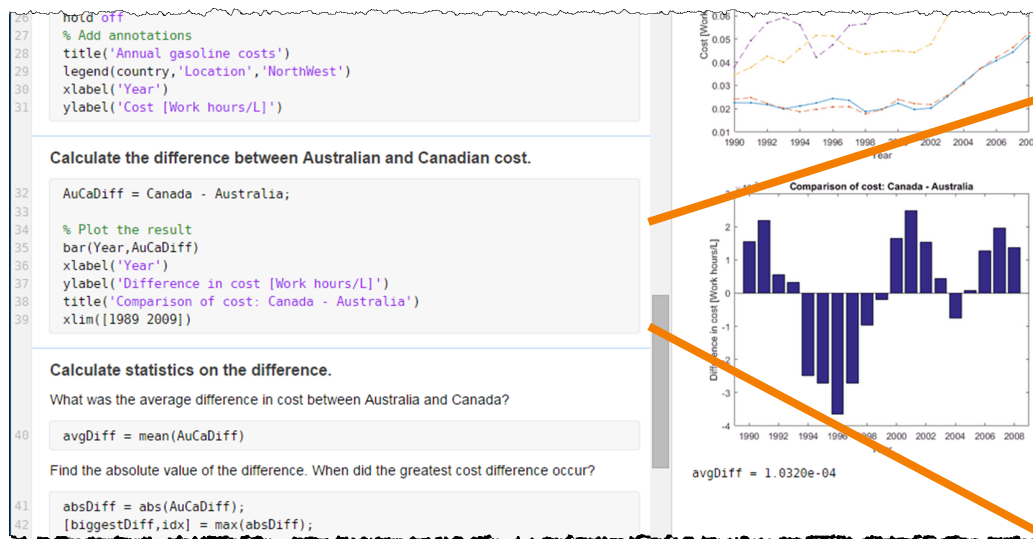
Additional Vector Plot Types
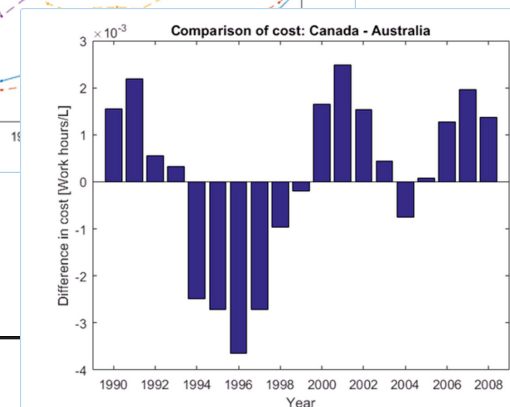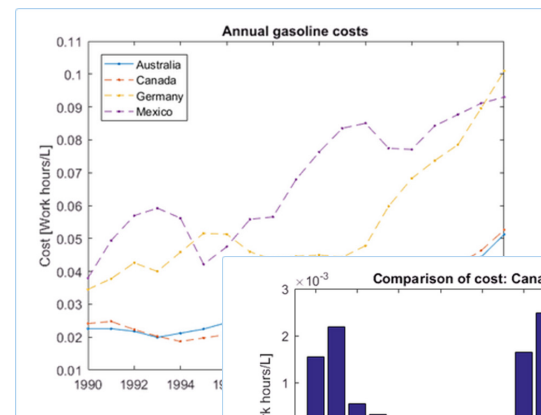

Automatic code
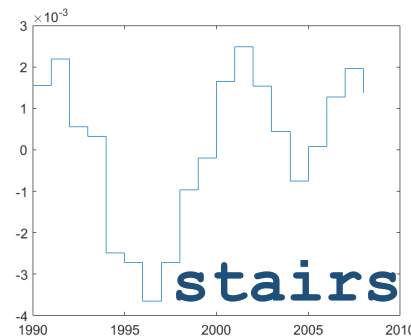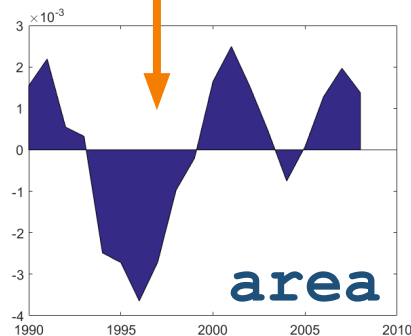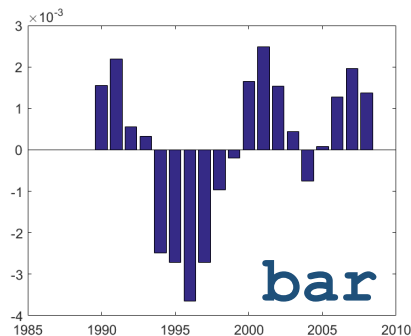
Axis Control

Sharing Live Scripts

Summary

- Calculations with vectors

- Creating vector variables

- Accessing and manipulating elements of vectors

- Sharing live scripts

Test Your Knowledge

1. Given a vector `x`, what is the command to add 3 to each element, double that value, then sum all the resulting values?

   A. `sum(2*x+3)`

   B. `sum(2*[x(k)+3])`

   C. `sum[2*x+3]`

   D. `sum(2*(x+3))`

Test Your Knowledge

2. (Select all that apply) Which commands are equivalent to the command `x = 1.4:2:6.8`?

   A. `x = [1.4 2 6.8]`

   B. `x = [1.4 6.8]`

   C. `x = [1.4 3.4 5.4]`

   D. `x = [1.4 3.4 5.4 6.8]`

   E. `x = [3.4 5.4]`