

1. Create a vector of the even whole numbers between 25 and 79.
2. Let  $x = [2 \ 3 \ 1 \ 9]$ .
  - a. Add 16 to each element
  - b. Add 3 to just the odd-index elements
  - c. Sum the whole vector.
  - d. Sort the vector in ascending order.
  - e. Sum just the odd-index elements
  - f. Compute the square root of each element
  - g. Compute the square of each element
3. Let  $x = [5;3;1;8]$  and  $y = [4;1;7;5]$ 
  - a. Raise each element of  $x$  to the power specified by the corresponding element in  $y$ .
  - b. Divide each element of  $y$  by the corresponding element in  $x$
4. Evaluate the following MATLAB expressions by hand and use MATLAB to check the answers
  - a.  $2 / 2 * 3$
  - b.  $6 - 2 / 5 + 7 ^ 2 - 1$
  - c.  $10 / 2 \setminus 5 - 3 + 2 * 4$
  - d.  $3 ^ 2 / 4$
  - e.  $3 ^ 2 ^ 2$
  - f.  $2 + \text{round}(6 / 9 + 3 * 2) / 2 - 3$
  - g.  $2 + \text{floor}(6 / 9 + 3 * 2) / 2 - 3$
  - h.  $2 + \text{ceil}(6 / 9 + 3 * 2) / 2 - 3$
5. Create a vector  $x$  with the elements,
 
$$x_n = (-1)^{n+1}/(2n-1)$$
6. Given a vector,  $t$ , of length  $n$ , write down the MATLAB expressions that will correctly compute the following:
  - a.  $\ln(2 + t + t^2)$
  - b.  $e^{(1 + \cos(3t))}$
  - c.  $\cos^2(t) + \sin^2(t)$
  - d.  $\tan^{-1}(1)$  (this is the *inverse* tangent function)
  - e.  $\cot(t)$
  - f.  $\sec^2(t) + \cot(t) - 1$

Test that your solution works for  $t = 1:0.2:2$
7. Make a plot (i.e., a non-choppy plot) of the function
 
$$f(x) = \sin(1/x)$$

for  $0.01 < x < 0.1$ .
8. Given  $x = [3 \ 1 \ 5 \ 7 \ 9 \ 2 \ 6]$ , visualize the output of the command.
  - a.  $x(3)$
  - b.  $x(1:7)$
  - c.  $x(1:\text{end})$
  - d.  $x(1:\text{end}-1)$
  - e.  $x(6:-2:1)$
  - f.  $x([1 \ 6 \ 2 \ 1 \ 1])$

9. Given the array  $A = \begin{bmatrix} 2 & 4 & 1 \\ 6 & 7 & 2 \\ 3 & 5 & 9 \end{bmatrix}$ , provide the commands needed to

- assign the first row of  $A$  to a vector called  $x_1$
- assign the last 2 rows of  $A$  to an array called  $y$
- compute the sum over the columns of  $A$
- compute the sum over the rows of  $A$
- compute the standard deviation of each column of  $A$
- compute the standard deviation of each row of  $A$

10. Given the arrays  $x = [1 \ 4 \ 8]$ ,  $y = [2 \ 1 \ 5]$  and  $A = \begin{bmatrix} 3 & 1 & 6 \\ 5 & 2 & 7 \end{bmatrix}$ , determine which of the following statements will correctly execute and provide the result. Try to understand why it fails.

- $x + y$
- $x + A$
- $x' + y$
- $A - [x' \ y']$
- $[x \ ; \ y']$
- $[x \ ; \ y]$
- $A - 3$

11. Given the array  $A = \begin{bmatrix} 2 & 7 & 9 & 7 \\ 3 & 1 & 5 & 6 \\ 8 & 1 & 2 & 5 \end{bmatrix}$ , explain the results of the following commands:

- $A'$
- $A(:, [1 \ 4])$
- $A([2 \ 3], [3 \ 1])$
- $\text{reshape}(A, 2, 6)$
- $A(:)$
- $\text{flipud}(A)$
- $\text{fliplr}(A)$

12. Give the following command to create an array called  $F$ :

```
>> randn('seed', 123456789)
>> F = randn(5, 10);
```

- Compute the mean of each column
- Compute the standard deviation of each column

13. Given that  $x = [1 \ 5 \ 2 \ 8 \ 9 \ 0 \ 1]$  and  $y = [5 \ 2 \ 2 \ 6 \ 0 \ 0 \ 2]$ , execute and explain the results of the following commands:

- $x > y$
- $y < x$
- $x == y$
- $x \leq y$
- $y \geq x$
- $x \mid y$
- $x \& y$
- $x \& (\sim y)$
- $(x > y) \mid (y < x)$
- $(x > y) \& (y < x)$

14. The exercises here show the techniques of logical-indexing (indexing with 0-1 vectors). Given  $x = 1:10$  and  $y = [3 \ 1 \ 5 \ 6 \ 8 \ 2 \ 9 \ 4 \ 7 \ 0]$ , execute and interpret the results of the following commands:

- a.  $(x > 3) \ \& \ (x < 8)$
- b.  $x(x > 5)$
- c.  $y(x \leq 4)$
- d.  $x((x < 2) \mid (x \geq 8))$
- e.  $y((x < 2) \mid (x \geq 8))$
- f.  $x(y < 0)$

15. Create the vector  $x = \text{randperm}(35)$  and then evaluate the following function using only logical indexing:

```
y(x) = 2          if x < 6
      = x - 4      if 6 <= x < 20
      = 36 - x     if 20 <= x <= 35
```

16. Evaluate the given MATLAB code fragment:

```
if z < 5          a. z = 1    w = ?
    w = 2*z       b. z = 9    w = ?
elseif z < 10     c. z = 60   w = ?
    w = 9 - z     d. z = 200  w = ?
elseif z < 100
    w = sqrt(z)
else
    w = z
end
```

17. Execute following commands :

- a. Study the function "imread" using Matlab's help on-line.  
`im = imread('cameraman.tif');`
- b. Study the function "im2double" and "rgb2gray" using Matlab's help on-line.

```
im2 = im2double(im);
im2 = rgb2gray(im2);
imshow(im2);

im3 = im2 + 0.2;
figure, imshow(im3);

imwrite(im3, 'bright.jpg');
```