

## Exercise

1. Let  $v_1 = (100 \ 600 \ 300)^T$  and

a. Draw a for-loop flow chart to evaluate  $v_k$

$$v_k = P \cdot v_{k-1}$$

A screenshot of a software window showing a matrix P. The matrix is a 3x3 grid of numbers:

0.1000	0.4500	0.4500
0.3333	0	0.6667
0.5000	0	0.5000

b.  $v_{10} = ?$   $v_{20} = ?$   $v_{100} = ?$

2. Revise your flow chart to force the for-loop break after detecting convergence of  $v_k$

3.  $x = [-1 \ 0 \ 1 \ 2 \ 3 \ 4]$ ;  $y = [2 \ 1 \ 4 \ 11 \ 22 \ 37]$ ;  $a = 2$ ;  $b = 1$ ;  $c = 1$

a.  $e = a \cdot x.^2 + b \cdot x + c - y$ ;  $mse = \text{mean}(e.^2)$ ;  $mse = ?$

b. Draw a for-loop flow chart to evaluate mse (mean square error).

c. Express mse mathematically

d. Derive normal equations of estimating a, b and c for given x and y.

e. Give vector codes to estimate a, b and c for given x and y. Equivalently solve the following linear system

A screenshot of a presentation slide titled "Matrix form". It shows a linear system of equations:

$$\begin{bmatrix} e_{11} & e_{12} & e_{13} \\ e_{21} & e_{22} & e_{23} \\ e_{31} & e_{32} & e_{33} \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix}$$

Below the matrix equation, the MATLAB code for solving this system is provided:

```
E(1,:)=[sum(x.^4) sum(x.^3) sum(x.^2)];
E(2,:)=[sum(x.^3) sum(x.^2) sum(x)];
E(3,:)=[sum(x.^2) sum(x) length(x)];
D=[sum(x.^2.*y) sum(x.*y) sum(y)];
```

\* f. Draw a for-loop flow chart to estimate a, b and c.

\*g. Write a Matlab function to implement your flow chart.