PolyFit

$$PolyFit(x, y, n) := \left| \begin{array}{l} \left[m := \mathrm{length}(x) \;\; r := [1..m] \;\; c := [1..(n+1)] \;\; A := \mathrm{matrix}(m, n+1)+1 \right] \\ A_{r\,c} := \left(x_r + \left(\left(x_r = 0\right) \wedge (c = 1)\right)\right)^{c-1} \\ \mathrm{eval}\left(\left(A^{\mathrm{T}} \cdot A\right)^{-1} \cdot \left(A^{\mathrm{T}} \cdot y\right)\right) \end{array} \right.$$

You can try to substitute the last line with someone one of the following, from dislin plugin, which are more robust and general

$\mathrm{dn\_LinAlgLLS\_COF}(A, y)$

$\mathrm{dn\_LinAlgLLS\_SVD}(A, y)$

$\mathrm{dn\_LinAlgLLS\_QRorLQ}(A, y)$

In matlab: (A\y).'

A is the Vandermonde matrix. The code $\left(x_r = 0\right) \wedge (c = 1)$ is for avoid the SMath error 0^0, Uncertainty.

$$PolyVal(p, x) := \left| \begin{array}{l} [P := 0 \;\; k := 0] \\ \text{for } c \in p \\ \quad \left[P := \mathrm{eval}\left(P + c \cdot \overrightarrow{x^{k}}\right) \;\; k := k+1 \right] \\ P \end{array} \right.$$

Horner Method

$$\sum_{k=1}^{n} p_k \cdot \overrightarrow{x^{k-1}}$$

$$R_{Pearson}(X, Y) := \left| \begin{array}{l} [\Xi \;\; \Psi] := [X \;\; Y] - \dfrac{1}{\mathrm{length}(X)} \cdot \left[\sum X \;\; \sum Y \right] \\ \dfrac{\sum \overrightarrow{\Xi \cdot \Psi}}{\sqrt{\left(\sum \overrightarrow{\Xi^2}\right) \cdot \left(\sum \overrightarrow{\Psi^2}\right)}} \end{array} \right.$$

Shorthands:

$$plot(M, n) := \left| \begin{array}{l} C := PolyFit(X, Y, n) \\ \left\{ \begin{array}{l} PolyVal(C, x) \\ M \\ \mathrm{augment}(X, Y, \text{"o"}) \\ \mathrm{augment}(X, PolyVal(C, X), \text{"x"}) \end{array} \right. \end{array} \right.$$

$$R2(X, Y, n) := \left| \; R_{Pearson}(Y, PolyVal(PolyFit(X, Y, n), X))^2 \right.$$

$$MCols(M) := \left| \begin{array}{l} [n := \mathrm{cols}(M) \;\; R := \mathrm{matrix}(1, n) \;\; c := [1..n]] \\ \mathrm{eval}\left(R_c := \mathrm{col}(M, c)\right) \end{array} \right.$$

PolyFit

Lineal Polyfit

$n := 1$

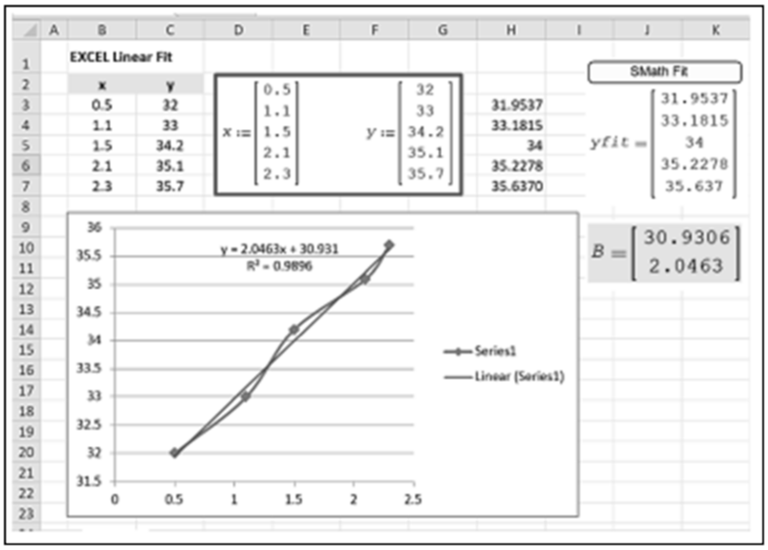
$$Data := \begin{bmatrix} 0.5 & 32 \\ 1.1 & 33 \\ 1.5 & 34.2 \\ 2.1 & 35.1 \\ 2.3 & 35.7 \end{bmatrix}$$

$[X \ Y] := MCols(Data)$

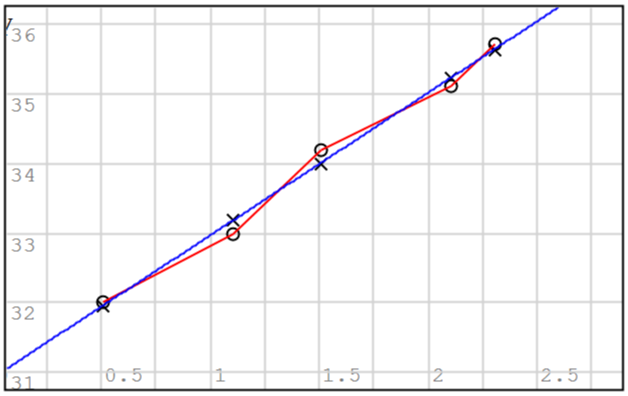
$C := PolyFit(X, Y, n) = \begin{bmatrix} 30.9306 \\ 2.0463 \end{bmatrix}$

$R2(X, Y, n) = 0.9895656$

$PolyVal(C, X) = \begin{bmatrix} 31.9537 \\ 33.1815 \\ 34 \\ 35.2278 \\ 35.637 \end{bmatrix}$



Amarasekera Excel screenshot



plot (Data , n)

Horinzontal Line Polyfit

$n := 0$

The polynom is the mean of tye Y-data. In this case, R2 is not defined

$$Data := \begin{bmatrix} 0.5 & 9 \\ 1.1 & 7.2 \\ 1.5 & 8.3 \\ 2.1 & 6 \\ 2.3 & 7.8 \end{bmatrix}$$

$[X \ Y] := MCols(Data)$

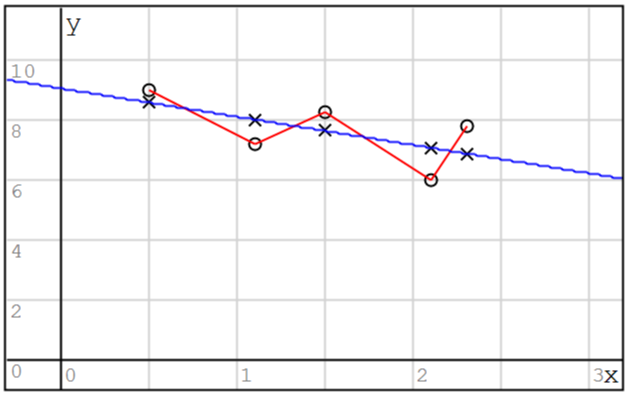
$C := PolyFit(X, Y, n) = 7.66$

$PolyVal(C, X) = \begin{bmatrix} 7.66 \\ 7.66 \\ 7.66 \\ 7.66 \\ 7.66 \end{bmatrix}$

$\dfrac{\sum Y}{\mathrm{length}(Y)} = 7.66$

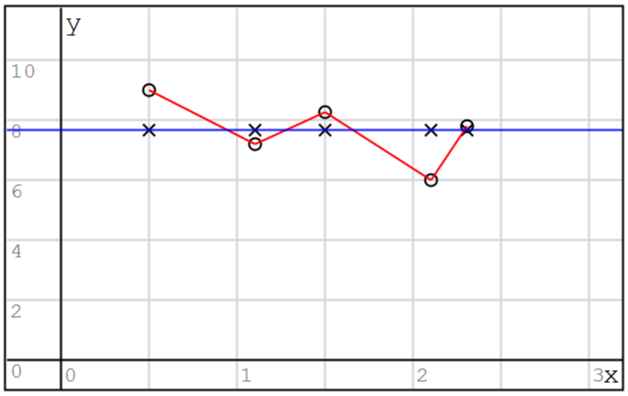
Some data are better interpreted as if they had a constant performance.

$n = 1$



plot (Data , 1)

$n = 0$



plot (Data , n)

Quadratic Polyfit

$n := 2$

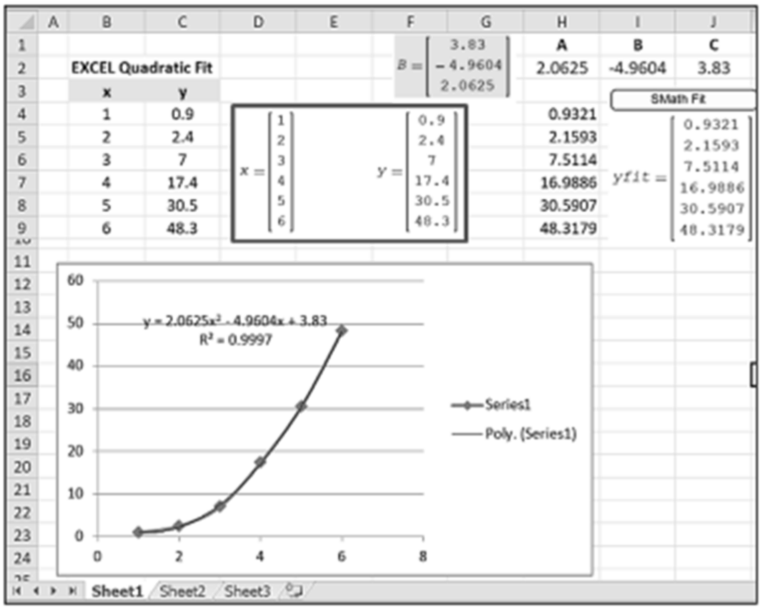
$$Data := \begin{bmatrix} 1 & 0.9 \\ 2 & 2.4 \\ 3 & 7 \\ 4 & 17.4 \\ 5 & 30.5 \\ 6 & 48.3 \end{bmatrix}$$

$[X\ Y] := MCols(Data)$

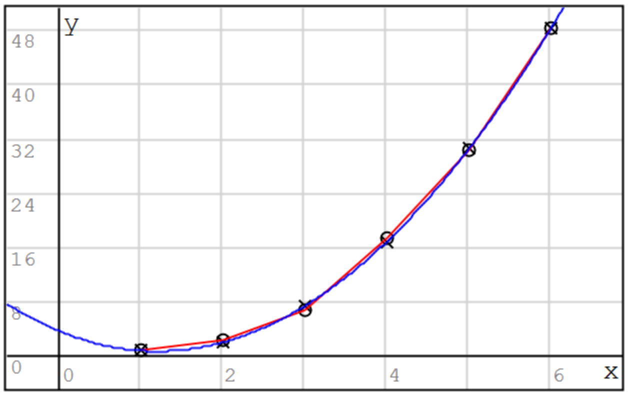
$R2(X, Y, n) = 0.9997121$

$$C := PolyFit(X, Y, n) = \begin{bmatrix} 3.83 \\ -4.9604 \\ 2.0625 \end{bmatrix}$$

$$PolyVal(C, X) = \begin{bmatrix} 0.9321 \\ 2.1593 \\ 7.5114 \\ 16.9886 \\ 30.5907 \\ 48.3179 \end{bmatrix}$$



Amarasekera Excel screenshot



$plot(Data, n)$

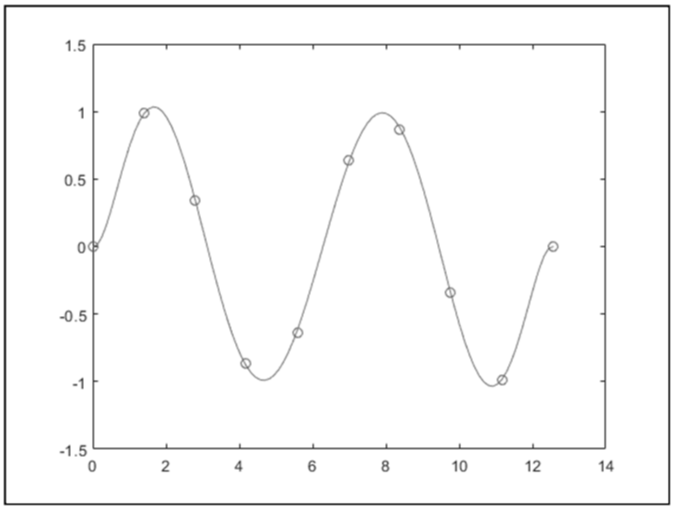
Matlab example

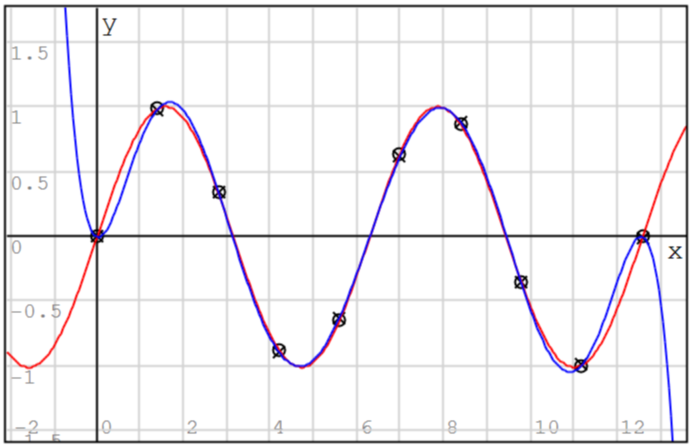
$n := 7$ https://la.mathworks.com/help/matlab/ref/polyfit.html?lang=en

$f(x) := \sin(x)$ $\quad X := \left[0, \frac{4}{9} \cdot \pi .. (4 \cdot \pi + 0.1)\right]$ $\quad Y := \overrightarrow{f(X)}$

$R2(X, Y, n) = 0.9995795$

Matlab screenshot





$plot(f(x), n)$

$$PolyFit(X, Y, 7) = \begin{bmatrix} 0.0002 \\ -0.1141 \\ 1.9084 \\ -1.3808 \\ 0.3702 \\ -0.0464 \\ 0.0028 \\ -6.2606 \cdot 10^{-5} \end{bmatrix}$$

```
x = linspace(0,4*pi,10);
y = sin(x);
p = polyfit(x,y,7)

p = 1×8
   -0.0001    0.0028   -0.0464    0.3702   -1.3808    1.9084   -0.1141    0.0002
```

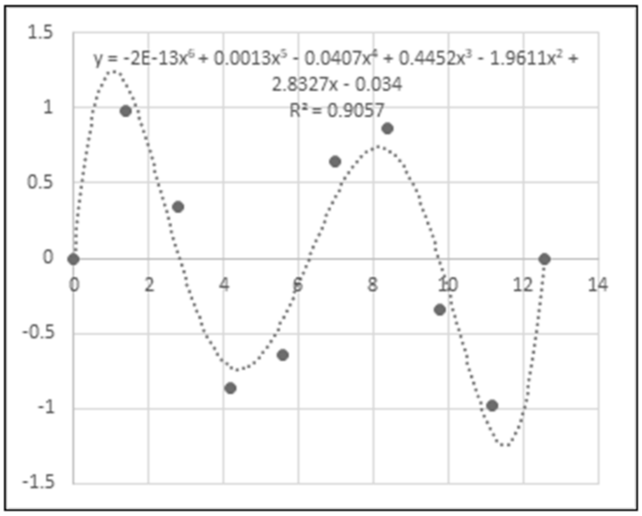
Matlab screenshot

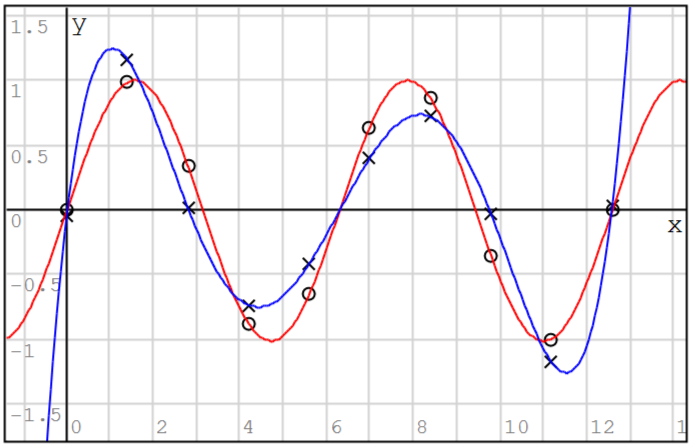
Matlab example in Excel

Notice that Excel accept only 6 as maximum n $n := 6$

$R2(X, Y, n) = 0.9057328$

Excel screenshot





plot $(f(x), n)$

The coefficients are the same in SMath, Matlab and Excel

$$PolyFit(X, Y, 6) = \begin{bmatrix} -0.034 \\ 2.8327 \\ -1.9611 \\ 0.4452 \\ -0.0407 \\ 0.0013 \\ -2.2 \cdot 10^{-14} \end{bmatrix}$$

```
x = linspace(0,4*pi,10);
y = sin(x);
p = polyfit(x,y,6)

p = 1×7
   -0.0000    0.0013   -0.0407    0.4452   -1.9611    2.8327   -0.0340
```

Matlab screenshot

Alvaro