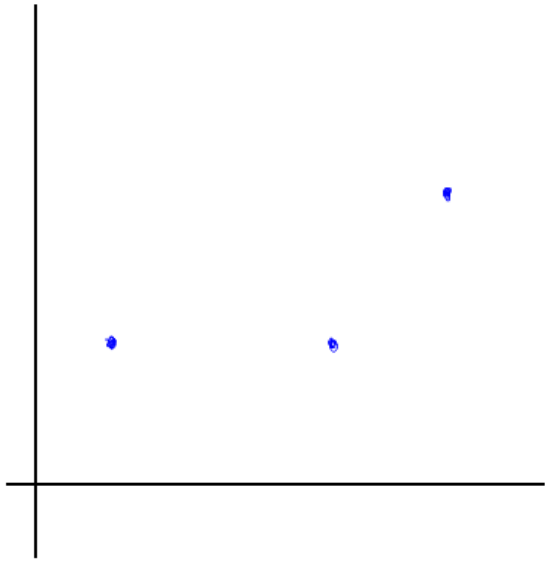

$$y = \alpha_0 + \alpha_1 P_1(x) + \alpha_2 P_2(x) + \cdots + \alpha_k P_k(x) + \epsilon$$

$$\mathbf{y} = X\alpha + \epsilon$$

$$X = \begin{pmatrix} P_0(x_1) & P_1(x_1) & \cdots & P_k(x_1) \\ P_0(x_2) & P_1(x_2) & \cdots & P_k(x_2) \\ \vdots & \vdots & \ddots & \vdots \\ P_0(x_n) & P_1(x_n) & \cdots & P_k(x_n) \end{pmatrix}$$

$$X^\top X = \begin{pmatrix} \sum_{i=1}^n P_0^2(x_i) & 0 & \cdots & 0 \\ 0 & \sum_{i=1}^n P_1^2(x_i) & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \sum_{i=1}^n P_k^2(x_i) \end{pmatrix} \quad \Rightarrow \quad (X^\top X)^{-1} = \begin{pmatrix} 1/\sum P_0^2(x_i) & & 0 \\ & 1/\sum P_1^2(x_i) & \\ 0 & & \ddots \end{pmatrix}$$

$$P_1(x_i) = \lambda_1 \left(\frac{x_i - \bar{x}}{d} \right)$$

$$P_2(x_i) = \lambda_2 \left[\left(\frac{x_i - \bar{x}}{d} \right)^2 - \left(\frac{n^2 - 1}{12} \right) \right]$$

```
(P1 = 2*(x-mean(x))/25)
```

```
 [1] -11  -9  -7  -5  -3  -1   1   3   5   7   9  11
```

```
(P2 = 3*(((x-mean(x))/25)**2 - 143/12))
```

```
 [1]  55  25   1 -17 -29 -35 -35 -29 -17   1  25  55
```

$n = 12$

	P_1	P_2	P_3	P_4	P_5
	1	−35	−7	28	20
	3	−29	−19	12	44
	5	−17	−25	−13	29
	7	1	−21	−33	−21
	9	25	−3	−27	−57
	11	55	33	33	33
A_{ii}	572	12012	5148	8008	15912
λ_i	2	3	$\frac{2}{3}$	$\frac{7}{24}$	$\frac{3}{20}$

```
poly(x,3)[1:nrow(datos),]
```

```
              P1           P2          P3
 [1,] -0.4599331  0.501828160 -0.45993311
 [2,] -0.3763089  0.228103709  0.04181210
 [3,] -0.2926847  0.009124148  0.29268470
 [4,] -0.2090605 -0.155110522  0.34843417
 [5,] -0.1254363 -0.264600302  0.26480997
 [6,] -0.0418121 -0.319345193  0.09756157
 [7,]  0.0418121 -0.319345193 -0.09756157
 [8,]  0.1254363 -0.264600302 -0.26480997
 [9,]  0.2090605 -0.155110522 -0.34843417
[10,]  0.2926847  0.009124148 -0.29268470
[11,]  0.3763089  0.228103709 -0.04181210
[12,]  0.4599331  0.501828160  0.45993311
```

polinomio lineal

```
sum(poly(x,3)[,1]*poly(x,3)[,2])
```

```
[1] -7.806256e-18 ≃ 0
```

```
sum(poly(x,3)[,1]*poly(x,3)[,3])
```

```
[1] -2.428613e-17 ≃0
```

```
sum(poly(x,3)[,2]*poly(x,3)[,3])
```

```
[1] -1.374768e-16 ≃ 0
```

ORTOGONALIDAD

				sqrt(CME)					
	Modelo	pvalor	R^2 aj	sigma	pvalor Shapiro	pvalor Breusch Pagan	pvalor DW	AIC	VIF
1	y ~ x	0,404	-0,022	15,96	0,2778	0,6505	1,298*10^-7	104,3542	
2	y ~ x + I(x^2)	1,18*10^-8	0,9789	2,296	0,4560	0,5543	0,0033	58,55	19,107
3	y ~ P1 + P2	1,18*10^-8	0,9789	2,296	0,4560	0,5543	0,0033	58,55	1
4	y ~ poly(x,3)	1,82*10^-9	0,9928	1,337	0,0870	0,7188	0,2355	46,17	1
5	y ~ poly(x,4)	1,55*10^-8	0,9940	1,224	0,6834	0,6491	0,7474	44,43	1

* X no necesariamente tiene el mismo espaciamiento

* pueden haber más variables predictoras:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 P_1(x) + \hat{\beta}_2 P_2(x) + \hat{\beta}_3 P_3(x) + \hat{\beta}_4 x_2 + \hat{\beta}_5 x_3$$

* Todo lo realizado debe ejecutarse en el TRAINING.

TESTING → evaluar el modelo.