

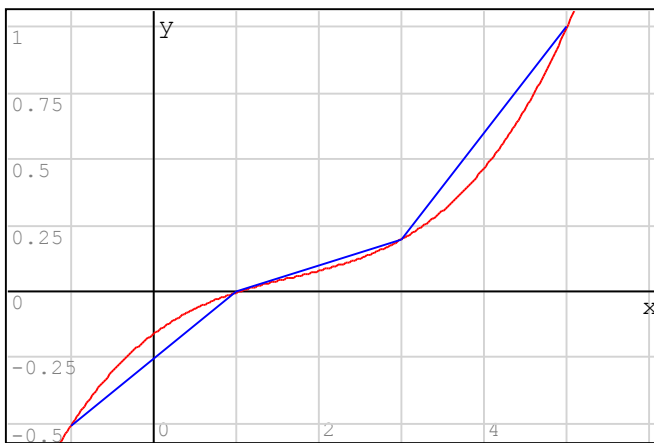
Lagrange interpolation polynomials

Polynomial passes through all the X,Y points

$$yL(X, Y, x) := \sum_{j=1}^{\text{length}(X)} \left(\prod_{i=1}^{\text{length}(X)} \begin{pmatrix} \text{if } i \neq j \\ x - X_i \\ \text{else} \\ 1 \\ \text{if } i \neq j \\ X_j - X_i \\ \text{else} \\ 1 \end{pmatrix} \cdot Y_j \right)$$

//Example

$$X := -1, 1 \dots 5 \quad Y := \begin{pmatrix} -0.5 \\ 0 \\ 0.2 \\ 1 \end{pmatrix} \quad XY := \text{augment}(X, Y)$$



{ XY
{ yL(X, Y, x)

Polynomial passes through the X,Y points starting from point nx of order m

$$yL(X, Y, nx, m, x) := \sum_{j=1}^{m+1} \left(\prod_{i=1}^{m+1} \begin{pmatrix} \text{if } i \neq j \\ x - X_{i+nx-1} \\ \text{else} \\ 1 \\ \text{if } i \neq j \\ X_{j+nx-1} - X_{i+nx-1} \\ \text{else} \\ 1 \end{pmatrix} \cdot Y_{j+nx-1} \right)$$

//Example

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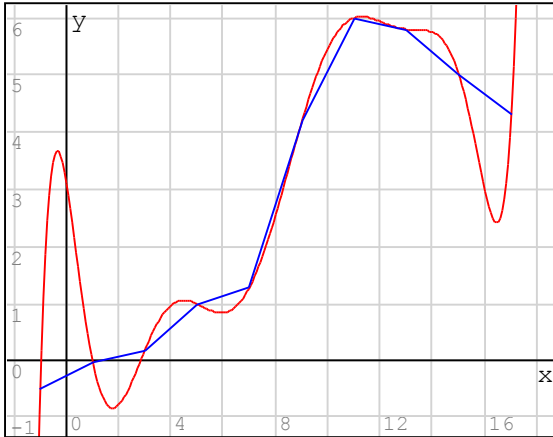
X:=-1, 1 .. 17    Y:=
  (-0.5)
  0
  0.2
  1
  1.3
  4.2
  6
  5.8
  5
  4.3
XY:=augment(X, Y)

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nx:=1 //Starting point (first point)
m:=9 //Polynomial order (maximal - (number of points-1))
yL(X, Y, nx, m, x)→
  (-1+x)·(1857945600·(-17+x)·(4128768·(-15+x)·(25804800·(-13+x)·(368640·(-11+x)·

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{ XY
{ yL(X, Y, nx, m, x)

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//Lagrange polynomials of large order are not suitable (error increasing)
 //(especially at the starting and ending points)
 //We can play with starting point and polynomial order.
 //Say, if we want to construct the polynomial of lower order
 //through the last 5 points, then:

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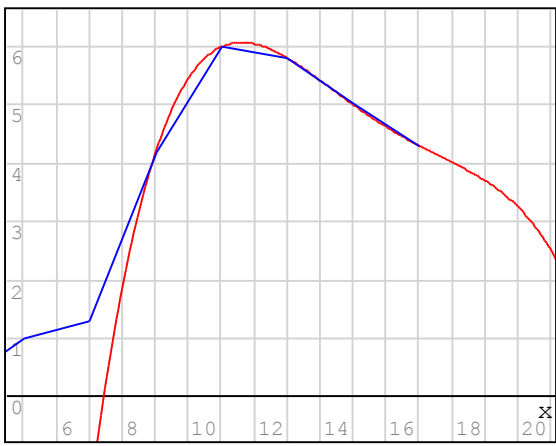
nx:=6 //Starting point
m:=4 //Polynomial order

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yL(X, Y, nx, m, x)→
  3840·(-17+x)·(96·(-15+x)·(320·(-13+x)·(112·(-11+x)-640·(-9+x))+296960·(-9+x)

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{ XY
{ yL(x, Y, nx, m, x)
```

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//END
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