Sample Usage of `polyinterp`

```
> read polyinterp:
```

```
> res1 := polyinterp(
  [[0,1],[1,6],[2,4],[3,0]],'x');
```

$$res1 := \frac{5}{6}x^3 - 6x^2 + \frac{61}{6}x + 1$$

```
> [seq(subs(x=i,res1),i=0..3)];
```

$$[1, 6, 4, 0]$$

```
> res2 := polyinterp(
  [[0,1],[1,6],[2,4],[3,0]],'f(x)');
Error, (in polyinterp) second argument must be a name
```

Use polyinterp to generate an interpolation formula for evenly spaced data

```
> res3 := polyinterp(
> [[-h,f[-1]], [0,f[0]], [h,f[1]]],'x');
```

$$res3 := \frac{1}{2}\frac{f_{-1}\,x^2}{h^2} - \frac{1}{2}\frac{f_{-1}\,x}{h} - \frac{f_0\,x^2}{h^2} + f_0 + \frac{1}{2}\frac{f_1\,x^2}{h^2} + \frac{1}{2}\frac{f_1\,x}{h}$$

In this case it is useful to collect terms proportional to the `f[i]`

```
> res3c := collect(res3,{f[-1],f[0],f[1]});
```

$$res3c := \left(\frac{1}{2}\frac{x^2}{h^2} - \frac{1}{2}\frac{x}{h}\right) f_{-1} + \left(-\frac{x^2}{h^2} + 1\right) f_0 + \left(\frac{1}{2}\frac{x^2}{h^2} + \frac{1}{2}\frac{x}{h}\right) f_1$$

Use polyinterp to fit to sin(x) on x = 0 .. 1.2*Pi

```
> seq(i,i=0..6);
```

$$0, 1, 2, 3, 4, 5, 6$$

```
> seq(0.2*i*Pi,i=0..6);
```

$$0, .2\,\pi, .4\,\pi, .6\,\pi, .8\,\pi, 1.0\,\pi, 1.2\,\pi$$

```
> [%];
```

$$[0, .2\,\pi, .4\,\pi, .6\,\pi, .8\,\pi, 1.0\,\pi, 1.2\,\pi]$$

```
> map(x->[x,sin(x)],%);
```

$$[[0, 0], [.2\,\pi, \sin(.2\,\pi)], [.4\,\pi, \sin(.4\,\pi)], [.6\,\pi, \sin(.6\,\pi)], [.8\,\pi, \sin(.8\,\pi)], [1.0\,\pi, 0], [1.2\,\pi, \sin(1.2\,\pi)]]$$

```
> sin_list := evalf(%);
```

$$sin\_list := [[0, 0], [.6283185308, .5877852524], [1.256637062, .9510565165], [1.884955592, .9510565163], [2.513274123, .5877852522], [3.141592654, 0], [3.769911185, -.5877852529]]$$

```
> p := polyinterp(sin_list,'x');
```

$$p := .99938790\,x - .16630848\,x^3 + .00139080\,x^2 - .00305064\,x^4 + .011275606\,x^5 - .0011963788\,x^6$$

Plot fitting polynomial and sin(x) on x=0 .. 2*Pi.   Note how fit deteriorates outside of original fitting range (i.e. for x > 1.2*Pi)

```
> plot([p,sin(x)],x=0..2*Pi,style=point);
```