# xint-regression

Classic regressions, with xint.

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```
\def\LISTEX{1,2,3,4,5,6}
\def\LISTEY{8.74,8.80,9.52,10.42,11.83,14.62}

\xintEXPreg[Alt]{\LISTEX}{\LISTEY}              %raw results
$a \approx \exprega$ and $b \approx \expregb$

\xintEXPreg[Alt,round=2]{\LISTEX}{\LISTEY}     %rounded results
$a \approx \exprega$ and $b \approx \expregb$\\

So $y \approx \mathrm{e}^{\exprega x+\expregb}$.
```

$a \approx 0.1014398394374648$ and $b \approx 7.343111895430519$
$a \approx 0.1$ and $b \approx 7.34$

So $y \approx \mathrm{e}^{0.1x+7.34}$.

```
\def\LISTEXX{0,50,100,140}
\def\LISTEYY{275,290,315,350}

\xintEXPOFFreg[offset=250]{\LISTEXX}{\LISTEYY}              %raw results
$a \approx \expregoffa$ and $b \approx \expregoffb$

\xintEXPOFFreg[offset=250,round=2/1]{\LISTEXX}{\LISTEYY}   %rounded results
$a \approx \expregoffa$ and $b \approx \expregoffb$\\

So $y \approx 250+\expregoffb e^{\expregoffa x}$
```

$a \approx 0.009866939273663047$ and $b \approx 24.69189584551776$
$a \approx 0.01$ and $b \approx 24.7$

So $y \approx 250 + 24.7e^{0.01x}$

# Contents

# 1 Introduction

## 1.1 Global usage

This package offers xint-based commands for working with classical regressions :

- linear regression $ax + b$ ;
- quadratic regression $ax^2 + bx + c$ ;
- cubic regression $ax^3 + bx^2 + cx + d$ ;
- power regression $ax^b$ ;
- exponential regression $ab^x$ or $e^{ax+b}$ or $be^{ax}$ or $C + be^{ax}$ ;
- logarithmic regression $a + b\ln(x)$ ;
- hyperbolic regression $a + \dfrac{b}{x}$.

For each type of regression, results can be stored in macros, either raw or with rounding (with individuals `[optional keys]`).
For example, if `[coeffa=xxA]`, the macro that will contain the value of coefficient `a` will be `\xxA`.

▶ If the lists differ in size, operations are applied only to the elements within the range of the shorter list.

## 1.2 Packages used

This package uses `simplekv`, `xintexpr`, `listofitems` and `xstring`.

```
%loading
\usepackage{xint-regression}
```

## 1.3 Warnings

The precision of the (determination) results seems to be good, which should normally guarantee satisfactory calculations and plots.
Nevertheless, it is advisable to be cautious about the results obtained and those expected.

# 2 The commands

## 2.1 Linear regression (xintLINreg or xintlinreg)

The equation is $\boxed{ax+b}$.

```
\xintLINreg[coeffa=...,coeffa=...,coeffr=...,coeffrr=...,round=...]{xlist}{ylist}
```

By default, `coeffa=linrega` ; `coeffb=linregb` and `round` is empty.
By default, `coeffr=linregr` ; `coeffrr=linregrr` and `round` is empty.
`round=...` can be given within `round=global` or `round=a/b`.

```
\def\LLX{83,71,64,69,69,64,68,59,81,91,57,65,58,62}%
\def\LLY{183,168,171,178,176,172,165,158,183,182,163,175,164,175}%
```

```
%default output
\xintLINreg{\LLX}{\LLY}%
$a \approx \linrega$ and $b \approx \linregb$ \\
$r \approx \linregr$ and $r^2 \approx \linregrr$
```

$a \approx 0.6232992732637560$ and $b \approx 129.5720998852522$
$r \approx 0.7883190802607096$ and $r^2 \approx 0.6214469723030911$

```
%personal macros + global rounding
\xintLINreg[coeffa=LINa,coeffb=LINb,round=2]{\LLX}{\LLY}%
$a \approx \LINa$ and $b \approx \LINb$
```

$a \approx 0.62$ and $b \approx 129.57$

```
%personal macros + individual rounding
\xintLINreg[coeffa=LINEARa,coeffb=LINEARb,round=2/0]{\LLX}{\LLY}%
$a \approx \LINEARa$ and $b \approx \LINEARb$
```

$a \approx 0.62$ and $b \approx 130$

## 2.2 Quadratic regression (xintQUADreg or xintquadreg)

The equation is $\boxed{ax^2+bx+c}$.

```
\xintQUADreg[coeffa=...,coeffb=...,coeffc=...,round=...]{xlist}{ylist}
```

By default, `coeffa=quadrega` ; `coeffb=quadregb`, `coeffc=quadrega` and `round` is empty.
`round=...` can be given within `round=global` or `round=a/b/...`.

```
\def\LLX{83,71,64,69,69,64,68,59,81,91,57,65,58,62}%
\def\LLY{183,168,171,178,176,172,165,158,183,182,163,175,164,175}%
```

```
%default output
\xintQUADreg{\LLX}{\LLY}%
$a \approx \quadrega$ ; $b \approx \quadregb$ and $c \approx \quadregc$
```

$a \approx -0.01683564807640720$ ; $b \approx 3.086723202993391$ and $c \approx 41.37453964053522$

```
%personal macros + global rounding
\xintQUADreg[coeffa=QUADa,coeffb=QUADb,coeffc=QUADc,round=2]{\LLX}{\LLY}%
$a \approx \QUADa$ ; $b \approx \QUADb$ and $c \approx \QUADc$
```

$a \approx -0.02$ ; $b \approx 3.09$ and $c \approx 41.37$

```
%personal macros + individual rounding
\xintQUADreg[coeffa=QUADRAa,coeffb=QUADRAb,coeffc=QUADRAc,round=4/3/2]{\LLX}{\LLY}%
$a \approx \QUADRAa$ ; $b \approx \QUADRAb$ and $c \approx \QUADRAc$
```

$a \approx -0.0168$ ; $b \approx 3.087$ and $c \approx 41.37$

## 2.3 Cubic regression (xintCUBreg or xintcubreg)

The equation for cubic is $\boxed{ax^3 + bx^2 + cx + d}$.

```
\xintCUBreg[coeffa=...,coeffb=...,coeffc=...,coeffd=...,round=...]{xlist}{ylist}
```

By default, `coeffa=cubrega` ; `coeffb=cubregb` ; `coeffc=cubregc` and `coeffd=cubregd`.

```
\def\LLX{83,71,64,69,69,64,68,59,81,91,57,65,58,62}%
\def\LLY{183,168,171,178,176,172,165,158,183,182,163,175,164,175}%
```

```
%individual roudings
\xintCUBreg[round=5/3/2/1]{\LLX}{\LLY}%
$a \approx \cubrega$ ; $b \approx \cubregb$ ; $c \approx \cubregc$ and $d \approx
↪  \cubregd$
```

$a \approx 0.0001$ ; $b \approx -0.039$ ; $c \approx 4.7$ and $d \approx 3.2$

## 2.4 Hyperbolic regression (xintHYPreg or xinthypreg)

The equation for hyperbolic is $\boxed{a + \dfrac{b}{x}}$.

```
\xintHYPreg[coeffa=...,coeffb=...,round=...]{xlist}{ylist}
```

By default, `coeffa=hyprega` and `coeffb=hypregb`.

```
\def\LLX{83,71,64,69,69,64,68,59,81,91,57,65,58,62}%
\def\LLY{183,168,171,178,176,172,165,158,183,182,163,175,164,175}%
```

```
%global roudings
\xintHYPreg[round=2]{\LLX}{\LLY}%
$a \approx \hyprega$ and $b \approx \hypregb$
```

$a \approx 220.77$ and $b \approx -3264.23$

## 2.5 Logarithmic regression (xintLOGreg or xintlogreg)

The equation for logarithmic is $\boxed{a + b\,\log(x)}$.

```
\xintLOGreg[coeffa=...,coeffb=...,round=...]{xlist}{ylist}
```

By default, `coeffa=logrega` and `coeffb=logregb`.

```
\def\LLX{83,71,64,69,69,64,68,59,81,91,57,65,58,62}%
\def\LLY{183,168,171,178,176,172,165,158,183,182,163,175,164,175}%
```

```
%individual roudings
\xintLOGreg[round=1/4]{\LLX}{\LLY}%
$a \approx \logrega$ and $b \approx \logregb$
```

$a \approx -20.2$ and $b \approx 45.6282$

## 2.6 Power regression (xintPOWreg or xintpowreg)

The equation for power is $\boxed{a \times x^b}$.

```
\xintPOWreg[coeffa=...,coeffb=...,round=...]{xlist}{ylist}
```

By default, `coeffa=powrega` and `coeffb=powregb`.

```
\def\LLX{83,71,64,69,69,64,68,59,81,91,57,65,58,62}%
\def\LLY{183,168,171,178,176,172,165,158,183,182,163,175,164,175}%
```

```
%default output
\xintPOWreg{\LLX}{\LLY}%
$a \approx \powrega$ and $b \approx \powregb$
```

$a \approx 56.48337543648656$ and $b \approx 0.2641537564865711$

## 2.7 Exponential regression

Available regressions are :

- $\boxed{a \times b^x}$ (`xintEXPABreg` or `xintexpabreg`);
- $\boxed{e^{ax+b}}$ (`xintEXPreg` or `xintexpreg`);
- $\boxed{b\,e^{ax}}$ (`xintEXPreg` or `xintexpreg` with `[Alt]` key);
- $\boxed{C + b\,e^{ax}}$ (`xintEXPOFFreg` or `xintexpoffreg`).

```
%a*b^x
\xintEXPABreg[coeffa=...,coeffb=...,round=...]{xlist}{ylist}
```

By default, `coeffa=expabrega` and `coeffb=expabregb`.

```
%e^(ax+b)
\xintEXPreg[coeffa=...,coeffb=...,round=...]{xlist}{ylist}
```

By default, `coeffa=exprega` and `coeffb=expregb`.

```
%b*e^(ax)
\xintEXPreg[Alt,coeffa=...,coeffb=...,round=...]{xlist}{ylist}
```

By default, `coeffa=exprega` and `coeffb=expregb`.

```
%C+b*e^(ax)
\xintEXPOFFreg[offset=C,coeffa=...,coeffb=...,round=...]{xlist}{ylist}
```

By default, `coeffa=expregoffa` and `coeffb=expregoffb`.

```
\def\LLX{83,71,64,69,69,64,68,59,81,91,57,65,58,62}%
\def\LLY{183,168,171,178,176,172,165,158,183,182,163,175,164,175}%
```

```
%a*b^x
\xintEXPABreg{\LLX}{\LLY}
$a \approx \expabrega$ and $b \approx \expabregb$

%e^(ax+b)
\xintEXPreg{\LLX}{\LLY}
$a \approx \exprega$ and $b \approx \expregb$

%b*e^(ax)
\xintEXPreg[Alt]{\LLX}{\LLY}
$a \approx \exprega$ and $b \approx \expregb$

%C+b*e^(ax)
\xintEXPOFFreg[offset=50]{\LLX}{\LLY}
$a \approx \expregoffa$ and $b \approx \expregoffb$
```

$a \approx 134.4457921893217$ and $b \approx 1.003610918317193$
$a \approx 0.003604414603197639$ and $b \approx 4.901161085752989$
$a \approx 0.003604414603197639$ and $b \approx 134.4457921893208$
$a \approx 0.005074417221205945$ and $b \approx 86.19808037780071$

# 3 Integration with other packages

## 3.1 Number formatting

It is possible to format the results, according to locale rules, for example with sinuitx.

With `[locale=FR]` :

```
%a*b^x
\xintEXPABreg[round=1/3]{\LLX}{\LLY}%
So we obtain $y \approx \num{\expabrega} \times e^{\num{\expabregb}\times x}$
```

So we obtain $y \approx 134{,}4 \times e^{1{,}004 \times x}$

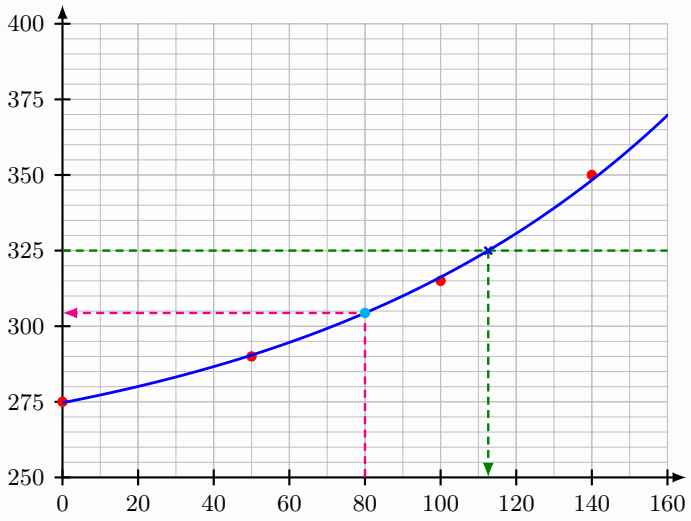
## 3.2 Plotting

It is also possible to integrate the package's commands into a plotting environment, such as tikz or pgfplots.

For example, with tkz-grapheur package :

```
\def\LISTEXX{0,50,100,140}%
\def\LISTEYY{275,290,315,350}%

\begin{GraphiqueTikz}
  [x=0.05cm,y=0.04cm,Xmin=0,Xmax=160,Xgrille=20,Xgrilles=10,
  Origy=250,Ymin=250,Ymax=400,Ygrille=25,Ygrilles=5]
  %window
  \TracerAxesGrilles[Elargir=2.5mm,Police=\footnotesize]{auto}{auto}
  %points
  \TracerNuage[Style=o,CouleurNuage=red]{\LISTEXX}{\LISTEYY}
  %regression expoffset C+b*epx(ax)
  \xintEXPOFFreg[offset=250]{\LISTEXX}{\LISTEYY}
  \DefinirCourbe[Nom=ajust,Couleur=blue,Trace]
    <ajust>
    {250+\expregoffb*exp(\expregoffa*x)}
  %constructions
  \PlacerImages[Couleurs=cyan/magenta,Traits]{ajust}{80}
  \PlacerAntecedents[Style=x,Couleurs=blue/green!50!black,Traits]{ajust}{325}
\end{GraphiqueTikz}
```



# 4 History

0.1.2: r and $r^2$ for linreg + new names (tks to quark67 for suggestion)
0.1.1: Bugfix
0.1.0: Initial version