

# Introduction to PARI/GP

B. Allombert

IMB  
CNRS/Université de Bordeaux

8/06/2018



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 676541

## Basic objects

? 57!

%1 = 40526919504877216755680601905432...

? 2 / 6

%2 = 1/3

? (1+I)^2

%3 = 2\*I

? (x+1)^(-2)

%4 = 1/(x^2+2\*x+1)

? Mod(2,5)^3

%5 = Mod(3,5)

? Mod(x, x^2+x+1)^3

%6 = Mod(1, x^2+x+1)

? a = ffgen([3,5], 'a); a^12 \\ in F\_3^5

%7 = 2\*a^4+2\*a^3+2



# Functions

? ?

- 1: PROGRAMMING under GP
- 2: Standard monadic or dyadic OPERATORS
- 3: CONVERSIONS and similar elementary functions
- 4: functions related to COMBINATORICS
- 5: NUMBER THEORETICAL functions
- 6: POLYNOMIALS and power series
- 7: Vectors, matrices, LINEAR ALGEBRA and sets
- 8: TRANSCENDENTAL functions
- 9: SUMS, products, integrals and similar functions
- 10: General NUMBER FIELDS
- 11: Associative and central simple ALGEBRAS
- 12: ELLIPTIC CURVES
- 13: L-FUNCTIONS
- 14: MODULAR FORMS

# Help

? ?4

? ?atan

atan(x): arc tangent of x.

? ??atan

atan(x):

Principal branch of  $\tan^{-1}(x) = \log((1+ix)/(1-ix))$

The library syntax is GEN gatan(GEN x, long prec)

? ??

? ??refcard

? ??tutorial

? ???determinant

algdisc

bnfsunit

charker

ellpadicregulator

forsubgroup

matdet

mathnfmod

matrixqz

mspolygon

polresultant

rnfdet

See also:

Finite abelian groups

Pseudo-bases, determinant

## Vectors and matrices

```
? V = [1, 2, 3];  
? W = [4, 5, 6]~;  
? M = [1, 2, 3; 4, 5, 6];  
? V*W  
%4 = 32  
? M*W  
%5 = [32, 77]~  
? U = [1..10]  
%6 = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

## Components

```
? V[2]
```

```
%7 = 2
```

```
? W[1..2]
```

```
%8 = [4, 5]~
```

```
? M[2, 2]
```

```
%9 = 5
```

```
? M[1, ]
```

```
%10 = [1, 2, 3]
```

```
? M[, 2]
```

```
%11 = [2, 5]~
```

```
? M[1..2, 1..2]
```

```
%12 = [1, 2; 4, 5]
```