Numerical Calculations

Arithmetic with Mathematica

```
x^y              power
-x               minus
x/y              divide
x y z or x*y*z   multiply
x+y+z            add
```

control grouping by explicitly using parentheses

Exact and Approximate Results

```
In[1]:= 2^100
```

return an exact result

```
Out[1]= 1267650600228229401496703205376
```

```
In[2]:= 2^100 //N
Out[2]= 1.26765×10^30
```

return an approximate num. result

```
In[3]:= 1/3 + 2/7
          13
Out[3]= ----
          21

In[4]:= 1/3 + 2/7 //N
Out[4]= 0.619048
```

This is taken to be an exact rational number, and reduced to its lowest terms.

```
In[5]:= 452/62
          226
Out[5]= ---
          31
```

Whenever you give a number with an explicit decimal point, Mathematica produces an approximate numerical result.

```
In[6]:= 452.3/62
Out[6]= 7.29032
```

Mathematical Functions

Mathematica includes a very large collection of mathematical functions, here are just a few examples: Help with ?Function

Sqrt[x]	square root ($\sqrt{x}$)
Exp[x]	exponential (e^x)
Log[x]	natural logarithm ($\log_e x$)
Log[b, x]	logarithm to base b ($\log_b x$)
Sin[x], Cos[x], Tan[x]	trigonometric functions (with arguments in radians)
ArcSin[x], ArcCos[x], ArcTan[x]	inverse trigonometric functions
n!	factorial (product of integers $1,2,\ldots,n$)
Abs[x]	absolute value
Round[x]	closest integer to x
Mod[n, m]	n modulo m (remainder on division of n by m)
Random[ ]	pseudorandom number between 0 and 1
Max[x, y, ...], Min[x, y, ...]	maximum, minimum of x, y, $\cdots$
FactorInteger[n]	prime factors of n

The arguments of all Mathematica functions are enclosed in square brackets.
The names of built-in Mathematica functions begin with capital letter and correspond to the English term.

Some common mathematical constants:

Pi	$\pi \approx 3.14159$
E	$e \approx 2.71828$ (normally output as e)
Degree	$\pi/180$: degrees-to-radians conversion factor (normally output as °)
I	$i=\sqrt{-1}$ (normally output as i)
Infinity	∞

Get numerical results in Mathematica to any degree of precision:

expr//N or N[expr]	approximate numerical value of expr
N[expr, n]	numerical value of expr calculated with n-digit precision

```
In[1]:= N[Pi,40]
Out[1]=  3.1415926535897932384626433832795028841 97
```

Complex Numbers

x + I y	the complex number $x+i\,y$
Re[z]	real part
Im[z]	imaginary part
Conjugate[z]	complex conjugate z^* or $\bar{z}$
Abs[z]	absolute value $\lvert z\rvert$
Arg[z]	the argument φ in $\lvert z\rvert e^{i\varphi}$

Mathematica does calculations with complex numbers

```
In[1]:= (4 + 3 I) / (2 - I)
Out[1]= 1 + 2 i
```