

TI-89/TI-89 Platinum/Voyage 200 tutorial

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The TI-89 is a great calculator. By a great calculator I mean that it is one of the best calculators you can find at the moment. Another great calculator is the HP 49g+ which is the first calculator to include an SD expansion Card.

The TI-89 will be a calculator that will assist you for many years to come. This short tutorial will let you be familiarized with some of the features of the calculator. The calculator main reference remains the TI-89 guidebook.

P.S. : I will use the TI-89 for simplification but the other calculators like the TI-89 Platinum and Voyage 200 are also concerned by the tutorial.

Contents

1 Solving equations & system of linear equations	3
2 Derivation & Integration	3
2.1 Derivation	3
2.2 Integration	5
3 Limits, sums & Taylor series	5
3.1 Limits	5
3.2 Sum	6
3.3 Taylor series	6
4 Polynomials	6
4.1 Expanding polynomials	6
4.2 Factoring polynomials	7
4.3 Common denominator	7
5 Number operations	7
5.1 Factoring a number	7
5.2 Finding the GCD & LCM	8
5.3 Testing if a number is prime or not	8
5.4 Finding the factorial of a number	8
6 Differential Equations	9
7 Sequence	9
7.1 The when() function	9
7.2 Using the Sequence mode	10

1 Solving equations & system of linear equations

Suppose we want to solve the following equation: $-3x^3 + 3x^2 - 2x + 5 = 0$
The syntax is:

```
solve(-3x^3+3x^2-2x+5=0, x)
or
zeros(-3x^3+3x^2-2x+5, x)
```



```
■ solve(-3·x^3 + 3·x^2 - 2·x + 5 = 0, x)
x = 1.38632
```

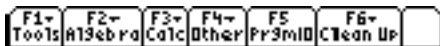


I have written ",x" after the equation because the variable to solve for in this equation is x
Suppose we want to solve the following system of linear equations:

$$\begin{aligned} 2x - 3y + 5z &= -1 \\ -3x + 5y - 2z &= 3 \\ 5x - 7y + 8z &= -2 \end{aligned}$$

The syntax is :

```
solve(2x+3y+5z=-1 and -3x+5y-2z=3 and 5x-7y+8z=-2, x, y, z)
or
zeros(2x+3y+5z+1, -3x+5y-2z-3, 5x-7y+8z+2, x, y, z)
```



```
■ solve(2·x - 3·y + 5·z = -1 and -3·x + 5·y - 2·z = 3 and 5·x - 7·y + 8·z = -2, x, y, z)
x = 21/10 and y = 19/10 and z = -1/10
```



2 Derivation & Integration

2.1 Derivation

Suppose we want to compute the derivative of : $x^2 + 3x - 5$
The syntax is:

```
d(function, variable, degree)
degree can be omitted, it's 1 by default
```

F1→ Tools	F2→ Algebra	F3→ Calc	F4→ Other	F5 Fr3mID	F6→ Clean Up	
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$$\frac{d}{dx}(x^2 + 3 \cdot x - 5) = 2 \cdot x + 3$$

$$\frac{d(x^2+3*x-5, x)}$$

MAIN RAD AUTO FUNC 1/30

Compute the partial derivative f_x of $f(x) = \sin xy + \cos^2(x + y)$

F1→ Tools	F2→ Algebra	F3→ Calc	F4→ Other	F5 Fr3mID	F6→ Clean Up	
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$$\frac{d}{dx}(\sin(x \cdot y) + (\cos(x + y))^2)$$

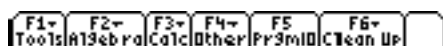
$$\cos(x \cdot y) \cdot y - 2 \cdot \sin(x + y) \cdot c$$

$$\frac{d(\sin(x*y)+\cos(x+y)^2, x)}$$

MAIN RAD AUTO FUNC 1/30

2.2 Integration

Let's say we want to compute $\int \sin x$:



$$\int \sin(x) dx = -\cos(x)$$

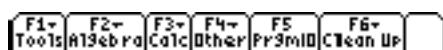
$J(\sin(x), x)$

MAIN RAD AUTO FUNC 1/30

Compute

$$\iint x^2y + y^2 + \sin y \, dx dy$$

To do that on paper we first integrate for x supposing y constant then we integrate for y supposing x constant



$$\iint (x^2 \cdot y + y^2 + \sin(y)) dx dy = -\cos(y) \cdot x + \frac{y^3 \cdot x}{3} + \frac{y^2 \cdot x^3}{6}$$

$J(J(x^2*y + y^2 + \sin(y), x), y)$

MAIN RAD AUTO FUNC 1/30

Let's say we want to compute the value of following integral $\int_1^{10} x \cos x$:



$$\int_1^{10} (x \cdot \cos(x)) dx = \cos(10) + 10 \cdot \sin(10) - \cos(1)$$

$J(x \cdot \cos(x), x, 1, 10)$

MAIN RAD AUTO FUNC 1/30

3 Limits, sums & Taylor series

3.1 Limits

Suppose we want to compute:

$$\lim_{x \rightarrow \infty} x^2$$

The syntax is:

lim(function, variable, point, direction)
 direction is either 1 or -1 and can be omitted
 1: limit from right
 -1: limit from left

3.2 Sum

Compute

$$\sum_{i=1}^n k^2$$



$\sum_{k=1}^n (k^2)$

$$\frac{n \cdot (n+1) \cdot (2 \cdot n + 1)}{6}$$

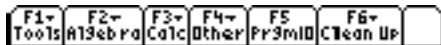
 $\Sigma(k^2, k, 1, n)$
 MAIN RAD AUTO FUNC

3.3 Taylor series

The syntax for computing Taylor series is:

taylor(function, variable, degree, point)
 point can be omitted, it is 0 by default

Suppose we want to know the 6th degree Taylor expansion of $\sin x$ around 0:



$\text{taylor}(\sin(x), x, 6, 0)$

$$\frac{x^5}{120} - \frac{x^3}{6} + x$$

 $\text{taylor}(\sin(x), x, 6, 0)$
 MAIN RAD AUTO FUNC 1/30

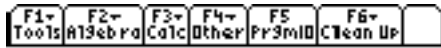
4 Polynomials

4.1 Expanding polynomials

The syntax is

expand(polynomial, variable)

Let's say we want to expand $(x + y)^4$



```

■ expand((x + y)^4, x)
x^4 + 4 · x^3 · y + 6 · x^2 · y^2 + 4 · y^3
-----
expand((x+y)^4, x)
MAIN          RAD AUTO  FUNC          1/30

```

4.2 Factoring polynomials

The syntax is:

```
factor(function, variable)
```

Let's factor the function $x^2 - 9$



```

■ factor(x^2 - 9, x)
(x - 3) · (x + 3)
-----
factor(x^2-9, x)
MAIN          RAD AUTO  FUNC          1/30

```

4.3 Common denominator

Let's put on the same denominator the function:

$$f(x, y) = \frac{1}{x^2} + \frac{1}{y^2 + 1}$$

```

x^2 · y^2 + x^2
■ comDenom(1/x^2 + 1/(y^2+1), x)
x^2 + y^2 + 1
-----
x^2 · y^2 + x^2
comdenom(1/x^2+1/(y^2+1), x)
MAIN          RAD AUTO  FUNC          2/30

```

5 Number operations

5.1 Factoring a number

The syntax is:

```
factor(number)
```

Let's factor the number 1050 for example:



```
■ factor(1050)      2·3·52·7
factor(1050)
MAIN          RAD AUTO  FUNC  1/30
```

5.2 Finding the GCD & LCM

The syntax is:

```
gcd(number1, number2) lcm(number1, number2)
```

To find the GCD & LCM of 3 numbers the syntax is:

```
gcd(gcd(number1, number2), number3)
lcm(lcm(number1, number2), number3)
```

5.3 Testing if a number is prime or not

```
isPrime(number)
```

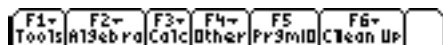
Let's see if 997 is prime or not



```
■ isPrime(997)      true
isPrime(997)
MAIN          RAD AUTO  FUNC  1/30
```

5.4 Finding the factorial of a number

Let's find : 64!



```
■ 64!
126886932185884164103433▶
64!
MAIN          RAD AUTO  FUNC  1/30
```


6 Differential Equations

Let's solve the following differential equation:

$$x'' + \omega^2 x = 0$$

The syntax is:

```
deSolve(function, x, y)
```

We must rename x to y



```

■ deSolve(y'' + w^2 · y = 0, x, ▶
  y = @3 · cos(w · x) + @4 · sin(w ·
MAIN      RAD AUTO      FUNC

```

Note that the result is: $@3\cos(w.x) + @4\sin(w.x)$ and $@3$ and $@4$ are constants like the constants c_1, c_2, \dots etc used in Mathematics courses.

7 Sequence

Suppose we want to find the terms of the following sequence:

$$U_{n+1} = 2U_n + 2, \quad U_0 = 2$$

We can use 2 methods: the *when* function or by using the *Sequence mode* of the calculator.

7.1 The when() function

The syntax of this function is:

```
when(condition, true value, false value, unknown value)
false value & unknown value can be omitted.
```

when($n=0, 2, 2u(n-1)+2$) $\rightarrow u(n)$

The sign \rightarrow is to store the function in $u(n)$

To compute u_1 , we write : $u(1)$



```

■ { 2, n = 0
  2 · u(n - 1), else → u(n)
Done
■ u(1) 4
u(1)
MAIN      RAD AUTO      SEQ

```

Suppose we want to find the 5 first terms of the sequence, we should write:

$$u(1), u(2), u(3), u(4), u(5)$$

F1 Tools	F2 R13cbr	F3 Calc	F4 Other	F5 Pr3mID	F6 Clean Up	
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■ $\begin{cases} 2, n=0 \\ 2 \cdot u(n-1), \text{else} \end{cases} \rightarrow u(n)$

Done

■ $\{u(1) \quad u(2) \quad u(3) \quad u(4) \quad \blacktriangleright\}$
 $\{4 \quad 8 \quad 16 \quad 32 \quad 64\}$

$\{u(1), u(2), u(3), u(4), u(5)\}$

MAIN	RAD AUTO	SEQ	2/30
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7.2 Using the Sequence mode

Let's take the previous example:
The syntax is:

$$U_1 = 2U_{n-1} + 2, \quad U_{i1} = 2$$

U_{i1} is the initial term

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 16.6%;">F1 Tools</td> <td style="width: 16.6%;">F2 Zoom</td> <td style="width: 16.6%;">F3 Edit</td> <td style="width: 16.6%;">F4 ✓</td> <td style="width: 16.6%;">F5 R11</td> <td style="width: 16.6%;">F6 Style</td> <td style="width: 16.6%;">F7 Axes...</td> </tr> </table> <p>+PLOTS</p> <p>✓ $u1=2 \cdot u1(n-1) + 2$</p> <p>$u_{i1}=2$</p> <p>$u2=$ ■</p> <p>$u_{i2}=$</p> <p>$u3=$</p> <p>$u_{i3}=$</p> <p>$u4=$</p> <hr/> <p>$u2(n)=$</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 16.6%;">MAIN</td> <td style="width: 16.6%;">RAD AUTO</td> <td style="width: 16.6%;">SEQ</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 16.6%;">F1 Tools</td> <td style="width: 16.6%;">F2 Setup</td> <td style="width: 16.6%;">F3 D1</td> <td style="width: 16.6%;">F4 D2</td> <td style="width: 16.6%;">F5 D3</td> <td style="width: 16.6%;">F6 D4</td> <td style="width: 16.6%;">F7 D5</td> </tr> <tr> <td>n</td> <td>u1</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>1.</td> <td>2.</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2.</td> <td>6.</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3.</td> <td>14.</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4.</td> <td>30.</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5.</td> <td>62.</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>n=1.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 16.6%;">MAIN</td> <td style="width: 16.6%;">RAD AUTO</td> <td style="width: 16.6%;">SEQ</td> </tr> </table>	F1 Tools	F2 Zoom	F3 Edit	F4 ✓	F5 R11	F6 Style	F7 Axes...	MAIN	RAD AUTO	SEQ	F1 Tools	F2 Setup	F3 D1	F4 D2	F5 D3	F6 D4	F7 D5	n	u1						1.	2.						2.	6.						3.	14.						4.	30.						5.	62.						MAIN	RAD AUTO	SEQ	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 16.6%;">F1</td> <td style="width: 16.6%;">F2</td> <td style="width: 16.6%;">F3</td> <td style="width: 16.6%;">F4</td> <td style="width: 16.6%;">F5</td> <td style="width: 16.6%;">F6</td> <td style="width: 16.6%;">F7</td> </tr> </table> <p style="text-align: center;">TABLE SETUP</p> <p>tblStart..... 1</p> <p>Δtbl..... 1</p> <p>Graph <-> Table OFF \rightarrow</p> <p>Independent..... AUTO \rightarrow</p> <p style="text-align: center;">Enter=SAVE ESC=CANCEL</p> <hr/> <p>$u2(n)=$</p> <p style="text-align: center;">TYPE + [ENTER]=OK AND [ESC]=CANCEL</p>	F1	F2	F3	F4	F5	F6	F7
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Note that the table starts at 1 so U_0 is equal to $n = 1$ on the calculator, there is a shift of 1 between the calculator and the real world.