

## Module 4

# CREATE FORMULAS WITH EFFICIENT TECHNOLOGY

**Here we create formulas that can be done with clicks.**

**We work with the standard variable library, which is already available**

**We also need the well-known pi constant [ $\pi$ ], which is stored in the constant library.**

We create the formulas: - BALL and  
- CYLINDERS

Every abaCal formula is built up in 3 blocks. These 3 blocks communicate with each other. In Module 3 you got to know this scheme for the first time.

The standard variables and constants are saved to the right of the editor. Working with standard variables is easier than with MyVariables. They are stored in a library, ready to use and no more units of measurement have to be added.

It is very important that you insert the standard variables and the pi constant into the formula using the click technique. This way you are faster in creating the formula.

## Ball-Formula

**Block 1:**  
**Formelname**

**Block 2:**  
**Editor + Rechner**

**Block 3:**  
**Variablen und Rechts Ergebnisse**

The screenshot shows the abaCal interface for creating a formula for a ball. It is divided into three main blocks:

- Block 1: Formelname** (Name, Category, Description, Subcategory)
- Block 2: Editor + Rechner** (Formula editor, Formula Display, Show Errors, Significant numbers, Calculate, Save, Back, Graph, Create MyVariable)
- Block 3: Variablen und Rechts Ergebnisse** (Variables & Constants, Tips for syntax, Results, Math operations, Logical operations, Functions, Sum and iteration, Call a formula, Tables, Prefix)

**Block 1: Formelname**

Name: BALL  
 Category: Mathematics  
 Description: Ball values  
 Subcategory: Stereometry

**Block 2: Editor + Rechner**

Formula editor:  
 /\* Volume of a ball with diameter d is : \*/  
 Vol = [π] / 6 \* d^3  
 /\* The surface of a sphere has an area A :\*/  
 A = [π] \* d^2

Formula Display:  

$$A = \pi * d^2$$

Show Errors:  Significant numbers: 4

π: Ratio of the circumference of a circle to its diameter, 3.14159  
 d: diameter, 4 cm  
 Vol: 33.51 cm³  
 A: 50.27 cm²

Buttons: Calculate, Save, Back, Graph, Create MyVariable

Notes:

**Block 3: Variablen und Rechts Ergebnisse**

Variables & Constants:

| Standardvariables | Value              | Unit  |
|-------------------|--------------------|-------|
| AL                | lower surface area | [cm²] |
| AU                | upper surface area | [cm²] |
| C                 | circumference      | [cm]  |
| D                 | great diameter     | [cm]  |
| V                 | volume             | [cm³] |
| a                 | length of a side   | [cm]  |
| b                 | length of a side   | [cm]  |
| c                 | length of a side   | [cm]  |
| d                 | small diameter     | [cm]  |
| d                 | diameter           | [cm]  |
| h                 | height             | [cm]  |

My Variables:  
 Constants:

Tips for syntax:  
 Results  
 Math operations  
 Logical operations  
 Functions  
 Sum and iteration  
 Call a formula  
 Tables  
 Prefix

## Create BALL formula

### Block 1: Definition of the formula

**Press My Formulas / Create:** an empty editor appears.

Enter Name: **BALL** and Description: **Ball Values**

**Category: Mathematics** and **Subcategory: Stereometry**

Enter.

By entering Category and Subcategory, we have defined which standard variables we want to work with.

### Block 2: Enter the formula in the editor

Write text: `/* Volume of a ball with diameter d is: */`

**Formula 1:**  $Vol = \{n\} / 6 * d^3$

1. Result field: **Vol** = write
2. Insert constant **[π]** from **constants table** with a click. It has to be inserted with a click, because abaCal perceives from the brackets that it is a constant.
3. Write **/ 6 \*** and click the **Standardvariables d** insert  
And write **^3**.

Press the **Calculate** key

and with **Formula Display**  
check the formula address

Formula Display

$$Vol = \frac{\pi}{6} d^3$$

Variables & Constants

Standardvariables

|           |                                |      |
|-----------|--------------------------------|------|
| <b>b</b>  | length of a side               | [cm] |
| <b>c</b>  | length of a side               | [cm] |
| <b>d</b>  | small diameter                 | [cm] |
| <b>d</b>  | diameter                       | [cm] |
| <b>h</b>  | height                         | [cm] |
| <b>l</b>  | length                         | [cm] |
| <b>n</b>  | real number                    |      |
| <b>r</b>  | radius                         | [cm] |
| <b>ri</b> | radius of the inscribed circle | [cm] |
| <b>w</b>  | width                          | [cm] |

Constants

Mathematical Constants

|            |                                                        |               |
|------------|--------------------------------------------------------|---------------|
| <b>e</b>   | Euler constant                                         | 2.7182818285  |
| <b>π</b>   | Ratio of the circumference of a circle to its diameter | 3.1415926536  |
| <b>dpr</b> | degree per radian                                      | 57,2958 °/rad |

Natural Constants

|           |             |                |
|-----------|-------------|----------------|
| <b>a0</b> | Bohr radius | 5.291772E-11 m |
|-----------|-------------|----------------|

**Block 2:** Enter the formula in the editor

Write down the text: /\* The surface of a sphere has an area A: \*/

**Formula 2:**  $A = [\pi] * d^2$

1. Result field: **A** = write
2. Insert constant  $[\pi]$  from constants table with a click
3. Write \* and insert standard variable d with a click and write  $^2$ .

Press the **Calculate** key

and with **Formula Display**  
check the formula address

Formula Display

$$A = \pi * d^2$$

**Block 3:** Show **Variables** (left) and **results** (right):

Show Errors



$\pi$  Ratio of the circumference of a circle to its diameter

3.14159

d diameter

cm

Significant numbers

Vol

33.51

cm<sup>3</sup>

A

50.27

cm<sup>2</sup>

## Create CYLINDERS formula

### Block 1: Definition of the formula

Press **My Formulas / Create**: an empty editor appears.

Enter Name: **CYLINDERS** and Description: **Cylinders Values**

**Category: Mathematics** and **Subcategory: Stereometry**

Enter.

By entering Category and Subcategory, we have defined which standard variables we want to work with.

### Block 2: Enter the formula in the editor

Write text: **/\* Volume \*/**

**Formula 1:  $V = [\pi] * d^2 * h / 4$**

1. Result field: **V =** write
2. Insert constant **[ $\pi$ ]** from **Constants-Tabelle** per click
3. Write **\* d^2** and insert **Standardvariables d** with a click
4. Write **\* h / 4** and insert, **Standardvariables h** with a click

Press the **Calculate** key

and with **Formula Display** check the formula address

Formula Display

$$V = \pi * d^2 * \frac{h}{4}$$

Variables & Constants

Standardvariables

|           |                                |      |
|-----------|--------------------------------|------|
| <b>b</b>  | length of a side               | [cm] |
| <b>c</b>  | length of a side               | [cm] |
| <b>d</b>  | small diameter                 | [cm] |
| <b>d</b>  | diameter                       | [cm] |
| <b>h</b>  | height                         | [cm] |
| <b>l</b>  | length                         | [cm] |
| <b>n</b>  | real number                    |      |
| <b>r</b>  | radius                         | [cm] |
| <b>ri</b> | radius of the inscribed circle | [cm] |
| <b>w</b>  | width                          | [cm] |

Constants

Mathematical Constants

|                         |                                                        |               |
|-------------------------|--------------------------------------------------------|---------------|
| <b>e</b>                | Euler constant                                         | 2.7182818285  |
| <b><math>\pi</math></b> | Ratio of the circumference of a circle to its diameter | 3.1415926536  |
| <b>dpr</b>              | degree per radian                                      | 57,2958 °/rad |

Natural Constants

|           |             |                |
|-----------|-------------|----------------|
| <b>a0</b> | Bohr radius | 5.291772E-11 m |
|-----------|-------------|----------------|

**Block 2:** Enter the formula in the editor

Write text:/\* **Surface** \*/

**Formula 2:**  $A = [\pi] * d * (d / 2 + h)$

5. Result field **A** = write
6. Insert constant **[ $\pi$ ]** from **Constants-Tabelle** with a click
7. Write **\*** and insert **Standardvariables ( d / 2\_** with a click
8. Write **Standardvariables h )** with a click

Press the **Calculate** key

and with **Formula Display**  
check the formula address

Formula Display

$$A = \pi * d * \left(\frac{d}{2} + h\right)$$

**Block 3:** Show **Variables** (left) and **Results** (right) :

|                                                              |                                                                 |                     |                                                               |
|--------------------------------------------------------------|-----------------------------------------------------------------|---------------------|---------------------------------------------------------------|
| Show Errors                                                  | <input checked="" type="checkbox"/>                             | Significant numbers | <input type="text" value="4"/>                                |
| $\pi$ Ratio of the circumference of a circle to its diameter | 3.14159                                                         | V                   | 125.7 <input type="text" value="cm&lt;sup&gt;3&lt;/sup&gt;"/> |
| d diameter                                                   | <input type="text" value="4"/> <input type="text" value="cm"/>  | A                   | 150.8 <input type="text" value="cm&lt;sup&gt;2&lt;/sup&gt;"/> |
| h height                                                     | <input type="text" value="10"/> <input type="text" value="cm"/> |                     |                                                               |