eActivity

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Preface

The use of worksheets in mathematics instruction has a long tradition. The using of a worksheet should the pupil train to structured work. In place of a verbal instruction, which presupposes a synchronous work of all pupils, the worksheet can be following worked on individually and its own timing. The succession of the job orders in the worksheet helps to recognize the logical structure of a problem; the work procedures help to penetrate the question.

As disadvantage of a sheet paper with job orders it is seen that the tools which can be used must be made available for instance. The pupil does not know always, how it is to accomplish its solution steps in detail. In addition are missing with a classical worksheet the self-check of the results, a feedback of the indexing steps and also the visualization of the results.

An extremely rich extension of the worksheet represents the again developed eActivity in the ClassPad 300. The eActivity combines the written representation of the setting of tasks of a worksheet with the tool level of the Classpad 300.

These tools are the individual menus or modules, which the ClassPad 300 offers: Computer algebra system, dynamic geometry software, computer statistics, curve plotter, and much more besides.

So all tasks can be worked on with the possibilities of the computer. At the same time the documentation of the work can be entered directly. The found results can to be visualized immediately or the results be able in a covered file to be seen. It takes place an interactive work of the pupil instead of between setting of tasks, the results and control of the results themselves.

These new possibilities are to be used on use of a ClassPad 300 by many. Therefore a uniform structure of an eActivity appears more than meaningful. The kind of the worksheet should be identifiable by the name of the file. It is suggested using an uniform initial letter which considers to this request.

Category	D	D-power	d from découvrir	discovery of a term, a rule, ...
Category	V	V-Heron	v from vérifier	reconstructing of a procedure, ...
Category	EC	EC-LGS	ec from exercice corrigée	exercises with solution
Category	ET	ET-LGS	et from exercice testée	exercises with a test character
Category	C	C-LGSA	c from cours	learning units
Category	M	M-rectangle	m from modeler	modelling
Category	P	P-LGS	p from protocole	protocol

Part 1

1. Introduction

In this article the possibilities of the eActivity function are discussed. These electronic worksheets are not however only to be described, but also adapted among themselves. They should serve the addition of the school book, but be nevertheless so extensive that and accessed material areas uncomplicatedly can be if possible detailed. There is therefore firm categories for the production and uniform expressions necessary, in order the users better overview and easy handles to ensure. First however the operational areas are to be worked out eActivities. In this paper there are two parts, the first part concerns itself with the production and use of an eActivity. Different categories are presented, which are clarified on the basis examples. In the second part it concerns the technical questions. Which tools one needs, as begins one, as produces one an eActivity and as one exchanges it.

2. Employment

2.1 Repetition

2.1.1 Systematic

A well sorted data base offers an outstanding possibility fast and problem-free material areas systematically to repeat. It is easy for the pupil to load down from the web itself and work on in the web the suitable topics. Also with the choaching falls the annoying material completely path search. Aimed a certain topic can selected, a certain type of task be practiced and difficult circumstances be explained.

2.1.2 Gap reconciliation

A further form of the repetition is within the range of the knowledge gaps. These could be concerned not only purposefully, but also eliminated efficiently. It is made easier for the teacher to fall back to already past learning units and tasks of sample solve to leave. This causes a better seizing and understanding by the productive repetitions. can serve in addition,

2.2 Entrance

The new medium ClassPad 300 as an additional motivation and facilitate so the hour entrance. So one hour can begin with a new learning unit or with minutes of the last hour. Also homework can be so better provided and compared more descriptive.

2.3 Security of results

A further application type would be the safety of the results, because also pupils can write eActivities.

This represents a good exercise and a necessary argumentation. Writing an eActivity presupposes not only a large portion of independence, but also an experienced operating authority. The moreover the author must prepare on the one hand materially and on the other hand methodically. All these given requirements can be seen to the protection of acquired knowledge as training aims and served.

3. Categories

The eActivities are divided in certain categories. So the user can select whether he wants to compile the material or a procedure would like to only reconstruct. There is the possibility of working on tasks with or without solution method. One can itself in addition, only topic-referred a new learning unit to acquire or under „modelling" to materially new tasks of text place themselves. Also it is possible to log lessons for itself or for others. Altogether 7 categories are differentiated. Everyone has its own contraction.

One differentiates:

Category D:	Discovery of a term, a rule, ...
Category V:	Reconstructing of a procedure, ...
Category EC:	Exercises with solution
Category ET:	Exercises with a test character
Category C:	Learning units
Category M:	Modelling
Category P:	Protocol

The structure listings should be well arranged, and teaching subjects according to category (fig. 1) and content (fig. 2) in the listing to be arranged.
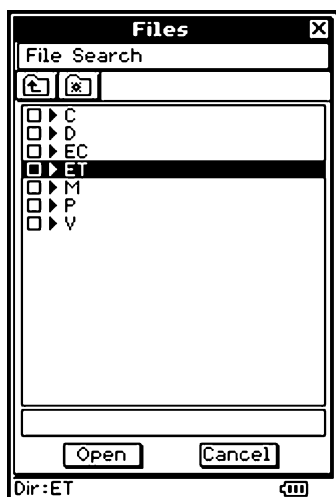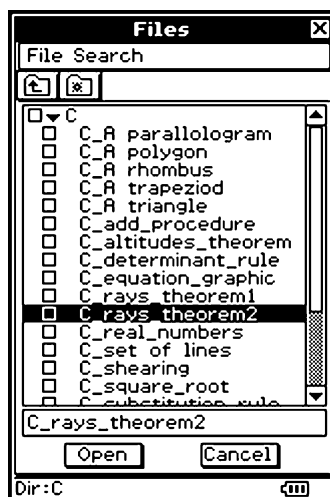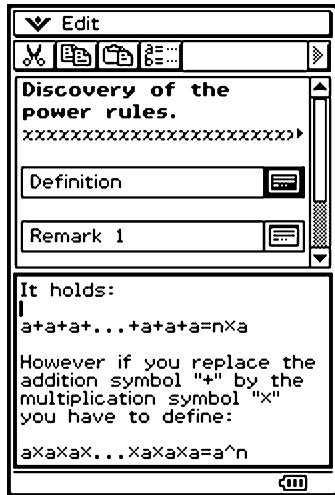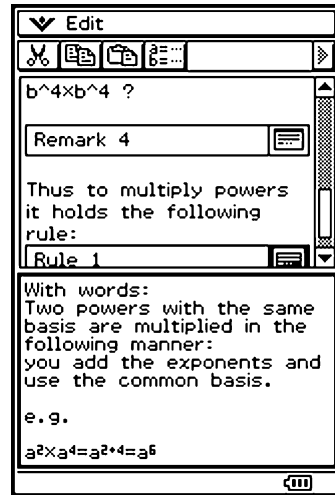

(fig. 1)   (fig. 2)

3.1 Category D: Discovery of a term, a rule, ...

Here goes it not describing the solution method of a type of task at the pocket calculator but through been suitable suggestions the way to a discovery. In this category one proceeds e.g. from a well-known term (fig. 3) and leads gradually characteristics and associated rules of computing (fig. 4).

Try from the given keywords the logical and visible structure as possible (see also Chap. 4) also here to produce.


```
  ✔ Edit
 ✂ 📋 📋 📃          ▷
Discovery of the       ▲
power rules.
xxxxxxxxxxxxxxxxxxx▸

 Definition          🖵

 Remark 1            🖵
                       ▼
It holds:
┃
a+a+a+...+a+a+a=n×a

However if you replace the
addition symbol "+" by the
multiplication symbol "×"
you have to define:

a×a×a×...×a×a×a=a^n
                     ▥
```
(fig. 3)

```
  ✔ Edit
 ✂ 📋 📋 📃          ▷
b^4×b^4 ?              ▲

 Remark 4           🖵

Thus to multiply powers
it holds the following
rule:
 Rule 1            🖵▼
With words:
Two powers with the same
basis are multiplied in the
following manner:
you add the exponents and
use the common basis.

e.g.

a²×a⁴=a²⁺⁴=a⁶
                     ▥
```
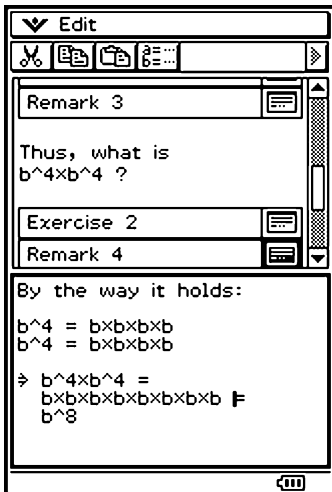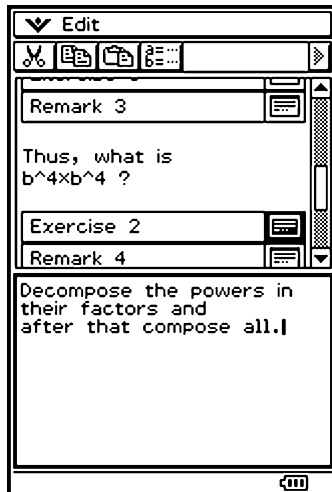(fig. 4)

Our example acts of the laws of powers:

It begins with the general definition (fig. 3) and by numeric remarks to the rules (fig. 4) is led.
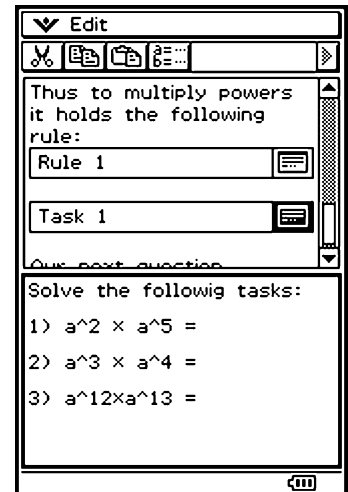
It is to be paid attention to neglect none of the accomplished steps. Everything should be formulated as detailed as possible. Nevertheless you should, in order to ensure a good overview, to keep the texts in the individual windows as short as possible. (fig. 5)


```
  ✔ Edit
 ✂ 📋 📋 📃          ▷
 Remark 3          🖵▲

Thus, what is
b^4×b^4 ?

 Exercise 2        🖵

 Remark 4          🖵▼
By the way it holds:

b^4 = b×b×b×b
b^4 = b×b×b×b

⇒ b^4×b^4 =
   b×b×b×b×b×b×b×b ⊨
   b^8
                     ▥
```
(fig.5)

```
  ✔ Edit
 ✂ 📋 📋 📃          ▷
 Remark 3          🖵▲

Thus, what is
b^4×b^4 ?

 Exercise 2        🖵

 Remark 4          🖵▼
Decompose the powers in
their factors and
after that compose all.┃
                     ▥
```
(fig.6)

```
  ✔ Edit
 ✂ 📋 📋 📃          ▷
Thus to multiply powers▲
it holds the following
rule:
 Rule 1            🖵

 Task 1            🖵

Our next question      ▼
Solve the followig tasks:

1) a^2 × a^5 =

2) a^3 × a^4 =

3) a^12×a^13 =
                     ▥
```
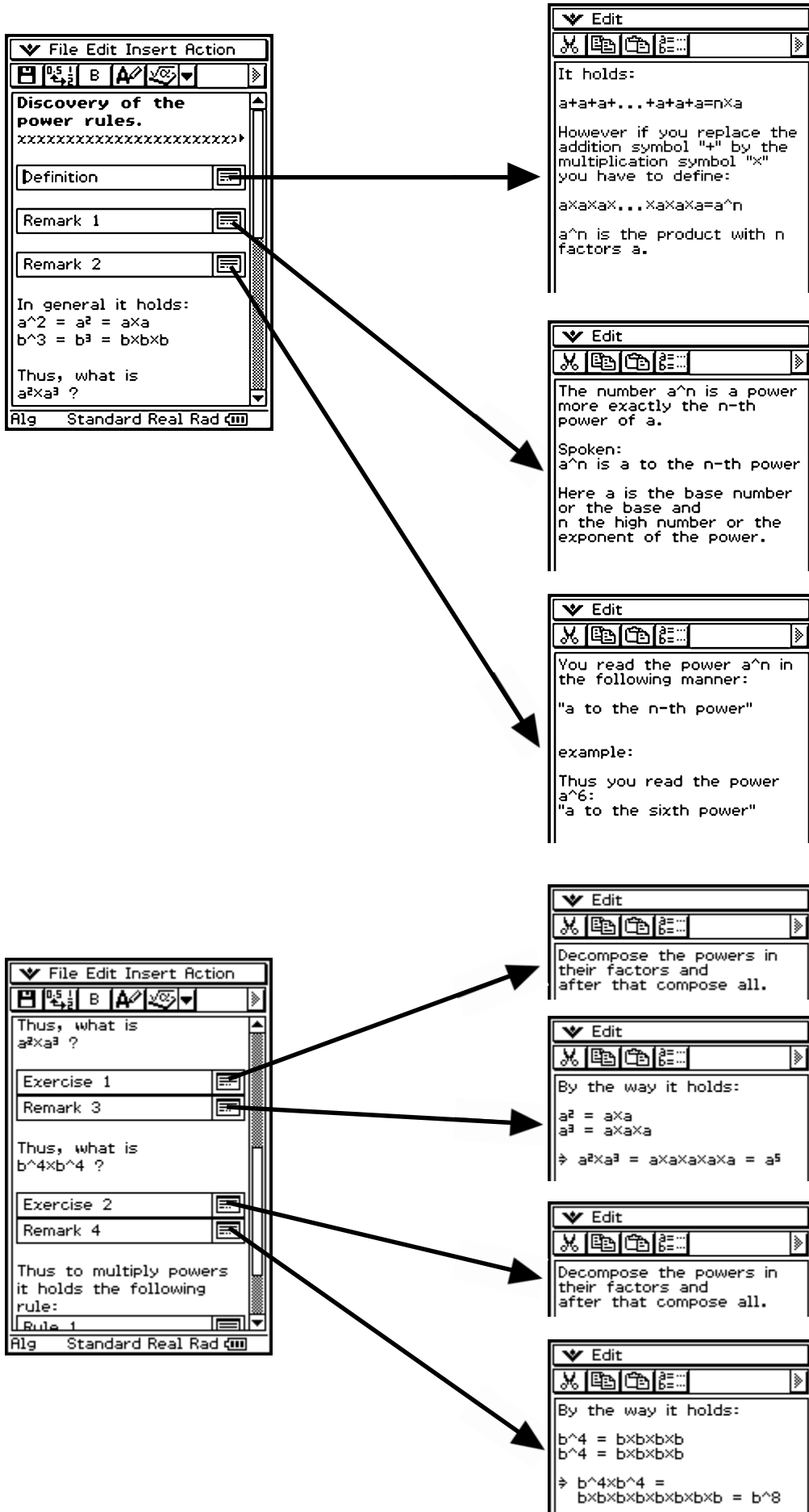(fig.7)

Pushed in questions help to get the development going. Under the key term "exercise" you find after a short guidance the possibility of working on these. This method to push in tasks in different places should the pupil to the self activity stimulate (fig.6).

According to a formulated rule it is also advisable to state a small setting of tasks in order to test the learning. These tasks are however so easy to arrange that a sample solution appears void and the pupil is encouraged in his activity.

Complete example of this type (D)

File Edit Insert Action

Discovery of the power rules.

xxxxxxxxxxxxxxxxxxxxx▸

| Definition |
| Remark 1 |
| Remark 2 |

In general it holds:
$a^2 = a^2 = a×a$
$b^3 = b^3 = b×b×b$

Thus, what is
$a^2×a^3$?

Alg   Standard Real Rad

Edit

It holds:

$a+a+a+...+a+a+a=n×a$

However if you replace the addition symbol "+" by the multiplication symbol "×" you have to define:

$a×a×a×...×a×a×a=a^n$

a^n is the product with n factors a.

Edit

The number a^n is a power more exactly the n-th power of a.

Spoken:
a^n is a to the n-th power

Here a is the base number or the base and
n the high number or the exponent of the power.

Edit

You read the power a^n in the following manner:

"a to the n-th power"

example:

Thus you read the power a^6:
"a to the sixth power"

File Edit Insert Action

Thus, what is
$a^2×a^3$?

| Exercise 1 |
| Remark 3 |

Thus, what is
$b^4×b^4$?

| Exercise 2 |
| Remark 4 |

Thus to multiply powers it holds the following rule:
Rule 1

Alg   Standard Real Rad

Edit

Decompose the powers in their factors and
after that compose all.

Edit

By the way it holds:

$a^2 = a×a$
$a^3 = a×a×a$

$⇒ a^2×a^3 = a×a×a×a×a = a^5$

Edit

Decompose the powers in their factors and
after that compose all.

Edit

By the way it holds:

$b^4 = b×b×b×b$
$b^4 = b×b×b×b$

$⇒ b^4×b^4 =$
$b×b×b×b×b×b×b×b = b^8$

First screen group

File Edit Insert Action

```
...has to multiply powers
it holds the following
rule:
```

| Rule 1 | ▦ |

| Task 1 | ▦ |

```
Our next question is:

How to proof the
equation a²×b²=(a×b)² ?
```

| Exercise 3 | ▦ |
| Remark 5 | ▦ |

| Rule 2 | ▦ |

Alg   Standard Real Rad

Edit (Rule 1)

```
With words:
Two powers with the same
basis are multiplied in the
following manner:
you add the exponents and
use the common basis.

e.g.

a²×a⁴=a²⁺⁴=a⁶
```

Edit (Task 1)

```
Solve the followig tasks:

1) a^2 × a^5 =

2) a^3 × a^4 =

3) a^12×a^13 =
```

Edit (Exercise 3)

```
Tip:

Try it with skillful
transforming!
```

Edit (Remark 5)

```
It holds:

    a×a×b×b
  = a×b×a×b
  = (a×b)×(a×b)
  = (a×b)²
```

Second screen group

File Edit Insert Action

| Rule 2 | ▦ |

| Task 2 | ▦ |

```
The last question is:
How to proof the rule
(a^s)^r = a^(s×r) ?
```

| Remark 6 | ▦ |

| Rule 3 | ▦ |

| Task 3 | ▦ |

```
By the help of the rules
```

Alg   Standard Real Rad

Edit (Rule 2)

```
With words:
powers with the same
exponent are multiplied
in the following manner:
you multiply all the
bases and than use the
common exponent.

e.g.

a⁴×b⁴×c⁴=(a×b×c)⁴
```

Edit (Task 2)

```
Solve the followig tasks:

1) a^2 × b^2 × g^2 =

2) f^13 × g^13 =
```

Edit (Remark 6)

```
For the term (a^s)^r we
have the following inter-
pretation.
The term (a^s)^r means:
It exist r factors of the
kind a^s.
Thus it follows:
It exist r×s factors of the
kind a.
```

With words:
We get a power of a power, say a^s to the r-th power (a^s)^r, by multiplying the exponents and using the given base.

e.g.

(a²)³ = a^(2×3) = a⁶

Solve the followig tasks:

1) (a^2)^7 =

2) (a^5)^3 =

On the left panel:

Remark 6

Rule 3

Task 3

By the help of the rules 1 and 2 you get the rule for the quotients:

$$\frac{a^r}{a^s} = a^{(r-s)}$$

and

$$\frac{a^r}{b^r} = \left(\frac{a}{b}\right)^r$$

Alg   Standard Real Rad
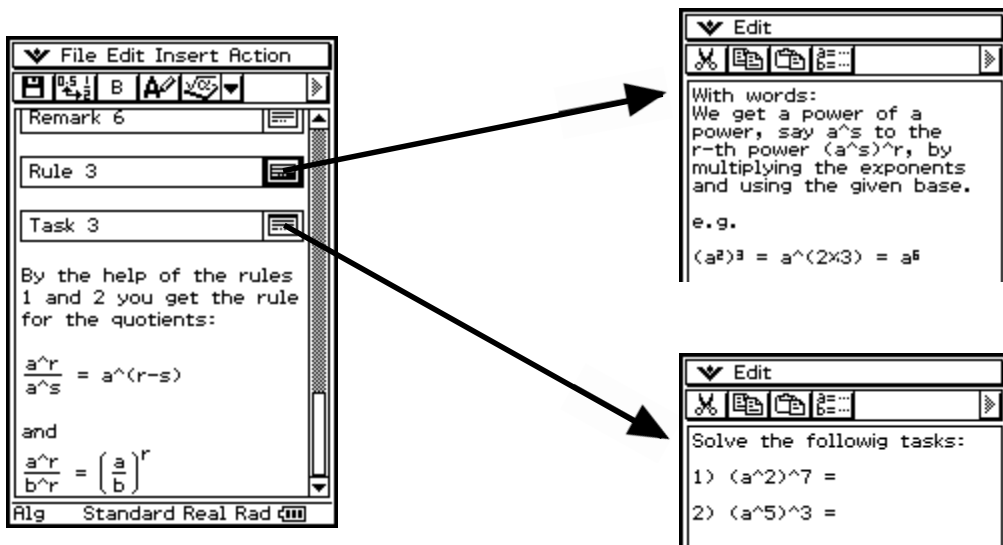
3.2 Category V: Reconstructing of a procedure

The task of the category V is clear. It serves the better understanding of circumstances or general procedures. In our example we approach to the solution procedure of square roots by the Heron's iteration. Under the keyword „employment" (see also chap. 4) generally one discusses, where the Heron's procedure finds its use (fig. 8).

Application

Find the following

number: $\sqrt{a}$

Factoring the number a:
$a = x_1 \times y_1$

Approximative procedure to get the square root of a number

Alg   Standard Real Rad

(fig. 8)

Choose an arbitrary but appropriate first value, the initial value x_1, and compute the other factor

y_1: $y_1 = \frac{a}{x_1}$

Remark 1

The arbitrary points $A(x_1, y_1)$ form an hyperbola.
Open the following geometry window and animate a point A.

Alg   Standard Real Rad

(fig. 9)

the initial value x_1, and compute the other factor

y_1: $y_1 = \frac{a}{x_1}$

Remark 1

Working 1

(fig. 10)

In the application the further procedure is described. It is to be made certain here that if possible all steps are documented and illustrated (fig. 9-11).
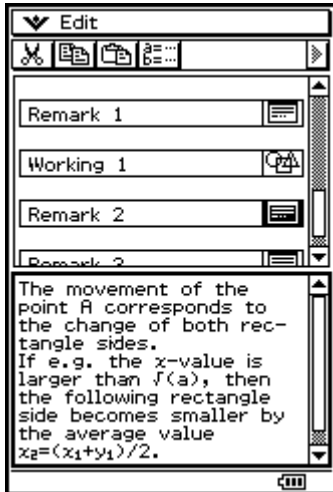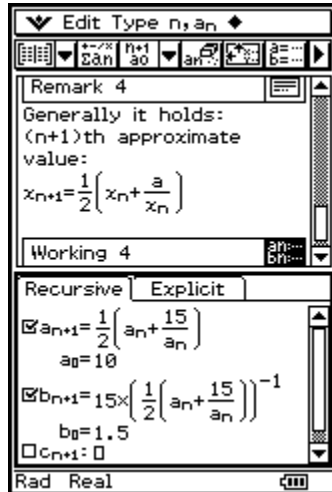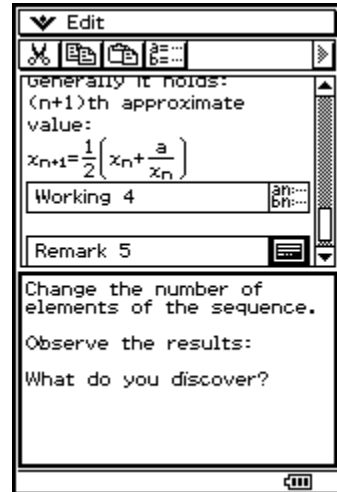
(fig. 11)   **(fig. 12)**   **(fig. 13)**

The most important attention is the application possibility of the procedure. It therefore is of advantage, if a task of sample is computed. This should happen however not as outstanding in the exercise categories step for step, but should be considered only as additional illustration (fig. 12).

In our example one is to extend and afterwards interpret the result of the task (fig. 13). This helps to understand the calculation steps and ensures again a deeper mental processing. Finally this category with a noticing set or a definition should be locked (fig. 14-15).
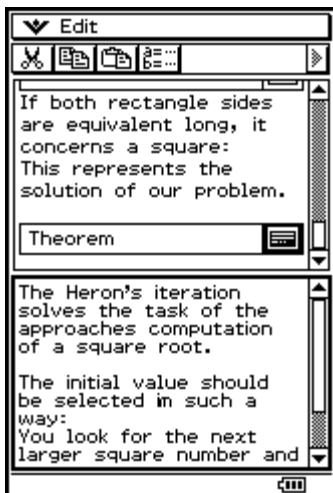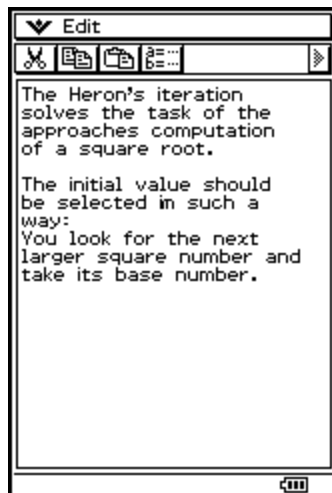
(fig. 14)   **(fig. 15)**

Naturally it can be placed still another control task, in order to give to the learning pupil an assistance for examining its acquired knowledge.

Complete example of this type (V)

Screen 1 (File Edit Insert Action):

Reconstructing of a procedure:
Heron of Alexandria
xxxxxxxxxxxxxxxxxxxxxx

Application

Find the following

number: $\sqrt{a}$

Factoring the number a:
$a = x_1 \times y_1$

Choose an arbitrary but
appropriate first value,
the initial value x_1, and

Alg   Standard Real Rad

Screen (Edit):

Approximative procedure
to get the square root
of a number

Screen 2 (File Edit Insert Action):

the initial value x_1, and
compute the other factor
y_1: $y_1 = \dfrac{a}{x_1}$

Remark 1

Working 1

Remark 2

Remark 3

Working 2

Formation of the

Alg   Standard Real Rad

Screen (Edit):

The arbitrary points
$A(x_1, y_1)$ form an
hyperbola.
Open the following
geometry window and
animate a point A.

Screen (Edit View Draw):

A

Screen (Edit):

The movement of the
point A corresponds to
the change of both
rectangle sides.

If e.g. the x-value is
larger than $\sqrt{(a)}$, then
the following rectangle
side becomes smaller by
the average value
$x_2 = (x_1 + y_1)/2$.

Screen (Edit):

The solution of the
equation

$$x^2 = a$$

correspondends to
the intersection of
the hyperbola with
the bisector.

Screen 1 (top left): File Edit Insert Action

Working 2

Formation of the average value:

$$x_2 = \frac{x_1 + y_1}{2} = \frac{1}{2}(x_1 + y_1)$$

Replaces y_1 by $\frac{a}{x_1}$

(2nd approximate value):

$$x_2 = \frac{1}{2}\left(x_1 + \frac{a}{x_1}\right)$$

It must apply: $y_2 \times x_2 = a$

Computation of y_2:

Working 3

Alg   Standard Real Rad

Screen 2 (top right): Edit View Draw
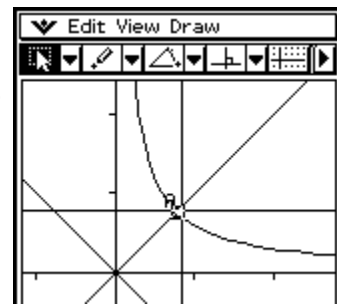
Screen 3 (middle left): File Edit Insert Action

Computation of y_2:

Working 3

Remark 4

Generally it holds:
(n+1)th approximate value:

$$x_{n+1} = \frac{1}{2}\left(x_n + \frac{a}{x_n}\right)$$

Working 4

Remark 5

If both rectangle sides

Alg   Standard Real Rad

Screen 4 (middle right): Edit Action Interactive

$$\frac{1}{2}\left(x_1 + \frac{a}{x_1}\right) \Rightarrow x_2$$

$$\frac{\frac{a}{x_1} + x_1}{2}$$

$$y_2 \times x_2 = a$$

$$\frac{y_2 \cdot \left(\frac{a}{x_1} + x_1\right)}{2} = a$$

$$\text{solve}\left(\frac{y_2 \cdot \left(\frac{a}{x_1} + x_1\right)}{2} = a, y_2\right)$$

$$\left\{ y_2 = \frac{2 \cdot a \cdot x_1}{a + x_1^2} \right\}$$

Screen 5 (lower right): Edit

The definition of the rectangle sides is generalized here:

We interpret all rectangle sides as elements of sequences and say

x_n becomes a_n

and

y_n becomes b_n.

Screen 6 (bottom right): Edit Type n, a_n

Recursive | Explicit

$$\boxtimes\, a_{n+1} = \frac{1}{2} \cdot \left(a_n + \frac{15}{a_n}\right)$$
$$a_0 = 10$$

$$\boxtimes\, b_{n+1} = \frac{15}{\frac{1}{2} \cdot \left(a_n + \frac{15}{a_n}\right)}$$
$$b_0 = 1.5$$

$$\square\, c_{n+1}:\ \square$$
$$c_0 = 0$$

13

Screen 1 (main window)

File Edit Insert Action

Working 4

Remark 5

If both rectangle sides are equivalent long, it concerns a square:

This represents the solution of our problem.

Theorem

Task 1

Working 5

Alg   Standard Real Rad

Screen 2 (Edit)

Edit

Change the number of elements of the sequence.

Observe the results:

What do you discover?

Screen 3 (Edit)

Edit

The Heron's iteration solves the task of the approaches computation of a square root.

The initial value should be selected in such a way:
You look for the next larger square number and take its base number.

Screen 4 (Edit)

Edit

Compute by the help of Heron's procedure the solution of the following equation:

$x^2 = 17$

Screen 5 (Edit Type)

Edit Type n, a_n

Recursive | Explicit

$\square\, a_{n+1}: \square$
$a_0 = 0$
$\square\, b_{n+1}: \square$
$b_0 = 0$
$\square\, c_{n+1}: \square$
$c_0 = 0$

3.3 Category EC: Exercises with solution

Two further categories represent the exercises.

First the exercises with solution method are mentioned. They lead the pupil step for step by a certain type of task and can be regarded as a sample solution. In the further process of an application the pupil should start to solve tasks independent without other help and then with the hidden solution control itself.

It is to be made certain that the examples are not too heavily selected at first, since otherwise understanding the task structure is made more difficult. Only in the process of the worksheet the degree of difficulty can increase. Each working step must be described and accomplished obviously, as with the addition process in fig. 16.
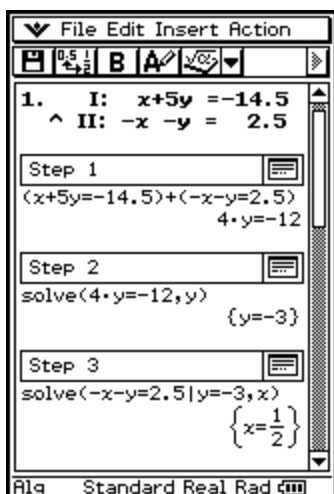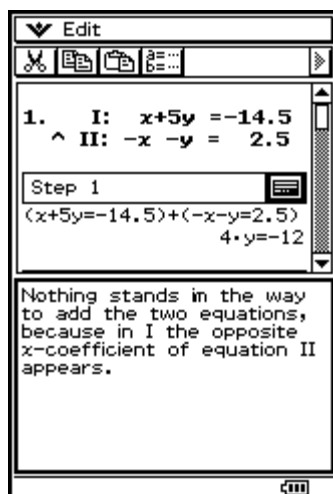
(fig. 16)   (fig. 17)

As you see, it follows after a task clearly placed a gradually accomplished way to the solution. First it is described by clicking the individual windows, what is afterwards accomplished (fig. 17). In order to promote the operating competence of the pupil, the way to the necessary instruction should be described likewise (fig. 18). If this instruction occurs several times in a worksheet, naturally an unique explanation is sufficient.

(fig. 18)   (fig. 19)

15
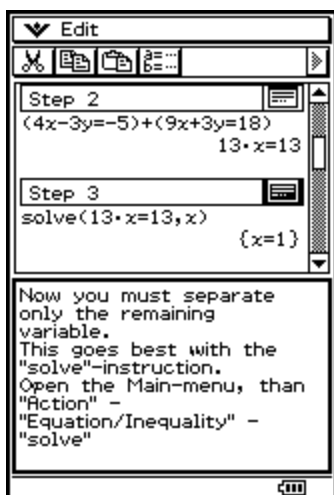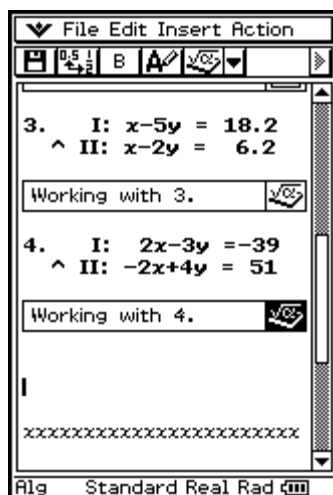
The instructions in the inserted windows should be as simple and clearly posed as possible. One should strive to keep the text short so that it can be seized with a view.

During the description it should be fallen back to firm of keywords. Only solution-relevant informations should be mentioned. For the self check of the pupils it should be placed far, as previously mentioned, also tasks with independent window of working (fig. 19).

These can be compared after the treatment with the sample solutions inserted at the end (fig. 19). Here becomes fast clear, where still pent-up demand exists or which steps are already controlled.

Complete example of this type (EC)

Screen 1 (left)

File Edit Insert Action

$5 \cdot x = \dfrac{23}{2}$

Step 2

$\text{solve}(5 \cdot x = \dfrac{23}{2}, x)$

$\left\{ x = \dfrac{23}{10} \right\}$

Step 3

$\text{solve}(2x + y = 10.3 \mid x = \dfrac{23}{10}, y)$

$\left\{ y = \dfrac{57}{10} \right\}$

3.   I: $x - 5y = 18.2$
  ^ II: $x - 2y = 6.2$

Alg   Standard Real Rad

Annotations (right)

Edit

By the "solve"-instruction
the x separate.

Edit

Use the received x-value
in equation I.

Screen 2 (left)

File Edit Insert Action

3.   I: $x - 5y = 18.2$
  ^ II: $x - 2y = 6.2$

Working with 3.

4.   I: $2x - 3y = -39$
  ^ II: $-2x + 4y = 51$

Working with 4.

xxxxxxxxxxxxxxxxxxxxxxxx

Alg   Standard Real Rad

Annotations (right)

Edit Action Interactive

Edit Action Interactive

17

3.4 Category ET: Exercises with a test character

The exercises with a test character are just as developed as the tasks with solution (fig. 20).
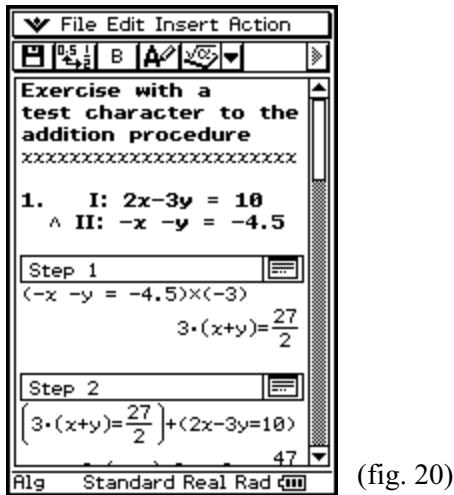
 (fig. 20)

A first conception of the type of task is recommended. Misunderstandings over the requirement and the solution method are avoided in this way to a large extent. After this introductory task then as many as desired tasks with rising degree of difficulty follow. This category can be used for the fast examination of learning, for the exercise or for a purposeful test. Here the automaticness is to be considered. Each pupil can solve as many tasks for itself as he would like. The speed can he here determine. So this work form can be used ideally in practice hours. The teacher has time, itself possible to care questions or problems. The computer places the tasks.

Complete example of this type (ET)
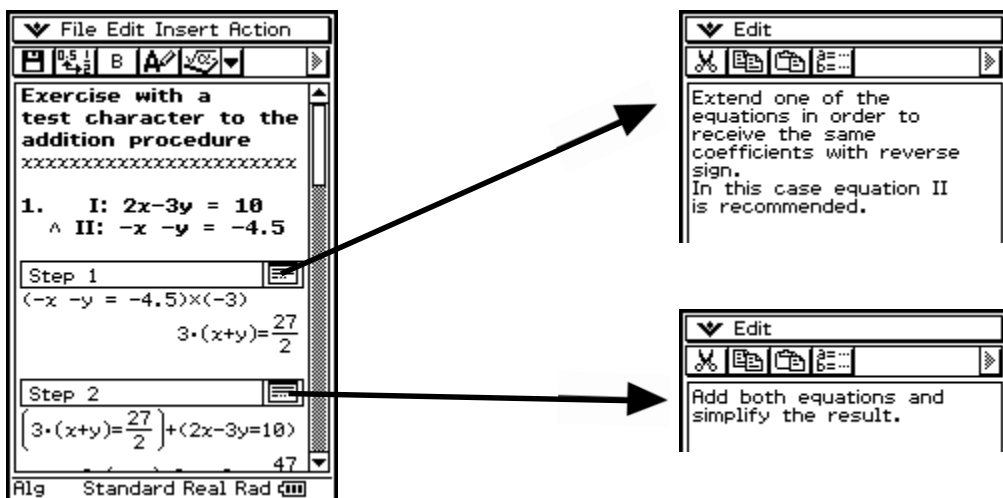
File Edit Insert Action

Step 2

$$\left(3 \cdot (x+y) = \frac{27}{2}\right) + (2x - 3y = 10)$$

$$3 \cdot (x+y) + 2 \cdot x - 3 \cdot y = \frac{47}{2}$$

simplify$(3 \cdot (x+y) + 2 \cdot x - 3 \cdot y$▶

$$5 \cdot x = \frac{47}{2}$$

Step 3

solve$\left(5 \cdot x = \frac{47}{2}, x\right)$

$$\left\{x = \frac{47}{10}\right\}$$

Step 4

Alg   Standard Real Rad

Edit

Get with the "solve"-instruction the value x.

File Edit Insert Action

Step 4

solve$\left(2x - 3y = 10 \mid x = \frac{47}{10}, y\right)$

$$\left\{y = -\frac{1}{5}\right\}$$

Remark

Working

2.   I: 3y−4x = 13.5
   ∧ II: −x −y = −4.5

Working for 2.

Alg   Standard Real Rad

Edit

Insert this value into one of the initial equations and then solve the equation to get the other unknown quantity.

Edit

In the following window of working it is a sample solution of the type of task which can be worked on.

Edit Action Interactive

$(-x - y = -4.5) \times (-3)$

$$3 \cdot (x+y) = \frac{27}{2}$$

$$\left(3 \cdot (x+y) = \frac{27}{2}\right) + (2x - 3y = 10)$$

$$3 \cdot (x+y) + 2 \cdot x - 3 \cdot y = \frac{47}{2}$$

simplify$(3 \cdot (x+y) + 2 \cdot x - 3 \cdot y$▶

$$5 \cdot x = \frac{47}{2}$$

solve$\left(5 \cdot x = \frac{47}{2}, x\right)$

$$\left\{x = \frac{47}{10}\right\}$$

solve$\left(2x - 3y = 10 \mid x = \frac{47}{10}, y\right)$

$$\left\{y = -\frac{1}{5}\right\}$$

Alg   Standard Real Rad
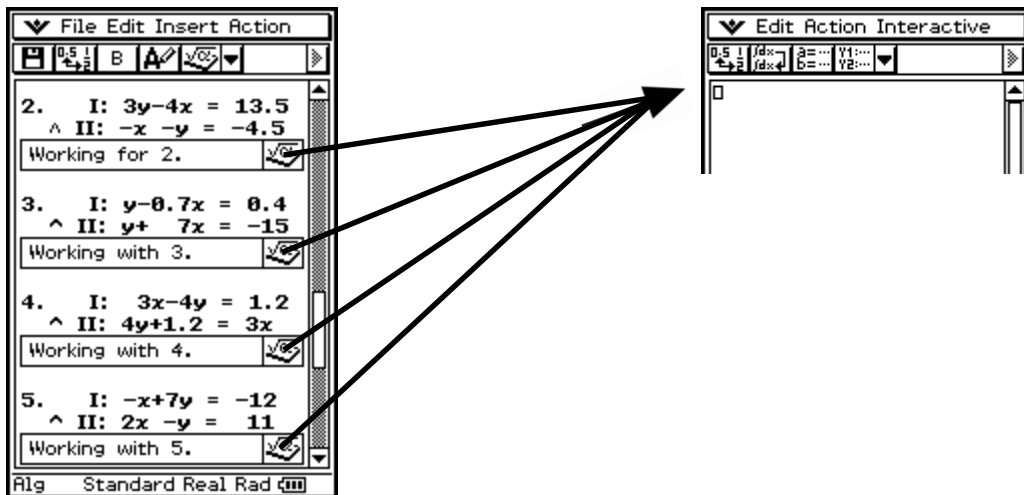
3.5 Category C: Learning units

The category C is generally occupied with learning contents. The material of new contents should be introduced and described here. This is suitable with the entrance into a new topic. With providing should be paid attention to ensure as large an overview as possible. Different goals should have to be called in different windows (fig. 21). So the remark should be separated also here to the general understanding (fig. 22) of intended purpose and proceeding (fig. 23). An example with the accompanying type of task can serve the further illustration.
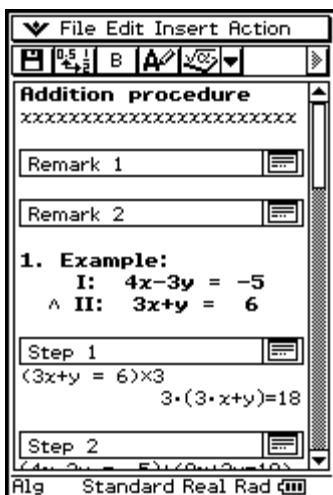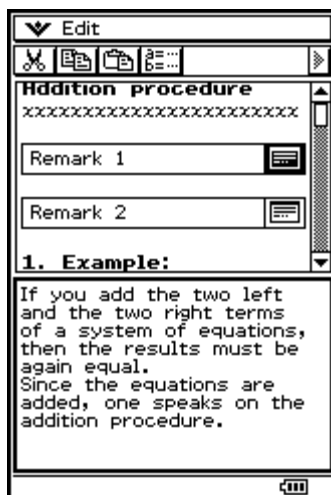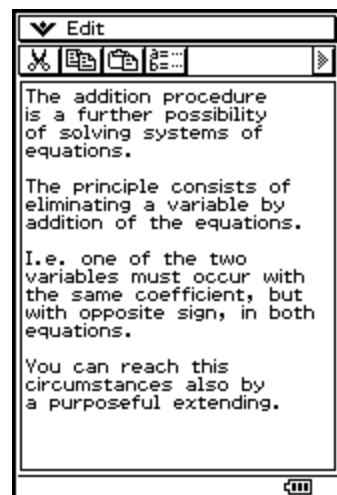
(fig. 21)	(fig. 22)	(fig. 23)

It is to be made certain as with the exercises that small solution steps are not ignored. At the conclusion of the category learning unit an verbal (fig. 24-25) and computational (fig. 26) solution of a task should to be represented.
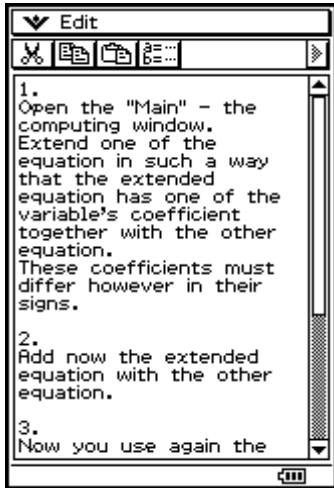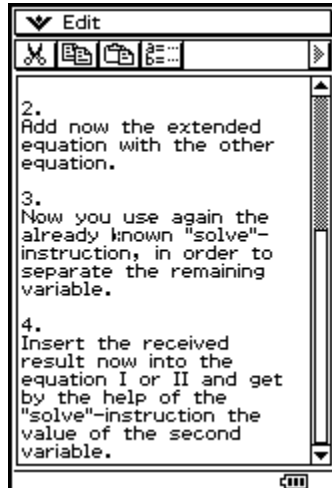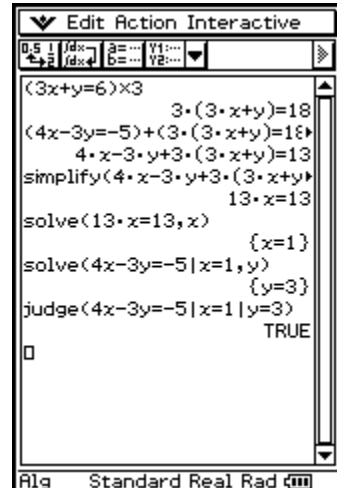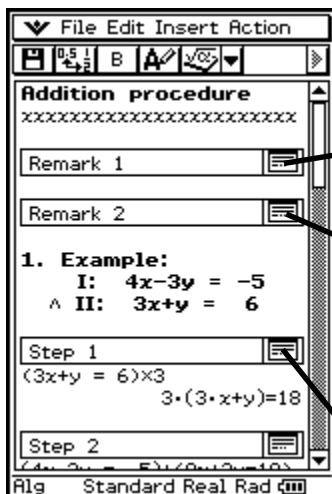
(fig. 24)   (fig. 25)   (fig. 26)

Complete example of this type (C)

Screen 1 (top left)
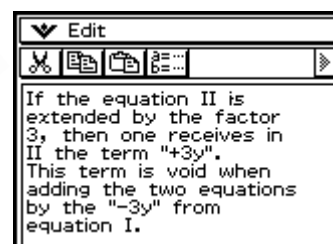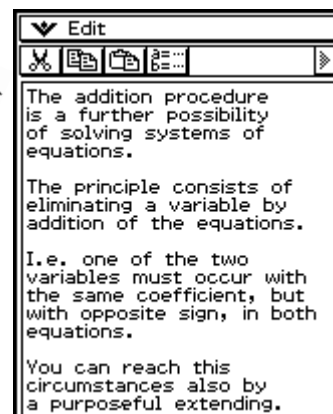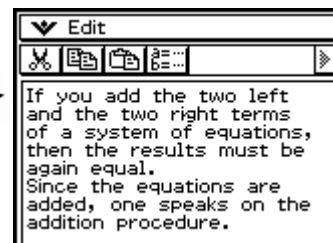
File Edit Insert Action

Step 2
$(4x-3y = -5)+(9x+3y=18)$
$$13 \cdot x=13$$

Step 3
$solve(13 \cdot x=13,x)$
$$\{x=1\}$$

Step 4
$solve(4x-3y = -5|x=1,y)$
$$\{y=3\}$$
$$\Rightarrow \quad L=\{(1|3)\}$$

Remark 3
Working 1
Working 2

Alg   Standard Real Rad

Screen (top right)

Edit

Now the two equations are added with one another.

There one of the variables in both equations with same coefficients, but with reverse sign, is present, is void this variable in the developing new equation in such a way.

Screen (second right)

Edit

Now the remaining variable must be only separated. This goes with the "solve"-instruction.

Open in the "Main"-menu:
"Action"-
"Equation/Inequality"-
"solve".

Screen 2 (middle left)

File Edit Insert Action

$(4x-3y = -5)+(9x+3y=18)$
$$13 \cdot x=13$$

Step 3
$solve(13 \cdot x=13,x)$
$$\{x=1\}$$

Step 4
$solve(4x-3y = -5|x=1,y)$
$$\{y=3\}$$
$$\Rightarrow \quad L=\{(1|3)\}$$

Remark 3
Working 1
Working 2

Alg   Standard Real Rad

Screen (middle right)

Edit

Now you insert the in such a way obtained value into one of the original equations I or II.

Now this equation must be solved only concerning the remaining unknown quantity to get the solution set L completely.

Screen (third right)

Edit

In the following windows the whole calculation method is summarized and represented again.

The "judge"-instruction examines the result for its correctness.

Screen 3 (bottom middle)

Edit Action Interactive

$(3x+y=6)\times 3$
$$3 \cdot (3 \cdot x+y)=18$$
$(4x-3y=-5)+(3 \cdot (3 \cdot x+y)=18)$
$$4 \cdot x-3 \cdot y+3 \cdot (3 \cdot x+y)=13$$
$simplify(4 \cdot x-3 \cdot y+3 \cdot (3 \cdot x+y))$
$$13 \cdot x=13$$
$solve(13 \cdot x=13,x)$
$$\{x=1\}$$
$solve(4x-3y=-5|x=1,y)$
$$\{y=3\}$$
$judge(4x-3y=-5|x=1|y=3)$
$$TRUE$$

Alg   Standard Real Rad

Screen (bottom right)

**Edit**

1.
Open the "Main" - the computing window. Extend one of the equation in such a way that the extended equation has one of the variable's coefficient together with the other equation.
These coefficients must differ however in their signs.

2.
Add now the extended equation with the other equation.

3.
Now you use again the already known "solve"-instruction, in order to separate the remaining variable.

4.
Insert the received result now into the equation I or II and get by the help of the "solve"-instruction the value of the second variable.

3.6 Category M: Modelling

With the modelling it goes around the ability to embed an everyday problem appropriately into a mathematical model. With it also learning will have to be used. It concerns here tasks of text, which above all the transfer thinking are to strengthen. A task in an extra window is placed (fig. 27-28) and carried out in meaningful learning steps the transition of the everyday life world to a mathematical world.
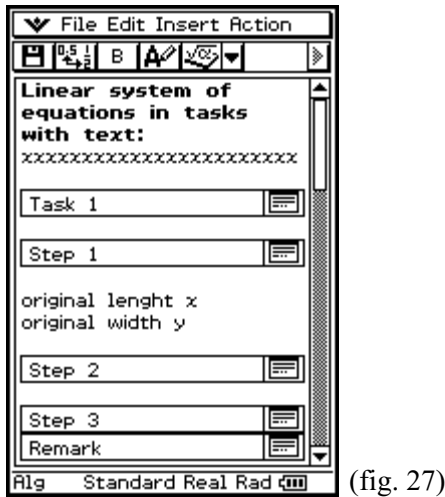

(fig. 27)
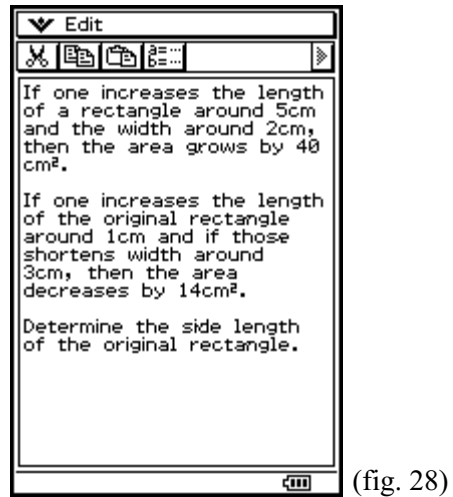
(fig. 28)

The proceeding for the treatment of the task is to be represented clearly. The pupils are to learn to set up from a text for example an equation. It must therefore be shown, how one selects the variables skillfully and how the individual conditions are used for an equation (fig. 29). Around an excessive demand of the pupil to avoid, one should interpret and show also the statement of the equation in such a way contentwise, how one can analyze its solution, in order to control itself again (fig. 30).
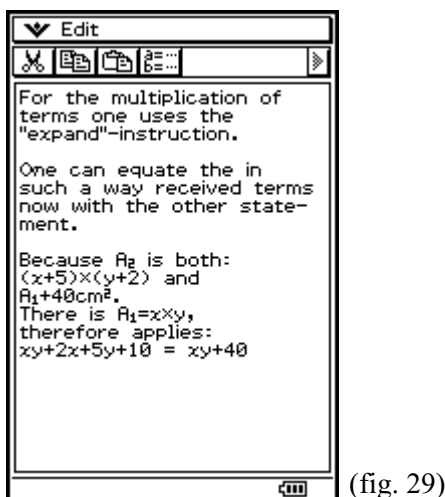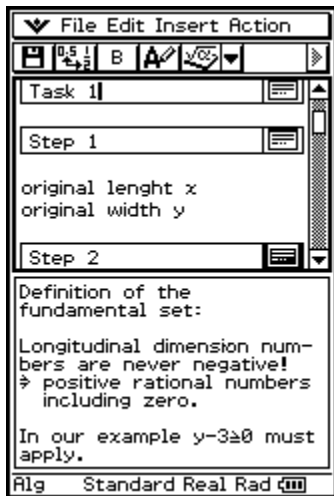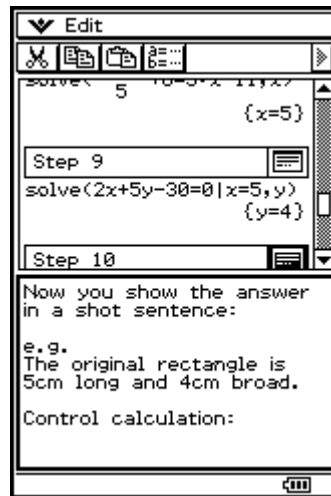

(fig. 29)
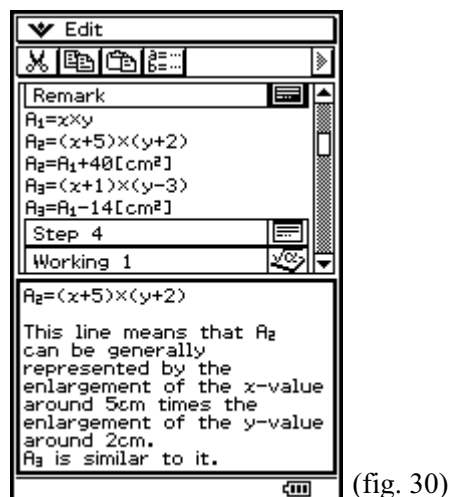
(fig. 30)

Also the investigation of the definition set of the variables should be discussed particularly.

This represents an additional examination possibility for the result which can be received and borders the model of the reality (fig. 31).
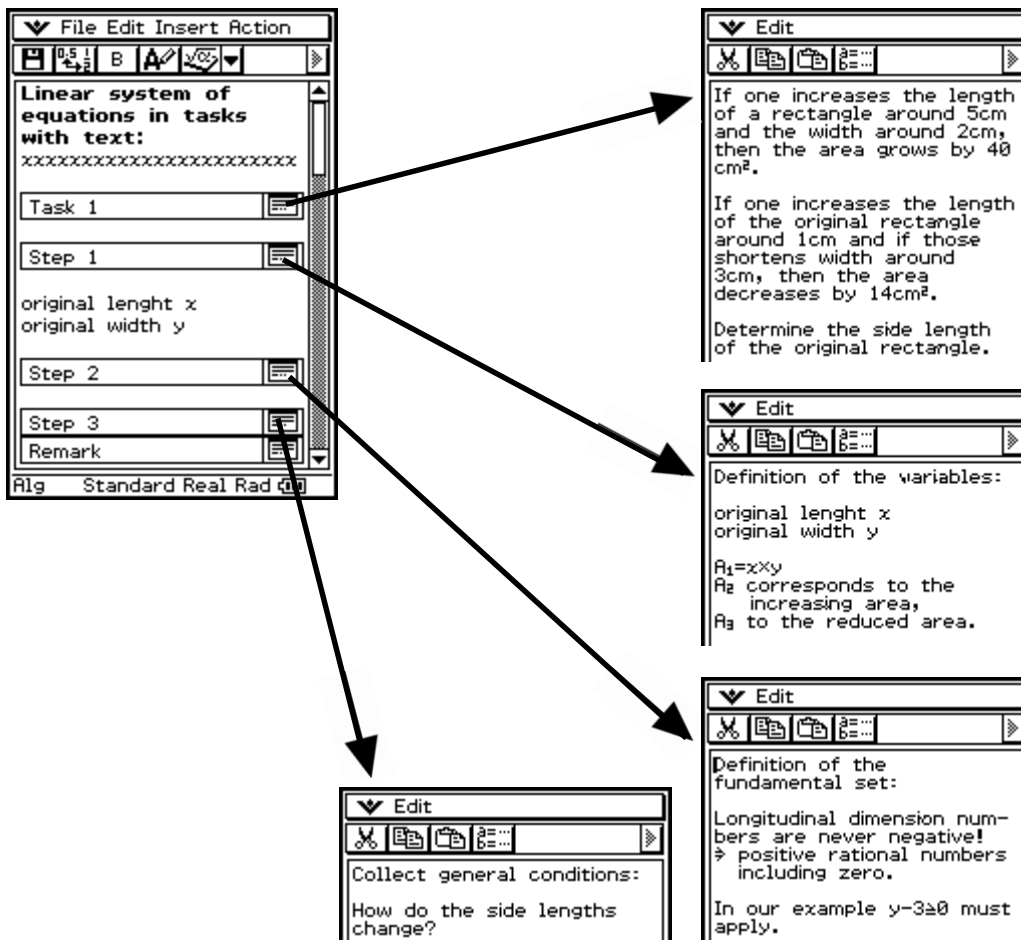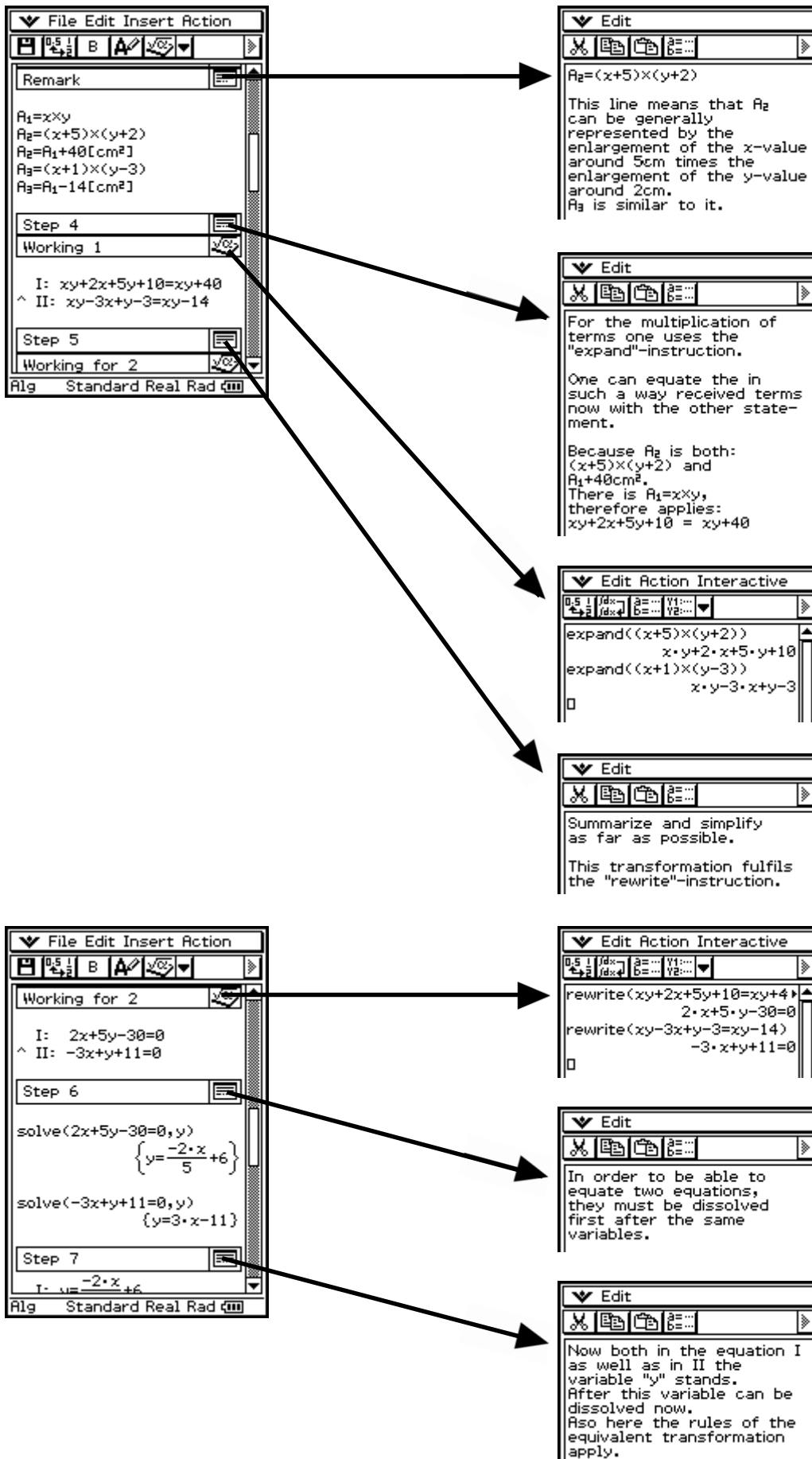

(fig. 31)

(fig. 32)

The pupil must learn the fact that a task with text is not terminated with the solution set but finished by an answer in text form (fig. 32). At the end of the detailed discussion a similar task should force the pupil to even use the learned. Specific practicing on tasks with text improves the text understanding and the transfer service.

Complete example of this type (M)

Screen 1 (top left)

File Edit Insert Action

Remark

$A_1 = x \times y$
$A_2 = (x+5) \times (y+2)$
$A_2 = A_1 + 40 [cm^2]$
$A_3 = (x+1) \times (y-3)$
$A_3 = A_1 - 14 [cm^2]$

Step 4

Working 1

I: $xy + 2x + 5y + 10 = xy + 40$
^ II: $xy - 3x + y - 3 = xy - 14$

Step 5

Working for 2

Alg   Standard Real Rad

Screen (top right)

Edit

$A_2 = (x+5) \times (y+2)$

This line means that A_2 can be generally represented by the enlargement of the x-value around 5cm times the enlargement of the y-value around 2cm.
A_3 is similar to it.

Screen

Edit

For the multiplication of terms one uses the "expand"-instruction.

One can equate the in such a way received terms now with the other state-ment.

Because A_2 is both: $(x+5) \times (y+2)$ and $A_1 + 40cm^2$.
There is $A_1 = x \times y$, therefore applies:
$xy + 2x + 5y + 10 = xy + 40$

Screen

Edit Action Interactive

expand$((x+5) \times (y+2))$
$\qquad x \cdot y + 2 \cdot x + 5 \cdot y + 10$
expand$((x+1) \times (y-3))$
$\qquad x \cdot y - 3 \cdot x + y - 3$

Screen

Edit

Summarize and simplify as far as possible.

This transformation fulfils the "rewrite"-instruction.

Screen 2 (bottom left)

File Edit Insert Action

Working for 2

I: $2x + 5y - 30 = 0$
^ II: $-3x + y + 11 = 0$

Step 6

solve$(2x + 5y - 30 = 0, y)$
$\qquad \left\{ y = \frac{-2 \cdot x}{5} + 6 \right\}$

solve$(-3x + y + 11 = 0, y)$
$\qquad \{ y = 3 \cdot x - 11 \}$

Step 7

I: $y = \frac{-2 \cdot x}{5} + 6$

Alg   Standard Real Rad

Screen (bottom right)

Edit Action Interactive

rewrite$(xy + 2x + 5y + 10 = xy + 4$
$\qquad 2 \cdot x + 5 \cdot y - 30 = 0$
rewrite$(xy - 3x + y - 3 = xy - 14)$
$\qquad -3 \cdot x + y + 11 = 0$

Screen

Edit

In order to be able to equate two equations, they must be dissolved first after the same variables.

Screen

Edit

Now both in the equation I as well as in II the variable "y" stands.
After this variable can be dissolved now.
Aso here the rules of the equivalent transformation apply.

File Edit Insert Action

I: $y=\dfrac{-2\cdot x}{5}+6$

^ II: $y=3\cdot x-11$

Step 8

solve$\left(\dfrac{-2\cdot x}{5}+6=3\cdot x-11,x\right)$

$\{x=5\}$

Step 9

solve$(2x+5y-30=0|x=5,y)$

$\{y=4\}$

Step 10

Working 3

Alg   Standard Real Rad

Edit

Now the equations can be equated and the variables be separated.
The received value of 5cm seems to be meaningful.
It means that the original rectangle length amounted to 5cm.

Edit

You insert this value now only into one of the initial conditions and so you receive the second unknown quantity.

Also the statement "y=4" is realistic. It means that the original side y is long 4cm.

Edit

Now you show the answer in a shot sentence:

e.g.
The original rectangle is 5cm long and 4cm broad.

Control calculation:

File Edit Insert Action

^ II: $y=3\cdot x-11$

Step 8

solve$\left(\dfrac{-2\cdot x}{5}+6=3\cdot x-11,x\right)$

$\{x=5\}$

Step 9

solve$(2x+5y-30=0|x=5,y)$

$\{y=4\}$

Step 10

Working 3

task 2

Alg   Standard Real Rad

Edit Action Interactive

$(5+5)\times(4+2)$

60

$(5+1)\times(4-3)$

6

5×4

20

Edit

A rectangle has the circumference 45cm.

If one extends a side by 3cm and if one shortens the other side at the same time around 3cm, then the area grows by 42cm².

Compute the length (width) of the original rectangle.

3.7 Category P: Protocol

The protocol has different application type. Ever more teacher go the way from the closed to open instruction. However it is often connected with time delay, to let collect and speak what in a group compiled. Frequently to the medium „foil for the overhead projector" or „poster" one falls back here. Here the ClassPad could be used.

The material is jointly to prepare, but individually noted. The teacher or the schoolmates have thereafter the possibility, after the lecture of the particular, of seeing the solutions of the group in different representations. The results compiled here can be presented moreover with the ClassPad simply and fast. Week plans or projects could be spoken so medium-supported.

Also concerning the minutes of the pupils it should be paid attention to the necessary form. The summary of learning contents can contain also elements of an eActivitiy. To self-sufficiency is to be paid attention however nevertheless. So also difficulties or proposals for solution can be stated by the pupil. These results can be worked on then in the class federation or in the single discussion.

Example (fig. 33-34):
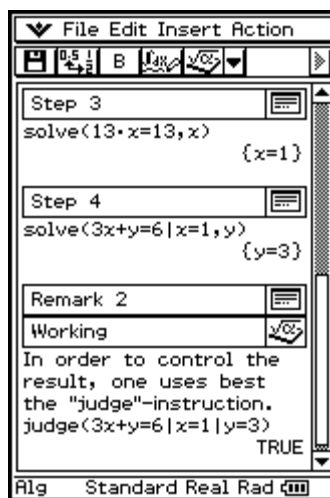
(fig. 33)　(fig. 34)

Complete example of this type (P)

File Edit Insert Action

Protocol by
Markus Mustermann
xxxxxxxxxxxxxxxxxxxxxxxx

| Remark 1 | ▤ |

| Task | ▤ |

| Step 1 | ▤ |
(3x+y=6)×3
  3·(3·x+y)=18
| Step 2 | ▤ |
(3·(3·x+y)=18)+(4x-3y=-
  4·x-3·y+3·(3·x+y)=13
simplify(4·x-3·y+3·(3·x+y▸
  13·x=13 ▾
Alg   Standard Real Rad ▥

Edit

If you add the two left
and the two right terms
of a system of equations,
then the results must be
again equal.

Since the equations are
added, one speaks on
the addition procedure.

This procedure serves
the solving a system of
equations therefore
likewise.

Edit

For this type of task the
following problem is
typical:

$\quad$ I:$\quad$ 4x-3y = -5
∧$\quad$ II:$\quad$ 3x+y = 6

Edit

So that one of the two
variables is void when
adding the equations,
it must be first extended.

One wants to reach that
in the equation a variable
coefficient with opposite
sign develops.

Here we extend the
equation II.

Edit

Now the two equations are
added and the result with
"simplify"-instruction is
simplified.

The variable y is
disappeared by adding with
the opposite term.

File Edit Insert Action

| Step 3 | ▤ |
solve(13·x=13,x)
  {x=1}

| Step 4 | ▤ |
solve(3x+y=6|x=1,y)
  {y=3}

| Remark 2 | ▤ |

| Working | ✍ |
In order to control the
result, one uses best
the "judge"-instruction.
judge(3x+y=6|x=1|y=3)
  TRUE
Alg   Standard Real Rad ▥

Edit Action Interactive

(3x+y=6)×3
  3·(3·x+y)=18
(3·(3·x+y)=18)+(4x-3y=-5▸
  4·x-3·y+3·(3·x+y)=13
simplify(4·x-3·y+3·(3·x+y▸
  13·x=13
solve(13·x=13,x)
  {x=1}
solve(3x+y=6|x=1,y)
  {y=3}
□
Alg   Standard Real Rad ▥

4. Keywords

The agreed keywords should not appear as restriction, but an additional internal arrangement they are seen. This makes possible a fast access to looked information. In the following now the individual keywords on function and contents are described. If individual keywords in an eActivity occur several times, then one becomes number these keywords additionally.

4.1 Setting of tasks

Setting of tasks should appear with their own window. Under the term „setting of tasks" or „task" you can deal on the one hand with the desired solution method, or on the other hand state simply setting of tasks. This window is suitable particularly for tasks with text, it can used also with the category „modelling" (fig. 35).
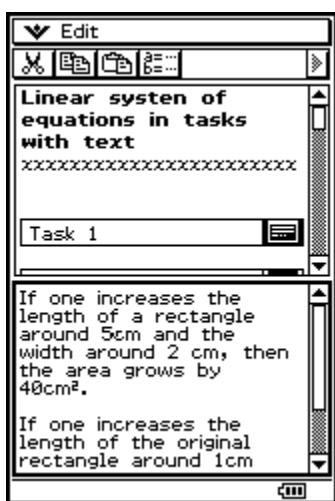
(fig. 35)

The extensive text can be in this way simply accessed. After reading the text one closes the window and can to the treatment dedicate itself. The e-Activity loses in such a way to extent and the overview is improved.

4.2 Remark

under remarks can be given solution assistance (fig. 36), or e.g. historical references. (fig. 37)
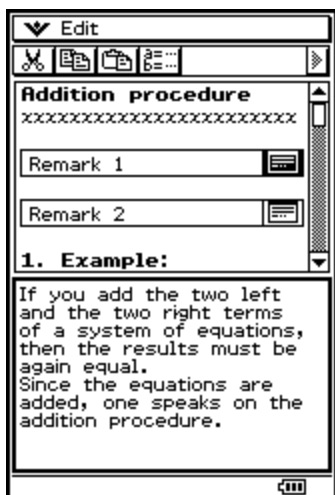
(fig. 36)
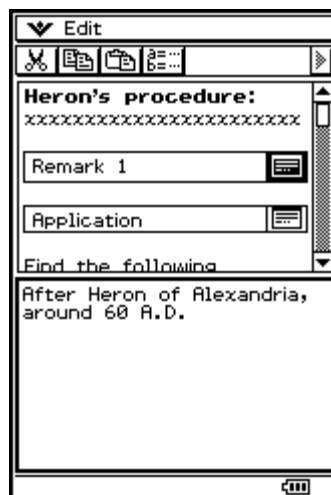
(fig. 37)

4.3 Exercises

Under „exercise" the pupil finds the possibility of trying solutions themselves. He is to approach playful the solution, discover rules themselves. These windows find particularly in the category D their employment (fig. 38).
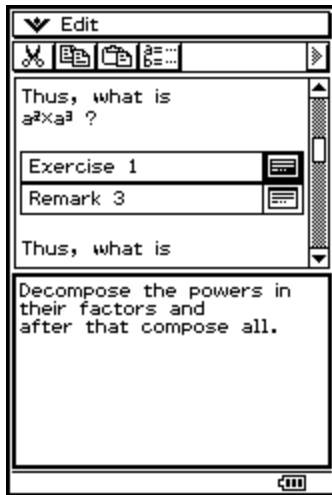
(fig. 38)

4.4 Step

The windows with the designation „step" serve the explanation of the individual steps of computation (fig. 39-41)
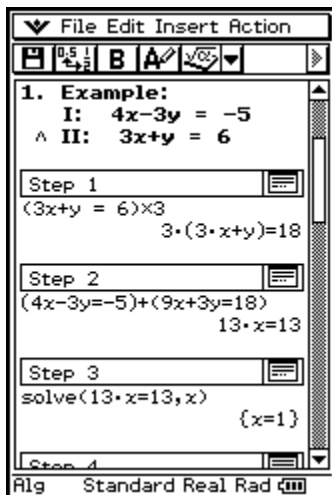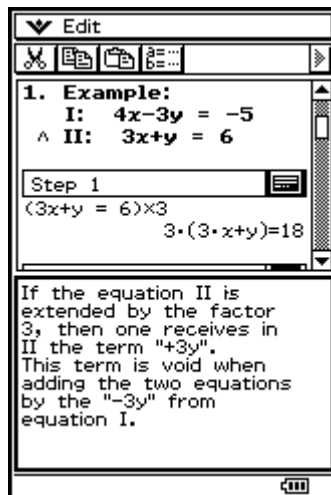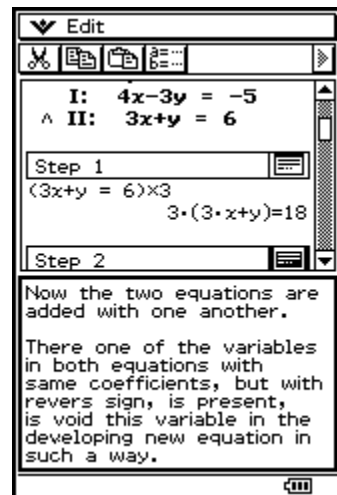
(fig. 39)   (fig. 40)   (fig. 41)

It is recommendable not to give the instructions too in detail. The pupil should have the possibility of discovering with one view the substantial. The requirements should be set on a suitable level, so that a positive work attitude remains keeping upright. Thus is meant that the pupil does not to have to consider each step, he can obvious jump over and complicated piece for piece seize.

4.5 Consideration

With the keyword „consideration" it gives to say actually not much. Nevertheless one should define it against the „remarks". The content of a conclusion or of a train of thought can be noted in the „consideration". So it could be written (fig. 42) also as „consideration":

(fig. 42)

4.6 Theorem (mnemonic sentence)

The keyword describes circumstances to note a „theorem". It concerns a found result, a theorem a compiled definition, which one is to note. Additionally it can offer however still important hints or noticing assistance (fig. 43).

(fig. 43)

4.7 Definition

Here stands generally valid definitions. With these definitions future arithmetic rules can be compiled. They are usually the starting situation of the category D (fig. 44).

(fig. 44)

4.8 Rule

With this keyword it concerns the worked out arithmetic rule. The window „rule" closes usually the application and it can be regarded thus also as educational aim (fig. 45).

(fig. 45)

Part 2

This document describes the production and the exchange of an eActivity by the help of the ClassPad 300 and the ClassPad Manager program.

5. Writing an eActivity

The eActivities are documents, in which you can combine different applications and abilities of the ClassPad with texts.

Start your ClassPad or the ClassPad manager (see below). Change into the main menu, the so called "Menu" and select the icon ![eActivity icon]. Now you see the eActivity window. The conditions of the last editing are indicated if necessary.

In the illustration (fig. 46) you see beside the menu border above to the row of icons completely and under it in addition the drop down menus of the icons. Over the menu and the icons you have access to the eActivity specific elements. The status line (down) is the same as in the „Main" menu.

In order to begin a new eActivity, you select [File], [New] and confirm the enquiry „Clear All" with [OK]. Now the field is empty and you can begin with the working.

The Insert menu to insert an application data strip

Text or Calculation input mode

Switching between **bold** and plain text

(fig. 46)
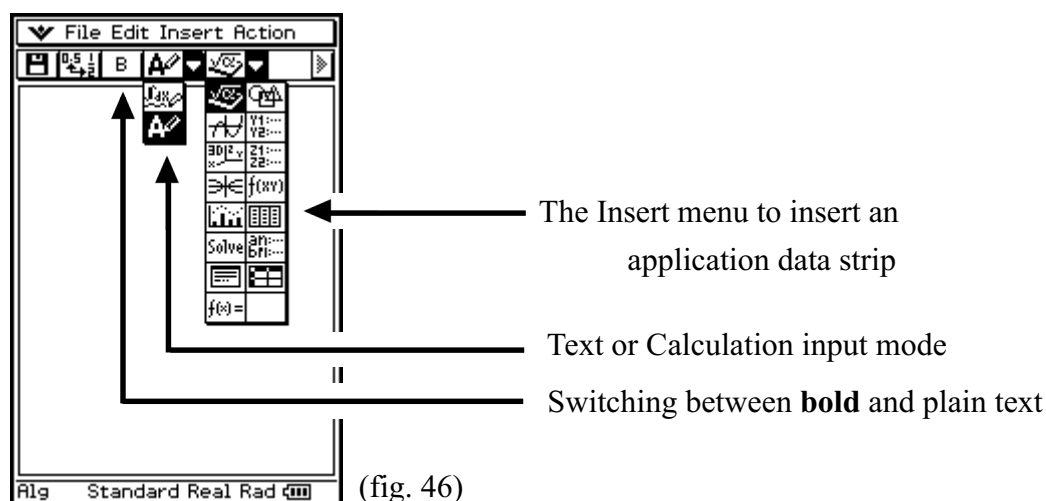
An eActivity consists in individual lines, which are from different nature and which you can combine arbitrarily:

- Text lines you recognize by the fact that the fourth icon of the icon row shows a ![A icon] (over this icon you switch also between calculation lines and text lines). Text lines can contain text, formulas etc. Mathematical formulas in text lines are not computed and have thus a purely informative character.

Over the icon $\boxed{\text{B}}$ you switch over for the entire line between bold and normal writing. For longer texts and references there is also an application data field (see below) „Note".

- Computation lines show instead as the fourth icon ▨ . Computation lines behave like the lines in the mathematical „Main" menu of the ClassPad.

- Geometry links you recognize by the symbol ▤ at the start of line, you can it create over [Insert], [Geometry Link] and geometry objects thereby indicate and modify (e.g. you can draw a straight line by Drag&Drop this way).

- Application data fields you add over the selection under ▨▾ or over the menu option [Insert] . They become represented by a header, which you can mark, and by an icon of respective application.

The selection of the icon in the application strip opens and closes the respective application. Which field is open straight, recognize by coloured inverting of the icon. They can build data from application with help of „pulling and placing" (Drag&Drop) into your eActivity and in reverse. Changes in an eActivity lead to appropriate changes in application and if necessary in reverse.

| Geometry application ▨ |

fig. 47: a geometry application strip
(with the header line „Geometry application")

5.1 A small example of use

For exemplary elucidation:

Change in the eActivity window and provide over [File], [New] a new eActivity. Press the keyboard key to let over indicate the soft keyboard and now you change by choice of the abc rider to the alphabetical keyboard.

Give as titles e.g.. „eActivity example".

Click up on $\boxed{\text{B}}$, in order to let the header appear bold.

Press two times (EXE), in order to begin a new line and to insert a further line distance.

Insert over [Insert], [Geometry Link] one geometry link - the start of line shows now the symbol ▤ . Enter now e.g.   y = 2x+1 .

Add over [Insert], [Geometry] or over the icon row a geometry data field - it is opened and the geometry menu border appears automatically.

Now you tap into the eActivity window (above), mark y = 2x+1, in which you pull with the pen over it. Set the pen on the marked expression and pull with the pen into the geometry data field. The straight line is drawn. If you place now two points on the straight line, you can change the straight line in their situation. These changes you see immediately in geometry link.

Close the geometry data field with one click on its icon. Type with the pen into the header line of the geometry data field and enter a title, e.g. „a straight line".
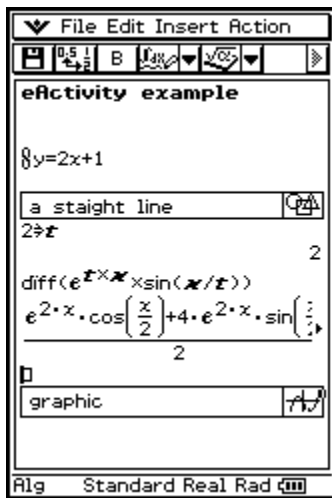
(fig. 48)

Completely similarly you insert a computation line and e.g. a diagram data field, compute something in the computation line and draw the result into the diagram data field, in order to produce a diagram. In fig. 48 you see the result. The cursor is located in the line over the diagram data field „graphic".

You recognize that it concerns a computation line, by the fact that the empty line ends with a small box and that shows the fourth icon .

Note: Use „Resize" in order to have for the application data fields the whole screen available.

6. Storage of an eActivity

Store your eActivity over [File], [Save] (store) or the choice of , indicate over the soft keyboard a name and press [Save]. By the example: enter as names „example on eActivity".

7. Opening of an eActivity

An already existing eActivity you open through [File], [Open] or the choice of , choice an eActivity and click [Open].

Note:
If you provide your eActivity with the ClassPad manager, you profit among other things from the possibility of the larger display, to the use of the PC keyboard and you can store your eActivity directly into an flash image (to select it in addition in the context menu, which you reach by means of the right mouse button, [Flash Image], [Save] or [Save As...]).

The **ClassPad manual** on the ClassPad Utilites CD offers a complete description of all eActivty elements and further examples in chapter 10 „The eActivity menu".

8. Data exchange between PC and ClassPad 300

8.1 Conditions

Before first data exchange between your ClassPad 300 and your computer you must install the ClassPad Manager. One on 180 days and 1000 uses limited version respectively (ClassPad Manager Limited) you find on the ClassPad Utilities CD, which was supplied with the ClassPad, in the subdirectory „ClassPad Manager Limited".

Thereby the use of the emulator function is limited. You can use also at expiration of the term the program still to the data communication. Install the ClassPad Manager by selection of the directory „ClassPad Manager Limited" on the ClassPad Utilities CD and doubleclick on „setup" and „setup.exe" respectively and obey the instructions on the screen. Read also the file „Readme.html" on the ClassPad Utilities CD. It permits among other things the access to the operating instructions of the ClassPad Manager, whose first chapter describes the installation.

8.2 Preparation

Connecting the ClassPad and PC with the USB cable - that is the provided cable with the flat plugs. The USB connections of your PC you find on back or front of the housing (with laptops also at the side). The plugs are so constituted that the connection is possible in one kind only.

If you switched off the ClassPad before connecting, it goes automatically into the connecting mode, if you to have selected in the communication menu over [Setup], [Open Setup Menu] „USB cable" and „wakeup Enable".

Otherwise you start your ClassPad, change in the main menu and then also with ![Communica...] to „communication".

Places over [Setup] and [Open Setup Menu] the type of cable „USB cable" and, if you wish it, „wakeup Enable" on. Confirm with choice of „Set" and select [Link], [Transmit] or click directly.

Now your ClassPad shows the message: Standby **Press [Clear] key to terminate**.
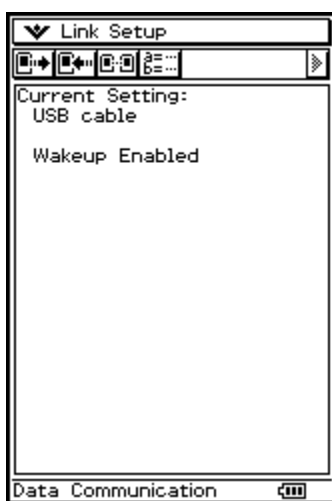
(fig. 49)

Note:
While the ClassPad is attached to a current PC, it refers electric current over the USB cable.

Start the ClassPad Manager. You should see now a ClassPad on your screen.

Call the context menu with the right mouse button, if the pointer of mouse is in any place of the virtual ClassPad you select the point „Exchange Window" (see fig. 50). At expiration of the service life ClassPad Manager starts automatically with the „Exchange Window".
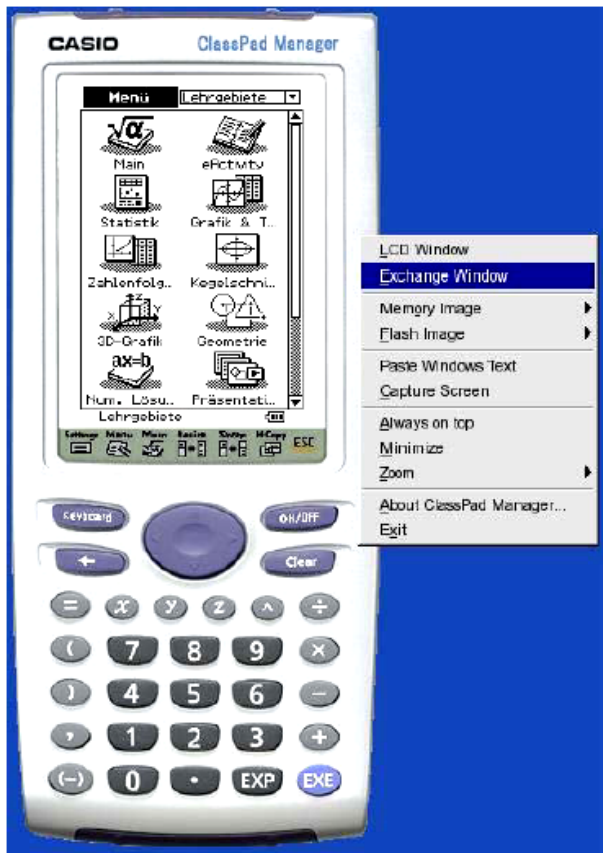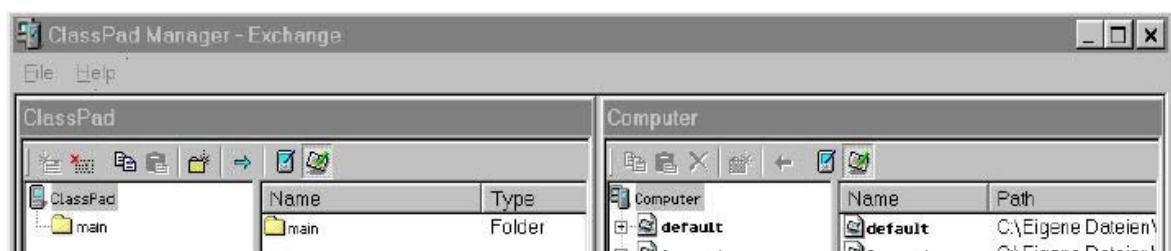

fig. 50:   ClassPad Manager with the context menu

The **„Exchange Window"** shows two split in each case Windows (see fig. 51).

(fig. 51)

Left you see the eActivity and programs and variables respectively of your ClassPad and on the right the same for the ClassPad Manager (computer).

The ClassPad (Manager) administers variables/programs and eActivities separately.

First (the variables) in a memory map with the file ending „mcs" and the latter (the programs) in an flash map with the file ending „fls". If you use in your eActivities variables, which you do not define in an eActivity, or if you use programs, thus you must send away during the data communication also the associated memory map (the MCS- file). You can use this, in order to produce e.g. with a test two groups.

The computer window shows the memory and the flash images respectively, which you inserted and put on respectively - at least the standard images of the ClassPad Manager (the files default.fls and default.mcs).

Click up , in order to connect the ClassPad and the ClassPad Manager. The ClassPad window shows now the files and/or variables of your ClassPad.

Click yourselves , in order to see the variables and/or memory maps and , in order to be able to see the eActivity files and/or flash images on your ClassPad and/or on your PC.

8.3 Data exchange

In order to store all eActivities and/or variables of your ClassPad in a new image, select . You are requested to indicate a name for the image. After you confirmed with [OK], the image is indicated in the computer window. The arrow in the other direction copies the eActivity and/or variables of the selected image straight on your ClassPad.

Particulars eActivity and/or variables you can copy comfortably by Drag&Drop from the ClassPad to the computer and in reverse. Provide if necessary over the context menu to the computer with [Add New Image] a new image.

(fig. 52)
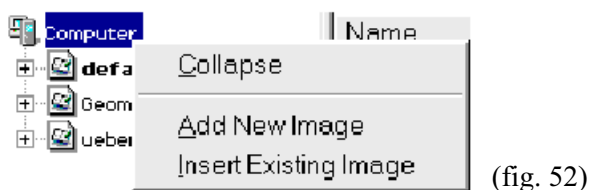
You can use for copying in addition both the context menu (over the right mouse button), the icons (mark the file/variables before you copy) and (mark the goal directory before you insert) and the usual combinations of keys Strg-C (copy) and Strg-V (insert).

By the example (this refers to the example in the preceding section „Writing an eActivity"):

Click , in order to be able to see the files/flash images. Click with the right mouse button on **computer** and select [Add New Image]. Give as names **example_send** (the ending .fls is added automatically).

Click over the new image with the right mouse button in the computer window and select [Create New Folder] or click first **example_send** and then, in order to put on a subdirectory. Enter as names „**example**".

In the ClassPad window you click on „**example to eActivity**" in the directory „main". Keep the mouse button pressed and move the pointer in the computer window on the initialized new directory „**example**". Thus your eActivity is copied into this directory.

Examining by you with a click an the directory.

Click up ⬛ , in order to terminate the connection between PC and ClassPad. Terminate the „Exchange Window" through [File], [Close] and terminate the ClassPad and ClassPad Manager by the On/Off button.

A detailed description of the „Exchange Window" is also in the operating instructions of the ClassPad Manager.

9. Exchange of eActivities between two ClassPad Managers

According to standard the ClassPad Manager stores into the subdirectory „Casio\ClassPad Manager" of the directory „own files" (see fig. 53).

(fig. 53)

However in principle you are not forced to be stored your files there. You see the memory place of the flash image and/or the memory maps within the computer range of the „Exchange Window", if you click on ⬛ Computer .

In the following it is proposed, you have put down your flash and memory maps in the standard directory, if that should not be the case, changes please instead of this directory into the memory place of the images on your PC.

9.1 Sending

Exchange over email

Start your email program and write an email to the person, to who you want to send your eActivity/ClassPad data and select [Files to attach], [Appendix], [Attachment] and so on, it dependents on the used program.
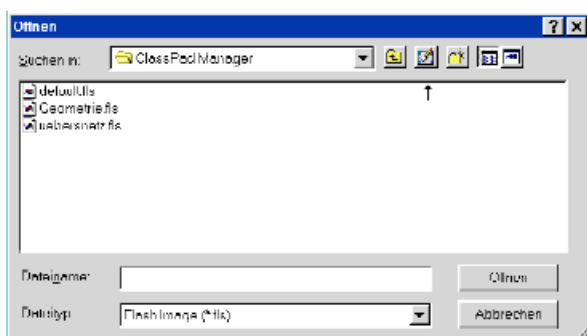
(fig. 54)

In the following dialogue of selection of files you select the flash file/files with the eActivities (ending „.fls"), which you want to send, and if necessary the assigned memory maps (ending „.mcs") (see above).

If the selection dialogue should not automatically open the directoryx „own files", then you reach this file most simply over the desktop icon and the choice of „own files".

9.2 Exchange over data medium

Copy the *.fls and if necessary the *.mcs file/files with the eActivities, which want to pass on, on a (portable) data medium (e.g. disk, zip disk, CD-RW) and pass on the data medium to the receiver.

By the example: select **example_send.fls** from the ClassPad Manager directory.

9.3 Receiving

As the receiver of an email with an eActivity and/or a flash image or a memory map select „appendix stores" or the like and secure the attached *.fls and *.mcs files into the ClassPad Manager directory.

If you receive a data medium with *.fls and/or *.mcs files, copy the files (e.g. with a file manager) into the ClassPad Manager directory.

You can download eActivities and/or flash images among other things also from the ClassPad page in the internet (e.g. **http://www.classpad.de/**) and store in the ClassPad Manager directory.

Pay attention to it if necessary not to overwrite your own flash and memoryimages (and thus your eActivities and variables).

If you start the ClassPad Manager, change over the context menu of the right mouse button into the „Exchange Window" (see above). Click over with the right mouse button and select [Insert Existing Image]. With the dialogue of selection of files now you open the received file.

Now you can access the eActivity and dispatch it at your ClassPad - exactly the same, like you copy an eActivity and variables/programs from the ClassPad to the ClassPad Manager (you have to repair may be in addition the connection again).

By the example:
We suppose, you receive the file **example_send.fls** sent above. Store it now under **example_receive.fls**. Start the ClassPad Manager and open you as described **example_receive.fls**. The received image contains the directory „**example**" with the eActivity „**example on eActivity**".

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