HOCHSCHULE FÜR TECHNIK UND WIRTSCHAFT DRESDEN UNIVERSITY OF APPLIED SCIENCES

Something about myself: Paul Ernst **Ludwig Paditz**

Education:

Diploma mathematics, TU Dresden, Germany, 1974.

Doctor Natural Science (Dr.rer.nat.), TU, Dresden, Germany, 1977.

Postgrad., State University, St. Petersburg, Russia, 1984-1985.

Habilitation (Dr.rer.nat.habil.), HfV Dresden, Germany, 1989.

Working:

Assistant, department mathematics, TU Dresden, 1977-1979.

Head assistant, HfV Dresden, Institute of Mathematics, 1979-1991,

applied professor, HfV Dresden, 1992.

Professor, Faculty informatics/mathematics, Univ. of Applied Sciences, Dresden, since 1992.


ME21
WELCOME TO THE 10TH INTERNATIONAL CONFERENCE
HOCHSCHULE FÜR TECHNIK UND WIRTSCHAFT
ME21
10th International Conference
"Models in Developing Mathematics Education"
September 11-17, 2009 - Dresden, Saxony, Germany

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Using CAS in Math Education – first experience in Germany with the newest ClassPad technology CP400

Preface:

Ministry of Education in Saxony/Germany introduced 2004:
Modern Math Education with CAS, DGS and TC
beginning in the 8th class upto 12th class,
using graphic calculators (GTR)

CAS – Computer Algebra Systems
DGS – Dynamic Geometry Software
TC – Spreadsheet (Table Calculation)

8th class:

- Knowledge of the use of CAS when forming more complex terms and equations

- Investigating the influence of parameters in the function equation to trace the graph with DGS, TC, GTR or CAS

- Finding equations for measurement series with the help of linear regression with GTR, CAS or TC

- Solving linear systems of equations with more complex coefficients with GTR or CAS (two equations with two unknown variables)

9th class:

Functions and Powers

Mastered of determining zero quadratic functions, graphical solving quadratic equations and solving with GTR or CAS

10th class:

Obtaining the inverse function with CAS, graphical interpretation

Use of CAS to demonstrate the properties of functions
Obtaining illustrative of the limit concept

Know of parametric representation and polar coordinates to describe curves with GTR and CAS

11/12th class:

Differential calculus

The use of CAS in particular, should promote discovery learning, and support for substantive tasks, the reflection on the facts and the interpretation of the result.

Integral Calculus

The use of CAS in particular, should promote discovery learning, and support for substantive tasks, the reflection on the facts and the interpretation of the result.

worksheets:

- ☞ The use of worksheets in mathematics instruction has a long tradition.
- ☞ The use of a worksheet should guide the students to a structured work.
- ☞ Instead of an oral instruction, which requires a synchronous work of all students, the worksheet individually and with their own timing can be processed next.
- ☞ The sequence of the work orders in the worksheet helps to recognize the logical structure of a problem;
  the work procedures help to penetrate the question.

worksheets:

The disadvantage of a sheet of paper with work orders is seen, that the tools which can be used must be made available about. The students do not know always, how to carry out its solution steps in detail. Moreover, in a classic worksheet are missing the self check of the results, a feedback of the partial steps and also the visualization of the results.

The new developed **eActivity in the ClassPad** represents an extremely rich extension of the worksheet. The eActivity combines the written representation of the setting of tasks of a worksheet with the tool level of the ClassPad.
These tools are the individual menus or modules, which the ClassPad offers: Computer algebra system, dynamic geometry software, computer statistics, curve plotter, and much more.

eActivity:

Thus, 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 may be in a hidden file, can be viewed.

It is an interactive work of the students, between setting of tasks and the results and control of the results themselves.

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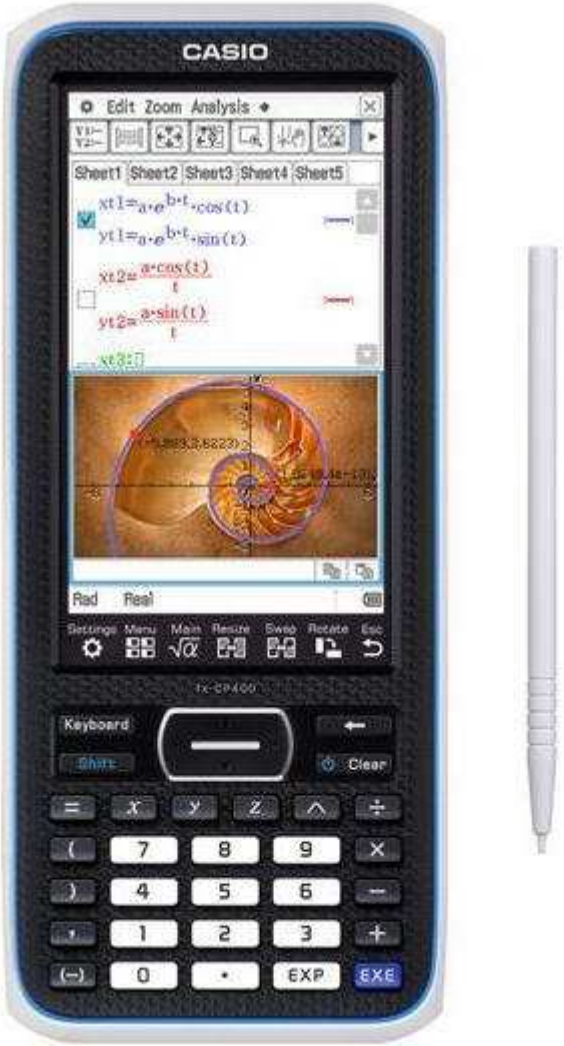
The tool – ClassPad 400:

Графический калькулятор
с сенсорным дисплеем

Fx-CP400 обладает рядом функций, помогающих школьникам лучше усваивать материал:

USB поддержка для быстрой и легкой передачи данных и совместимость с **проектором** CASIO для отображения информации на доске.

http://edu.casio.ru/fx-cp400/



The tool – Beamer XJ-A146:

http://casio-projectors.ru/products/xja146/

The **ClassPad-software by CASIO** was introduced in 2003 for a new generation of handheld calculators and simultaneously for the Windows PC:

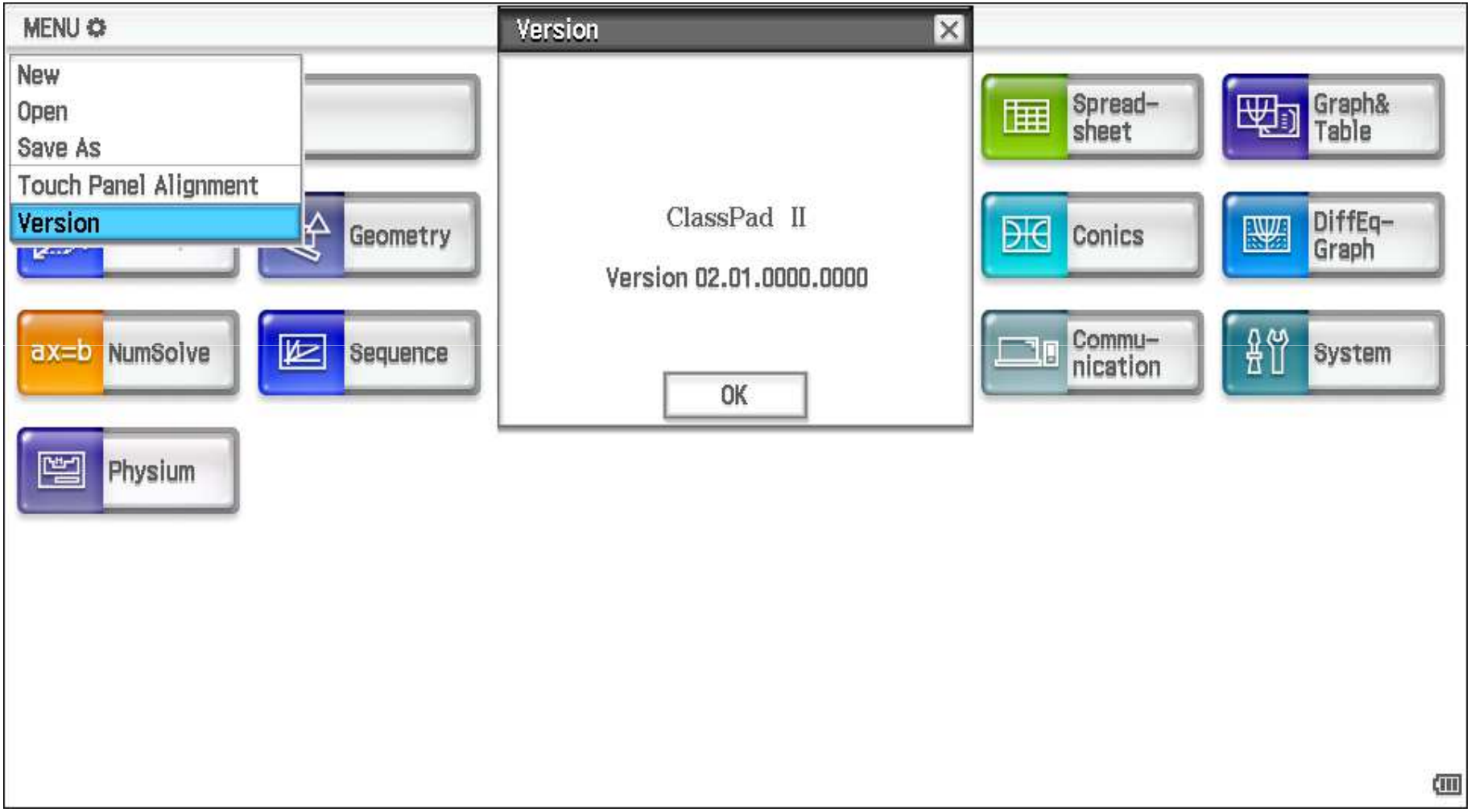
emulator version of the handheld calculator.

Now we have the ClassPad 400 (ClassPad II) with the **new software version 02.01.2000** (13.06.2017), the emulator version is named:

ClassPad Manager Subscription for ClassPad II Series v2.01, cp. https://edu.casio.com/

Have a look in the emulator version:

Levenberg-Marquardt Algorithm using ClassPad



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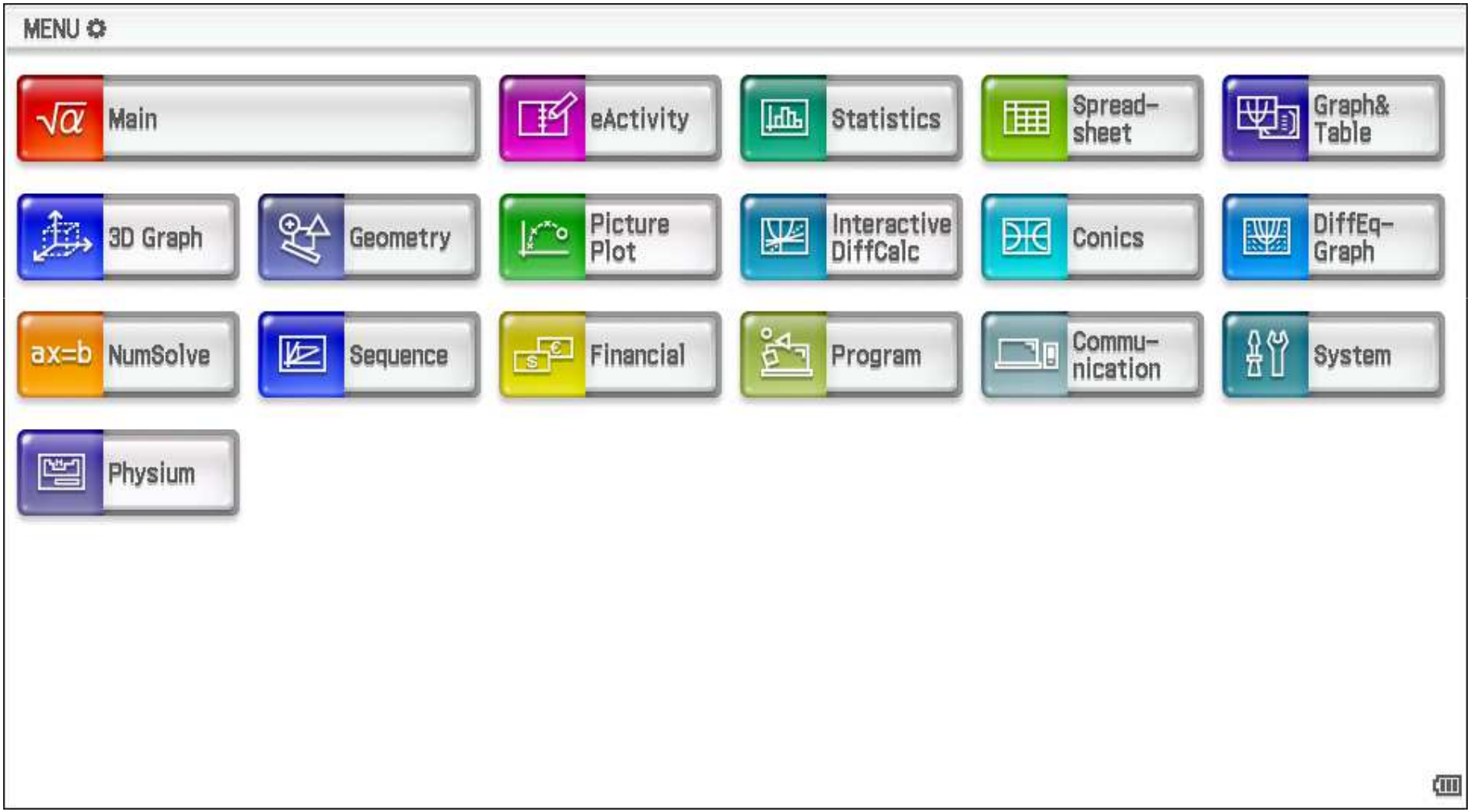
The desktop in the PC emulator version: full screen



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An **eActivity** in the PC emulator version: full screen

File Edit Insert Action

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Prof. Dr. Ludwig Paditz  14.05.2017

internationale Klimafinanzierung (Deutschland 2005-2015)
==================================================

deutsche Ausgaben für den internationalen Klimaschutz in Millionen-EUR/Jahr

{5,6,7,8,9,10,11,12,13,14,15}+2000⇒listx
                                {2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015}
{471,515,648,881,1063,1431,1563,1664,1950,2344,2684}⇒listy
                                {471,515,648,881,1063,1431,1563,1664,1950,2344,2684}
================================
Jahreszählung (Datentransformation)
seq(x,x,1,11,1)⇒listx
                                                                {1,2,3,4,5,6,7,8,9,10,11}
deutsche Ausgaben für den internationalen Klimaschutz in Mrd-EUR/Jahr
```

Alg Decimal Real Rad

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The Logarithmic Regression (quasilinear): full screen

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File Edit Insert Action

deutsche Ausgaben für den internationalen Klimaschutz in Mrd-EUR/Jahr
{471,515,648,881,1063,1431,1563,1664,1950,2344,2684}/1000⇒listy
                    {0.471,0.515,0.648,0.881,1.063,1.431,1.563,1.664,1.95,2.344,2.684}
LogReg listx,listy
                                                                          done
DispStat
                                                                          done
==========================
Log. Regression
y=a+b·ln(x)
   a = -0.043327
   b = 0.8964872
   r = 0.8981729
   r² = 0.8067145
 MSe = 0.1187862
==========================

Alg   Decimal   Real   Rad
```
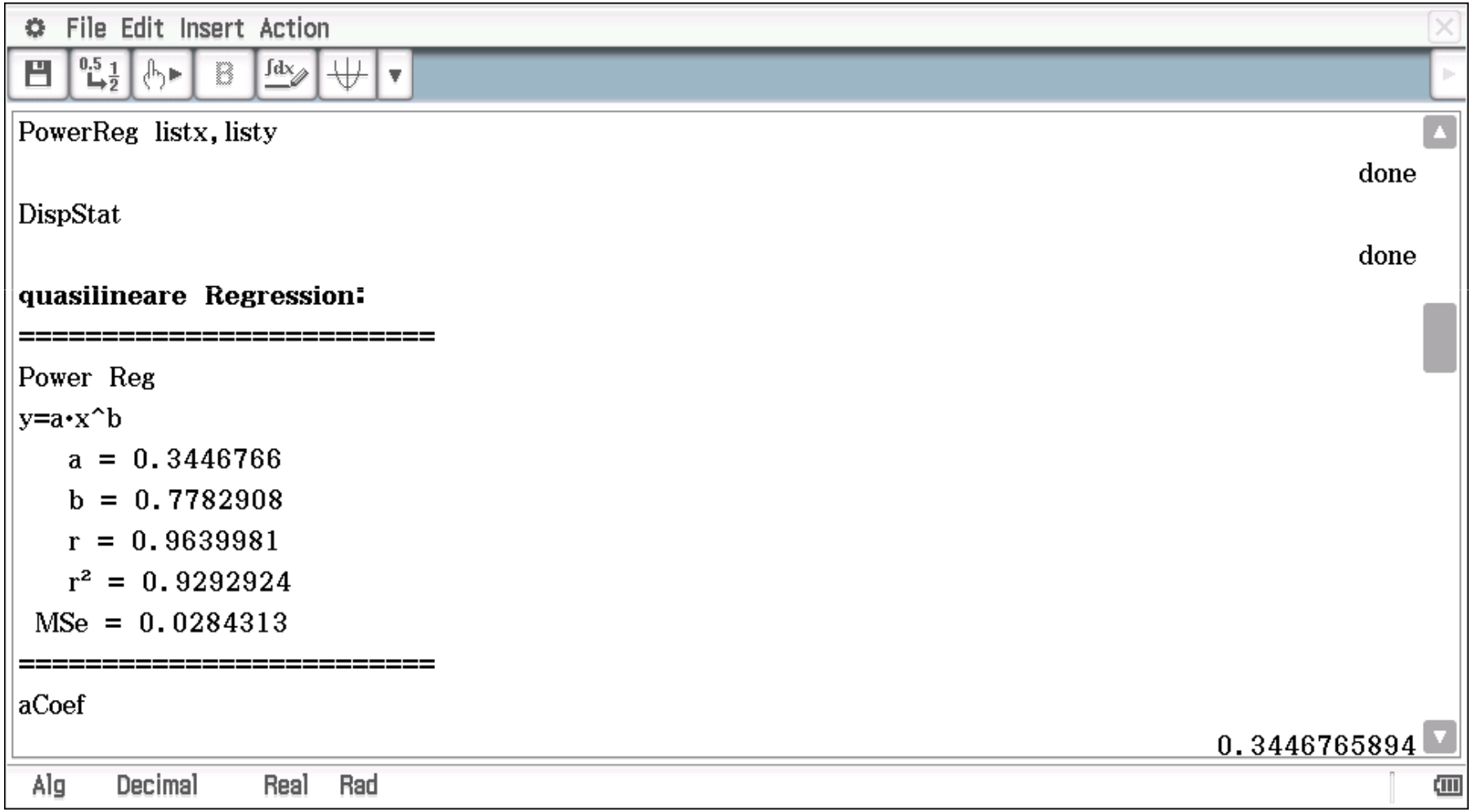

The Power Regression (quasilinear): full screen



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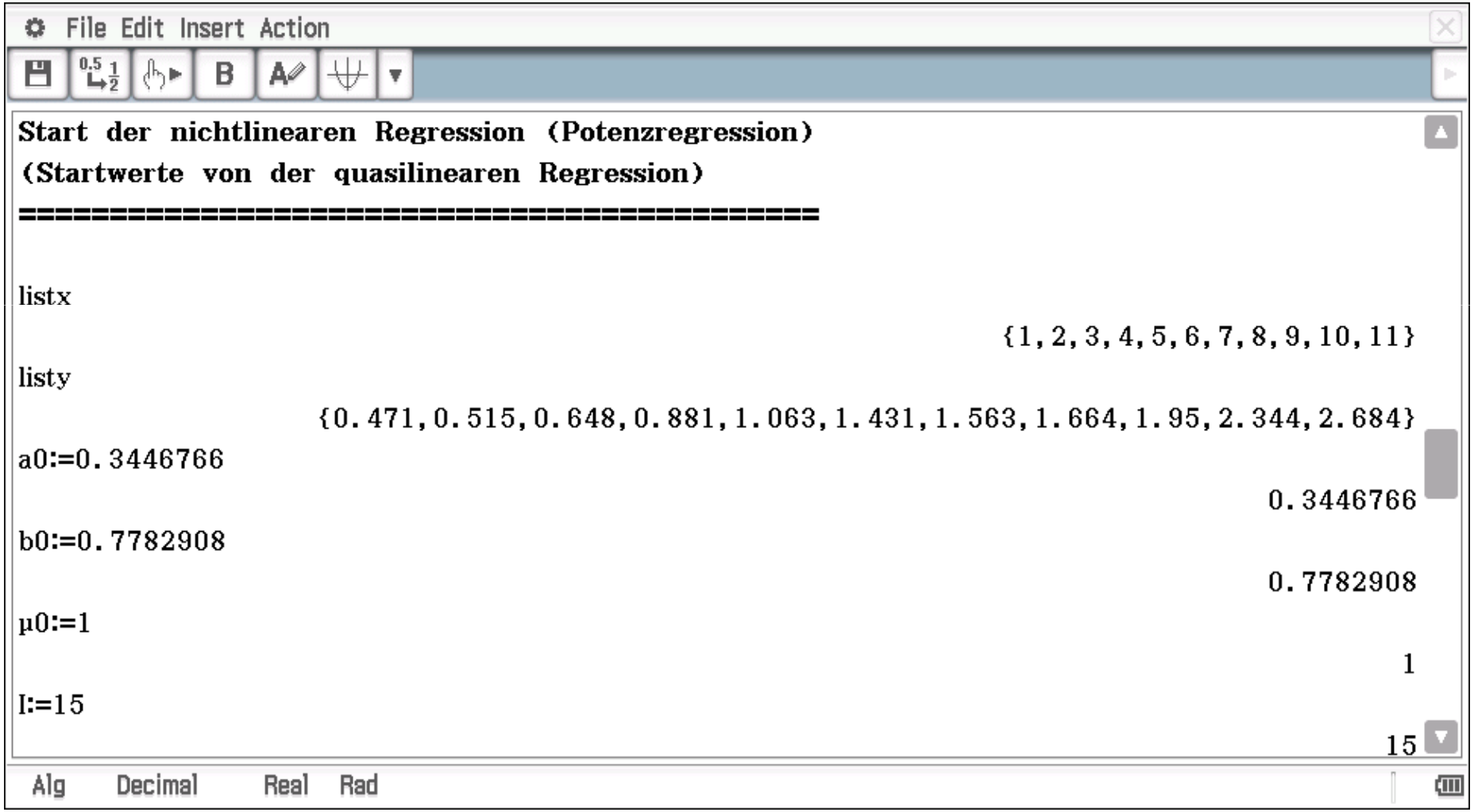
The Power Regression (new, nonlinear): full screen



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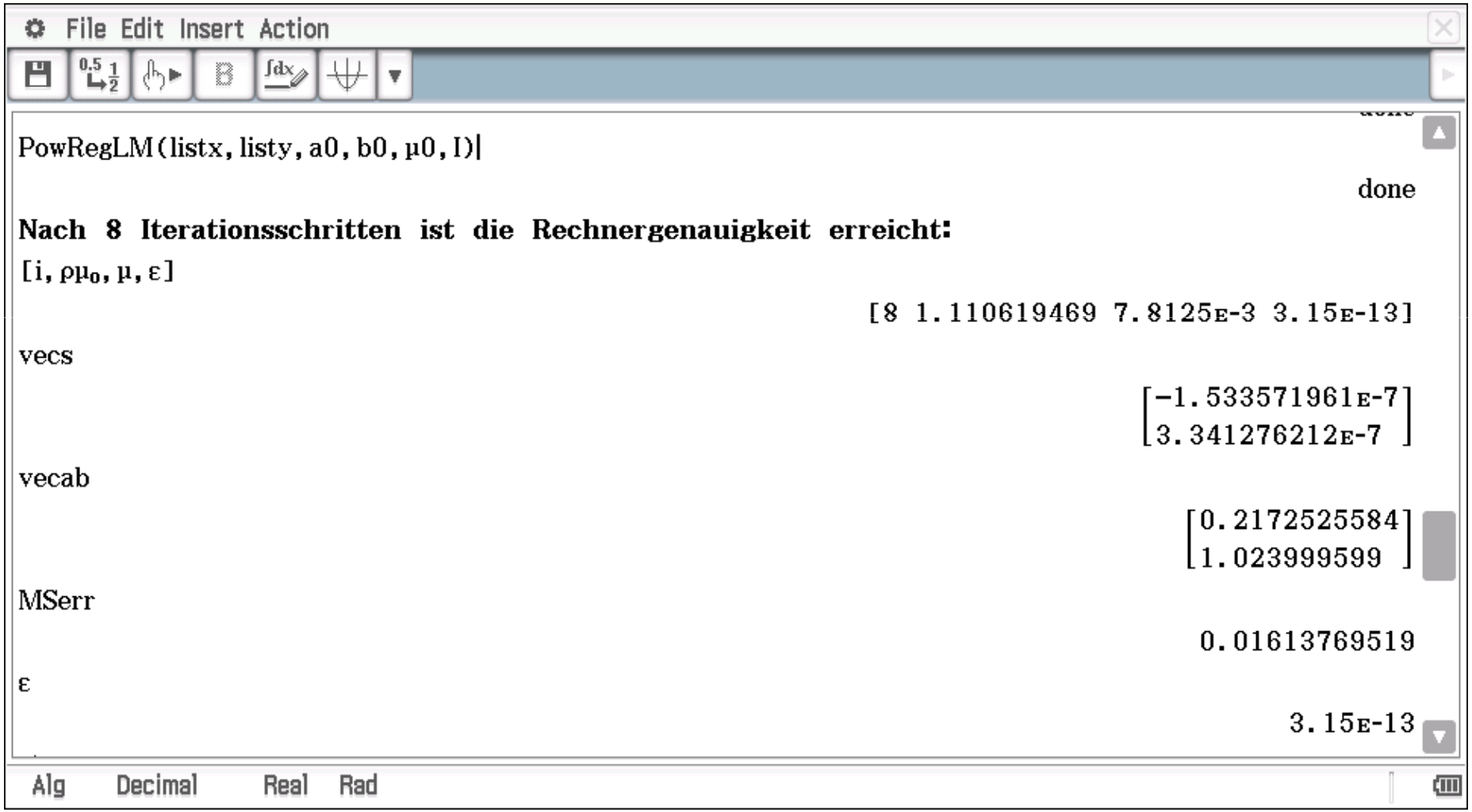
The Power Regression (new, nonlinear): PowRegLM



The regression functions and the MSe values:

LogReg y(x)=a+b*ln(x): MSe = 0.1187862

PowerReg y(x)=a*x^b : MSe = 0.0284313
(**quasilinear:** ln(y) = ln(a) + b*ln(x))

now real MSe: 0.3446766⇒a (optimal, quasilinear)
0.7782908⇒b (optimal, quasilinear)
MSe = sum((listy-a*listx^b)^2)/9 = 0.0421417077

PowRegLM y(x)=a*x^b: MSerr = **0.01613769519**

Levenberg-Marquardt Algorithm using ClassPad

File Edit Type

	listx	listy	list3	list4	list5	list6
1	1	0.471				
2	2	0.515				
3	3	0.648				
4	4	0.881				
5	5	1.063				
6	6	1.431				
7	7	1.563				
8	8	1.664				
9	9	1.95				
10	10	2.344				
11	11	2.684				

Cal▶

[7]=

Sheet1 Sheet2 Sheet3 Sheet4 Sheet5

y1=−0.043327+0.8964872·ln(x)|x>0

y2=0.3446766·$x^{0.7782908}$|x>0

y3=0.2172525584·$x^{1.023999599}$|x>0

y4:

y5:

y6:

y7:

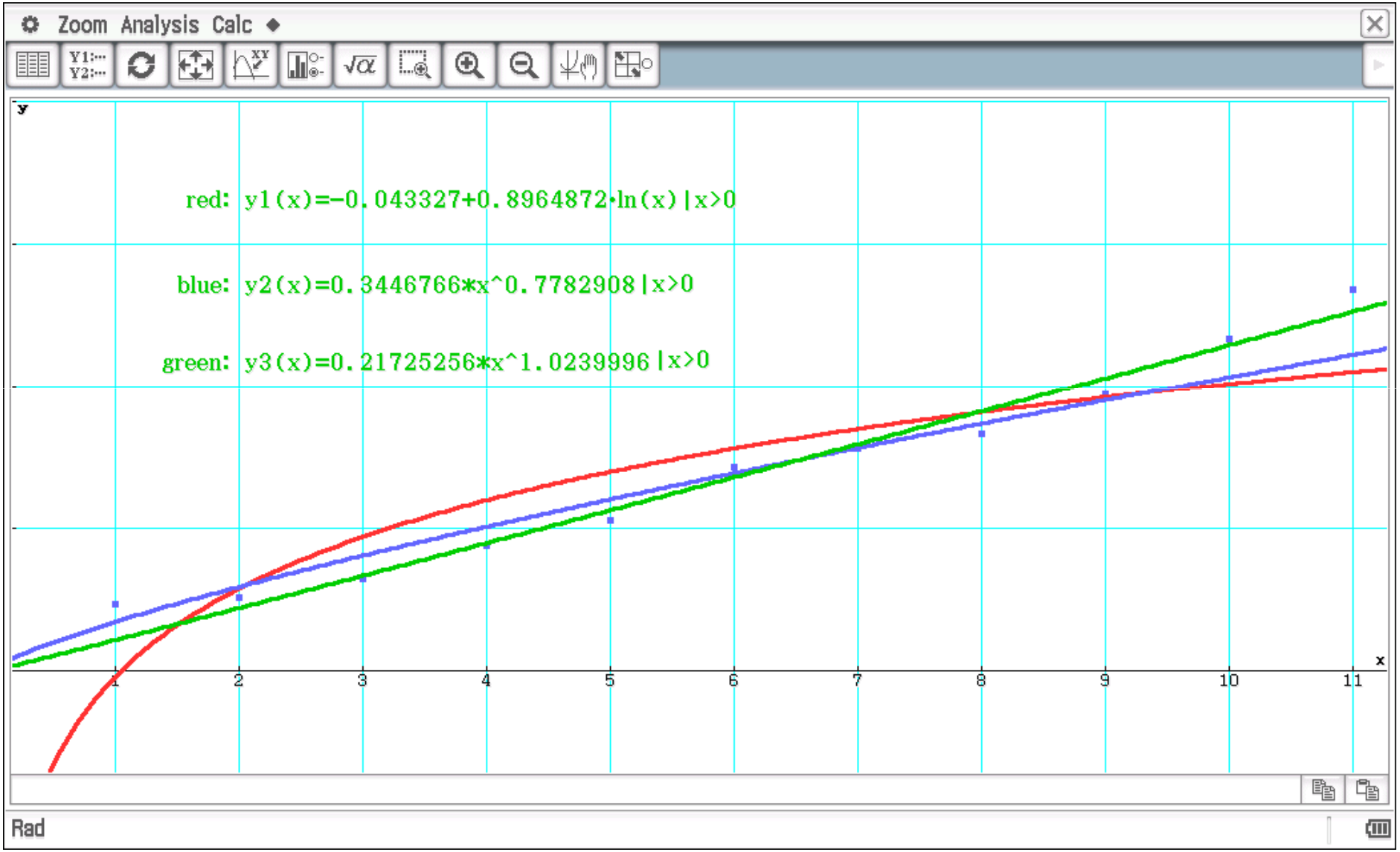
y8:

y9:

y10:

Rad Real

Levenberg-Marquardt Algorithm using ClassPad



The general **logistic** regress. y(x)=c/(1+a*e^(-b*x))+d and the **arctan**-regression y(x) = a*arctan(c*(x -b))+d respectively we discuss with a **real data set**:

listx:={1, 2, …, 50} contains time points (with step 1),

listy:={3.25,3.35,3.54,3.65,3.74,3.82,3.87,3.94,4,4.06,
4.11,4.22,4.22,4.27,4.32,4.34,4.39,4.44,4.46,4.52,
4.56,4.62,4.7,4.73,4.77,4.82,4.89,4.93,5,5.09,5.19,
5.31,5.47,5.65,6.08,8.33,9.22,9.44,9.61,9.74,9.8,
9.88,9.92,9.96,10.01,10.05,10.06,10.08,10.1,10.13}

contains chemical data generated during an experiment in the class room (chemical reaction, pH values).

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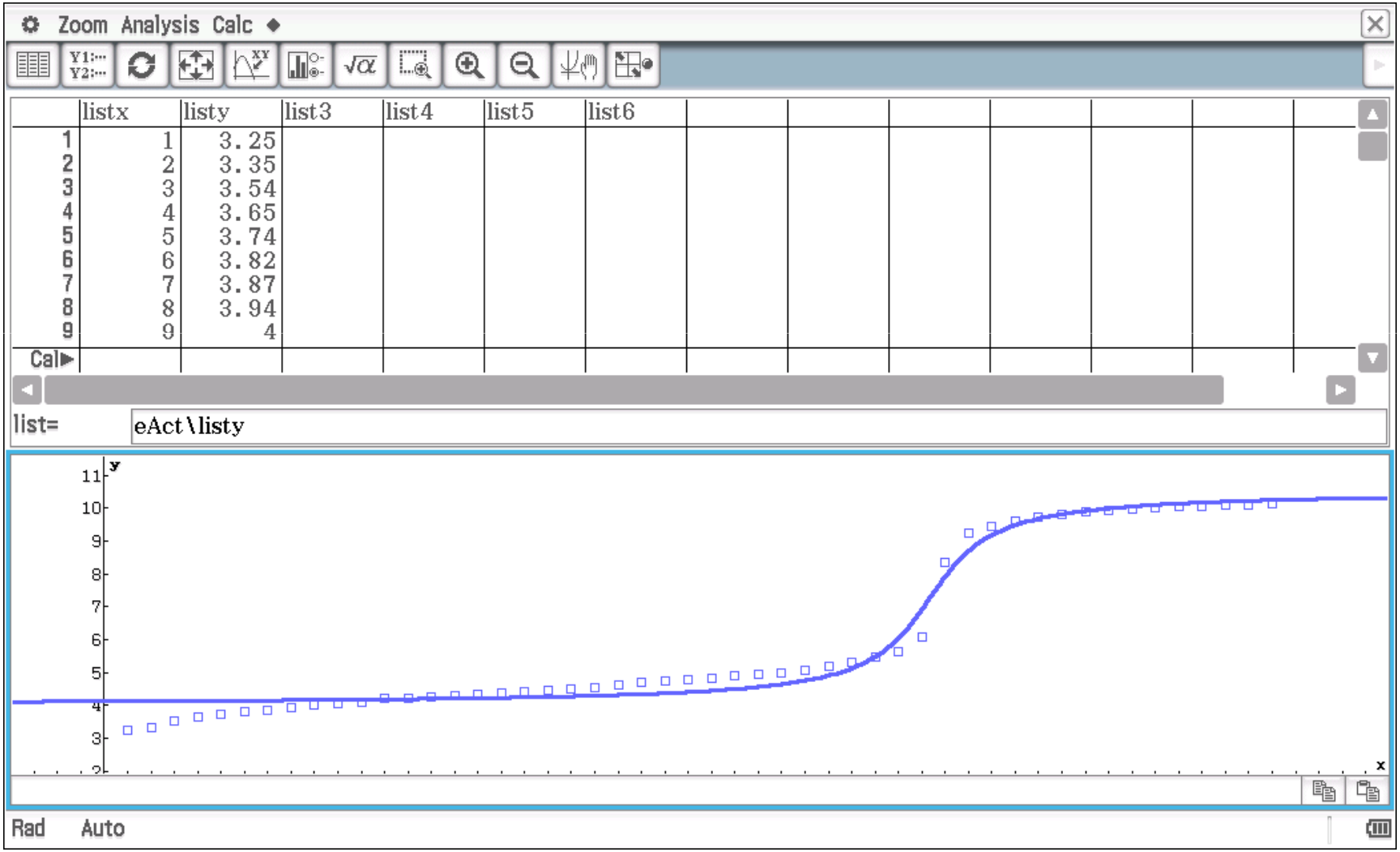
What is a good regression function?



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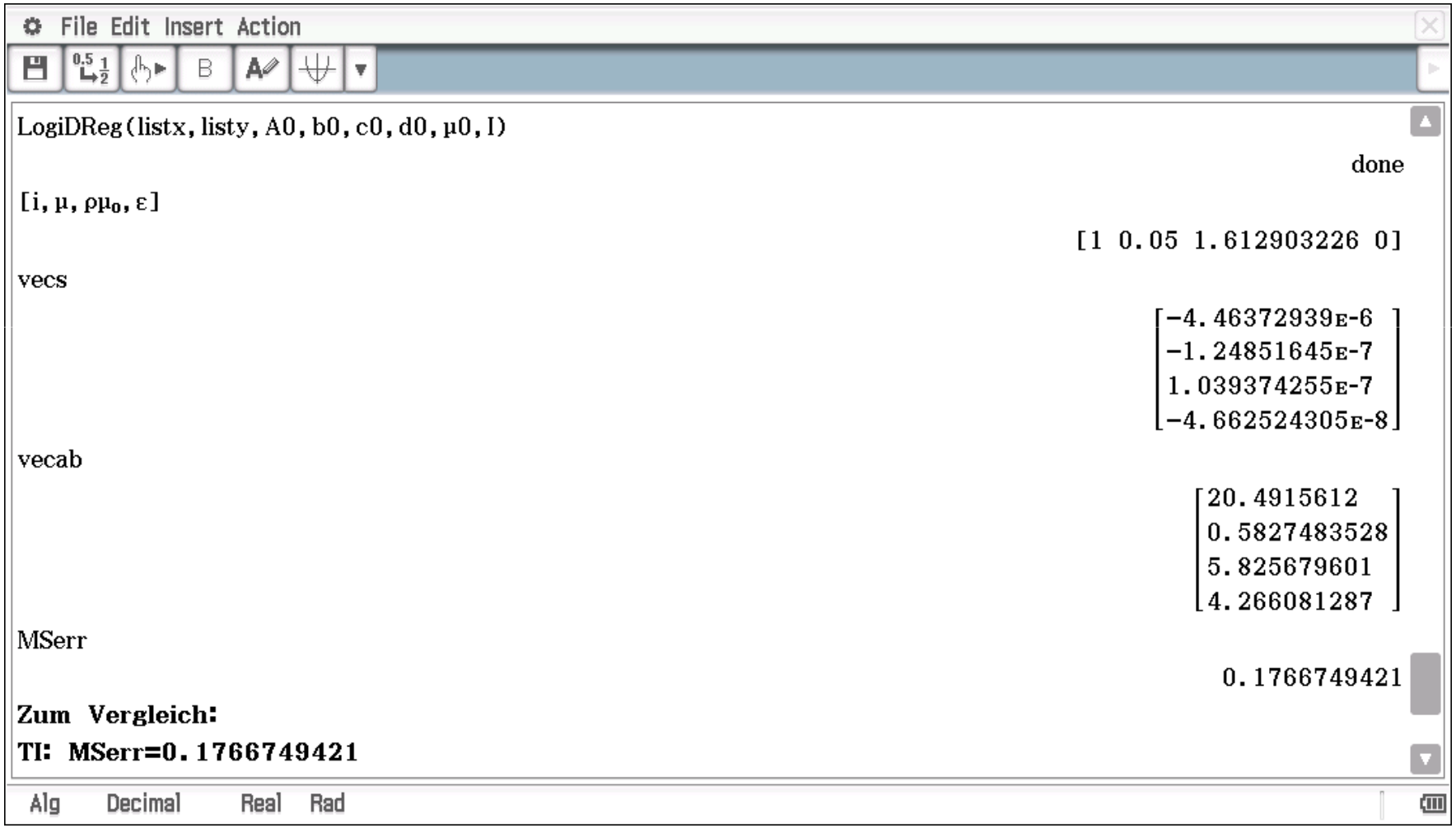
The result with **LogiDReg**-program: Mserr=0.176675



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The result with **ArctDReg**-program: Mserr=0.112791

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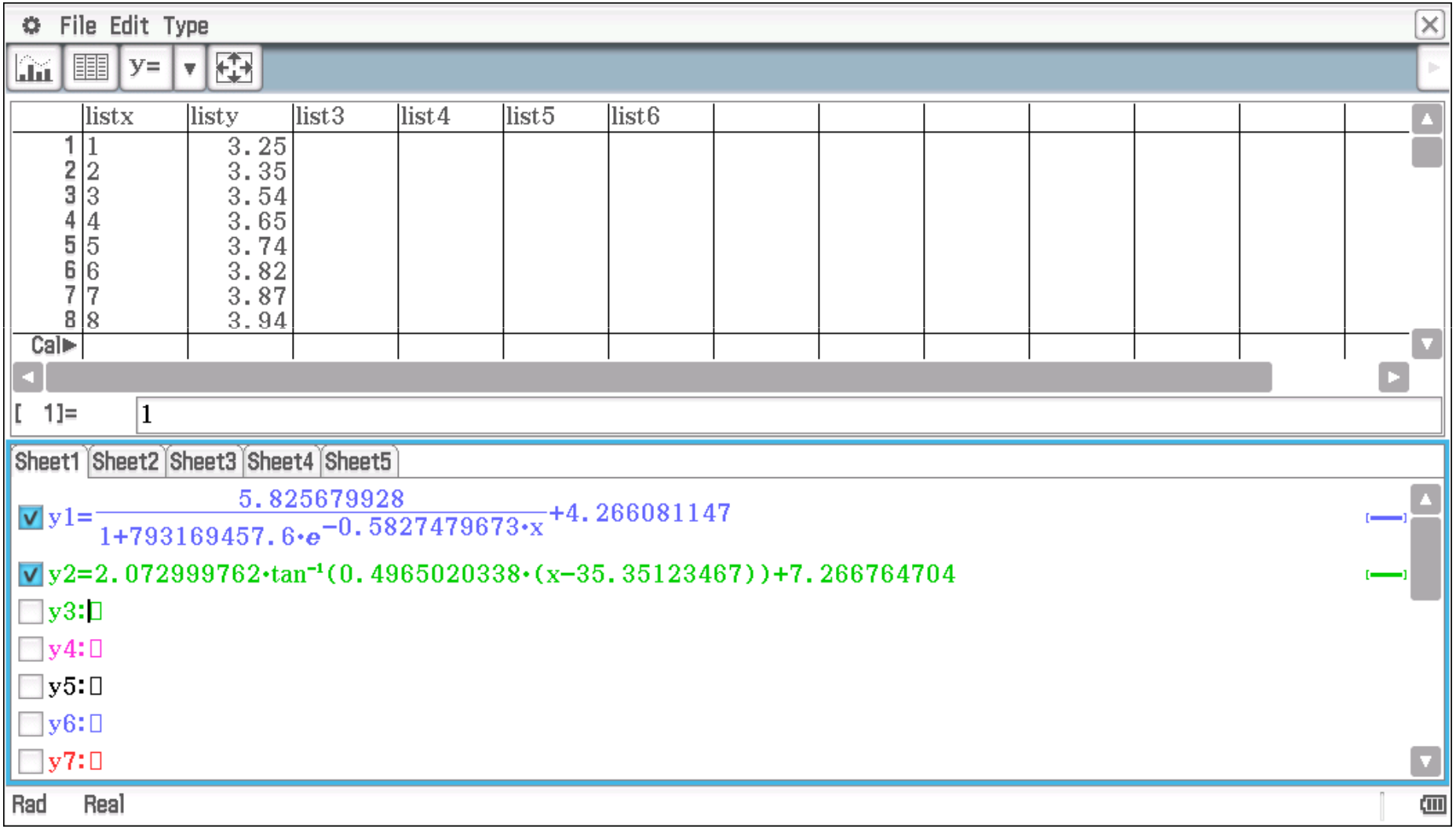
The logistic and arctan-regression in comparision:



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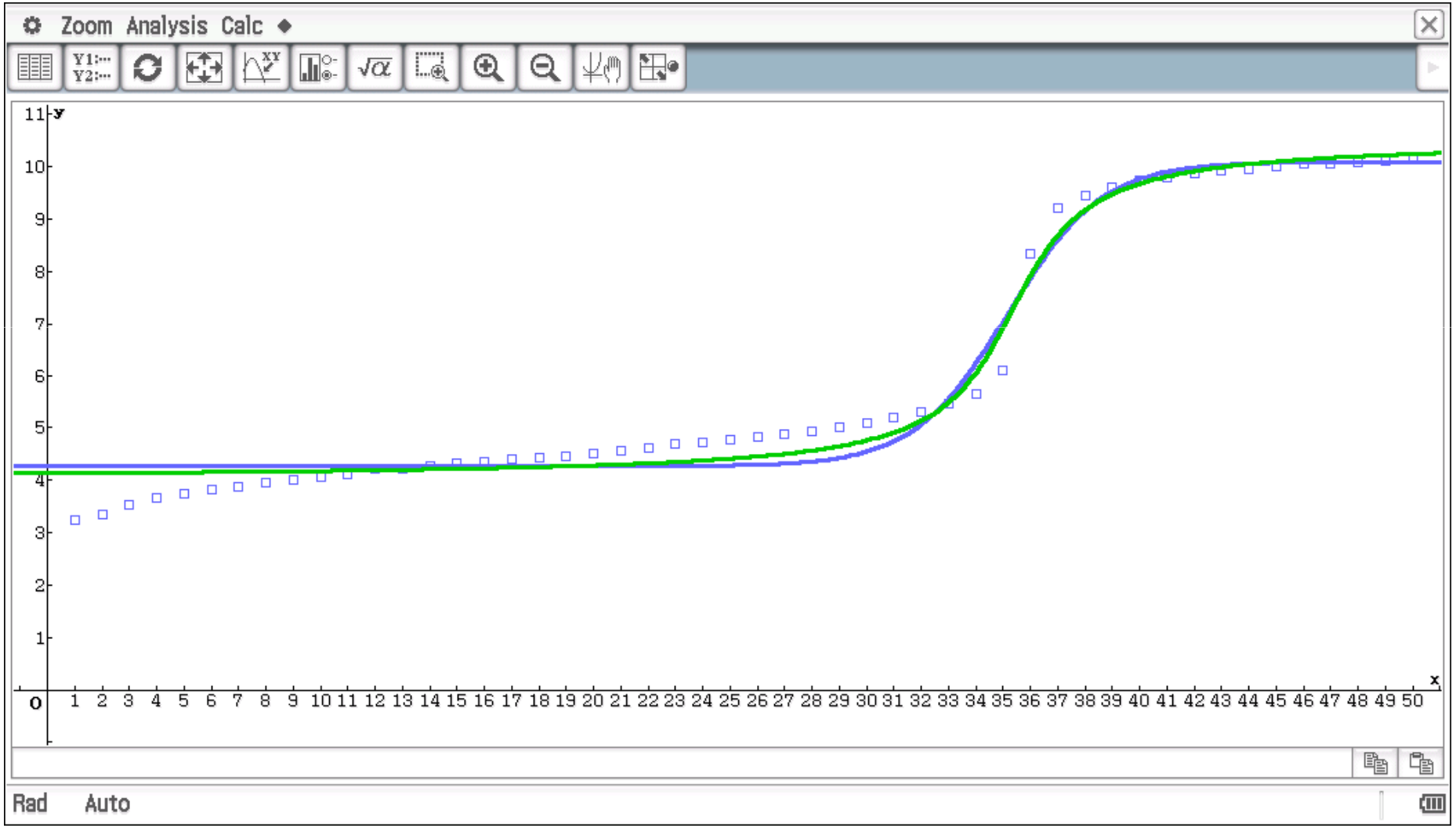

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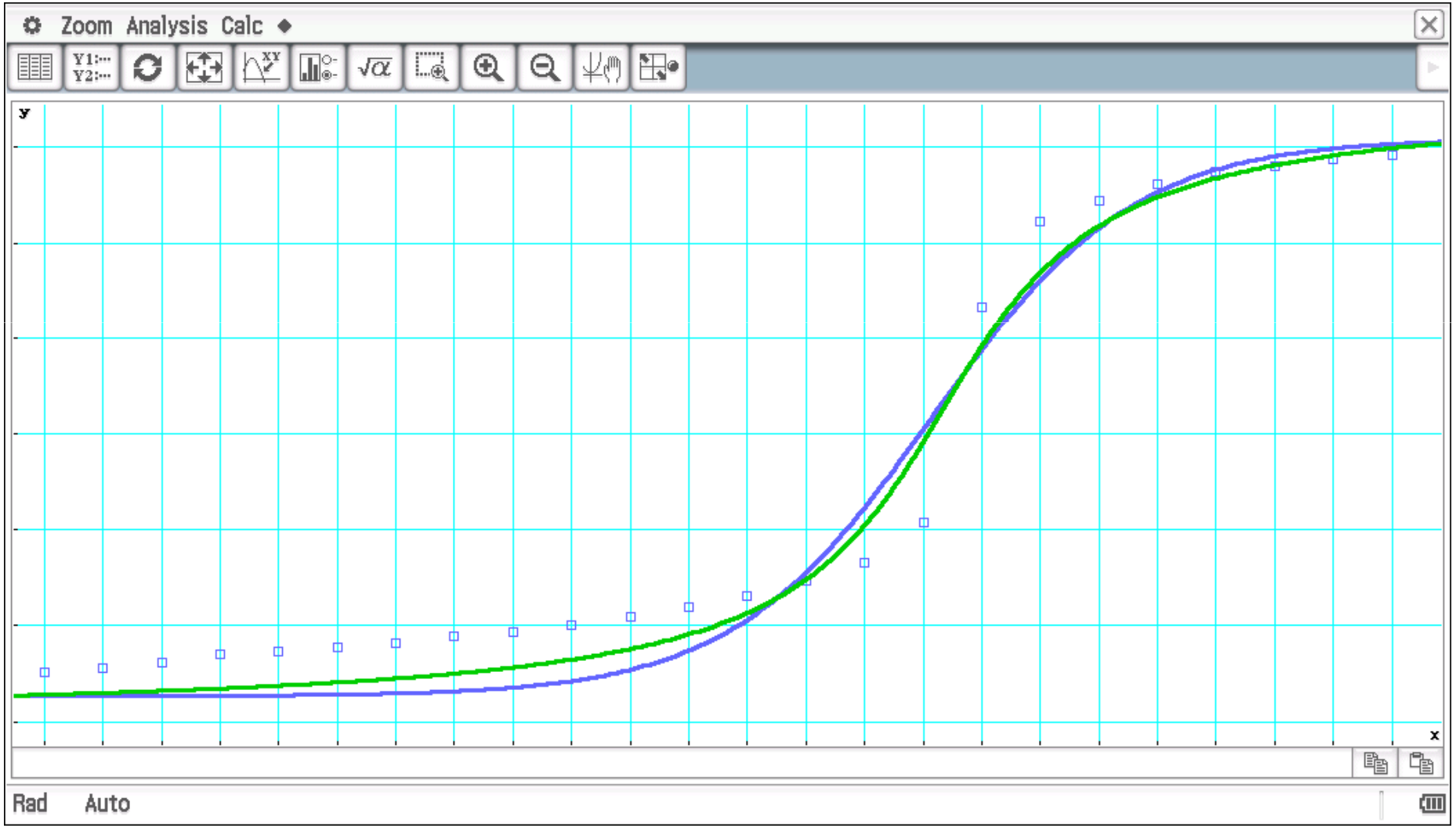
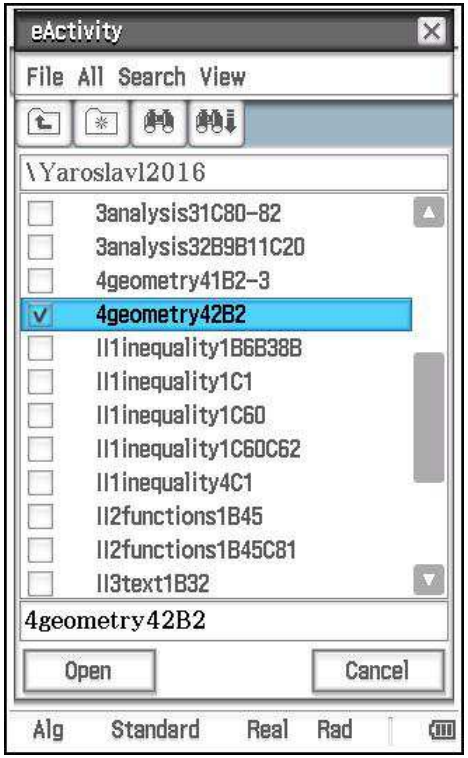
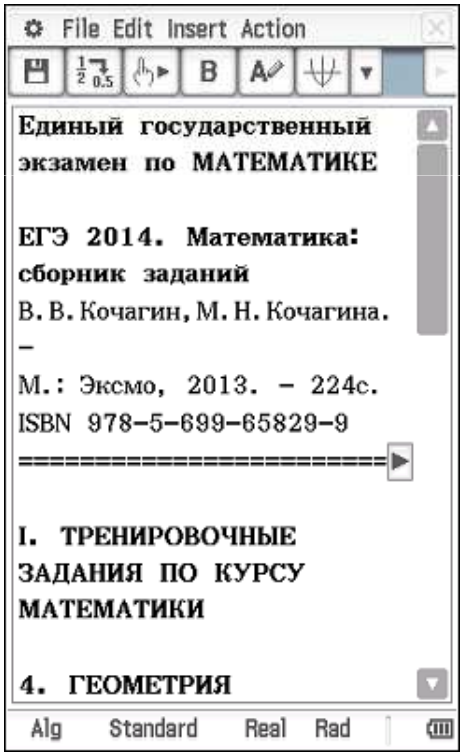
The logistic and arctan-regression in comparision:

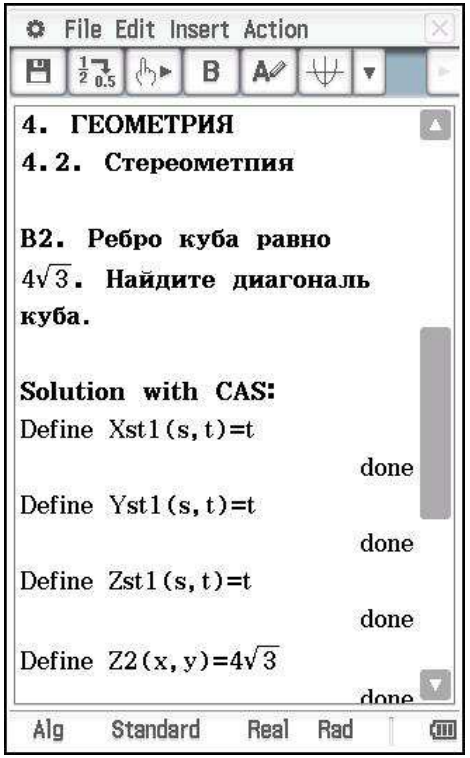


eActivity: 4. ГЕОМЕТРИЯ 4.2. Стереометпия

Ребро куба равно 4√(3). Найдите диагональ куба.

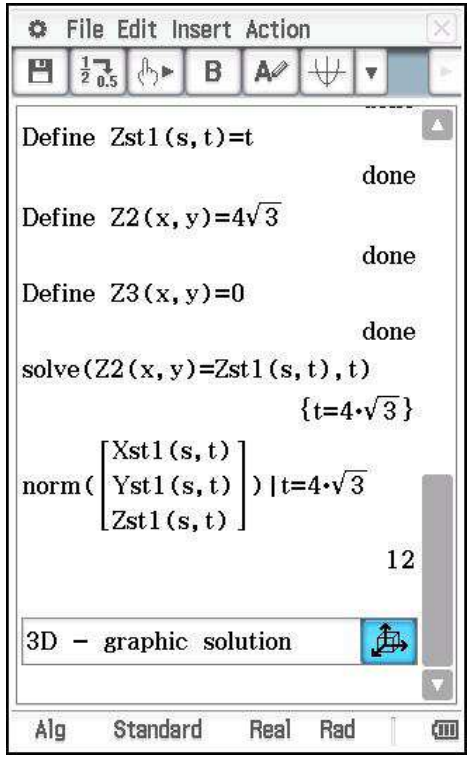


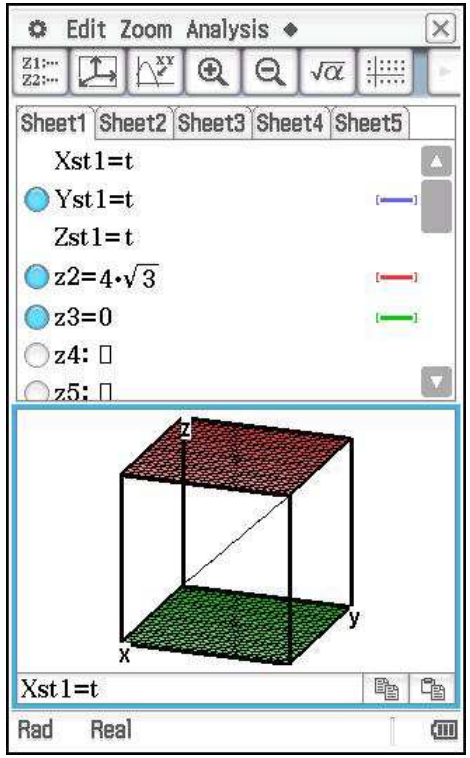


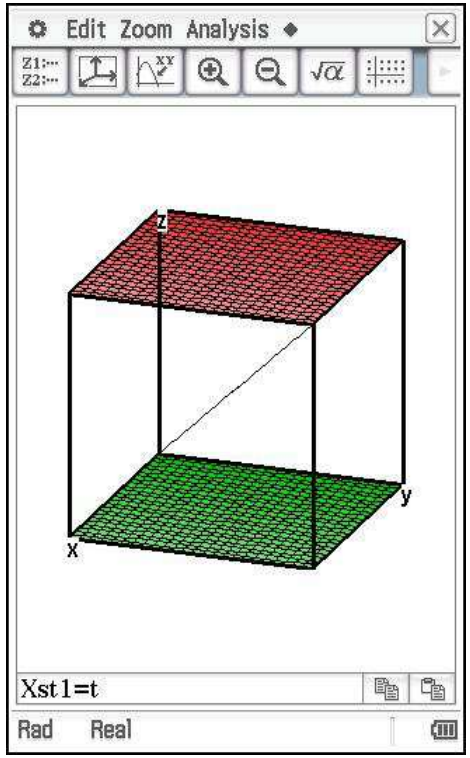


eActivity: 4. ГЕОМЕТРИЯ 4.2. Стереометпия

Ответ: диагональ куба равно 12.

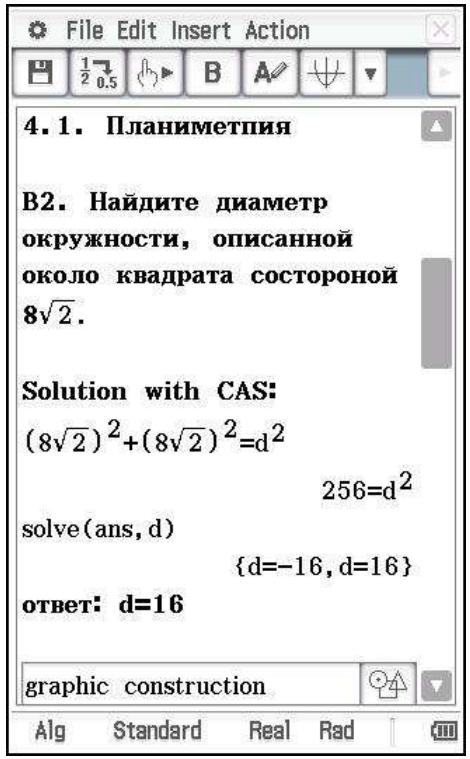


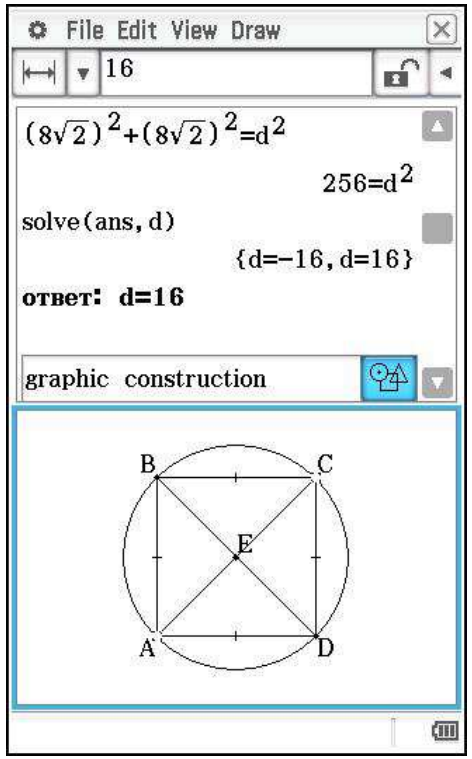




eActivity: 4. ГЕОМЕТРИЯ 4.1. Планиметпия

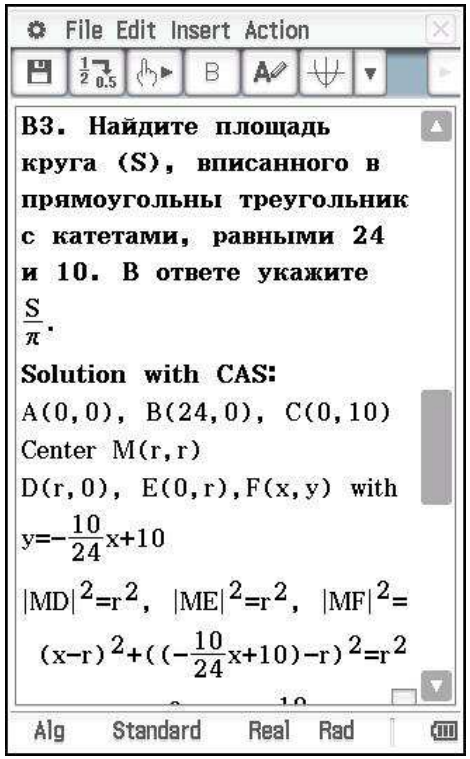
Найдите диаметр окружности, описанной около квадрата состороной 8√(2).

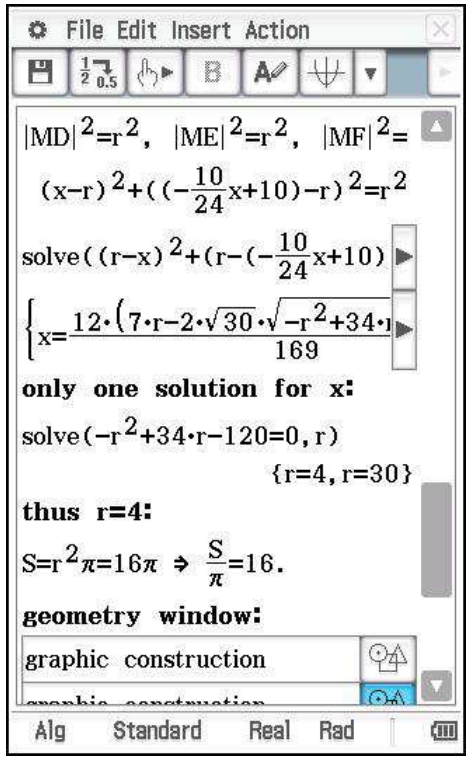


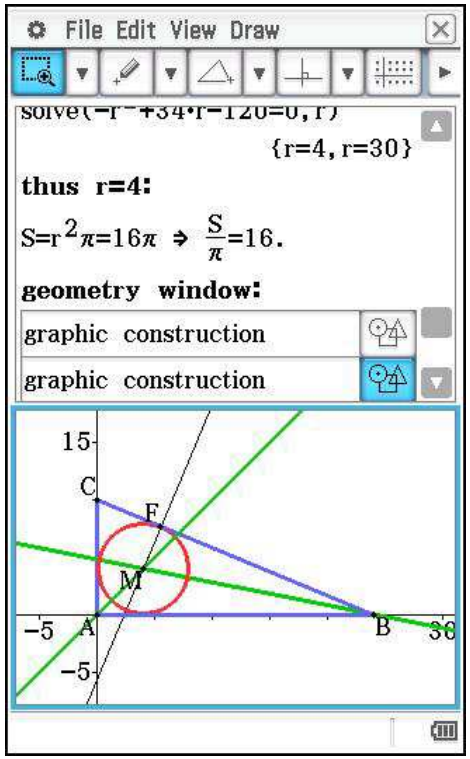


eActivity: 4. ГЕОМЕТРИЯ 4.1. Планиметпия

Найдите площадь круга (S), вписанного в прямо-угольны треугольник с катетами, равными 24 и 10. В ответе укажите S/π.







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eActivity: 4. ГЕОМЕТРИЯ 4.1. Планиметпия

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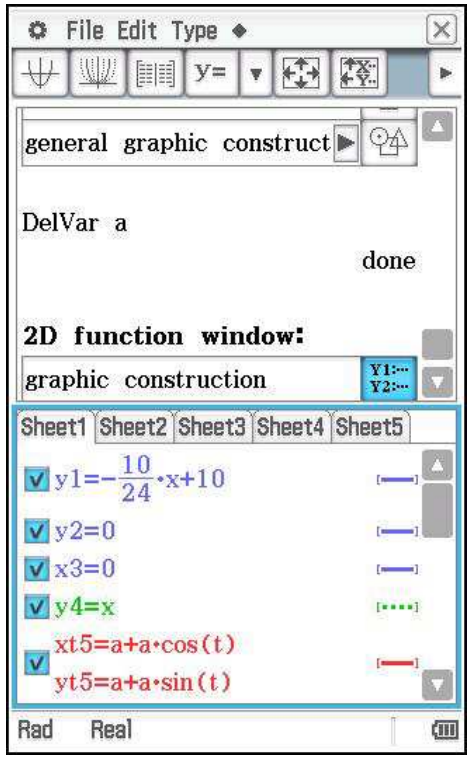

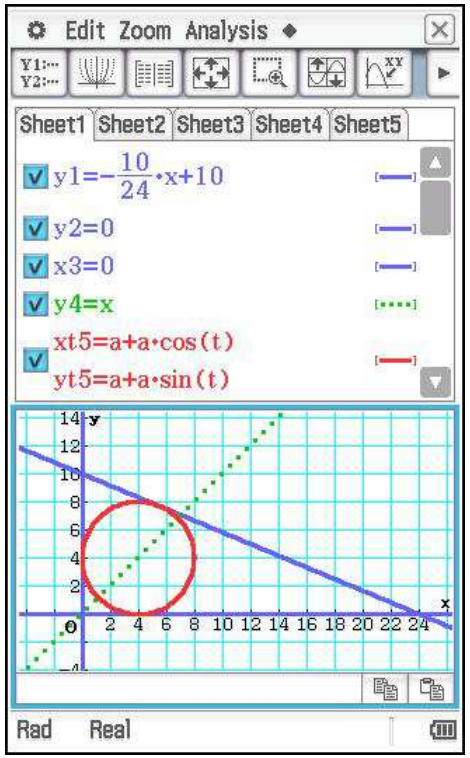

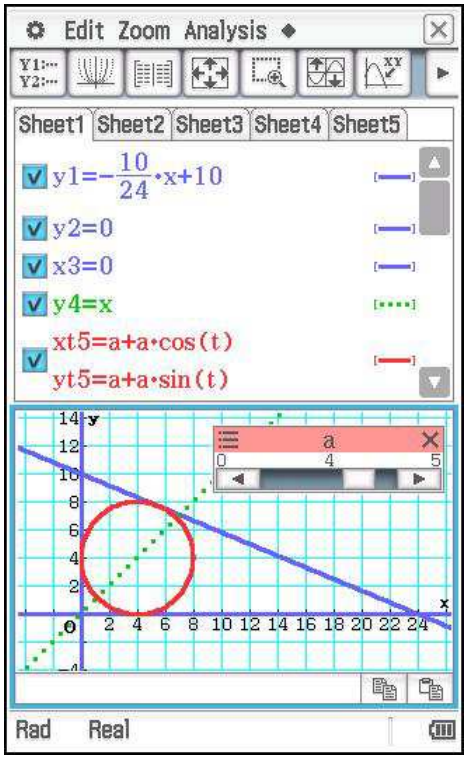

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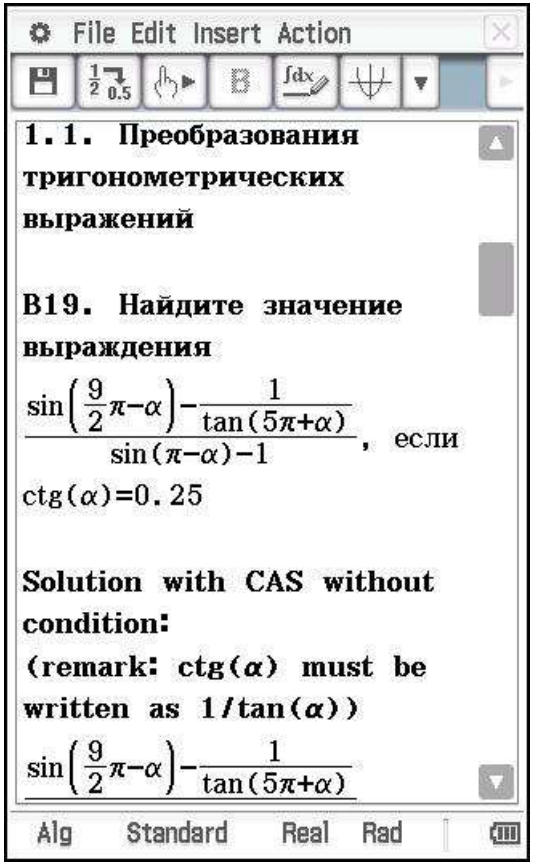
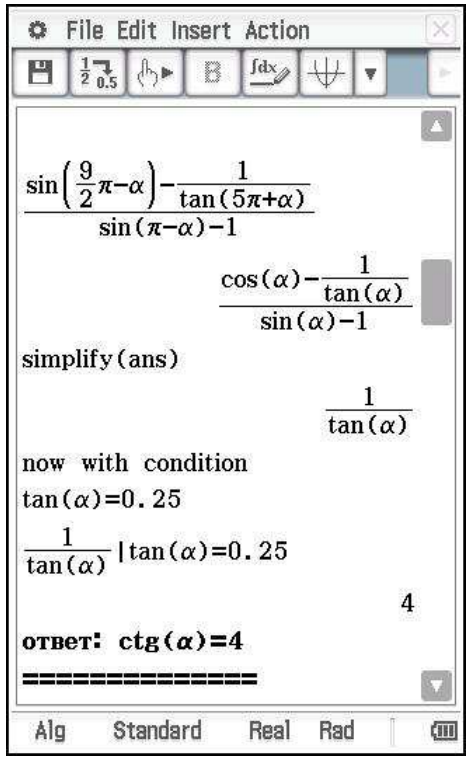
eActivity: 1. ТРИГОНОМЕТРИЯ

1.1. Преобразования тригонометрических выражений





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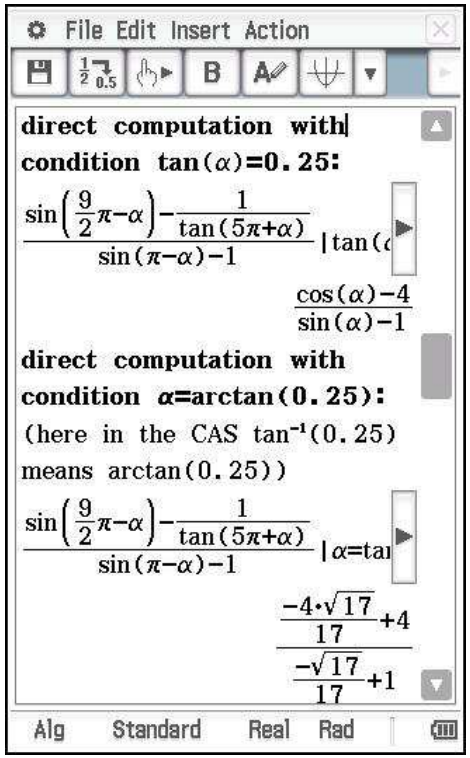
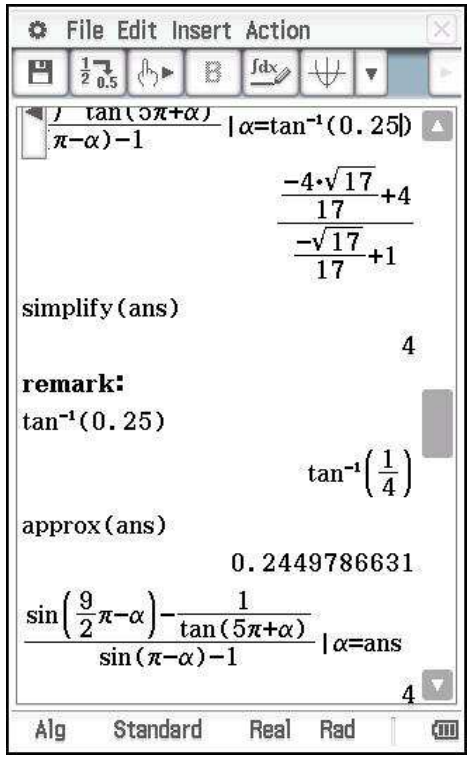
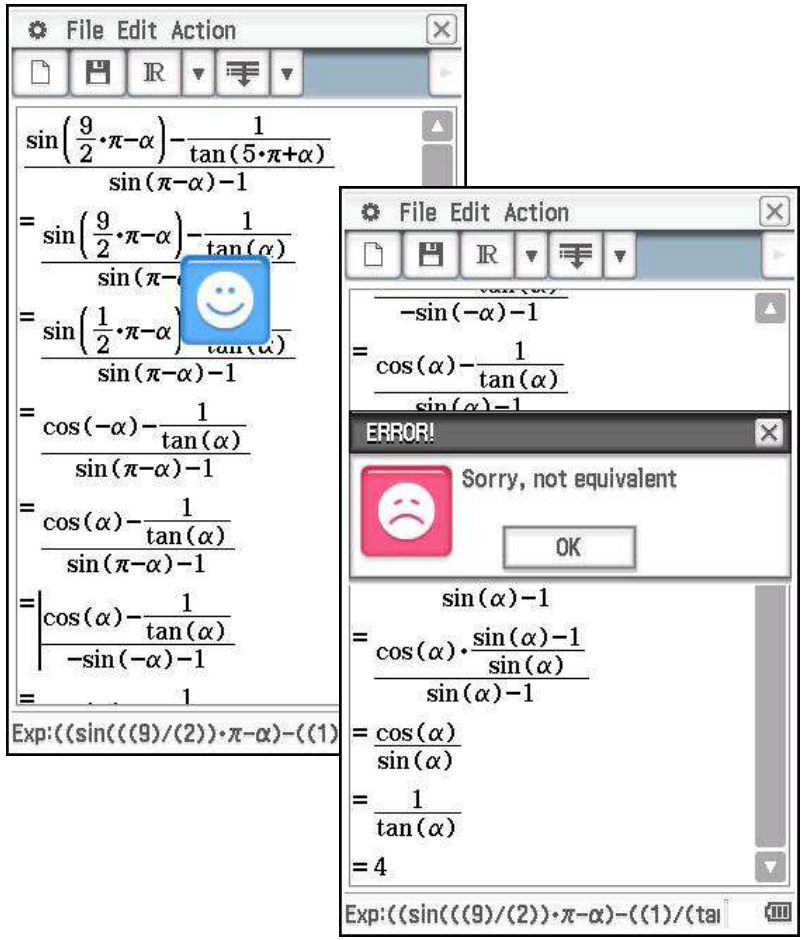
eActivity: 1. ТРИГОНОМЕТРИЯ

1.1. Преобразования тригонометрических выражений

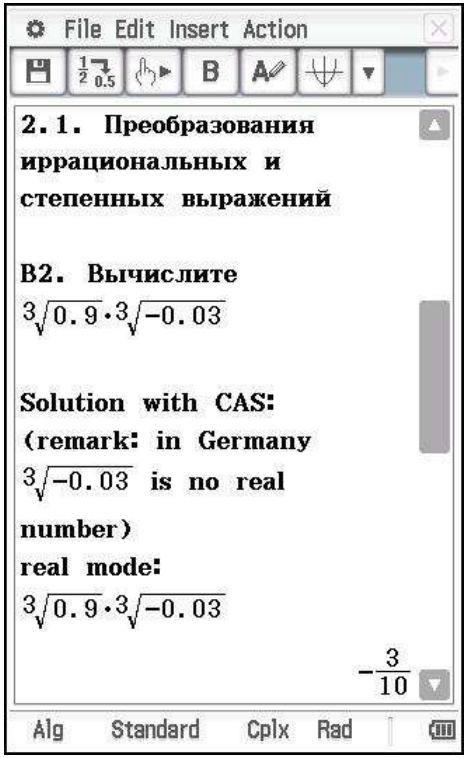


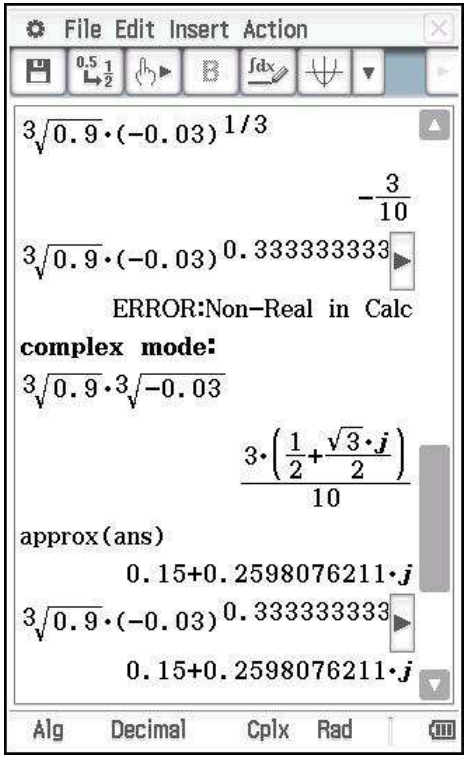




eActivity: 2. АЛГЕБРА

2.1. Преобразования иррациональных и степенных выражений





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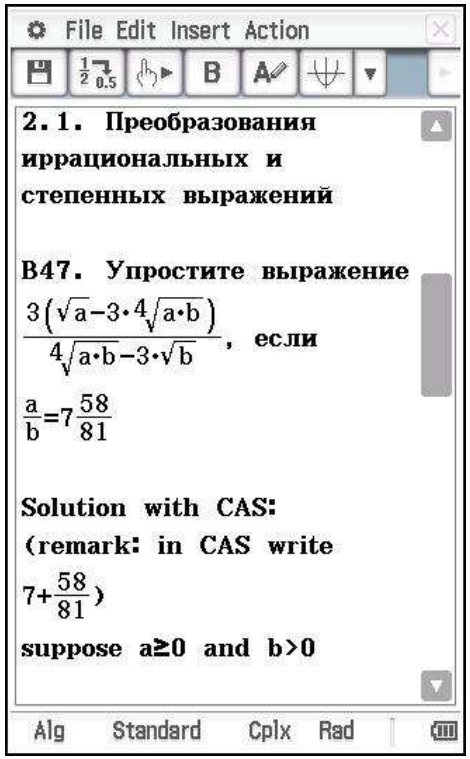
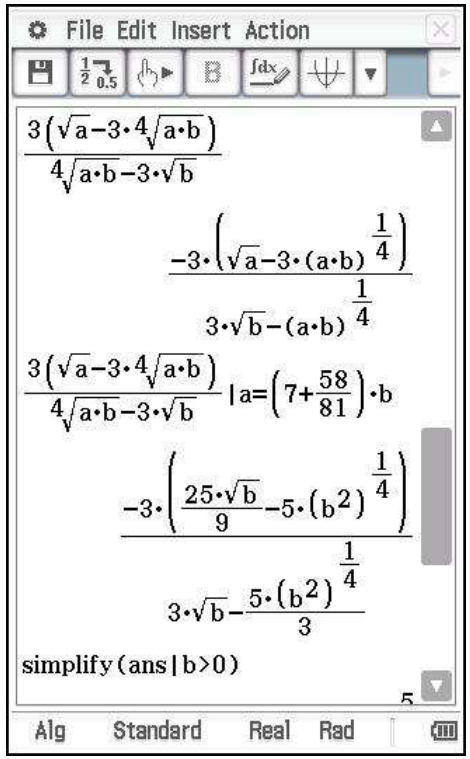
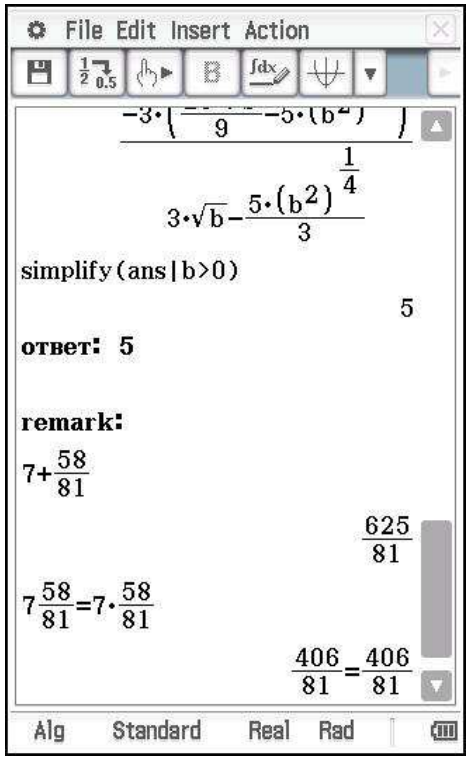
eActivity: 2. АЛГЕБРА

2.1. Преобразования иррациональных и степенных выражений



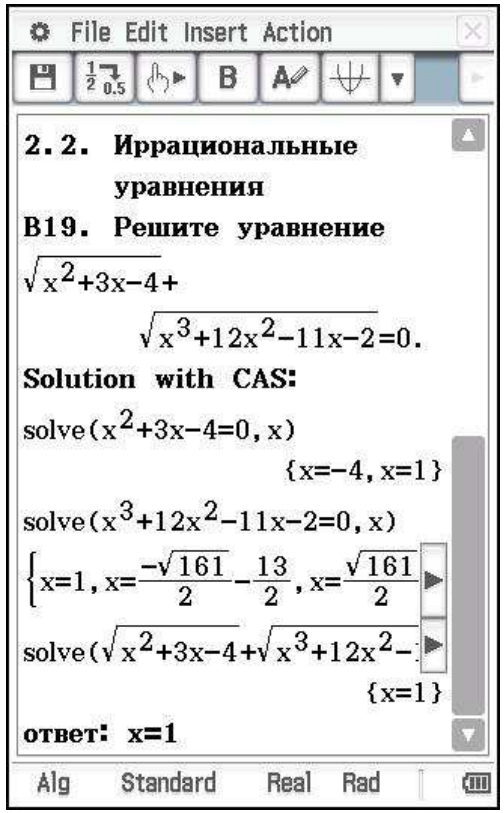


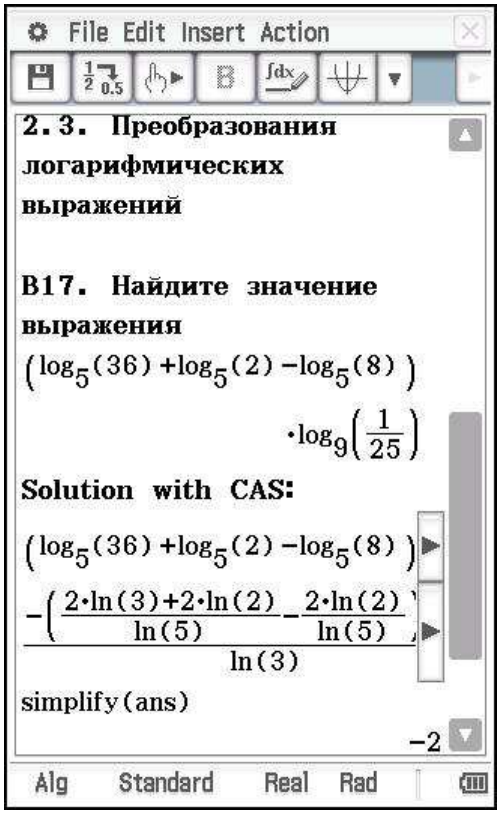


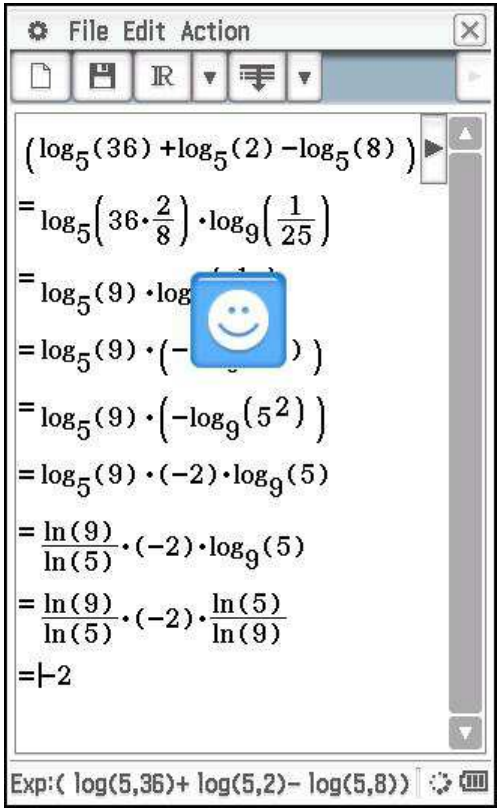
eActivity: 2. АЛГЕБРА

2.2. Иррациональные уравнения

2.3. Преобразования логарифмических выражений

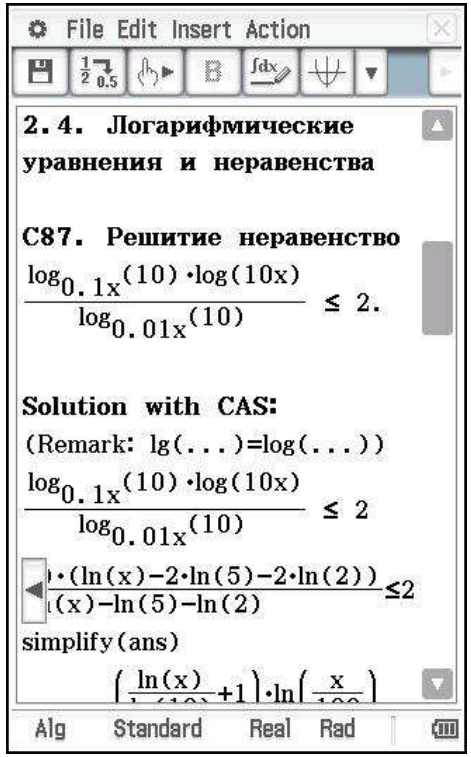


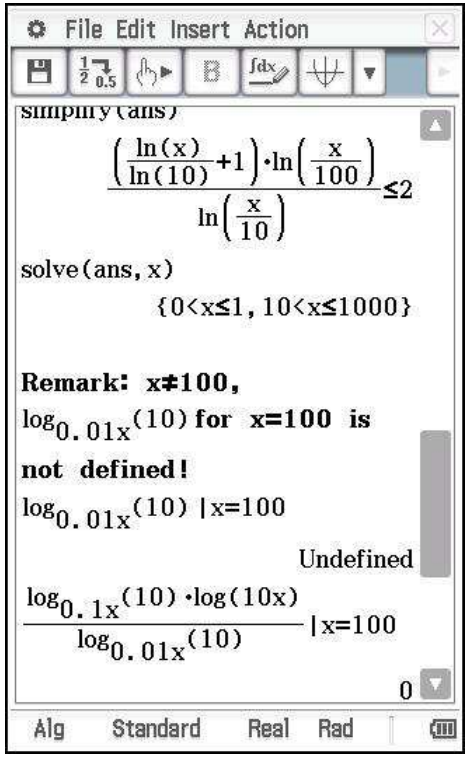


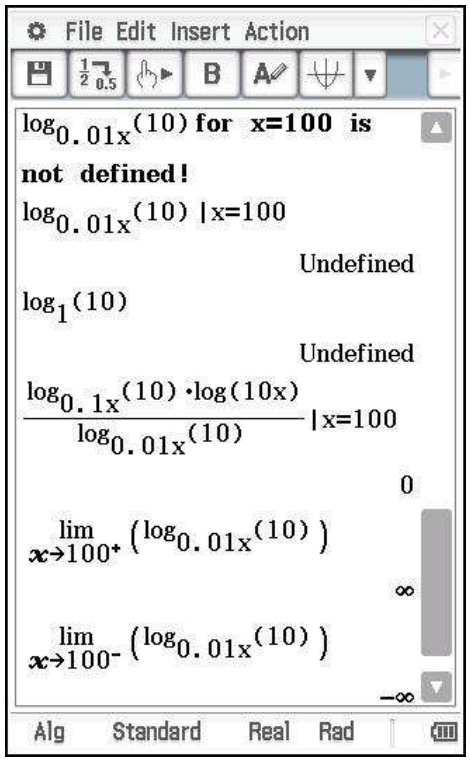


eActivity: 2. АЛГЕБРА

2.4. Логарифмические уравнения и неравенства

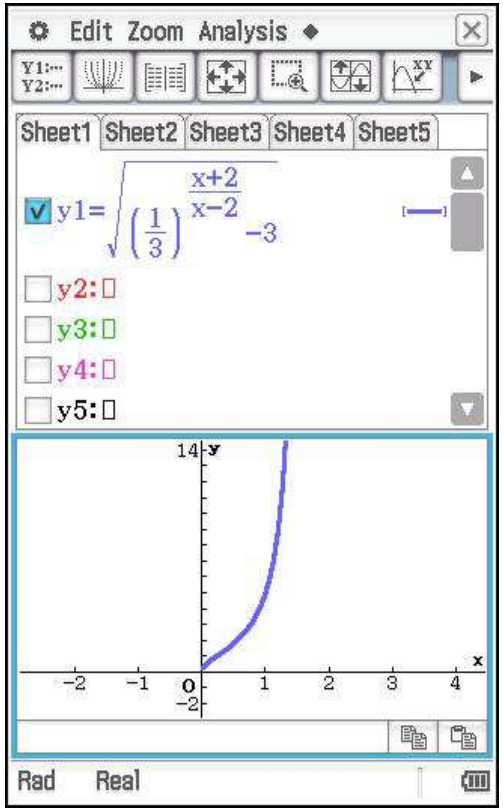


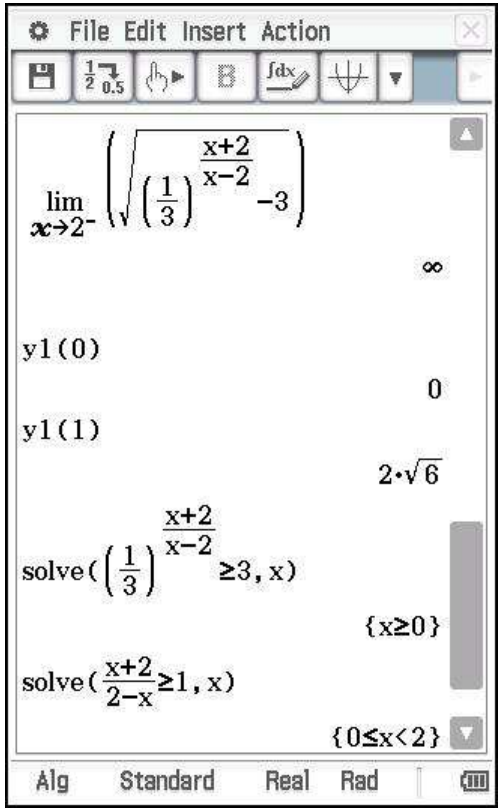




eActivity: 2. АЛГЕБРА

2.5. Показательные уравнения и неравенства





ответ: 2 (x=0, x=1)

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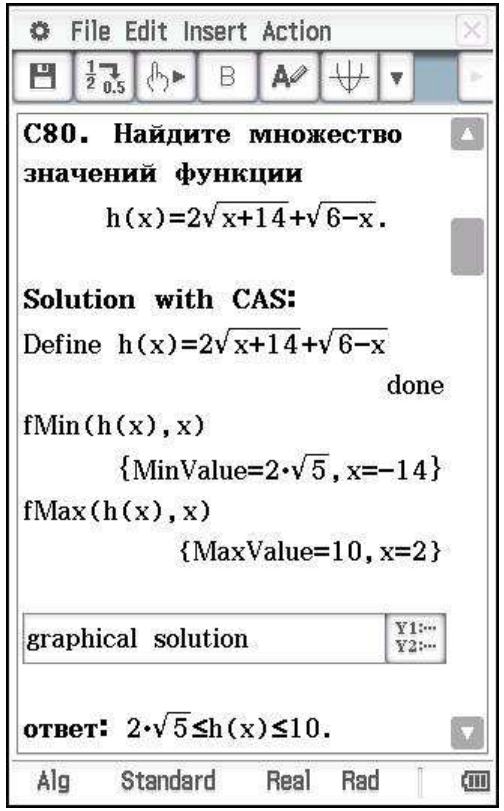
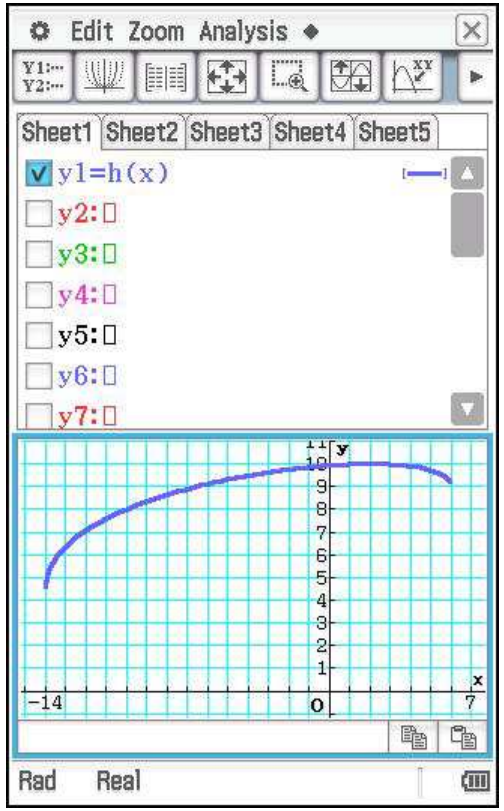
eActivity: 3. ЭЛЕМЕНТЫ МАТЕМАТИЧСКОГО АНАЛИЗА

3.1. Производная функции

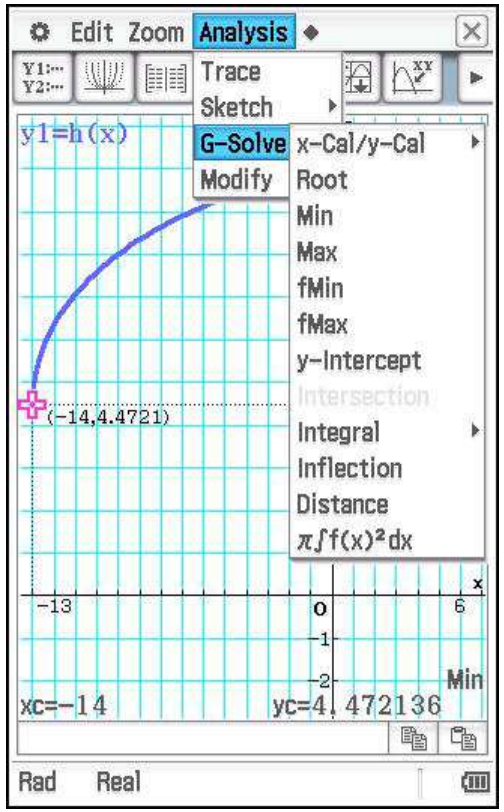


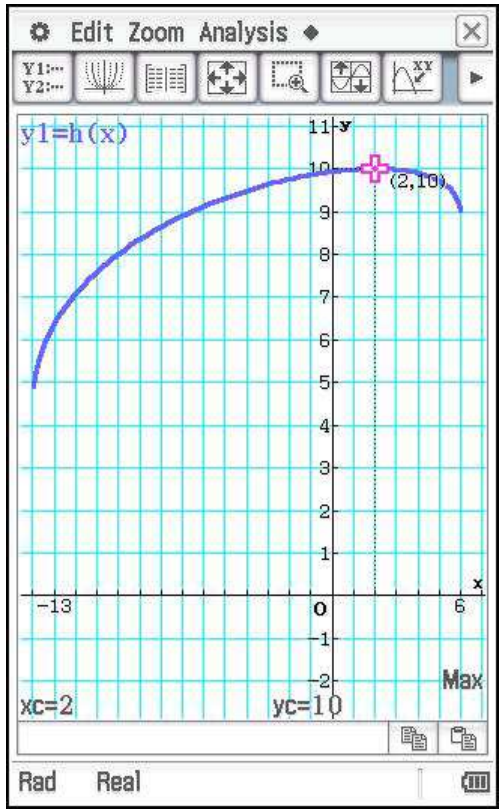


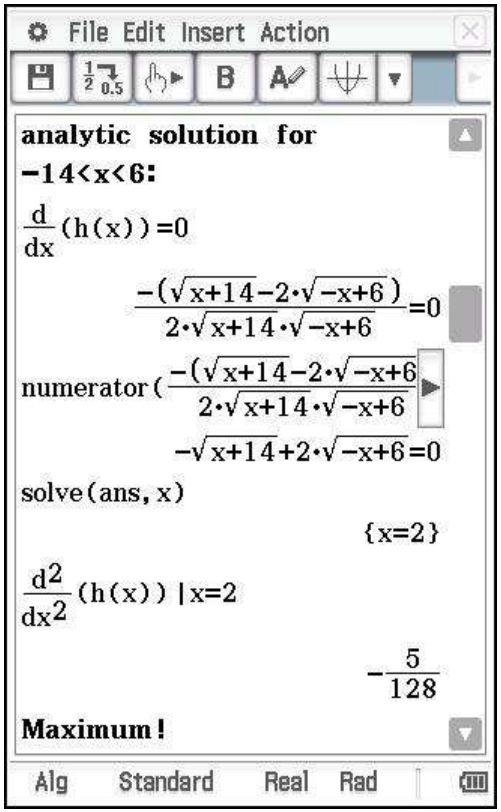
ответ: 2√(5)≤h(x)≤10

eActivity: 3. ЭЛЕМЕНТЫ МАТЕМАТИЧСКОГО АНАЛИЗА

3.1. Производная функции



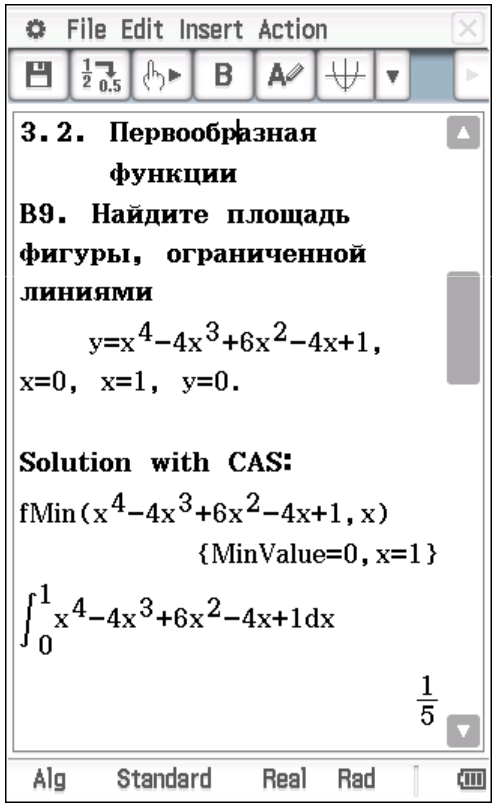


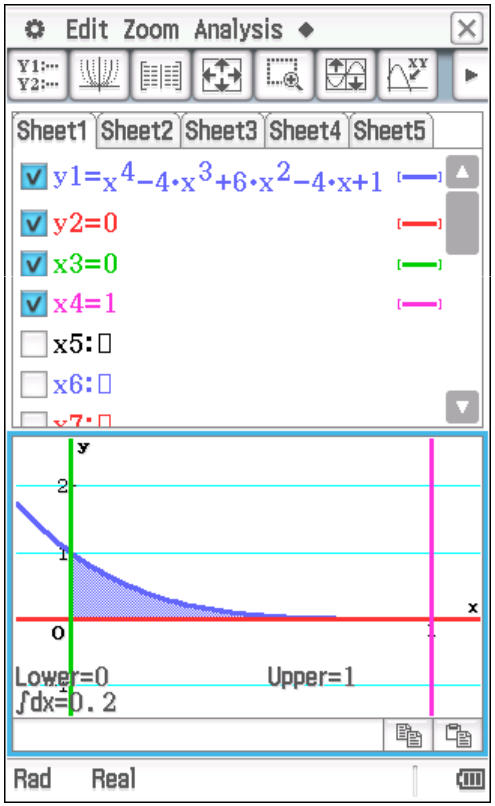


ответ: 4.472136≤h(x)≤10

eActivity: 3. ЭЛЕМЕНТЫ МАТЕМАТИЧСКОГО АНАЛИЗА

3.2. Первообразная функции

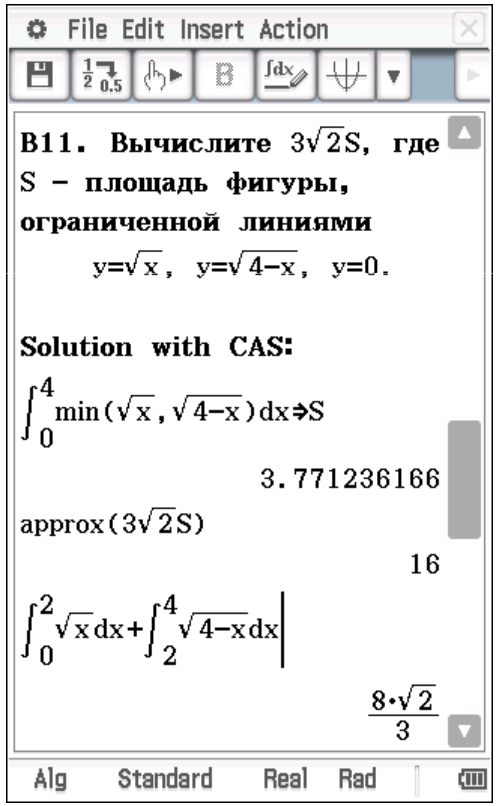


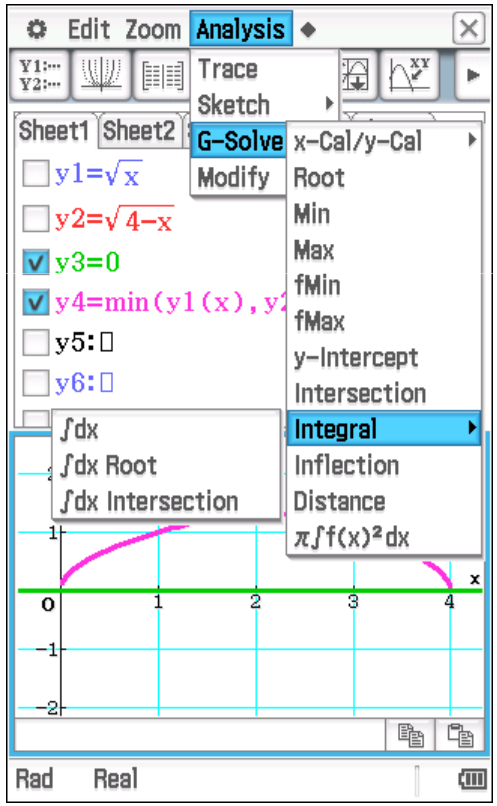


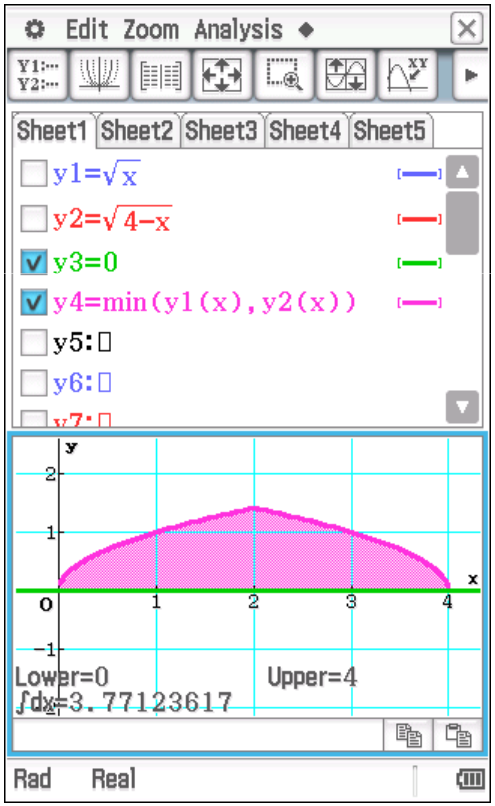
ответ: 0.2

eActivity: 3. ЭЛЕМЕНТЫ МАТЕМАТИЧСКОГО АНАЛИЗА

3.2. Первообразная функции



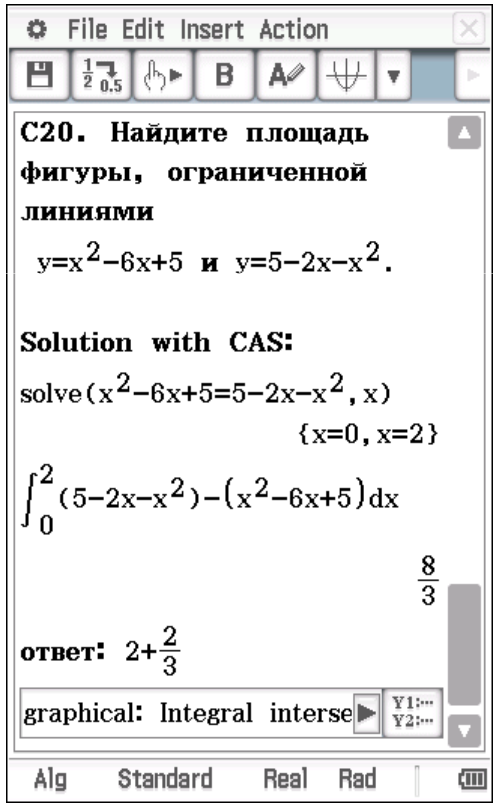


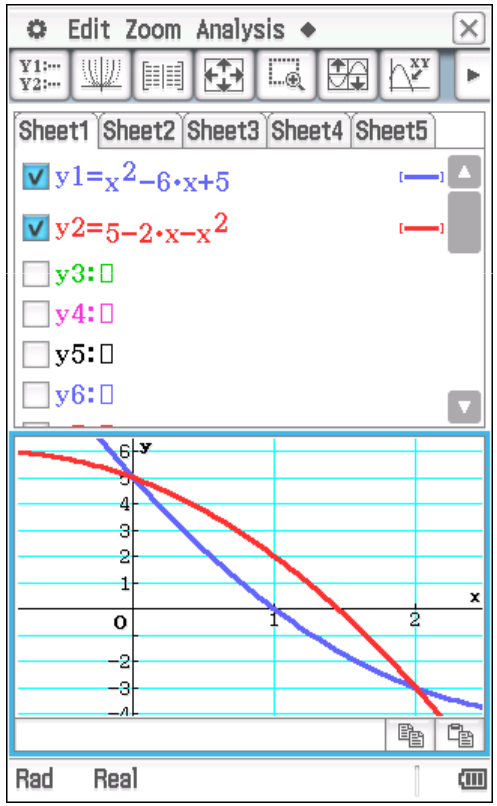


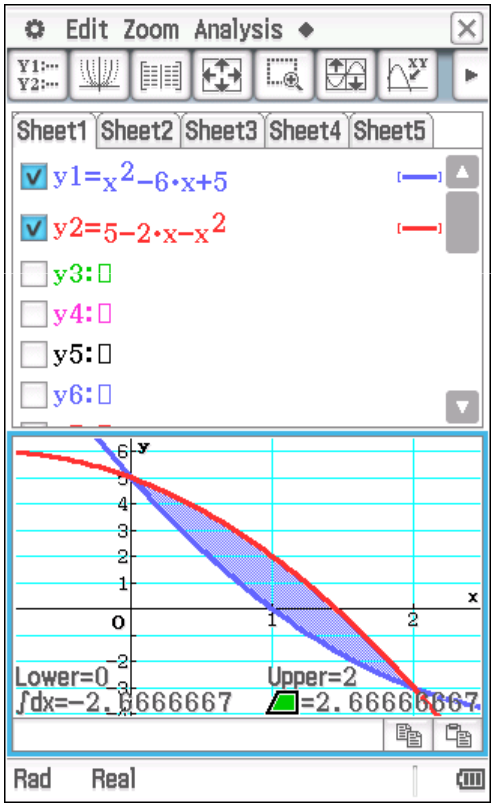
ответ: 16

eActivity: 3. ЭЛЕМЕНТЫ МАТЕМАТИЧСКОГО АНАЛИЗА

3.2. Первообразная функции



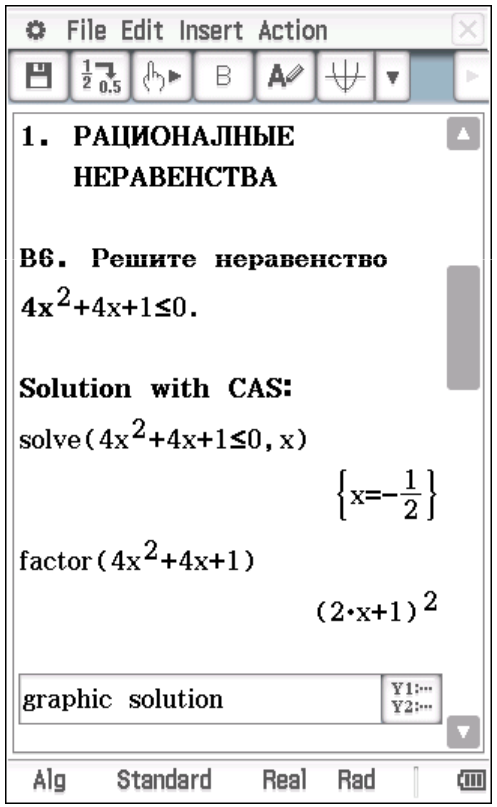


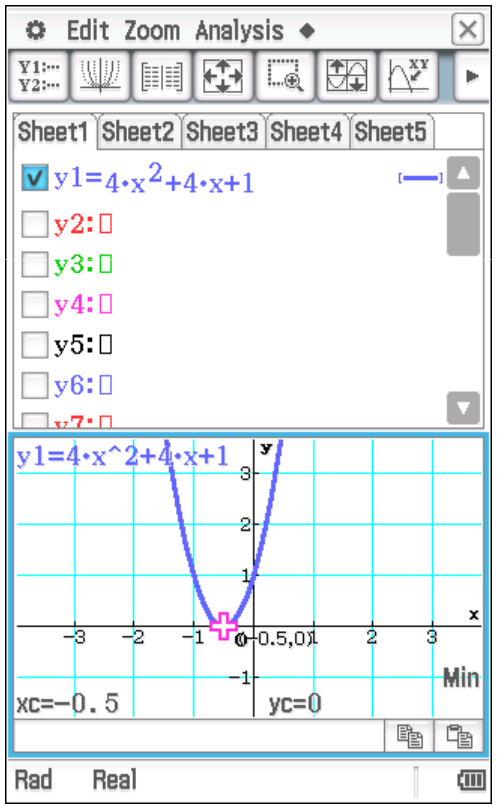


ответ: 2+2/3

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

1. РАЦИОНАЛНЫЕ НЕРАВЕНСТВА

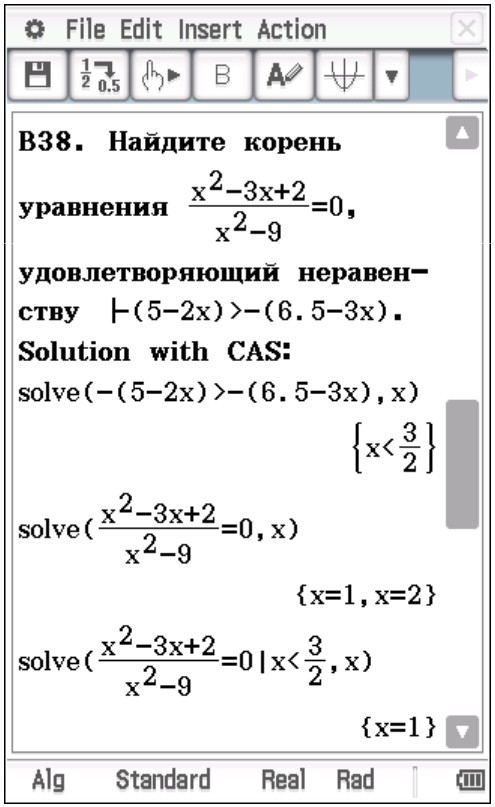


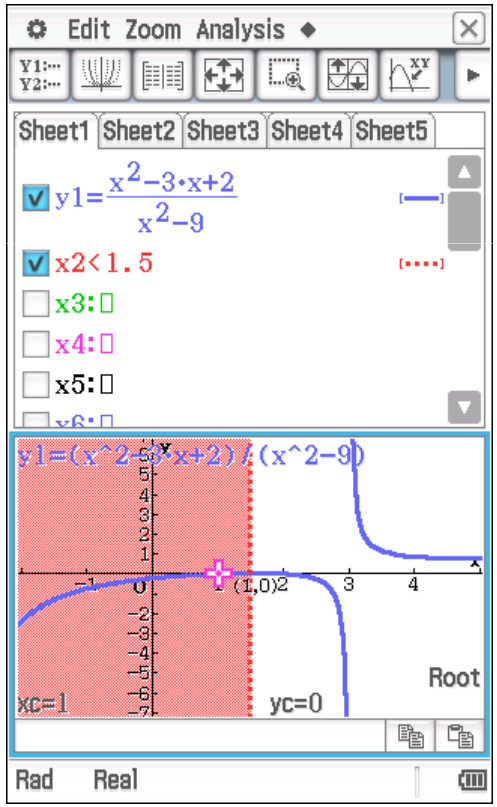


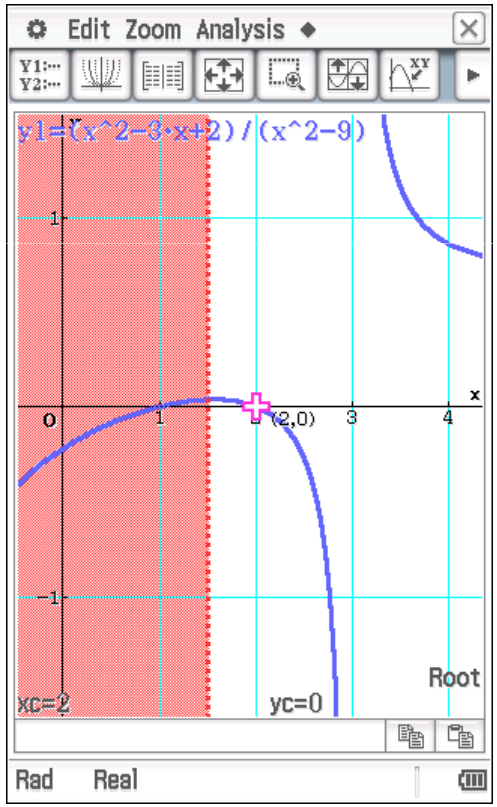
ответ: -1/2

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

1. РАЦИОНАЛНЫЕ НЕРАВЕНСТВА



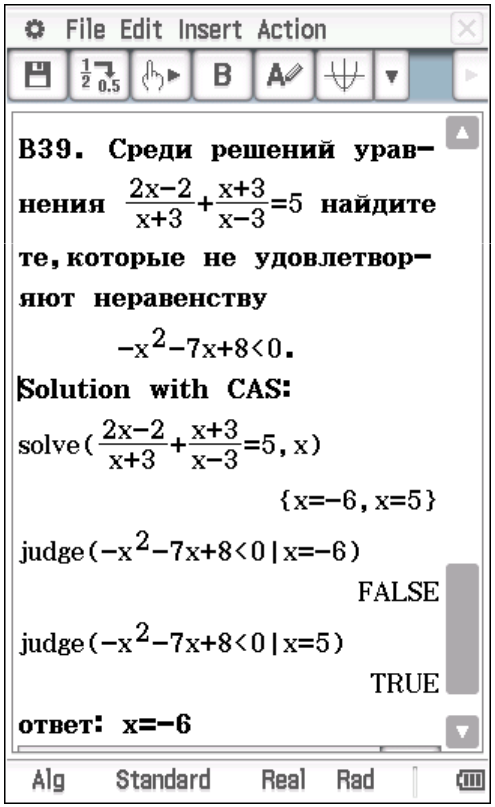


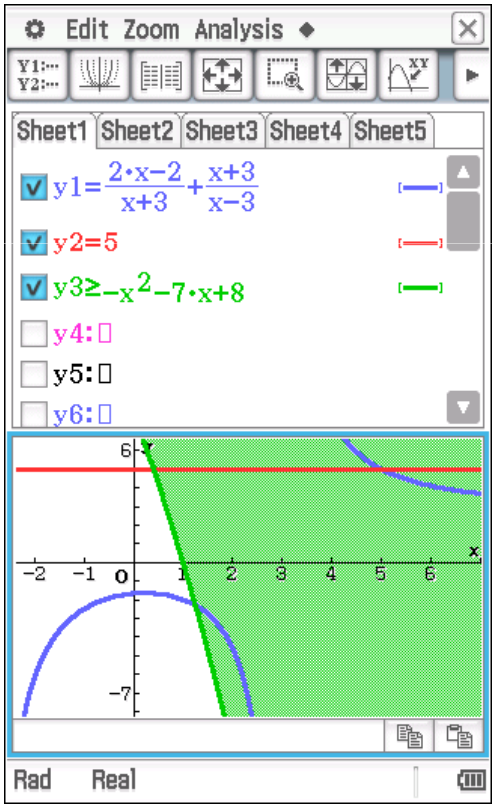


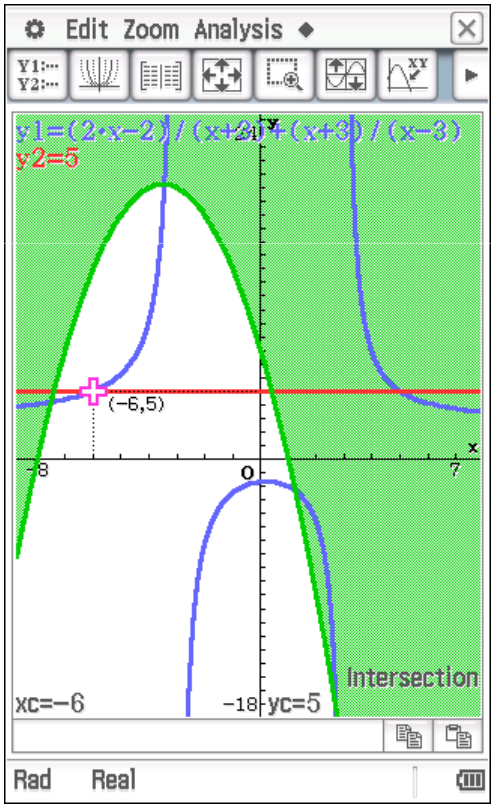
ответ: 1

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

1. РАЦИОНАЛНЫЕ НЕРАВЕНСТВА



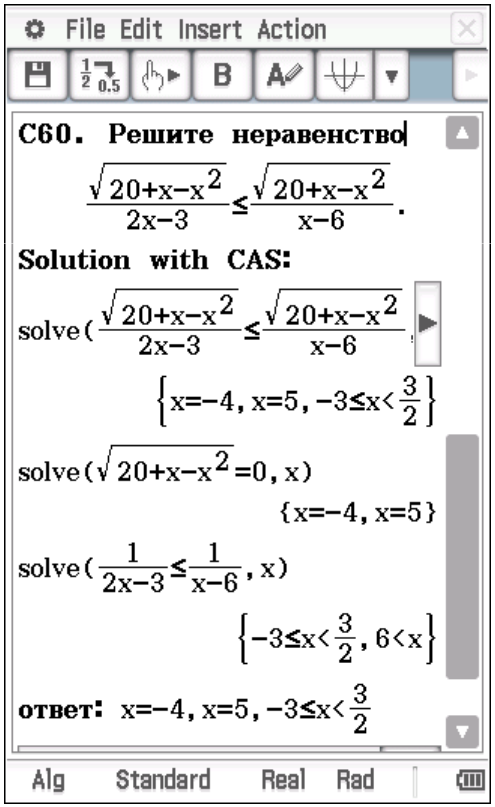


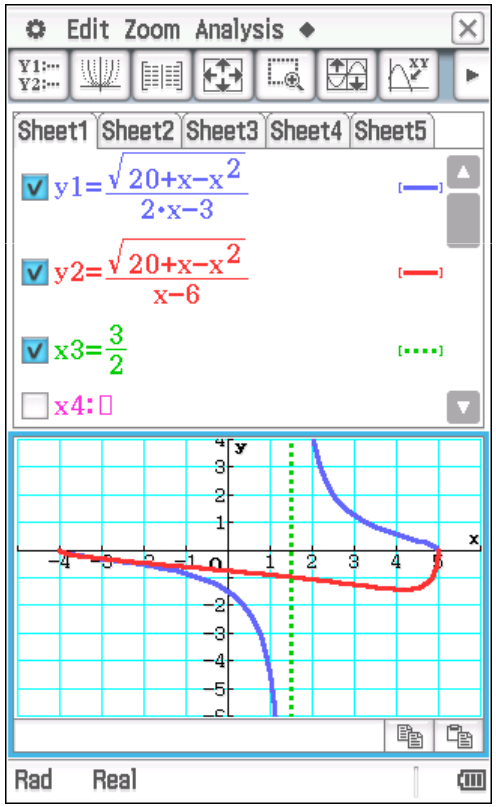


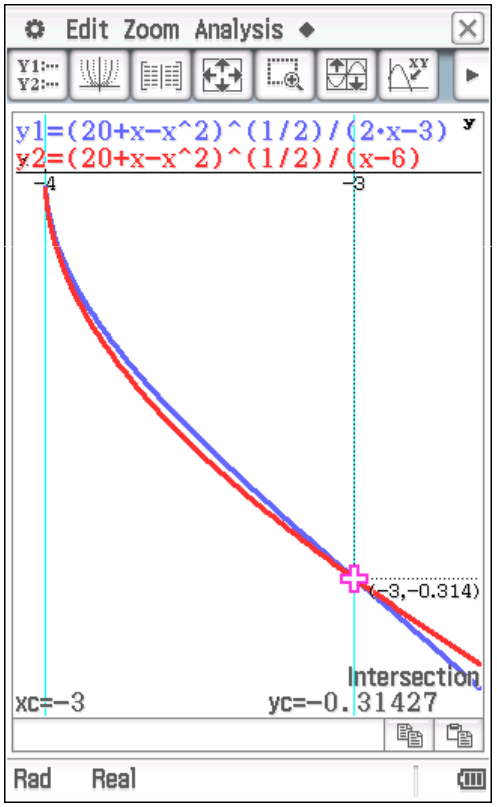
ответ: -6

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

1. РАЦИОНАЛНЫЕ НЕРАВЕНСТВА







ответ: x=-4, x=5, -3≤x<3/2

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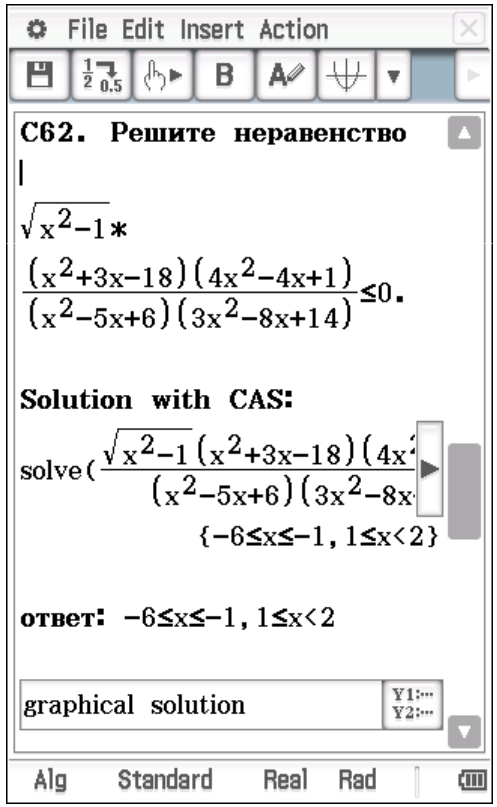
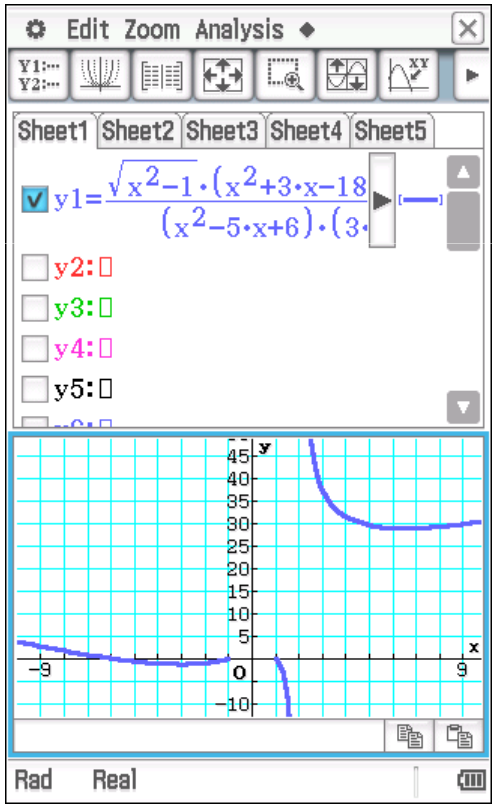
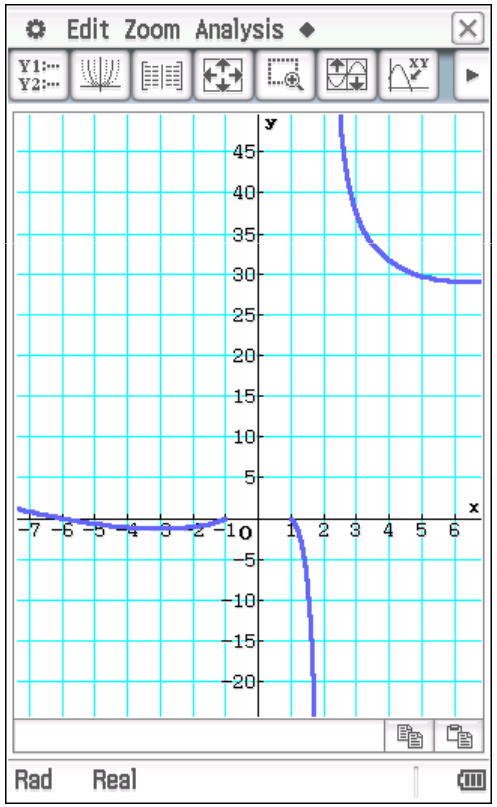
eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

1. РАЦИОНАЛНЫЕ НЕРАВЕНСТВА



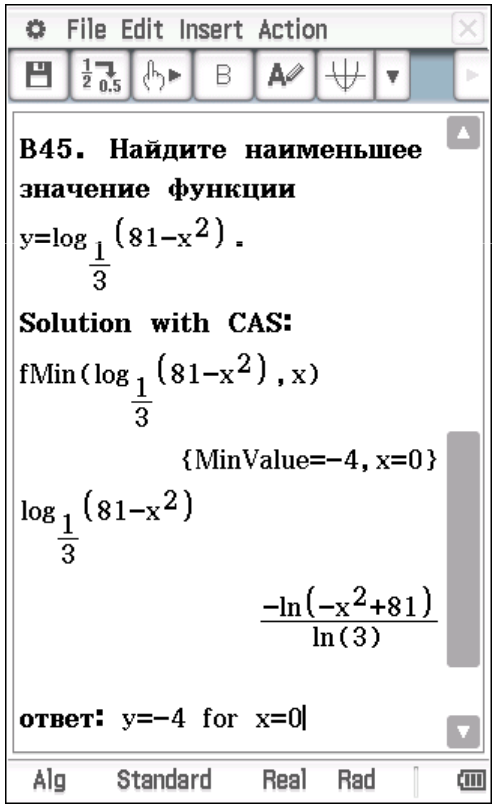


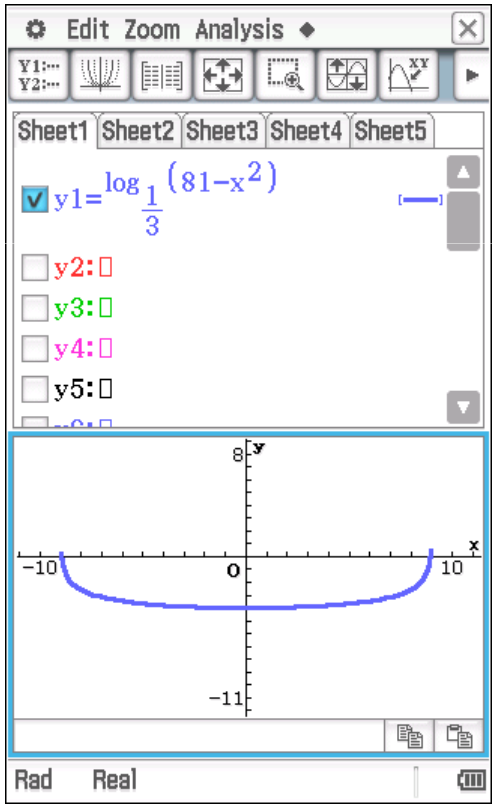


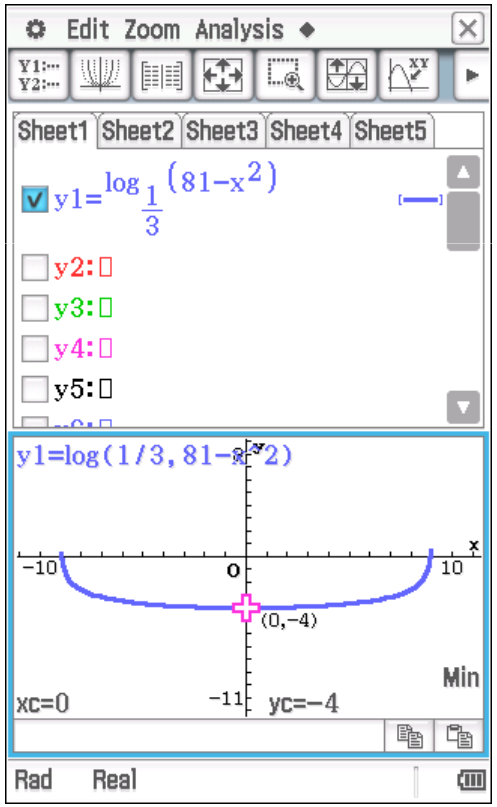
ответ: -6≤x≤-1, 1≤x<2

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

2. ИССЛЕДОВАНИЕ ФУНКЦИЙ ЭЛЕМЕНТАРНЫМИ МЕТОДАМИ



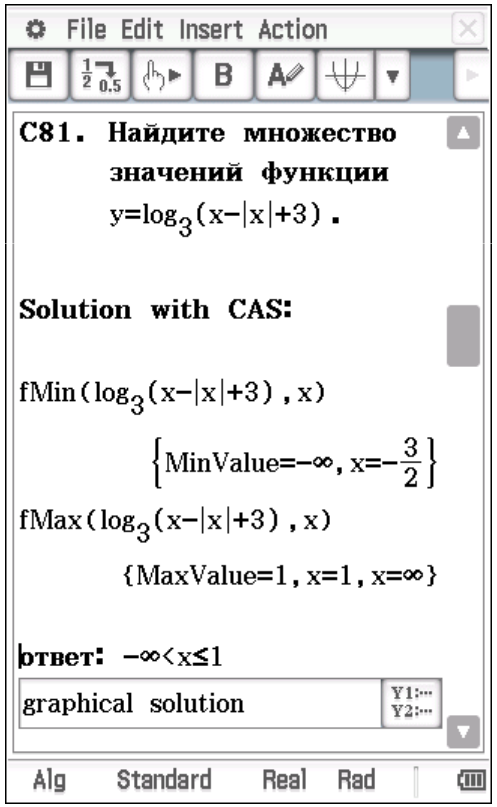


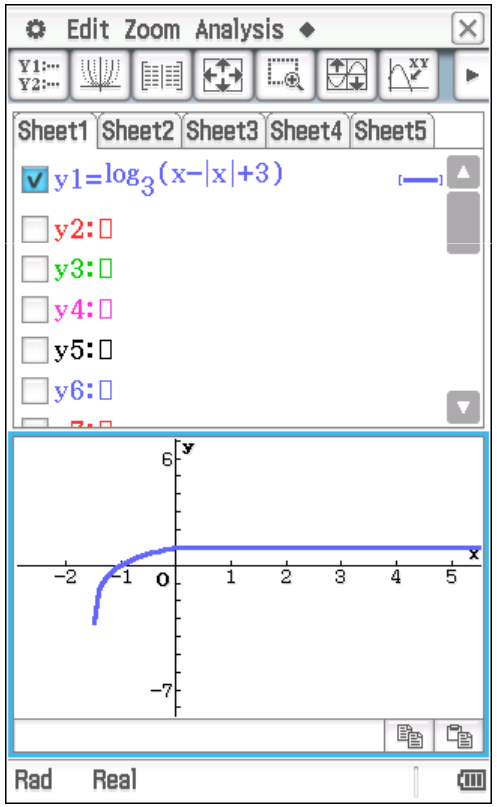


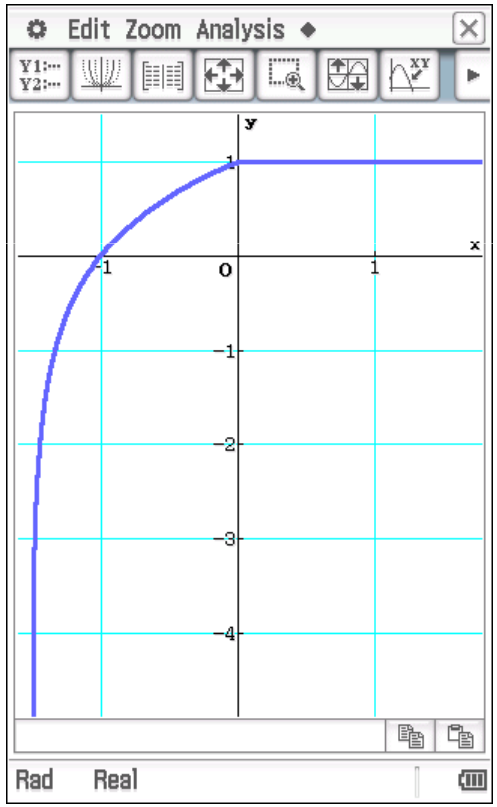
ответ: y=-4 for x=0

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

2. ИССЛЕДОВАНИЕ ФУНКЦИЙ ЭЛЕМЕНТАРНЫМИ МЕТОДАМИ



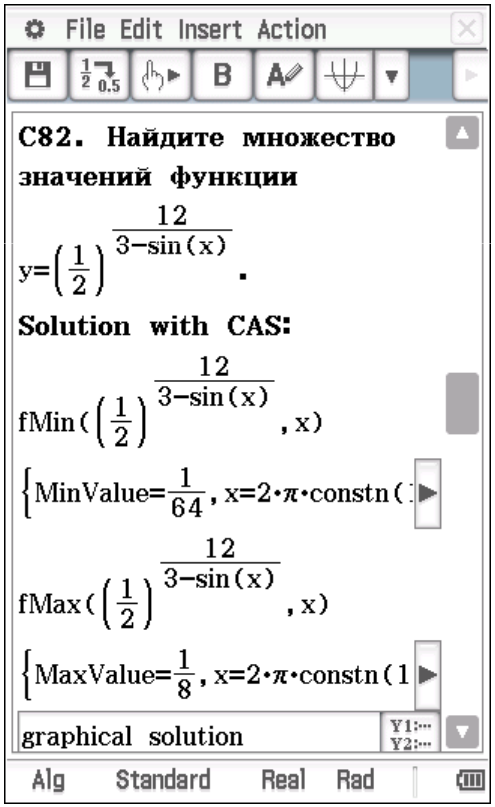


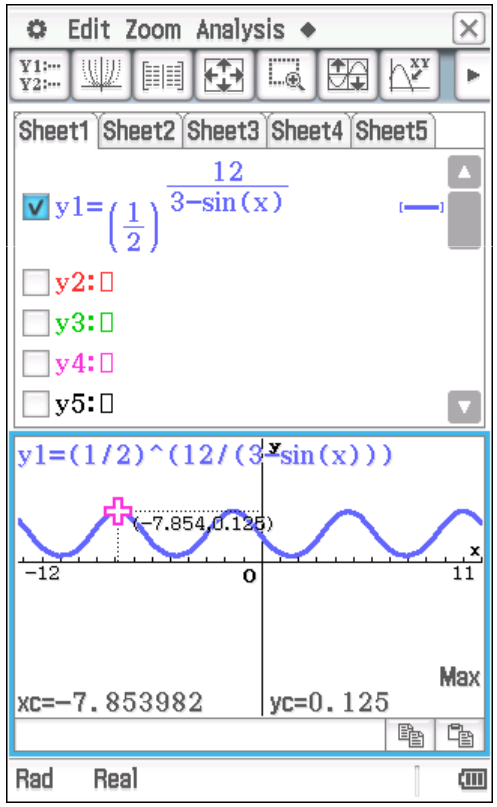


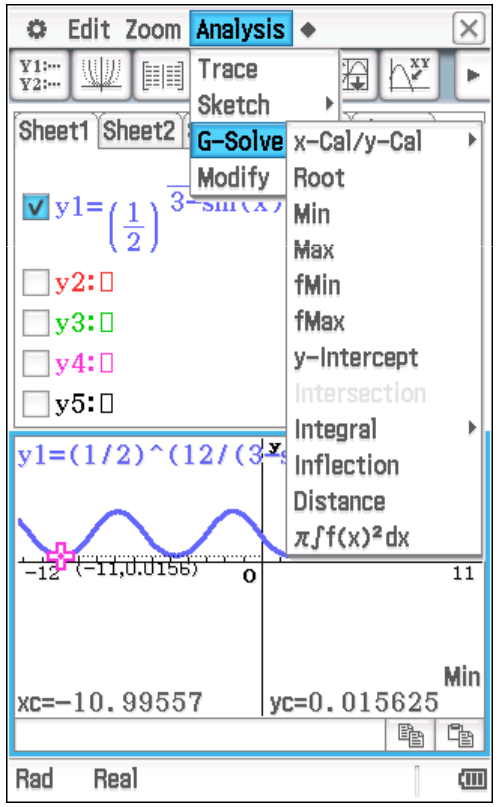
ответ: $-\infty < x \leq 1$

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

2. ИССЛЕДОВАНИЕ ФУНКЦИЙ ЭЛЕМЕНТАРНЫМИ МЕТОДАМИ



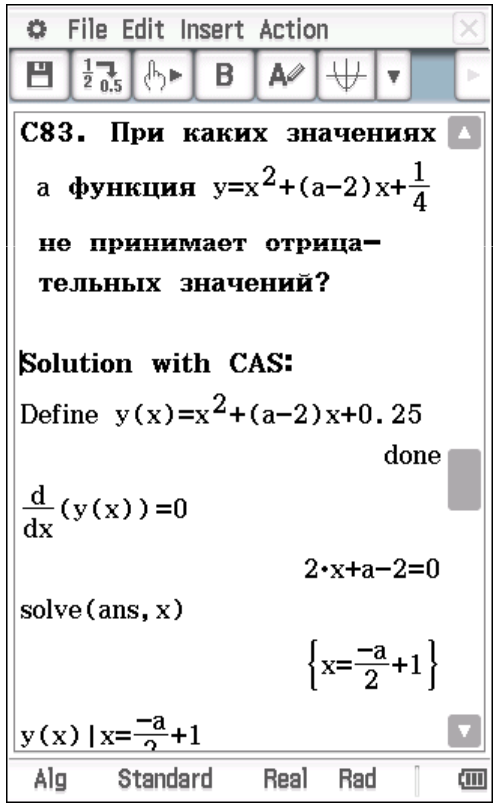


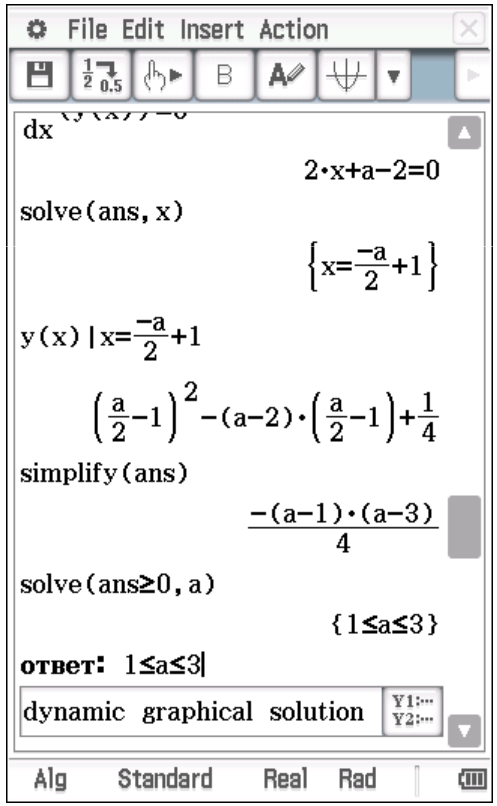


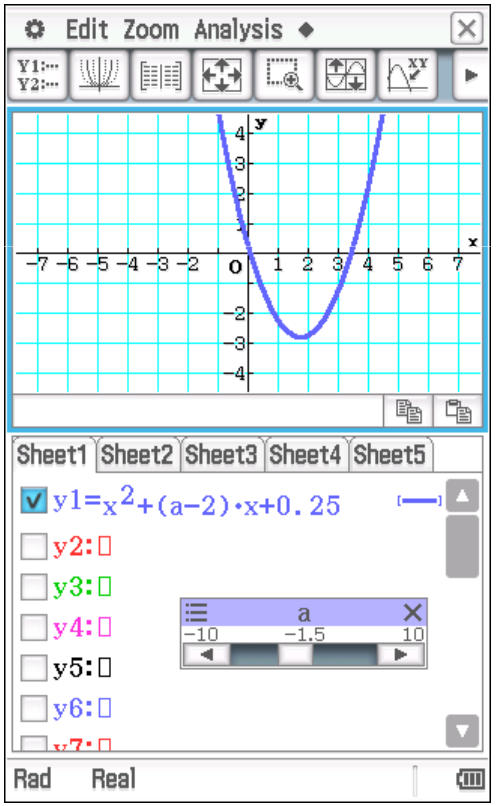
ответ: $1/64 \le x \le 1/8$

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

2. ИССЛЕДОВАНИЕ ФУНКЦИЙ ЭЛЕМЕНТАРНЫМИ МЕТОДАМИ



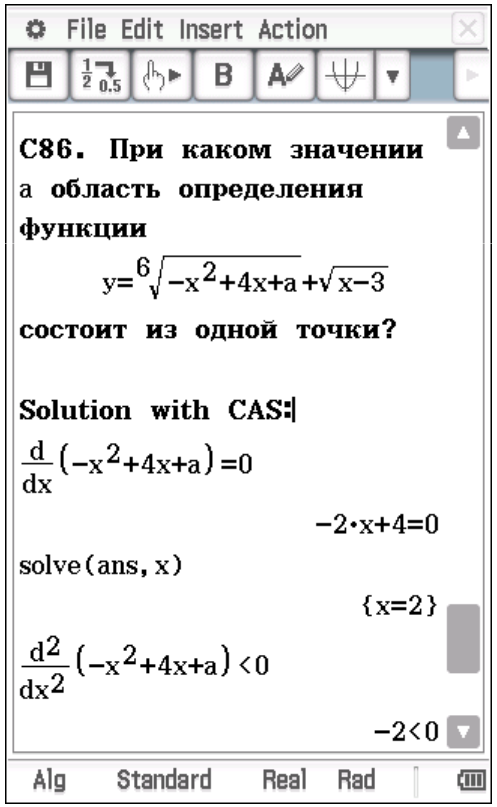


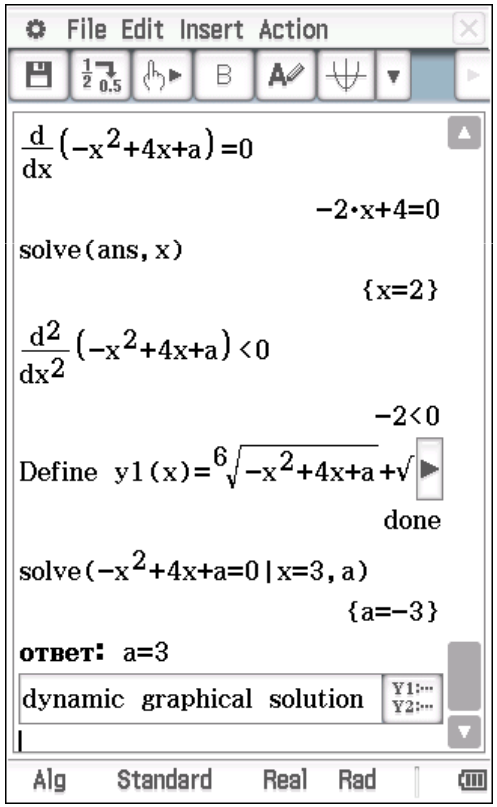


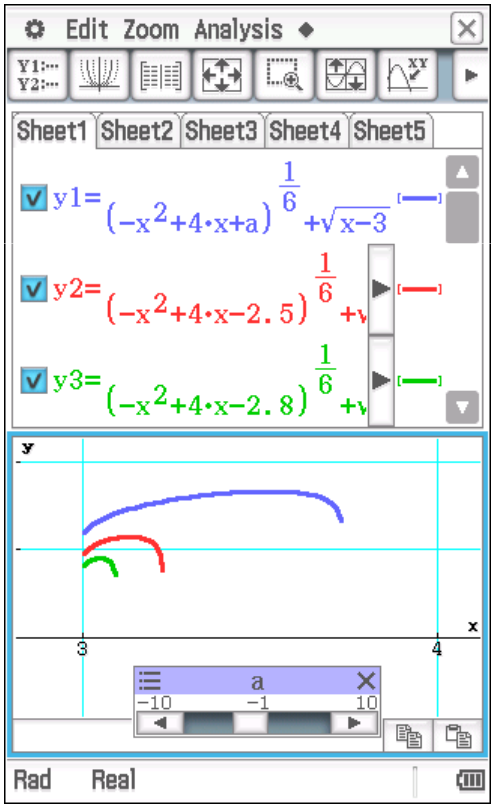
ответ: $1 \le a \le 3$

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

2. ИССЛЕДОВАНИЕ ФУНКЦИЙ ЭЛЕМЕНТАРНЫМИ МЕТОДАМИ



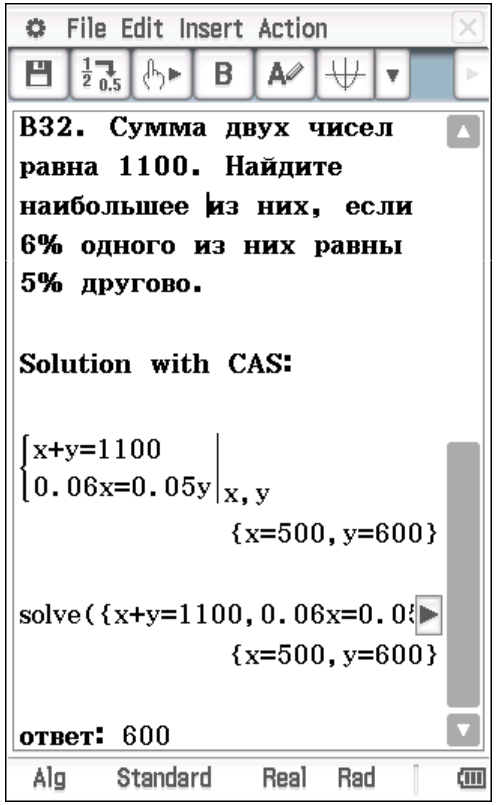




ответ: a = -3

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

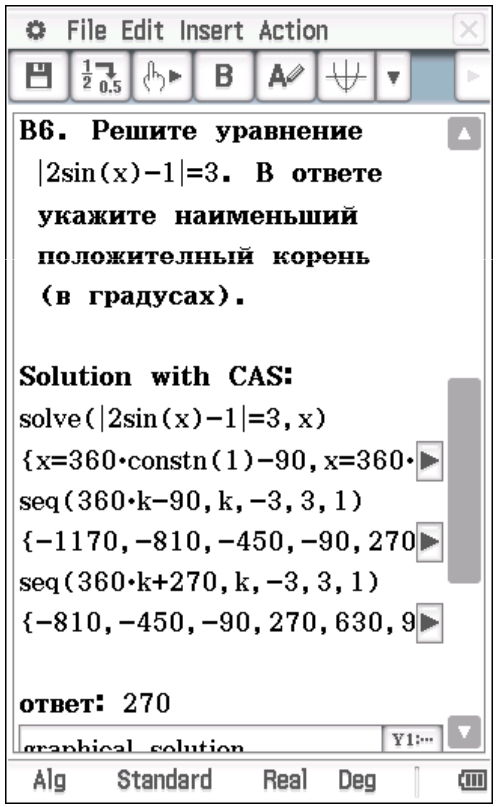
3. ТЕКСТОВЫЕ ЗАДАЧИ

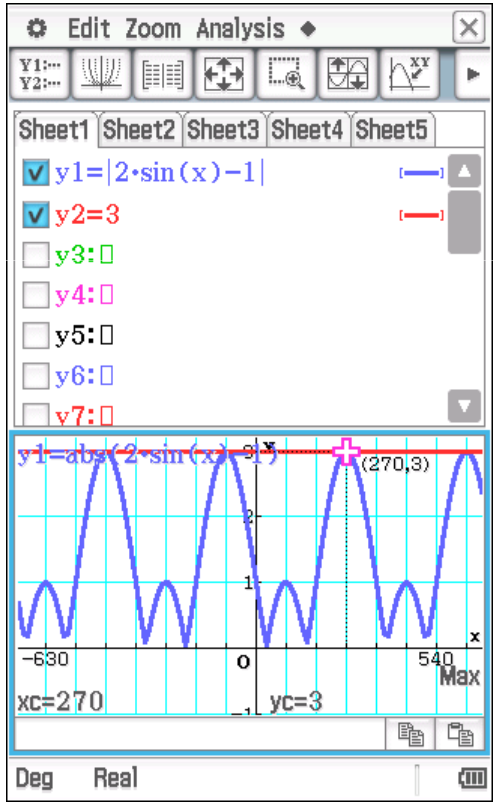


ответ: 600

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

4. УРАВНЕНИЯ И НЕРАВЕНСТВА С МОДУЛЕМ

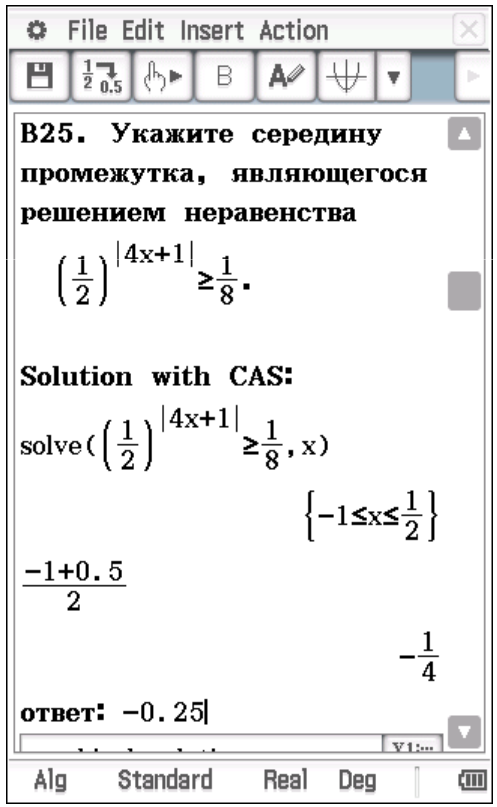


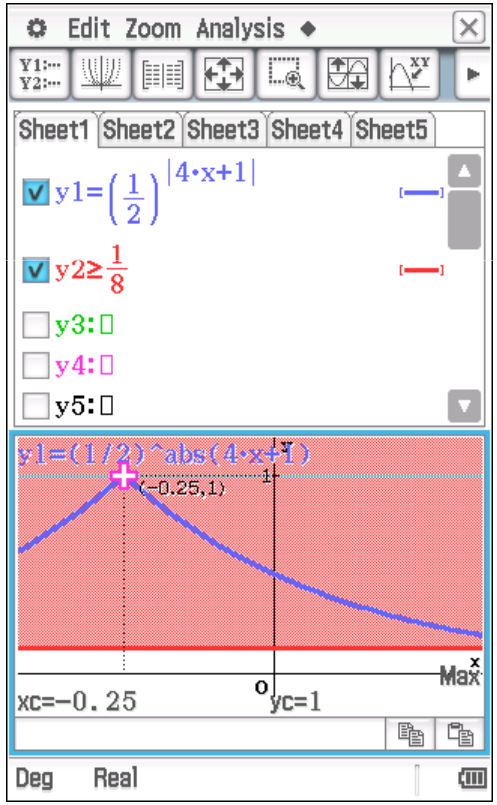


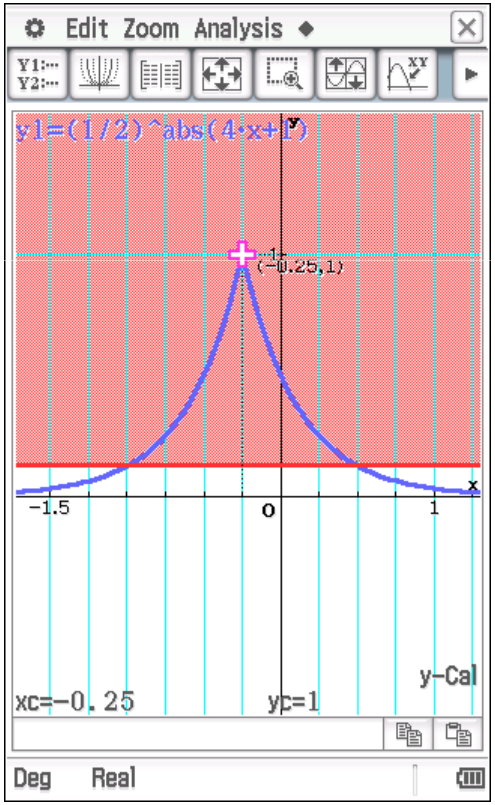
ответ: 270°

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

4. УРАВНЕНИЯ И НЕРАВЕНСТВА С МОДУЛЕМ







ответ: -0.25

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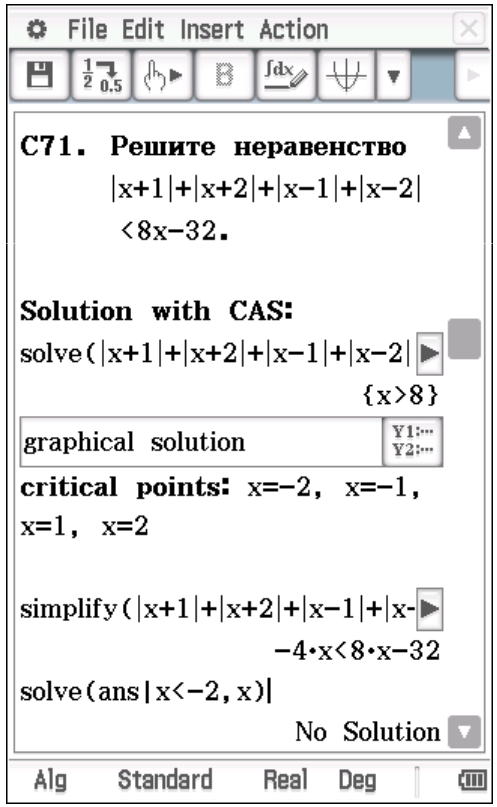
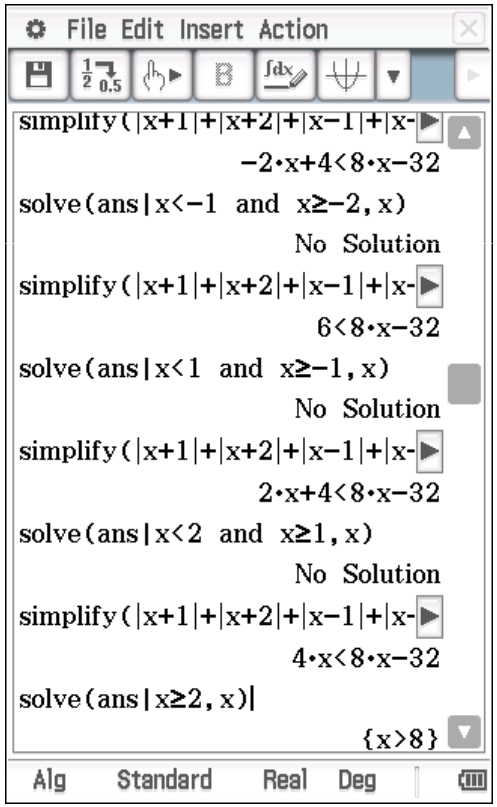
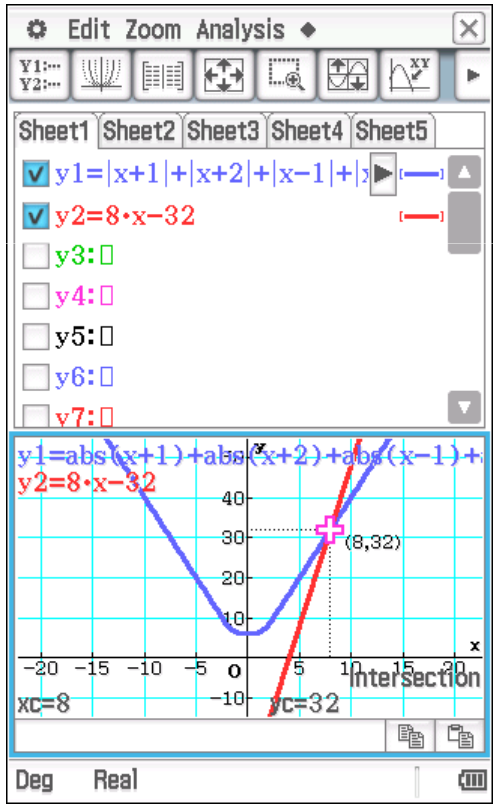
UNIVERSITY OF APPLIED SCIENCES

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

4. УРАВНЕНИЯ И НЕРАВЕНСТВА С МОДУЛЕМ



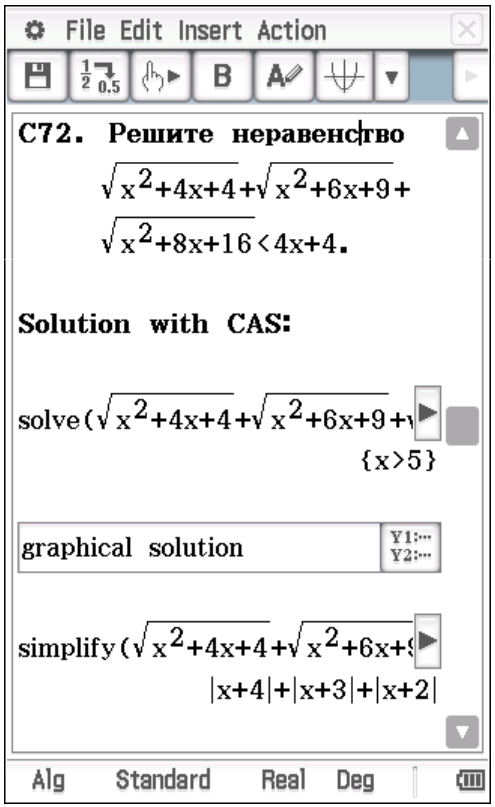


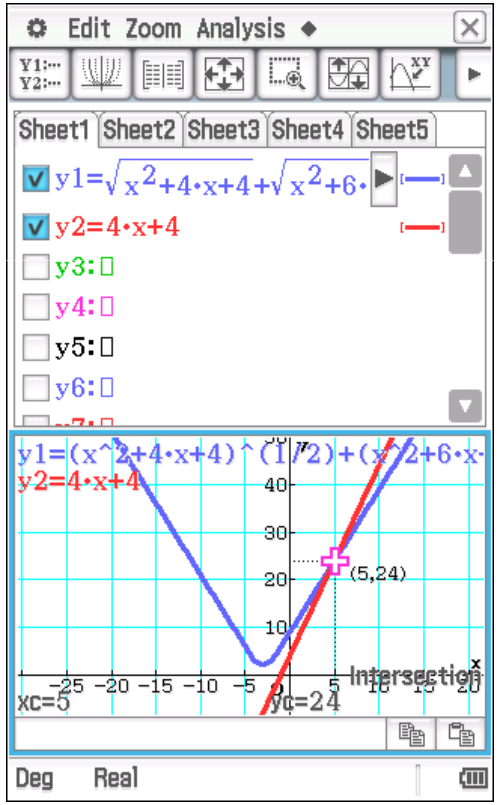


ответ: x>8

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

4. УРАВНЕНИЯ И НЕРАВЕНСТВА С МОДУЛЕМ

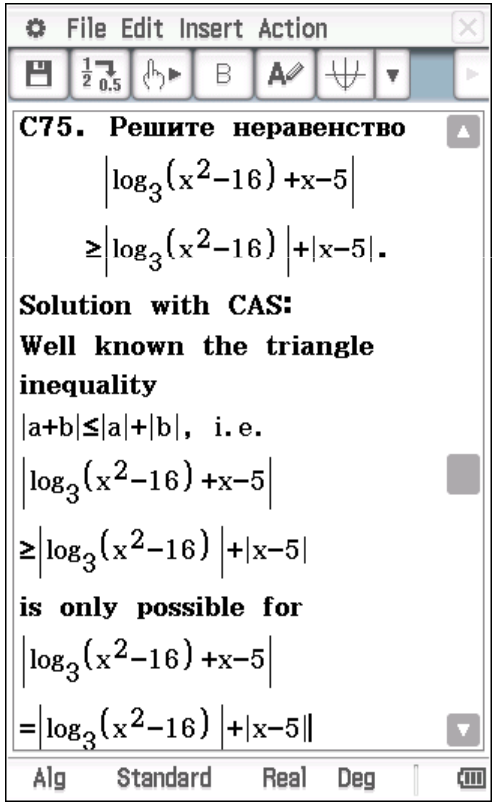


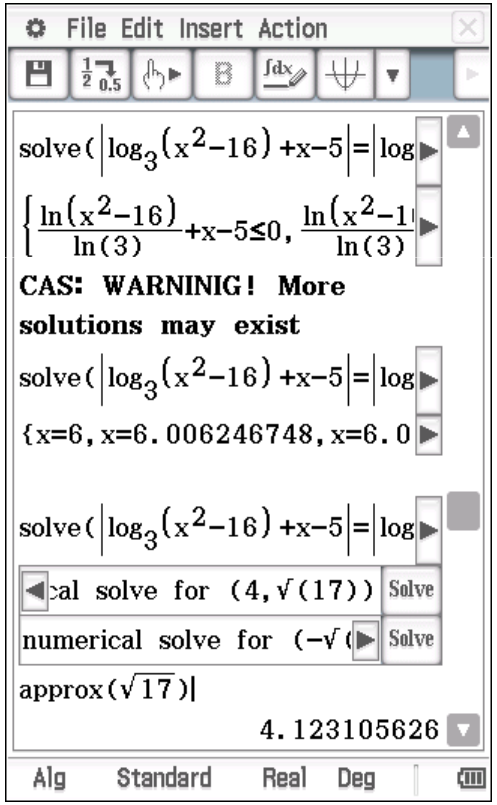


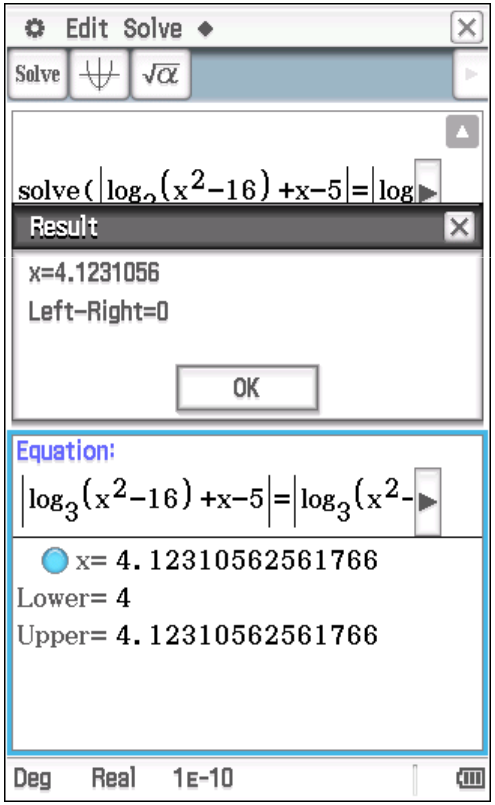
ответ: x>5

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

4. УРАВНЕНИЯ И НЕРАВЕНСТВА С МОДУЛЕМ



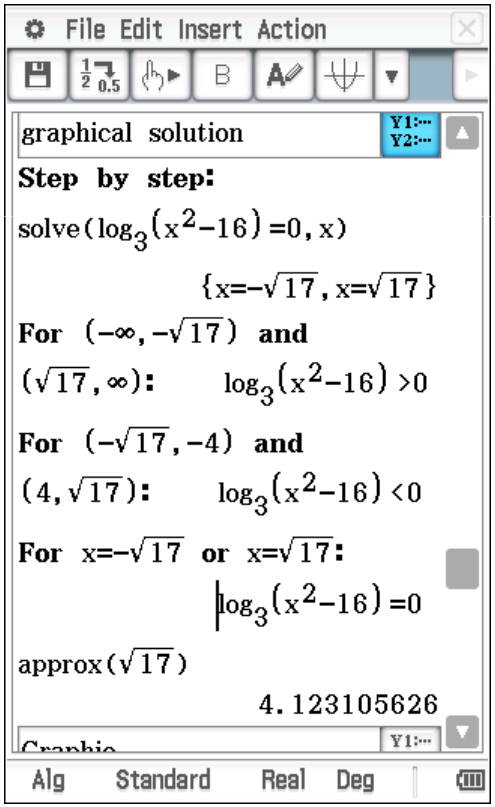


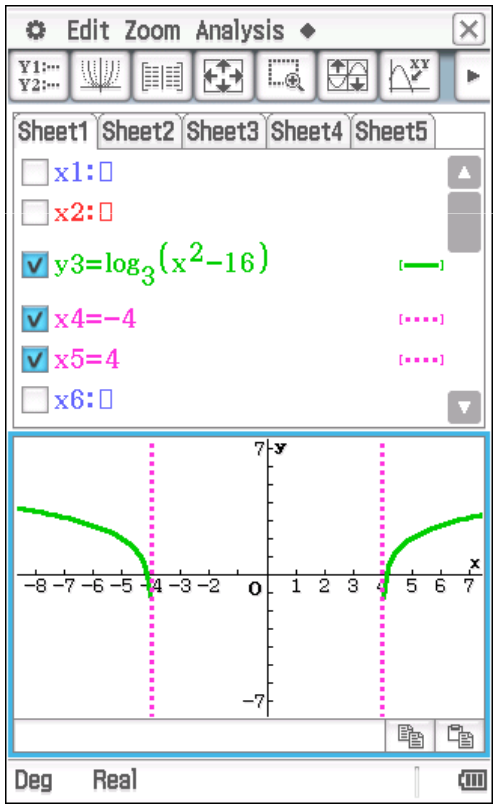


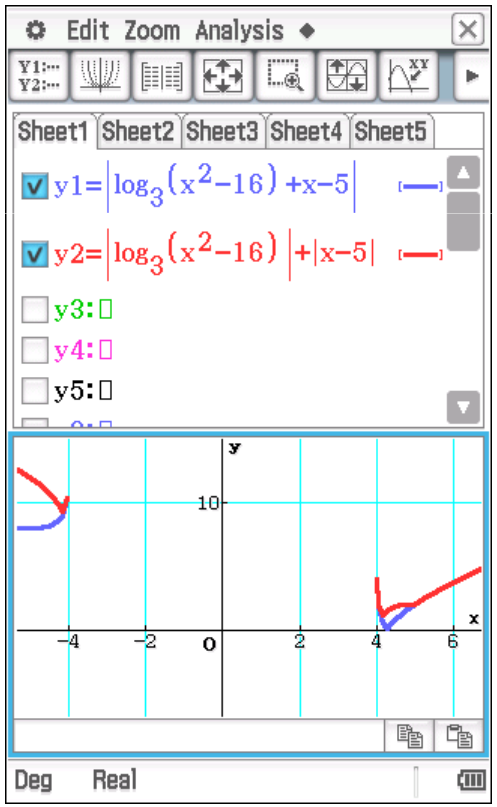
ответ: x ∈ [-√(17), -4) ∪ (4, √(17)] ∪ [5,∞)

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

4. УРАВНЕНИЯ И НЕРАВЕНСТВА С МОДУЛЕМ

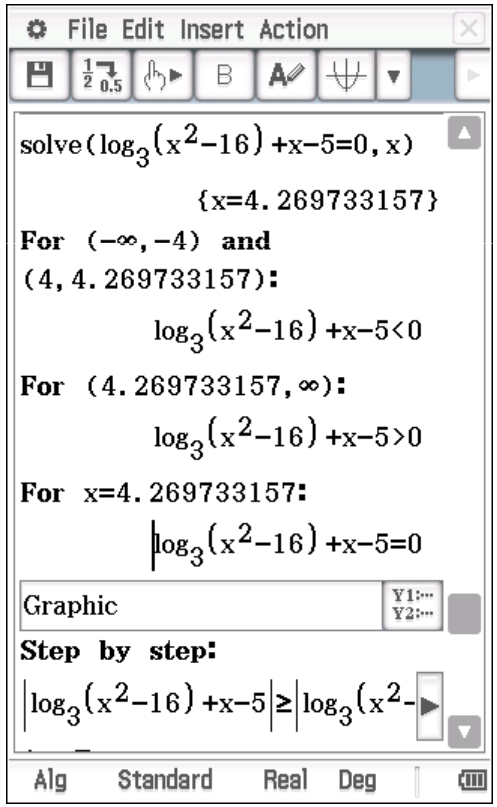


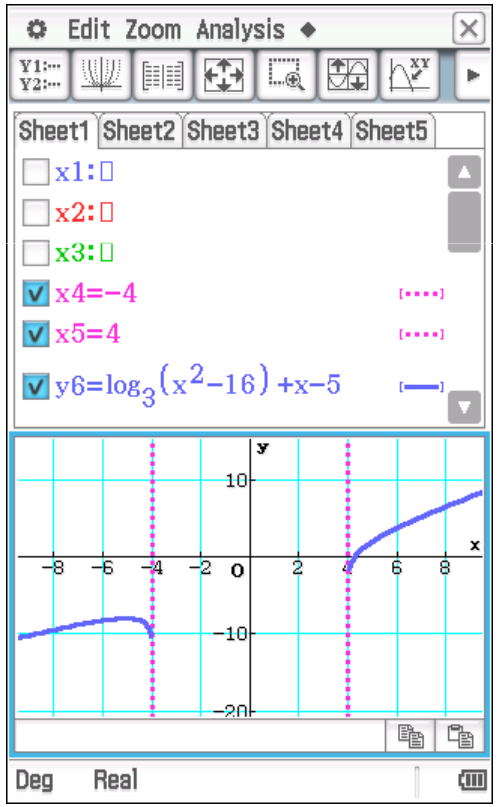


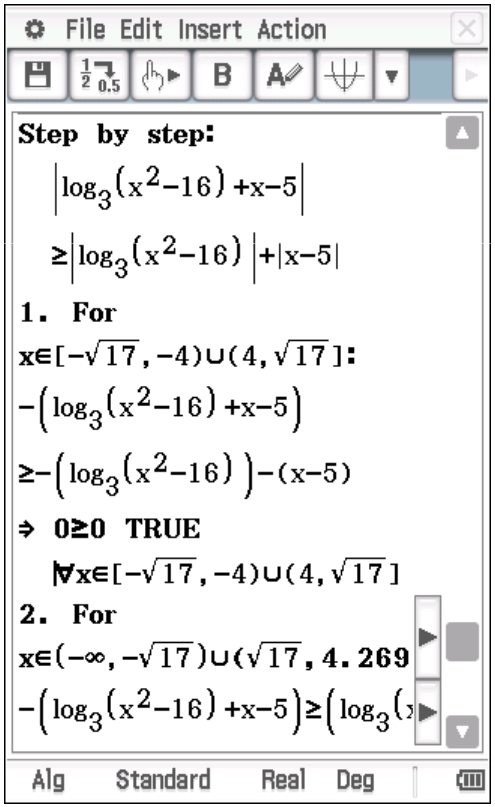


eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

4. УРАВНЕНИЯ И НЕРАВЕНСТВА С МОДУЛЕМ

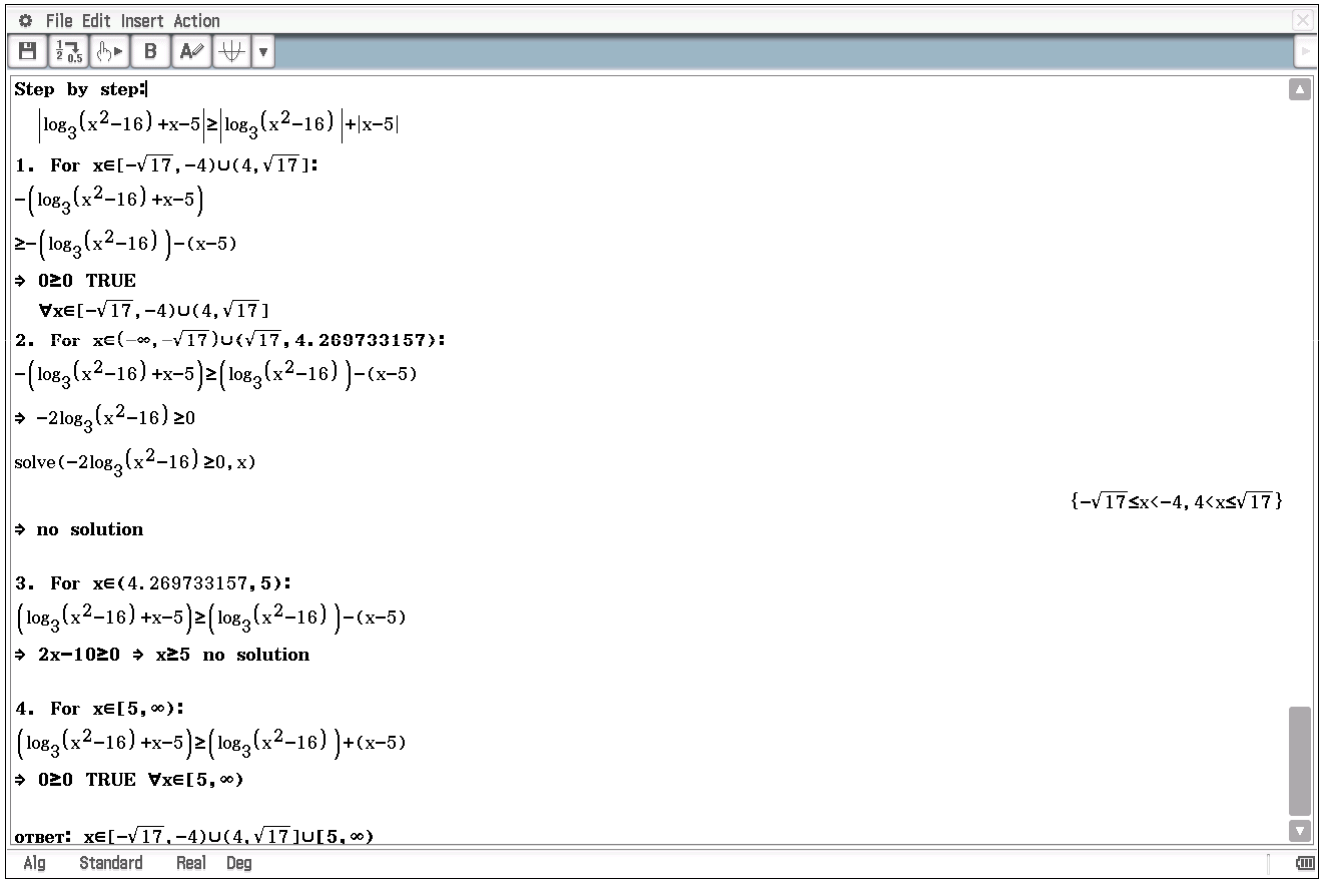






ответ: x ∈ [-√(17), -4) ∪ (4, √(17)] ∪ [5,∞)

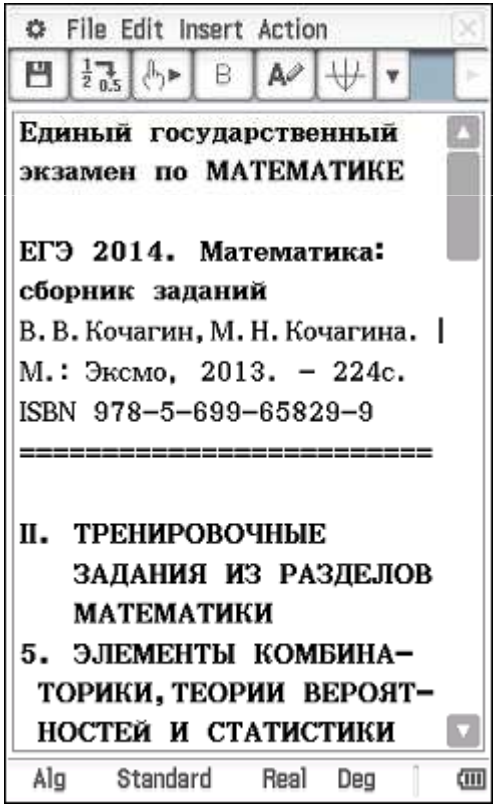
eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

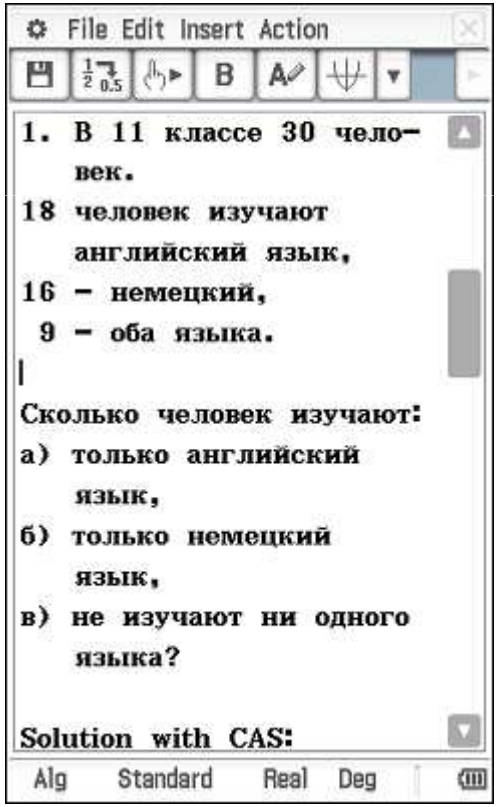


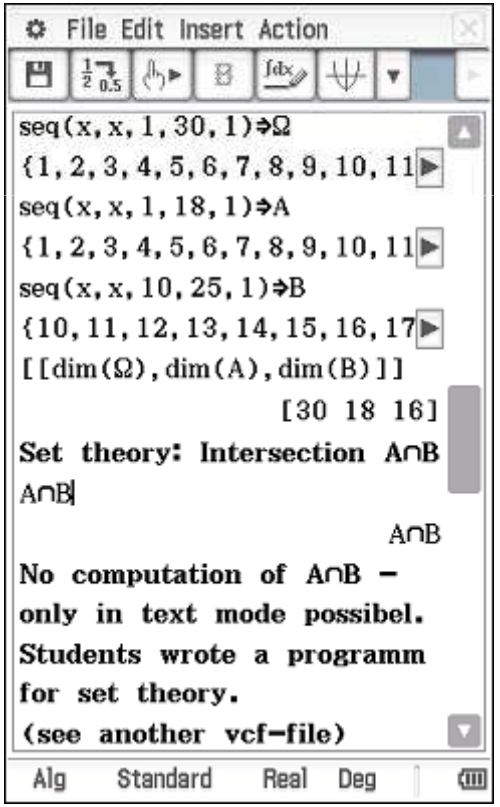
ответ: x ∈ [-√(17), -4) ∪ (4, √(17)] ∪ [5,∞)

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ

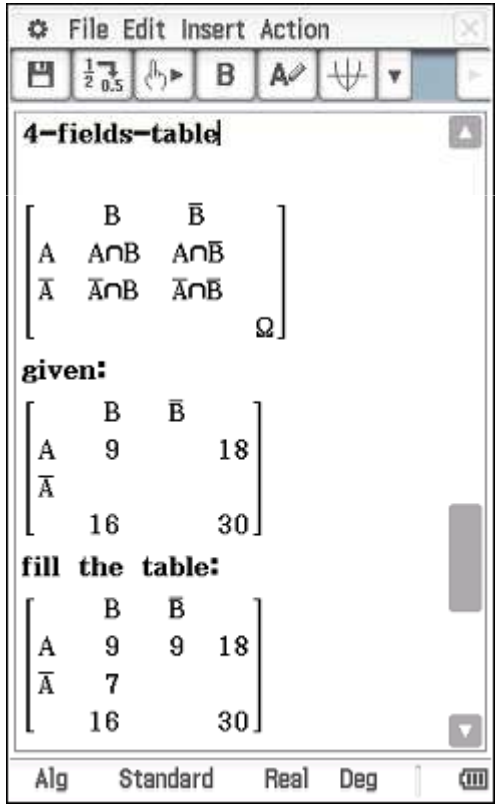


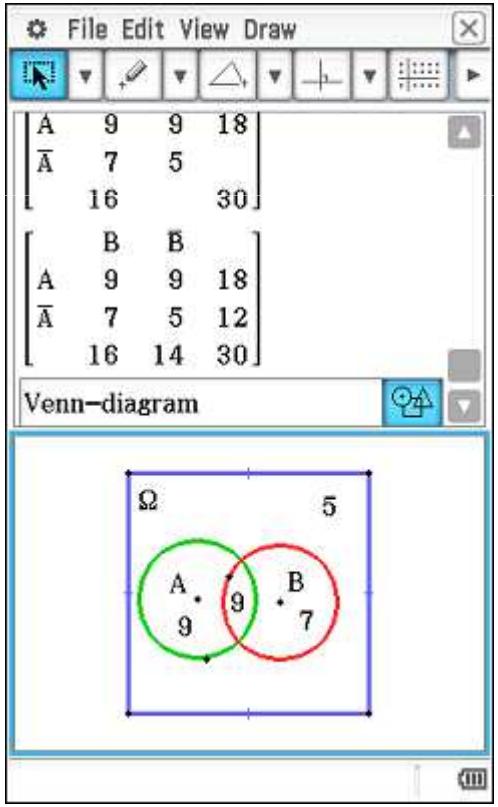




eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ

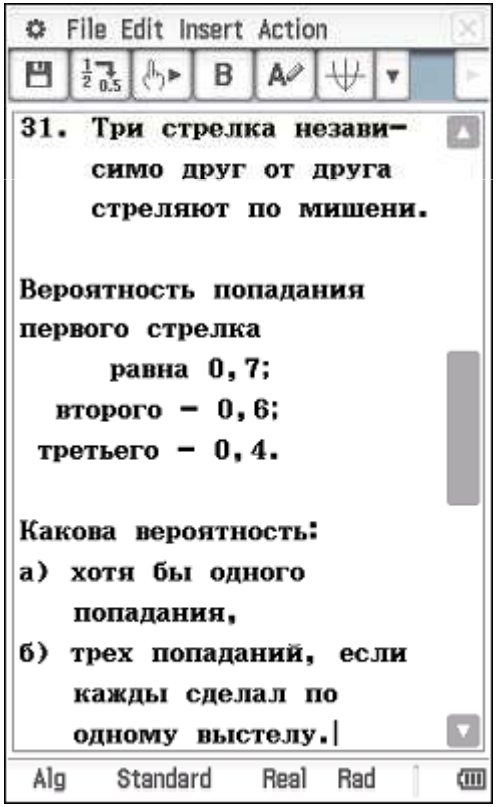


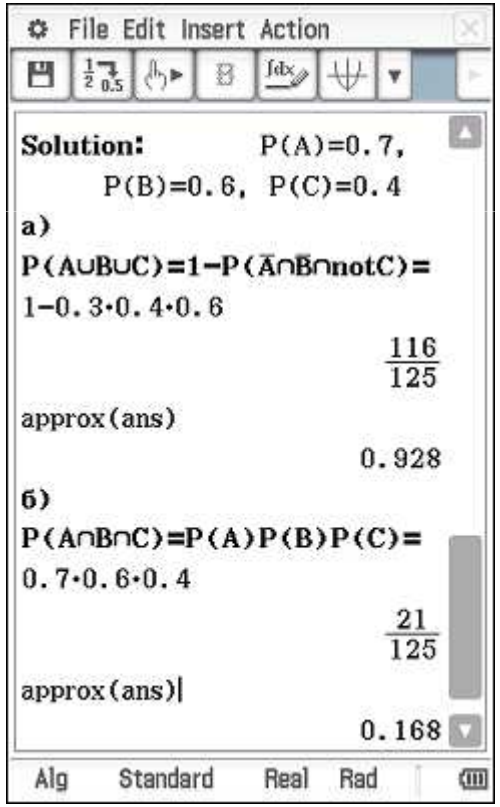


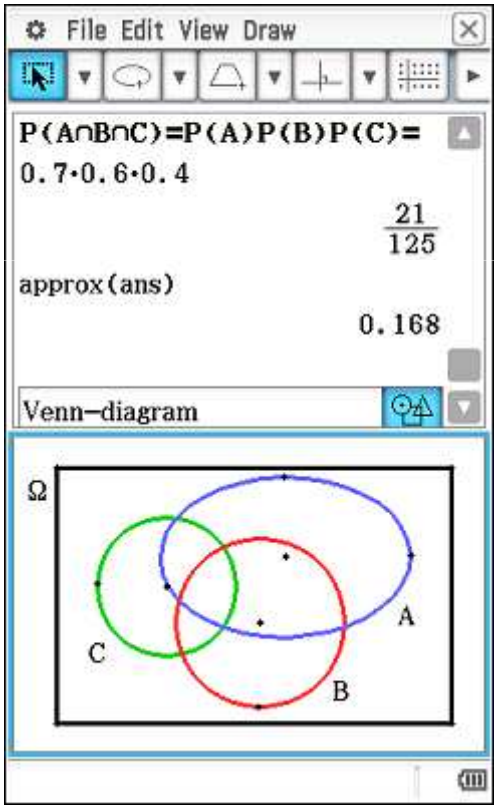
ответ: а)9 б)7 в)5

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ



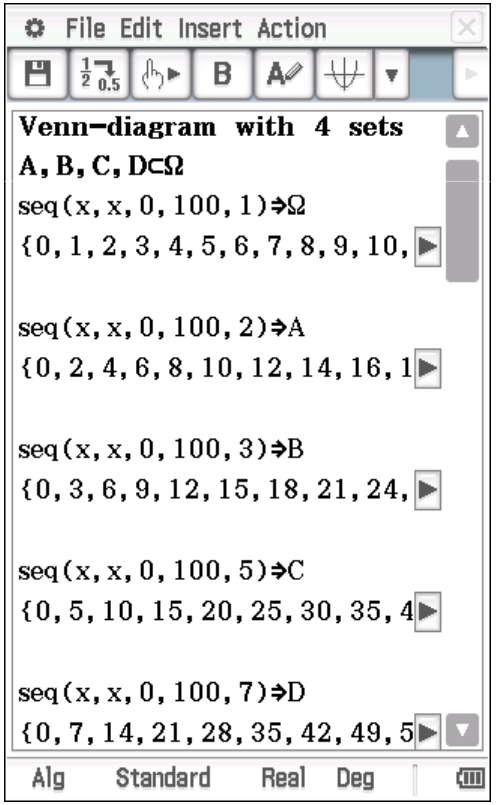


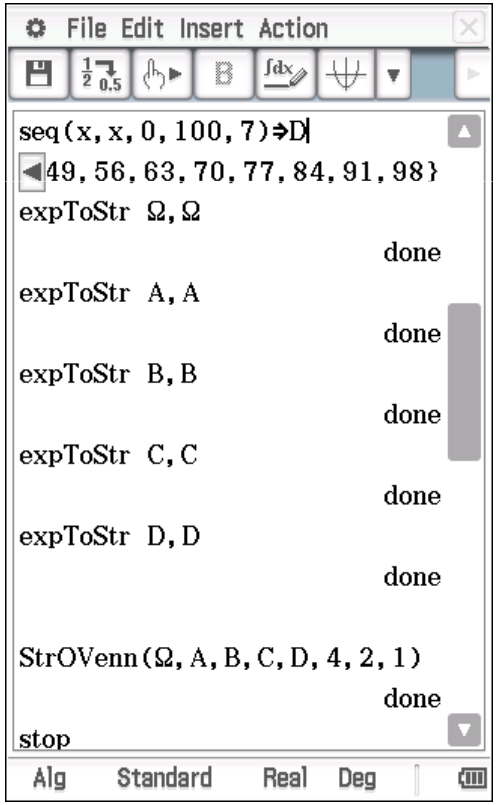


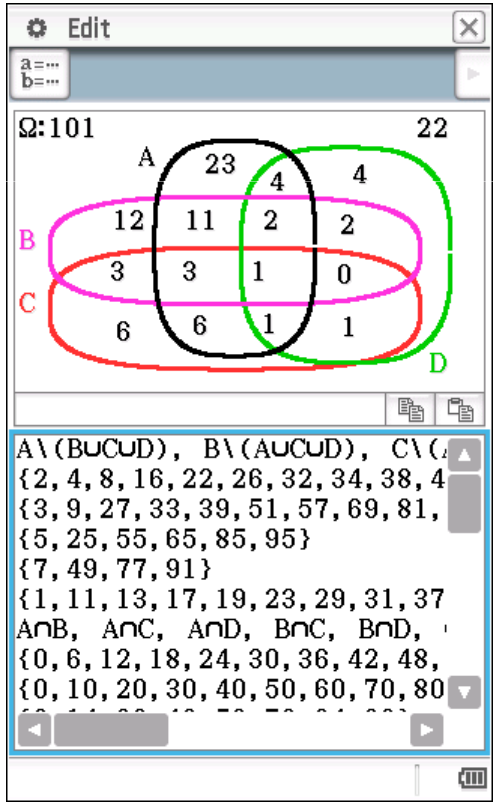
ответ: а)0.928 б)0.168

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ – Venn-diagram with 4 sets A,B,C,D⊂Ω







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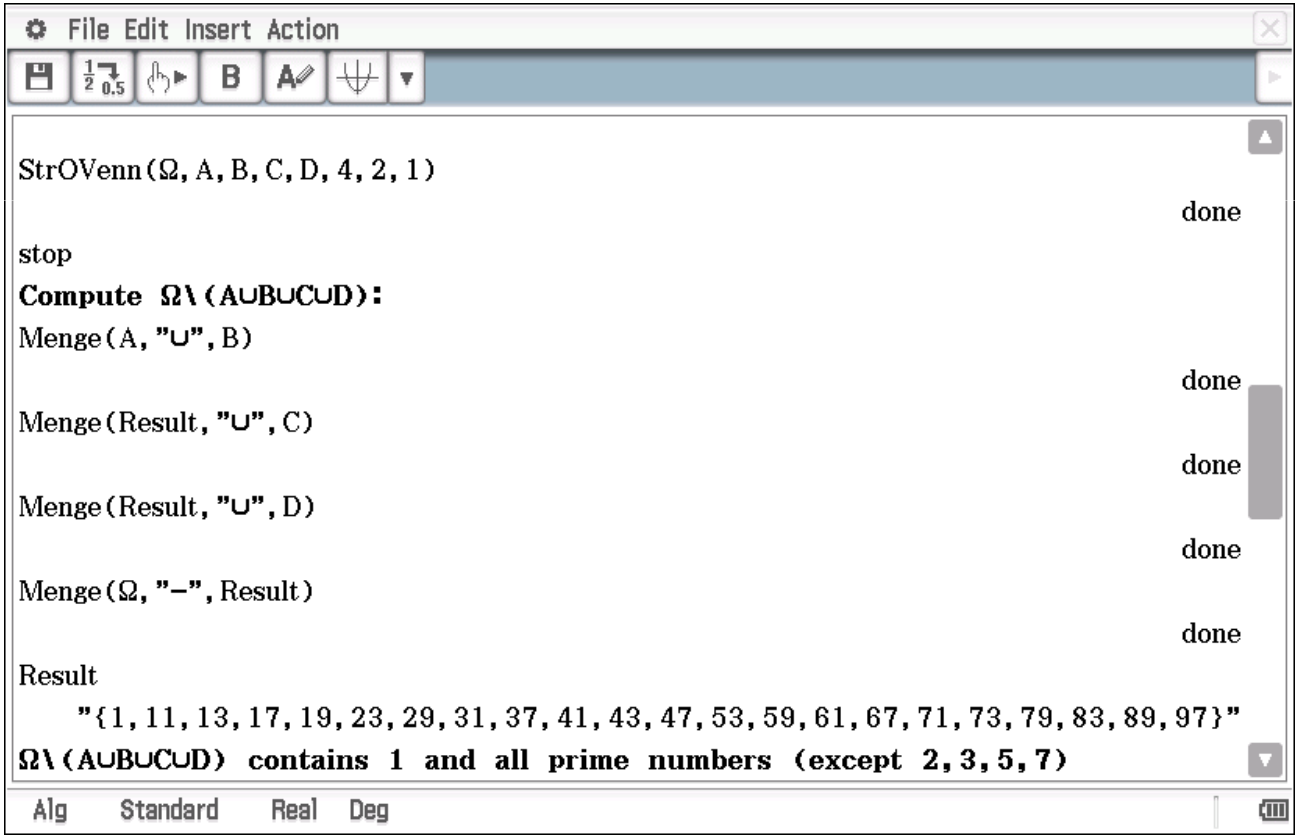
eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ – Venn-diagram with 4 sets A,B,C,D⊂Ω

```
Edit
A\(B∪C∪D), B\(A∪C∪D), C\(A∪B∪D), D\(A∪B∪C), Ω\(A∪B∪C∪D)
{2,4,8,16,22,26,32,34,38,44,46,52,58,62,64,68,74,76,82,86,88,92,94}
{3,9,27,33,39,51,57,69,81,87,93,99}
{5,25,55,65,85,95}
{7,49,77,91}
{1,11,13,17,19,23,29,31,37,41,43,47,53,59,61,67,71,73,79,83,89,97}
A∩B, A∩C, A∩D, B∩C, B∩D, C∩D, A∩B∩C, A∩B∩D, A∩C∩D, B∩C∩D, A∩B∩C∩D
{0,6,12,18,24,30,36,42,48,54,60,66,72,78,84,90,96}
{0,10,20,30,40,50,60,70,80,90,100}
{0,14,28,42,56,70,84,98}
{0,15,30,45,60,75,90}
{0,21,42,63,84}
{0,35,70}
{0,30,60,90}
{0,42,84}
{0,70}
{0}
{0}
(A∩B)\(C∪D), (A∩C)\(B∪D), (A∩D)\(B∪C), (B∩C)\(A∪D), (B∩D)\(A∪C), (C∩D)\(A∪B)
{6,12,18,24,36,48,54,66,72,78,96}
{10,20,40,50,80,100}
{14,28,56,98}
{15,45,75}
{21,63}
{35}
(A∩B∩C)\D,(A∩B∩D)\C,(A∩C∩D)\B,(B∩C∩D)\A
{30,60,90}
{42,84}
{70}
∅
```

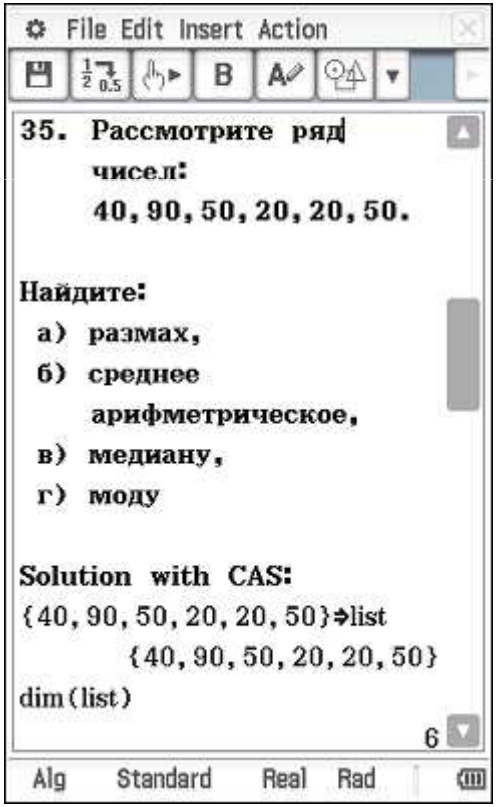
eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

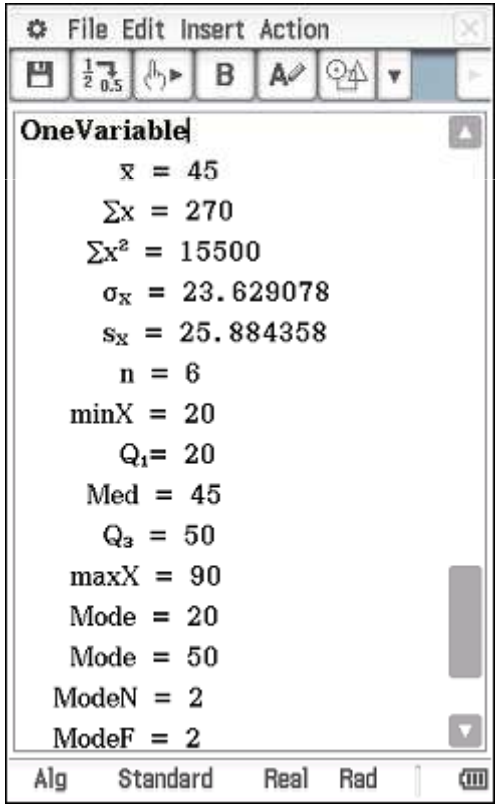
5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ – Compute Ω\(A∪B∪C∪D) with 4 sets A,B,C,D⊂Ω



eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

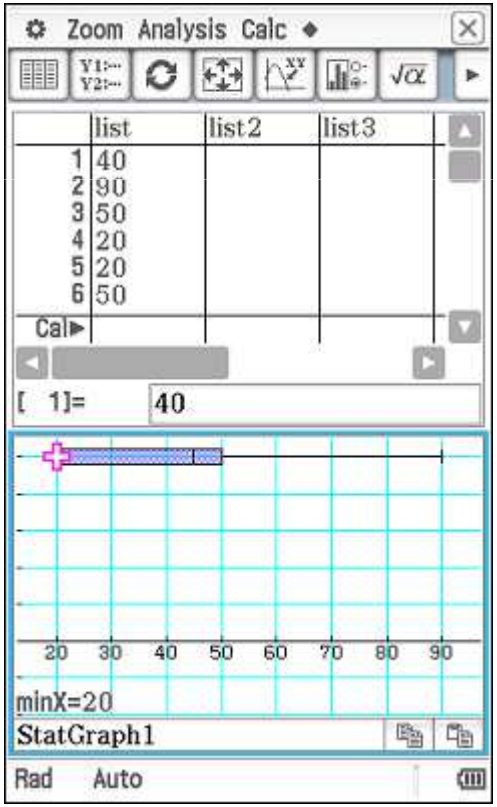
5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ

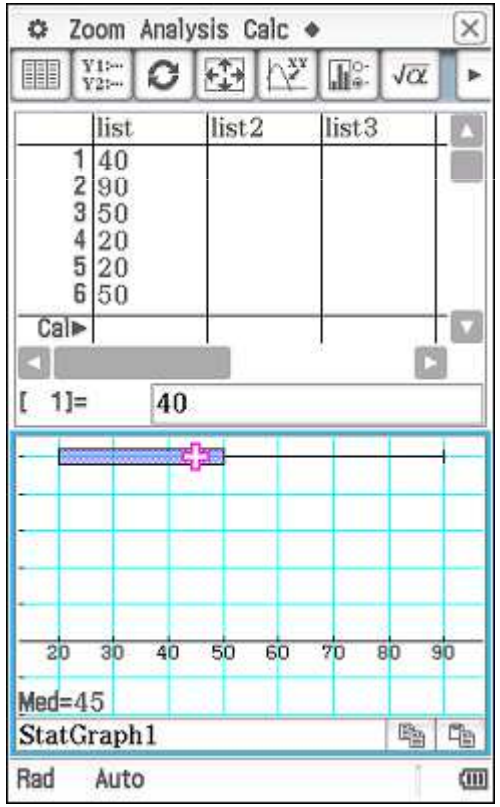


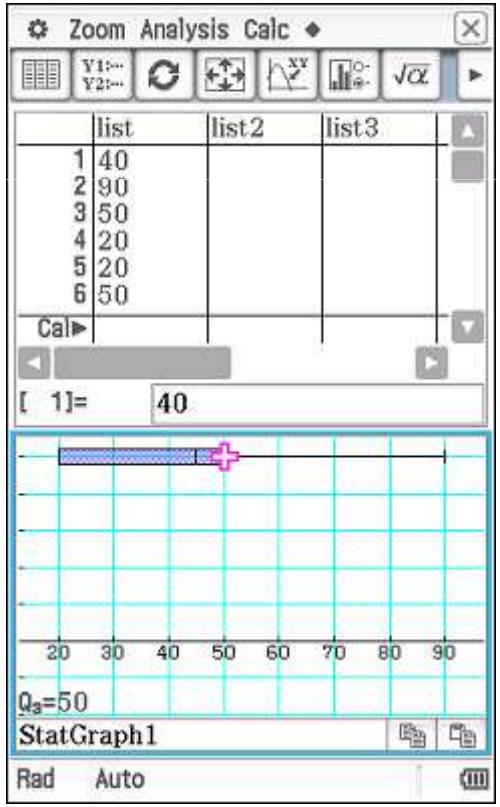


eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ (Boxplot)

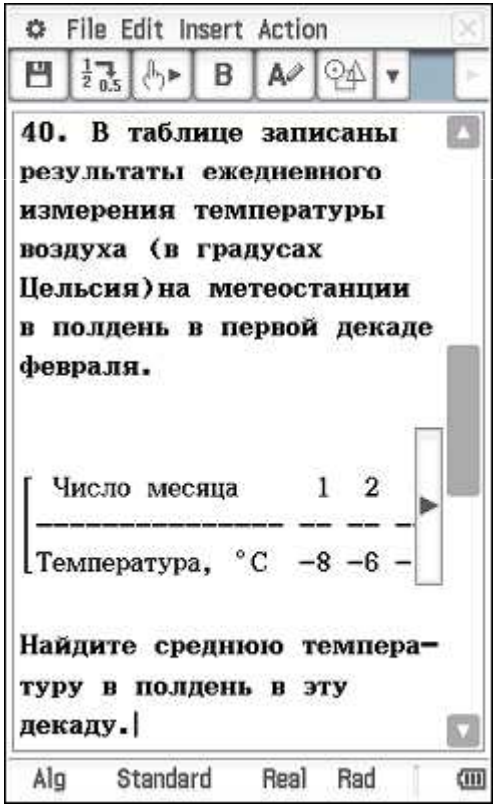


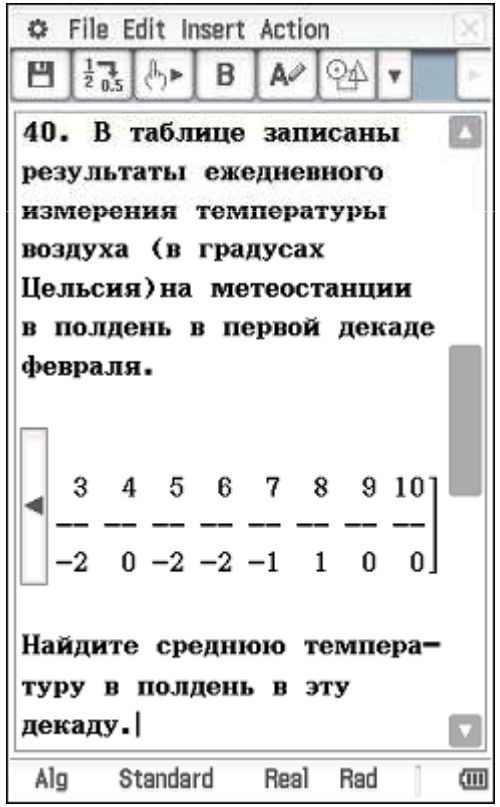


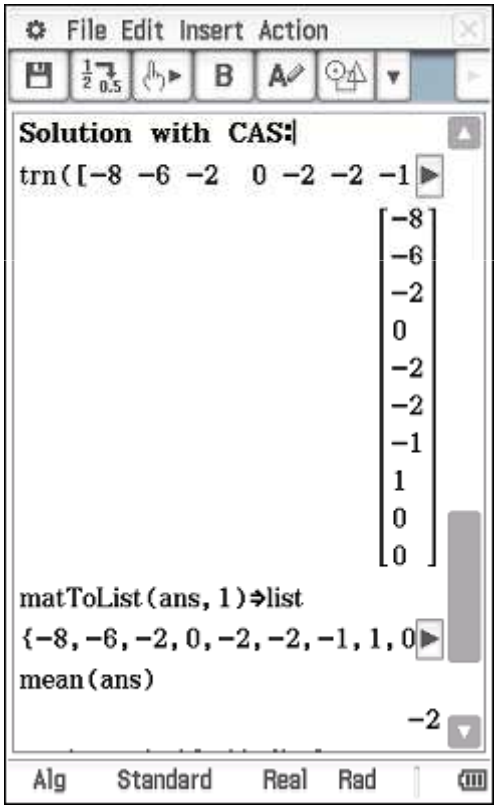


eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

5. ЭЛЕМЕНТЫ КОМБИНАТОРИКИ,ТЕОРИИ ВЕРОЯТНОСТЕЙ И СТАТИСТИКИ







ответ: -2°

eActivity: II. ТРЕНИРОВОЧНЫЕ ЗАДАНИЯ ИЗ РАЗДЕЛОВ МАТЕМАТИКИ

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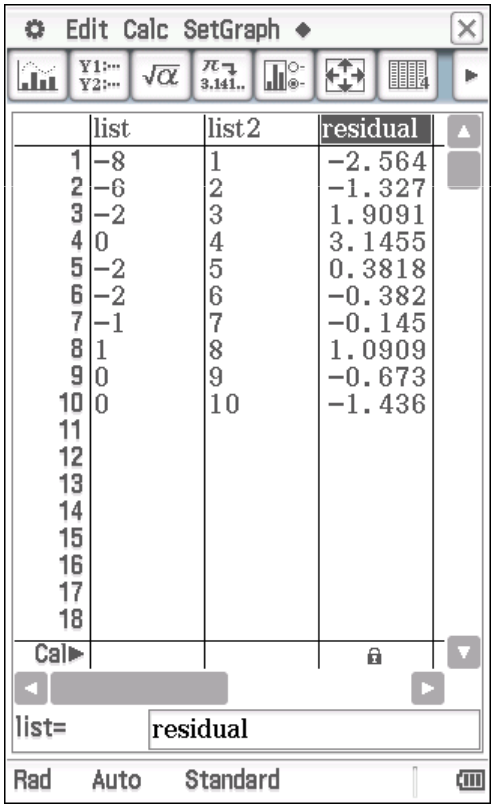

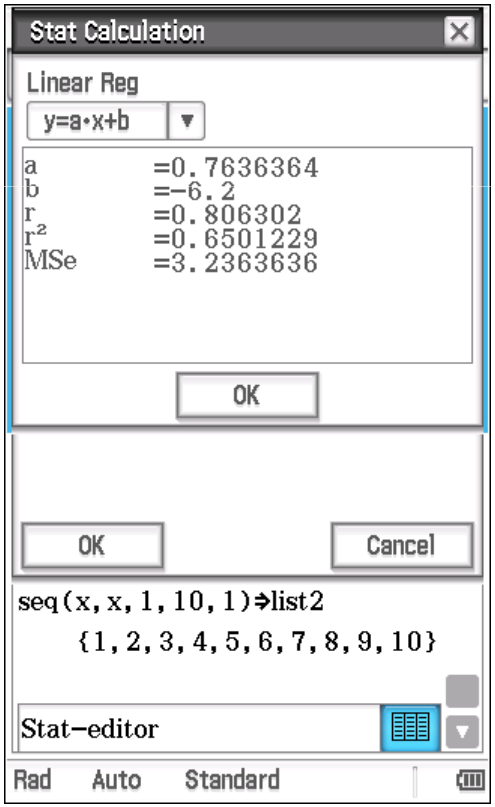

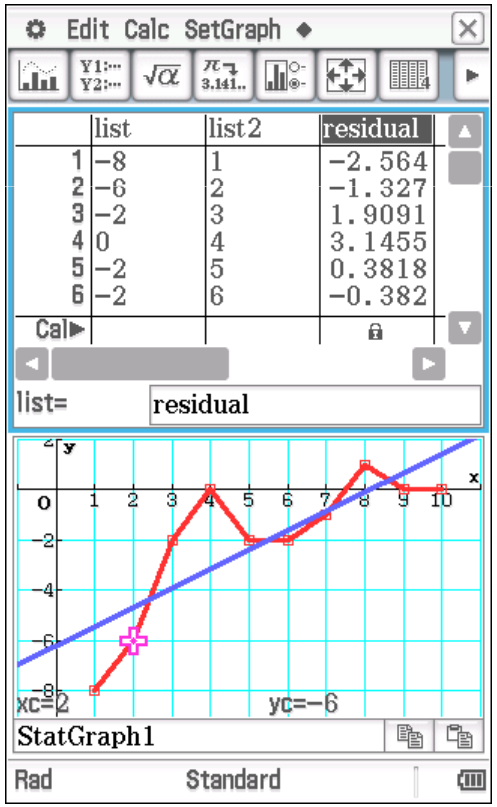

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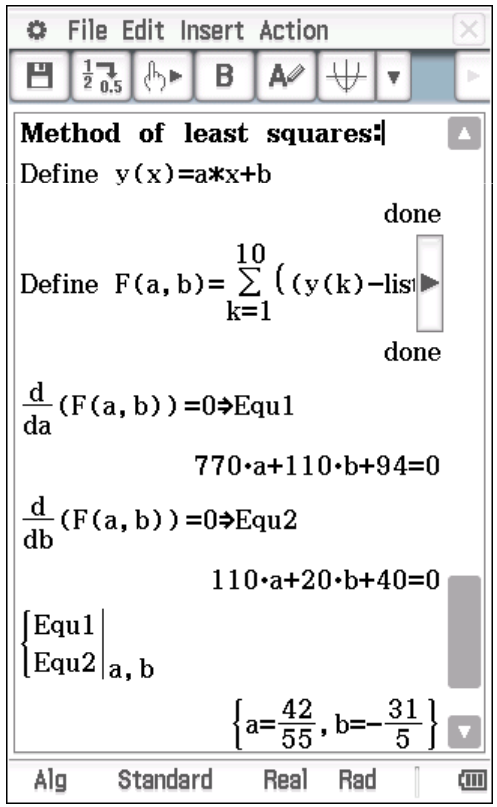
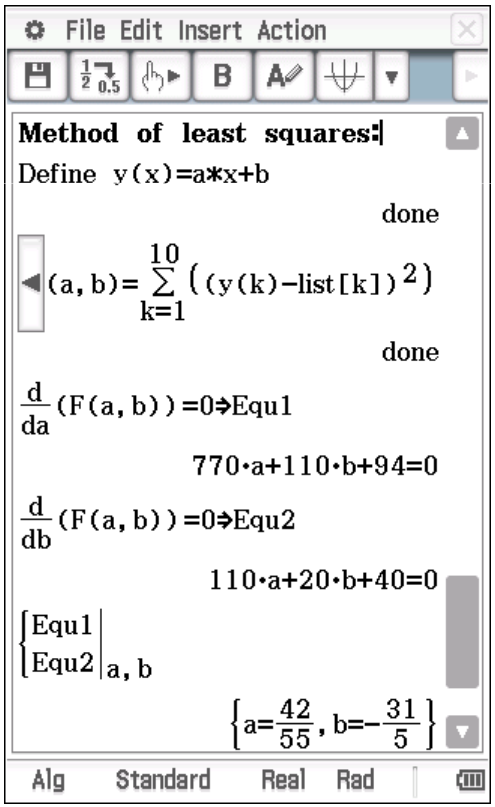
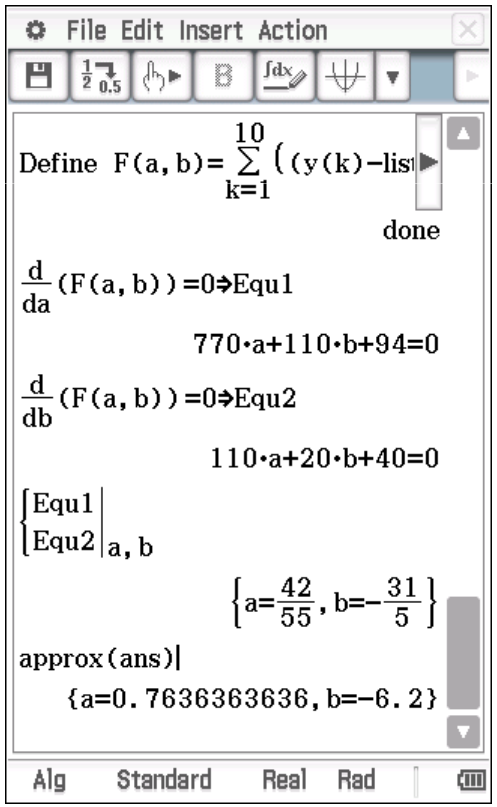






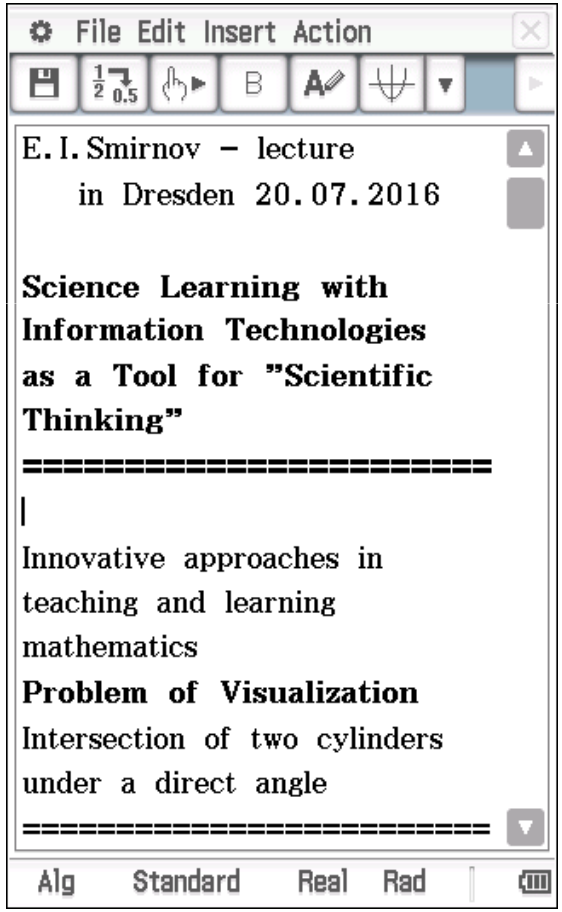
eActivity: E.I.Smirnov – lecture in Dresden 20.07.2016

Science Learning with Information Technologies as a Tool for "Scientific Thinking"

Innovative approaches in teaching and learning mathematics

Problem of Visualization

Intersection of two cylinders under a direct angle



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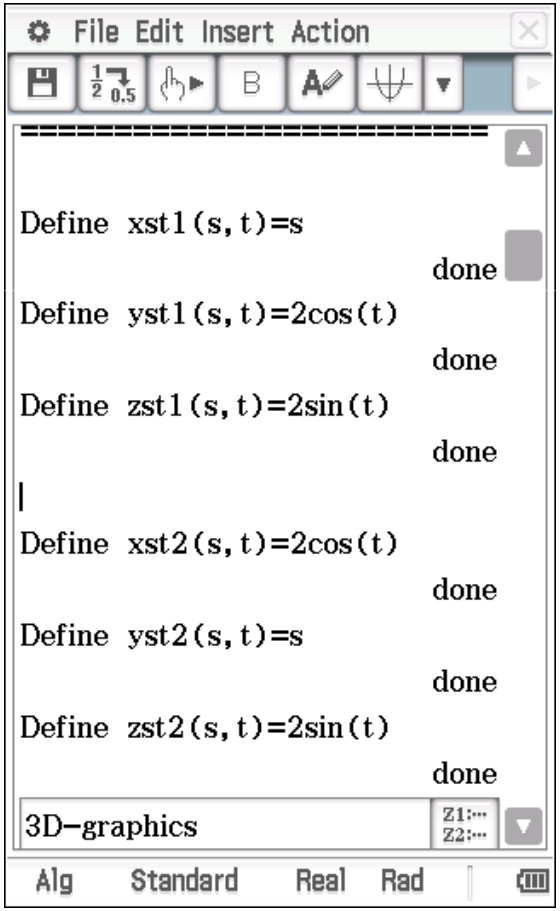

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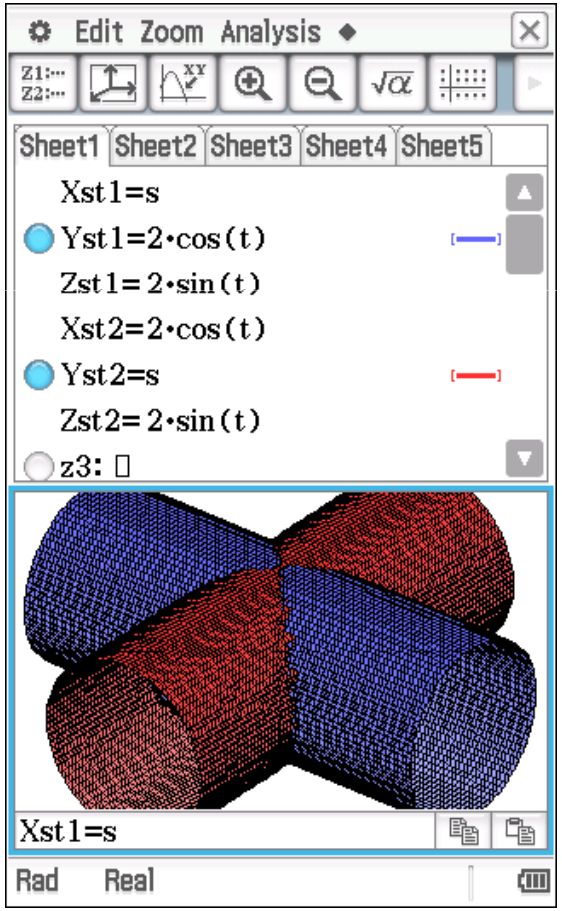

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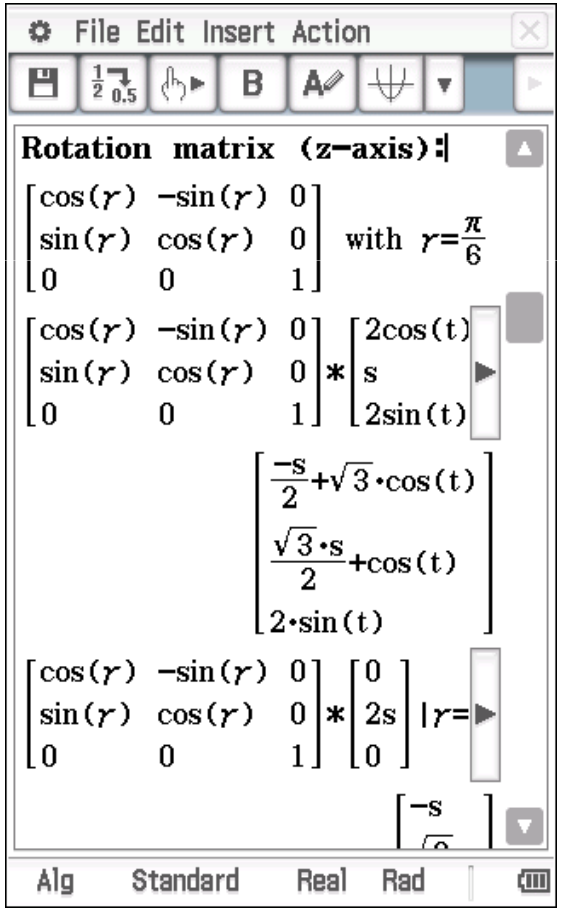

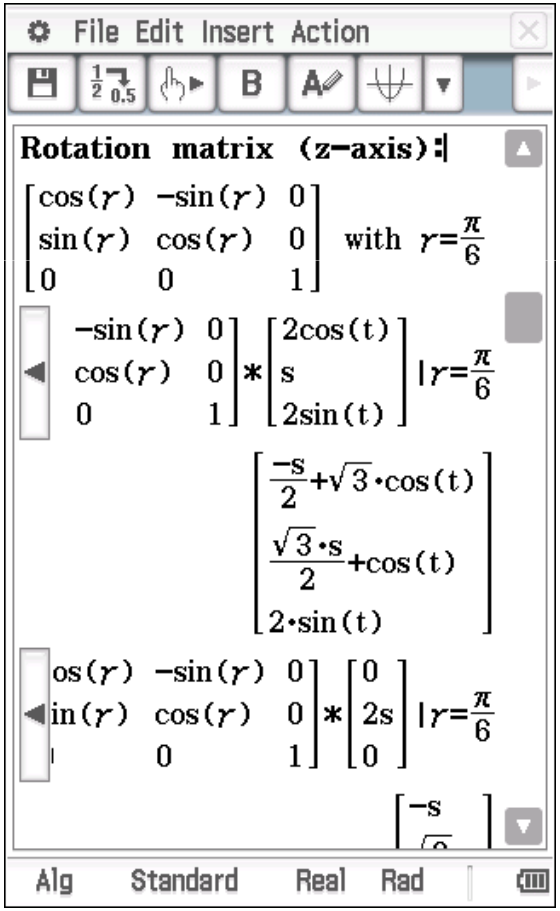

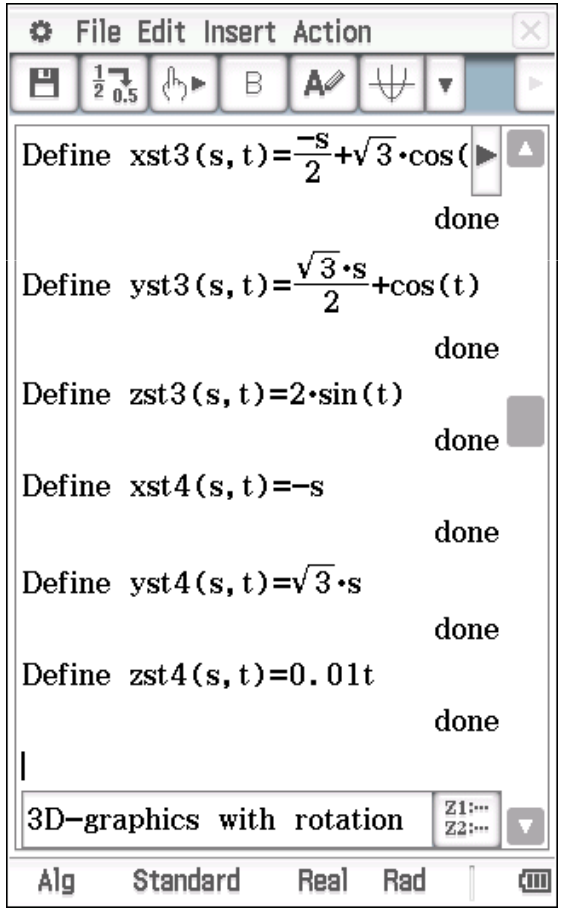

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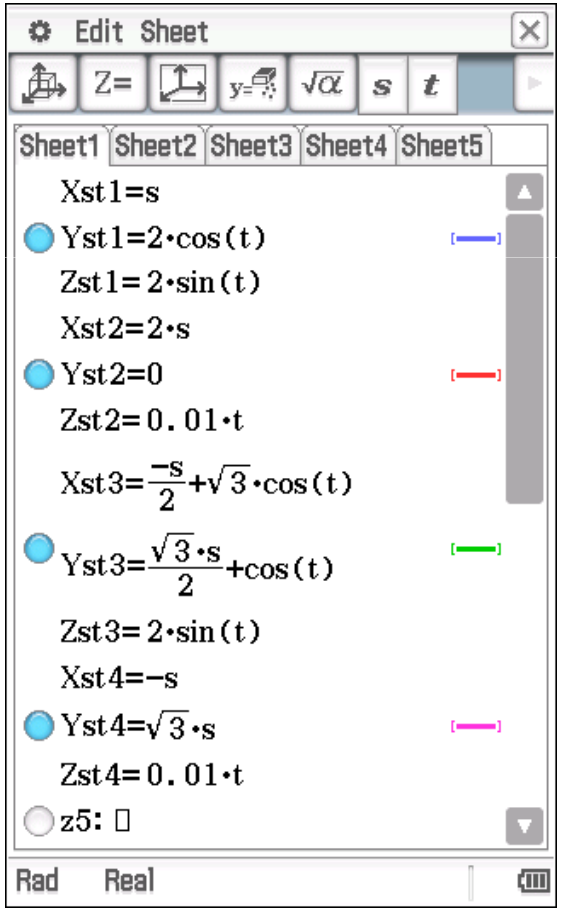

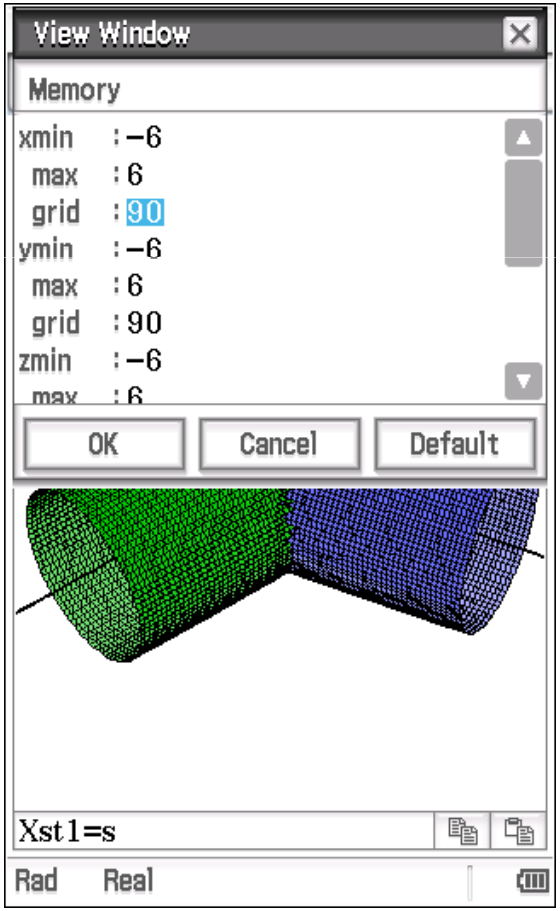

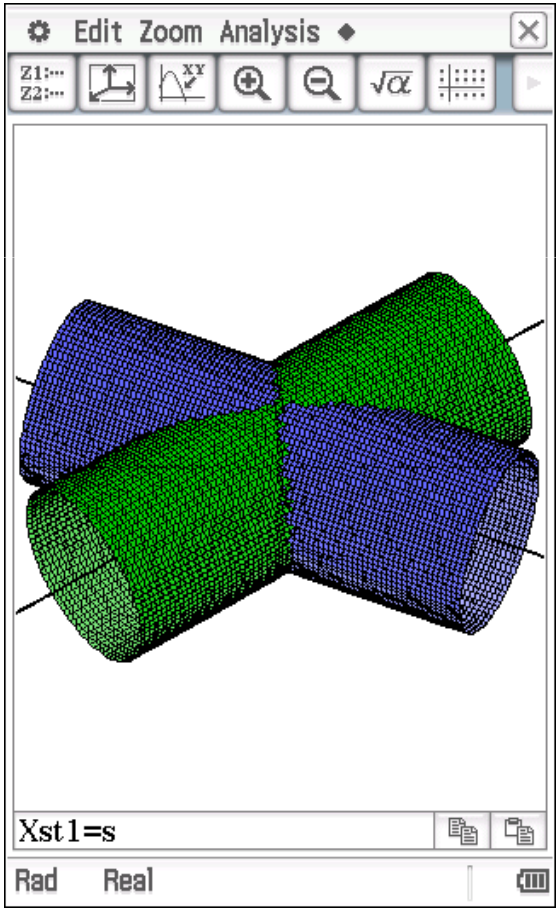

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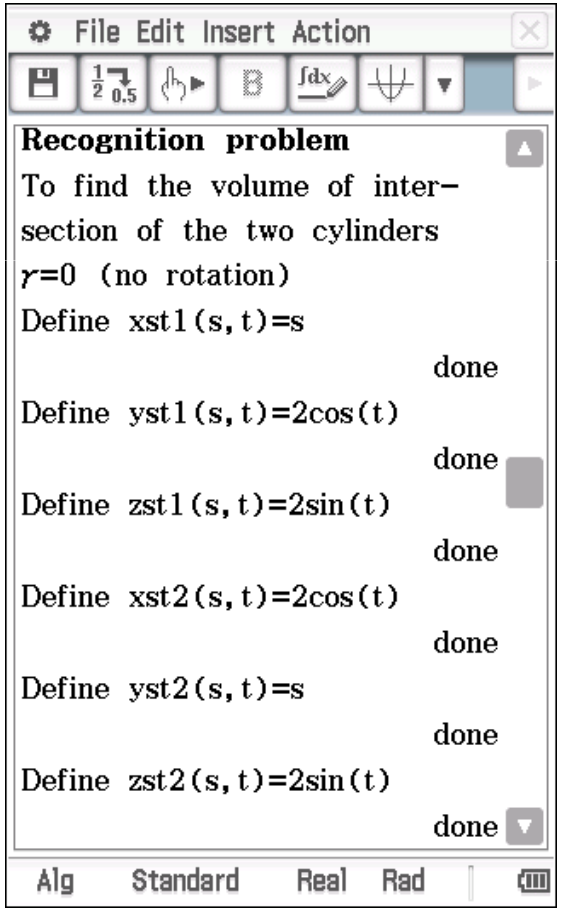

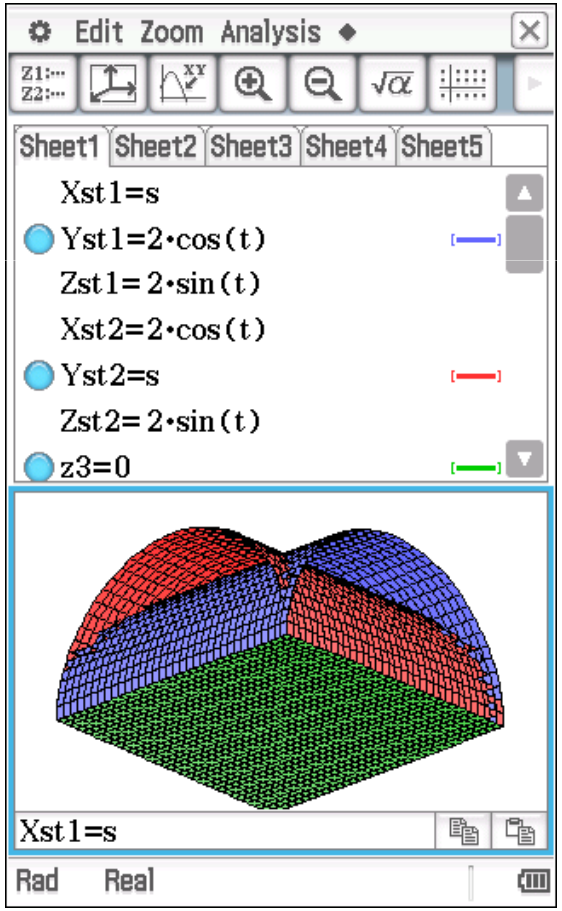

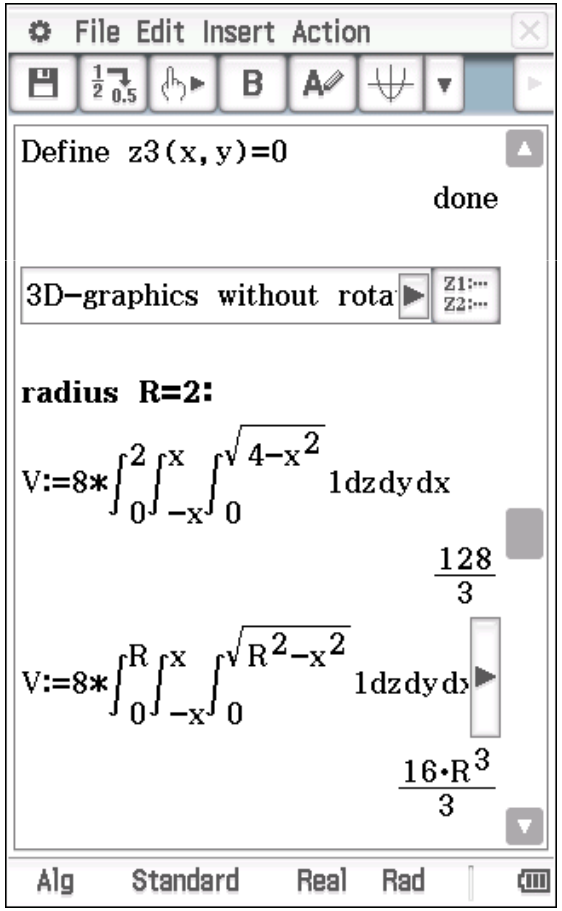

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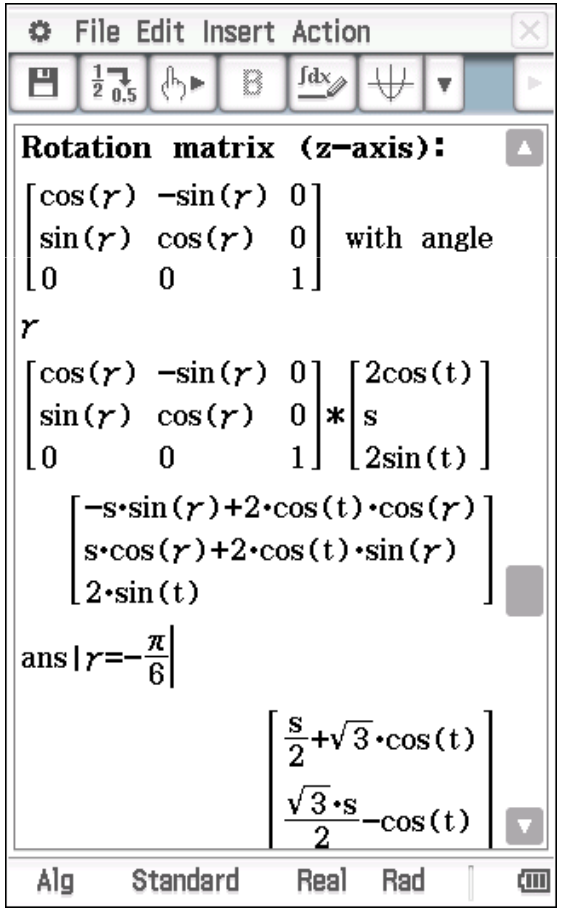

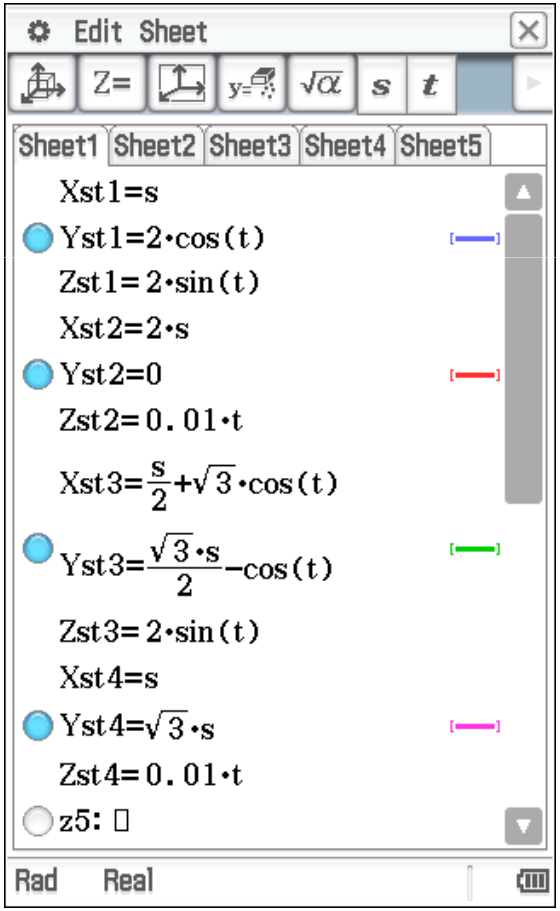

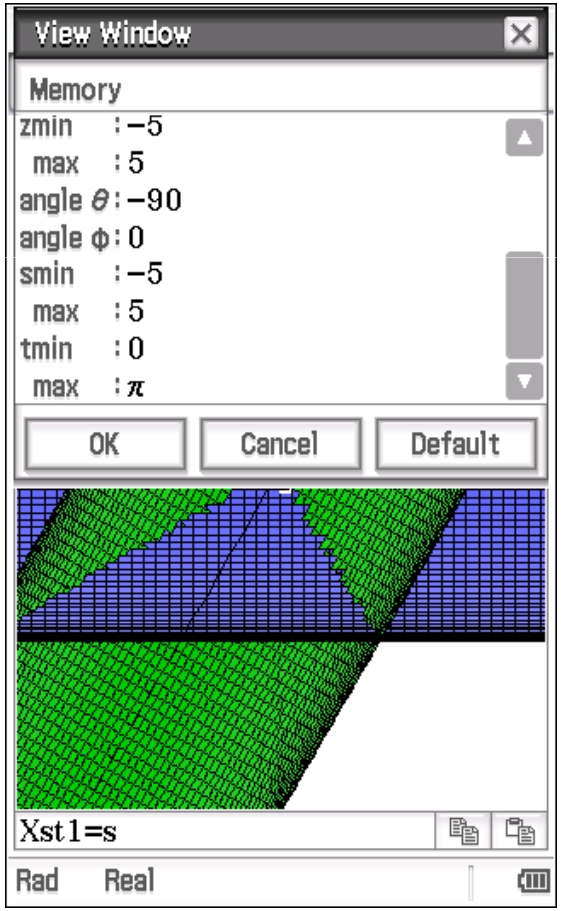

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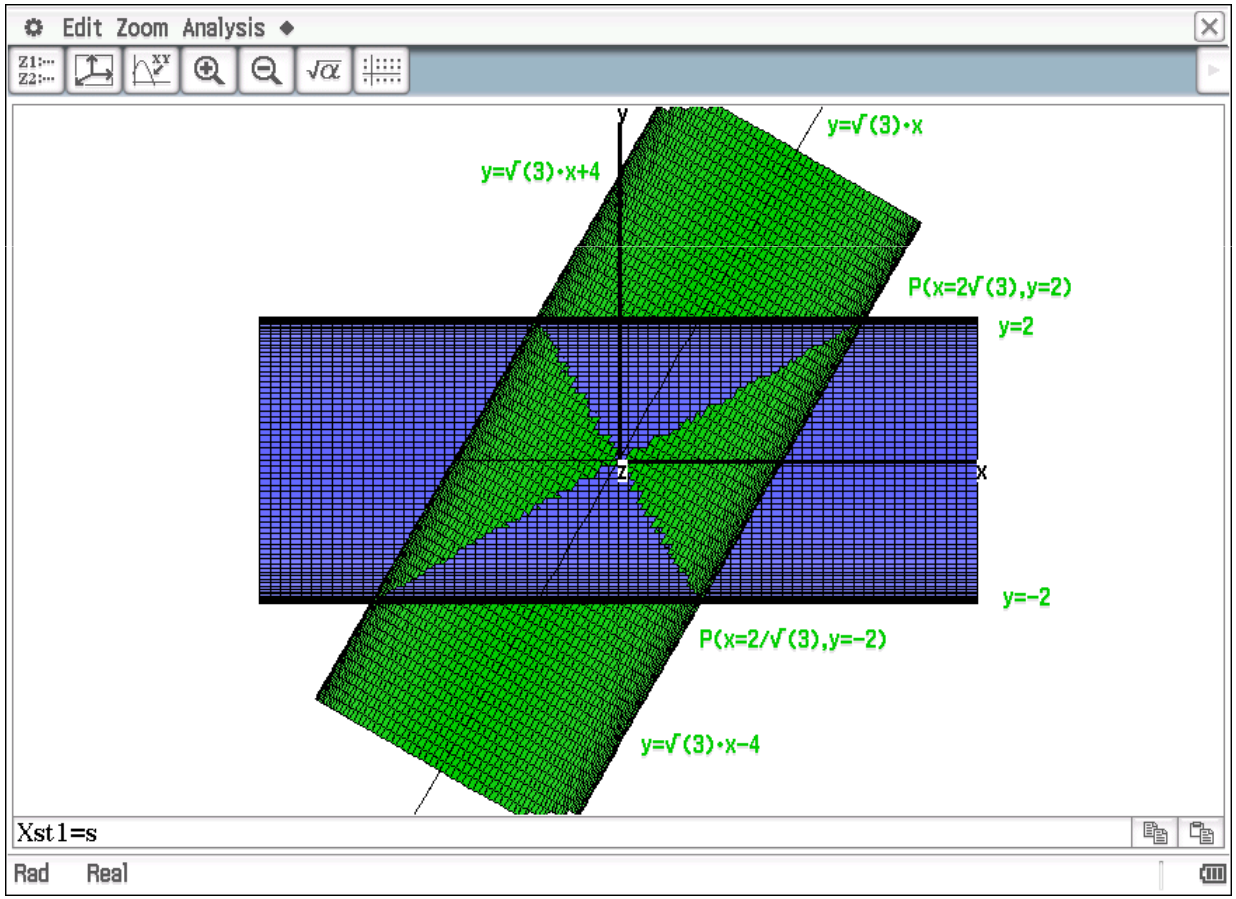

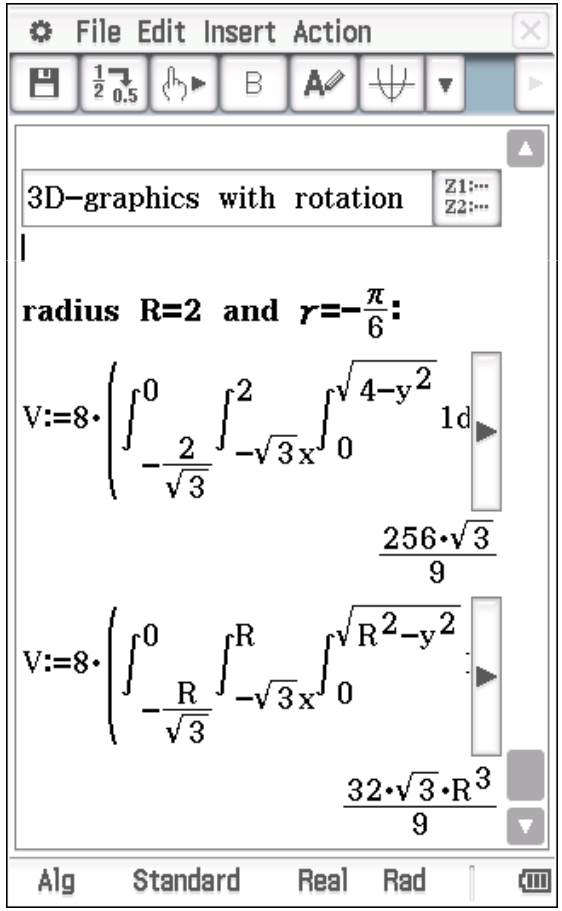

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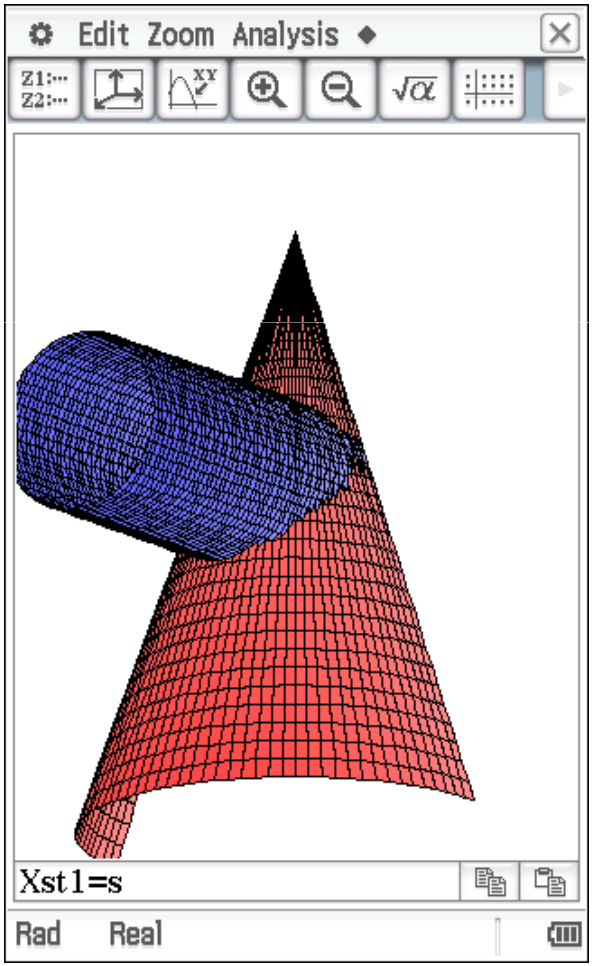
Science Learning with Information Technologies as a Tool for "Scientific Thinking"

Innovative approaches in teaching and learning mathematics

Problem of Visualization

Intersection of a cylinder and a cone



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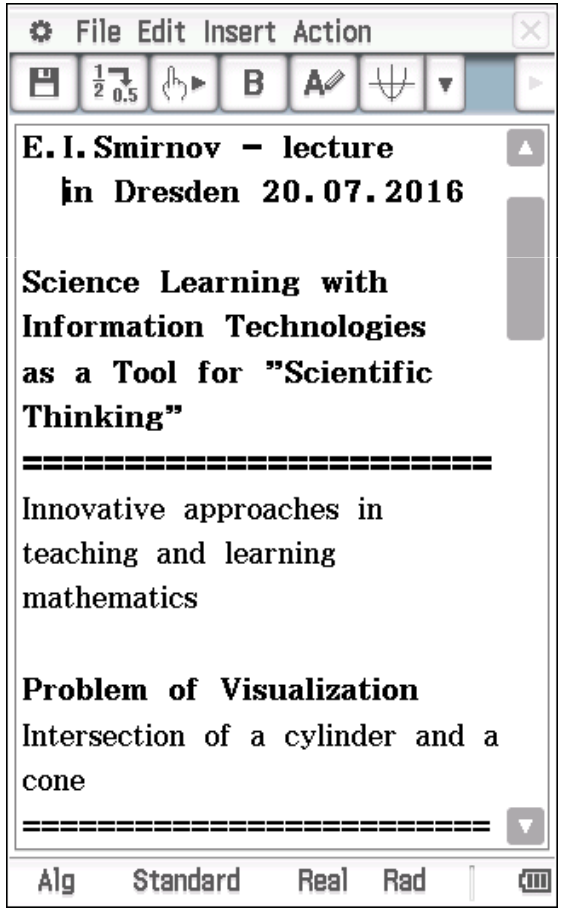
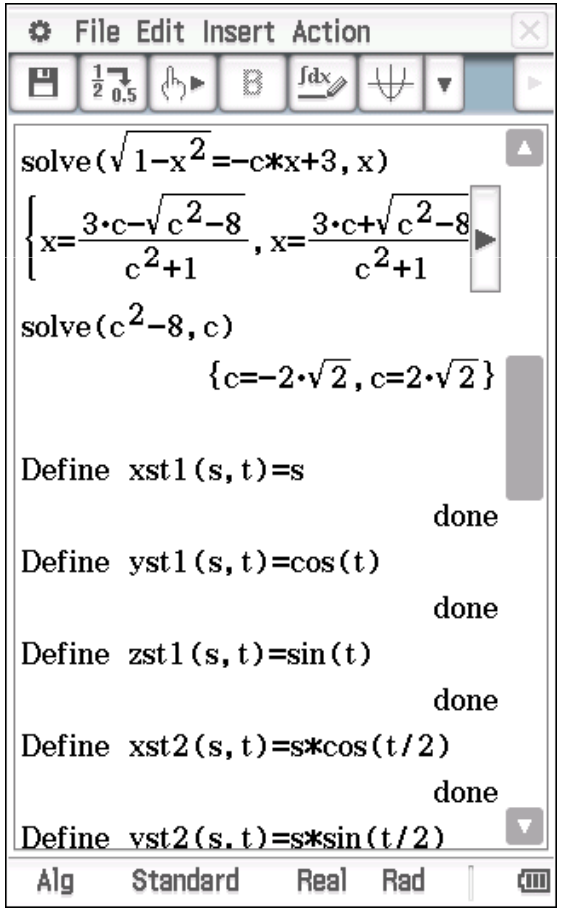
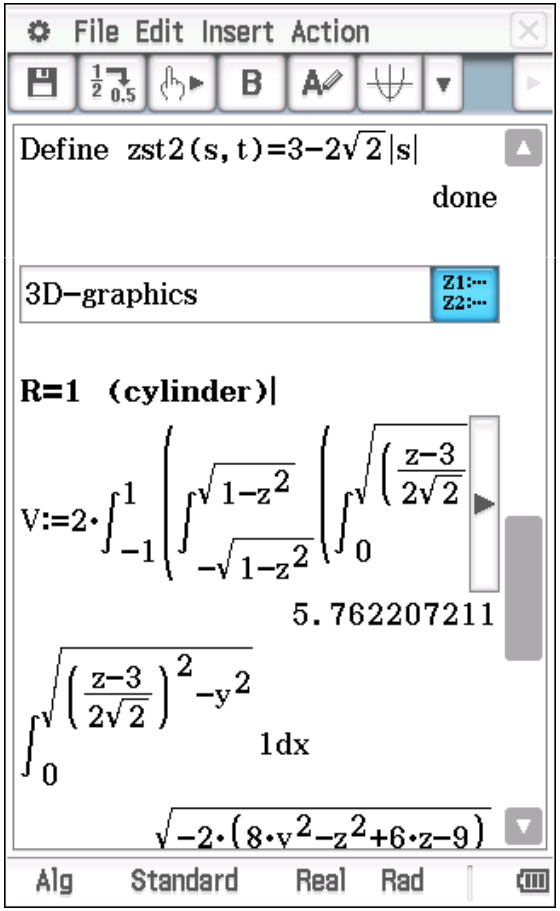
Science Learning with Information Technologies as a Tool for "Scientific Thinking"







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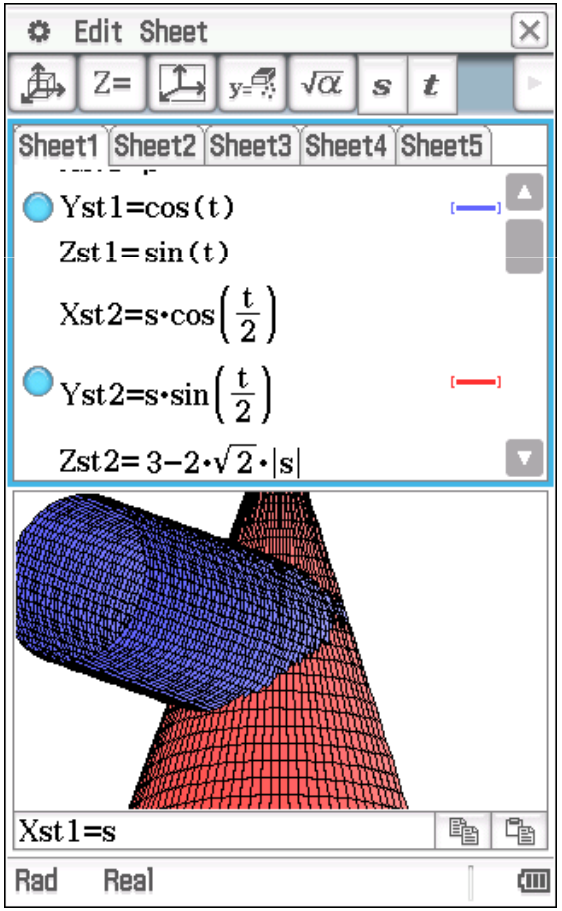

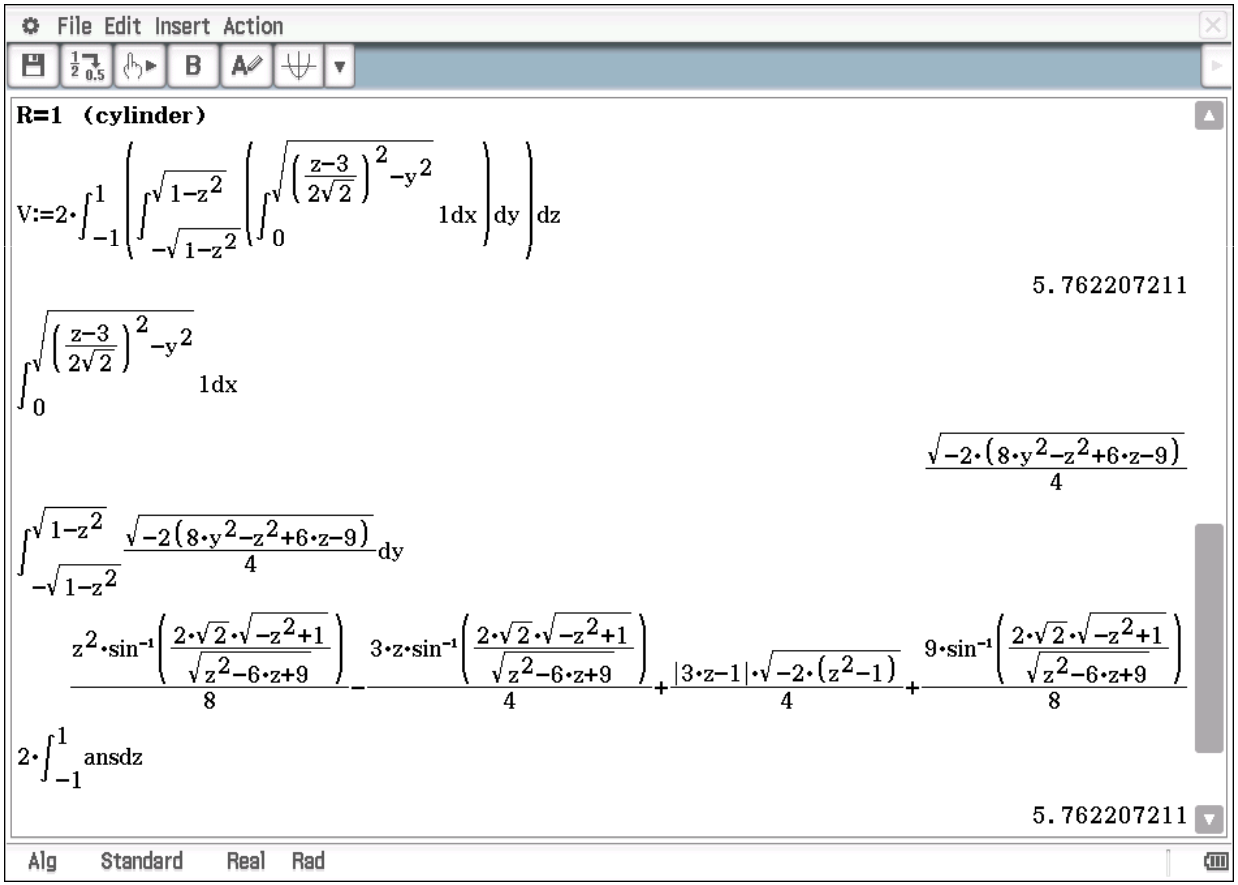

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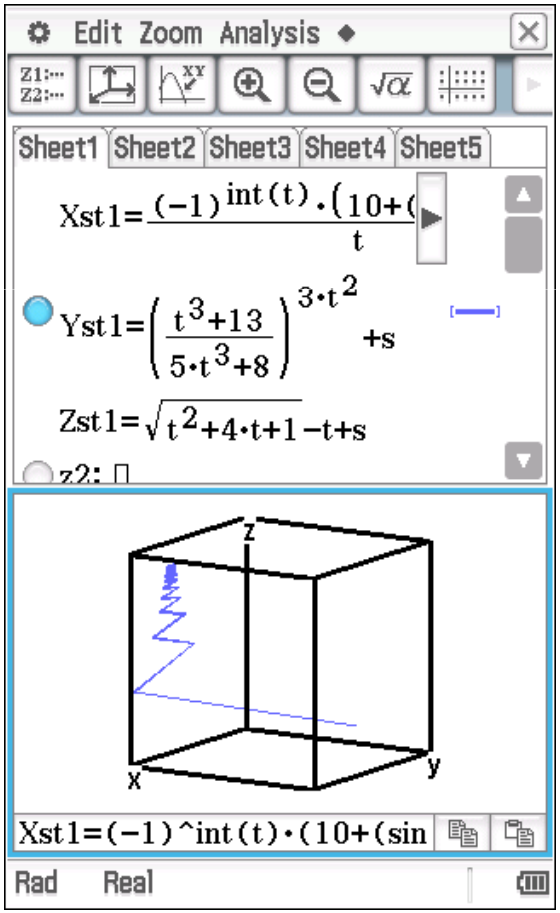
Science Learning with Information Technologies as a Tool for "Scientific Thinking"

Innovative approaches in teaching and learning mathematics

Problem of subject's Essence

To find the limit of a sequence Mn



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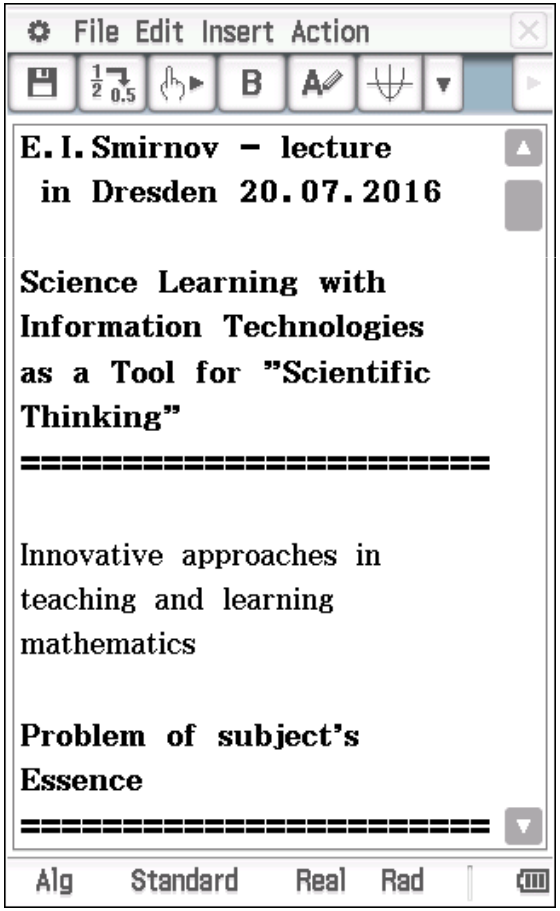

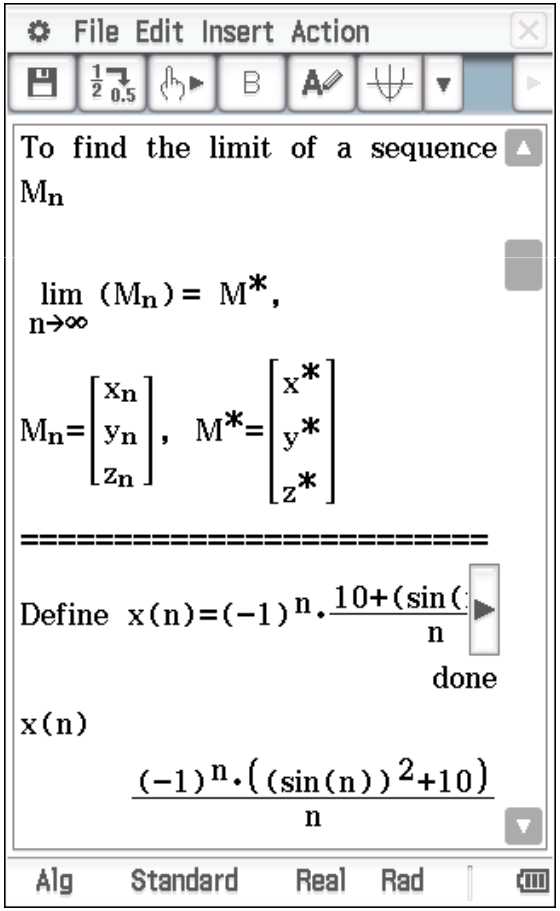

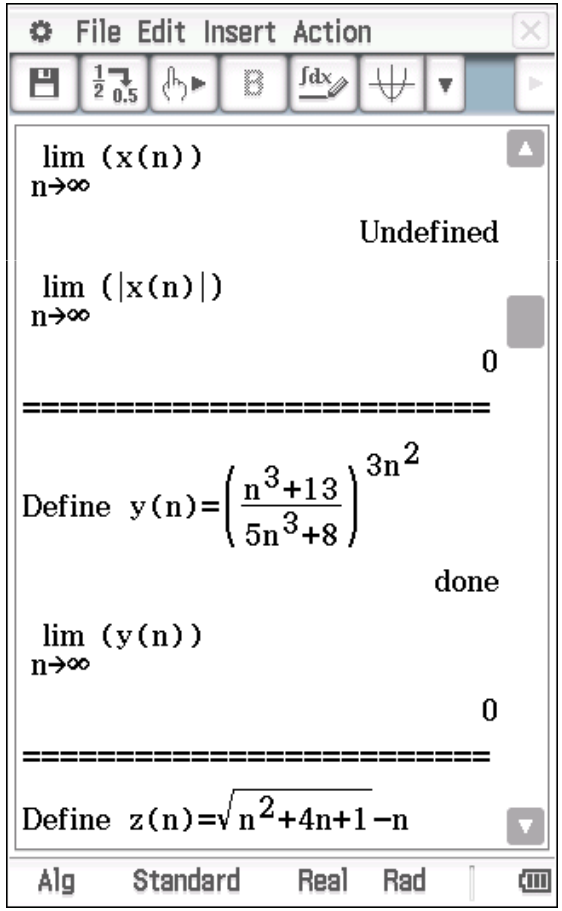

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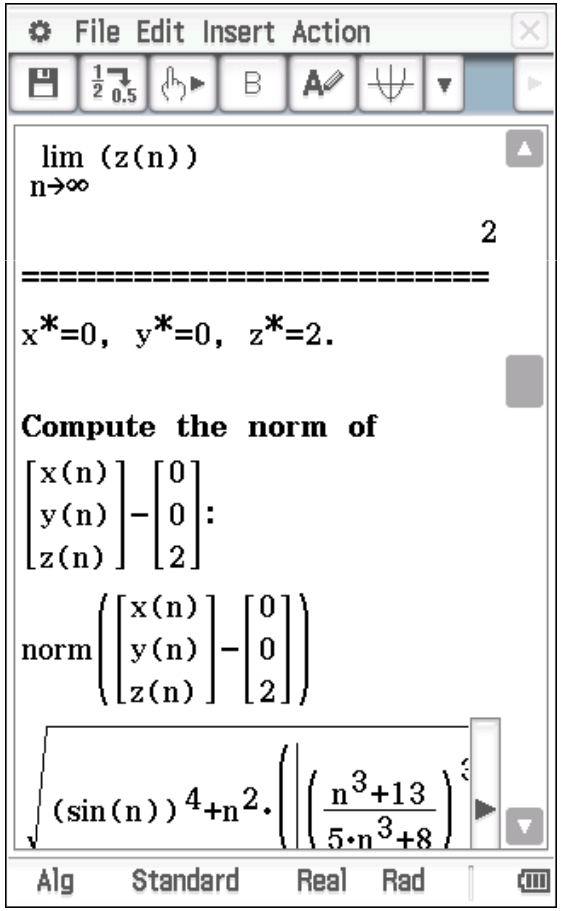

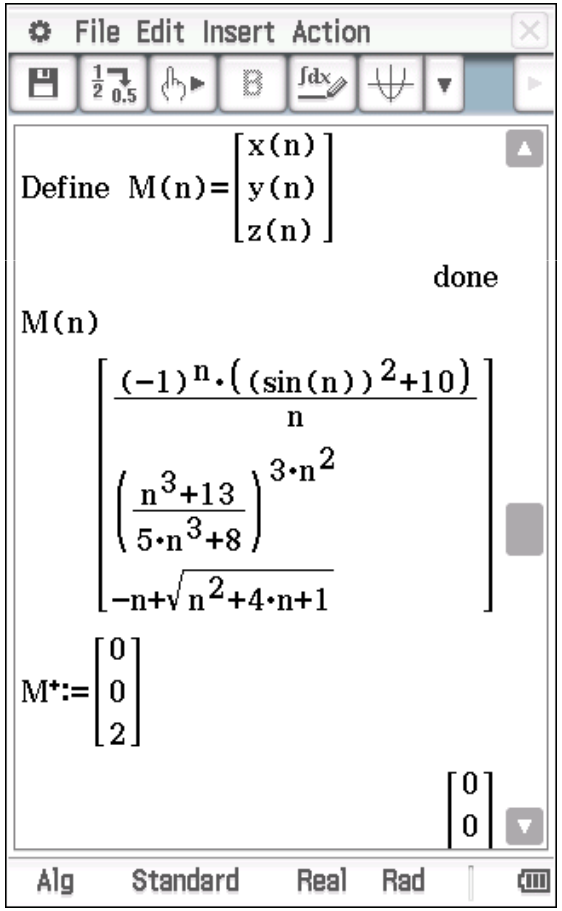

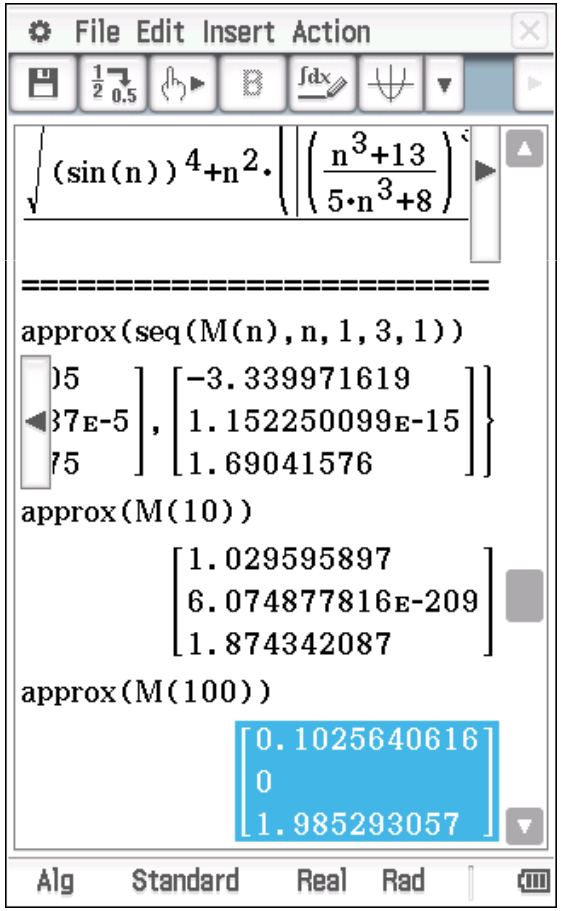

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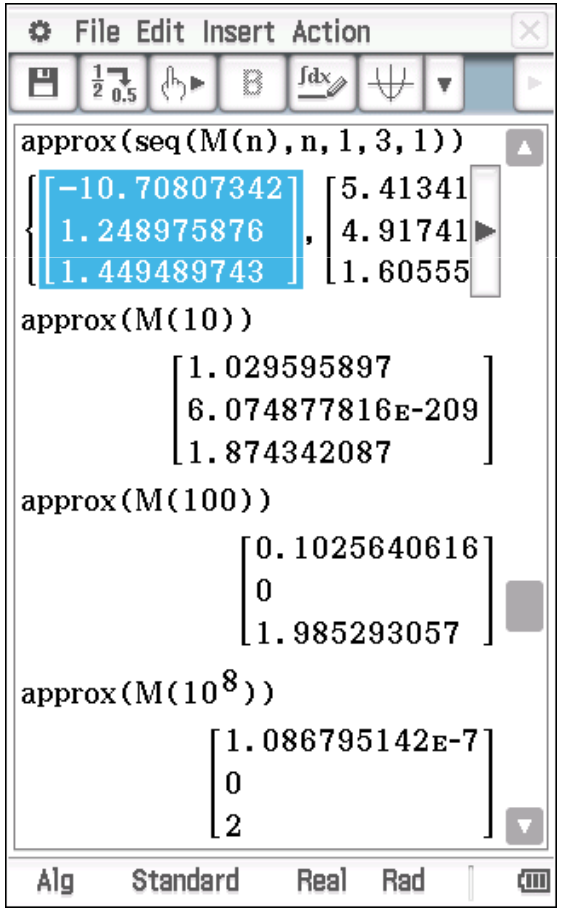

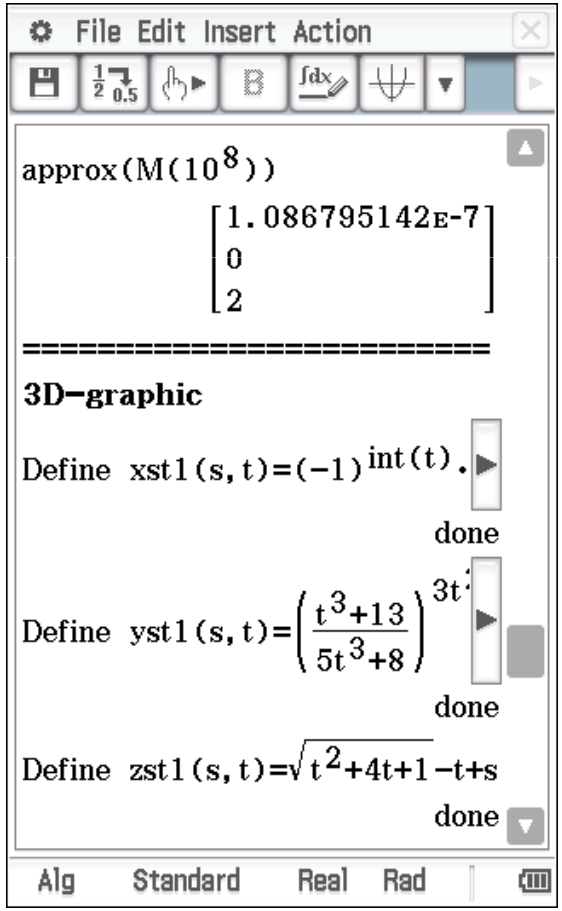

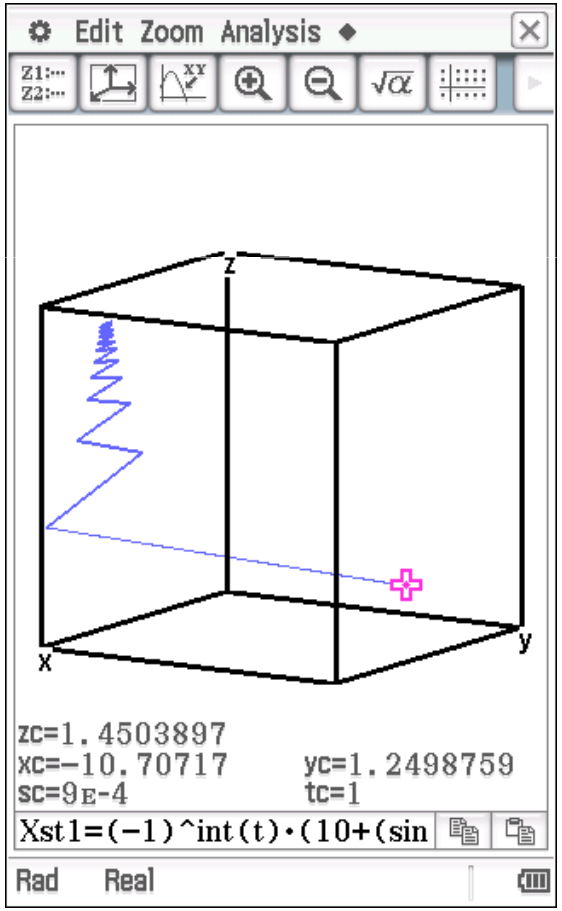

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File Edit Insert Action

3D–graphic

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Computing the limits step by step:

x(n):

$$\left|(-1)^n \cdot \frac{10+(\sin(n))^2}{n}\right|$$

$$=\frac{10+(\sin(n))^2}{n}$$

$$<\frac{10+1}{n}=\frac{11}{n}\to 0,\quad n\to\infty$$

Alg Standard Real Rad

File Edit Insert Action

y(n):

$$\left(\frac{n^3+13}{5n^3+8}\right)^{3n^2}\to\left(\frac{1}{5}\right)^{\infty}=0,\quad n\to\infty$$

$$\text{approx}\left(\text{seq}\left(\frac{n^3+13}{5n^3+8},n,1,10,1\right.\right.$$

$$\{1.076923077, 0.4375, 0.27$$

$$\frac{n^3+13}{5n^3+8}<1,\quad \text{if } n>1.$$

$$\frac{n^3+13}{5n^3+8}=\frac{1}{5}\cdot\frac{n^3+13}{n^3+8/5}$$

$$=\frac{1}{5}\cdot\left(\frac{n^3+1.6}{n^3+1.6}+\frac{11.4}{n^3+1.6}\right)$$

$$=\frac{1}{5}\cdot\left(1+\frac{11.4}{n^3+1.6}\right)$$

Alg Standard Real Rad

File Edit Insert Action

$$=\frac{1}{5}\cdot\left(\frac{n^3+1.6}{n^3+1.6}+\frac{11.4}{n^3+1.6}\right)$$

$$=\frac{1}{5}\cdot\left(1+\frac{11.4}{n^3+1.6}\right)$$

z(n):

$$\sqrt{n^2+4n+1}-n=\frac{4n+1}{\sqrt{n^2+4n+1}+n}$$

$$=\frac{4+1/n}{\frac{1}{n}\sqrt{n^2+4n+1}+n/n}$$

$$=\frac{4+1/n}{\sqrt{1+4/n+1/n^2}+1}\to\frac{4}{1+1}=2,$$

for $n\to\infty$

Alg Standard Real Rad


Большое спасибо за ваше внимание!