Polymath Software Report

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CACHE Trustee's Meeting
Notre Dame University
June 19, 2014

POLYMATH – Brief History

- CACHE Site Licenses Started in 1990
- Polymath Software 2014

  Currently ~ 125+ paid CACHE site licenses plus ~ 40 institutions in developing countries, used with seven textbooks, personal educational and professional versions available via Internet sales
- Himmelblau Award of CAST Division to authors 2010

Current CACHE Site Licenses (now into 25th year)

Site licenses for POLYMATH software are available through the CACHE Corporation to academic departments (mostly CHEG) to some engineering colleges and schools. Computer labs, networks, faculty, and staff receive copies on an annual basis.

Current CACHE supporting departments pay $175 for the first year and $125 for each successive year thereafter. CACHE nonmember institution rates are an initial $300 for the first year and a $250 annual fee for subsequent years.

POLYMATH Individual Educational Licenses

- **Internet Sales Currently**
  4-months $20
  12-months $30
  Unlimited use $39
- **Special Sales with Textbooks Using Polymath at 50% of the Prices Given Above**
  Thus a student with the latest Cutlip, Fogler, and Himmelblau books can get over a semester of unlimited use for ONLY $10.

POLYMATH Individual Professional License

- **Unlimited use $189**

POLYMATH Current Activities

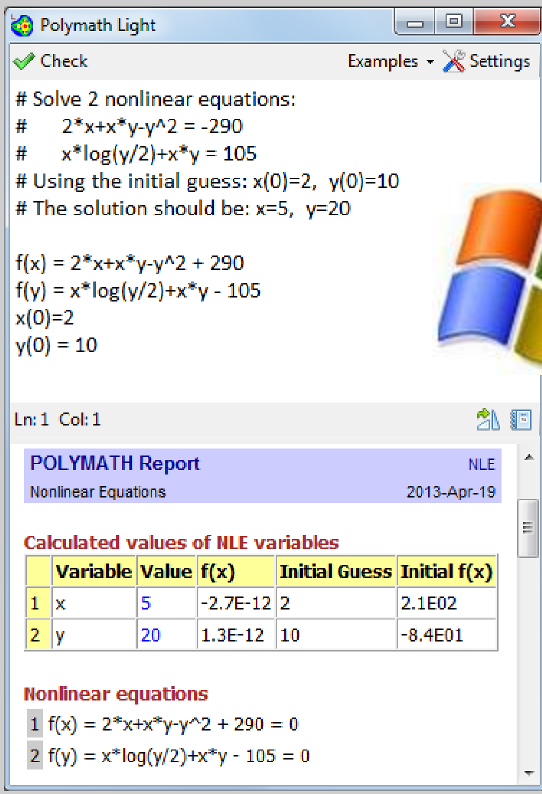
- POLYMATH 6.2 Educational Site License Version now included Limited DIPPR Database and User Interface at no cost.
- DIPPR Add-On May be made Available
  - Educational Site License Add-On $700/YR
  - Single User Educational License Add-On $100/YR
  - Single User Professional License Add-On $300/YR
- POLYMATH 7 under Development and Class Testing Underway – Completely .NET 4.0 code

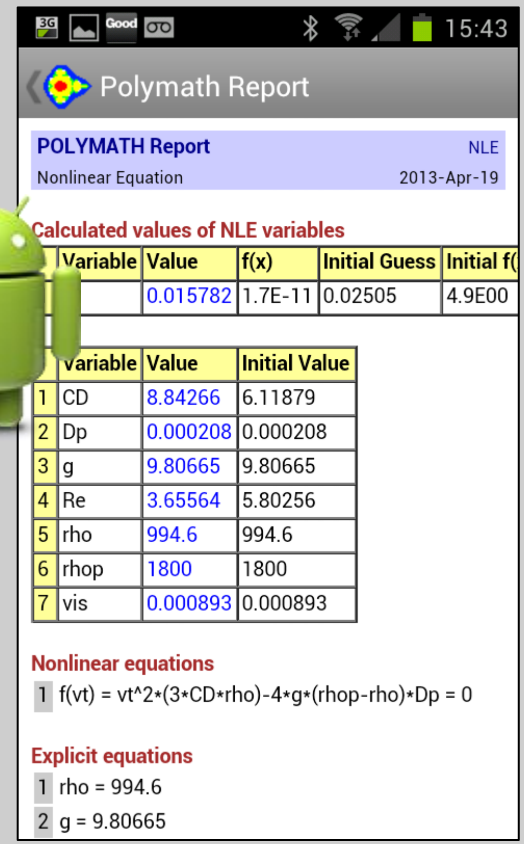
POLYMATH 7 Coming in 2014

1. **Linear Programming – New Simplex Solver**
2. **Nonlinear Equations – Automated Creation of complete MATLAB m-files**
3. **Differential Equations – Output Options, Creation of MATLAB m-file, Tabular Outputs at Desired Intervals, Export to Excel with ODE Solver Add-In**
4. **Simulation with Parameter Estimation in Dynamical Systems**
5. **DIPPR Database Interface for Constant and Variable Properties with output to Polymath, MATLAB and Excel**

PolyMathLite is Coming to Android is here!!!!!

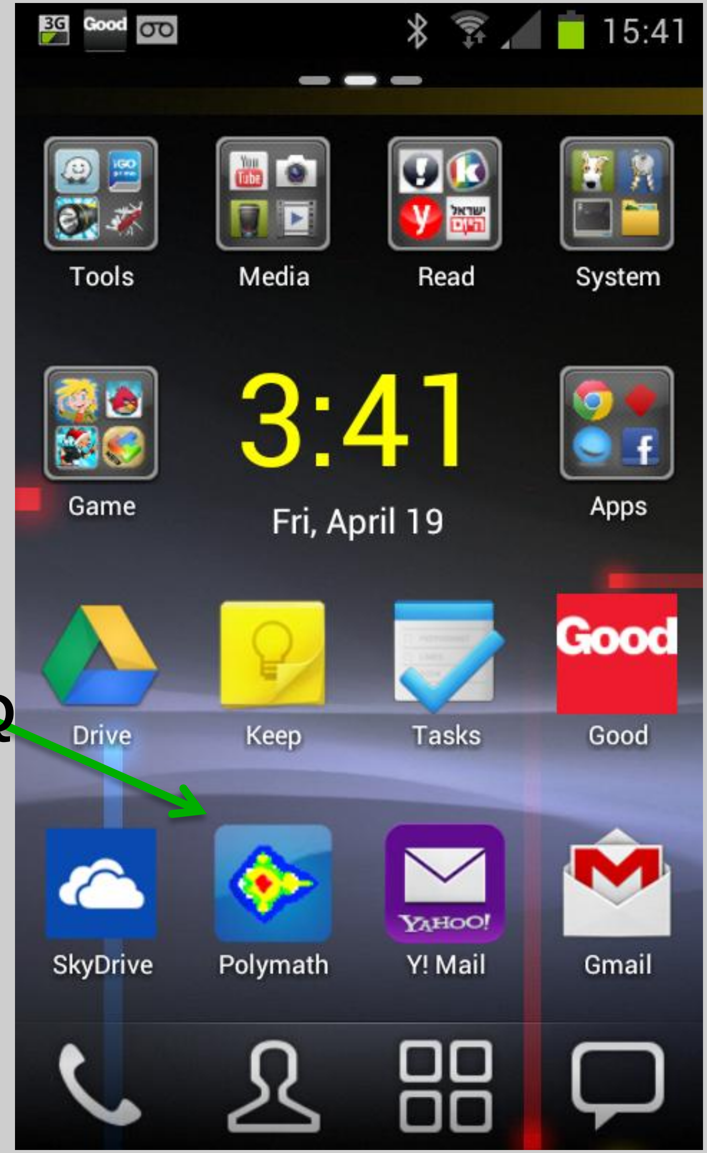
www.polymathlite.com





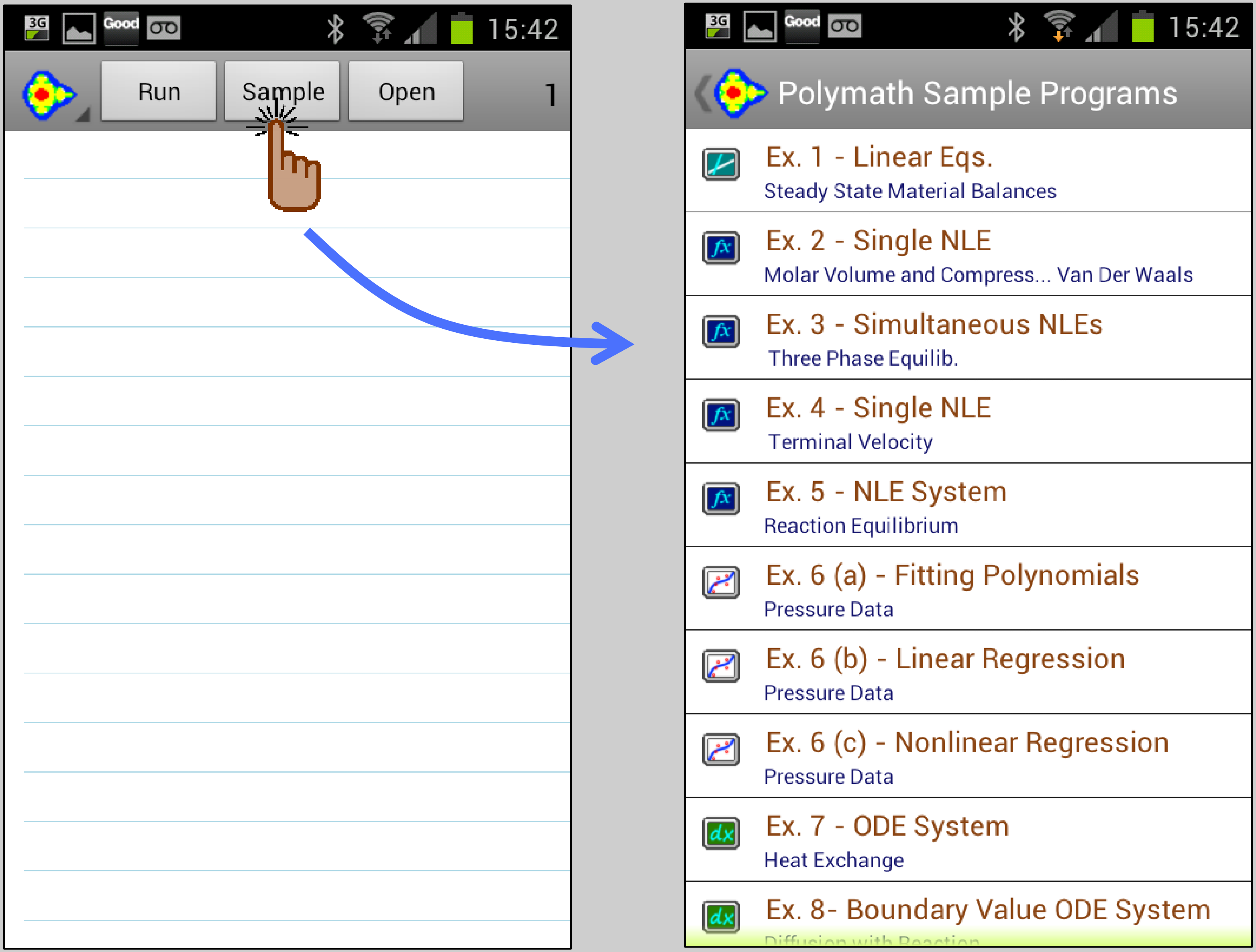
Android Based PolyMathLite

Polymath Lite

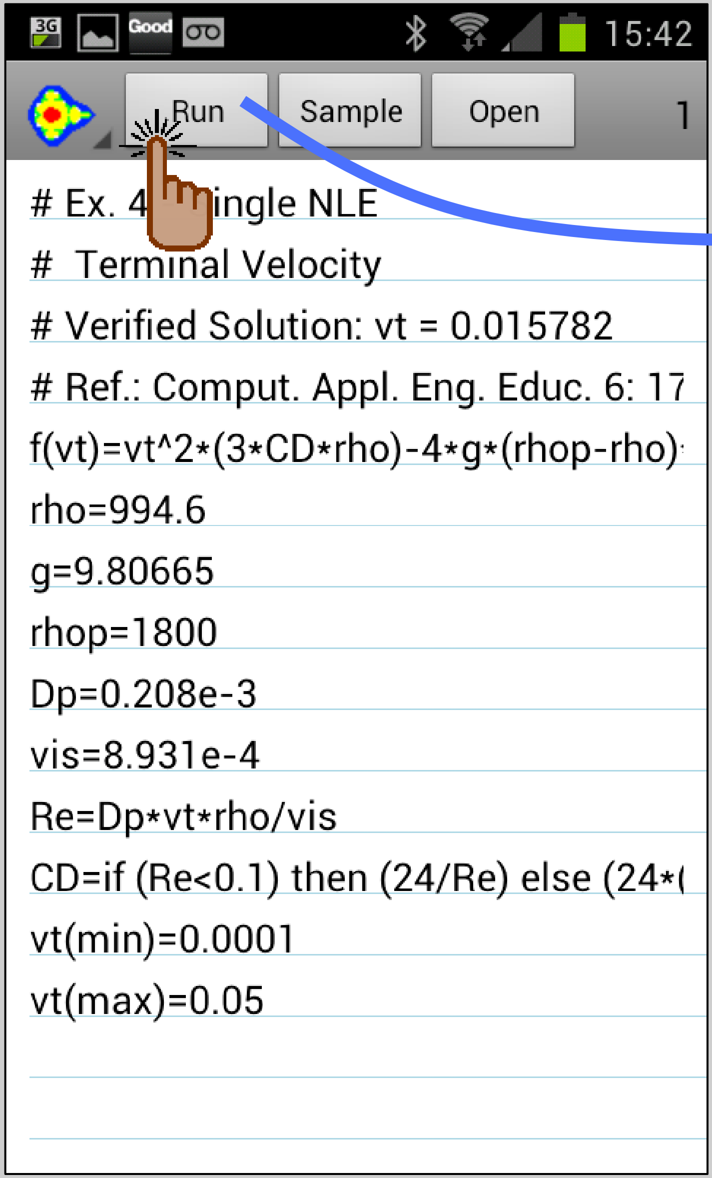


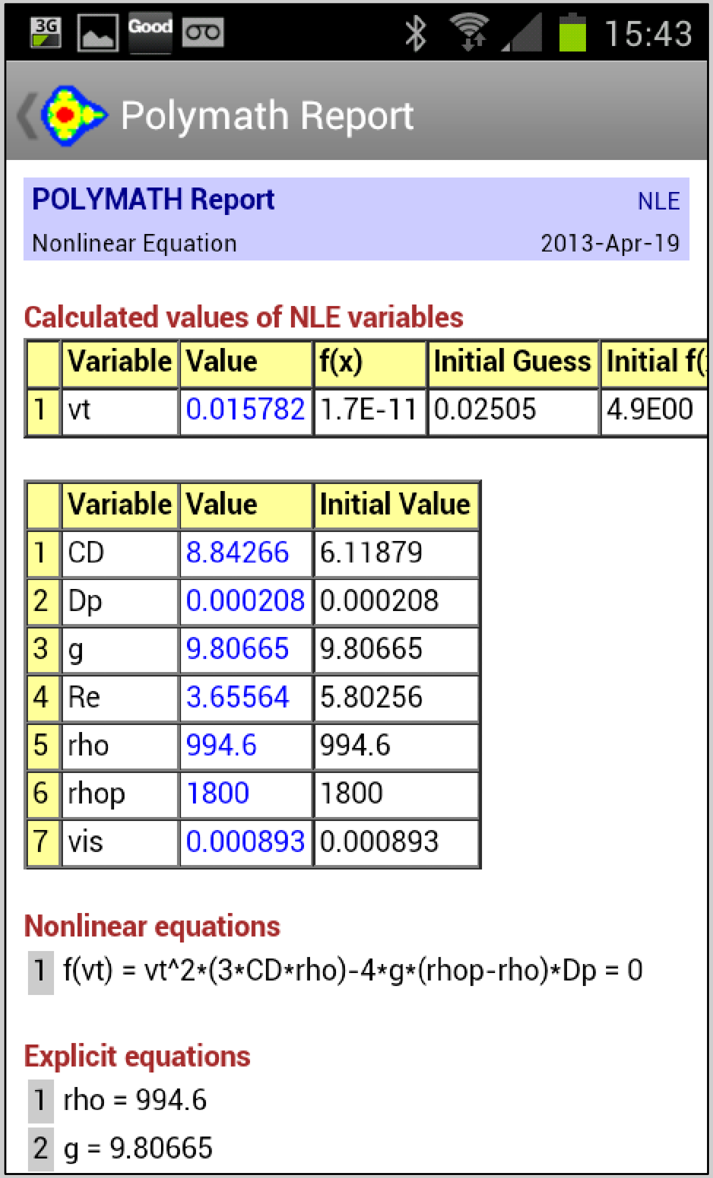
Same program syntax for NLE, DEQ
Simplified Syntax for LEQ
Simplified Syntax for REG
Access to Chart Software
Direct Conversion to Matlab
Sharing Options via E-mail and Bluetooth

Home Screen, Open Sample

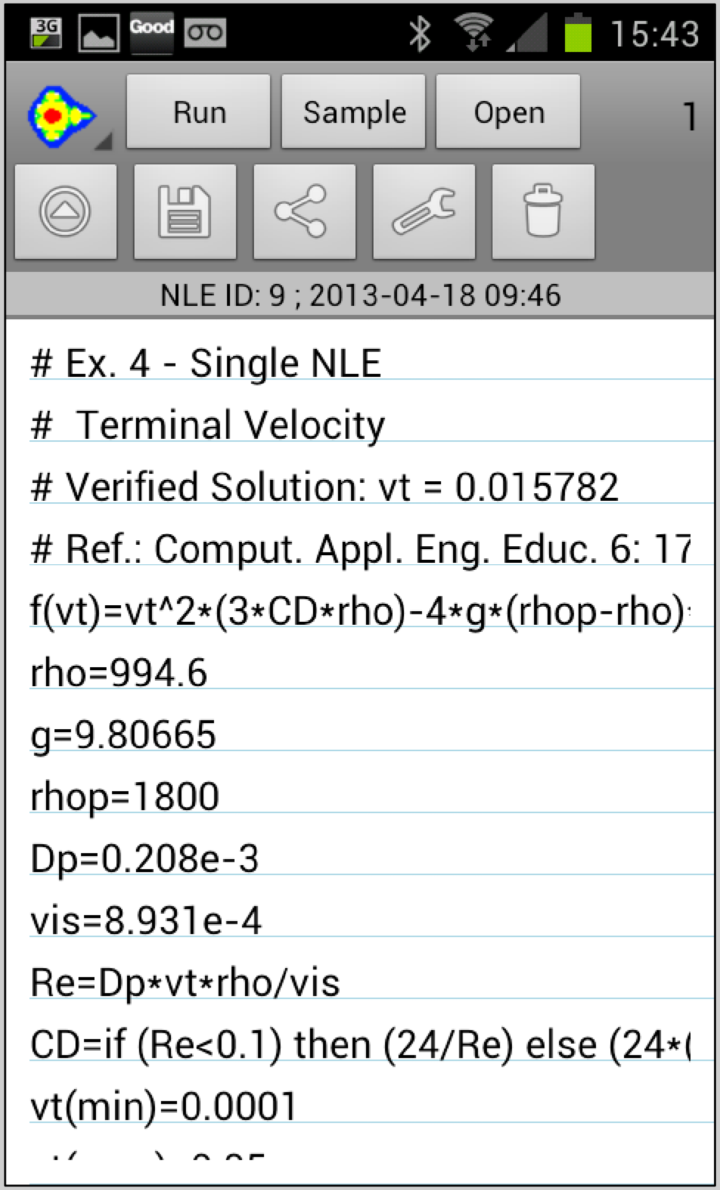


Edit Program, Run Program, Get Solution Report

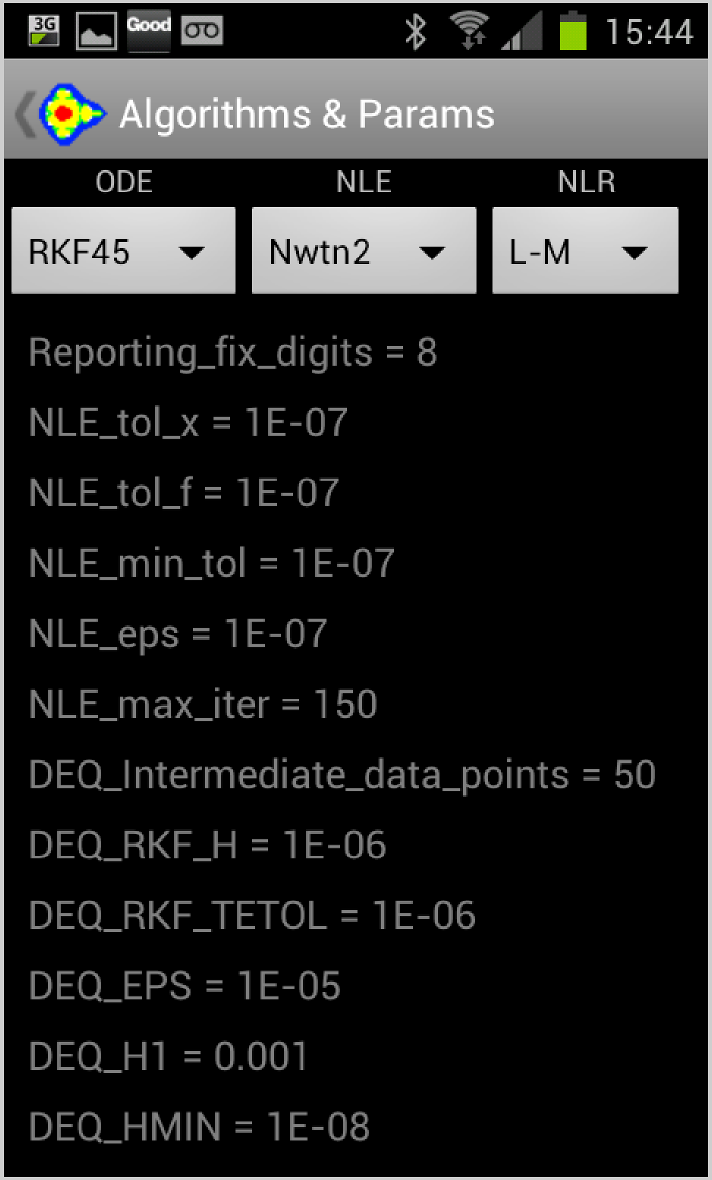




Open Saved File, Save/Share/Settings Buttons



Settings Screen



Polymath Help

Polymath Light for Android

Polymath is a proven computational system, which has been specifically created for educational or professional use. It allows the user to apply effective numerical analysis techniques during interactive problem solving on Android OS smart phones and Tablets.

Results are presented with a standard html based report for easy understanding and can be shared across for incorporation into mail messages, papers, and reports. Students, engineers, mathematicians, scientists, or anyone with a need to problems will appreciate the efficiency and speed of problem solution.

This Help will enable you to start using Polymath for engineering problem solving. For advanced applications please refer also to PolyMathLite User's Manual which is available at the website:www.polymathlite.com

Content:

1:50 AM

Polymath Help

applications please refer also to PolyMathLite User's Manual which is available at the website:www.polymathlite.com

Content:

Main Problem Entry Screen

Condition Operator	These operators return "1" if the condition met, and "0" if the condition does not meet. Examples: The expression '3>6' returns 0. The expression '4>=4' returns 1. Valid conditional operators: >, <, >=, <=, ==
Boolean Operator	The Boolean operators return "1" if the condition is met, and "0" if the condition is not met. Example: The expression '(2>3) or (1>0)' returns 1. The expression '1 and 0' returns 0. Valid Boolean operators: And, Or

If-Then-Else	There are three case-insensitive keywords which compose the if-then-else expression structure.
	The three keywords are: If, Then, Else.
	
	Samples:
	If (2>5) Then (sin(12)+4) Else (sin(12)+8)
	if(2>5)then(sin(12)+4)else(sin(12)+8)

	Open Parenthesis: (

A special 'if' statement is available, with the following syntax:

```
if (condition) then (expression1) else (expression2)
```

The parentheses are optional.
The condition may include the following operators: and, or (Boolean operators), > (greater than), < (less than), >= (greater than or equal), <= (less than or equal), == (equals).
The expressions may be any formula, including another 'if' statement.

For example:

```
A = if (x>0) then (log(x)) else(0)
b = if (T<minT) then (minT) else (if (T>maxT) then (maxT) else
(T))
Vol_h1 = if (a>5 and c<2) then 1.12 else 7.89
```

Available Functions

Available Functions

A number of standard functions are available for use in the various programs. The arguments of the functions must be enclosed in parentheses. The arguments may be themselves expressions or other functions. The nesting of functions is allowed.

Function Name	Description
abs ( )	absolute value
arccos ( )	trigonometric inverse cosine with result in radians
arccosec ( )	trigonometric inverse cosecant with result in radians
arccosech ( )	inverse hyperbolic cosecant
arcsech ()	inverse hyperbolic secant
arccosh ( )	inverse hyperbolic cosine
arccotan ( )	trigonometric inverse cotangent with result in radians
arccotanh ( )	inverse hyperbolic cotangent
arcsec ( )	trigonometric inverse secant with result in radians

cosec ( )	trigonometric cosecant with argument in radians
cosech ( )	hyperbolic cosecant
cosh ( )	hyperbolic cosine
cotan ( )	trigonometric cotangent with argument in radians
coth ( )	hyperbolic cotangent
exp ( )	exponential (e^x)
erf ( )	error function
exp10 ( )	exponential of 10 (10^x)
exp2 ( )	exponential of 2 (2^x)
fact (N)	factorial of integer part of number N (this only operates on a number)
frac ( )	fractional part
int ( )	integer part
ln ( )	natural logarithm to the base e
log ( )	logarithm to the base 10
psi ( )	psi function


1:03 AM
Polymath Sample Programs
Ex. 1 - Linear Eqs.
Steady State Material Balances
Ex. 2 - Single NLE
Molar Volume and Compress... Van Der Waals
Ex. 3 - NLE System
Three Phase Equilib.
Ex. 4 - Single NLE
Terminal Velocity
Ex. 5 - NLE System
Reaction Equilibrium
Ex. 6 (a) - Fitting Polynomials
Pressure Data
Ex. 6 (b) - Linear Regression
Pressure Data
Ex. 6 (c) - Nonlinear Regression
Pressure Data
Ex. 7 - ODE System
Heat Exchange
Ex. 8- Boundary Value ODE System
Diffusion with Reaction
Ex. 9 - ODE System
Reversible Reaction in a PBR

Run Sample Open 1

```
# Ex. 2 - Single NLE
# Molar Volume and Compress... Van Der Waals
# Verified Solution:  V=0.574892, Z =0.871827
# Ref.: Comput. Appl. Eng. Educ. 6: 171-172, 1998
f(V)=(P+a/(V^2))*(V-b)-R*T
P=56
R=0.08206
T=450
Tc=405.5
```

1:07 AM

Polymath Report

POLYMATH Report NLE

Nonlinear Equation 2013-Jun-14

Calculated values of NLE variables

	Variable	Value	f(x)	Initial Guess	Initial f(x)
1	V	0.574892	9.5E-11	0.7	5.9E00

	Variable	Value	Initial Value
1	a	4.19695	4.19695
2	b	0.037371	0.037371
3	P	56	56
4	Pc	111.3	111.3
5	Pr	0.503145	0.503145
6	R	0.08206	0.08206

1:08 AM

Polymath Report

	Variable	Value	f(x)	Initial Guess	Initial f(x)
1	V	0.574892	9.5E-11	0.7	5.9E00

	Variable	Value	Initial Value
1	a	4.19695	4.19695
2	b	0.037371	0.037371
3	P	56	56
4	Pc	111.3	111.3
5	Pr	0.503145	0.503145
6	R	0.08206	0.08206
7	T	450	450
8	Tc	405.5	405.5
9	Z	0.871827	1.06155

1:09 AM

Polymath Report

Nonlinear equations

1 f(V) = (P+a/(V^2))*(V-b)-R*T = 0

Explicit equations

1 P = 56

2 R = 0.08206

3 T = 450

4 Tc = 405.5

5 Pc = 111.3

6 Pr = P/Pc

7 a = 27*(R^2*Tc^2/Pc)/64

8 b = R*Tc/(8*Pc)

9 Z = P*V/(R*T)

1:09 AM

Polymath Report

Problem source text

```
# Ex. 2 - Single NLE
# Molar Volume and Compress... Van Der Waals
# Verified Solution: V=0.574892, Z =0.871827
# Ref.: Comput. Appl. Eng. Educ. 6: 171-172, 1998
f(V)=(P+a/(V^2))*(V-b)-R*T
P=56
R=0.08206
T=450
Tc=405.5
Pc=111.3
Pr=P/Pc
a=27*(R^2*Tc^2/Pc)/64
b=R*Tc/(8*Pc)
Z=P*V/(R*T)
```

1:10 AM

Polymath Report

Matlab formatted problem

Create m file called PolyNle.m and paste the following text into it.

```
% Polymath NLE problem conversion to Matlab
% NLE
function PolyNle
  xguess = 0.7 ;
  x = fzero(@NLEfun,xguess);
  fprintf('The NLE solution is %g\n', x);
end

function fV = NLEfun(V)
  P = 56;
  R = 0.08206;
  T = 450;
  Tc = 405.5;
  Pc = 111.3;
  Pr = P / Pc;
  a = 27 * R ^ 2 * Tc ^ 2 / Pc / 64;
  b = R * Tc / (8 * Pc);
  Z = P * V / (R * T);
  fV = (P + a / (V ^ 2)) * (V - b) - (R * T);
end
```

1:10 AM

Polymath Report

```
  Pr = P / Pc;
  a = 27 * R ^ 2 * Tc ^ 2 / Pc / 64;
  b = R * Tc / (8 * Pc);
  Z = P * V / (R * T);
  fV = (P + a / (V ^ 2)) * (V - b) - (R * T);
end
```

General Settings

Total number of equations	10
Number of implicit equations	1
Number of explicit equations	9
Elapsed time	0.07 sec
Reporting digits	8
Solution method	safenewt
Max iterations	150
Tolerance F	1E-07
Tolerance X	1E-07
Tolerance min	1E-07

Data file: no file

1:12 AM

```
# Ex. 2 - Single NLE
# Molar Volume and Compress... Van Der Waals
# Verified Solution:  V=0.574892, Z =0.871827
# Ref.: Comput. Appl. Eng. Educ. 6: 171-172, 1998
f(V)=(P+a/(V^2))*(V-b))-R*T
P=56
R=0.08206
T=450
Tc=405.5
Pc=111.3
```

Done

1:12 AM

Run Sample Open 5

```
# Ex. 2 - Single NLE
# Molar Volume and Compress... Van Der Waals
# Verified Solution:  V=0.574892, Z =0.871827
# Ref.: Comput. Appl. Eng. Educ. 6: 171-172, 1998
f(V)=(P+a/(V^2))*(V-b))-R*T
P=56
R=0.08206
T=450
Tc=405.5
```

Polymath Report

Errors in NLE

	Message
1	Error in Line #5, unequal number of parantheses. Too many ')'
2	Implicit variables (1) V
3	Explicit variables (9) P, R, T, Tc, Pc, Pr, a, b, Z
4	All variables (10) P, a, V, b, R, T, Tc, Pc, Pr, Z

1:14 AM

```
# Ex. 2 - Single NLE
# Molar Volume and Compress... Van Der Waals
# Verified Solution:  V=0.574892, Z =0.871827
# Ref.: Comput. Appl. Eng. Educ. 6: 171-172, 1998
f(V)=(P+a/(V^2))*(V-b)-R*T
P=56
R=0.08206
T=450
Tc=405.5
```

Done

1:15 AM

Polymath Report

Errors in NLE

	Message
1	1 Undefined variable exists; v
2	Implicit variables (1) V
3	Explicit variables (9) P, R, T, Tc, Pc, Pr, a, b, Z
4	All variables (11) P, a, V, v, b, R, T, Tc, Pc, Pr, Z

1:16 AM

Polymath Sample Programs

Ex. 12 - Single Partial Diff. Eq.
Unsteady State Heat Conduction.

Ex. 13 - Nonlinear Regression
Catalytic Reforming Reac.

Ex. 14(a) - Multi-Linear Regression
Heat of Hardening

Ex. 14(b) - Multi-Linear Regression via origin
Heat of Hardening

Ex. 15 - Linear Eqs.
Biological Reactors

Ex. 16 - Stiff ODE System
Biological Reactors

1:17 AM

Run | Sample | Open | 7

```
# Ex. 12 - Single Partial Diff. Eq.
# Unsteady State Heat Conduction.
# Verified final values: T2= 48.6618,  T4= 52.644
# T6= 50.7581,  T8= 50.701, T10= 50.9248
# Ref.:Prob. 9.12 in  Problem Solving in Chemical...
d(T4)/d(t)=alpha/deltax^2*(T5-2*T4+T3)
d(T5)/d(t)=alpha/deltax^2*(T6-2*T5+T4)
d(T3)/d(t)=alpha/deltax^2*(T4-2*T3+T2)
d(T6)/d(t)=alpha/deltax^2*(T7-2*T6+T5)
```

1:19 AM

Run Sample Open 19

```
tau=365
t0=37
T11=Tm
Ts=Tm-deltaTs*cos((2*3.1416/tau)*(t-t0))
T1=Ts
t(0)=0
T4(0)=51
T5(0)=51
```

1:20 AM

Run Sample Open 7

```
# Ex. 12 - Single Partial Diff. Eq.
# Unsteady State Heat Conduction.
# Verified final values: T2= 48.6618,  T4= 52.644
# T6= 50.7581,  T8= 50.701, T10= 50.9248
# Ref.:Prob. 9.12 in  Problem Solving in Chemical...
d(T4)/d(t)=alpha/deltax^2*(T5-2*T4+T3)
d(T5)/d(t)=alpha/deltax^2*(T6-2*T5+T4)
d(T3)/d(t)=alpha/deltax^2*(T4-2*T3+T2)
d(T6)/d(t)=alpha/deltax^2*(T7-2*T6+T5)
```

1:20 AM

Polymath Report

POLYMATH Report DEQ

Ordinary Differential Equations 2013-Jun-14

Calculated values of DEQ variables

	Variable	Initial value	Final value	Minimal value	Maximal value
1	alpha	0.9	0.9	0.9	0.9
2	deltaTs	25	25	25	25
3	deltax	8	8	8	8
4	t	0	365	0	365
5	t0	37	37	37	37
6	T1	30.9018	30.9016	26.0001	75.9937
7	T10	51	50.9248	50.9248	51
8	T11	51	51	51	51
9	T2	51	48.6618	39.6826	61.7579

1:21 AM

Polymath Report

Differential equations

1 d(T4)/d(t) = alpha/deltax^2*(T5-2*T4+T3)
2 d(T5)/d(t) = alpha/deltax^2*(T6-2*T5+T4)
3 d(T3)/d(t) = alpha/deltax^2*(T4-2*T3+T2)
4 d(T6)/d(t) = alpha/deltax^2*(T7-2*T6+T5)
5 d(T2)/d(t) = alpha/deltax^2*(T3-2*T2+T1)
6 d(T7)/d(t) = alpha/deltax^2*(T8-2*T7+T6)
7 d(T8)/d(t) = alpha/deltax^2*(T9-2*T8+T7)
8 d(T9)/d(t) = alpha/deltax^2*(T10-2*T9+T8)
9 d(T10)/d(t) = alpha/deltax^2*(T11-2*T10+T9)

Explicit equations

1 alpha = 0.9

1:22 AM

Polymath Report

Problem source text

```
# Ex. 12 - Single Partial Diff. Eq.
# Unsteady State Heat Conduction.
# Verified final values: T2= 48.6618, T4= 52.644
# T6= 50.7581, T8= 50.701, T10= 50.9248
# Ref.:Prob. 9.12 in Problem Solving in Chemical...
d(T4)/d(t)=alpha/deltax^2*(T5-2*T4+T3)
d(T5)/d(t)=alpha/deltax^2*(T6-2*T5+T4)
d(T3)/d(t)=alpha/deltax^2*(T4-2*T3+T2)
d(T6)/d(t)=alpha/deltax^2*(T7-2*T6+T5)
d(T2)/d(t)=alpha/deltax^2*(T3-2*T2+T1)
d(T7)/d(t)=alpha/deltax^2*(T8-2*T7+T6)
d(T8)/d(t)=alpha/deltax^2*(T9-2*T8+T7)
d(T9)/d(t)=alpha/deltax^2*(T10-2*T9+T8)
d(T10)/d(t)=alpha/deltax^2*(T11-2*T10+T9)
alpha=0.9
deltax=8
Tm=51
```

Polymath Report

Matlab formatted problem

Create m file called PolyOde.m and paste the following text into it.

```
% Polymath ODE problem conversion to Matlab
% DEQ
function PolyOde
  tspan = [0 365]; % Range for the independent variable
  y0 = [51; 51; 51; 51; 51; 51; 51; 51; 51]; % Initial values for the dependent variables
  [t,y]=ode45(@ODEfun,tspan, y0);
  plot (t,y);
  xlabel('t');
  legend('T4','T5','T3','T6','T2','T7','T8','T9','T10');
  fprintf('T4 = %16.6f \n',y(length(y),1));
  fprintf('T5 = %16.6f \n',y(length(y),2));
  fprintf('T3 = %16.6f \n',y(length(y),3));
  fprintf('T6 = %16.6f \n',y(length(y),4));
  fprintf('T2 = %16.6f \n',y(length(y),5));
  fprintf('T7 = %16.6f \n',y(length(y),6));
  fprintf('T8 = %16.6f \n',y(length(y),7));
  fprintf('T9 = %16.6f \n',y(length(y),8));
  fprintf('T10 = %16.6f \n',y(length(y),9));
end

function dYfuncvecdt = ODEfun(t,Yfuncvec)
```

Polymath Report

```
  T7 = Yfuncvec(6);
  T8 = Yfuncvec(7);
  T9 = Yfuncvec(8);
  T10 = Yfuncvec(9);
  alpha = 0.9;
  deltax = 8;
  Tm = 51;
  deltaTs = 25;
  tau = 365;
  t0 = 37;
  T11 = Tm;
  Ts = Tm - (deltaTs * cos(2 * 3.1416 / tau * (t - t0)));
  T1 = Ts;
  dT4dt = alpha / (deltax ^ 2) * (T5 - (2 * T4) + T3);
  dT5dt = alpha / (deltax ^ 2) * (T6 - (2 * T5) + T4);
  dT3dt = alpha / (deltax ^ 2) * (T4 - (2 * T3) + T2);
  dT6dt = alpha / (deltax ^ 2) * (T7 - (2 * T6) + T5);
  dT2dt = alpha / (deltax ^ 2) * (T3 - (2 * T2) + T1);
  dT7dt = alpha / (deltax ^ 2) * (T8 - (2 * T7) + T6);
  dT8dt = alpha / (deltax ^ 2) * (T9 - (2 * T8) + T7);
  dT9dt = alpha / (deltax ^ 2) * (T10 - (2 * T9) + T8);
  dT10dt = alpha / (deltax ^ 2) * (T11 - (2 * T10) + T9);
  dYfuncvecdt = [dT4dt; dT5dt; dT3dt; dT6dt; dT2dt; dT7dt; dT8dt; dT9dt; dT10dt];
end
```

1:24 AM

Polymath Report

General

Total number of equations	18
Number of differential equations	9
Number of explicit equations	9
Reporting digits	8
Elapsed time	0.30 sec
Solution method	RKF_45
Step size guess. h	1E-06
Truncation error tolerance. eps	1E-06
Calculated Intermediate data points	50

Data file: no file

Calculated data points

	t	T4	T5	T3	T6	T2	T7	T8	T9	T10	T11	Ts	T1
1	0	51	51	51	51	51	51	51	51	51	51	30.9018	30.9018
2	16.7188	50.9674	50.9982	50.5598	50.9999	46.8263	51	51	51	51	51	27.9524	27.9524
3	22.5588	50.9273	50.9945	50.2582	50.9997	45.6043	51	51	51	51	51	27.1082	27.1082
4	34.2388	50.7897	50.9765	49.5305	50.9978	43.5003	50.9998	51	51	51	51	26.1195	26.1195

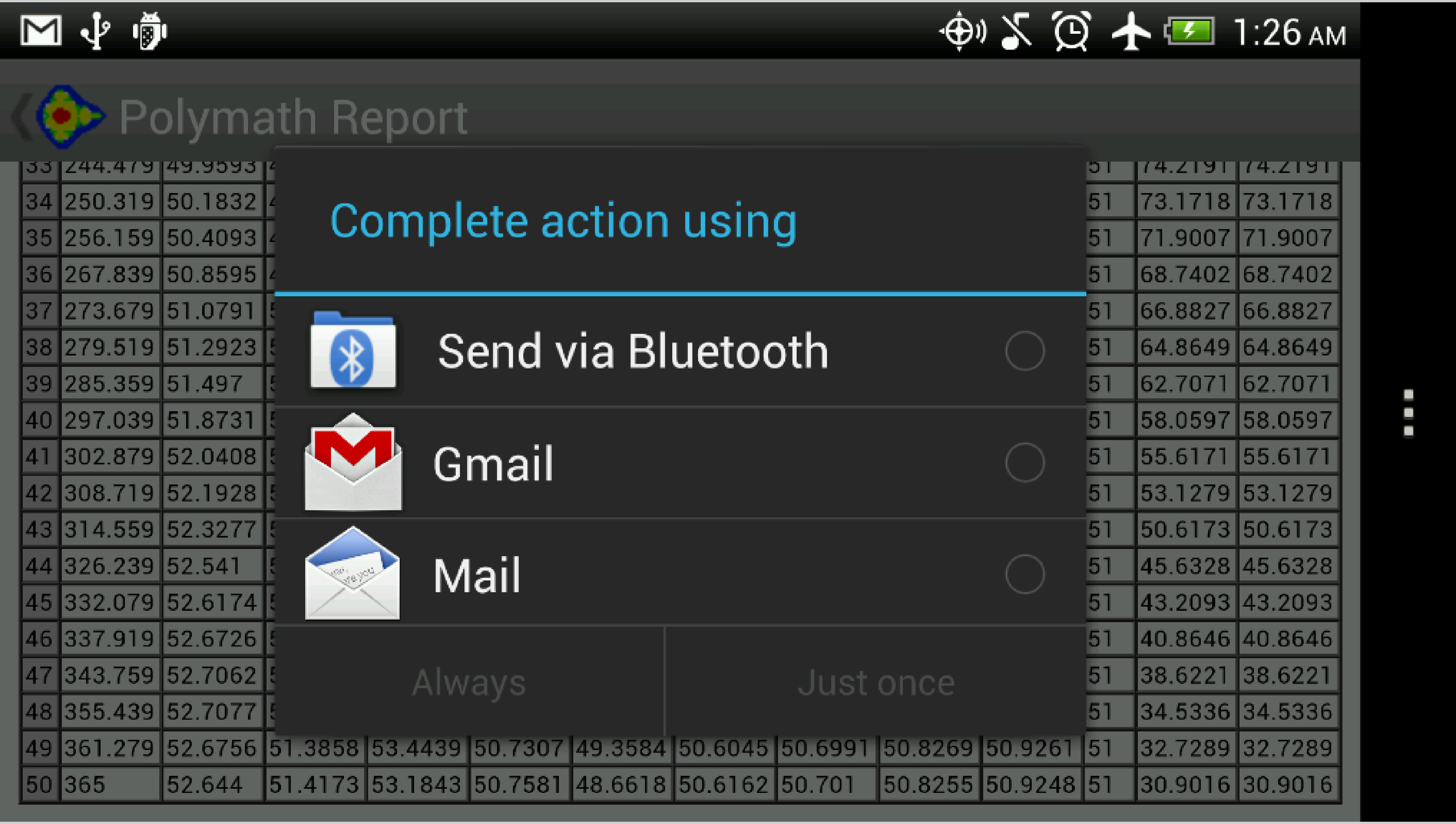
1:25 AM

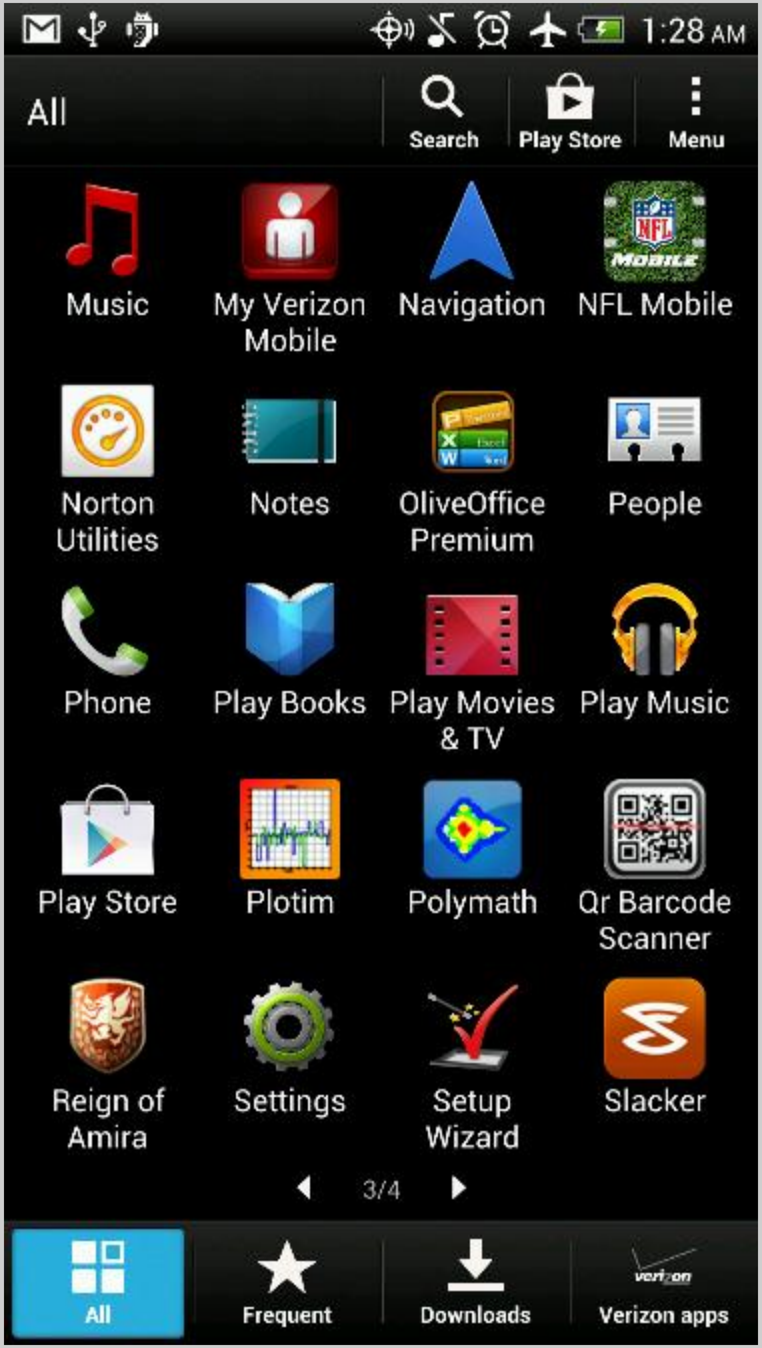
Polymath Report

33	244.479	49.9593	49.6506	52.9726	50.1131	61.2682	50.5534	50.8104	50.9297	50.9783	51	74.2191	74.2191
34	250.319	50.1832	49.7177	53.3932	50.1134	61.5561	50.5391	50.7992	50.9238	50.976	51	73.1718	73.1718
35	256.159	50.4093	49.7918	53.7848	50.118	61.7347	50.5262	50.7882	50.9178	50.9737	51	71.9007	71.9007
36	267.839	50.8595	49.9587	54.4654	50.14	61.7579	50.5056	50.7671	50.9056	50.9686	51	68.7402	68.7402
37	273.679	51.0791	50.0499	54.7479	50.1571	61.6025	50.498	50.7573	50.8994	50.966	51	66.8827	66.8827
38	279.519	51.2923	50.1451	54.9879	50.1783	61.3374	50.4922	50.7479	50.8932	50.9633	51	64.8649	64.8649
39	285.359	51.497	50.2435	55.1831	50.2032	60.9655	50.4884	50.7392	50.887	50.9605	51	62.7071	62.7071
40	297.039	51.8731	50.4459	55.4321	50.2634	59.9171	50.4867	50.7236	50.875	50.9549	51	58.0597	58.0597
41	302.879	52.0408	50.5482	55.4835	50.2982	59.2514	50.4888	50.717	50.8692	50.952	51	55.6171	55.6171
42	308.719	52.1928	50.6497	55.4854	50.3357	58.5	50.4929	50.7112	50.8636	50.9492	51	53.1279	53.1279
43	314.559	52.3277	50.7497	55.4379	50.3755	57.6706	50.4988	50.7062	50.8582	50.9463	51	50.6173	50.6173
44	326.239	52.541	50.9411	55.1973	50.4606	55.8119	50.5162	50.6989	50.8483	50.9408	51	45.6328	45.6328
45	332.079	52.6174	51.0307	55.0068	50.5052	54.8016	50.5275	50.6966	50.8438	50.9381	51	43.2093	43.2093
46	337.919	52.6726	51.1151	54.7719	50.5505	53.7507	50.5403	50.6953	50.8396	50.9354	51	40.8646	40.8646
47	343.759	52.7062	51.1935	54.4951	50.5961	52.6699	50.5546	50.6949	50.8358	50.9329	51	38.6221	38.6221
48	355.439	52.7077	51.3295	53.8277	50.6866	50.4626	50.5868	50.6968	50.8294	50.9282	51	34.5336	34.5336
49	361.279	52.6756	[illegible]	53.4439	50.7307	49.3584	50.6045	50.6991	[illegible]	[illegible]	[illegible]	32.7289	32.7289
50	365	52.644	51.4173	53.1843	50.7581	48.6618	50.6162	50.701	50.8255	50.9248	51	30.9016	30.9016

Mail

Copy Tables


1:26 AM
Polymath Report
Complete action using
Send via Bluetooth
Gmail
Mail
Always
Just once


1:28 AM
All
Search
Play Store
Menu
Music
My Verizon Mobile
Navigation
NFL Mobile
Norton Utilities
Notes
OliveOffice Premium
People
Phone
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Play Movies & TV
Play Music
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Plotim
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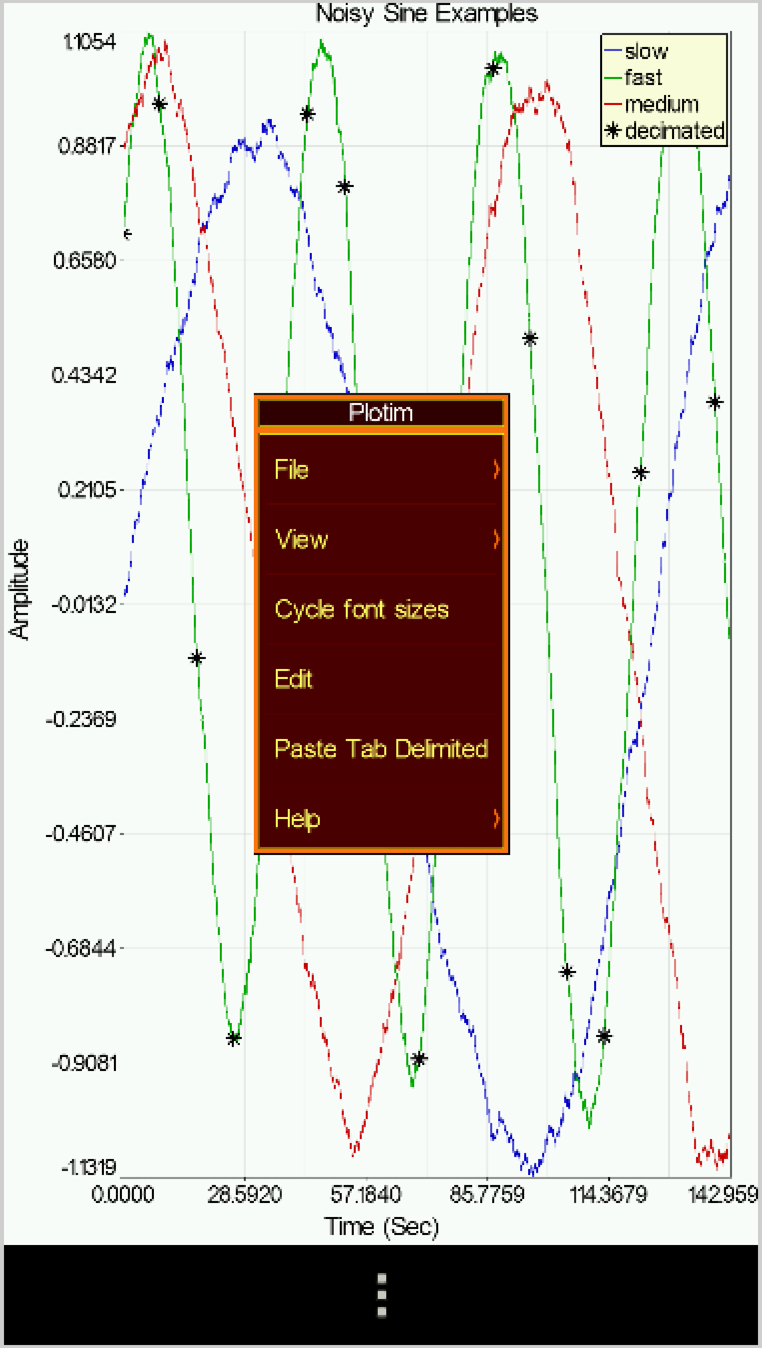
Verizon apps



Noisy Sine Examples
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-0.9081
-1.1319
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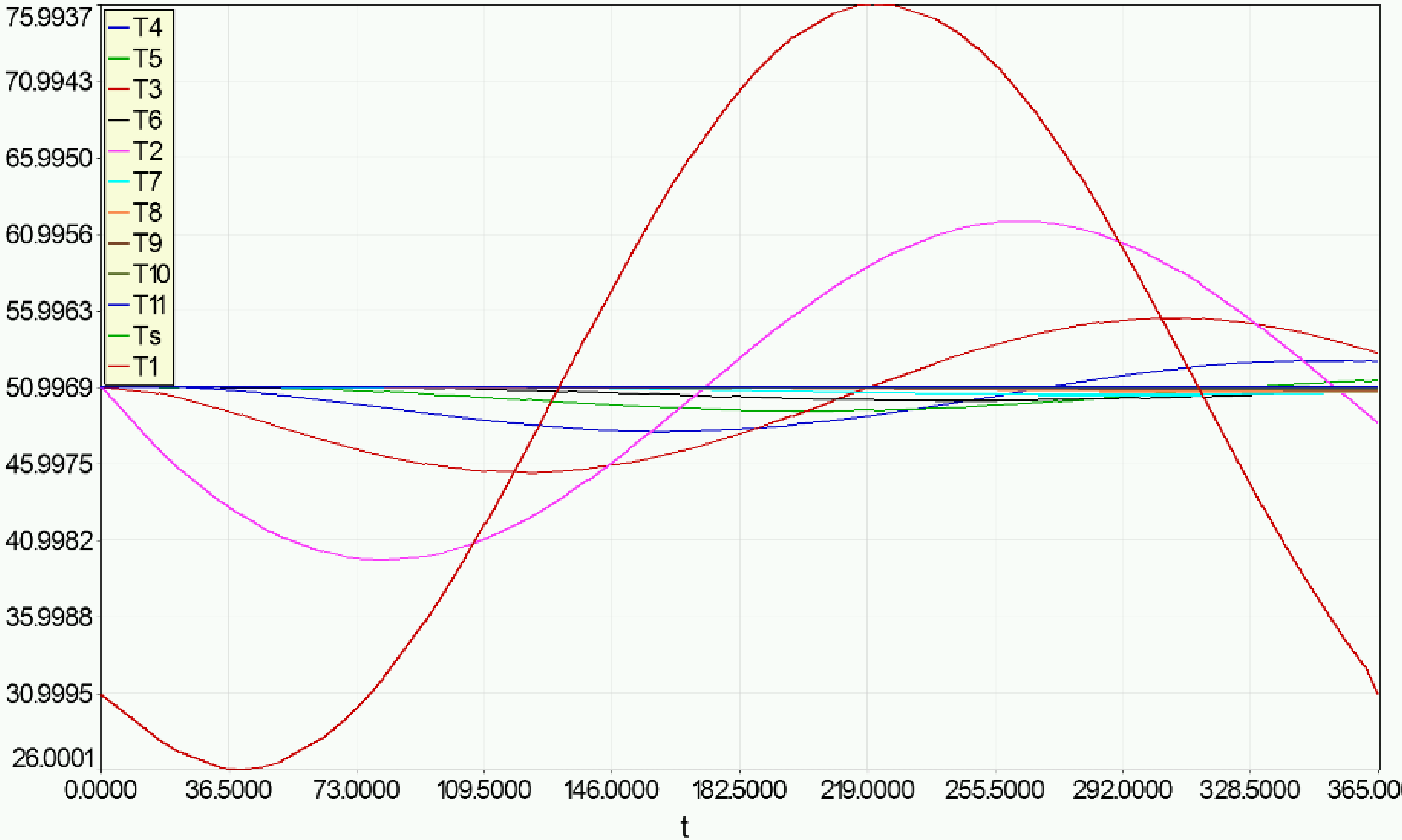

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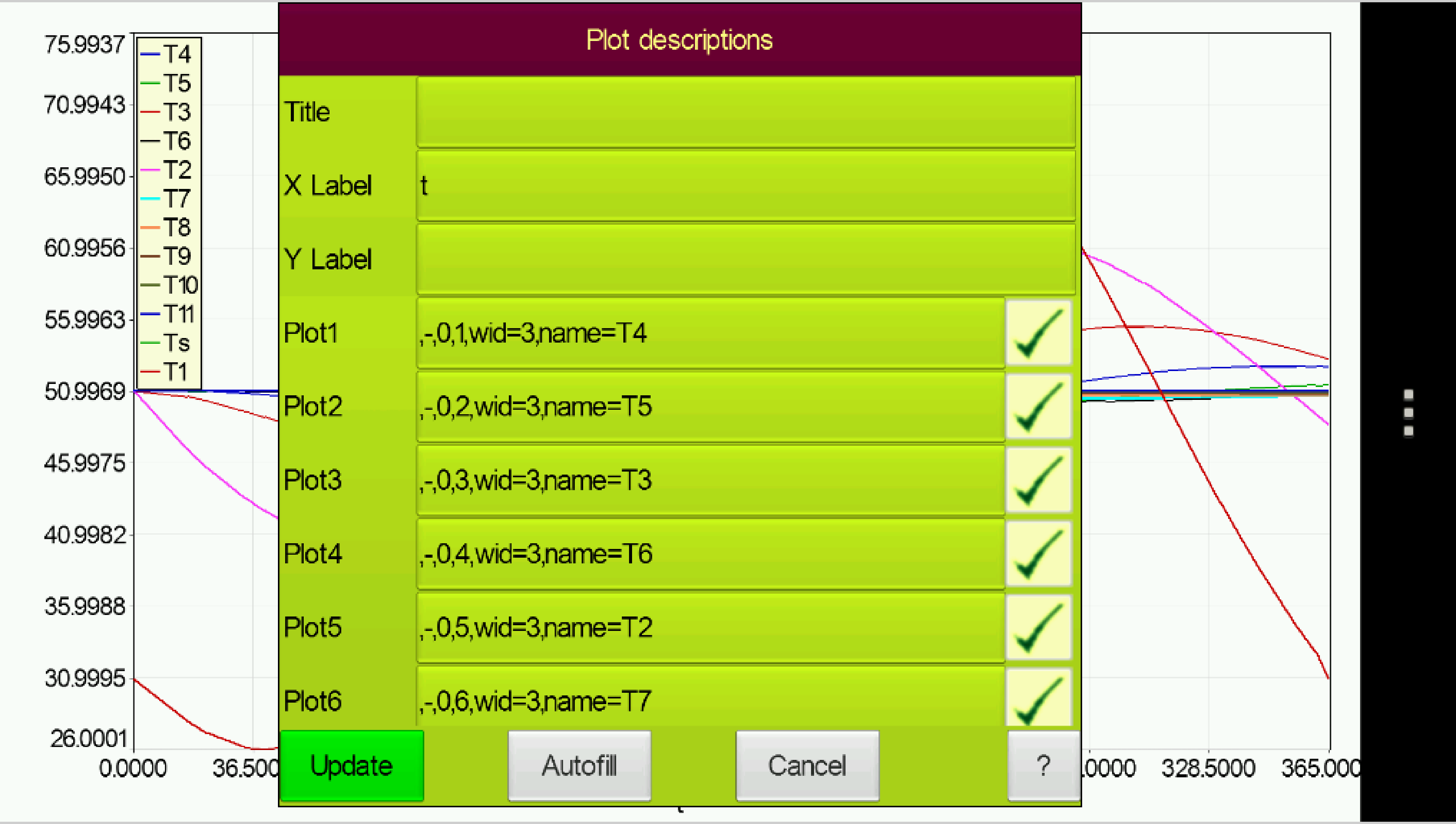
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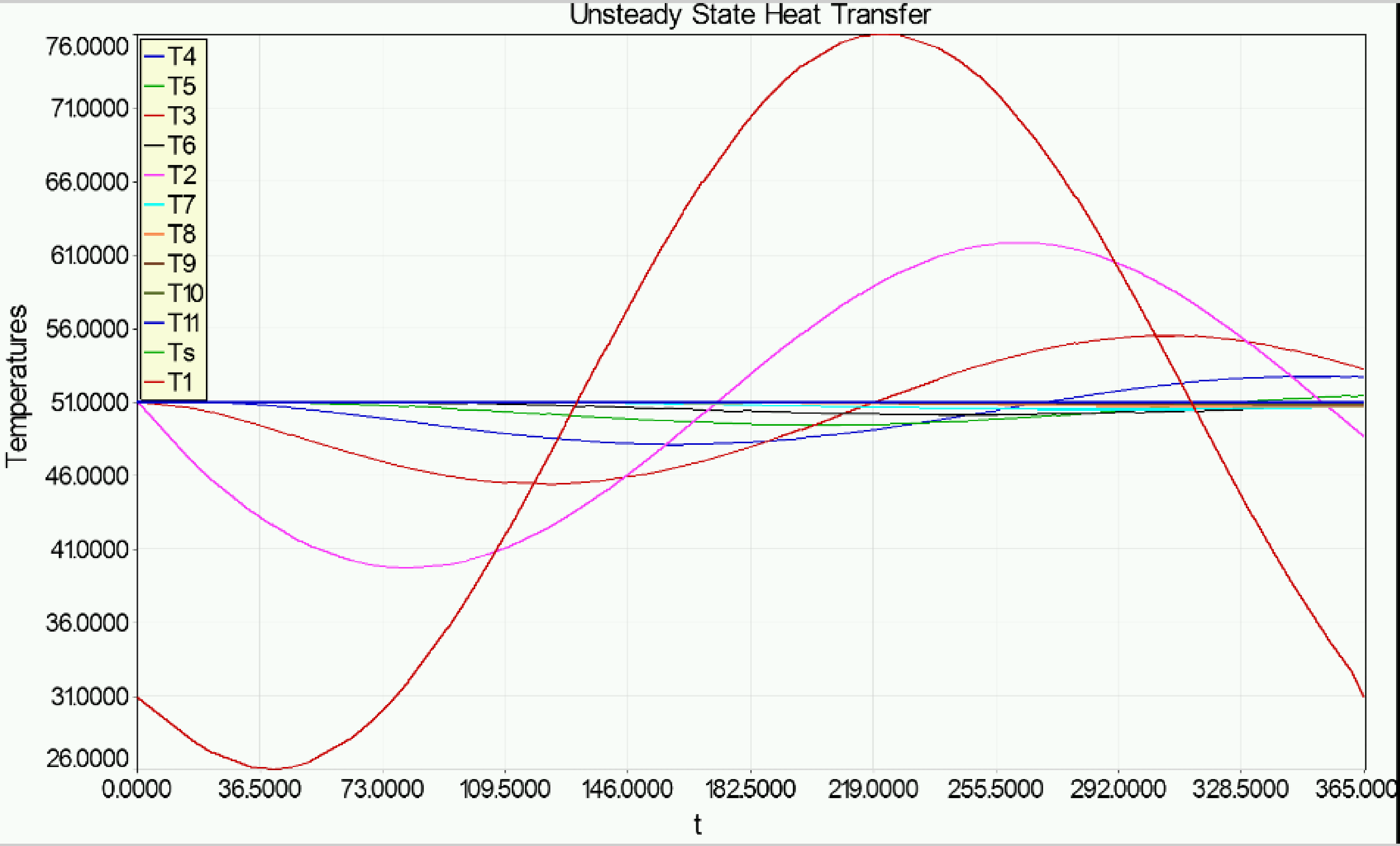
Unsteady State Heat Transfer
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6:55 AM

Polymath Sample Programs

Ex. 4 - Single NLE
Terminal Velocity

Ex. 5 - NLE System
Reaction Equilibrium

Ex. 6 (a) - Fitting Polynomials
Pressure Data

Ex. 6 (b) - Linear Regression
Pressure Data

Ex. 6 (c) - Nonlinear Regression
Pressure Data

Ex. 7 - ODE System
Heat Exchange

```
# Ex. 6 (c) - Nonlinear Regression
# Pressure Data
# Verified Solution: A =5.76735, B = 677.094, C= 153.885
# Ref.: Comput. Appl. Eng. Educ. 6: 173, 1998
TC = [-36.7, -19.6, -11.5, -2.6, 7.6, 15.4, 26.1, 42.2, 60.6, 80.1]
P = [1, 5, 10, 20, 40, 60, 100, 200, 400, 760]
logP=log(P)
nlinfit logP=A-B/(C+TC)
m(A)= 8.752
```

Polymath Report

POLYMATH Report REG

Nonlinear Regression (L-M) 2013-Jun-15

Model: logP = A-B/(C+TC)

Variable	Initial guess	Value	95% confidence
A	8.752	5.76735	0.152084
B	2035	677.094	48.1591
C	273	153.885	5.68709

R^2	R^2adj	Rmsd	Variance
0.9996879	0.9995987	0.0047228	0.0003186

Source data points and calculated data points

7:13 AM

Run Sample Open 6

```
# Ref.: Comput. Appl. Eng. Educ. 6: 173, 1998
TC = [-36.7, -19.6, -11.5, -2.6, 7.6, 15.4, 26.1, 42.2, 60.6, 80.1]
P = [1, 5, 10, 20, 40, 60, 100, 200, 400, 560]
logP=log(P)
nlinfit logP=A-B/(C+TC)
m(A)= 8.752
m(B)= 2035
m(C)=273
```

7:13 AM

Polymath Report

POLYMATH Report REG

Nonlinear Regression (L-M) 2013-Jun-14

Model: logP = A-B/(C+TC)

Variable	Initial guess	Value	95% confidence
A	8.752	5.24952	0.021573
B	2035	533.906	3.14521
C	273	137.924	0.75135

R^2	R^2adj	Rmsd	Variance
0.9988048	0.9984633	0.0090329	0.0011656

Source data points and calculated data points

1:38 AM

Polymath Sample Programs

Ex. 1 - Linear Eqs.
Steady State Material Balances

Ex. 2 - Single NLE
Molar Volume and Compress... Van Der Waals

Ex. 3 - NLE System
Three Phase Equilib.

Ex. 4 - Single NLE
Terminal Velocity

Ex. 5 - NLE System
Reaction Equilibrium

Ex. 6 (a) - Fitting Polynomials
Pressure Data

Polymath Sample Programs

Ex. 6 (b) - Linear Regression
Pressure Data

Ex. 6 (c) - Nonlinear Regression
Pressure Data

Ex. 7 - ODE System
Heat Exchange

Ex. 8- Boundary Value ODE System
Diffusion with Reaction

Ex. 9 - ODE System
Reversible Reaction in a PBR

Ex. 10(a) - ODE System
Dynamics of Heated Tank-Open loop


1:43 AM
Polymath Sample Programs
Ex. 10(b) - ODE System
Dynamics of Heated Tank-Closed loop
Ex. 10(c) - ODE System
Dynamics of Heated Tank-limits on energy input
Ex. 11(a) - Single NLE
Initial Bubble Point.
Ex. 11(b) - DAE System
Binary Batch Distillation
Ex. 12 - Single Partial Diff. Eq.
Unsteady State Heat Conduction.
Ex. 13 - Nonlinear Regression
Catalytic Reforming Reac.

1:44 AM

Polymath Sample Programs

Ex. 11(b) - DAE System
Binary Batch Distillation

Ex. 12 - Single Partial Diff. Eq.
Unsteady State Heat Conduction.

Ex. 13 - Nonlinear Regression
Catalytic Reforming Reac.

Ex. 14(a) - Multi-Linear Regression
Heat of Hardening

Ex. 14(b) - Multi-Linear Regression via origin
Heat of Hardening

Ex. 15 - Linear Eqs.
Biological Reactors

1:45 AM

Polymath Sample Programs

Ex. 15 - Linear Eqs.
Biological Reactors

Ex. 16 - Stiff ODE System
Biological Reactors

Ex. 17 - NLE System
Combustion of Propane

Ex. 18 - NLE System
Complex Chemical Equilibrium

Ex. 19 - Consecutive calculations
Gas pressure from SRK equation of state

Ex. 20 - Consecutive calculations
Physical property calculator for liquid CO2