Coding in the Classroom for Comprehension And Contextual Learning

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Why Teach Kids to Program in a Math Class?

- Some ideas in mathematics are routines/procedures
- Sometimes kids are taught to rotely memorize these procedures and they quickly forget them
- Conceptual understanding of the ideas leads to the ability to remember longer
- Being able to break down the steps of the procedure into a programming language can lead to that conceptual understanding

What procedures might you choose from Algebra, PreCalculus and Calculus

- Systems of Linear Equations (two equations and two unknowns)
- Quadratics
  - Completing the Square/Quadratic Formula
  - Vertex of form of a Parabola
- Slope of a Secant Line/Difference Quotient (as the points grow closer)
- Polynomials
  - End Behavior/Limits at infinity
  - Asymptotes/Limits at a
- Lines
  - Slope, y-intercept, and x-intercept given a line in standard form
  - The slope and equation of a line given two points
  - The equation of a line given a point and slope

Enhance student understanding

CCSS.Math.Content.HSF.IF.C.7.a

Graph linear and quadratic functions and show intercepts, maxima, and minima.

CCSS.Math.Content.HSF.IF.C.7.c

Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

CCSS.Math.Content.HSF.IF.C.7.d

(+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

CCSS.Math.Content.HSF.IF.C.7.e

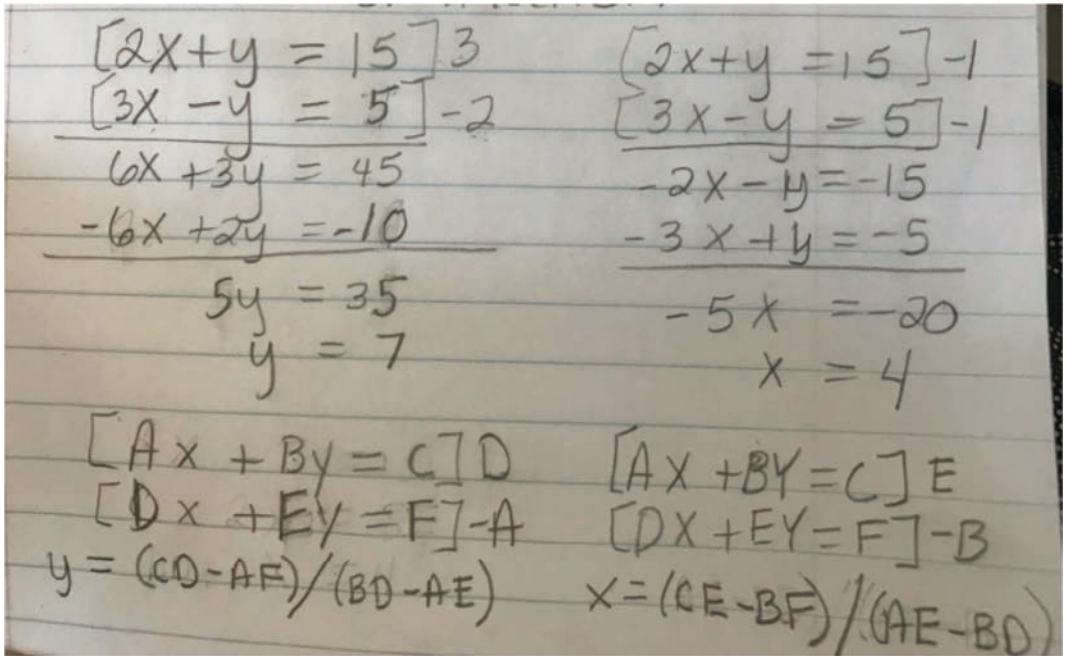
Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Systems of Linear Equations
(2 equations and 2 unknowns)

$2x + y = 15$

$3x - y = 5$

Systems of Linear Equations
(2 equations and 2 unknowns)



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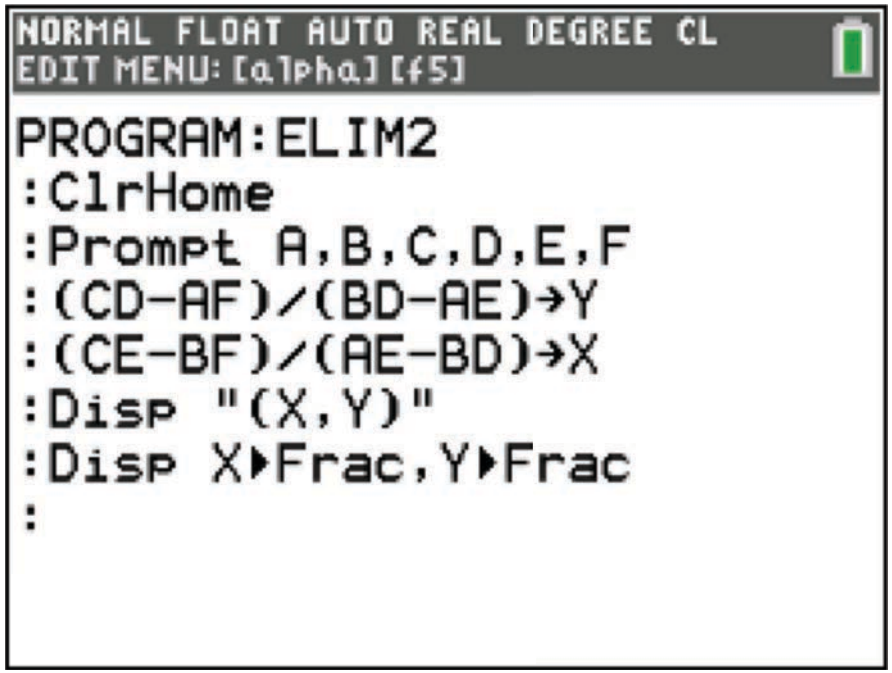
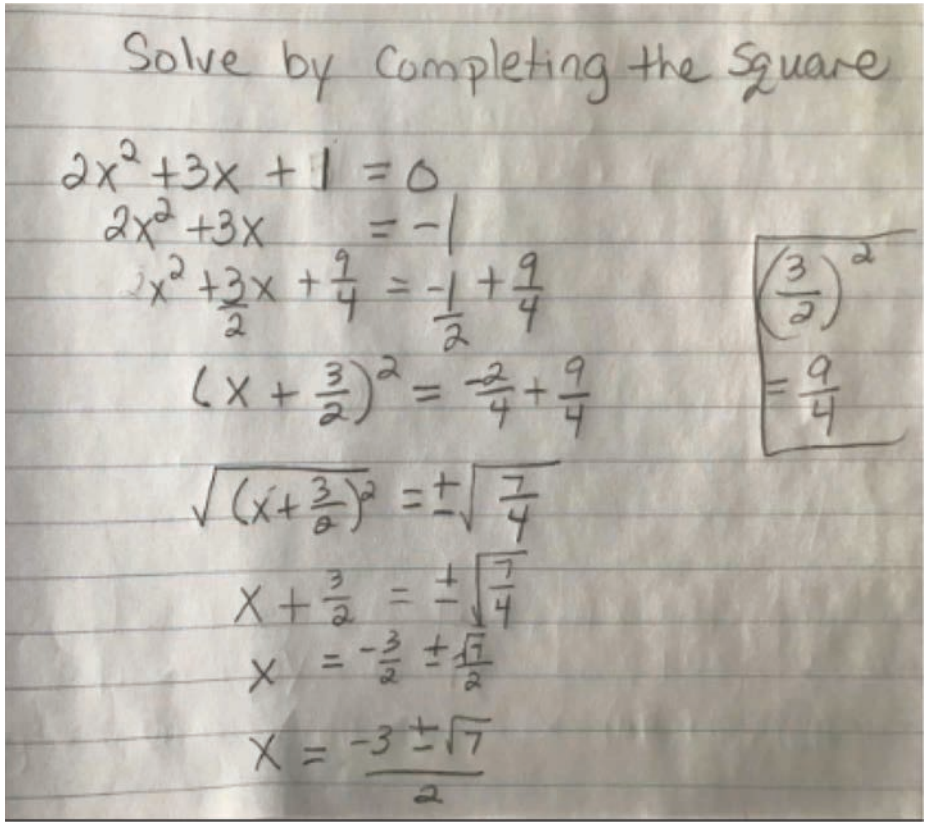
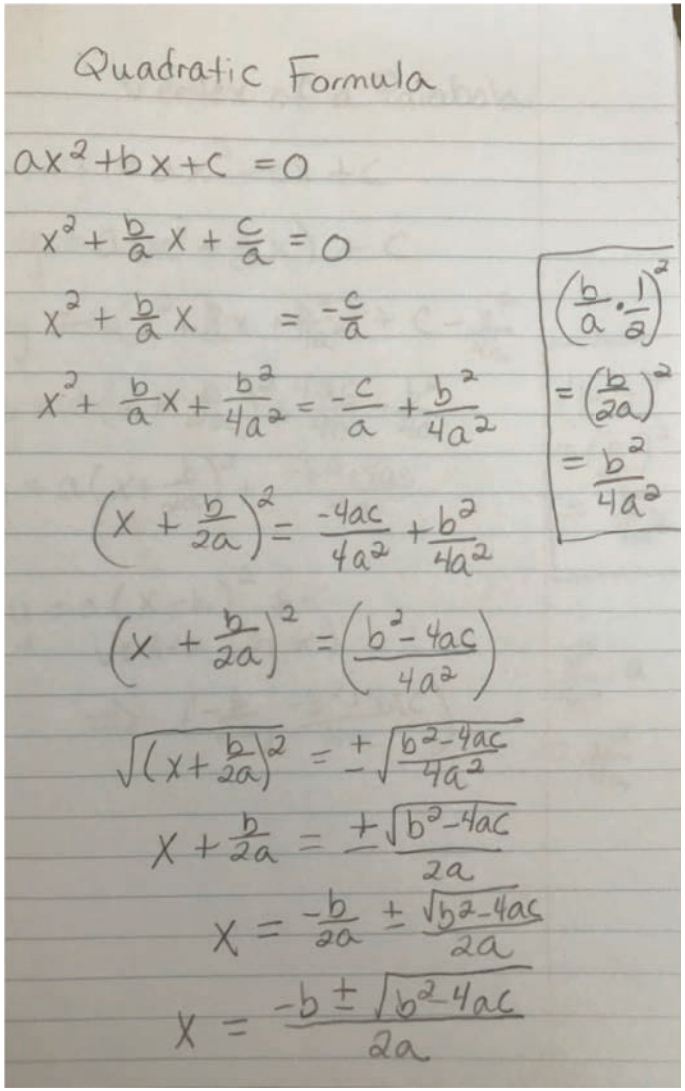
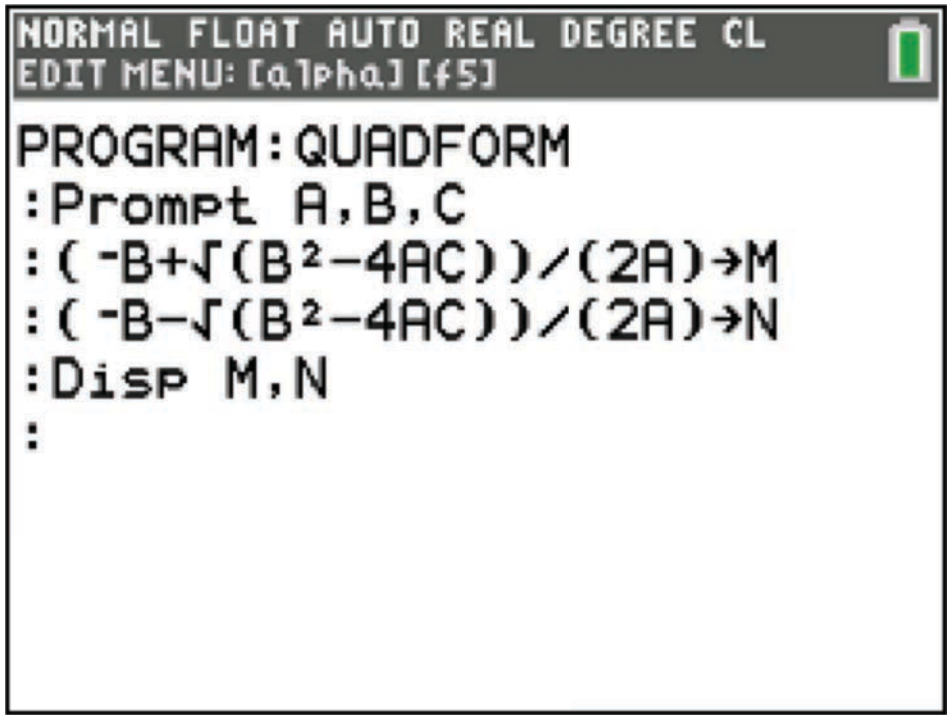


Solving by Completing the Square/ The Quadratic Formula

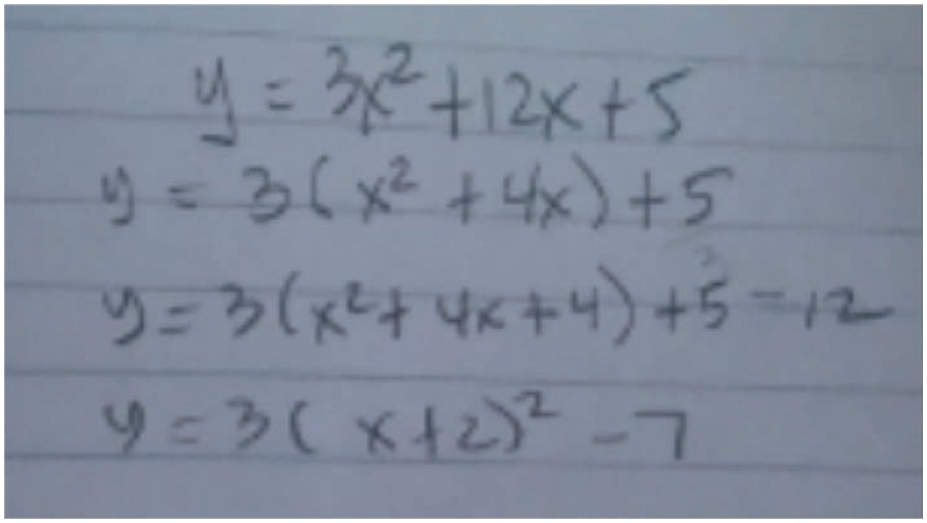


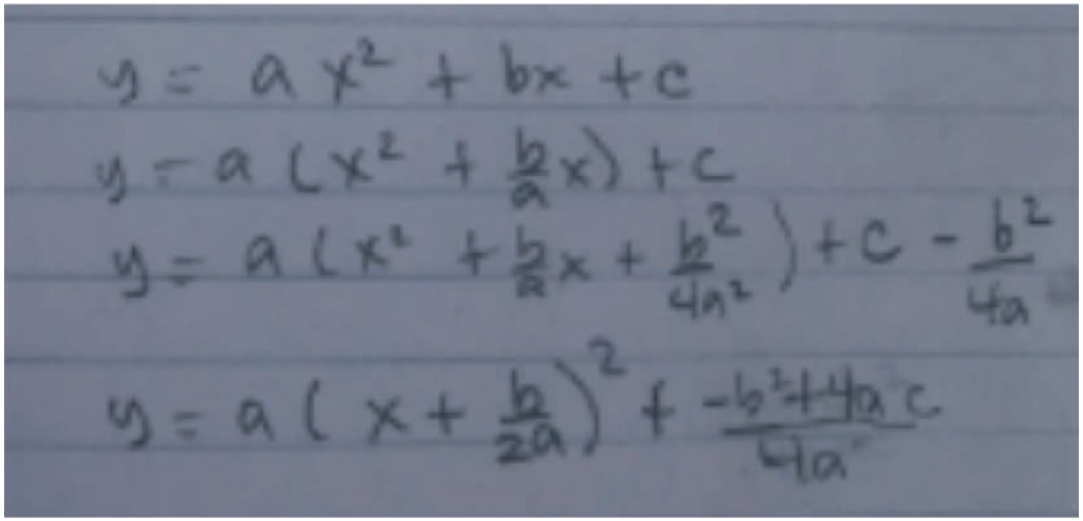


Quadratic Formula Program

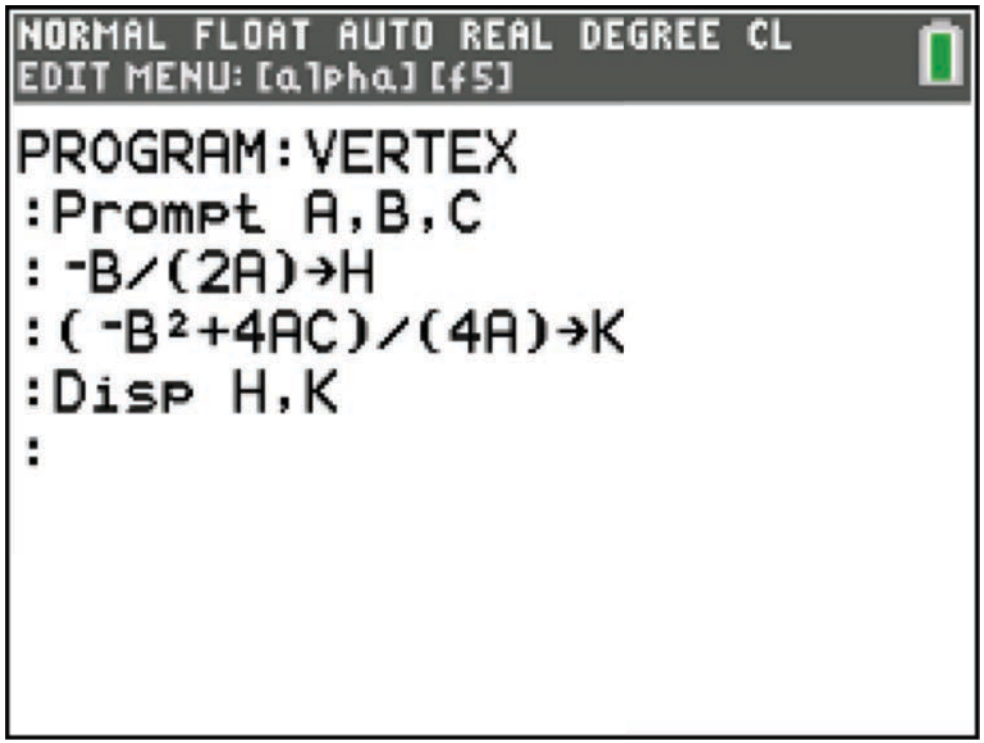


Vertex Form of a Parabola



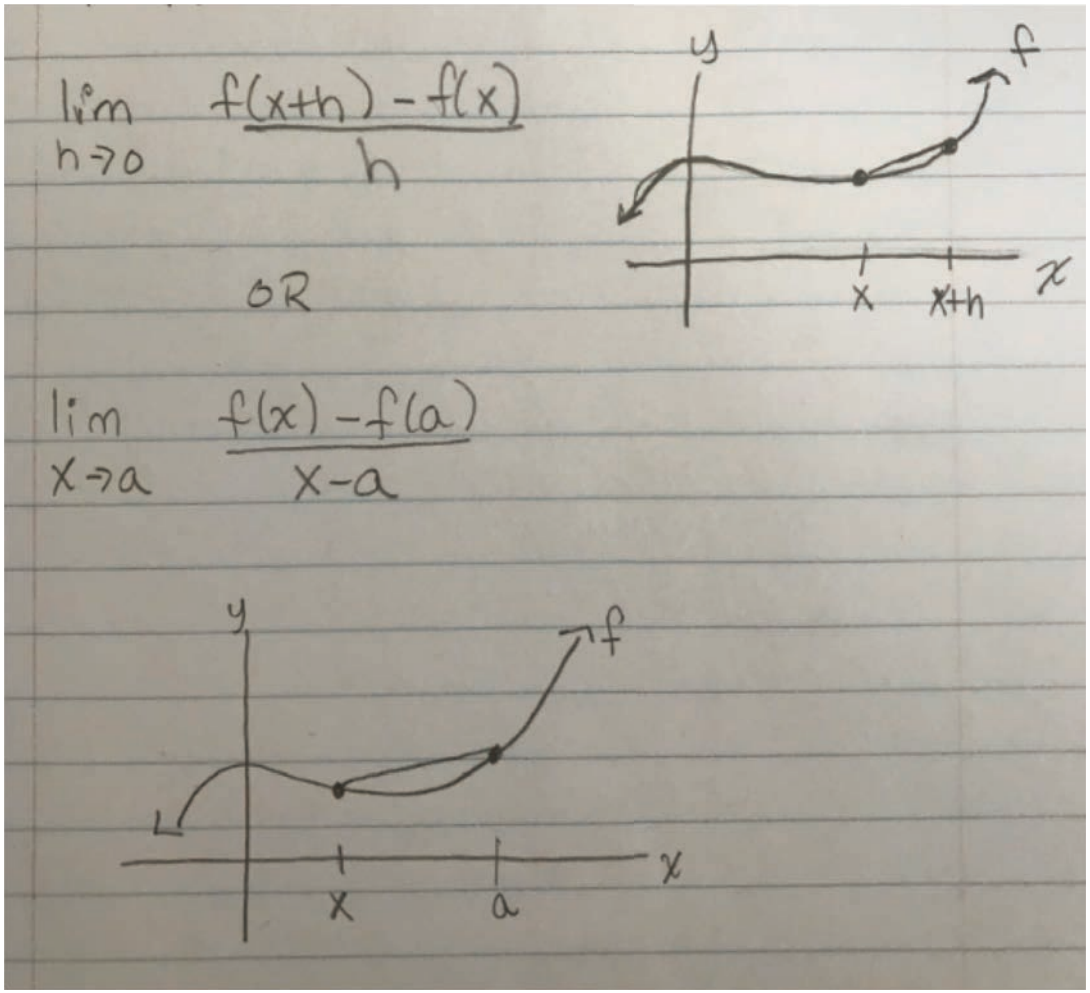


Vertex of a Parabola Program



Difference Quotient/ Derivatives

```
NORMAL FLOAT AUTO REAL DEGREE CL
EDIT MENU: [alpha] [f5]
PROGRAM:SECTBL
:Prompt A,B
:(Y1(A)-Y1(B))/(A-B)→M
:Disp M
:
```



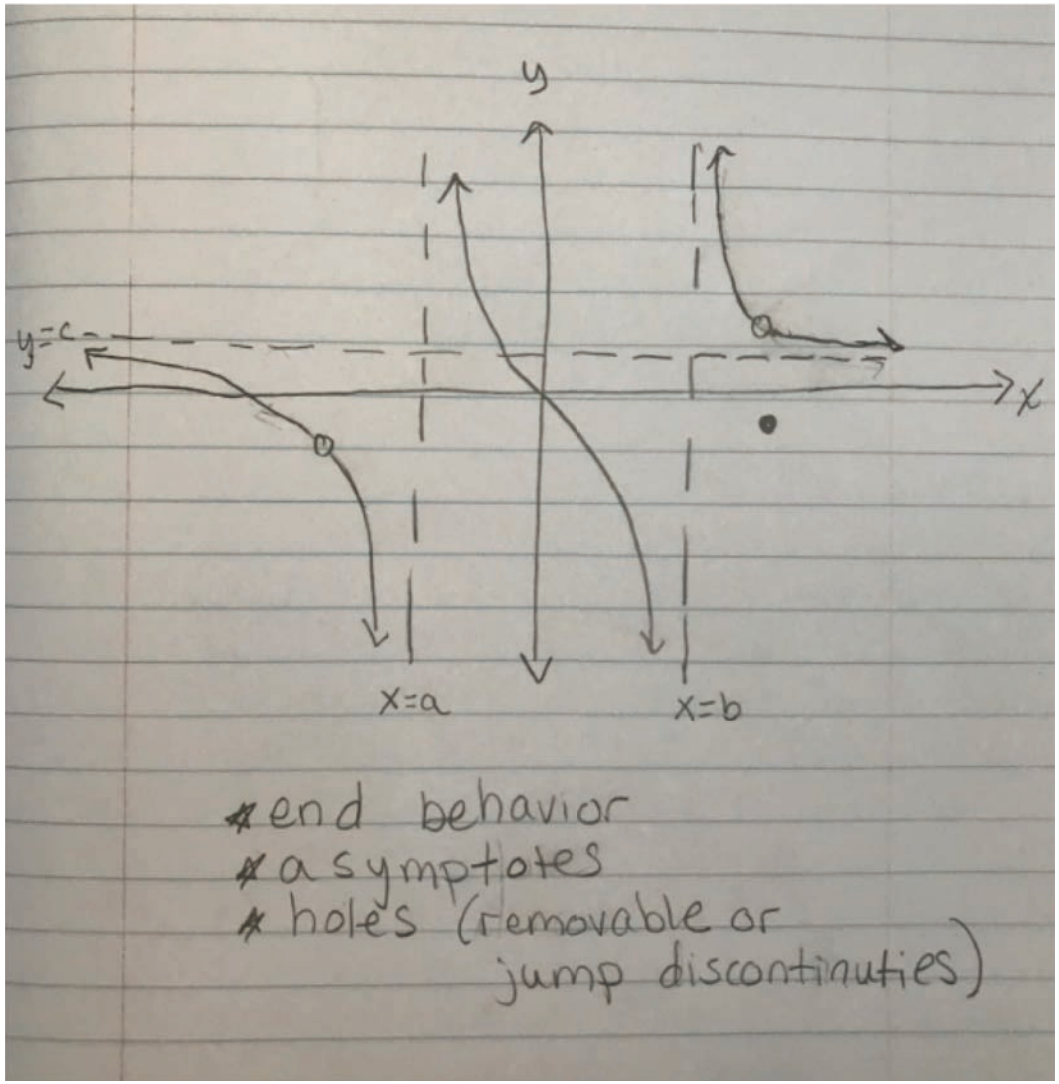
Scrutinizing Functions

NORMAL FLOAT AUTO REAL RADIAN MP

```
PROGRAM:NEARA
:Prompt A
:{A+.1,A+.01,A+.001,A+.000
1,A+.00001,A-.1,A-.01,A-.0
01,A-.0001,A-.00001}→L1
:Y1(L1)→L2
```

NORMAL FLOAT AUTO REAL RADIAN MP

```
PROGRAM:ENDBEHAV
:{10,100,1000,10000,100000
,1000000}→L3
:Y1(L3)→L4
:-L3→L5
:Y1(L5)→L6
```



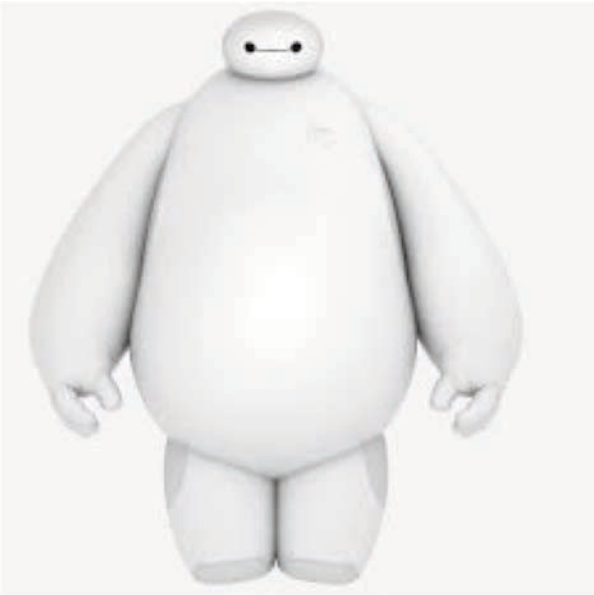
Applying student understanding

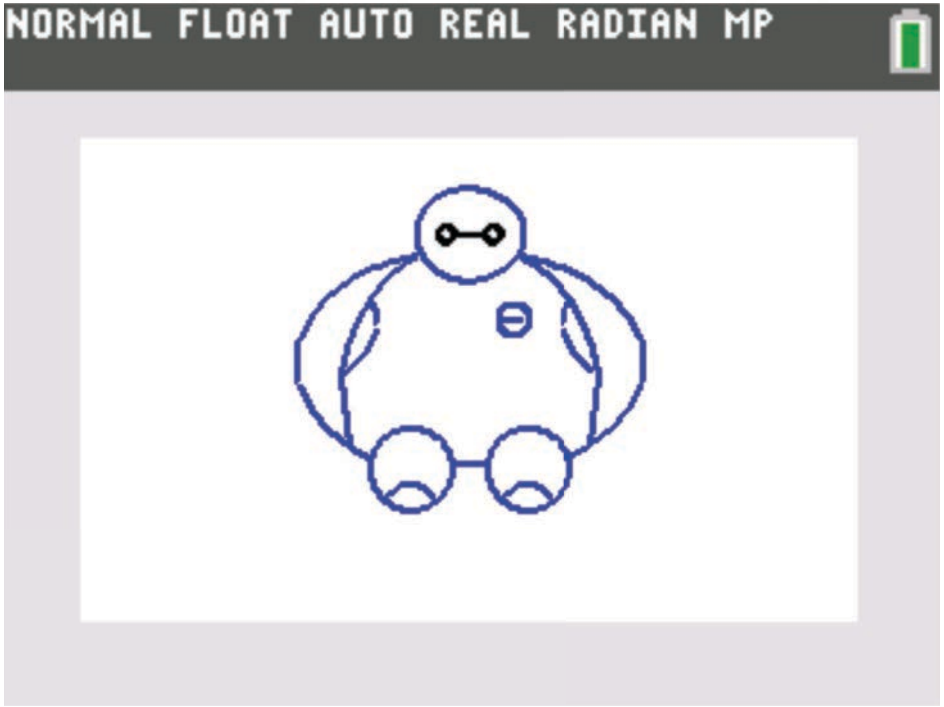
Airpact Impact Study

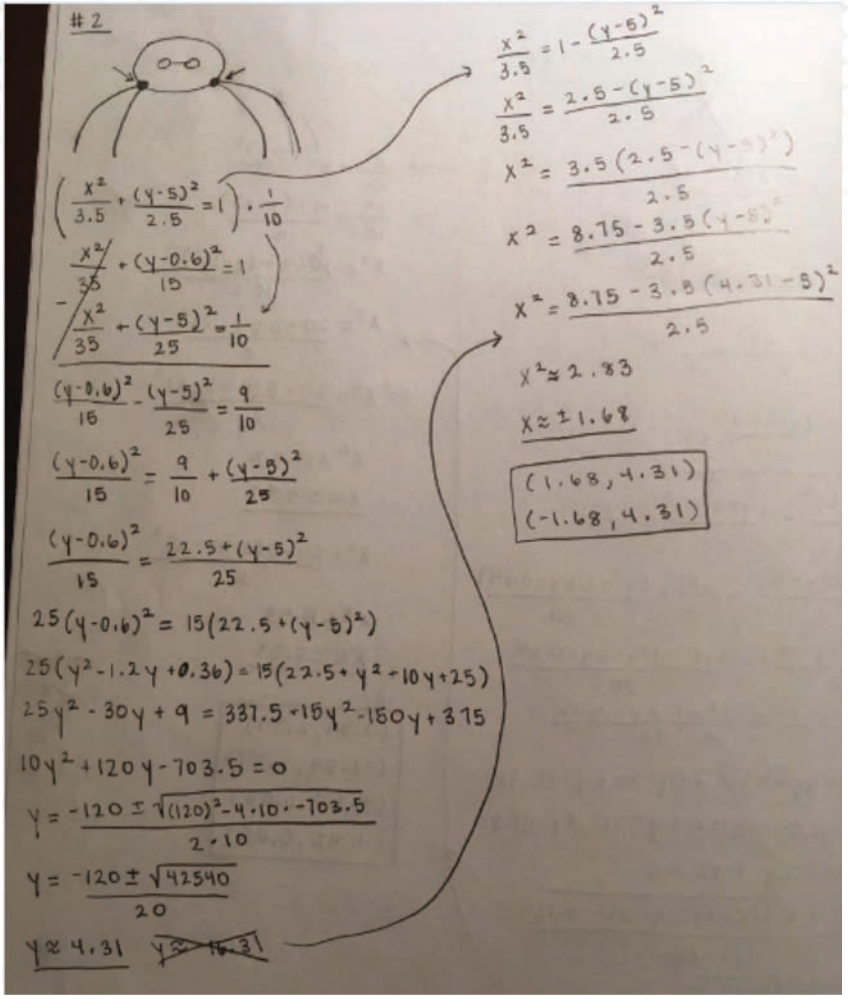
Blood Alcohol Content

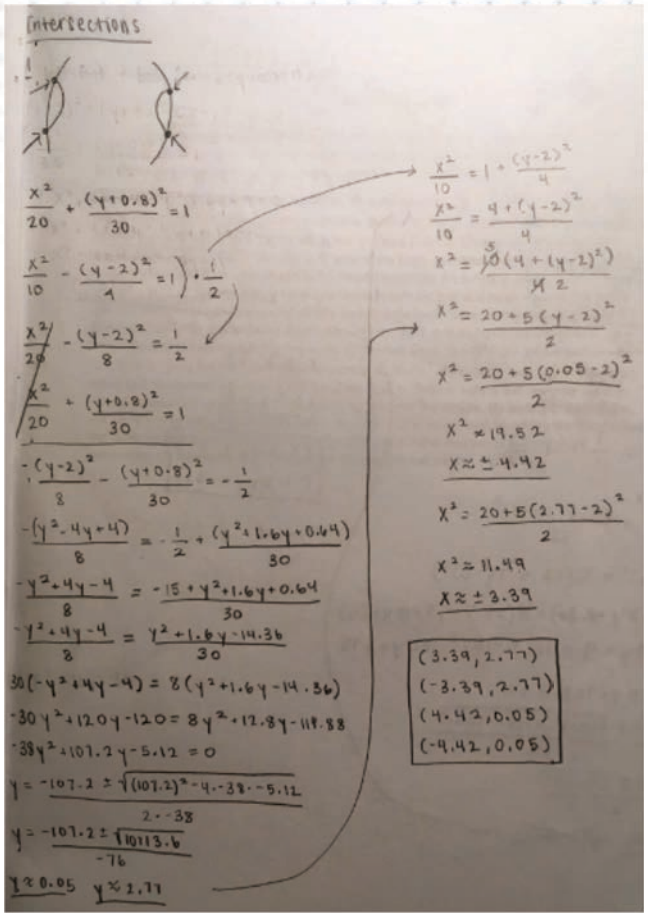
```
Input "INDEPENDENT LIST IN { }",L1
Input "DEPENDENT LIST IN { }",L2
Disp "X*Y="
L1*L2→L4
Pause L4
L1²→L3
Disp "X²*Y="
L2*L3→L4
Pause L4
Disp " "
Disp "IS Y INVERSELY RELATED TO"
Disp "X OR X²?"
Pause
Input "WHAT IS K?",K
Input "TYPE WITH QUOTES Y1=",Y1
Input "Y-VALUE",I
K/I→E
Disp "X-VAL IF INVERSELY TO X"
Disp E
√(K/I)→D
Disp "X-VAL IF INVERSELY TO X²"
Disp D
```

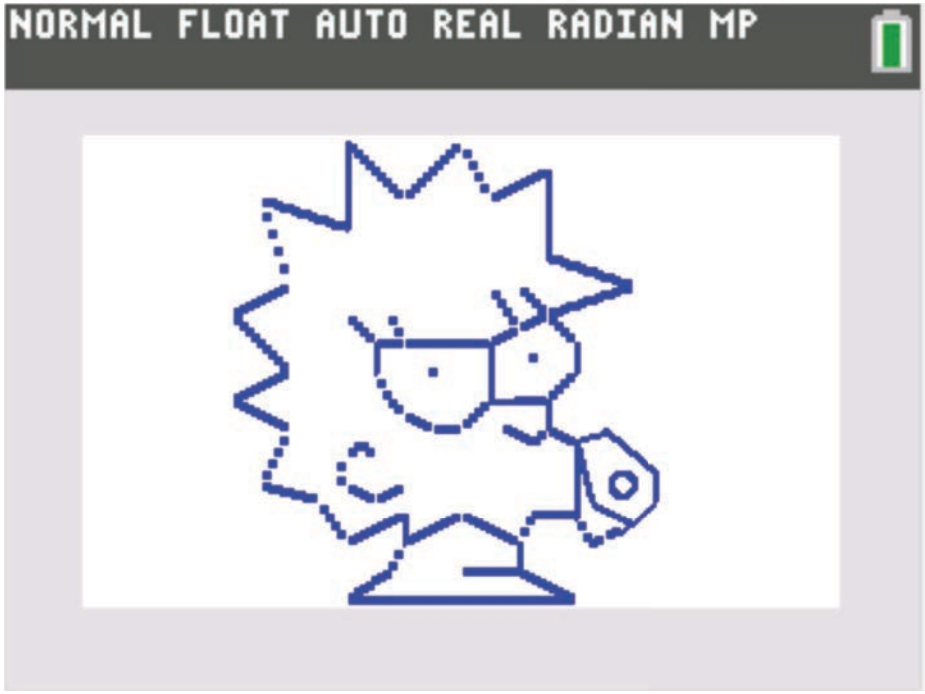
Check student understanding

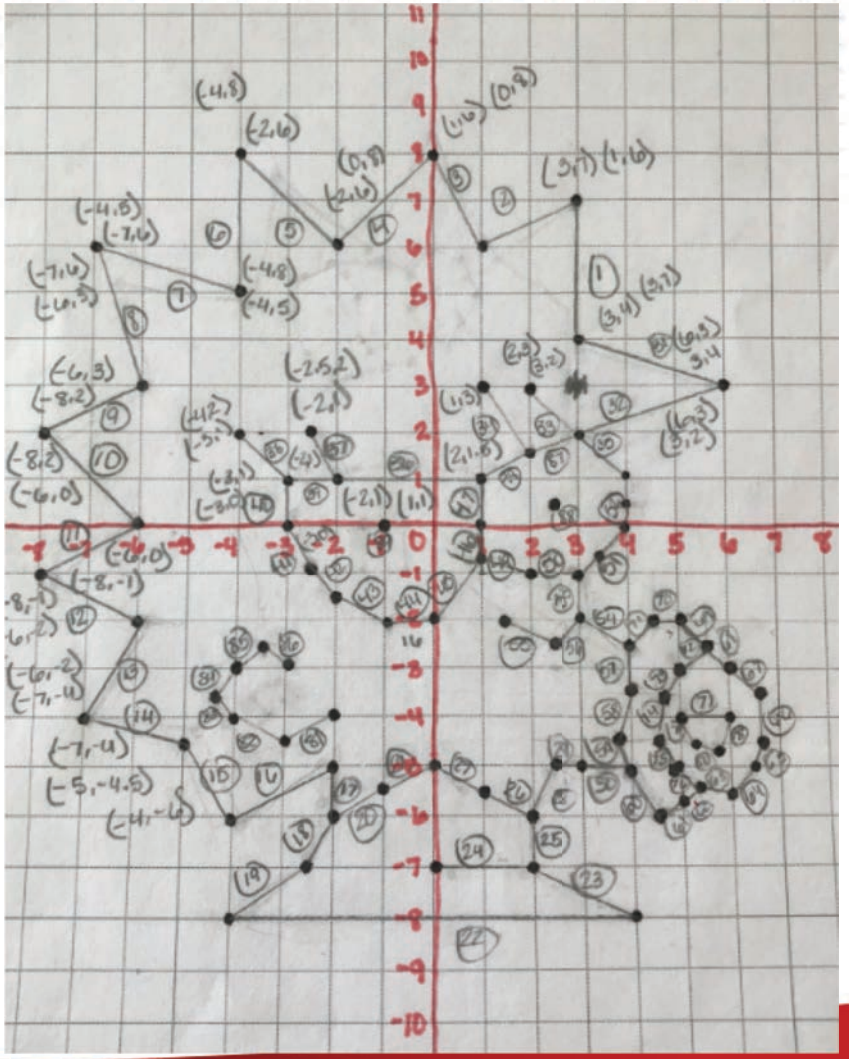


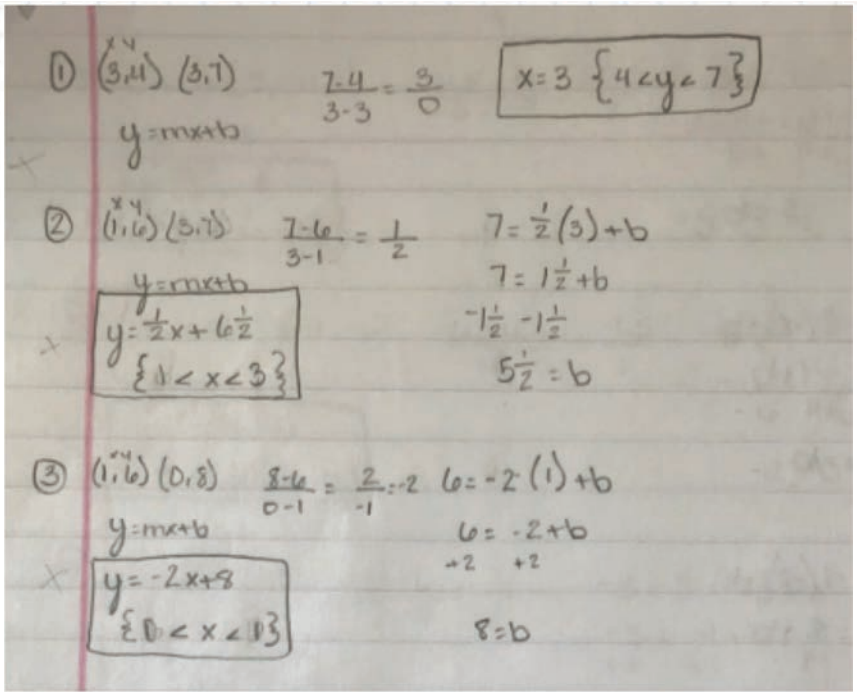


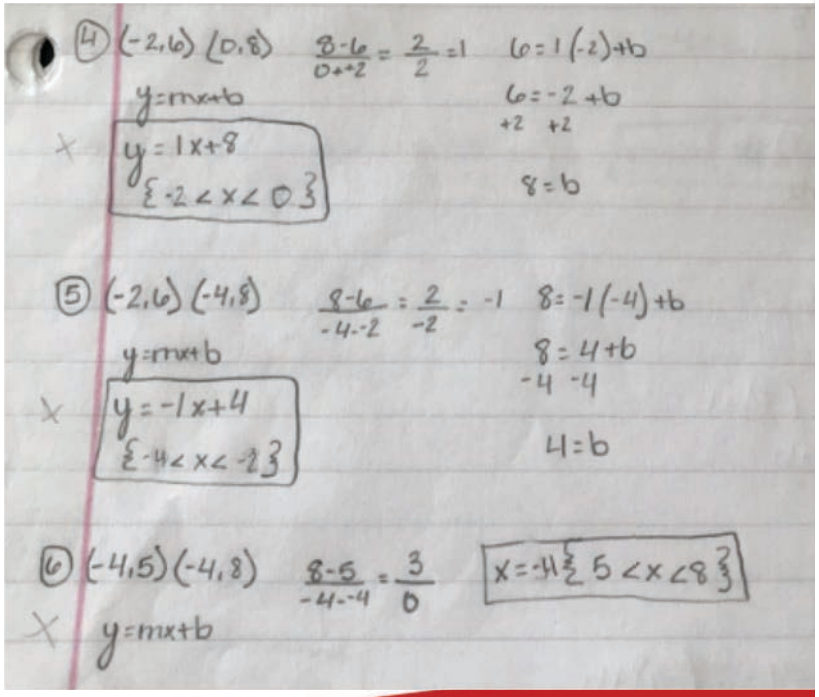












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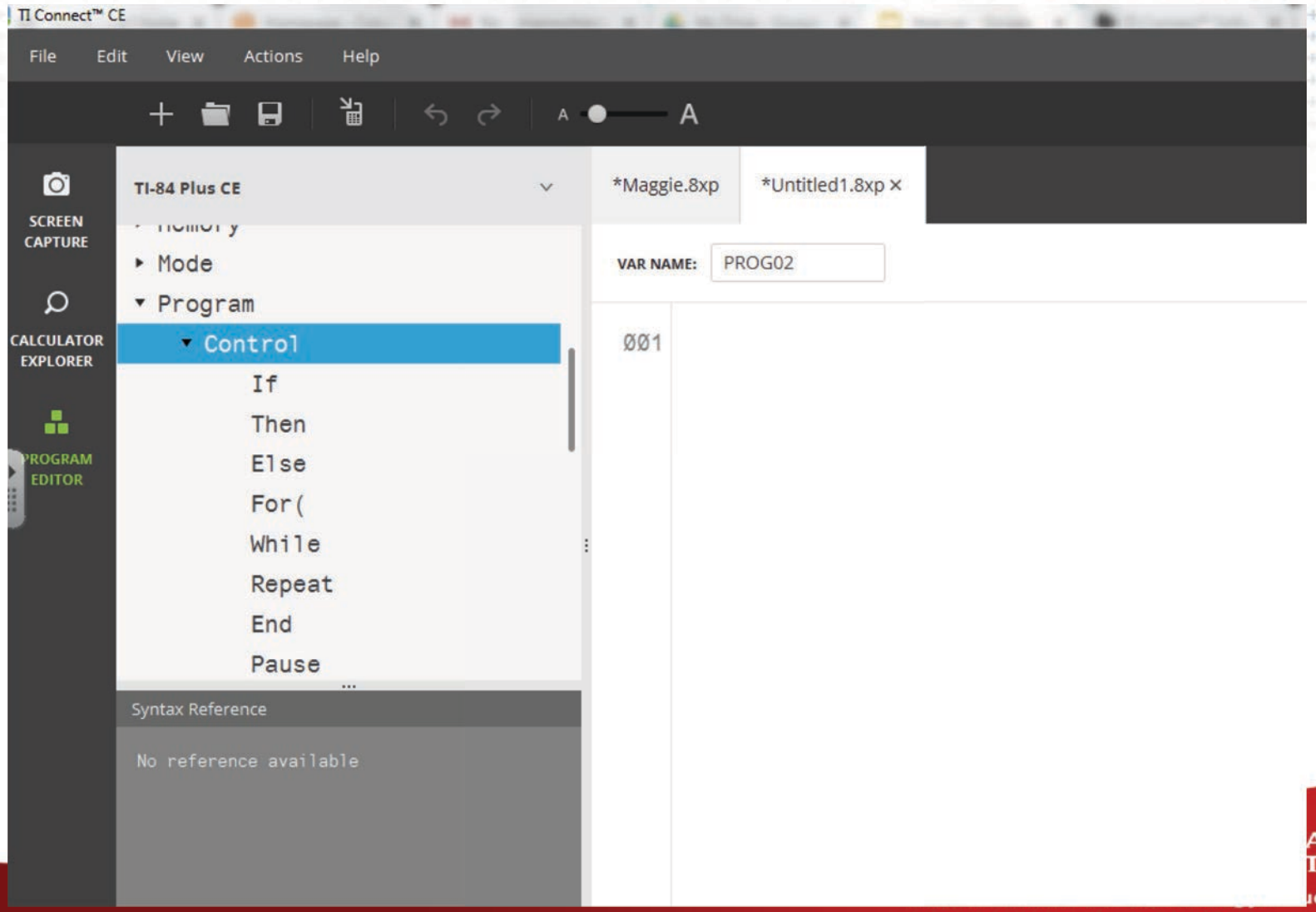
TI Connect™ CE
File
Edit
View
Actions
Help
SCREEN CAPTURE
CALCULATOR EXPLORER
PROGRAM EDITOR
TI-84 Plus CE
Mode
Program
Control
If
Then
Else
For(
While
Repeat
End
Pause
Syntax Reference
No reference available
*Maggie.8xp
*Untitled1.8xp
VAR NAME:
PROG02
ØØ1

Maggie (part 1)

```
ClrDraw:GridOff
AxesOff:Radian:DetectAsymOff
BackgroundOff
PlotsOff
-6.6*2→Xmin:6.6*2→Xmax
-4.1*2→Ymin:4.1*2→Ymax
For(A,Ø,9)
GraphStyle(A,7)
GraphColor(A,1Ø)
End
"piecewise(.5X+5.5,1<X<3,-2X+8,Ø<X<1,X+8,-2<X<Ø,-X+4,-4<X<-2,(-1/3)X+(3+2/3
"piecewise(-3X-15,-7<X<-6,-1.5X-12,-5<X<-4,.5X-4,-4<X<-2)"→Y2
"piecewise(.5X+6,-8<X<-6,2X-2,-2.5<X<-2,(2/3)X-(5+1/3),-4<X<-2.5,-.5X-6,2<X
"piecewise(-X-6,-8<X<-6,.5X-5,-2<X<Ø,-.5X-5,Ø<X<2,2X-1Ø,2<X<2.5,-5,2.5<X<4)
"piecewise(.5X+3,-8<X<-6,(-1/3)X+5,3<X<6,-X+5,2<X<3,-1.5X+4.5,1<X<2,1,-2<X<
"piecewise(-.5X-5,-8<X<-6,-8,-4<X<4,-2X+3,4<X<4.5,.4X-7.8,4.5<X<5,.6X-8.8,5
"piecewise(2X+1Ø,-7<X<-6,(1/3)X+1,3<X<6,-2X-3,-2.5<X<-2,-X-2,-4<X<-3,-2,-1<
"piecewise(-.25X-5.75,-7<X<-5,-X+5,3<X<4,1,-3<X<-2,-.5X-2.5,-2<X<-1,X-2,Ø<X
"piecewise(-2X-6,-3<X<-2.5,-X-3.5,-2.5<X<-2,.5X+.5,1<X<2,-1,1<X<3,X-4,3<X<4
"piecewise(-.5X-.5,3<X<4,-.5X-1.25,1.5<X<2.5,X-5,2.5<X<3,5X-23.5,3.8<X<4)"→
DispGraph
StorePic 1
```

Maggie (part 2)

```
"piecewise(-2.5X+5,3.8<X<4)"→Y1
"piecewise(.5X-3,-3<X<-2)"→Y2
"piecewise(X+8,-2<X<Ø)"→Y3
"piecewise(1.5X+3,-4.4<X<-4,X+1,-4<X<-3.5,-X-6,-3.5<X<-3)"→Y4
"piecewise(-.5X-6,-4<X<-3,-X-8,-4.4<X<-4,.5X+.5,2<X<3)"→Y5
RecallPic 1
Pt-On(2.5,Ø.5)
Pt-On(-1,Ø)
Line(3,4,3,7)
Line(-4,5,-4,8)
Line(-2,-6,-2,-5)
Line(2,-7,2,-6)
Line(-3,Ø,-3,1)
Line(1,-1,1,1)
Line(4,Ø,4,1)
Line(3,-1,3,-2)
Line(4,-2.5,4,-3.5)
Line(6.8,-3.5,6.8,-4.5)
Line(1,-1,2,-1)
Line(4,-2.4,5,-2.1)
Line(5.6,-5.6,6.8,-4.6)
Line(4.6,-4.6,5.9,-5.3)
```

```
Circle(5.6,-3.9,.4)
Line(4,-2.5,4.5,-4.5)
Line(5,-2,6.8,-3.5
```

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