GRAPHING CALCULATORS 2

Participants continue to work with various math activities on the graphing calculator.

Lesson Goals
❑ Learn how to edit pictures on the graphing calculator using the DRAW menu. ❑ Model ways to have students develop understanding of mathematical concepts by using the graphing calculator. ❑ Learn how the CBR (Calculator Based Ranger) works with the graphing calculator.

Word Bank	
❑ Function	❑ Archive Memory
❑ Slope	❑ DRAW Menu
❑ Y-Intercept	❑ CBR

ISTE National Educational Technology Standards
❑ I-A: Demonstrate introductory knowledge, skills, and understanding of concepts related to technology ❑ II-A: Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners ❑ II-D: Plan for the management of technology resources within the context of learning activities ❑ II-E: Plan strategies to manage student learning in a technology-enhanced environment ❑ III-B: Use technology to support learner-centered strategies that address the diverse needs of students ❑ III-C: Apply technology to develop students' higher order skills and creativity
Mathematics- In Brief
• Find the equation of a line given two points • Develop understanding of how a line graph tells a story • Connect slope to the steepness of a line

QuickTime™ and a
Photo - JPEG decompressor
are needed to see this picture.

A FUNCTION GAME THAT DEMONSTRATES AN APPLIED USE FOR ALGEBRA

By Stuart Moskowitz

In algebra classes, students are given equations and asked to plot points and draw the graph. But in the real world, data analysis works in the reverse order. Given raw data, the mathematician's role is to find an appropriate model (function) that fits the data. This program challenges the student to find linear and quadratic functions, given 2 or 3 randomly plotted points.

The program was inspired by the function graphing game *Green Globs and GraphIng Equations* published by Sunburst Corp. written by Sharon Dugdale and David Kibby. An early calculator version for the TI-81 was written by Chuck VonderEmbse and Tim Tilton.

Run the program by selecting FUNC84 from the program menu of your TI-8x.
At the prompt, choose the number of desired points (2 for linear data, 3 for quadratic)
Enter your guess in the Y= menu. If necessary, modify your guess. If each guess is put into y1, then only the most recent guess is displayed. If each guess is put into a different function in the Y= menu, then all guesses will be displayed.

Make your guesses using trial and error, or press trace to get the coordinates of each point. Then use algebraic methods, regression analysis, or matrices (depending on the level of your studies)

The following program code works for the TI-83 and TI-84

PROGRAM: FUNC84

```
Disp "USE ESTIMATION"
Disp "TO FIND AND DRAW"
Disp "A GRAPH THRU THE"
Disp "SELECTED PLOTS."
Disp "ENTER EQUATION"
Disp "INTO Y= MENU."
-9.4→Xmin
9.4→Xmax
1→Xscl
-6.2→Ymin
6.2→Ymax
1→Yscl
Disp "2 OR 3 POINTS?"
Input A
ClrList L1,L2
DelVar Y1
DelVar Y2
DelVar Y3
DelVar Y4
DelVar Y5
DelVar Y6
PlotsOff
For(B,1,A)
randInt(-9O,9O)*.1→L1(B)
randInt(-6O,6O)*.1→L2(B)
End
Plot1(Scatter,L1,L2,□)
DispGraph
```

2 points define a straight line (linear function).
Graph linear equations in the form:

$y = m x + b$ slope-intercept form

3 points define a parabola (quadratic function).
Graph quadratic equations using one of the following forms:

$y = a x^2 + b x + c$ standard form

$y = a (x – h)^2 + k$ vertex form

$y = a (x – r_1) (x – r_2)$ factored form

Welcome Agents:

You have entered a secure zone.

Your ultimate mission…SHOULD you decide to accept it…
is to determine how to get a graphing calculator to
draw the graph at the bottom of the graph activity sheet.
The most "acceptable" answer may require some critical thinking.

BEFORE you can complete the ultimate mission, you must determine how you should walk so as to make a motion detector detect your movement and show graphs like the first eight graphs shown in the graph activity sheet**.**

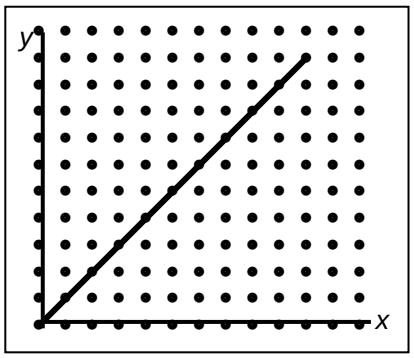
[Hint: Determine WHEN you should stand still,
WHEN you should walk,
HOW FAST, HOW SLOW, WHICH DIRECTION –
- TOWARD the detector or AWAY FROM the detector.]

You see, the motion detector sends out an electronic beam that you can't see. (Don't worry; you can't feel it either!) When the beam "runs into" your body, a dot will show up on the graph. The dot will help track the time that passed by before the beam reached AND how far away (distance) from the motion detector you were at the time.

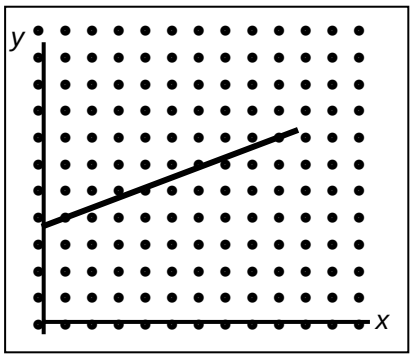
This is NOT an impossible mission. I expect you will enjoy it. You may collaborate with fellow agents on your team to determine your next move.

I look forward to seeing you WALK YOUR TALK when next we meet! Good luck on your mission.

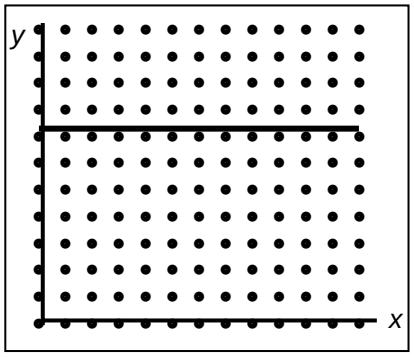
A.



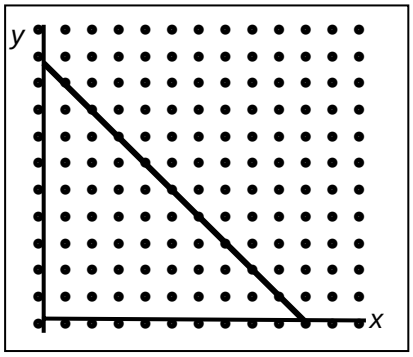
B.



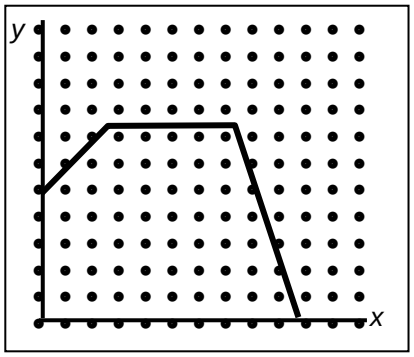
C.



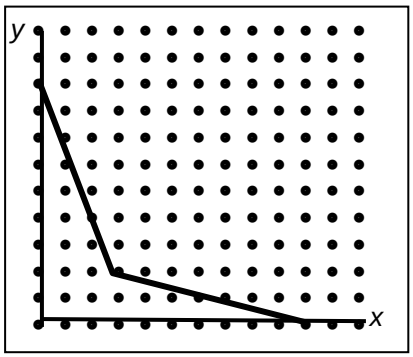
D.



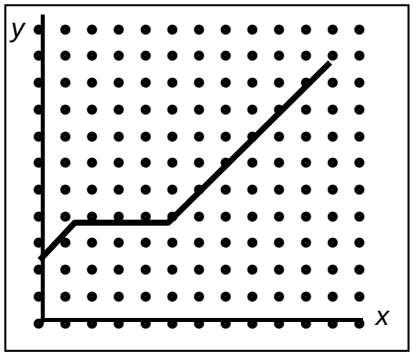
E.



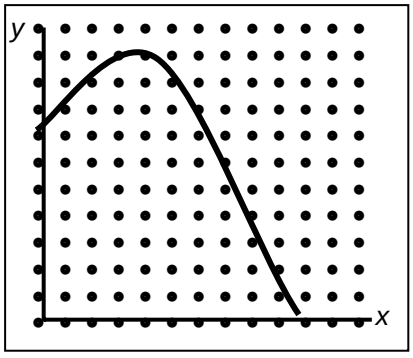
F.



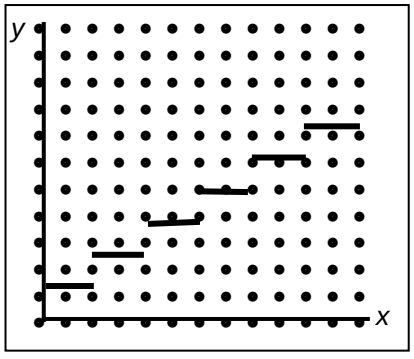
G.



H.



I.



BONUS!

GRAPHICAL MATCHING SUMMARY QUESTIONS

1. What is the physical representation of the y-intercept?

2. What is the physical representation of y=0?

3. How can you tell the direction in which the person walked?

4. How can you tell if the person walked slowly or quickly?

5. Can you duplicate a circle? Why or why not?

Graphing Calculator 2 Cheat Sheet

Linking Calculators to Transfer Programs

- Plug in the linking cord to both → turn both calculators on
- On the calculator receiving the program: 2nd LINK → right arrow over to RECEIVE → 1:Receive → ENTER
- On the calculator sending the program: 2nd LINK → 3:Prgm… → press ENTER next to the program(s) that you want to send and a square should appear next to them → right arrow over to TRANSMIT → 1:Transmit → ENTER

Editing Pictures Using the DRAW Menu From the GRAPH Screen

- From the GRAPH screen: 2nd DRAW
- To draw a line segment: 2:Line(→ move cursor where you want to begin the line → ENTER → move cursor where you want to end the line → ENTER
- To draw a circle: 9:Circle (→ move cursor where you want the center of the circle → ENTER → move cursor away from center as far as you want the radius → ENTER
- To write text: 0:Text (→ move cursor to where you want to write letters and/or numbers and type → to type letters: ALPHA → press the letter you would like
- To clear all of the drawings from the graph screen: 1:ClrDraw

Editing Pictures Using the DRAW Menu From the Home Screen

- From the home screen: 2nd DRAW
- To draw a line segment: 2:Line(→ identify the coordinates of the endpoints of the line you wish to draw → To draw a line from (9,4) to (9,0) type : Line(9,4,9,0)
- To draw a circle: 9:Circle(→ identify the coordinates of the center of the circle and the length of the radius → To draw a circle with center (1,3) and a radius of length 5 type: Circle (1,3,5)
- To shade the area between two functions: 7:Shade(→ identify the functions that you want to shade the common areas of → To shade the common areas of the two functions y=x and y= x^2 type: Shade (x, x^2)

Making "Nice" Coordinates

- In order for the coordinates to be easy to read they need to match the number of, or multiple of the, pixels on the screen. On a calculator screen there are 95 columns (or pixels across) and 63 rows (or pixels down). Since there are 95 columns there are 94 steps in between them. Likewise, there are 62 steps in between the rows.
- To find friendly coordinates for the x-coordinates: the distance between each x-coordinate can be calculated by $\frac{x_{\max} - x_{\min}}{94}$. If the difference between $x_{\max}$ and $x_{\min}$ is 94, the coordinates will by 1 unit apart. If the difference is 9.4, the coordinates will be .1 apart, 18.8 will be .2 apart, and so forth.
- To find friendly coordinates for the y-coordinates: use the formula $\frac{y_{\max} - y_{\min}}{62}$. In order to have pixels that are all .1 unit apart, the total distiance from Xmin and Xmax

must be 9.4. One way to achieve a friendly window would be to have: x_{max} = 4.7, x_{min} = -4.7, y_{max} = 3.1, and y_{min} = -3.1.

Calculator Memory

- If a program has an * by it it is using archive (ARC) memory and it is unaccessible until it is moved to the RAM memory. This can be compared to moving it out of the hard drive onto the desktop of a computer.
- To move a program from ARC memory to RAM memory: MEM → 2: Mem Mgmt/Del… → 7: Prgm… → press ENTER next to the program you want to change and the * will disappear → the program is now using RAM memory and can be accessed.

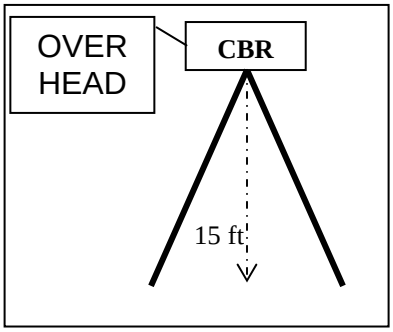
Function Game Warning

- The Function Game uses lists L1 and L2 in the calculator. Thus, it replaces any previous data that was in L1 and L2. If you have data stored in L1 and L2 (i.e. previous class homework), make sure to review saving data in Lists (see Calc1 Cheat Sheet) before running the game.

Clearing the Function Game From Your Calculator (Clearing Data From Lists)

- To clear the graph screen of the points: turn PLOT1 off
- Clear the data out of lists L1 and L2: STAT → 1:Edit → arrow up to move cursor on top of L1 → CLEAR → ENTER → arrow over and up to move cursor on top of L2 → CLEAR → ENTER

Classroom Set Up for Using the CBR



- Make sure the calculator is linked securely to the CBR.
- Set up 15 ft of clear space where participants can move (see drawing).
- Move desks and chairs away from the area.
- Place the CBR about 3 ft off the ground (make sure it is aiming at the average student waist).
- Tell students that they need to stay clear of the cone. Any movement within the cone will be picked up by the Ranger and skew the graph.

Calculator Directions for 'Walking' Graphs Using a CBR

- Make sure that all equipment is hooked up and turned on
- **To Graph on a Blank Screen**: APPS → CBL/CBR → Press any key → RANGER → ENTER → SETUP/SAMPLE → MAIN MENU should say (going down): REAL TIME: YES, TIME (S): 15, DISPLAY: DIST, BEGIN ON: [ENTER], SMOOTHING: NONE, UNITS: METERS → If correct, move cursor up to START NOW (upper left corner) → ENTER → when ready, press ENTER to begin motion detector

- **To Graph on Same Screen as Premade Graphs:** APPS → CBL/CBR → Press any key → RANGER → ENTER → APPLICATIONS → METERS → DIST MATCH (or VEL MATCH) → ENTER to view random graph → ENTER to begin motion detector

PROBLEM OF THE WEEK – Manipulative Comparison

This assignment asks you to investigate virtual math manipulatives and their use in the classroom. Present your findings in the following way:

1) Create a graphic organizer comparing virtual manipulative websites
   - Review and evaluate at least 5 websites (from the list provided or your own sites) that contain virtual math manipulatives
   - Compare 5 different traits of the sites (i.e. pros, cons, cost, etc.)
   - Organize your findings into a graphic organizer (i.e. table, etc.)

Some websites with virtual manipulatives:

http://nlvm.usu.edu/en/nav/vlibrary.html
A library of virtual manipulatives covering grades Pre-K through 12 and each math subject strand.

http://mason.gmu.edu/~mmankus/talks/nctm2000/nctmch00.htm
Basic applets for virtual manipulatives with a short tutorial on how to use them effectively. Also has links to other sites.

http://www.arcytech.org/java/
Contains Java™ applets whose purpose is to be used as tools to help and enhance the education of children.

http://www.ies.co.jp/math/java/geo/index.html
Virtual manipulatives aimed at middle school geometry.

http://illuminations.nctm.org/index.aspx
A library of virtual manipulatives collected by NCTM.

http://www.galaxy.gmu.edu/~drsuper/
Dr. Super's Virtual and Concrete Math Manipulatives