Exploring the new Algebra 1 TEKS with the TI-84 Plus C Silver Edition Graphing Calculator

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Recursion and Tables on the Home Screen

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will use the recursive procedure on the home screen to numerically explore patterns.

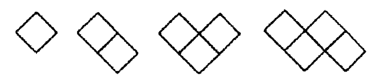
Concepts

- Number sense
- Recursion
- Patterns

Materials

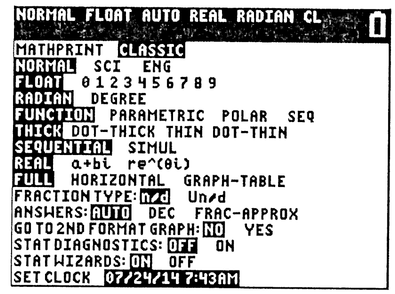
- TI-84 Plus C Silver Edition graphing calculator

Generating Recursive Sequences to Explore Linearity

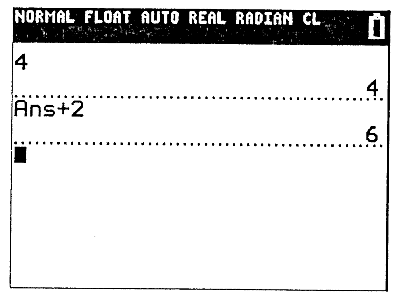


In this activity we will:

- Define a perimeter pattern recursively.
- Generate a recursive sequence using the TI-84 Plus C using two methods.
- Use recursion to answer questions.

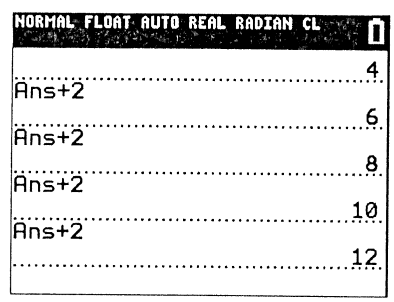


1. Press [MODE], highlight CLASSIC, and press [ENTER].
   - On the home screen, press [CLEAR].
   - Type the perimeter of the first figure in the illustration above (4), and press [ENTER].
   - Press [+] [2] [ENTER].
   - This will show how the perimeter grows when the next square is added.



2. Press [ENTER], [ENTER], [ENTER] to show the perimeter for the next three figures.

   Unfortunately, this method will not be very useful if you are asked how many squares will have a perimeter of 34 units.



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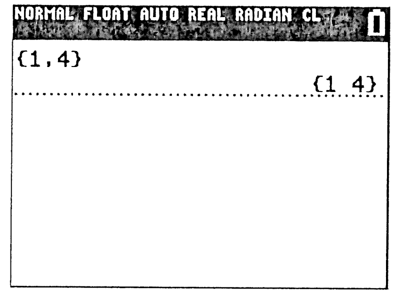
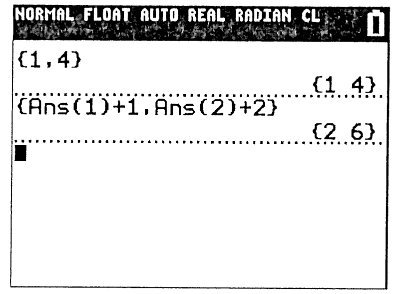
3. Clear the home screen. Press [2nd] [(] [1] [,] [4] [2nd] [)] [ENTER]. This defines your first term as {1 square, perimeter of 4 units}.



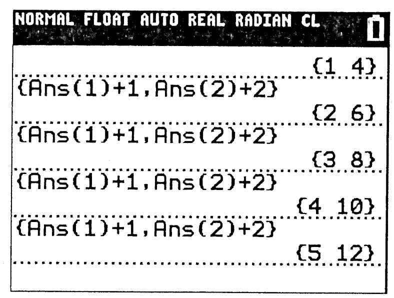
4. Now you need to show that as the number of squares increase by one, the perimeter increases by 2.
   - Press [2nd] [(] [2nd] [(-)] [(] [1] [)] [+] [1] [,] [2nd] [(-)] [(] [2] [)] [+] [2] [2nd] [)] [ENTER].
   - The result {2 6} indicates that the figure with 2 squares has a perimeter of 6 units.

   Note: CLASSIC was chosen so if the expression entered is longer than the display, the expression would wrap to the next line.

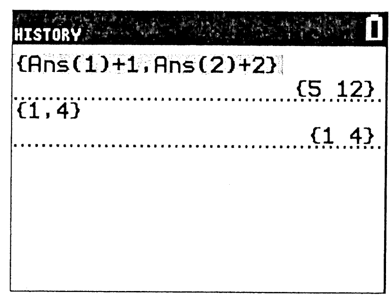


5. Press [ENTER], [ENTER], [ENTER] to show the perimeter for the next three figures.

   How many squares will have a perimeter of 34 units?



6. Clear the home screen and retype (1, 4}. Instead of retyping {Ans(1) + 1, Ans (2) +2} , press [▲] to climb the stack of entries until you highlight this entry, then press [ENTER] to bring it to the entry line. Press [ENTER] again to run the command.
7. Press [ENTER] to answer questions like "What will the perimeter be when there are 20 squares? How many squares will give a perimeter of 50?"



8. Since having a *constant rate of change* is a characteristic of linearity, this sequence can be produced with a linear function.
   - Use your knowledge of linear equations to create a function rule that you think will produce a table to match the sequence where *x* is number of squares and *y* is perimeter.
   - Press [Y=], and enter your equation.

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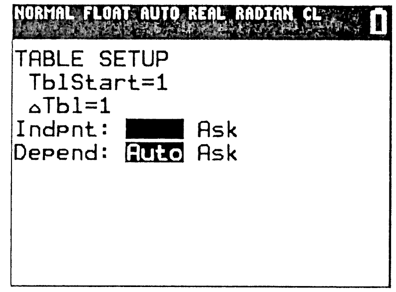
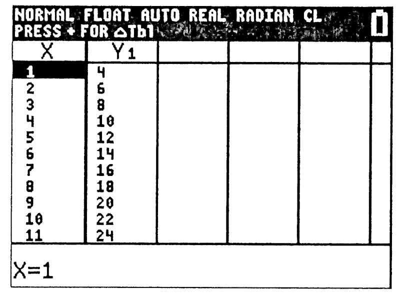
9. Press [2nd] [TBLSET] to start your table at 1 square and climb in steps of 1. Press [2nd] [TABLE] to observe the table.



Determine if your equation is correct by checking the table.



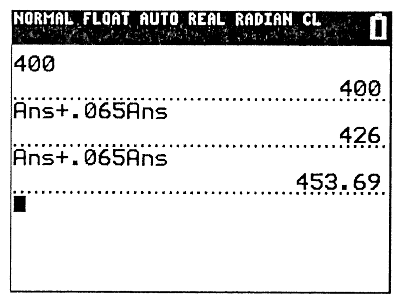
Generating Recursive Sequences to Explore Exponential Patterns

In this activity we will define an exponential pattern recursively.

1. You invest $400 in an account that pays 6.5% interest per year. If the interest is compounded annually, how long, to the nearest year, will it take for your $400 investment to double? Investigate on the home screen.

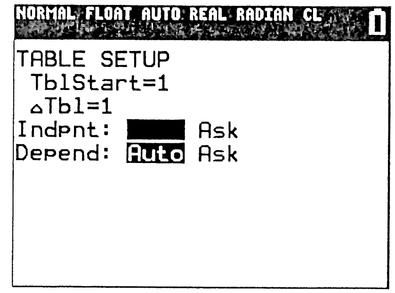
2. Clear the home screen. Enter the value 400.
3. Type Ans+.065Ans and press [ENTER].

   Press [ENTER] again to replay the command. Each press of the [ENTER] button is another year of growth. Count the number of years until you have doubled. (An equivalent strategy is to use 1.065Ans.)

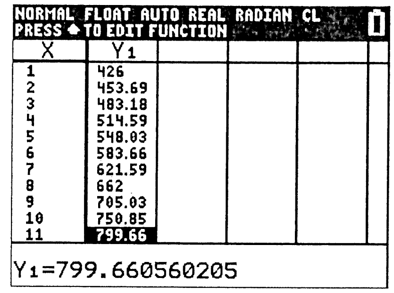


4. Since having a constant factor is a characteristic of an exponential pattern, this sequence can be produced with an exponential function of the form $y = a*b^x$.
   - Use your knowledge of exponential functions to create a rule that will produce a table to match the sequence where x is the number of years and y is the total amount of the investment.
   - Press [Y=], and enter your equation.

5. Determine if your equation is correct by checking the table. Press [2nd] [TBLSET] to start your table at 1 year and climb in steps of 1.



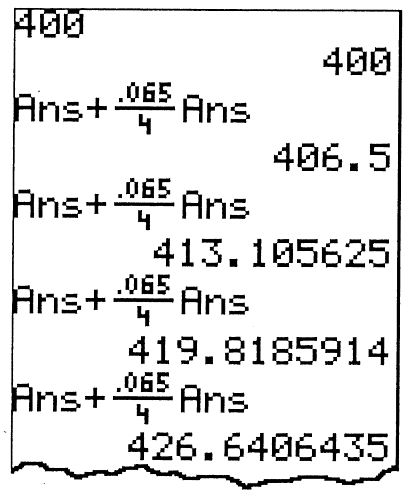
6. Press [2nd] [TABLE] to observe the table and compare with the sequence of values on the home screen.



7. Suppose interest is 6.5% per year but compounded *quarterly*. Find the amount after the first year.

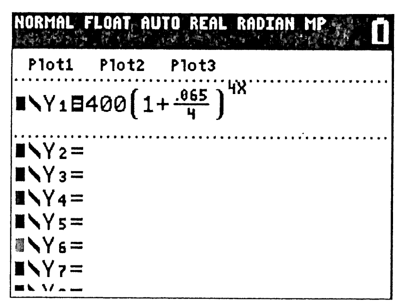
Solution: Since the *annual* percentage rate is 6.5%, the *quarterly* percentage rate is 0.065÷4. Using the home screen, each press of the [ENTER] button is another *quarter* of growth. After four quarters the amount at the end of a year will be $426.64.

Tip: For the stacked fraction, press [ALPHA] [F1] to access the shortcut menu for the n/d soft key. You could also use the usual division key, or type (1+ 0.065/4)*Ans.



8. How long, to the nearest 0.01 year, will it take for your $400 investment to double?

Press [Y=], and enter an equation where *x* is the number of years and *y* is the total amount of the investment.



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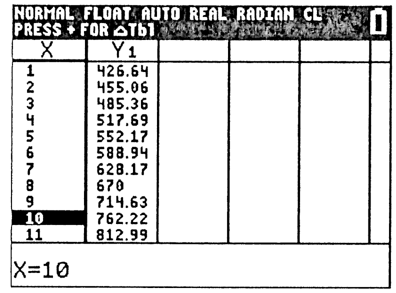
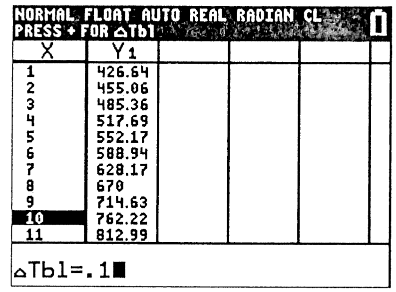
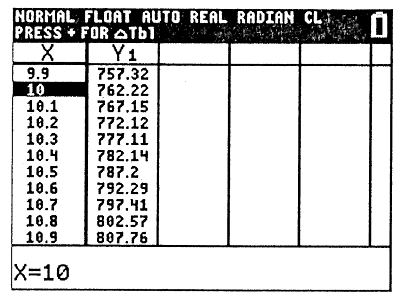
9. Determine if your equation is correct by checking the table.
   - Press [2nd] [TBLSET] to start your table at 1 year and climb in steps of 1. Press [2nd] [TABLE] to observe the table.
   - Scroll to see the amount doubles somewhere between $x = 10$ and $x = 11$ years. Sit your cursor on the value $x = 10$.



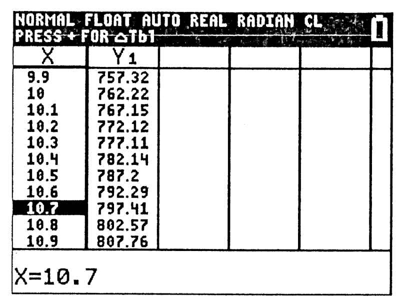
10. Press [+] and the ΔTbl shortcut appears. Type the value 0.1 and press [ENTER].



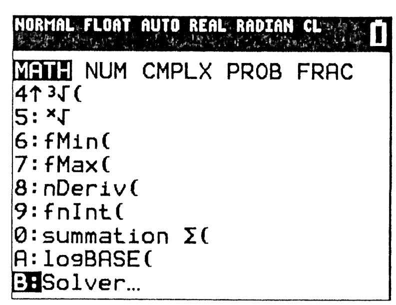
11. The table will now climb in steps of 0.1 and have a new start value (which was the last position of the cursor before you pressed [ENTER].



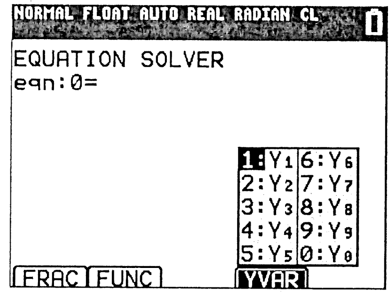
12. Repeat the procedure. Scroll to see the amount doubles somewhere between $x = 10.7$ and $x = 10.8$ years.
   - Sit your cursor on the value $x = 10.7$, press [+] to change ΔTbl to 0.01, and press [ENTER].
   - How many years will it take, to the nearest 0.01 years, to double?



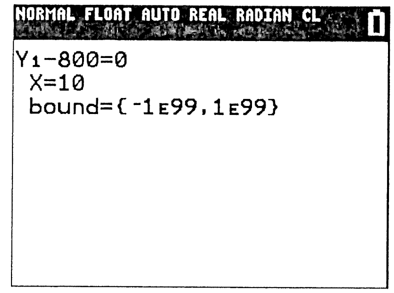
13. Press [MATH] and scroll to the Solver…



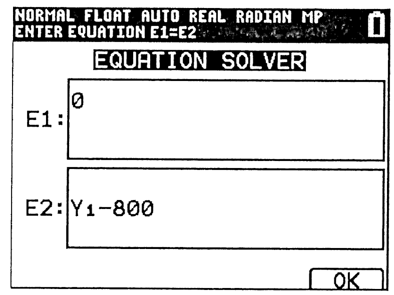
14. Use the shortcut menu so that 0 = Y1−800 is the equation to be solved and press [ENTER].



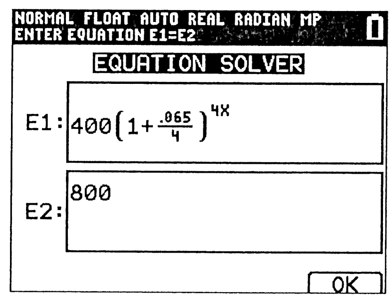
15. Type a guess (say X = 10), and press [ALPHA] [SOLVE] to check your solution.



16. Change the MODE back to MATHPRINT. The Solver looks different. The previous express is already entered in. Solve this equation or try other expressions in E1 and E2.



Note: The Solver on the TI-84 Plus C Solver Edition provides context help, enables the use of the MathPrint™ feature, and now lets you solve E1=E2 instead of 0 = E1−E2.



17. Explore the solution using other strategies:

   a. Graphically, by finding the intersection point of the function Y1 and the line Y2=800.

   b. Analytically, by solving the equation with logarithms

Recursion and Tables on the Home Screen

Challenge 1:

Pick a Prize: The Mighty Mathematicians of Pythagorean High School are having a contest. The winner of the contest will have a choice of two prizes.

- Prize A starts with $100 and adds $100 per day for 20 days after that day.
- Prize B starts with 1 penny and doubles the money each day for 20 days after that day.

The winner will get the money on the 20th day. Which prize would you choose? Explain your reasoning.

Challenge 2:

A patient takes 4 mg of medication every morning. After each 24 hour period, half of the medication in his body is metabolized. Discuss:

- What amount is in his body right after the second dose? The third? The *n*th?
- What happens in the long run?

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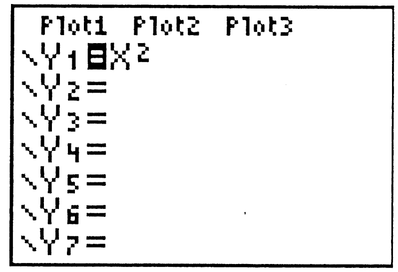
Graphing Quadratic Functions

Name ____________________

Class ____________________

Problem 1 – Vertex form

Enter $y = x^2$ into **Y1**. Press [ZOOM] and select **ZStandard**.



1. Describe the shape of the curve, which is called a parabola.

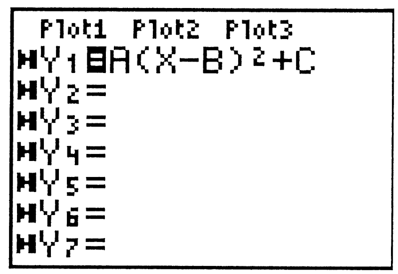
The vertex form of a parabola is $y = a(x - h)^2 + k$.

For example, the equation $y = 2(x - 3)^2 + 1$ is in vertex form. Graph this equation in **Y1**.

2. What is the value of a? Of h? Of k?

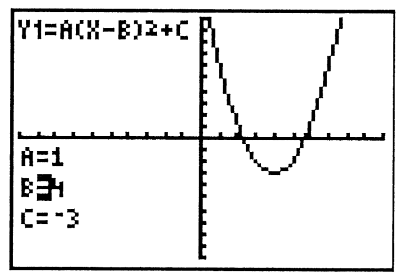
Now you will see how the values of a, h, and k affect the characteristics of the parabola.

Open the **Transformation Graphing** app, press [Y=], and enter A(X – B)^2**+ C** in **Y1**. This is the equation of a parabola in vertex form.



Press [GRAPH].

Press the down arrow to move to the = next to B. Remember that B corresponds to h in the vertex form $y = a(x - h)^2 + k$.



Change the value of B (h) and observe the effect on the graph.

3. What happens when h is positive? When h is negative?

4. What happens as the absolute value of h gets larger? h gets smaller?

5. a. What do you think will happen to the parabola if h is 0?

b. Change h to zero. Was your hypothesis correct?

6. Record the equation of your parabola.

a = A = ____ h = B = 0 k = C = ___

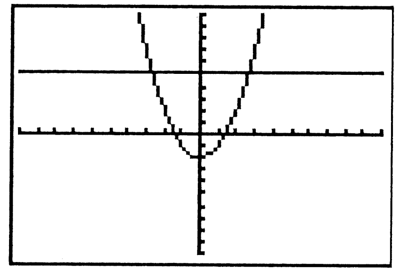
$y = a(x - h)^2 + k$ = ____$(x - 0)^2$ + ____

Graphing Quadratic Functions

Turn off the **Transformation Graphing** app ([APPS] > **Transfrm > Uninstall**).

Next, enter the equation you recorded in Question 6 in **Y1**. Press [GRAPH].

Draw a line parallel to the *x*-axis that intersects the parabola twice. Experiment with different equations in **Y2** until you find such a line.

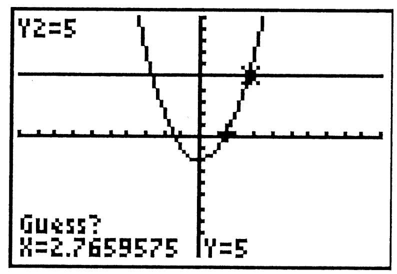


Record the equation in the first row of the table.

Line	Left intersection	Distance from left intersection to *y*-axis	Right intersection	Distance from right intersection to *y*-axis
y =	(,)		(,)	
y =	(,)		(,)	
y =	(,)		(,)	

Use the **intersect** command ([2nd] [CALC]) to find the coordinates of the two points where the line intersects the parabola. Record them in the table.

Choose a new line parallel to the *x*-axis and find the coordinates of its intersection with the parabola. Repeat several times, recording the results.



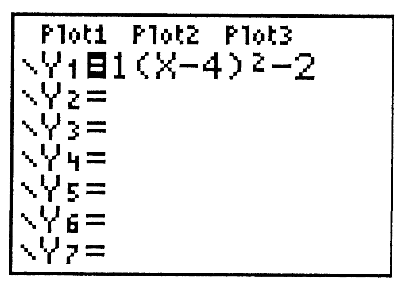
7. What do you notice about the points in the table? How do their *x*-coordinates compare? How do their *y*-coordinates compare?

8. Calculate the distance from each intersection point to the *y*-axis. What do you notices about the distances from each intersection point to the *y*-axis?

9. The relationships you see exist because the graph is symmetric and the *y*-axis is the *axis of symmetry*. What is the equation of the axis of symmetry?

How do you think the graph will move if *h* is changed from 0 to 4? Change the value of *h* in the equation in **Y1** from 0 to 4.

As before, enter an equation in Y2 to draw a line parallel to the *x*-axis that passes through the parabola twice. Find the two intersection points.



Left intersection: ____________

Right intersection: ____________

Graphing Quadratic Functions

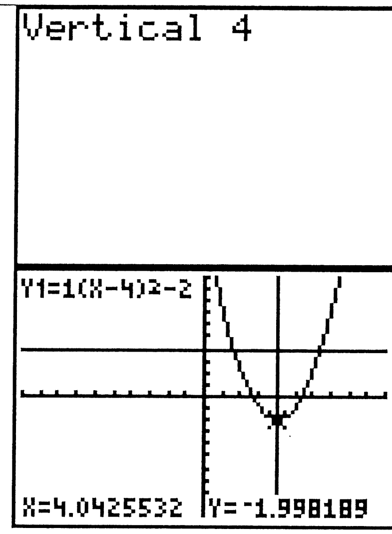
The axis of symmetry runs through the midpoint of these two points. Use the formula to find the midpoint of the two intersection points.

midpoint: ______________

midpoint $(x1, y1)$ and $(x2, y2)$
=
$$\left(\frac{x1+x2}{2}, \frac{y1+y2}{2}\right)$$

Draw a vertical line through this midpoint. On the Home screen, press [2nd] [DRAW] and choose the **Vertical** command. Enter the *x*-coordinate of the midpoint.

The command shown here draws a vertical line at $x = 4$.This vertical line is the axis of symmetry.



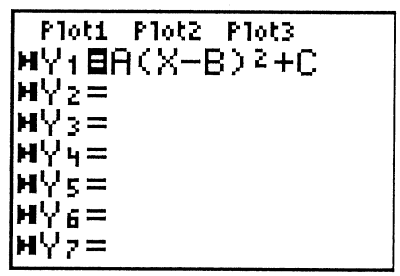
Use the **Trace** feature to approximate the coordinates of the point where the vertical line intersects the parabola. Round your answer to the nearest tenth. This point is the vertex of the parabola.

vertex: ______________

10. Look at the equation in **Y1**. How is the vertex related to the general equation $y = a(x - h)^2 + k$?

Now we will examine the effect of the value of *a* on the "width" of the parabola. Turn the **Transformation Graphing** app on again and enter **A(X – B)² + C** in **Y1**.

Change the value of A (*a*) and observe the effect on the graph.



11. What happens when *a* is positive? When *a* is negative?

12. What happens as the absolute value of *a* gets larger? *a* gets smaller?

13. The coefficient ____ determines whether the parabola opens upward or downward, and how wide the parabola is.

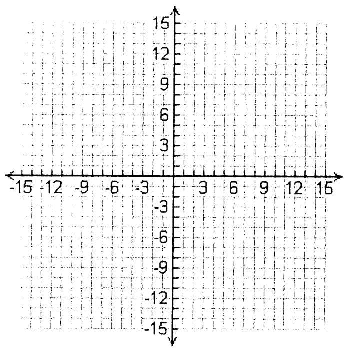
14. The vertex of the parabola is the point with coordinates _______.

15. The equation of the axis of symmetry is x = ______.

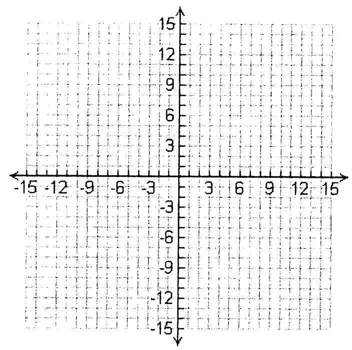
Graphing Quadratic Functions

Sketch the graph of each function. Then check your graphs with your calculator. (Turn off **Transformation Graphing** first.)

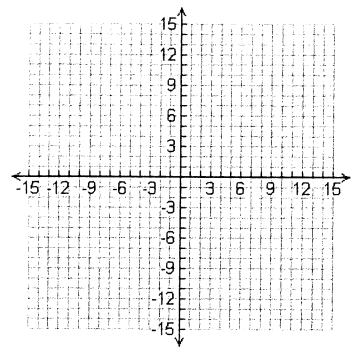
16. $y = x^2 - 3$



17. $y = (x-7)^2$



18. $y = -(x+5)^2 + 4$



Problem 2 – Standard form

The standard form of a parabola is $y = ax^2 + bx + c$. Let's see how the standard form relates to the vertex form.

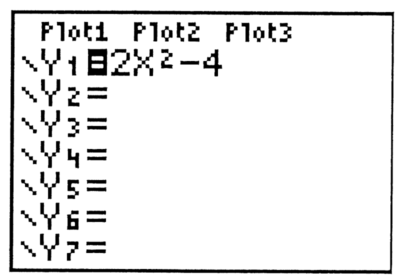
$$y = a(x-h)^2 + k$$
$$y = a(x^2 - 2xh + h^2) + k$$
$$y = \boxed{a}x^2 \boxed{-2ah}x + \boxed{ah^2 + k}$$

$$b = -2ah$$
$$h = -\frac{b}{2a}$$

$$y = \boxed{a}x^2 + \boxed{b}x + \boxed{c}$$

1. For the standard form of a parabola $y = ax^2 + bx + c$, the x-coordinate of the vertex is ______.

The equation $y = 2x^2 - 4$ is in standard form. Graph this equation in **Y1**.



2. What is the value of a? Of b? Of c?

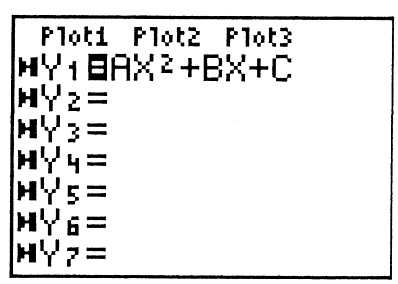
3. What is the x-coordinate of the vertex?

4. Use the **minimum** command to find the vertex of the parabola.

vertex: _____________

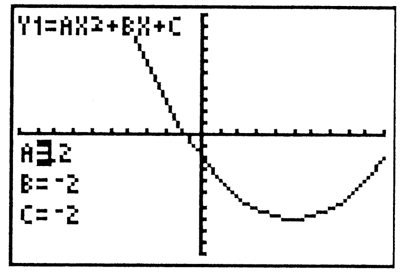
How do you think changing the coefficient of x^2 might affect the parabola?

Turn on the **Transformation Graphing** app and enter the equation for the standard form of a parabola in **Y1**.

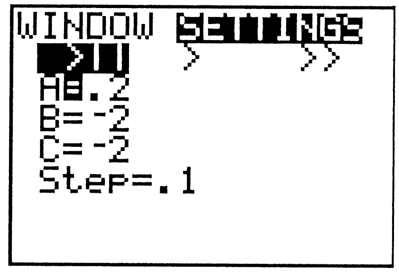


Graphing Quadratic Functions

Try different values of *A* in the equation. Make sure to test values of *A* that are between –1 and 1.



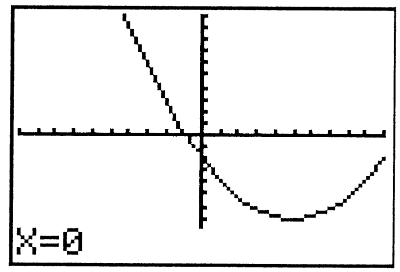
You can also adjust the size of the increase and decrease when you use the right and left arrows. Press [WINDOW] and arrow over to **Settings**. Then change the value of the step to 0.1 or another value less than 1.



5. Does the value of *a* change the position of the vertex?

6. How does the value of *a* related to the shape of the parabola?

To find the *y*-intercept of the parabola, use the **value** command ([2nd] [CALC]), to find the value of the equation at $x = 0$.



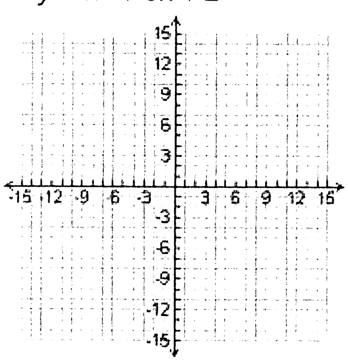
Change the values of *a*, *b*, and/or *c* and find the *y*-intercept. Repeat several times and record the results in the table below.

Equation	A	B	C	*y*-intercept
$y = 2x^2 - 4$	2	0	–4	–4

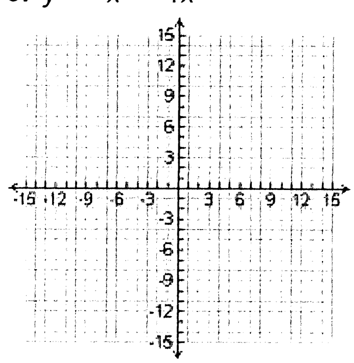
7. How does the equation of the parabola in standard form relate to the *y*-intercept of the parabola?

Sketch the graph of each function. Then check your graphs with your calculator. (Turn off **Transformation Graphing** first.)

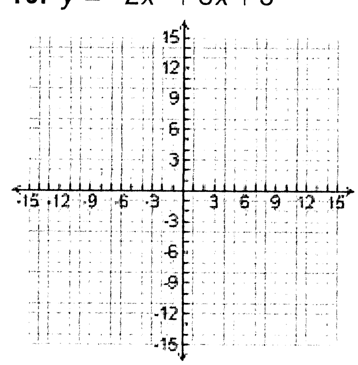
8. $y = x^2 + 6x + 2$



9. $y = -x^2 - 4x$



10. $y = -2x^2 + 8x + 5$



Graphing Quadratic Functions

ID: 9406

Time required
60 minutes

Activity Overview

In this activity, students graph quadratic functions and study how the constants in the equations compare to the coordinates of the vertices and the axes of symmetry in the graphs. The first part of the activity focuses on the vertex form, while the second part focuses on the standard form. Both activities include opportunities for students to pair up and play a graphing game to test how well they really understand the equations of quadratic functions.

Topic: Quadratic Functions & Equations

- *Graph a quadratic function $y = ax^2 + bx + c$ and display a table for integral values of the variable.*
- *Graph the equation $y = a(x - h)^2$ for various values of a and describe its relationship to the graph of $y = (x - h)^2$.*
- *Determine the vertex, zeros, and the equation of the axis of symmetry of the graph $y = x^2 + k$ and deduce the vertex, the zeros, and the equation of the axis of symmetry of the graph of $y = a(x - h)^2 + k$*

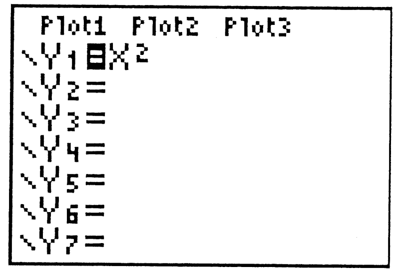
Teacher Preparation and Notes

- *This activity is designed to be used in an Algebra 1 classroom. It can also be used as review in an Algebra 2 classroom.*
- *This activity is intended to be mainly **teacher-led**, with breaks for individual student work. Use the following pages to present the material to the class and encourage discussion. Students will follow along using their calculators.*
- *This activity uses the Transformation Graphing Application. Make sure that each calculator is loaded with this application before beginning the activity.*
- *Problem 1 introduces students to the vertex form of a quadratic equation, while Problem 2 introduces the standard form. You can modify the activity by working through only one of the problems.*
- *If you do not have a full hour to devote to the activity, work through Problem 1 on one day and then Problem 2 on the following day.*
- *Before beginning this activity, clear out any functions from the **Y=** screen and turn all plots off.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "9406" in the keyword search box.***

Associated Materials

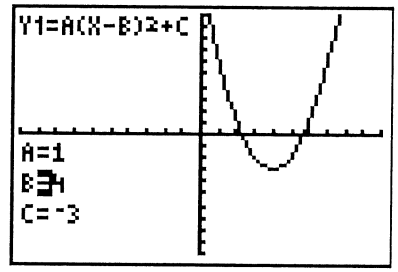
- *GraphingQuadraticFunctions_Student.doc*

Problem 1 – Vertex form



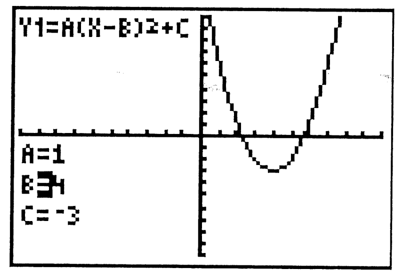
Students enter the equation $y = x^2$ into **Y1**. and view the graph. Ask them to describe the shape of the graph. Be sure to mention that this curve is called a parabola.

Discuss the vertex form of a parabola, $y = a(x - h)^2 + k$. For the equation $y = 2(x - 3)^2 + 1$, make sure that students are able to identify the values of a, h, and k.



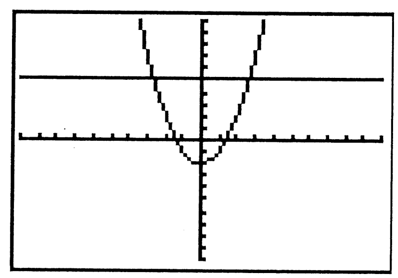
Students will explore the values of a, h, and k, to see how the values affect the characteristics of the parabola (such as the vertex, axis of symmetry, and maximum or minimum values).

They are to open the **Transformation Graphing** app, press [Y=], and enter **A(X – B)²+ C** in **Y1**. When they press [GRAPH], the calculator has chosen values for A, B, and C and graphed a parabola. Note that the **=** next to A is highlighted.



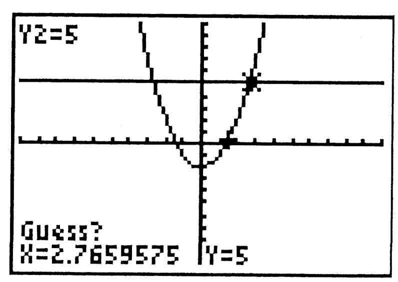
First, students are to change the value of B, which corresponds to h in the vertex form $y = a(x - h)^2 + k$. They can type in a new value and press [ENTER] or use the left and right arrow keys to decrease or increase the value of B by 1.

They should observe where h is positive and negative. Students end their investigation of B by setting B = 0.



Now, students will investigate the axis of symmetry. After turning off the **Transformation Graphing** app, they are to graph their equation recorded on the worksheet in Y1 and view the graph.

In Y2, students are to draw a horizontal line that intersects the parabola twice. This equation should be recorded in the first column of the table.

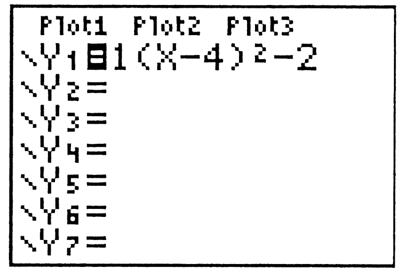


Using the **intersect** command, they will find the coordinates of the two points where the line intersects the parabola.

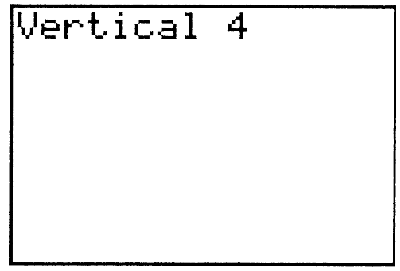
They should repeat this until they have 3 different horizontal lines and their intersection points recorded in the table.

Students should see that the distance from each intersection point to the y-axis is equal. Discuss how the y-axis or the line $x = 0$ is the **axis of symmetry**.

Students will now find the axis of symmetry when the value of *h* is 4. After graphing $y = (x - 4)^2 - 2$ in Y1, they are to graph a horizontal line in Y2 and find the intersection points.



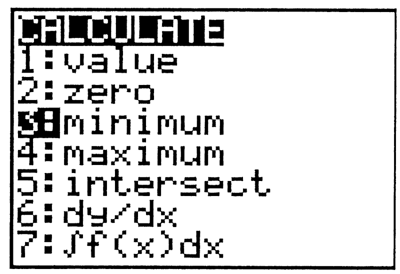
They will use the midpoint formula to find the midpoint between the two intersection points. Then they are to draw a vertical line through it using the **Vertical** command.



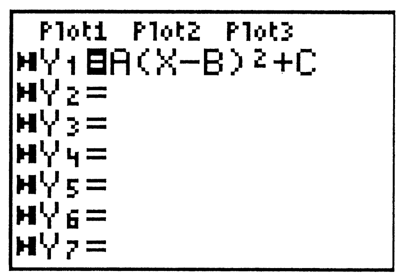
Note: Make sure students are on the Home screen when selecting the Vertical command.

Discuss with students that the axis of symmetry is the li[illegible]

Using [illegible] students approximate the coordinates of the vertex. Explain to students that since the vertex is the lowest point on the graph, it is also a [illegible]. Have them check their answer by usin[illegible]mmand (2nd [CALC]).



Now students will investigate the effect of *a* on the "width" of the parabola. They need to turn the **Transformation Graphing** app on again and enter **A(X – B)^2 + C** in **Y1**. Then they change the value of of A (*a*) and observe the effect on the graph.



Discuss with students what happens when *a* is positive and negative. Explain to students that if the graph opens downward (*a* is negative), the vertex is a ***maximum*** because it is the highest point on the graph.

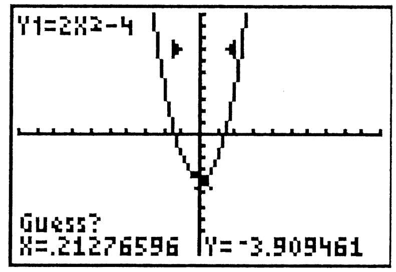
On the worksheet students will practice sketching given functions and then verify using the calculator.

Problem 2 – Standard form

Students are first introduced to how the standard form of a parabola, $y = ax^2 + bx + c$, is related to the vertex form. They should see that the x-coordinate of the vertex, or h-value, is equal to $-\frac{b}{2a}$.

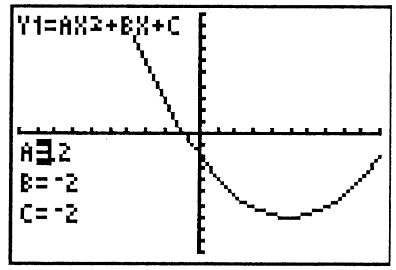
Students are to graph the equation $y = 2x^2 - 4$ in **Y1**. They should determine the values of *a*, *b*, *c*, and the *x*-coordinate of the vertex.

Then students need to use the **minimum** command to find the vertex of the parabola.

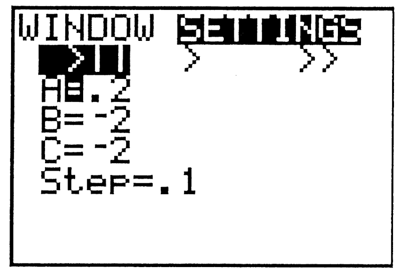


Now students will investigate how changing the coefficient of x^2 affects the parabola, using the **Transformation Graphing** app.

They first enter the standard form of a parabola in **Y1** and then change the value of A. Encourage students to test positive and negative values.

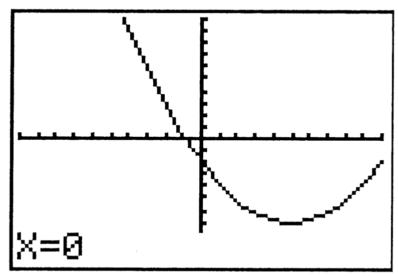


Students should also try values of A that are not integer values. To do this, press WINDOW, arrow over to **Settings**, and change Step = 0.1 or another value less than 1.



They should see that changing the value of a does not change the position of the vertex, but does change the width of the parabola.

Now, students will investigate the *y*-intercept of parabolas. They will use the **value** feature to find the *y*-intercept, i.e., the value of the equation at $x = 0$.



They should change the values of *a*, *b*, and/or *c* and find the *y*-intercept several times, recording the results in the table on the worksheet.

Discuss with students how the equation of the parabola in standard form is related to the *y*-intercept of the parabola.

On the worksheet students will practice sketching given functions and then verify using the calculator.

Solutions

Problem 1

1. Answers will vary. Sample answer: the curve appears symmetric, and becomes less steep as x increases or decreases.
2. $a = 2$, $h = 3$, $k = 1$
3. When h is positive, the lowest point of the graph is to the right of the y-axis. When h is negative, the lowest point of the graph is to the left of the y-axis.
4. When the absolute value of h gets larger, the graph moves away from the y-axis. When the absolute value of h gets smaller, the graph moves closer to the y-axis.
5. a. The graph will center on the y-axis.
   b. Answers will vary.
6. Equations will vary.
7. The x-coordinates of the points are opposites of each other. The y-coordinates of the points are the same.
8. The left and right points are equidistant from the y-axis.
9. $x = 0$
10. The vertex is (h, k).
11. When a is positive, the parabola opens up. When a is negative, the parabola opens down.
12. When the absolute value of a gets larger, the parabola becomes "narrower." When the absolute value of a gets smaller, the parabola becomes "wider."
13. a
14. (h, k)
15. h

16–18. Check students' graphs.

Problem 2

1. $-\frac{b}{2a}$
2. $a = 2$, $b = 0$, $c = -4$
3. 0
4. (0, 4)
5. No
6. When a is positive, the parabola opens up. When a is negative the parabola opens down. The greater the absolute value of a, the "narrower" the parabola. The smaller the absolute value of a, the "wider" the parabola.
7. c is the y-intercept of the parabola

8–10. Check students' graphs.

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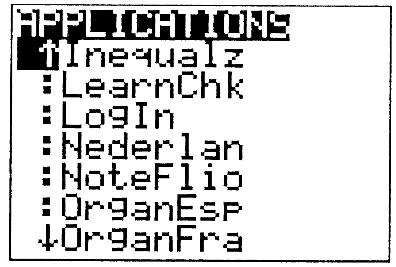
Border Patrol

Name ______________________

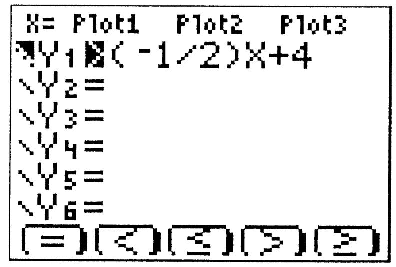
Class ______________________

Problem 1 – Graphing one inequality

Start the Inequalities Application by pressing [APPS] and selecting **Inequalz**.



Suppose the inequality, $y > -\frac{1}{2}x + 4$, can be used to describe a region of the United States on the US/Mexico border.



To graph this inequality, press [Y=]. Now, with the cursor over the equal sign, press [ALPHA] then the key directly below the desired symbol (in this case, [TRACE].) Now enter the rest of the equation and press [ZOOM] and select **ZStandard** to view the graph of the inequality.

- What does the dashed line represent? Why is it dashed and not solid, in context of the inequality and in the context of the problem?

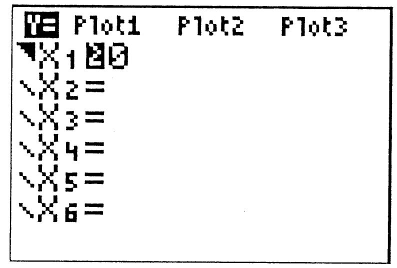
- Which side represents US territory? Mexico territory?

- If the point (8, –1) represents a town, is it a US or Mexican town? Is this a solution to the inequality? Why?

- Use the arrow keys to move to a location that is not a solution to the inequality. What are the coordinates of this point?

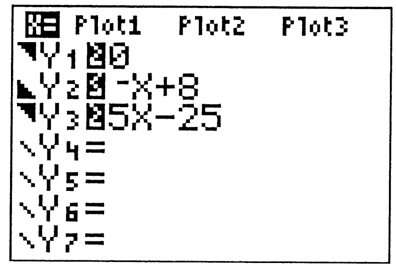
Problem 2 – Graphing a system of linear inequalities

The following system of inequalities represents the fenced-in area of someone's yard. Graph the inequalities. To graph the $x \geq 0$, move the cursor to the top-left corner of the screen where the **x=** appears and press [ENTER]

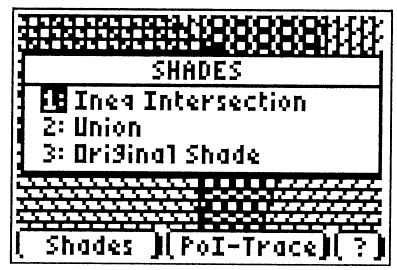


$$\begin{cases} x \geq 0 \\ y \geq 0 \\ y \leq -x + 8 \\ y \geq 5x - 25 \end{cases}$$

Once these have been entered, press [ZOOM] and select **ZStandard** to view the graphs of these inequalities.



While the graphing window looks very cluttered, there is a way to have it only display the solution to this system of equations (where all the graphs of the inequalities overlap.) To view this region (called the fundamental region) for this system of inequalities, press [ALPHA] [F2] and select **Ineq Intersection**.



- Why are the lines solid in the context of the system of inequalities? In the context of the problem?

- Suppose the owner wanted to place a post in the yard on which to hang a bird feeder. Give a point that could represent the post (found by using the arrow keys.) What does this point represent for the system of inequalities?

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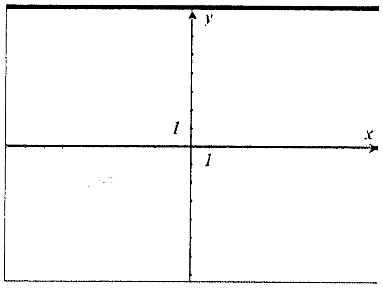
Problem 3 – Practice graphing systems of inequalities

Graph the systems of inequalities given below on your graphing calculator. Copy the graph from your calculator and shade ONLY the solution set below. Then, determine if the points below each graph are solutions to the system.

$$x-5y<18$$
$$2x+3y\geq 10$$

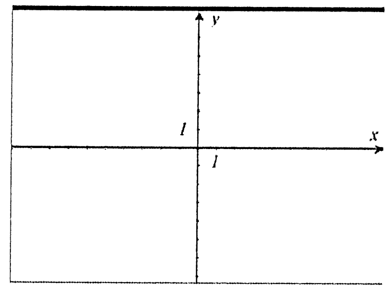


(0,1)　(8,-5)

(–1,4)　(–4,–1)

(7,3)　None of these

$$9x+4y>-7$$
$$3x-5y>-34$$

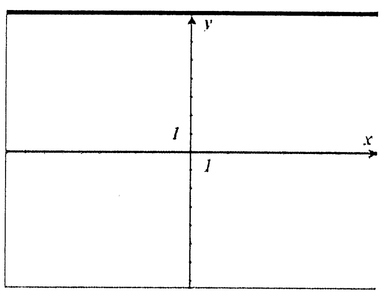


(0,0)　(–1,0)

(3,3)　(–3,–3)

(–1,8)　All of these

$$4x-y\leq -11$$
$$4x-y\geq 7$$

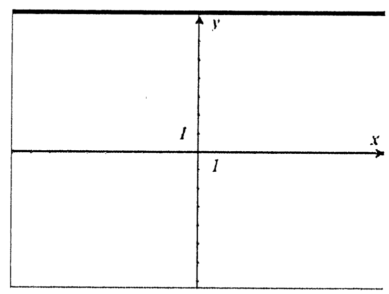


(0,3)　(5,8)

(–4,2)　(–6,–1)

(2,–4)　None of these

$$2y<-5x+10$$
$$-x+y\geq 5$$



(0,0)　(2,0)

(–8,3)　(4,3)

(–2,–4)　All of these

- Explain how you know a point is in the solution set without using the graph.

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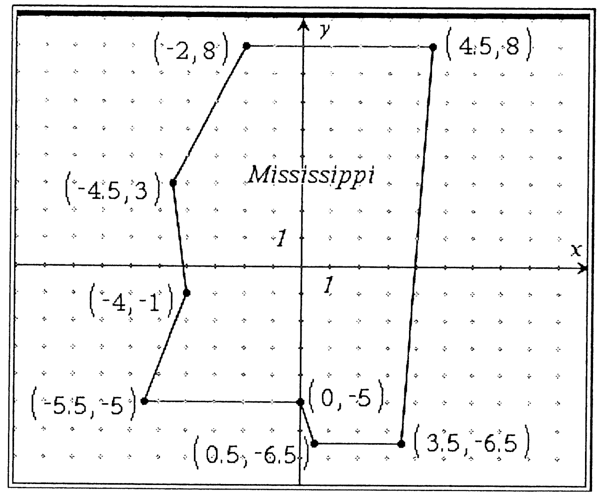
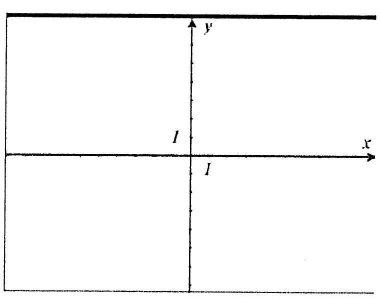
Extension – Writing systems of linear inequalities

1. To the right is an approximate map of Mississippi. Write the system of inequalities whose solution graphs the state of Mississippi.



2. The Student Senate committee must consist of 6 to 9 representatives from the junior and senior classes. The committee must include at least 2 juniors and 3 seniors.
   - Write a system of inequalities to describe the situation.
   - Graph the system and copy the solution of the graph here.



   - Which combinations of juniors and seniors listed below satisfy the system?

     3 juniors, 5 seniors

     2 juniors, 7 seniors

     4 juniors, 4 seniors

     3 juniors, 6 seniors

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ID: 11602

Time required
20 minutes

Activity Overview

In this activity, students will graph one linear inequality and then graph a system of linear inequalities as they apply to an area of land. Students will practice graphing systems of inequalities and determining if a points lies in the solution. In the extension, students are challenged to write a system of inequalities that describe the area of Mississippi.

Topic: Linear Systems

- *Linear inequalities in two variables*
- *Solution sets*

Teacher Preparation and Notes

- *The teacher should introduce and practice graphing an inequality before using the activity.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "11602" in the keyword search box.***

Associated Materials

- *BorderPatrol_Student.doc*

Suggested Related Activities

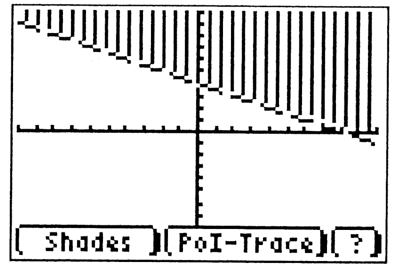
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

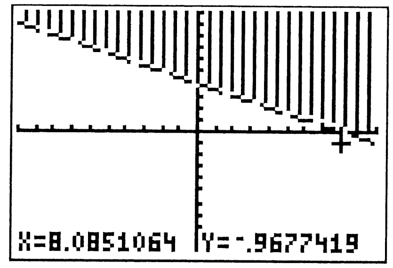
- *Solving Linear Equations and Inequalities (TI-Nspire technology) — 8992*
- *Winning Inequalities Part 1 (TI-84 Plus family) — 4283*
- *The Impossible Task (TI-84 Plus family) — 9316*

Problem 1 – Graphing one inequality

Students are to graph an inequality that represents United States territory along the US/Mexico border. Directions for graphing the inequality are provided on the student worksheet.

To answer the questions, students can use the arrow keys on the calculator to move to different locations on the graphing window.





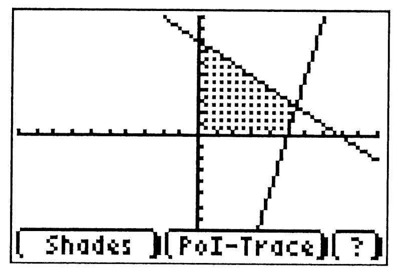
Discussion Questions:

- Why does line appear dotted?
- How can one determine if the calculator has shaded the plane correctly?
- Can a town lie on the border and be considered in US territory?

Problem 2 – Graphing a system of linear inequalities

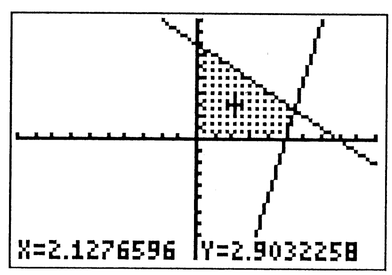
Students are given a system of inequalities that represent a fenced-in yard.

Students should see that the lines are solid because the fence is the owner's property and the inequality symbols are ≤ and ≥.



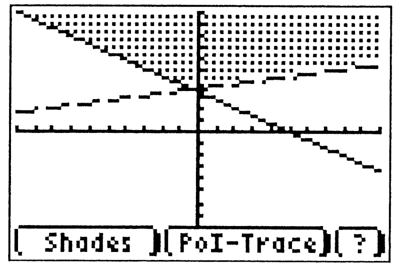
Once the students have press [ALPHA] [F2] and select **Ineq Intersection**, they will see the screen to the right displaying the fundamental region.

They will need to use the arrow keys on the calculator to move to a location within the yard for the bird feeder.



Problem 3 – Practice graphing systems of inequalities

Students will graph systems of linear inequalities given on the student worksheet page. They are to graph the systems and then determine if the points given below the graph are in the solution set. To do this, they can either use the arrow keys, or determine if the point satisfies both inequalities by using the calculator ability of their handheld.

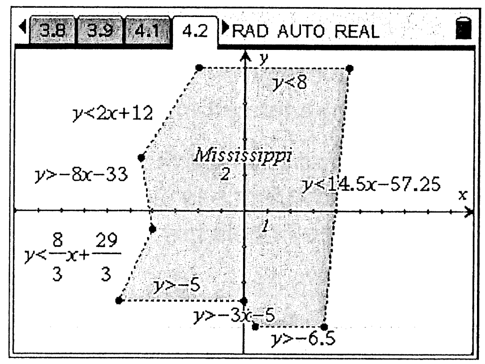


<u>Discussion Questions</u>:

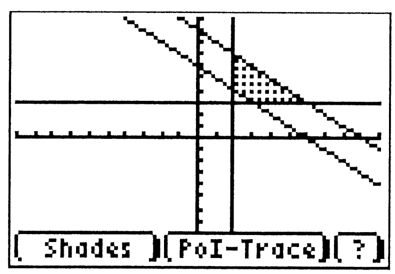
- How can we determine the solution set by examining the graph?
- Is there a way to describe the solution set using non-graphical notation?

Extension – Writing a system of linear inequalities

In the first extension, students are given a graph of the shape of the state of Mississippi. They are to determine the system of linear inequalities that describe the area of the state. The inequalities should have < or > because the borders are imaginary.



In the second extension, students are given a word problem from which they will write a system of linear inequalities. They can graph the system on page 4.4. One of the constraints is $x > 2$. Students can add a vertical line at $x = 2$ and place text on the screen notifying that there is that constraint.



Students must then determine which of the combinations of juniors and seniors listed on are possible solutions to the problem.

<u>System of inequalities:</u>

$$\begin{cases} x \geq 2 \\ y \geq 3 \\ y \leq -x + 9 \\ y \geq -x + 6 \end{cases}$$

<u>Answers:</u>

3 juniors, 5 seniors

4 juniors, 4 seniors