8-11-2009

Rules, What Rules ? (Linear Equations, y=,x/y Tables, Graphing) [8th grade]

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Trinity University

UNDERSTANDING BY DESIGN

Unit Cover Page

Unit Title: Rules, What Rules? (Linear Equations, y =, x/y Tables, Graphing)

Grade Level: 8th grade (SSI)

Subject/Topic Area(s): Math

Designed By: Catherine Risinger

Time Frame: 2 weeks (45 minutes/day)

School District: North East Independent School District

School: Tejeda Middle School

School Address and Phone: 2909 E. Evans Rd
San Antonio, TX 78259
(210)482-2260

Brief Summary of Unit (Including curricular context and unit goals):

The students will be introduced to linear equations. The main understandings that I want my students to develop is that even though there are multiple ways to solve problems, each way and representation can convey the same information.

Students will demonstrate their knowledge of linear equations by solving them using a situation, algebraically, graphically, and using a table. Students will be able to generate a different representation of data given another representation of the same data. Students will explore real world examples of linear equations and discuss when different representations of linear equations are better models to use even though all the representations convey the same information.

Students will apply what they have learned over the course of the 7 days and apply their knowledge of linear equations in the performance task. Each student will create a picture using only straight lines and then write the directions on how to get from each set of points on a coordinate plane as well as writing the equation of each line. Students will be assessed on the accuracy of their equations, using only straight lines to create their picture, a direction sheet of "code", and a self-assessment of how they felt they did using the 3-2-1 strategy.

Unit: Rules, What Rules? (Linear Equations, y =, X/Y Tables, Graphing)
Grade: 8th grade (SSI)
TEKS: Mathematics 8.3a, 8.4a, 8.5a, 8.16a

Stage 1: Desired Results

Understandings

Students will understand that…

- *There are many methods to represent patterns/rules in mathematical problems*
- *Mathematics allows patterns/rules that may otherwise not be seen by using multiple representations*

Essential Questions

- What are rules?
- What different ways can you convey the same information?

Knowledge	**Skills**
Students will know… • Key Terms – equation, rule, pattern, variable, rate of change, proportional, non-proportional, slope, y-intercept, constant • How to generate linear equations from tables, graphs, and real world problems	*Students will be able to…* • *Use graphs, tables, and algebraic representations to make predictions and solve problems* • *Connect various representations of a numerical relationship*

Stage 2: Assessment Evidence

Performance Task:

- You are an artist and you are renowned for your ability to turn ordinary pictures into works of art that only require the use of straight lines. Someone has recently offered to manufacture your piece of art using metal sheets. The company would like to mass produce this using a method called plasma cutting. Plasma cutting allows the metal sheets to be precisely cut to the specifications of your design. The good thing is that this is all done using a specialized machine called a CNC (Computer Numerically Controlled), what this means for you is that you have to now take your work of art and write the code for the computer so that it will be able to cut out your design with precision.
- Since the computer that controls the CNC uses a coordinate plane to cut out each design it is your job to write the "code" that will allow the computer to be able to convert your design from paper to a metal sheet. For each line that will be cut, the computer requires that you provide it with a starting point, ending point, and the equation of each line that will be needed to cut out your piece of art using the CNC. If this can be done you will make history as the first artist who has their artwork mass produced for the public using the process of plasma cutting.
- You piece of art work is made up of a minimum of 20 straight lines. Your artwork may contain some intersecting lines but there are no coinciding lines (repeating lines) in your piece. You will be graded according to the provided rubric and you will fill out a 3-2-1 self assessment.
    - **3 -** Name 3 things that you feel helped you to be successful in this unit.
    - **2 -** Name 2 new things you learned about rules
    - **1 -** What 1 thing do you feel you will use in the future? And why?

Other evidence: *(quizzes, tests, academic prompts, self-assessments, etc. note – these are usually included where appropriate in Stage 3 as well)*
Class work – Situation Match Cards, Green Globs
Mini-quizzes
Self-Assessment

Stage 3: Learning Activities

(Steps taken to get students to answer Stage 1 questions and complete performance task)

Day 1 (Introduction & Review)

- Warm-up: Silent chalk talk using the EQ **"What are rules?"**
- Introduce the unit with a discussion of the EQ, **"What are rules?"**
- Discuss with students how the previous unit of proportions was used to compare different types of situations (part to whole, unit rate, part to part) and how those situations can have rules (linear equations).
- Review the concept of proportional vs. non-proportional and create a checklist that will help students remember the difference between proportional and non-proportional.
- The teacher will display mathematical situations on the board and ask students to decide if something is proportional or non-proportional. Students will respond accordingly by going to different sides of the room.

Day 2 (Tables)

- Warm-up: Post 5 proportion problems and have students decide if they are proportional or non-proportional
- The teacher will briefly revisit with students the EQ, **"What are rules?"**
- The teacher will now proceed to give students a set of tables and ask to see whether or not they can find a rule in each of the examples and have them explain how they arrived at their rule. (The tables will be proportional, non-proportional, and there will be 1-2 non-linear tables)
- After students have had time to explore patterns on their own, the teacher will begin to review with students X/Y tables, the teacher will then explain to students that when they were looking for rules/patterns earlier they were exploring the concept of slope. Students will learn that you can find the slope in a table through a strategy known as "bird beaks" by obtaining the ratio (rate of change) Y/X and that slopes can be both positive and negative. Students will see that some of the tables will start at 0 and some will not and at that point the concept of y-intercept will be introduced.
- The teacher will then show students that in a table the y-intercept can be easily found by looking to see when X = 0, there is a Y value associated with it. Or they can use the table they have and continue the pattern for both the X and Y values.
- The students will then find the slope and y-intercept on a provided worksheet of 10 problems. If they do not finish it they will complete it tomorrow as their warm-up
  **"Bird Beaks" will be explained at the end of the unit.
  **The teacher if they so wish may like to discuss with students domain and range as X and Y values are discussed.

Day 3 (Graphing)

- Warm-up: Display 5 tables and ask students to determine the slope and y-intercept of each problem. ** If students did not finish yesterday's class work they will complete that for their warm-up instead.
- Students will use yesterday's class work on slope and y-intercept to create stairs on the coordinate plane being provided using "ryse"/run.
- After students have created their stairs they will use the previous day's tables to plot the ordered pairs and discuss how a line exists from these points and we can obtain an equation from the line.
- Students will now be given problems containing a slope and y-intercept and be asked to graph those on a coordinate plane.
- At the end of class students will take a **mini-quiz** over finding the slope & y-intercept from tables and graphing lines using the given slope and y-intercept.

Day 4 (Writing Equations)

- Warm-up: Students will engage in another chalk talk and the answer the other EQ **"What different ways can you convey the same information?"**
- Teacher and students will discuss their thoughts and whether or not they can now make the connection of how to write a linear equation when given a table or a graph
- Students will now use both the tables and graphs to write linear equations in slope intercept form "$y = mx \pm b$". (The teacher will also briefly inform students that in high school the slope intercept equation may look like "$y = ax \pm b$")
- Students will look back at the class work over the past couple of days and now practice writing linear equations from a table and from a graph as well as when given a linear equation they are able to create a table of values and graph it.
  *Students will see that all of the equations, tables, and graphing of the lines are conveying the same information.
  **Possible extension activity is to play "Guess who?" in order to further check for students level of understanding. Ex. "does your equation contain a positive slope?", "Is you equation proportional?" etc. Students will try to figure out the linear equation based on the questions they ask their classmate.

Day 5 (Practice day writing equations)

- Warm-up: Display 2 tables and 3 graphs and ask students to write the linear equation
- During the 1st half of class, have students create 5 tables/graphs and write the linear equation (answers) for each representation on a separate sheet of paper. Once students have completed this task, ask them to exchange their paper with a classmate to see if they can write the equation of the lines when given tables or graphs.
- After students have been given time to complete the task from the 1st half of class, the teacher will discuss with students that we can turn linear equations into real world situations. The teacher will provide a couple of examples for students. The teacher will now ask students to use the warm-up problems and the problems they created to make-up their own situation problems in small groups that would match the linear equations they choose.

Day 6 (Practice & application)

- Warm-up: Students will be given 3 real world situation problems. Students will create a table of values, graph the situation on a coordinate plane, and write the equation of the line
- Students will then be put into small groups (groups of at least 3-4 people normally work best). Each group will be given a set of **situation match cards** and a recording sheet. It will be each group's task to match each situation card to the correct, table of values, graph, and linear equation and then record their answers on a recording sheet.
- At the end of class students will turn in their completed recording sheet. (**Depending on the flow of class, this activity may take an additional day to complete)

Day 7 (Green Globs computer game)

- Warm-up: Upon entering the computer lab students will pick up a direction sheet on "How to Play Green Globs", pick up the **mini-quiz**, and then proceed to log in to their assigned computer in the computer lab.
- Students will take a **mini-quiz** of 10 problems at the beginning of class that should last no more than 15-20 minutes.
- After students have completed their mini-quiz, they will play the Sunburst computer program **"Green Globs"** to practice writing linear equations. The object of the game is to kill the green glob(s) by obtaining the highest score. In order to determine the equation students may have to create a table of values or graph the line between the glob(s).

Day 8 (Performance Task)

- Warm-up: Belinda Beluga
- Introduce the Performance Task to students.
- The teacher will provide examples of pictures that use straight lines and pictures that do not use straight lines. Overlay a coordinate grid over the picture to demonstrate to students that equations can be derived from all the lines in the picture.
- Ask students to try to figure out the equation of a set of lines that you choose from the picture.
- If there is time, students will begin their work on the performance task.

Days 9/10 (**Performance Task**)

- Warm-up: None (Students will come into class and continue to work on drawing their picture & writing the "code" for their picture
- Spend class time creating the picture and writing the "code"
- At the end of class on Day 10 students should be able to turn into their teacher their picture as well as the "code" for the CNC and a **self-assessment** using the 3-2-1 strategy (3-Name 3 things that you feel helped you to be successful in this unit. 2-What are 2 new things you learned about rules? 1-What 1 thing do you feel you will use in the future? And why?)

Notes:

**All provided worksheets & activities are from the North East Independent School District Curriculum www.neisd.net

**Bird Beaks is a way to help students to see slope as rate of change and set-up the ratio y/x in linear equations. An example of bird beaks is being provided.

x	y
0	3
1	5
2	7
3	9
7	17
10	23

+1, +2; +1, +2

Rule: **y = 2x + 3**

$M = \frac{Y}{X} = \frac{+2}{+1} = 2$

x	y
0	0
1	5
2	10
3	15
7	35
10	50

+1, +5; +1, +5

Rule: **y = 5x**

$M = \frac{Y}{X} = \frac{+5}{+1} = 5$

A First of Its Kind

You are an artist and you are renowned for your ability to turn ordinary pictures into works of art that only require the use of straight lines. Someone has recently offered to manufacture your piece of art using metal sheets. The company would like to mass produce this using a method called plasma cutting. Plasma cutting would allow the metal sheets to be precisely cut to the specifications of your design. The good thing is that this is all done using a specialized machine called a CNC (Computer Numerically Controlled), what this means for you is that you have to now take your work of art and write the code for the computer so that it will be able to cut out your design with precision.

Since the computer that controls the CNC uses a coordinate plane to cut out each design it is your job to write the code that will allow the computer to be able to convert your design from paper to a metal sheet. For each line that will be cut, the computer requires that you provide it with a starting point, ending point, and the equation of the line that is necessary to connect both points. If this can be done you will make history as the first artist who has their artwork mass produced for the public using the process of plasma cutting

Requirements:

- A minimum of 20 straight lines. Lines may intersect but are not able to coincide (repeat/overlay).
- You artwork drawn on separate coordinate planes
    - 1 picture is drawn on the coordinate plane (Clean Copy)
    - 1 picture is drawn on the coordinate plane but each line is labeled with the equation of the line (Your Answer sheet)
- A direction sheet of code for the CNC (refer to the example below)
- Complete a self-assessment using the 3-2-1 strategy
    - **3 -** Name 3 things that you feel helped you to be successful in this unit.
    - **2 -** Name 2 new things you learned about rules
    - **1 -** What 1 thing do you feel you will use in the future? And why?
- Staple a rubric to the front of your completed project

CNC Code Format Example

1. Equation y = 3x + 5

   Start (2,5)

   End (3,8)

2. Equations y = -4x

   Start (3,8)

   End (2,4)

** Number all of your directions so that the CNC knows what order to cut out each line**

A First of It's Kind - Rubric

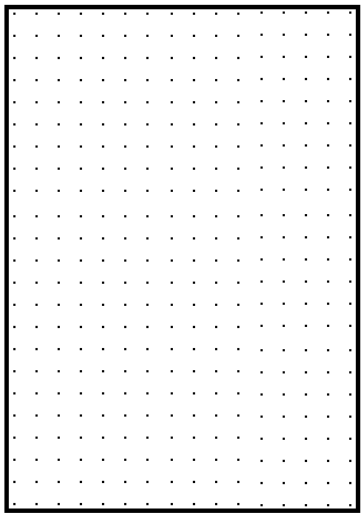
Name: _____ **Teacher: _____**

Grade: _____ **Date: _____**

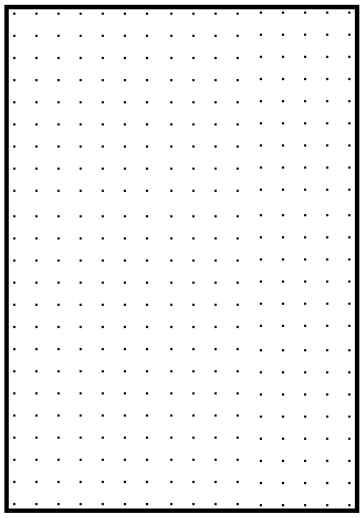
Criteria					Value
	4	3	2	1	
Artwork (Straight Lines)	There are at least 20 straight lines, and they are easy to see	There are 15-19 straight lines, and they are easy to see	There are 10-14 straight lines, and thet are easy to see	There are less than 10 straight lines, and they are easy to see	_____
Accuracy of Equations	All equations are labeled neatly, are correct and easy to see.	Equations are labeled neatly and are mostly correct	Equations are labeled, and are 50-75% correct	Equations are mostly labeled, and 50% or less are correct	_____
Code Page (Directions)	My code is complete and is in sequential order	My code is complete and is in almost sequential order	My code is complete and is listed in sequential order at least 50%	My code is listed but not in sequential order	_____
Self-Assessment	All of the questions were answered in complete sentences	Most of the questions were answered with some complete sentences	The questions were answered but not in complete sentences	Not all of the questions were answered	_____
				Total	_____

Teacher Comments:

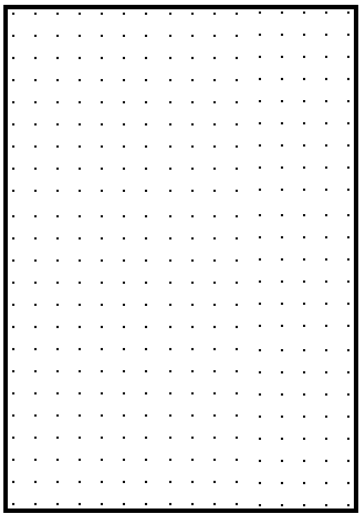
Stairs (Slopes)



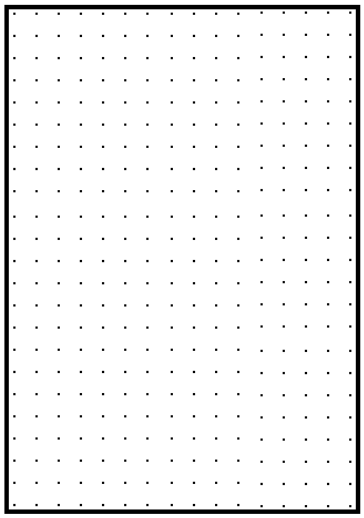
1. m= ___ y-intercept ____



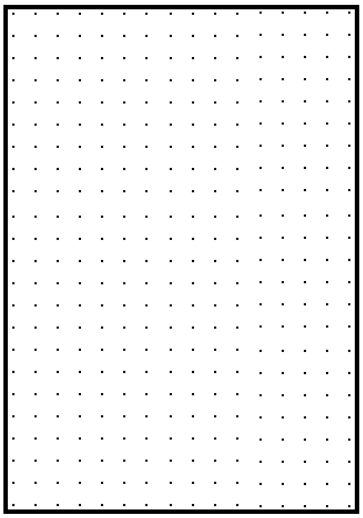
2. m= ___ y-intercept ____



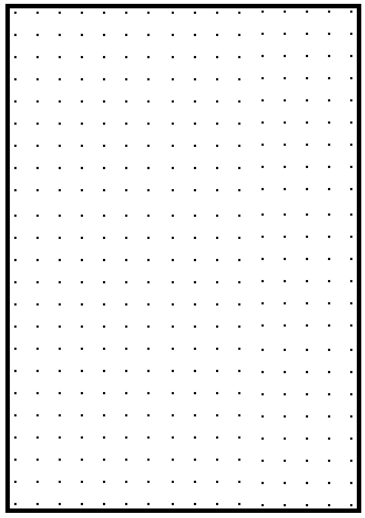
3. m= ____ y-intercept ____



4. m= ___ y-intercept ____



5. m= __ y-intercept ___



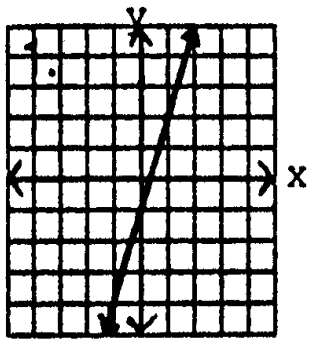
6. m= ___ y-intercept ____

$y = 3x - 1$

John wants to get a running start for his race, so he starts running one block away from the start line & runs 3 blocks every minute.

X	*Y*
2	5
-1	-4
0	-1

1

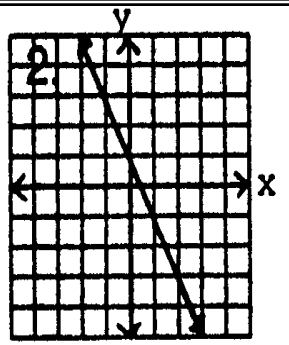


$y = -2x + 1$

Peggy has $1 in her wallet, but must pay two dollars for every ticket she buys at the carnival.

X	*Y*
-3	7
0	1
3	-5

2

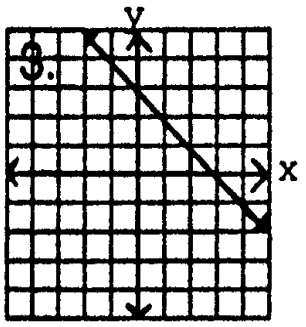


$y = -1\ x + 3$

Kathy **has 3 pieces of candy and gives them away to her classmates one at a time.**

X	*Y*
-1	4
0	3
5	-2

3

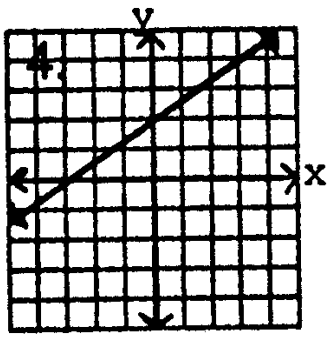


$y = 2/3\,x + 2$

Chris, a 2 yr. old, is racing his 5 yr. old brother down the sidewalk. Chris gets a head start of 2 feet and walks 2 feet every 3 seconds.

X	*Y*
-6	-2
-3	0
0	2

4

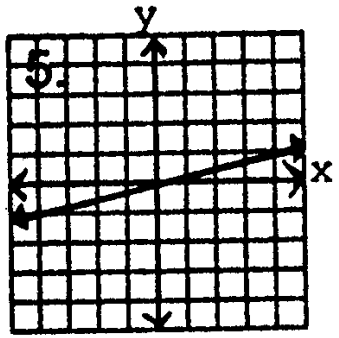


$y = 1/4\,x$

James works at a carnival ride and begins his shift with no money. He will collect 25¢ from every rider that gets on the ride.

X	Y
-8	-2
0	0
2	$\frac{1}{2}$

5

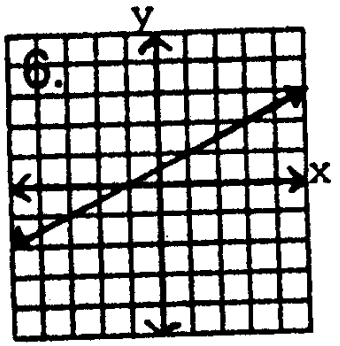


$y = 1/2\ x + .5$

Juan **is charged 50¢ to enter the ballpark and then an additional 50¢ for each hot dog and soda he gets at the snack bar.**

X	Y
-1	0
0	$\frac{1}{2}$
1	1

6

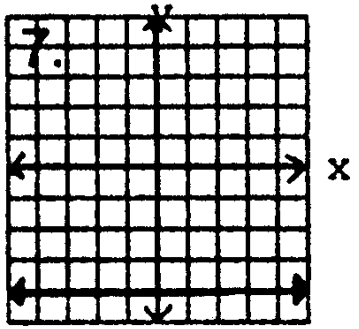


y = - 4

The sound of the starter's gun rang out as the *Olympic* race began. One runner froze with excitement & just stayed standing 4 ft. behind the line.

X	*Y*
-6	-4
0	-4
3	-4

7

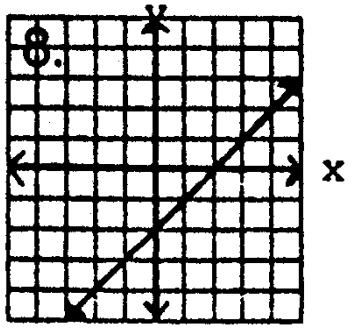


y = 1 x - 2

Billy owes his friend $2, but will save one dollar a week from his allowance and be able to pay his friend back real soon.

X	*Y*
-5	-7
0	-2
.5	-1.5

8

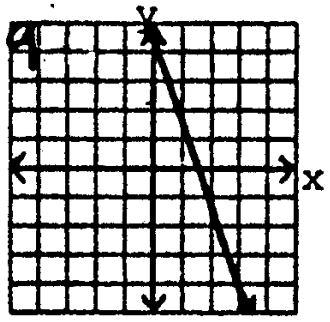


$y = -3x + 5$

Calvin has five pebbles and will be getting rid of his collection. He will be giving three pebbles away each day.

X	*Y*
-1	8
0	5
3	-4

9



Match each graph with a table, an equation, and a situation.

Graph	Table	Equation	Situation
#1			
#2			
#3			
#4			
#5			
#6			
#7			
#8			
#9			

Match each graph with a table, an equation, and a situation.

Graph	Table	Equation	Situation
#1			
#2			
#3			
#4			
#5			
#6			
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Graph	Table	Equation	Situation
#1			
#2			
#3			
#4			
#5			
#6			
#7			
#8			
#9			

Situation Match Game Answer Key

Match each graph with a table,
an equation, and a situation.

Graph	Table	Equation	Situation
#1	(2,5)	Y=3x-1	John
#2	(-3,7)	Y=-2x+1	Peggy
#3	(-1,4)	Y=-1x+3	Kathy
#4	(-6,-2)	Y=2/3x+2	Chris
#5	(-8,-2)	$Y=\frac{1}{4}x$	James
#6	(-1,0)	$Y=\frac{1}{2}x+0.5$	Juan
#7	(-6,-4)	Y=-4	Olympic
#8	(-5,-7)	Y=1x-2	Billy
#9	(-1,8)	Y=-3x+5	Calvin

Graphs: Are numbered in the upper right hand corner
Table: Have students list the first ordered pair of the table
Equations: Students write out the equation
Situation: Students write out the underlined word from the card

**Suggestion: Make multiple sets of the cards (at least 6 sets of cards). To avoid getting the sets of cards mixed up accidently, use different colored paper/cardstock for each entire set and laminate the cards if possible to be used in the future.

Green Globs – Instructions for Play

1. Double Click on Green Globs icon to open the program.

2. At the top of the screen, click on Programs and then choose Green Globs.

3. At the top of the new screen, click on Green Globs and then choose Start New Novice (beginner) Game. The computer will put up a new game board.

5. Type in your y = mx + b equation in the box under the game board. Press enter. The computer will graph your line and you will receive points for the green globs you hit.

6. Use the backspace key to erase your old equation. Then, type in a new equation and press enter. Continue playing until you have destroyed of the green globs.

7. When you get the "Congratulations!" screen, raise your hand so your teacher can record your score. This is for your classwork grade.

8. If the computer asks, "Do you want to add your game to the Records?" Choose yes.

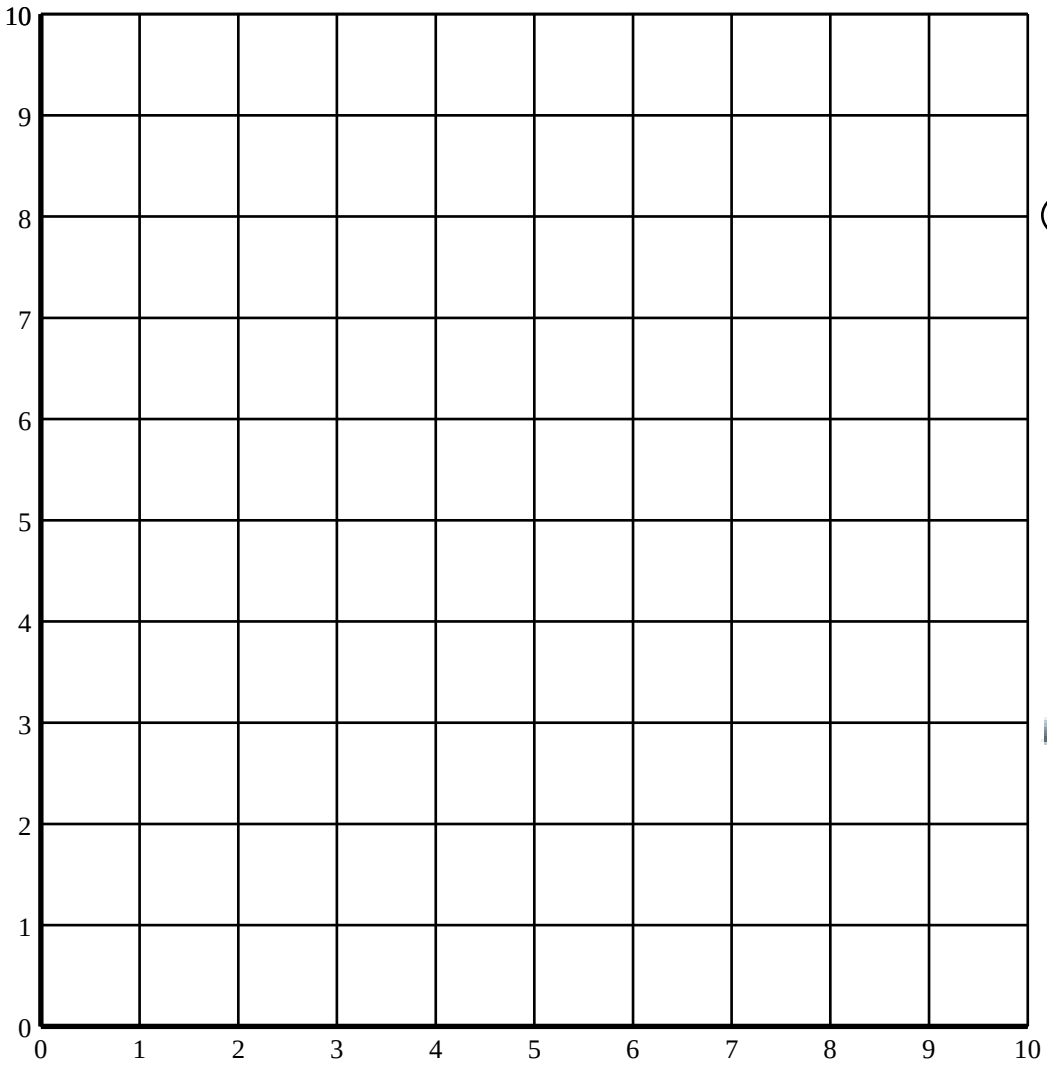
9. Type in your names and click ok. When it tells you that you have been added to the records, click ok again.

10. Then you can either click New Game (green globs will be in different places) or Restart Game (globs will be in the same place as the last game if you think you can score higher).

11. When you are finished playing, go to the top of the screen and click on File and then choose Exit.

A Day in the Life of Belinda Beluga

This activity involves graphing and listening skills. A story about a beluga whale in its natural environment will be read to the class. Record on your graph the coordinates as they are read throughout the story and connect them with a line as you go from point to point.



A Day in the Life of Belinda Beluga

(Teacher Page)

DIRECTIONS:

This activity involves graphing and listening skills. Read the following story about a beluga whale in its natural environment. The students will record on their graph the coordinates as they are read. Please pause when giving coordinates to allow students to locate the points and connect them as they are read.

STORY:

White whales, or belugas, can swim under the ice that covers the Arctic. They probably use echolocation to find holes in the ice that they can breathe through. Echolocation also helps them find food and avoid danger. Last Tuesday, Belinda Beluga spent the day swimming in the sea near the North Pole. Follow Belinda as she swims along.

Mark the point (1, 4) where she began to look for breakfast. She sent echolocation sounds though the water and found a squid at (3, 4). She swam up to the hole in the ice at (3, 6) and took a deep breath. A hungry polar bear saw her and started after her. She swam up to (2, 7). Was the coast clear? What were those sounds? It was other beluga whales in her pod. She swam to meet them at (6, 8). The group met two more friends at (7, 8). It was time for the whole pod to breathe. They made a big hole in the ice with their backs at (7, 7). Mack a dark circle to show that hole, but do not connect it to any other points. Back at (7, 8) they decided to look for lunch. Belinda was not very hungry, so she swam off to (8, 8). A huge iceberg blocked her path. What now? Why, swim around it! She swam first to (8, 6), then (9, 7), and finally to (9, 5).

Now Belinda was hungry. She used her echolocation sense to look for food, but instead found killer whales nearby. She swam as fast as she could to (7, 3), then (6, 3), and then (5, 2). She was safe, but very hungry. She found some tasty squid on the ocean floor at (5, 3) and some shrimp for dessert at (4, 3). Just then she heard her pod. They were far away at (3, 1). She swam to join them. An enormous iceberg was in their way, so the pod made a detour. They traveled to (3, 3) and home at last to (1, 4). What did Belinda find there? Her favorite food…do you know what that was?

(The final drawing should be a fish).