

NTTI Media-Rich Lesson

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NAME

“Let’s Keep It Straight”

LESSON TITLE

Ninth Graders

GRADE LEVELS

One class period/approximate length of class period 90 minutes

TIME ALLOTMENT

Background/Overview

Using a discussion of Cartography (the art of making maps) and the origin of this craft is an excellent way to start this lesson. Additionally, providing each student with a copy of an actual map of his or her city would be ideal. Begin the lesson with a short review on plotting and naming points in a coordinate plane. Since this will be a review of previous learned concepts, the review should be an interactive one.

Teacher Information

For this review activity, provide a connection using Cartography (the art of map making). Use a state map/place the map on a coordinate plane using numbers 1,2,3,... along the vertical or y-axis and capital alphabets A,B,C,... along the horizontal or x-axis. Give each student a copy of the map and questions. Ask several questions relative to locating highways and street intersections (See sample questions/attached). Follow this short activity with a “talking mathematics” activity, which will provide the students the opportunity to talk about the connection they see between Cartography and locating points on a coordinate plane. This activity will provide a gateway into what a linear equation is or what a linear equation looks like when graphed. Allow the students to give/write their own examples of equations, which are linear, and tell/explain orally their examples (spend about 15 minutes). The capacity to identify a linear equation is a prerequisite skill. Remember, students cannot graph or picture what they cannot first recognize and understand.

Directions

Next, guide your class into understanding what the graph of a linear equation will look like by initiating a conversation about the word “linear”. Ask the question: Just looking at the word linear, what do you think the root word for linear is?

Next, review plotting and locating points in a coordinate plane. Through this “talking mathematics” activity, students will gain comprehensive background knowledge, which is needed to be successful in graphing linear equations on the x and y-coordinate plane.

After students are able to demonstrate their understanding of what a linear equation is through identification and definition, then they should be ready for this lesson.

In this lesson, students get their first exposure to the connection between the equations that they have solved and what the equations look like graphically.

Algebra 1

SUBJECT MATTER

LEARNING OBJECTIVES

Students will be able to:

- Identify a linear equation
- Define/Explain what a linear equation is and what it should look like graphically
- Graph linear equations in two variables on a x and y-coordinate plane
- Graph linear equations in two variables using a graphing calculator

STANDARDS

Georgia Core Curriculum for grades 9-12

<http://www.glc.k12.ga.us>

Standards # 3 Communication

Communicates mathematical ideas by using language and symbolism: reflects upon and clarifies thinking about mathematical ideas and relationships; formulates mathematical definitions and expresses generalizations discovered through investigation; expresses mathematical ideas both orally and in writing; interprets written presentations of mathematics; asks clarifying and extending questions related to mathematics about which they have read or heard.

Standard # 21

Graphs linear equations in two variables and identifies graphs of lines, including special cases such as vertical, horizontal, parallel, and perpendicular lines.

Standard #16

Graphs points (ordered pairs of numbers) in the coordinate plane, and identifies the coordinates of given points in the plane.



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MEDIA COMPONENTS

Videos:

Algebra Action #115 “What is the Coordinate Plane?”

***Algebra Action # 116 “ How Do You Graph Lines on the Coordinate Plane?” Part 1**

Algebra Action # 118 “ How Do You Graph Lines on the Coordinate Plane?” Part 2

Website References:

Graphing Points

www.simpson.edu

You will need graph paper to complete this assignment. On all graphs, label and place a scale on each axis. Graphing points on a rectangular coordinate system: This site will provide specific points for the students to graph. Graph these points on graph paper labeling each with the letter.

Graphs

www.syllabus.syr.edu

This site will provide a quick review so that the students will be able to: identify the x and y axes, identify the origin on a graph, identify x and y coordinates of a point, and plot points on a graph. What is a graph?

The x,y-Plane Lesson

www.ppurplemath.com

This site provides a good review explaining the reasoning behind the Cartesian plane, and demonstrates how to plot points and determine quadrants.

SCORE Lesson-Coordinate Graphing

www.score.kings.k12.ca.us

Teacher Lesson Plan in this lesson. In this site, students will have the opportunity to learn the basics of coordinate graphing and to practice plotting points on the coordinate axis. Students need to be able to differentiate between negative and positive numbers.

Graphing Equations

www.pldhs.com

This site explains how to graph a linear equation. It gives a step-by-step example beginning with: you must first insert the x and y points that you want to plot. The student is given five specific points to plot: A (1,2) B (2,4) C (4,8) D (8,16) E (16,32).

Section 2: Plotting Points

www.ex.ac.uk

Plotting points in this section, students will review how to plot points on a graph. They will receive a step-by-step explanation using specific examples.



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MATERIALS

- Sample Equations for Introductory Group Activity
- Video Summary Quiz Questions
- Vocabulary List
- Sample Group Summary Write-up Sheet
- Sample equations for zip lock bags to be used in Identifying Linear Equation Activity
- Copies of standard graph paper
- Copies of a city map

Per Student:

- Graph paper (at least five sheets) per student
- Graphing calculator
- Ruler
- Hand-out of Websites
- Video discussion guide questions

Per Group:

- One packet of sample equations (5 to 10) equations per pack for review engagement activity

PREP FOR TEACHERS

Prior to teaching this lesson:

- Research Cartography (the art of making maps)
- Bookmark the Websites used in the lesson on each computer in your classroom.
- Prepare/Make copies of graph paper; enough for entire class.
- Prepare/Make copies of selected websites to be used.
- Obtain TV Monitor/Gateway/video player.
- Prepare packets (zip lock bags will do) of different kinds of equations (some quadratic, not equations at all, and some linear equations) each packet should contain at least 10 equations. The number of groups will determine the number of packets to prepare. One packet per group.
- Prepare scaffolding sheet for group write-up activity (identifying linear equations).
- Prepare focus questions/activities for each selected media interaction.
- Prepare a technology guide sheet for using the graphing calculator

INTRODUCTORY ACTIVITY: SETTING THE STAGE (Engage)

Step 1

Divide the class into at least four cooperative groups. Distribute the equation packets (one packet to each group). Direct each group to work together and separate the equations into two categories: linear and non-linear (a prerequisite skill). Next, have each group to complete the group write-up sheet where they tell why they have placed each equation where they placed it. Provide each group with a scaffolding sheet. The



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sheet should have a place for the actual linear equation and 2-3 lines for the group's reasons for identifying the equation as linear.

Step 2

Have each group report to the class their write-up (reasons) for identifying each equation as linear or not linear. This activity will give the students an opportunity to demonstrate their capacity to identify and define linear equations.

LEARNING ACTIVITY 1

Step 1

Ask the question: Just looking at the word linear, what do you think the root word for linear is? You will get several responses. Hopefully, one of the student responses will be the word "line", which is the correct response. Next, ask the class: Who could put express in words the relationship between the root word for linear and the graph of a linear equation. This activity will help concrete the fact that the graphs of all linear equations must be straight lines.

Step 2

Next, review plotting and locating points in a coordinate plane. Many of your students probably have encountered ordered pairs as early as 5th or 6th grade, but it is good to start by reviewing the basic skills of locating points on a coordinate plane. Explain to your students that they will have to remember how to locate and name points in the coordinate plane to graph linear equations. Survey the class, by show of hands, to see how many remember how to locate and name points on a coordinate plane. Allow several of the students, who raised their hand, to go to the class board coordinate plane and locate and name points. Allow several of the students, who did not raise their hand, to call out aloud the points/ordered pairs they are to plot. Allow four students to demonstrate their understanding of locating and naming points, and let four other students name the points to be plotted. Class discussion: To reinforce needed vocabulary, ask the class to define/with example the following terms: ordered pair, origin, x-coordinate, and y-coordinate. Therefore, a short review will serve as a springboard for the graphing of linear equation lesson.

Step 3

Ask your students to log on to the website at www.simpson.edu. The audio component for this presentation should be provided by one set of speakers loud enough for the class to hear clearly. **FOCUS FOR MEDIA INTERACTION:** To provide the class with a specific task to complete, ask the class to use their graph paper and follow the directions for setting up, labeling, and placing a scale on each axis of a coordinate plane. Next, ask the class to graph points on their rectangular coordinate plane. Points will be provided with names on the website. All names and point locations should be the same for each student. **CHECK FOR COMPREHENSION** by asking the class to exchange papers and check each other's work. The teacher should have a wall/board rectangular coordinate plane available, and allow individual students to locate and name the correct point on the large coordinate plane for the entire class to see. Have students return papers to the person with whom they exchanged their papers



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Through this website activity, students will gain comprehensive background knowledge, which is needed to be successful in graphing linear equations on the x and y-coordinate plane.

Learning Activity 2

Step 1: Tell the students that they will be watching and listening to segments from a video on graphing linear equations (Algebra Action # 116 How Do You Graph Lines on the Coordinate Plane?). **FOCUS FOR MEDIA INTERACTION:** To provide students with a specific task, which to focus upon while viewing the video clip, ask the class to look and listen for specific things: the direction of the line representing a linear equation having only one variable, either x or y; steps to find the points or ordered pairs for plotting; and how many points are needed to graph a straight line. **CHECK FOR COMPREHENSION** by giving each student a Video Summary Fact/Quiz Sheet for each student to complete after viewing the video. **(Video Summary Fact/Quiz Sheet is provided.)**

Cue the video to the beginning. **Play** the video until the speaker/lady has graphed the equation $x = 2$. **Pause the video.** **FOCUS FOR MEDIA INTERACTION: Class Discussion:** Ask the class what they think the graph of $y = 3$ would look like. Wait until you receive several responses from students. **CHECK FOR COMPREHENSION** by asking the class how they would go about graphing $y = 3$? Do not say whether the responses are correct or not correct. After receiving two or three responses, then say to the class: let's see if you are correct. **Resume play.** **Play the video** until the speaker has graphed the equation $y = 3$. **Pause.** **Class Discussion:** Ask the class to explain what they think the general rule is for graphing/or what all linear equations of the form $y = a$ number will look like. Allow the class to talk freely for about a minute or two. **Resume play.** **Play the video** until the lady puts her ordered pairs on the table. **Pause.** **Class Discussion:** Ask the class to use their graph paper and plot, name, and connect the points, which are on the table. Walk around the room to see when most, if not all of the class is finished. **Focus:** To provide students with a specific task, which to focus upon while viewing the next segment, say that you will **now resume play**, and you want the class to compare their graphs to the graph the lady has drawn on the video. **Pause the video.** Ask the class how many of their graphs are correct. Take a poll by show of hands. **Stop.** **FOCUS FOR MEDIA INTERACTION Class Activity:** Ask the class to graph the linear equation $y = x + 2$. Give the class the x values of $x = 2$, $x = 0$, and $x = -2$. Have the class set up a table like the person did in the video and to find the corresponding y values to find three ordered pairs and then graph. **Play the video.** **Pause the video** after the lady has graphed the linear equation $y = x + 2$. **Discussion:** **CHECK FOR COMPREHENSION** asking the class to compare their table/ordered pairs and graph with the video graph. Move around the room spot-checking to see how many students' ordered pairs are correct, graphs are straight lines, and lines slanted in the right direction. Praise those students who got all ordered pairs and graph correct. **CHECK FOR COMPREHENSION** by asking the students if they have questions/if someone needs additional explanation or would like to replay a segment of the video for farther discussion.

CULMINATING ACTIVITY

Step 1

After answering all questions and completing the video/class interactive activities, your students will probably have developed a comprehensive understanding of how to graph vertical, horizontal, and slanted graphs of linear equations.

For this activity, the students will work in groups and complete a short video summary/quiz, which will provide them the opportunity to demonstrate their understanding of the concepts presented and serve as an informal assessment.

Step 2

Have the class get back into the same four groups they were in during the review activity. Distribute the Video Summary Activity. Have the groups to complete the video summary activity. Directions: Have each group to identify two persons to complete the a, b,c questions, two people to complete the short essay question, and two people to complete the table and graph question. Tell the groups to discuss each pair of students' answers and to agree on all answers because: (1). They will receive a group grade (2). When the groups report out during the next class period, each pair of students will have to orally explain the response of a question they were not responsible for answering.

Step 3

Take up summary activity/quiz and tell the class that they will receive feedback the next class session with a discussion/review of summary/quiz results and answers. (Next Class Session) Allow students to give answers to all of the summary/quiz answers. Facilitate a discussion for those questions, which requires an explanation by allowing students to volunteer to share their responses. Have a student to put up the table and another to graph.

CROSS-CURRICULAR EXTENSIONS

Social Studies

- Research the art of map making (Cartography). Compare Cartography to the Cartesian Coordinate Plane and its Quadrant Set-up.
- Research City-Planning and its Connection to Cartesian Coordinate Plane and its Quadrant Set-up.
- Research demographics. Supply data relative to a small community's percent rate of change of adults with college degrees. Place in a table and make a scatter plot of the data and draw the line of best fit. Discuss the validity of the bline of best fit as a predictor over future years.

Statistics/Economics

Research statistical data. Put data into a table showing the independent variable (x) and dependent variable (y) and graph.

Technology

Using the graphing calculator, provide students with statistical data. Input data into the STAT program. GRAPH. and find the line of best fit graphically.



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Science

To predict or estimate how long it would take one to hear the thunder from a storm that is a given distance away. Provide the linear equation $y = .21t$; where y equals the distance in the rule that sound travels in 't' seconds. Substitute different values for t and find the corresponding y values and graph.

COMMUNITY CONNECTIONS

1. Invite a speaker from the department of City Planning to discuss and demonstrate how they use an understanding of the Cartesian Coordinate Plane and Graphing linear equations in their work.
 - Teacher should have students prepare possible questions to ask the guest speaker.
2. Students could be asked to Interview people who collect, analyze, and graph data. Teacher should provide a list of suggested persons to interview.
3. For additional insight into community-based projects, go to the *Making Family and Community Connections* site at www.thirteen.org/edonline/conceDt2class/month9.



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HANDOUT 1

Sample Questions for Introductory Activity

1. What county is in sector (A, 5)?
2. What highway goes from sector (A, 2)?
3. Name all of the sectors interstate Highway 75/85 passes through?
4. What expressway goes from sector (A, 1) to sector (F, 3)?

You can add more questions based on the students' capacity to understand/respond correctly to just these few questions.



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HANDOUT 2

1. $x = 2$

2. $x + y = 6$

3. $2x - y = 4$

4. $x^2 + y = 6$

5. $x/2 + y/3 = 6$

6. $2x + y = 10$

7. $x/y + 3 = 8$

8. $y = 3$

9. $1/2x + 2/3y = 2$

10. $2a + 3b = 6$

Remember that a list of equations can be given to the members of each group; or each equation could be written on paper and placed individually into zip lock bags.



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HANDOUT 3

VOCABULARY

Upon completing this lesson, you should be familiar with the following terms:

1. ordered pair
2. coordinate plane
3. linear equation
4. y-axis
5. x-axis
6. origin
7. x-coordinate
8. y-coordinate
9. quadrant
10. graph
11. ordinate
12. abscissa



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HANDOUT 4

SAMPLE

**GROUP WRITE-UP SHEET
ACTIVITY FOR OPENING ENGAGEMENT**

GROUP NAME: _____

LIST LINEAR EQUATION (S): _____

GIVE EXPLANATION/REASON (S) FOR YOUR IDENTIFICATION:

**GROUP WRITE-UP SHEET
ACTIVITY FOR OPENING ENGAGEMENT**

GROUP NAME: _____

LIST NON-LINEAR EQUATION (S): _____

GIVE EXPLANATION/REASON (S) FOR YOUR IDENTIFICATION:



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HANDOUT 5

**Culminating Group Activity
VIDEO SUMMARY
SHEET**

1. What does a linear equation in the form $x = \text{any number}$ look like?
a. slanted b. vertical c. horizontal Be able to explain why.
2. What does a linear equation in the form $y = \text{any number}$ look like?
a. slanted b. vertical c. horizontal Be able to explain why.
3. How many points determine a straight line? a. 1 b. 2 c. 3 Be able to explain why.
4. What is the general name for a point on a coordinate plane?

5. a. Where is the origin located on the coordinate plane? b. What are the coordinates of the origin. c. What role does the origin play when one is graphing ordered pairs?

a.

b.

c.

6. Describe what you would do to graph the following linear equation.

$$X + y = 8$$

1.

2.

.

.

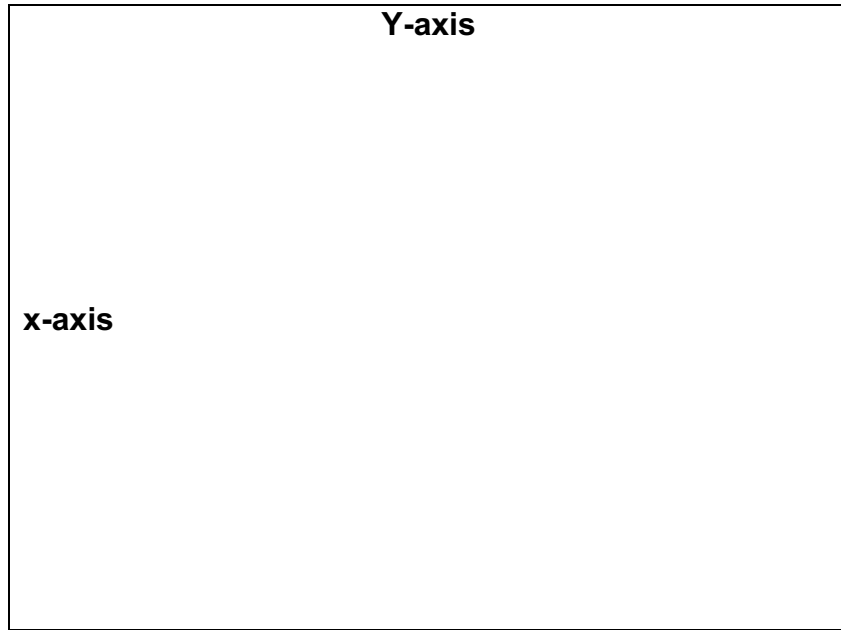
HANDOUT 5 Continued



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Now, graph the above equation. Include a table showing how you found your ordered pairs. Find at least three points (ordered pairs) on the line before you graph the line. Remember to always name or label your points.



Group Members' Names

Number of Question

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

Group Grade: _____

Comments: _____



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