Solve by Graphing—On the Floor!!

Contents Standards and Objectives

Standard 2: Algebra (MA.S.2)
Students will:
- demonstrate understanding of patterns, relations and functions;
- represent and analyze mathematical situations and structures using algebraic symbols;
- use mathematical models to represent and understand quantitative relationships;
- analyze change in various context through communication, representation, reasoning and proof , problem solving, and making connections within and beyond the field of mathematics

Objectives:

AM2.2.2/A1.2.8   determine the slope of a line given an equation of a line, the graph of a line and two points to be identified.

AM2.2.3/A1.2.9   graph linear equations using slope-intercept, point slope, and x- and y-intercepts

AM2.2.5/A1.2.11   solve systems of linear equations numerically and graphically, by elimination method and by the substitution method

Best Practices for Instructional and Instructional Strategies

This instructional activity involves small group "hands-on" activity titled "Solve by Graphing—On the Floor!!" The goal of this activity is to graph the intersection of a given system of equations. Students will model the coordinate plane on a tile floor and graph systems of equations with string. They will then identify the solution to the systems. They will give the solution as an ordered pair. Students will be able to state the slope and y-intercepts of each line. Students can check their solutions algebraically (by substitution) and graphically (using the TI-83 graphing calculator).* *See Integration of Technology section for multi-representations using the TI-83 graphing calculator.*

See Teacher Notes for Agleblock application.

Using Performance Descriptors to Measure Student Achievement

Distinguished –
The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceed the standard in **Algebra 1.** The student solves literal, and linear equations to interpret solutions of complex, practical application problems. The student justifies and judges the reasonableness of real number solutions given in both exact and approximate forms in a clear concise manner. The student solves linear systems numerically and graphically justifying solutions analytically. Given graphical and numerical data, the student determines the slope and various forms of the equation of a line and performs linear regressions using the regression equation to predict.

Above Mastery –
The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in **Algebra 1.** The student solves simple, multi-step practical application problems using literal and linear equations. The student solves linear systems numerically and graphically. The student determines the slope and equation of a line given graphical and numerical data and performs linear regressions giving the regression equation.

Mastery –
The student will demonstrate fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meet standard in **Algebra 1**. The student solves simple, multi-step problems using literal and linear equations. The student determines the slope of a line from two points or from the equation of a line, and given a graph solves linear systems.

Partial Mastery –
The student demonstrated basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in **Algebra 1**. Performance needs further development. The student inconsistently solves one-step linear equations. The student determines the slope of a line given the equation of a line.

Novice –
The student demonstrates substantial needs for the development of fundamental knowledge and skills; characterized by fragmented and incomplete performance in **Algebra 1.** Performance needs considerable development. The student solves one-step linear equations in one variable with procedural errors and recognizes simplified algebraic expressions.

Adaptations for Diverse Learners

- reduce number of problems on one page
- use a variety of methods to teach and reteach
- involve student in group assignments and cooperative learning
- provide "hands-on" activities or involve some form of physical activity
- sequential steps
- use various methods   for   grouping students and change groups often
- use "self talk" in which students verbally plan and execute actions

Additional Resources

Algebra One Interactions, Course 2
Holt, Rinehart and Winston
Sea Harbor Drive
Orlando, Florida 32887

Math and Science in Motion: Activities for Middle School
Texas Instruments Incorporated
7800 Banner Drive
Dallas, TX 75251
Telephone: 1-800-TI-CARES
e-mail: ti-cares@ti.com

TI-82/83 Graphing Calculator Activities for Middle School Math
MathWare
P.O. Box 3025
Urbana, Illinois 61801
Telephone: (217) 384-7043

Math Investigation with the TI-30X IIS: Activities for Secondary Mathematics
Texas Instruments Incorporated
7800 Banner Drive, M/S 3918
Dallas, Texas
Telephone: 1-800-TI-CARES
e-mail: ti-cares@ti.com

Web-Based Resources

- LDOnLine
- Classroom Accommodation List
- Appropriate School-Based Accommodations and Interventions
- National Council of Teachers of Mathematics
- NCTM Illuminations

Additional Websites:

System of Linear Equations Lesson

Slope Lesson

Straight-Line Equation Lesson

System of Linear Equations Modeling! This web site is for hearing impaired students

Integration of Technology

Standard 3: Technology Productivity Tools (TEC.S.3)
Students will:
* use technology tools to enhance learning, increase productivity, and promote creativity; and
* use productivity tools to collaborate in constructing technology-enhanced models, preparing publications, and producing other creative works.

Technology Productivity Tools Objectives:
TEC.9-12.3.2 select and use appropriate technology tools to efficiently collect, analyze and display data that is relevant to class assignments.

Use the TI-83+ graphing calculator and handout to enhance students learning of solving equations by graphing.

Instructional Materials
* Worksheet #1 – Solve by Graphing—On the Floor!!
* Graphing kits: (2) pieces orange caution tape 14 feet long; (2) pieces each of (5) different color string 10 feet long; masking tape; and
* a room with square tile floor
* Worksheet #2 – Using Your Calculator to Solve by Graphing
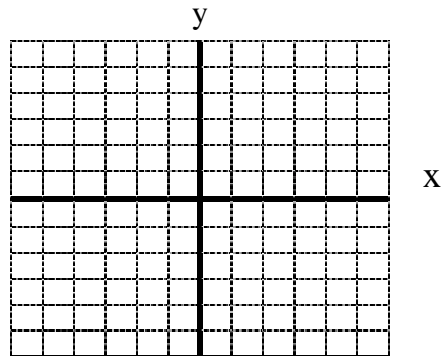* TI-83+ calculator

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Worksheet 1
Solve by Graphing—On the Floor!!!

Name _____

Date _____

Period _____

On the tile floor, mark out a grid from –6 to 6 on both the x-axis and y-axis with orange tape. Use masking tape to attach to floor. Allow each tile be one unit. See diagram. Label the x- and y-axes and the origin on the masking tape.

Use two strings of the same color and graph the pair of equations given below. Mark their intersection with masking tape. Record the coordinates on your paper.

1.   y = -x + 4   and   y = 2x - 5   *color* _____   answer_____

Leave the string and tape down on the floor and do the same with a two strings of another color for each of the remaining equations.

2.   y = -x and   y = 2/3x - 5   *color* _____   answer_____

3.   y = -2x + 6   and   x + y = 3   *color* _____   answer_____

4.   x + y = 1   and   2x – 2y = 6   *color* _____   answer_____

5.   3x + 2y = 9   and   4x – y = 1   *color* _____   answer_____

Worksheet 2
Using Your Calculator to Solve by Graphing

Press the obutton. If there are any equations in any of the equations, press □ and then ⊆ to clear the equation. Press ⊆ to go to the next equation. Use the up } arrow to go back to $y_1=$.

Enter the equation into the calculator for **$y_1=$**
$y_1 = -x + 4$ and then for $y_2 =$ $y_2 = 2x - 5$

Check to see that all the plots are off (if they are highlighted then they are on). If they are on, arrow } up to the plot and press enter then arrow □ down. The highlight should now be off.

Press σ and the screen should display a graph. It may not look like the graph you want so press θ and choose **6: Standard**. If you still cannot see the graph, press θ and choose **3: Out** and press ⊆. Each time you press enter the screen will zoom out from the graph. If you have gone too far, press θ and choose **2: In** and press ⊆. Each time you press enter the screen will zoom in on the graph.

In order to see the intersection of the two lines press ψ ρ **(Calc)** and choose **5: Intersect**. Press ⊆. If the intersection is not on the screen, you can move the curser towards the intersection and then recalculate.

The screen will show $y_1 = -x + 4$. Press ⊆ again and the screen will show $y_2 = 2x - 5$. Press ⊆ again and the calculator asks if you want to guess the intersection. Press ⊆ one more time and it will give you the intersection in the form x =   and y =

Check the intersection of the following:

1. y = -x	2. y = -2x +6	3. x + y = 1
y = 2/3x – 5	x + y = 3	2x – 2y = 6
4. 3x + 2y = 9	5. y = -2x + 1	6. 5x – y = 1
4x – y = 1	y = 5/2x – 1/2	3x + y = 1

Teacher Notes

☺ When changing equations to slope-intercept form, some of my students try to add/subtract x values from constants. I use the Algeblocks to show the difference again.
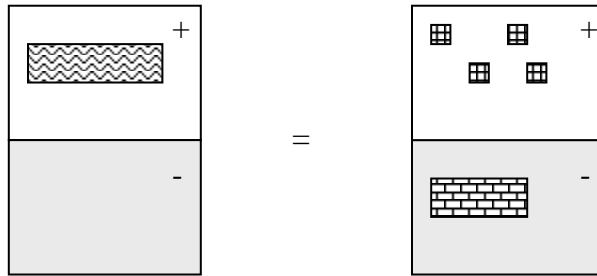
$$y = -x + 4$$

☺ When applying slope to a point, go up for positive slopes and down for negative slopes. ALWAYS go OVER to the right, says Mrs. Wright!!!

If written in fraction form 2/3 you go up two from the point since it is positive. Then go over the right three. Notice 2 *over* I stress the fraction bar. "Two OVER three" 3

If slope is –4/5 you go down four then over to the right five.

If slope is written as an integer, remind them to go over 1. (2 and 2/1 are the same.)

Sample work: Mastery

Solve by Graphing

Name
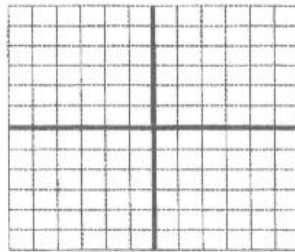
Date _ *Mastery*

On the tile floor, mark out a grid from –6 to 6 on both the x-axis and y-axis with orange tape. Allow each tile be one unit. See diagram.

Use two strings of the same color and graph the pair of equations given below. Mark with tape their intersection. Record the coordinates on your paper.

1. $y = -x + 4$ and $y = 2x - 5$ *color* __pink__   answer __(3,1)__

Leave the string and tape down on the floor and do the same with a two strings of another color for each of the remaining equations.

2. $y = -x$ and $y = 2/3x - 5$ *color* orange   answer (+3, -3)

3. $y = -2x + 6$ and $x + y = 3$ *color* green   answer (3, 0)

4. $x + y = 1$ and $2x - 2y = 6$ *color* yellow   answer (2, 1)

5. $3x + 2y = 9$ and $4x - y = 1$ *color* gold   answer (1, 3)
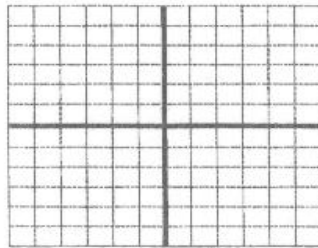
Partial Mastery

Solve by Graphing

Name _Partial_

Date _Mastery_

8/10

On the tile floor, mark out a grid from −6 to 6 on both the x-axis and y-axis with orange tape. Allow each tile be one unit. See diagram.

Use two strings of the same color and graph the pair of equations given below. Mark with tape their intersection. Record the coordinates on your paper.

1. $y = -x + 4$ and $y = 2x - 5$ color _Orange_ answer _3_ $(3, 1)$

Leave the string and tape down on the floor and do the same with a two strings of another color for each of the remaining equations.

2. $y = -x$ and $y = 2/3x - 5$ color _gold_ answer _3 −3_

3. $y = -2x + 6$ and $x + y = 3$ color _pink_ answer _0, 3_

$y = mx + b$

$y = -x + 3$

4. $x + y = 1$ and $2x - 2y = 6$ color _Green_ answer _2 −1_

$y = -x + 1$

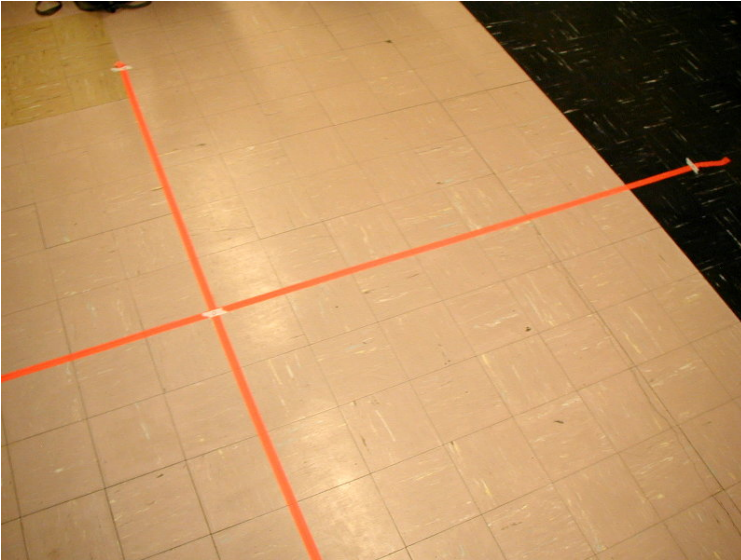$\dfrac{-2y = -2x + 6}{-2 \quad -2 \quad -2}$
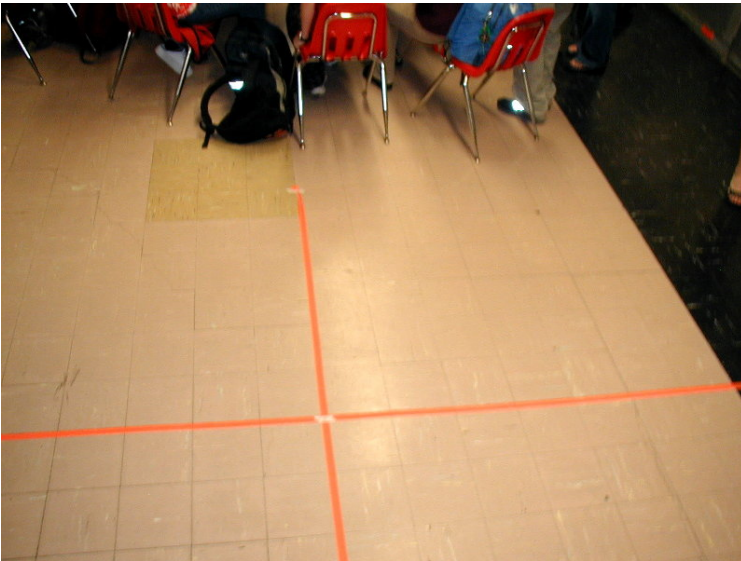
$y = 1x - 3$

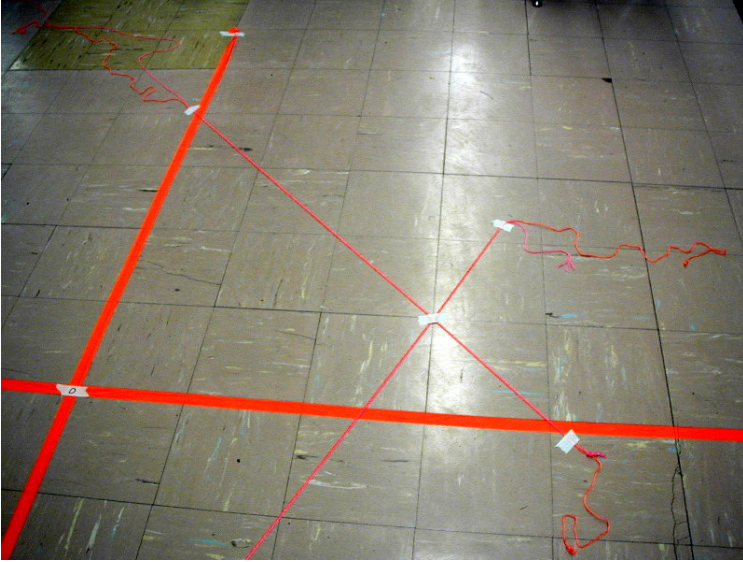5. $3x + 2y = 9$ and $4x - y = 1$ color _yellow_ answer _1 3_

Photo page:

Grid 1 shows set up of axes.

Grid 2 shows axes set up as well.

Square 1 shows one line graphed in string.