

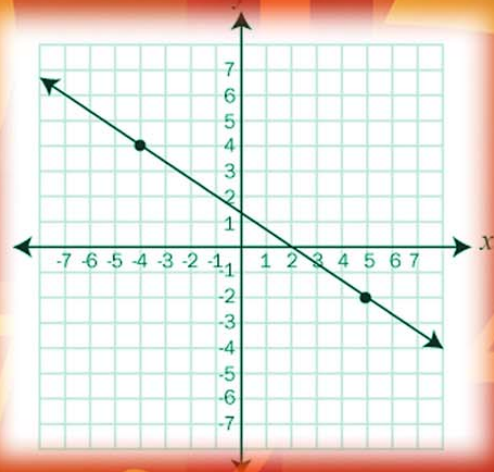
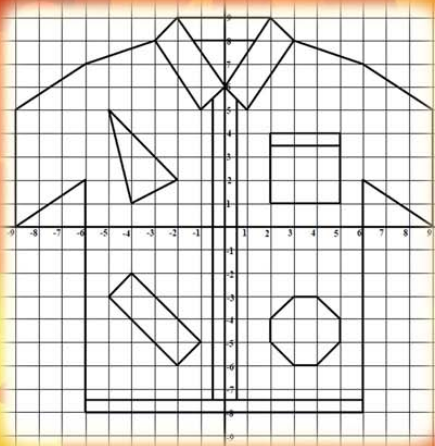
Digital Lesson.com Presents

Marvelous

Middle School

Math

Algebra and Functions Activities



By Mark P. Tully

Mark Tully is a mathematics teacher at Oak Middle School in the Los Alamitos Unified School District, Los Alamitos, California. He has been teaching for about 25 years and during that time has served as Mathematics Department Chairman and as a Mathematics Mentor Teacher. He enjoys developing activities that are designed to present the prescribed mathematics curriculum and standards in a way that is active and engaging.

Mark's website, www.DigitalLesson.com, is designed to meet the needs of middle school math teachers. DigitalLesson.com specializes in providing instant downloads of engaging, hands-on math lessons and projects. These middle school math activities are designed to enhance the middle school math program. Also included on the site are other math resources tailored for the middle school math teacher.

Mark also publishes the *Middle School Math Treasures* newsletter. The newsletter includes resources, ideas, and activities for middle school math teachers. A subscription to *Middle School Math Treasures* is free! Sign up on the home page of Digital Lesson.com. Unsubscribe at any time. We will never rent or sell your e-mail address. Enjoy this great, free resource!

We would love to hear about your experiences using this book, *Algebra and Functions Activities*, in your classroom. Please e-mail us with any comments at digitallesson@yahoo.com.

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Preface

Digital Lesson.com is dedicated to being a valuable resource for middle school math teachers who not only want to excel in the teaching of mathematics, but also want to deliver the mathematical curriculum in a manner that engages and involves students. The collection of lessons and projects in this book strive to place mathematics into an active context that is inherently interesting.

Instant

The lessons and projects at Digital Lesson.com are instantly available. Upon receipt of payment, your lesson or project is automatically sent to you via e-mail. Save your lesson file to your computer for later use. Then, just “Print and Present” your lesson. No more waiting for delivery and no shipping costs.

Engaging

Our math lessons and projects offer students an interesting way to connect to the mathematics prescribed by your required curriculum. Hands-on activities and contextual lessons heighten the sense of usefulness and purpose students find in their mathematics.

Teacher Friendly

All blackline masters for the math lessons and projects are included. We have seen far too many great ideas for lessons on the internet that would take hours of time and effort to format before actually being able to use them. All of our lessons come ready to implement in your classroom immediately. Just make a few copies and get ready to inspire your students!

Teacher Tips are provided with each lesson to eliminate as many of the “Oh, I’ll do that differently next time,” moments as possible. The goal of the *Teacher Tips* is to make you an expert in the lesson BEFORE you teach it, not after. Too many lesson plans and projects that we have seen and received over the years leave it up to teachers to use trial and error before they ever teach the lesson effectively. The tips will immediately empower the teacher to teach the lesson more effectively.

Standards Based

Finally, the math lessons and projects on Digital Lesson.com have been designed to specifically meet the NCTM math standards and state math standards that teachers are expected to teach. Our intent is to provide more engaging activities, while still covering the same mathematical standards as the textbook. The lessons are intended to be served a la carte, to fill in curriculum holes or just to infuse some excitement and activity into your classroom as you teach a familiar math standard.

Wishing you inspiration and motivation to be the best math teacher you can be!

Mark Tully

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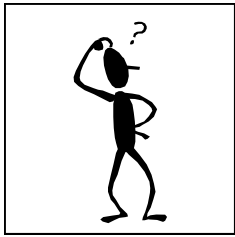
It's In The Bag! is a hands-on activity that requires students to design a mystery bag using written clues to describe the relationships between the objects hidden in their bags. Other students then analyze their clues, create equations, and solve these equations to determine the contents of the mystery bags.

What's



the Point?



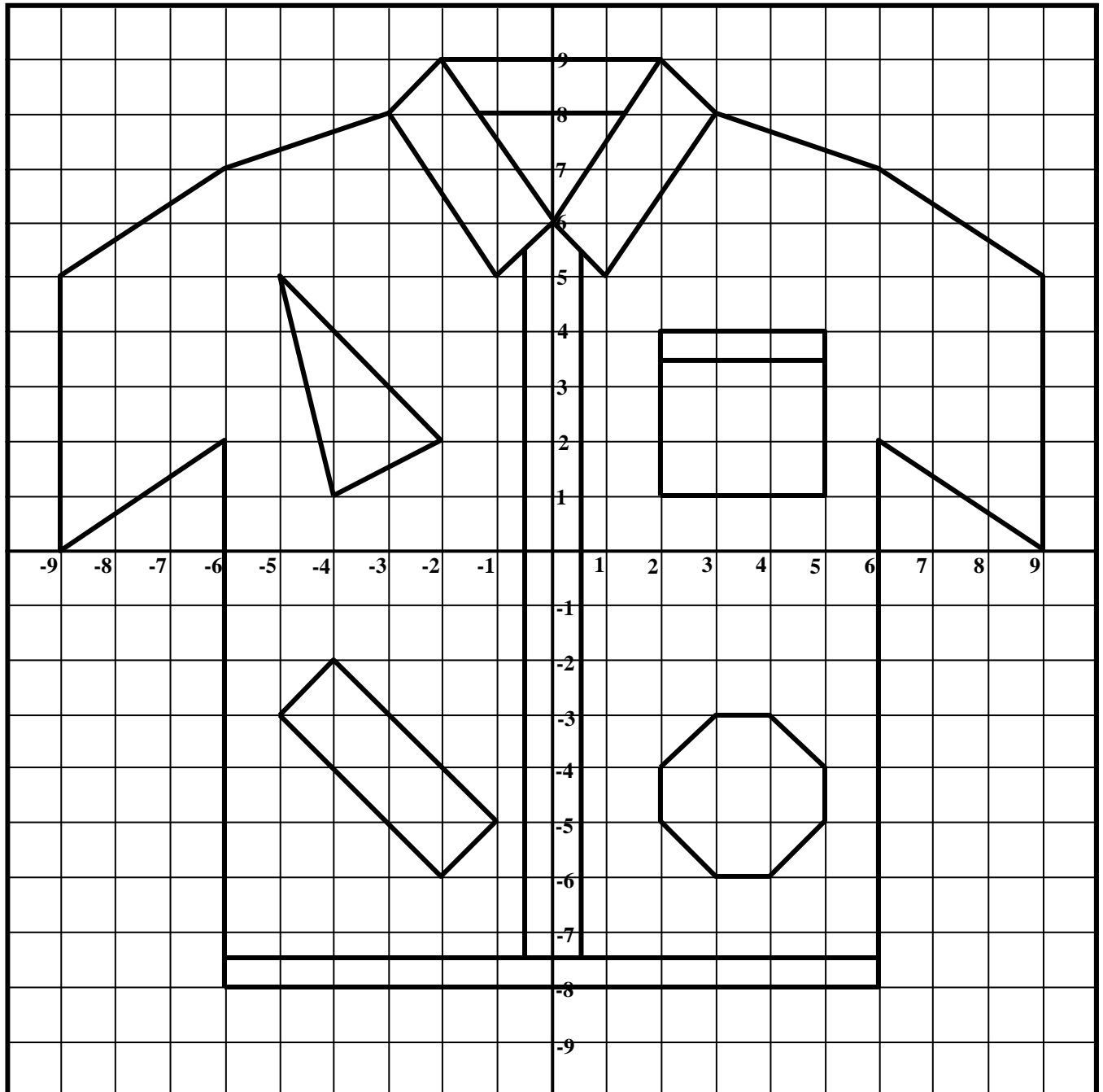


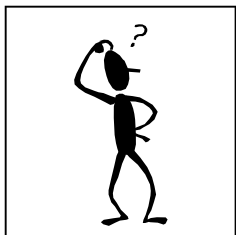
What's the Point?

2 - Geo Fashion

Graph the points and connect them with line segments. Do not connect points with DNC between them.

Start (-4,1) (-5,5) (-2,2) (-4,1) DNC (2,-4) (3,-3) (4,-3) (5,-4) (5,-5) (4,-6) (3,-6) (2,-5) (2,-4) DNC
(-5,-3) (-4,-2) (-1,-5) (-2,-6) (-5,-3) DNC (2,1) (2,4) (5,4) (5,1) (2,1) DNC (2,3.5) (5,3.5) DNC (-6,-8)
(-6,2) (-9,0) (-9,5) (-6,7) (-3,8) (-2,9) (2,9) (3,8) (6,7) (9,5) (9,0) (6,2) (6,-8) (-6,-8) DNC (-6,-7.5)
(6,-7.5) DNC (-3,8) (-1,5) (0,6) (-2,9) DNC (3,8) (1,5) (0,6) (2,9) DNC (-1.3,8) (1.3,8) DNC (-0.5,5.5)
(-0.5,-7.5) DNC (0.5,5.5) (0.5,-7.5) **End**





What's the Point?

Teacher Tips

(1 of 2)

Lesson Description: “What’s the Point?” is a fun lesson that requires students to graph points (ordered pairs) on the coordinate plane in order to create a picture. The lesson includes three different graphing assignments and answer keys, as well as a template to allow students to create and graph their own pictures using ordered pairs. Students really enjoy this lesson!

Math Content: Graphing Ordered Pairs (with possible extension activities in finding the area and perimeter of irregular geometric figures)

Time Required: 1 Class Period

“What’s the Point?” includes:

- * 3 “What’s the Point?” worksheets
- * 3 “What’s the Point?” worksheet Answer Keys
- * 1 “What’s the Point?” Template to create your own (or have students create their own!)
- * 2 “What’s the Point?” Teacher Tips pages
- * 1 “What’s the Point?” Cover Sheet

10 Pages in all!

Materials Needed: Rulers (to draw line segments when connecting plotted points)

Suggested Grade Level: 5th - 8th

Teacher Testimonial: As they work through this more advanced version of “connect the dots,” the students enjoy trying to figure out what they are creating as they plot the ordered pairs in each quadrant. This lesson provides great practice in plotting points, a skill that is essential for students to have mastered when they graph equations and inequalities. It is also a terrific place to introduce mathematical vocabulary terms such as coordinate plane, origin, ordered pair, x-coordinate, y-coordinate, x-axis, y-axis, and quadrant.

Teacher Tips:

- * The “What’s the Point?” lesson is a great opportunity to introduce or review many mathematical terms including those listed above in the Teacher Testimonial.
- * Have the students cross out each ordered pair as they graph it. This keeps students from losing their place when they are working.
- * Have the students color their finished assignments and then post them to create a colorful, mathematical bulletin board.
- * There are points to be graphed in this lesson that include decimals. Most of them include the decimal .5 and should clearly be graphed in the exact middle of two lines. There are, however, a few points which include decimals such as .3. Where these occur, it is obvious that they are intended to connect to an already existing line segment.
- * Consider giving a few extra credit points to students who create an original graphed picture.



What's the



Point 2?



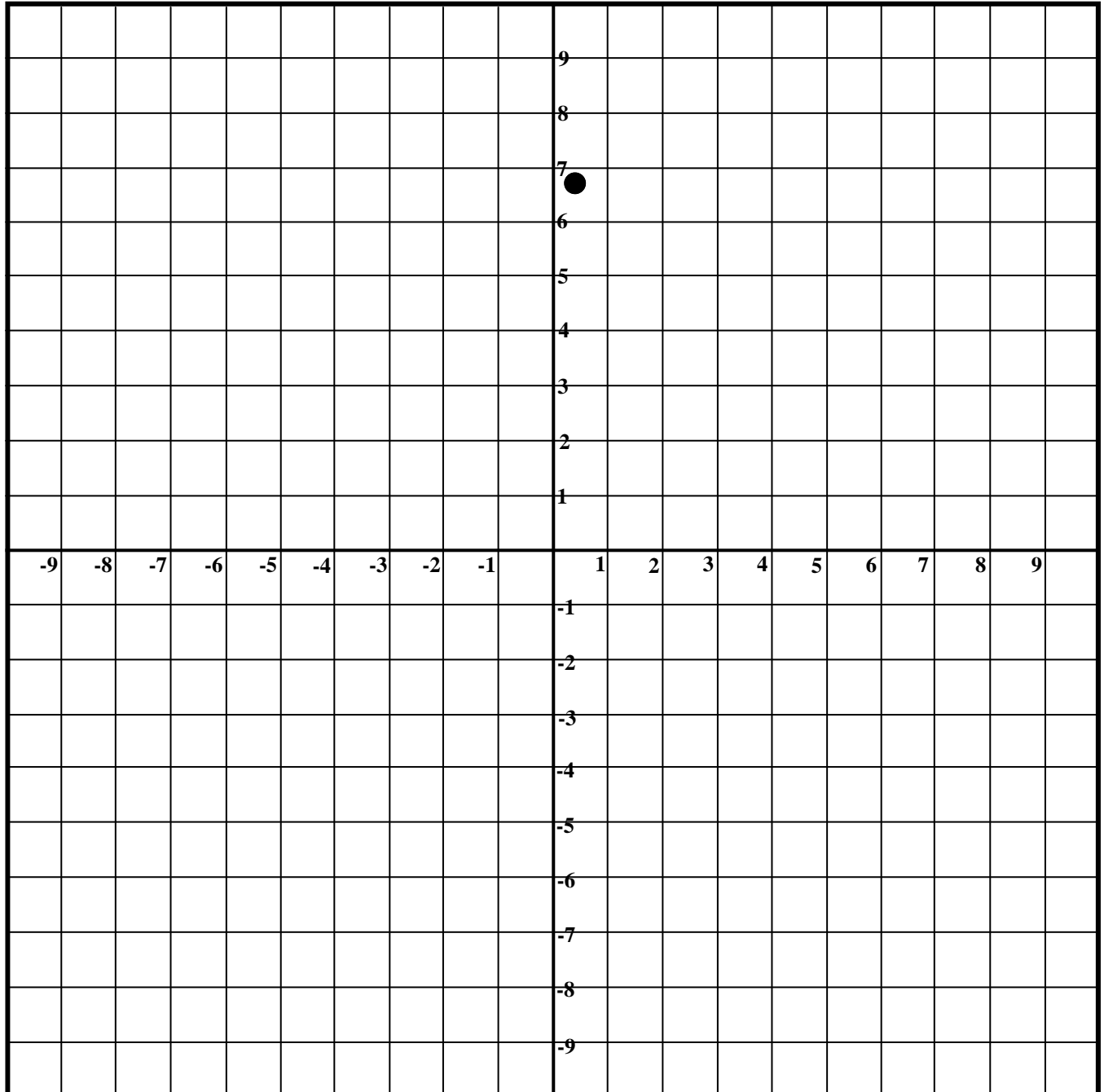


What's the Point?

7 - Under the Sea

Graph the points and connect them with line segments. Do not connect points with DNC between them.

Start (-1,9) (-2,8) (-3,8) (-3,7) (-4,7) (-4,6) (-5,6) (-5,5) (-6,5) (-6,4) (-7,5) (-7,-1) (-6,0) (-6,-2) (-5,-3) (-5,-5) (-4,-6) (-4,-7) (-2,-7) (-2,-8) (0,-8) (0,-7) (1,-7) (1,-6) (2,-6) (2,-5) (3,-4) (3,-3) (2,-2) (0,-2) (0,-4) (1,-3) (1,-4) (0,-6) (-2,-4) (-2,-3) (0,-1) (0,2) (-2,4) (-1,5) (3,5) (3,6) (2,6) (1,7) (1,8) (0,8) (-1,9) DNC (5,-10) (3,-7) (6,-3) (4,2) (5,8) (6,5) (5,2) (7,-3) (5,-7) (6,-10) DNC (7,-10) (6,-6) (9,-1) (9,-3) (7,-6) (8,-10) DNC (-9,-10) (-7,-8) (-9,-3) (-8,-2) (-6,-8) (-7,-10) **End**



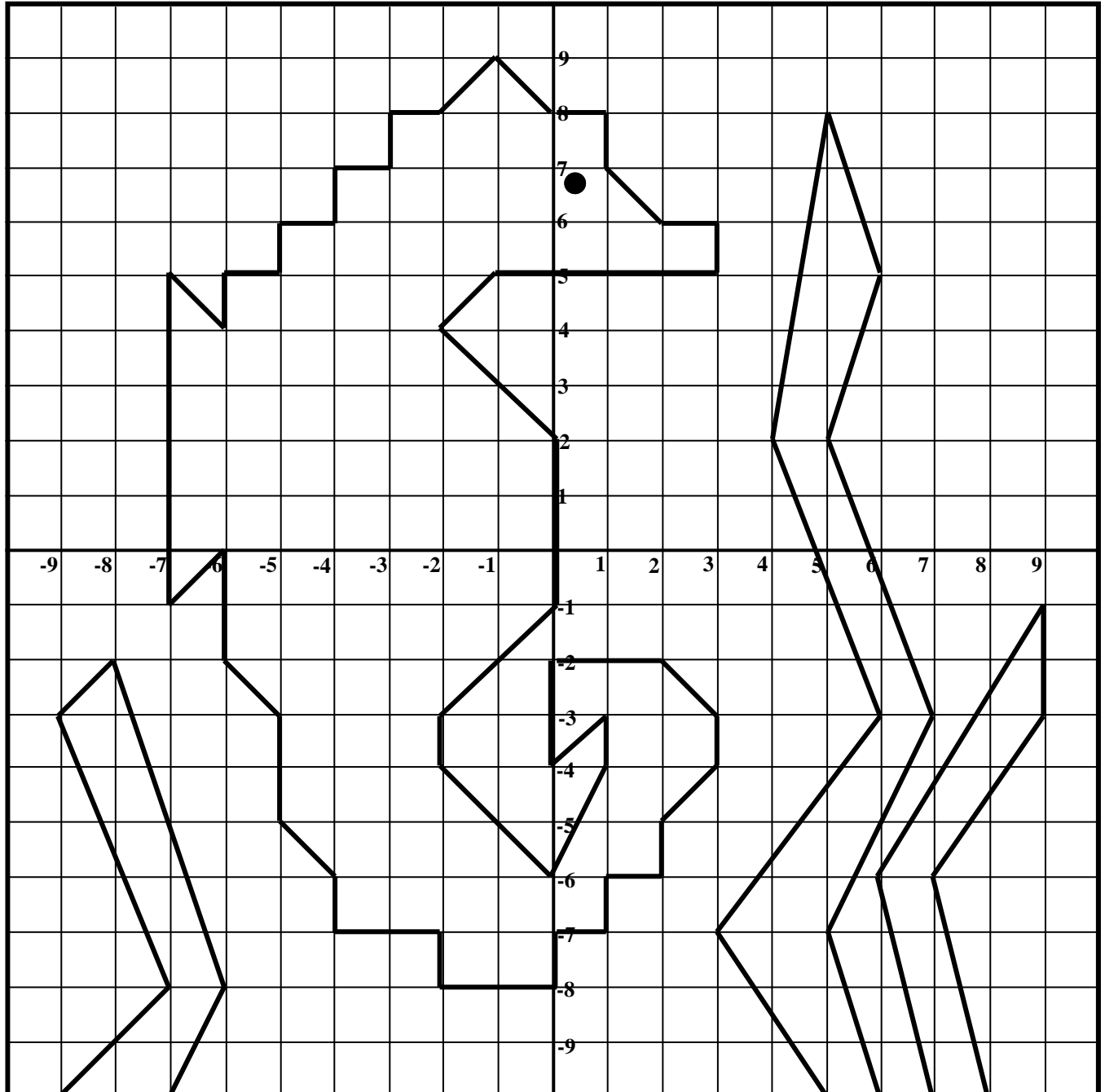


What's the Point?

7 - Under the Sea

Graph the points and connect them with line segments. Do not connect points with DNC between them.

Start (-1,9) (-2,8) (-3,8) (-3,7) (-4,7) (-4,6) (-5,6) (-5,5) (-6,5) (-6,4) (-7,5) (-7,-1) (-6,0) (-6,-2) (-5,-3) (-5,-5) (-4,-6) (-4,-7) (-2,-7) (-2,-8) (0,-8) (0,-7) (1,-7) (1,-6) (2,-6) (2,-5) (3,-4) (3,-3) (2,-2) (0,-2) (0,-4) (1,-3) (1,-4) (0,-6) (-2,-4) (-2,-3) (0,-1) (0,2) (-2,4) (-1,5) (3,5) (3,6) (2,6) (1,7) (1,8) (0,8) (-1,9) DNC (5,-10) (3,-7) (6,-3) (4,2) (5,8) (6,5) (5,2) (7,-3) (5,-7) (6,-10) DNC (7,-10) (6,-6) (9,-1) (9,-3) (7,-6) (8,-10) DNC (-9,-10) (-7,-8) (-9,-3) (-8,-2) (-6,-8) (-7,-10) **End**





What's the Point?

Teacher Tips (1 of 2)

Lesson Description: “What’s the Point?” is a fun lesson that requires students to graph points (ordered pairs) on the coordinate plane in order to create a picture. The lesson includes four different graphing assignments and answer keys, as well as a template to allow students to create and graph their own pictures using ordered pairs. Students really enjoy this lesson!

Math Content: Graphing Ordered Pairs (with possible extension activities in finding the area and perimeter of irregular geometric figures)

Time Required: 1 Class Period

“What’s the Point?” includes:

- * 4 “What’s the Point?” worksheets
- * 4 “What’s the Point?” worksheet Answer Keys
- * 1 “What’s the Point?” Template to create your own (or have students create their own!)
- * 2 “What’s the Point?” Teacher Tips pages
- * 1 “What’s the Point?” Cover Sheet

12 Pages in all!

Materials Needed: Rulers (to draw line segments when connecting plotted points)

Suggested Grade Level: 5th - 8th

Teacher Testimonial: As they work through this more advanced version of “connect the dots,” the students enjoy trying to figure out what they are creating as they plot the ordered pairs in each quadrant. This lesson provides great practice in plotting points, a skill that is essential for students to have mastered when they graph equations and inequalities. It is also a terrific place to introduce mathematical vocabulary terms such as coordinate plane, origin, ordered pair, x-coordinate, y-coordinate, x-axis, y-axis, and quadrant.

Teacher Tips:

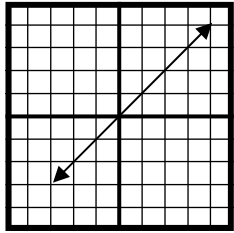
- * The “What’s the Point?” lesson is a great opportunity to introduce or review many mathematical terms including those listed above in the Teacher Testimonial.
- * Have the students cross out each ordered pair as they graph it. This keeps students from losing their place when they are working.
- * Have the students color their finished assignments and then post them to create a colorful, mathematical bulletin board.
- * There are points to be graphed in this lesson that include decimals. Most of them include the decimal .5 and should clearly be graphed in the exact middle of two lines.
- * Consider giving a few extra credit points to students who create an original graphed picture.



Graphing



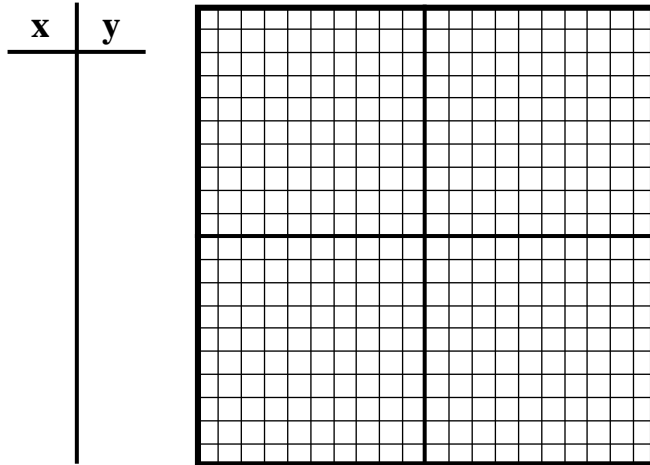
Equations



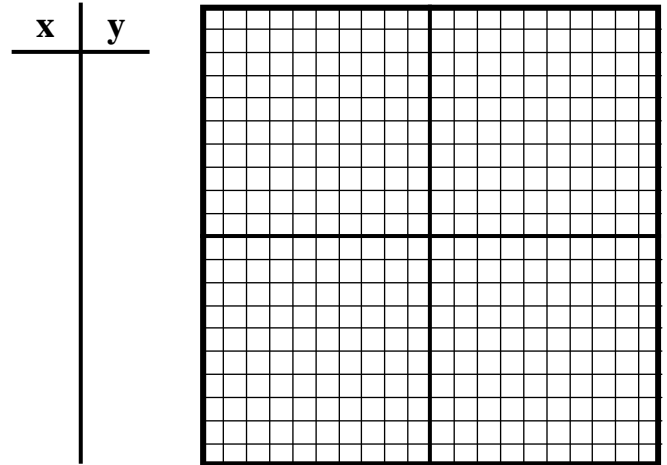
Graphing Equations

Graphing Equations 1

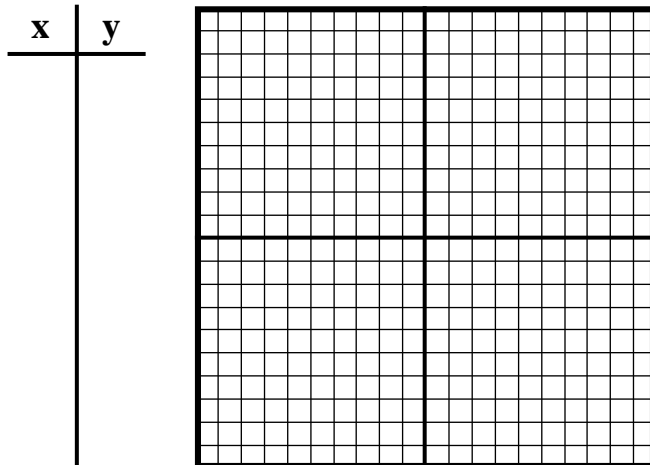
1) $y = 2x^2 - 3$



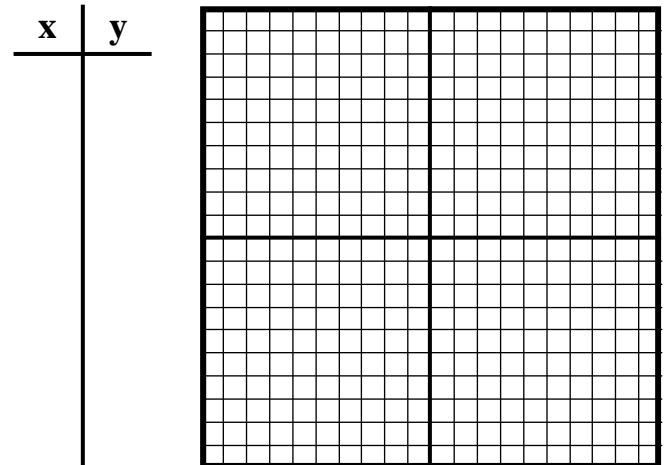
2) $y = 2x + 3$



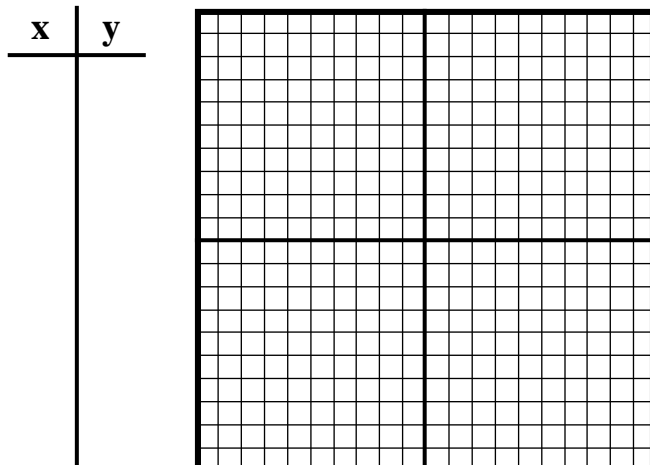
3) $y = -3|x| + 2$



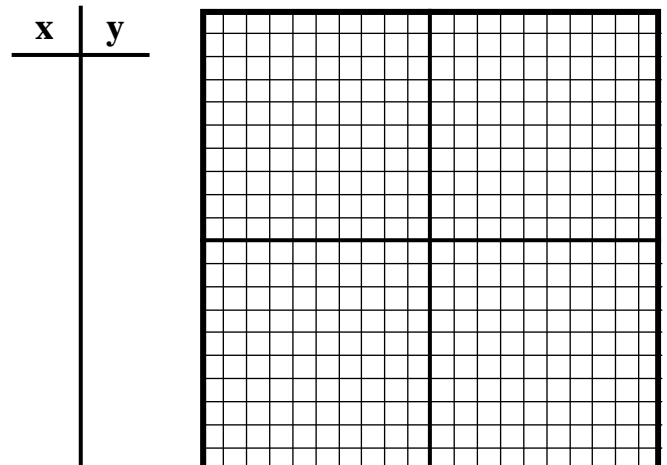
4) $y = -x^2 + 5$

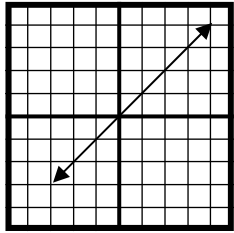


5) $y = -3x + 1$



6) $y = |x| - 4$





Graphing Equations

Teacher Tips (1 of 2)

Lesson Description: Graphing Equations is a lesson designed to introduce students to different types of equations and their resulting graphs. Students use t-tables to find solutions for the given equations and then graph them. As they graph they discover the differences between linear functions, quadratic functions, and absolute value functions. The Analyzing the Graphs worksheet gives students the opportunity to look carefully at the different graphs and learn from their observations.

Math Content: Graphing Linear Equations, Graphing Quadratic Equations, Graphing Absolute Value Equations, Using T-Tables, Graphing Ordered Pairs, Identifying Functions, Exponents, and Absolute Value

Time Required: 1-2 Class Periods

Graphing Equations includes:

- * 2 Graphing Equations student worksheets
- * 2 Graphing Equations student worksheet Answer Keys
- * 1 Graphing Equations Analyzing the Graphs worksheet
- * 1 Graphing Equations Analyzing the Graphs worksheet Answer Key
- * 1 Graphing Equations template
- * 2 Graphing Equations Teacher Tips pages
- * 1 Graphing Equations Cover Sheet

10 Pages in all!

Materials Needed: Rulers for drawing graphs (optional)

Suggested Grade Level: 5th - 8th

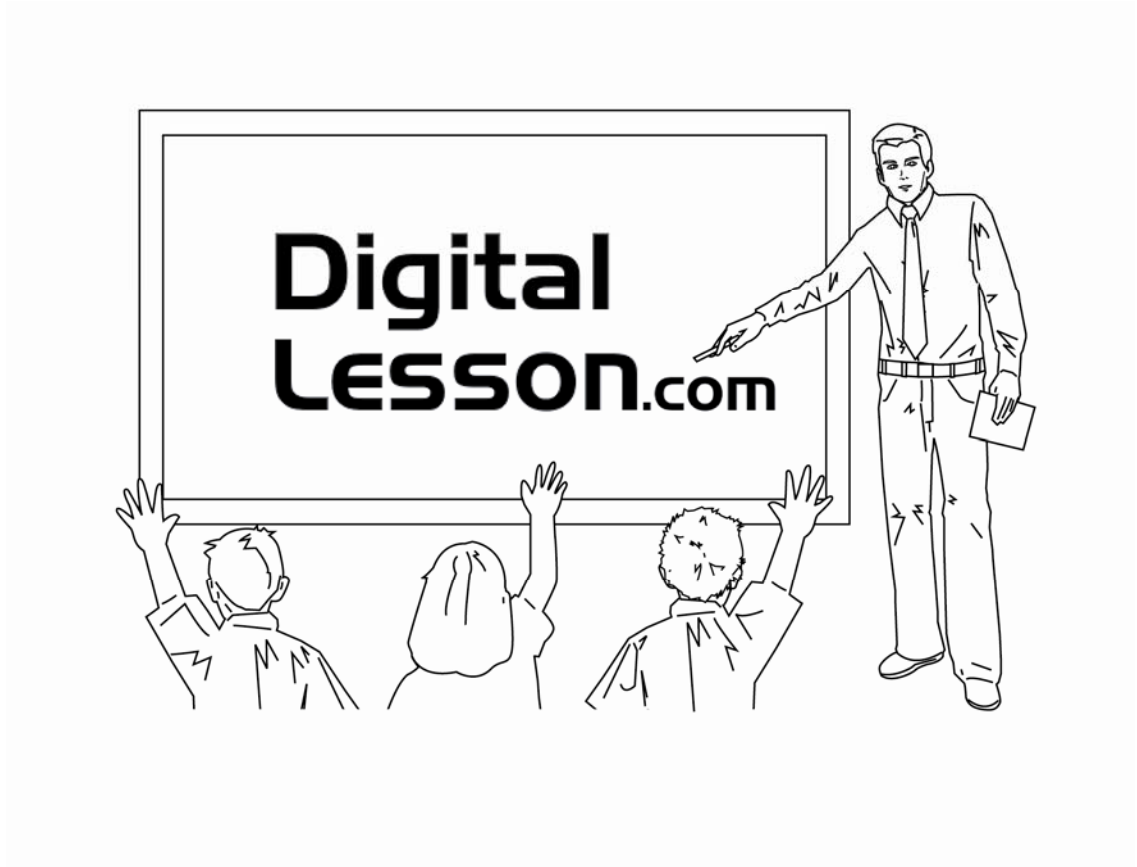
Teacher Testimonial: Graphing Equations is a lesson that allows students to discover several different types of functions as they use t-tables to find solutions for each equation. This lesson is a perfect extension activity to use after students have been taught to graph linear equations. Students discover what the graph of a quadratic function or an absolute value function looks like and this provides a foundation for future learning of these concepts. The format of the lesson encourages students to analyze different types of graphs and to construct meaning as they proceed through the lesson.

Teacher Tips:

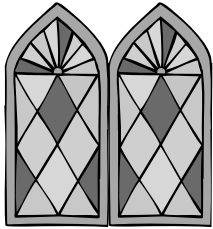
- * An extra Graphing Equations template is included in this lesson. The teacher can use it to create additional worksheets or to quickly create a quiz on graphing equations.
- * Students should graph at least five solutions for each equation. They should write them on their t-tables before graphing them. The more ordered pairs the students graph the clearer their graphs will become to them.



Stained Glass



Window



Stained Glass Window

Linear Equation Worksheet

Circle three linear equations in each box and write them over the t-tables below. Complete each table with at least three ordered pairs (with coordinates of 10 or less) that are solutions to the linear equation. Then graph these twelve linear equations on the coordinate plane provided. Write the equation neatly on each line that you graph. When you are done graphing the equations use markers to color each section and create your stained glass window.

$x = -8$ $x = -5$ $x = -1$ $x = 2$ $x = 7$ $x = 9$	$y = -9$ $y = -5$ $y = -2$ $y = 1$ $y = 6$ $y = 8$	$y = x + 5$ $y = 2x - 7$ $y = 4x + 8$ $y = 2x + 18$ $y = \frac{1}{4}x - 6$ $y = \frac{1}{2}x - 3$	$y = -x - 9$ $y = -2x + 8$ $y = -\frac{1}{3}x - 3$ $y = -\frac{1}{4}x + 5$ $y = -2x$ $y = -x + 12$
---	---	--	---

x = _____

x	y

y = _____

x	y

y = _____

x	y

y = _____

x	y

x = _____

x	y

y = _____

x	y

y = _____

x	y

y = _____

x	y

x = _____

x	y

y = _____

x	y

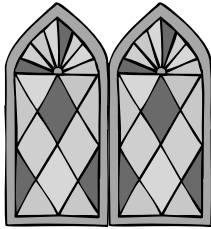
y = _____

x	y

y = _____

x	y

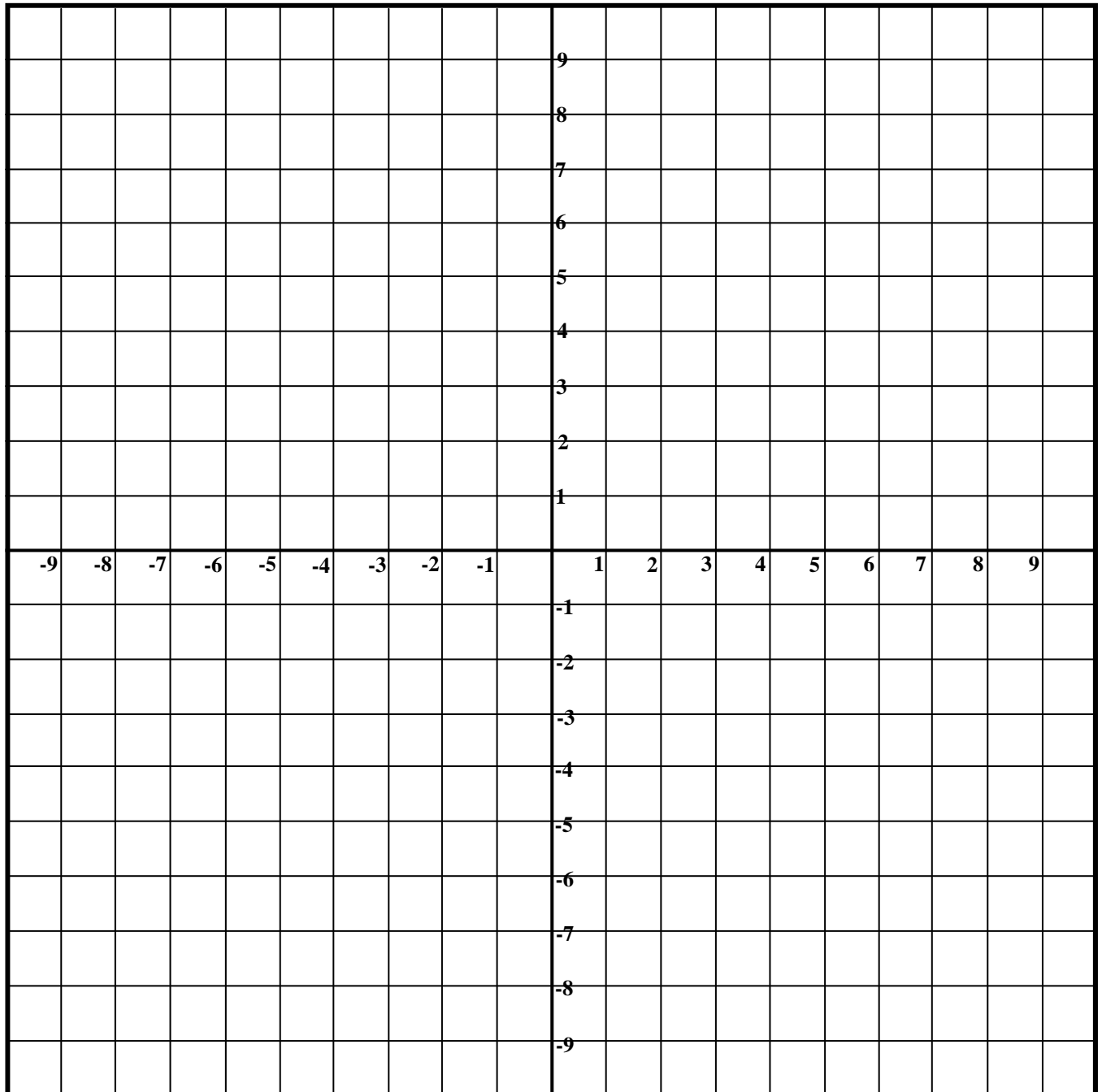


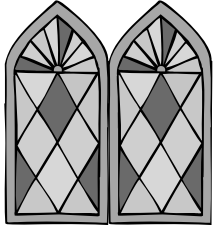


Stained Glass Window

Stained Glass Window Project

On the coordinate plane below, graph the linear equations that you circled on the Linear Equations Worksheet. Use the three ordered pair solutions that you listed for each equation to graph it. Write the equation neatly on each line that you graph. When you are finished graphing the equations, use markers to color each section to create your stained glass window.





Stained Glass Window

Teacher Tips (1 of 2)

Lesson Description: Stained Glass Window is a project that requires students to graph Linear Equations in order to create a colorful (yet mathematical) display window. Each student selects and graphs at least twelve linear equations from the equation bank to create their own unique window. This visual/kinesthetic project will help students to clearly identify the equations of horizontal and vertical lines and to easily distinguish between positive and negative slope. Key vocabulary will also be developed.

Math Content: Linear Equations, Graphing Linear Equations, Finding Solutions for Linear Equations, Slope, Y-Intercept, Coordinate Plane, Ordered Pairs, and Coordinates

Time Required: 1-2 Class Periods

Stained Glass Window includes:

- * 1 Stained Glass Window Linear Equations student worksheet
- * 1 Stained Glass Window Project student worksheet
- * 1 Stained Glass Window Project Linear Equations student worksheet sample
- * 1 Stained Glass Window Project Sample that goes with student worksheet sample
- * 1 Stained Glass Window Project Answer Key with all 24 equations graphed
- * 2 Stained Glass Window Teacher Tips pages
- * 1 Stained Glass Window Cover Sheet

8 pages in all!

Materials Needed: Rulers, Colored Markers

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Stained Glass Window is a project that provides needed practice for students in the area of Graphing Linear Equations. Students are able to be creative in selecting the equations that they want to graph and then choose colors in order to create their own unique Stained Glass Window. Then, they have the opportunity to put their window together with others in the class to create large Stained Glass Windows in the classroom.

Teacher Tips:

- * The Stained Glass Window Project can be administered by the teacher in a number of ways:
 - 1) Hand out the Linear Equations Worksheet and allow the students to choose the twelve linear equations that they will graph according to the worksheet directions. This will allow each student to have their own unique Stained Glass Window Project.
 - 2) Prior to handing out the Linear Equations Worksheet, circle the twelve equations identified on the Sample Linear Equations Worksheet. By doing this, every student will end up with the exact same Stained Glass Window Project and you will already have a completed answer key (see the Sample Stained Glass Window Project). You can make a transparency of the Sample Stained Glass Window Project and place it over the student projects to quickly evaluate them.

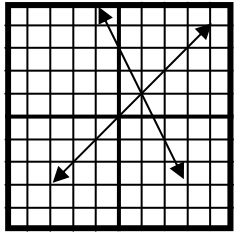


Graphing



Systems of Equations





Graphing Systems of Equations

Answer Key

Systems of Equations 2

Directions: Read each set of words below, write the corresponding equations, and use the t-table to graph at least five ordered pairs that are solutions to each equation. Then graph these points and draw the line that represents all of the solutions for each equation. Finally, write the slope, y-intercept, and the solution to this system of equations.

Words: Sally is fifteen years less than three times as old as her brother Joe.

Words: The sum of Joe's age and Sally's age is 13.

(Let x = Joe's age) (Let y = Sally's age)
Equation:

$$y = 3x - 15$$

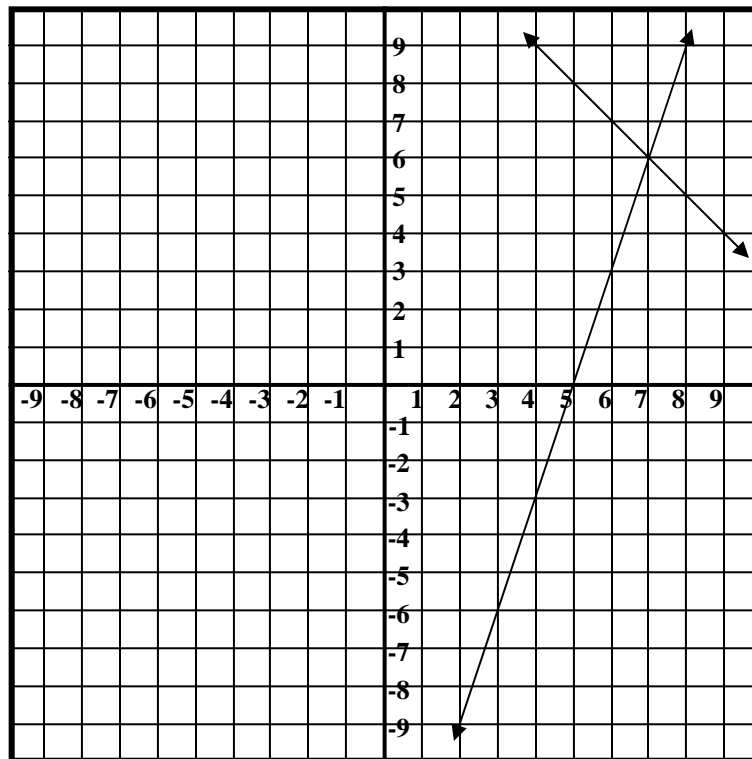
(Let x = Joe's age) (Let y = Sally's age)
Equation:

$$x + y = 13$$

x	y
2	-9
3	-6
4	-3
5	0
6	3
7	6
8	9

Slope 3

y-intercept -15



Solution: (7, 6)

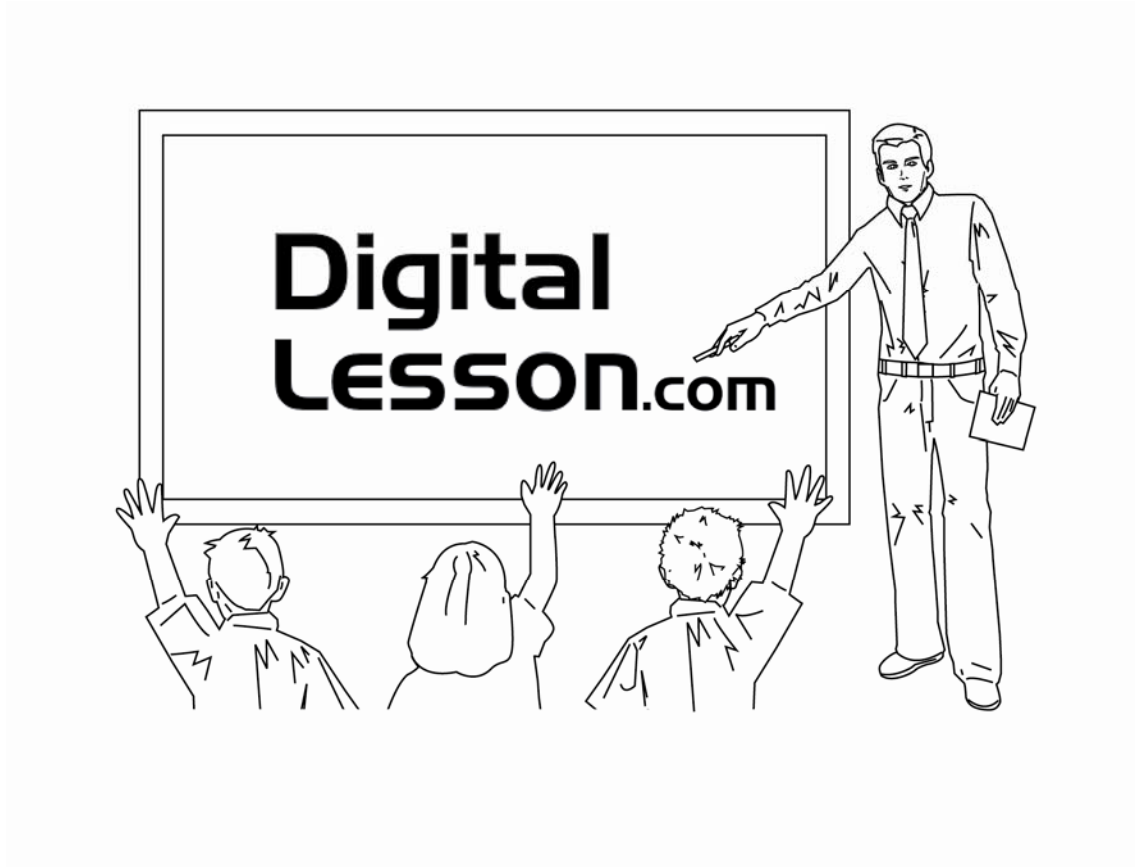
x	y
4	9
5	8
6	7
7	6
8	5
9	4

Slope -1

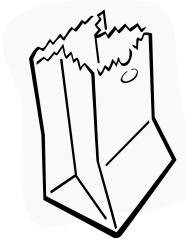
y-intercept 13



It's In



The Bag!

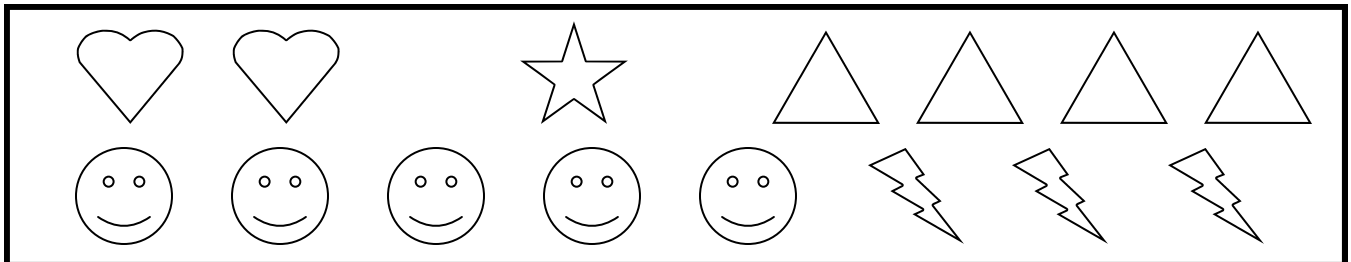


It's In The Bag!

Descriptions and Algebraic Equations

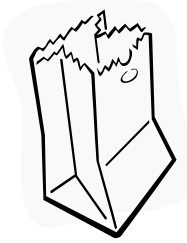
Using the shapes below, write (in words) four relationships between the shapes. Then translate your written words into algebraic equations using variables.

Let **h** = number of hearts, **s** = number of stars, **t** = number of triangles,
f = number of faces, and **b** = number of lightning bolts.



Written Relationship Regarding Number of Shapes	Equation
Example: Two times the number of lightning bolts minus the number of stars equals the number of faces.	$2b - s = f$





It's In The Bag!

Create Your Own Mystery Bag!

Use the template below to create a rough draft of your bag project. Before creating your actual bag, have **two** students check to make sure that your clues are logical and lead to your intended answer.

I have completed this mystery bag activity and verified that the clues lead to the intended answer.

Student Signatures: (1) _____ (2) _____
(clearly written)

Statement telling the three objects in your bag. (Not the number!)	Heading:
Written Clue #1:	
Written Clue #2:	
Written Clue #3:	
Written Clue #4:	
Written Clue #5:	
Hint:	
Answer:	



It's In The Bag! - Mystery Bag Verification Sheet

Student Who Created This Bag: _____

Objects in the Mystery Bag: _____

Assign Variables:

Write Equations:

Mystery Bag Answers:

Peer Feedback:

I was able to successfully complete this bag activity: _____

Student Bag Reviewer's Name

It's In The Bag! - Mystery Bag Verification Sheet

Student Who Created This Bag: _____

Objects in the Mystery Bag: _____

Assign Variables:

Write Equations:

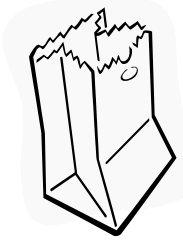
Mystery Bag Answers:

Peer Feedback:

I was able to successfully complete this bag activity: _____

Student Bag Reviewer's Name





It's In The Bag!

Teacher Tips

(1 of 3)

Lesson Description: It's In The Bag is a hands-on activity that requires students to design a mystery bag using written clues to describe the relationships between the objects hidden in their bags. Other students then analyze their clues, create equations, and solve these equations to determine the contents of the mystery bags.

Math Content: Creating verbal descriptions of the relationships between quantities of items, Writing Expressions and Writing Equations from verbal descriptions, Solving Equations, Problem Solving, Logical Thinking

Time Required: 2-3 Class Periods (plus time at home for the actual designing of the project bag.)

It's In The Bag includes:

- * 1 It's In The Bag! Descriptions and Algebraic Equations student worksheet
- * 1 It's In The Bag! Solve the Mystery Bag! student worksheet
- * 1 It's In The Bag! Solve the Mystery Bag! Answer Key
- * 1 It's In The Bag! Student Directions sheet
- * 1 It's In The Bag! Create Your Own Mystery Bag! student worksheet
- * 1 It's In The Bag! Bag Verification Sheet student worksheet
- * 3 It's In the Bag! Teacher Tips pages
- * 1 It's In The Bag! Cover Sheet

10 pages in all!

Materials Needed: Paper lunch bags

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

It's In The Bag! is a project that puts writing and solving equations into a concrete context. The creation of their own mystery bag project requires a deeper level of student understanding of the key concepts of writing and solving equations. Students are required to create their own mystery bag by identifying and describing relationships between quantities and then writing equations that represent these relationships. This creative process builds conceptual understanding and students enjoy the opportunities that they have to solve the mystery bags created by other students. Finally, the bag designs and clues that some students create are incredible!

It's In The Bag Activity Sequence:

The following is a suggested sequence to use with the "It's In The Bag!" activity:

- 1) Students complete "Descriptions and Algebraic Expressions" worksheet.
- 2) Students complete the "Solve the Sample Mystery Bag!" worksheet
- 3) Students use the "Project Directions and Checklist" sheet and the "Create Your Own Mystery Bag!" template sheet to design the rough draft of their mystery bags.
- 4) At least two students solve the completed rough draft of each student's mystery bag to verify that the clues lead to the intended answer. These two students then sign the bag creator's "Create Your Own Mystery Bag!" template.

