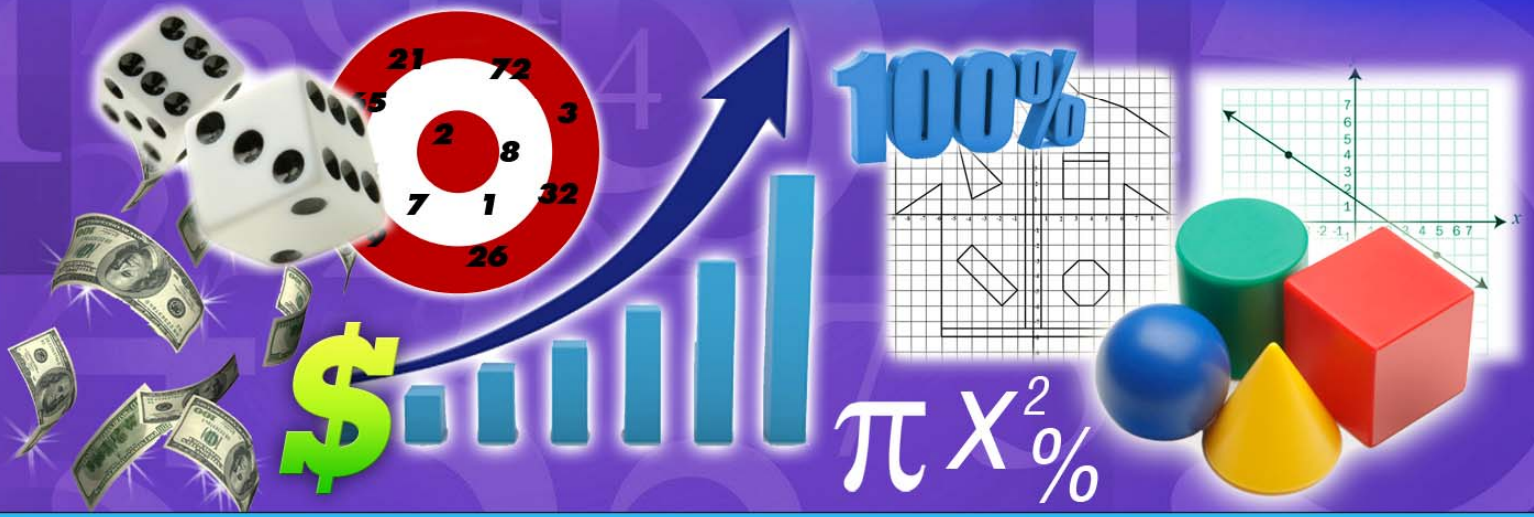
Digital Lesson.com Presents

Marvelous Middle School Math

The Complete Collection of Lessons, Projects, and Games



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. It specializes in providing instant, inexpensive, and engaging math lessons and projects to enhance the middle school math program. Also included on the site are other math resources tailored to 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, *The Complete Collection of Lessons, Projects, and Games*, in your classroom. Please e-mail us with any comments at digitallesson@yahoo.com.

Note: The easiest way to access the individual lessons, projects and games included in this large eBook is to click on the bookmark that will take you directly to that activity. You will find the bookmarks by clicking on the bookmark tab at the left side of your screen when this pdf file is open.

For a more complete description of each activity see the Table of Contents for the eBook that the activity is in. Again, you can access this directly from the bookmark tab at the left side of this pdf file.

A publication of Digital Lesson.com

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 P. Tully
Founder, DigitalLesson.com

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Number Sense Activities

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

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

Mark Tully

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Amateur

Architect

Amateur Architect - Ruler Skills 1

Measuring Line Segments

Measure each line segment to the nearest 1/16" and write the length in the box under the segment. Use mixed numbers when appropriate and write each number in simplest form.

1. _____ _____ _____ _____

2. _____ _____ _____

3. _____ _____

4. _____

5. _____ _____

6. _____ _____ _____

Answer Key

Amateur Architect - Ruler Skills 2

Drawing Line Segments

Place a point at the beginning of each line segment. Then measure the given distance from the starting point and place an endpoint. Finally, shade in the segment between the two points. ***(Exchange papers and correct. Segments should be within 1/16".)***

1) 4 5/16"

2) 1 7/16"

3) 5 3/16"

4) 2 1/8"

5) 3 3/4"

6) 5 1/16"

7) 4 1/2"

8) 3 5/8"

9) 15/16"

Amateur Architect

Use the following directions to construct your street, curb, house, and garage. (NOTE: All dimensions are given as length by width (l x w). Length is measured from left to right. Width is measured from top to bottom.) Use a clean, white sheet of paper turned to landscape mode.

I. Street and Curb

1. The street is 11" x 1 1/2" and is located at the very bottom of the page.
2. a) A broken median line runs the length of the street. Each median segment is 1" x 1/8" and segments are spaced 1" apart.
   b) Center these segments between the street line and the bottom edge of the paper.
   c) The first median segment begins 1" from the left edge of the paper.
3. The curb line rises 1/4" above the street line and is parallel to the street line.

II. House

1. The left side of the house is 1/2" from the left edge of the paper.
2. The length of the front wall of the house is 9/16 of the length of the paper.
3. The width of the front wall of the house is 2 15/16" less than the length of the house.
4. The distance between the top of the house's front wall and the top of the roof is ten times the width of one broken median segment in the street.
5. The roof angles in at 40° from each top corner of the house. The top of the roof is parallel to the top of the front wall.

III. Garage

1. The distance between the right side of the house and the left side of the garage is 36/48".
2. The length of the garage is 1 7/8" more than the distance from the top of the house wall to the top of the house roof.
3. The width of the garage is 3 7/16" less than the length of the house.
4. The garage roof angles in at 35° from each top corner of the garage and meets at a point.

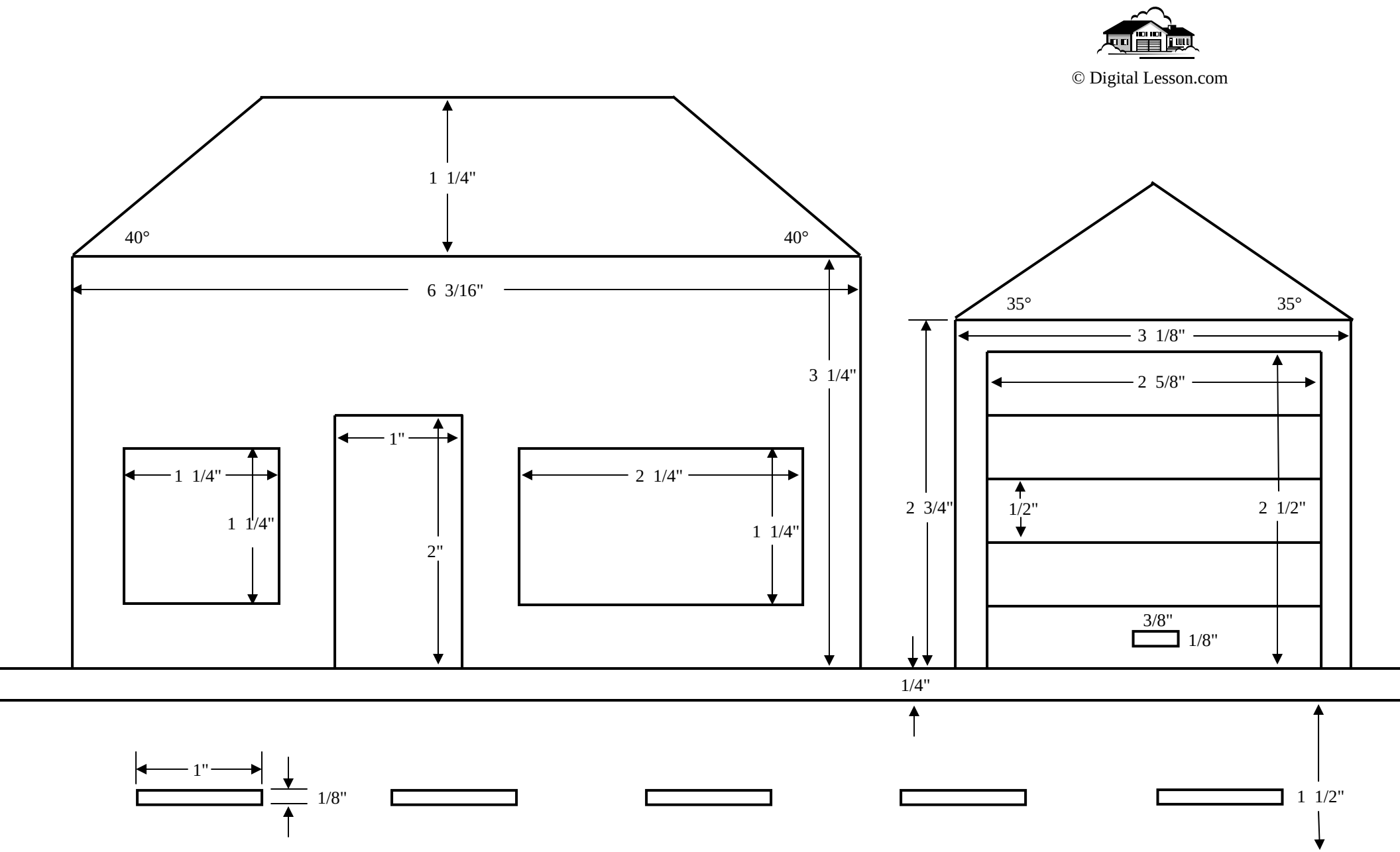
Amateur Architect - Fraction Calculations

The calculation numbers below correspond to the numbers on the Amateur Architect project. Show all of your work and then place the answer for each calculation in the answer box. Problems without answer boxes can be solved in more than one way. All fractions should be reduced to simplest form.

I-2 Centering Median Segments	II-2 Length of the Front Wall	II-3 Width of the Front Wall
II-4 Distance Between Top of Wall and Top of Roof	III-2 Length of the Garage	III-3 Width of the Garage
IV-1 Location of Door	IV-2 Width of House Door	V-1 Center Left Window
V-2 Center Right Window	VI-1 Center Garage Door	VI-3 Five Equal Garage Door Panels

Amateur Architect

Grading Template



Teacher Tips

Amateur Architect

Lesson Description: Amateur Architect is a hands-on math project that requires students to compute fraction operations problems and use the resulting measurements to construct a house and garage. Students use pencil and ruler to draw and center parts of the house and garage. This project combines the foundational skill of solving fraction operation problems with the practical application of ruler measuring skills.

Math Content: Fraction Operations, Measuring and Constructing Drawings with a Ruler

Time Required: This project usually takes about 4 - 7 class periods, depending on whether or not the Ruler Skills worksheets are used and if you allow any part of the project (such as the final title and drawing) to be done at home.

Amateur Architect includes:

* 1 Amateur Architect project cover sheet
* 3 Ruler Skills worksheets (for optional preparation prior to the Amateur Architect project)
* 3 Ruler Skills answer keys
* 2 Amateur Architect project pages
* 1 Amateur Architect project Fraction Calculations worksheet
* 1 Amateur Architect project Fraction Calculations worksheet answer key
* 2 Amateur Architect Grading Templates (one with dimensions included)
* 1 Amateur Architect Project Terms Transparency
* 2 Amateur Architect Teacher Tips pages
* 1 Amateur Architect Grading Rubric **17 pages in all!!**

Materials Needed: Rulers (class set), two transparencies, construction paper (optional)

Suggested Grade Level: 5th -8th

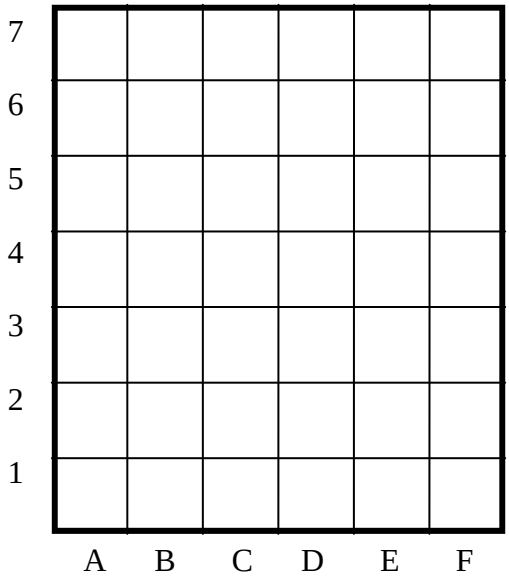
Teacher Tips:

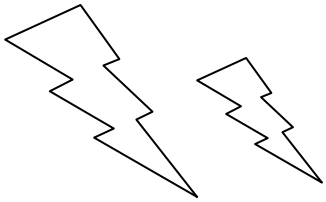
* **Before printing** make sure "**NONE" is selected for Page Scaling**. Otherwise templates of project and lengths of segments on Ruler Skills pages will not be accurate.
* Have students calculate and draw simultaneously. Some students want to solve all of the problems first. **Some calculations depend on previous calculations**, so it is important to be able to visualize the reasonableness of math calculations by drawing them.
* Calculations should be shown, with all work, on the Fraction Calculations worksheet.
* Teach, and encourage students to use, at least two guide points when constructing lines.
* Grading for the project is very fast!! Simply check the main calculations using the answer key and then **place a transparency of the project over the student's work** to check for accuracy. Line up the left side of the house and the curb line as reference points, **not** the edge of the transparency. (Note: Projects will not be perfectly accurate but look at the number and degree of miscalculations or incorrect drawings.) See Grading Rubric.

Proportional

Pictures

Proportional Pictures





Proportional Pictures

7

6

5

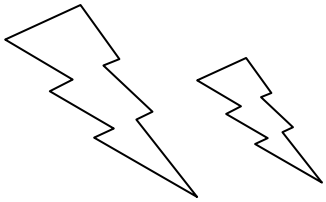
4

3

2

1

A B C D E F



Proportional Pictures

1. Are the two figures that you have drawn similar? Explain.

2. What scale have you used to make your larger drawing?

3. Using your two figures compare their perimeters and areas using the chart below. Use string to help you estimate the perimeter.

	SMALL PICTURE	LARGE PICTURE	RATIO: $\frac{\text{LARGE PICTURE}}{\text{SMALL PICTURE}}$ = X.XX
PERIMETER			——— =
AREA			——— =

4. About how many times greater is the perimeter of the large figure? Why do you think that the perimeter is this many times greater?

5. About how many times greater is the area of the large figure? Why do you think that the area is this many times greater?

6. If we had made our large picture five times larger than the small picture, how many times larger would the area have been? Explain your reasoning. Can you generalize a rule for this relationship?

Math

Shadows

Math Shadows

_____

_____

_____

Indirect Measurement 2

Name _____
Height _____
Shadow _____

Student		**Hoop**
height / shadow	=	height / shadow
_____	=	____X____

Height of Hoop (x) = _____

Basketball Hoop
Height = x
Shadow = _____

Name _____
Height _____
Shadow _____

Student		**Tree**
height / shadow	=	height / shadow
_____	=	____X____

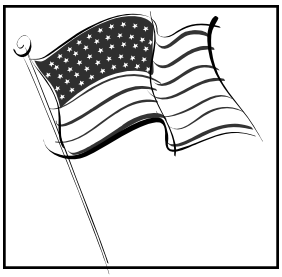
Height of Tree (x) = _____

Tree
Height = x
Shadow = _____

Name _____
Height _____
Shadow _____

Student		**Flag**
height / shadow	=	height / shadow
_____	=	____X____

Height of Flag (x) = _____



Flagpole
Height = x
Shadow = _____

Math Shadows

Teacher Tips

(1 of 2)

Lesson Description: Math Shadows is a hands-on, outside-the-classroom lesson in which students use shadows, similar triangles, and proportions to indirectly measure the heights of several objects on campus. By measuring the height and shadow of a student and the shadow of an object (basketball hoop, tree, flagpole) the students can create proportions to mathematically discover the height of these objects. This is a fun, active lesson that can be completed in one class period.

Math Content: Indirect Measurement, Similar Triangles, Proportions, and Metric Measurement

Time Required: 1 Class Period

Math Shadows includes:

* 3 Math Shadows student worksheets
* 2 Math Shadows Teacher Tips pages
* 1 Math Shadows Cover Sheet

Materials Needed: Tape Measures (inches or centimeters)

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Math Shadows is an activity lesson that gives students the opportunity to use some of their mathematical knowledge in the real world. They work in groups and walk around campus applying their math skills in order to find the heights of a tree, a basketball hoop, and a flagpole. A worksheet is included which allows the teacher to personalize the activity for his students by choosing other objects that are found on his own campus. Students enjoy the change of pace and the chance to work together.

Teacher Tips:

* Be sure to select a **sunny day** to use this activity with your classes. If it is not sunny (and you cannot easily identify shadows) it will be impossible to complete this activity.
* If you do not have a basketball hoop, tree, and flagpole on your campus that would work well for this activity you may want to create your own worksheet(s) using the template provided.
* The first page, *Indirect Measurement 1*, is optional. If you have already taught this concept you may want to skip page one and let the students complete *Indirect Measurement 2* and possibly *Indirect Measurement 3*. The first page is intended to help teach the math concept of indirect measurement prior to students completing the rest of the lesson. The **rounded answer to the sample problem on page one** is **1068 cm or 420 in.**
* Decide ahead of time what units of measure (inches or centimeters) you want students to use as they complete the lesson. I prefer using the metric system because the decimals are easier to work with than all of the fractions involved in using feet and inches. At the end of the lesson we often convert the metric answers back to our standard feet and inches so that students have a better understanding of the results.

Amazing

Birthday Cards

1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

16 17 18 19

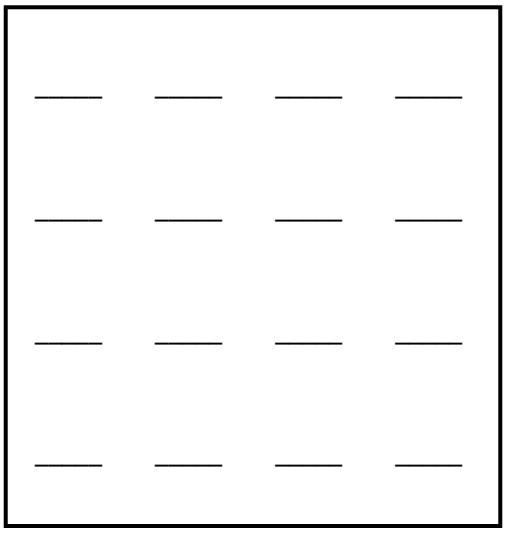
20 21 22 23

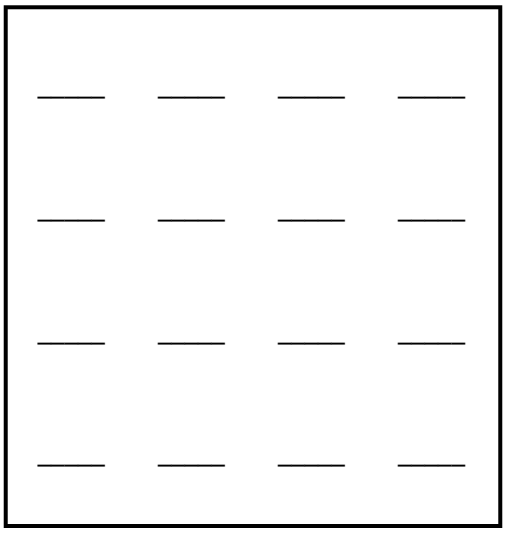
24 25 26 27

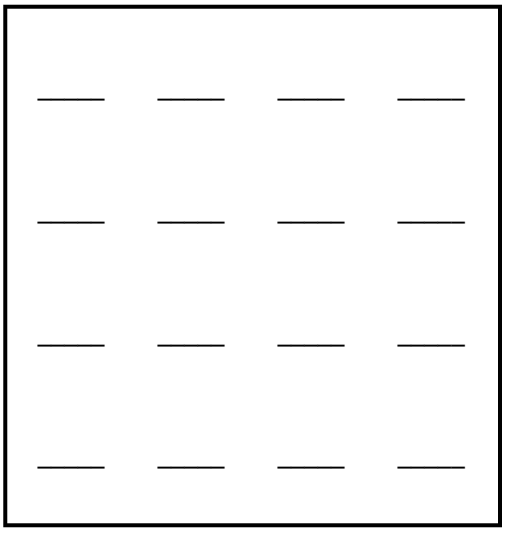
28 29 30 31

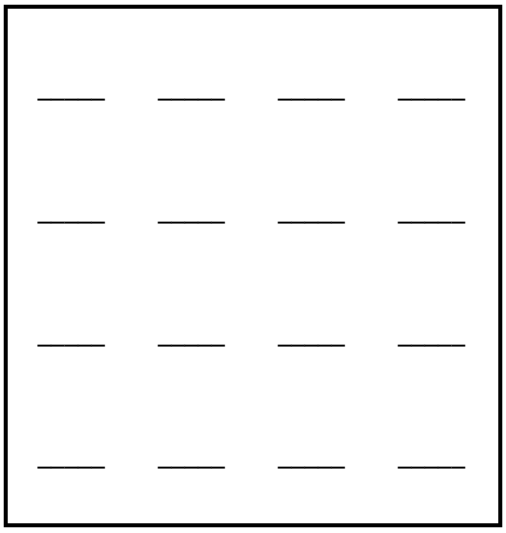
Amazing Birthday Cards

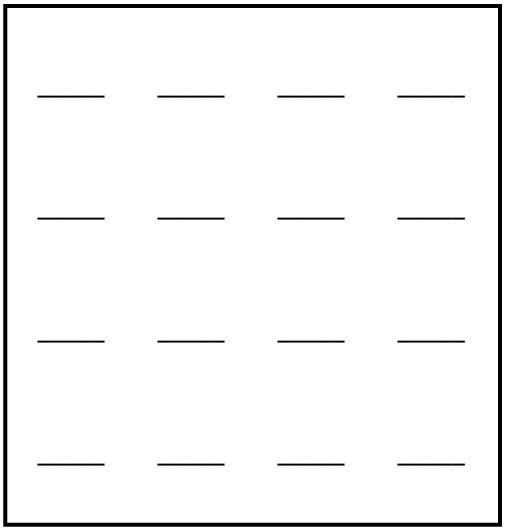
Birthday Cards Number Pattern











Amazing Birthday Cards

Birthday Cards Mathematics

The Base 2 Number System

The Amazing Birthday Card Activity works because the person demonstrating the activity (whether she knows it or not) is using the base 2 number system to identify the unknown number. In our base 10 number system each place value column is worth ten times the previous column and the highest number that can be used in a column in the base 10 system is a nine. In the base 2 system each place value column is worth two times the previous column and the highest number that can be used in a column is a one.

As you complete the chart below pay especially close attention to the way that the first five numbers are made in the base 2 system. Placing a "1" under a column in the base two number chart is the same as saying "yes" on the birthday card that has that place value number in the top left-hand corner of the card. Placing a "0" in a column is the same as saying "no" when that number is in the top left-hand corner of a card.

Base Ten			Number	Base Two						
100	10	1		64	32	16	8	4	2	1
			3							
			5							
			8							
			25							
			31							
			43							
			75							
			100							

Amazing Birthday Cards

Teacher Tips

(1 of 2)

Lesson Description: Amazing Birthday Cards is an activity in which students respond "yes" or "no" to five numbered cards and the teacher uses mathematical patterns to determine the birthdays of these students based on their responses. Students discover the mathematical pattern that enables the teacher to identify the birthdays and they come to understand that this activity is based upon the base 2 number system. Comparing our base 10 number system to the base 2 number system also deepens student understanding of our system. Amazing Birthday Cards never ceases to amaze the students!

Math Content: Number Patterns, Logic, Base 2 Number System, Other Number Systems

Time Required: 1 Class Period (or small parts of several class periods)

Amazing Birthday Cards includes:

* 1 Amazing Birthday Cards Teacher Notes page
* 5 Amazing Birthday Cards Numbered Activity Cards
* 1 Amazing Birthday Cards Number Pattern worksheet
* 2 Amazing Birthday Cards Mathematics worksheets
* 2 Amazing Birthday Cards Mathematics worksheet Answer Keys
* 2 Amazing Birthday Cards Teacher Tips pages
* 1 Amazing Birthday Cards Cover Sheet **14 pages in all!**

Materials Needed: None

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Amazing Birthday Cards is an activity I use every year. The students enjoy participating in this activity and are amazed that by simple saying "yes" or "no" in response to the five cards that I hold up, I can tell them their birthdays. I only take a few of the many volunteers I have each day, thereby building up the suspense before I reveal the mathematical basis for my success in the activity. (Some students think that I actually take my class rosters home and memorize 200+ birthdays each year! As if I had time for that!) The Birthday Cards Number Pattern worksheet allows the students to generate the number pattern themselves and try it out on their friends and family.

Teacher Tips:

* Amazing Birthday Cards is an activity that can be divided into three parts. The teacher may choose to use one or all of the parts of this activity depending upon the time available and the mathematical objectives of the teacher. As the teacher, you may just want to present the activity to your students without having them delve into the mathematical basis for its success. I always want students to understand the mathematical basis of this activity so I have them complete the Number Pattern worksheet. This takes just a few minutes. As an extension, a quick study of different base systems helps to clarify student thinking about the activity and our own base 10 number system.

Humongous

Hero

Humongous Hero

_____

_____

_____

Project Directions

I. Determine the Height of the Humongous Hero

1. Complete the "Hero's Height" worksheet to calculate the hero's height.
2. Select one group member to be the "measurement model" for your hero's measurements.

II. Find the Scale for Your Drawing of the Humongous Hero

1. Which student is your group going to measure to complete this project? _____
2. What is the hero's height according to this student's proportion? _____
3. How tall is the space (in centimeters) that you will draw your hero in? _____
4. Divide the hero's actual height (see #2) by the space you will draw it in (see #3) and round down to the nearest centimeter to determine the scale factor that you will use to draw the hero. Show your work below.

Scale: 1 cm = _____ cm

III. Determine the Dimensions of the Humongous Hero

1. Complete the "Hero Dimensions" worksheet pages to determine the dimensions of the hero.
2. Calculate the dimensions of the scale model of the hero using the same worksheets.

IV. Draw and Label the Dimensions of the Humongous Hero

1. Draw the hero and label its dimensions on the right side of the poster board.
2. Leave room for the hero's name at the top and the worksheets to be attached on the left side.

V. Find the Measurements of the Humongous Hero's Possessions

1. Draw and label the dimensions of four objects that are owned by the hero.
2. Show all work (proportions) used to determine the dimensions of these objects.

Humongous Hero

_____

_____

_____

Hero Dimensions 1

Use the table below to determine the dimensions of the Humongous Hero. All measurements should be rounded to the nearest tenth of a centimeter. Use the hero height that was determined using the height of your group's measurement model (see page 2).

Body Part	**Measurements**		**Scaled Measurements (1 cm = _____ cm)**	
Sample: neck to finger tip height (model's hero)	Student Model: 94 cm = Hero: x 189.2 cm 975 cm	x = 484.4 cm	484.4 ÷ 19 = (19 is sample scale factor.)	25.5 cm
length of face height				
width of face height				
shoulder to shoulder height				
base of neck to waist height				
waist width height				
waist to knee height				
knee to foot height				
length of foot height				

Humongous Hero

Teacher Tips

(1 of 3)

Lesson Description: Humongous Hero is a group project that involves proportions and the use of scale. Students use proportions and the handprint of the Humongous Hero to determine its height and body measurements. Then they make a scale model of the superhero that can be drawn on poster board. Finally, students use proportions to determine the dimensions of various items owned by the hero.

Math Content: Writing and Solving Proportions; Using Proportional Reasoning to Create a Scale Model; Metric Measurement; Using Proportions to Solve Problems

Time Required: 3-5 Class Periods

Humongous Hero includes:

* 5 Humongous Hero assignment sheets
* 3 Humongous Hero Teacher Tips pages
* 1 Humongous Hero Cover Page

Materials Needed: Centimeter measuring tapes, poster board, butcher paper, large hand cutouts

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Humongous Hero is a group project that the students really enjoy. They measure each other to help determine the size of the Humongous Hero and then use a scale to reduce the superhero down to a size that can be drawn on their poster board. When I have used this project before, the students really enjoyed designing the look of the person (superhero) and used mathematics to keep him in proportion.

Teacher Tips:

* The Humongous Hero project should be completed in groups. I have always used groups of four, but a group of three would also be acceptable. Larger groups allow too many spectators.
* Using an overhead projector and sheets of white butcher paper, create a "Humongous Hero hand" for each group. Tape the butcher paper to the wall and then use a tracing of your hand to draw the "humongous hands". Simply move the overhead further away from the butcher paper to make the hand bigger. **(Note: I have always used hands that are about 102 centimeters from the base of the palm to the tip of the longest finger. This is A little more than 5 times the length of my hand and so creates a Humongous Hero that is about 900 centimeters, nearly 30 feet, tall.)**
* Of course you may use a different "humongous hand" size if you want students to calculate the size of a larger or smaller Humongous Hero.

Creative

Equations

Creative Equations Project

_____

_____

_____

Teacher Project Directions

Administering the Creative Equations Project:

1. **Choose which four numbers the students will use to create their equations.**
   * Although using four fours or four nines allow many possible answers to be generated, the answers for these puzzles can be found on the internet.
   * Some teachers like to choose the numbers of the calendar year. For instance, in 1998 some teachers used a 1, 9, 9, and 8. This will not work well in years that have several zeros.
   * You may want to choose the four numbers yourself or allow the students to choose them.
   * Each class should use the same four numbers. Using different numbers for different classes will encourage more individual work.

2. **Select the number of equations that each individual or group will find.**
   * I have used the sheets for all 100 equations with motivated students.
   * Some students may have more success becoming involved in the project if only the equations with solutions from 1-25 or 1-50 are used. Other equations might count toward extra credit. Weigh the level (and ability to persevere) of your students.
   * The number of equation solutions selected should also be partially determined by the amount of time, in class and at home, that you want students to spend on the project.

3. **Distribute the Creative Equations packet to your students.**
   * Each student should have a Student Project Directions sheet, one or two Creative Equations Recording Sheets, and a copy of the Creative Equations Scavenger Hunt.

4. **Give students time to start the project in class.**
   * Students should work in groups or teams with 2 to 4 students in each group.
   * All students in a group **must have the exact same equations** on their respective papers. This promotes cooperation, increases the mathematics done, and helps students to teach each other regarding misunderstandings in the use of Order of Operations.
   * Calculators should be discouraged except in cases where exponents, factorial, etc. cause the numbers to be temporarily very large.

5. **Post the Creative Equations Class Chart with Student Signature Lines sheet.**
   * I require students to check with me before posting equations and signing their names.
   * Make it a class goal to find equations for as many of the solution numbers as possible.

6. **Conclude the Project by Finding Scavenger Hunt Winners and Scoring Papers.**
   * Have students share their Scavenger Hunt results and reward winners for each problem.
   * Facilitate the switching of papers and scoring of one group by another.
   * I have the top two teams switch papers, the third and fourth teams, and so on.
   * In a fixed amount of time, have correcting groups start with the number of successful equations reported and then deduct a point for each incorrect equation found.

Creative Equations Project

_____

_____

_____

Creative Equations Recording Sheet 1

Equation Numbers: _____ _____ _____ _____

_____	= 1	_____	= 26
_____	= 2	_____	= 27
_____	= 3	_____	= 28
_____	= 4	_____	= 29
_____	= 5	_____	= 30
_____	= 6	_____	= 31
_____	= 7	_____	= 32
_____	= 8	_____	= 33
_____	= 9	_____	= 34
_____	= 10	_____	= 35
_____	= 11	_____	= 36
_____	= 12	_____	= 37
_____	= 13	_____	= 38
_____	= 14	_____	= 39
_____	= 15	_____	= 40
_____	= 16	_____	= 41
_____	= 17	_____	= 42
_____	= 18	_____	= 43
_____	= 19	_____	= 44
_____	= 20	_____	= 45
_____	= 21	_____	= 46
_____	= 22	_____	= 47
_____	= 23	_____	= 48
_____	= 24	_____	= 49
_____	= 25	_____	= 50

Creative Equations Project

_____

_____

_____

Class Chart with Student Signature Lines

Equation Numbers: _____ _____ _____ _____

_____	= 1	_____
_____	= 2	_____
_____	= 3	_____
_____	= 4	_____
_____	= 5	_____
_____	= 6	_____
_____	= 7	_____
_____	= 8	_____
_____	= 9	_____
_____	= 10	_____
_____	= 11	_____
_____	= 12	_____
_____	= 13	_____
_____	= 14	_____
_____	= 15	_____
_____	= 16	_____
_____	= 17	_____
_____	= 18	_____
_____	= 19	_____
_____	= 20	_____
_____	= 21	_____
_____	= 22	_____
_____	= 23	_____
_____	= 24	_____
_____	= 25	_____

Creative Equations Project

_____

_____

_____

Class Chart with Student Signature Lines

Equation Numbers: _____ _____ _____ _____

_____	= 76	_____
_____	= 77	_____
_____	= 78	_____
_____	= 79	_____
_____	= 80	_____
_____	= 81	_____
_____	= 82	_____
_____	= 83	_____
_____	= 84	_____
_____	= 85	_____
_____	= 86	_____
_____	= 87	_____
_____	= 88	_____
_____	= 89	_____
_____	= 90	_____
_____	= 91	_____
_____	= 92	_____
_____	= 93	_____
_____	= 94	_____
_____	= 95	_____
_____	= 96	_____
_____	= 97	_____
_____	= 98	_____
_____	= 99	_____
_____	= 100	_____

Creative Equations Project

Teacher Tips

(1 of 2)

Lesson Description: Creative Equations is a group math project that requires students to create equations with a variety of solutions from four given numbers. In the process students manipulate the given numbers using many mathematical symbols. The project helps students to become fluent in the use of Order of Operations. It includes work with square roots, factorials, the proper use of parentheses in equations, and all operational symbols.

Math Content: Order of Operations, Equations, Square Roots, Factorials, Number Operations (Addition, Subtraction, Multiplication, and Division), Exponents, and Using Parentheses

Time Required: 2-3 Class Periods

Creative Equations Project includes:

* 1 Creative Equations Teacher Project Directions Sheet
* 1 Creative Equations Student Project Directions Sheet
* 2 Creative Equations Project student worksheets
* 1 Creative Equations Project Four Fours sample Answer Key for Equations 1-50
* 4 Creative Equations Project Classroom Charts for posting equations in class.
* 1 Creative Equations Scavenger Hunt Sheet
* 2 Creative Equations Project Teacher Tips pages
* 1 Creative Equations Project Cover Sheet **13 pages in all!**

Materials Needed: None

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Creative Equations Project is a fun group activity that focuses on Order of Operations and manipulating numbers using many mathematical symbols. It encourages working with numbers in unique ways and allows students many "aha!" moments.

Teacher Tips:

* Students must have a clear understanding of Order of Operations in order to complete this project successfully. This project would be a perfect follow-up to student instruction of this important math topic.
* Have students use only **one** equal sign at the end of the equation. In other words, if your equation is $4 + 4 + 4 + 4 = 16$ it should not be written as $4 + 4 = 8 + 4 = 12 + 4 = 16$. You want one clean-looking equation for each possible answer.
* Four fours and four nines are numbers number puzzles that have been done before by others and there are **solutions on the internet** for these puzzles. I have included a sample answer key for the first fifty equations using four fours. Some numbers have many solutions. This page will give you an idea for the types of equations that are possible, regardless of the numbers chosen.

Creative Equations Project

Teacher Tips

(2 of 2)

Teacher Tips: (continued)

*You may want to pick another combination of numbers that students will not be able to find on the internet. Including at least one nine or one four allows for more equations to be found as you can find the square root for each number, effectively giving you one more number choice to use in your equations.

* Depending on the numbers selected by the teacher for this project, it may or may not be possible to write equations with solutions for every number.

* Some students may become confused regarding the proper order of operations if they are using a calculator. Some inexpensive calculators do not automatically perform order of operations. More complex calculators do perform equations using order of operations. Have students do the equation 3 + 8 x 4 on their calculators. Type in the numbers without using an equal sign until the end. If a student gets a solution of 44 his calculator is not using order of operations. An answer of 35 clarifies that the calculator is automatically performing order of operations.

* I spend about 30 minutes in class the first day introducing the project and letting the students choose groups to begin working on the project. A few times before the final project due date make sure that students have the opportunity to share their equations with their group. Have students write the equations on a separate paper until it is officially approved by the group. Then spend about another 15 to 30 minutes on the due date to exchange papers (by group) and correct.

* As you get down to just a handful of creative equations remaining to complete the assignment, write these numbers on the board. Students will enthusiastically seek solutions for the remaining numbers. You may even want to offer prizes for the last few solution numbers.

* **Important:** Give students a selected amount of time per night to work on the project. Without guidelines, some students will spend hours each day trying to find the often elusive (or perhaps impossible given our rules) equation solution. I suggest about 10 minutes per day for the length of the project.

Middle School Math Treasures Newsletter:

To receive DigitalLesson.com's Middle School Math Treasures newsletter please visit our website at www.DigitalLesson.com and enter your e-mail address in the subscription box . You will then become eligible to receive new lesson updates, math resources and ideas, and a **free printable math game** with **each** bimonthly newsletter. You may unsubscribe at any time using the link in our newsletter.

Enjoy your lesson!!
Mark

Math

Madness

Math Madness

Tournament Problem Set 1

Tournament Entry Problem: Triple the Square

If you triple the length of the sides of a square, by how many times does the area of the square increase? Include an example.

First Round Problem: Large Cookie

Sandra baked a very large cookie which weighed 10 pounds. Each day she and her friends ate one half of the remaining portion of the cookie. How long will the cookie last?

Second Round Problem: Lightning Laura

Laura ran 100 yards in 14 seconds. To the nearest hundredth, what was her speed in miles per hour?

Quarterfinal Problem: More Money

Jose started a new job with a salary of $45,000 per year. If he gets a 6% raise each year, what will his salary be at the beginning of the 8th year?

Semifinal Problem: Winning Streak

When a baseball team won 5 games in a row its winning percentage increased from 40% to 50%. How many games had the team lost?

Final Problem: Stop Sign Angles

What is the measure of each exterior angle of a stop sign?

Math Madness

Answer Key

Tournament Problem Set 3

Tournament Entry Problem: Handshake Problem

There are 66 handshakes. Twelve people each shake hands with eleven other people. Twelve times eleven is 132 handshakes. However, half of these handshakes would be repeats so you divide 132 by 2 and end up with 66. The mathematical formula for this type of handshake problem is n x (n-1)/2 where n represents the number of people.

First Round Problem: Count the Squares

There are 30 squares in the figure. If you consider this large square to be a 4 x 4 square with four smaller squares making up each side then you can breakdown the problem in the following manner. There are 16 small squares (1 x 1). There are 9 squares (2 x 2) made up of four small squares. There are 4 squares (3 x 3) made up of nine smaller squares. Finally, there is 1 large square (4 x 4) made up of all 16 small squares. The pattern for solving this type of problem is $4^2 + 3^2 + 2^2 + 1^2$.

Second Round Problem: Four or Less

The probability that the sum of the numbers will be less than or equal to four is 1/54. When rolling three number cubes there are 216 total possible combinations (6 x 6 x 6). Only four of these combinations (1-1-1, 1-1-2, 1-2-1, and 2-1-1) have a sum that is less than or equal to four. The fraction 4/216 can be reduced to 1/54.

Quarterfinal Problem: Free Throw Shooting

Skeeter would have to make 38 free throws in a row. So far he has made about 40.9 percent of 208 free throws or 85 free throws. He has missed 208 - 85 or 123 free throws. If he makes 38 more free throws in a row he will have made 123 and missed 123 free throws and his free throw percentage will be 50 percent.

Semifinal Problem: Long Addition

The sum of the numbers is 500,500. If you look at the set of numbers (1, 2, 3, ……..998, 999, 1000) you can see that adding the first and last numbers will give you a sum of 1,001. The second and the second to last numbers can be added together to equal 1,001 and so on. There will be 500 pairs of numbers whose sum is 1,001. (500 x 1,001 = 500,500)

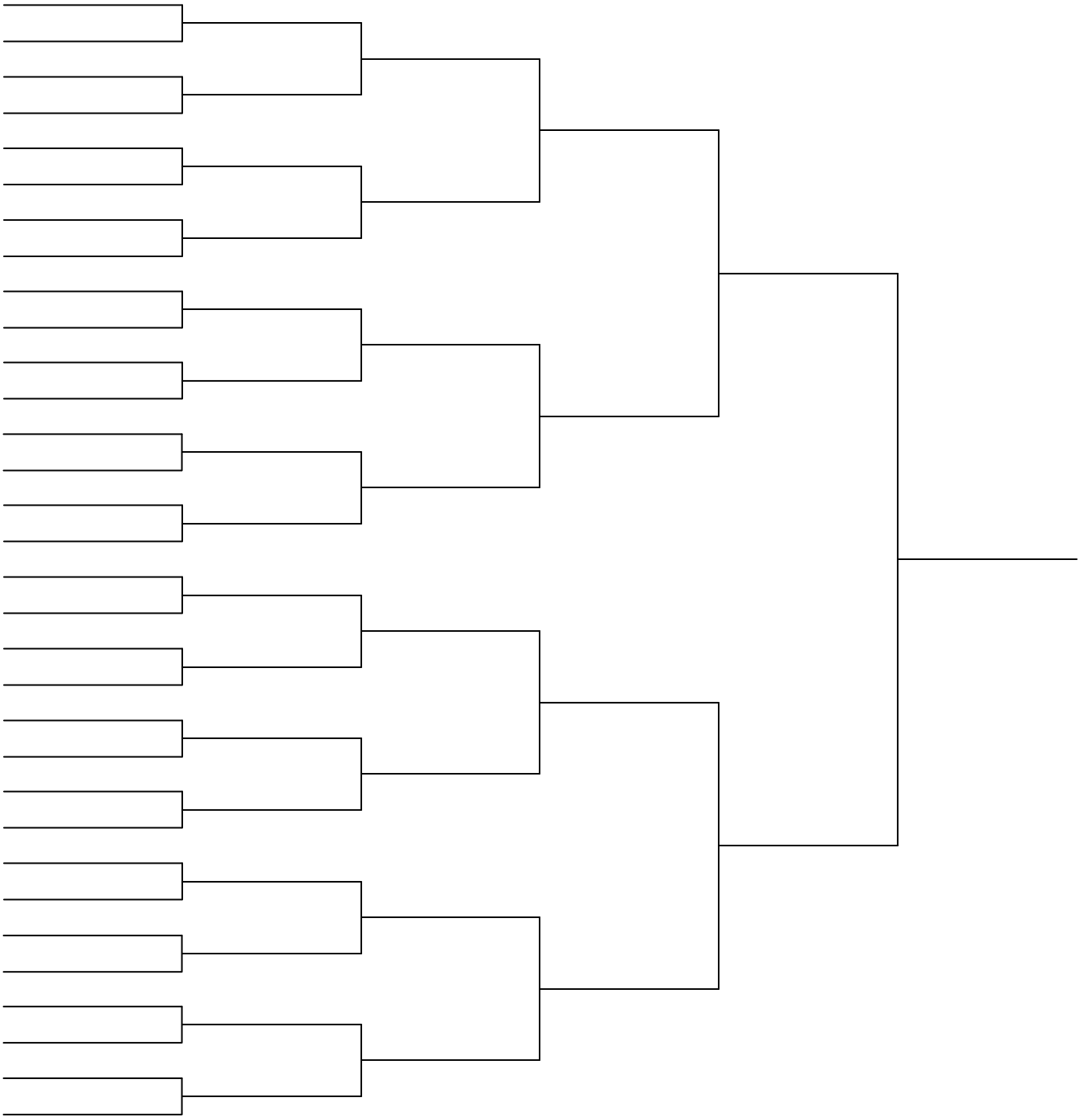
Final Problem: Greek Travels

Marti first visited Greece in 1993. Let x be the first year Marti visited Greece. The next visit would be x + 5, then x + 10 and so on. The equation is 7x + 105 = 14,056 and x = 1993.

Math Madness

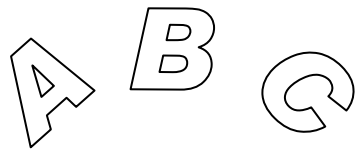
Math Tournament Bracket

FIRST ROUND SECOND ROUND QUARTERFINALS SEMIFINALS FINALS CHAMPION



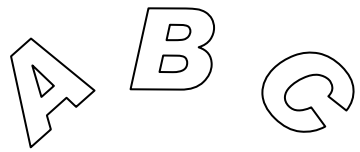
Grade Sheet

Lesson



GRADE SHEET

No.	Date	Assignment	Score	Decimal	Percent	Grade	Class Total	Decimal	Percent	Class Grade	Parent Signature
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											



GRADE SHEET ASSIGNMENTS

Basketball Star's Grades:

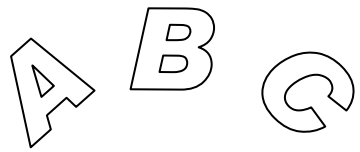
Number	Date	Assignment	Score
1.	9/12	Practicing Hard	49/50
2.	9/16	Signing Autographs	18/20
3.	9/19	Free Throws	32/35
4.	9/22	Commercials	10/10
5.	9/26	Acrobatic Dunks	53/50
6.	10/1	3-point Shooting	25/30
7.	10/3	Defense	44/45
8.	10/7	Layup Drills	9/10
9.	10/10	Team Leadership	39/40
10.	10/14	NBA Finals	97/100

Surf Dude's Grades:

Number	Date	Assignment	Score
1.	9/3	Wave Theory Quiz	19/20
2.	9/5	Surf Slang	42/50
3.	9/10	Weather Knowledge	24/25
4.	9/12	Wave Tricks	25/30
5.	9/17	Surf Competition	83/100
6.	9/22	Respect for Others	42/40
7.	9/26	Swimming Skills	46/50
8.	9/30	Mini Surf Competition	40/50
9.	10/2	Extra Credit: Rescue Swimmer	10/0
10.	10/7	Final Surf Competition	95/100

Baddy Siszhon's Grades:

Number	Date	Assignment	Score
1.	9/5	Basic Facts Quiz	15/20
2.	9/9	Chapter 1 Test	83/100
3.	9/15	Chapter 1 Homework	20/44
4.	9/16	Fraction Project	29/30
5.	9/19	Chapter 2 Quiz	18/20
6.	9/23	Chapter 2 Test (cheated)	0/100
7.	9/26	Chapter 2 Homework	40/50
8.	9/30	Adding Decimals Quiz	30/30
9.	10/3	Decimal Project (not turned in)	0/30
10.	10/8	Chapter 3 Quiz	19/20



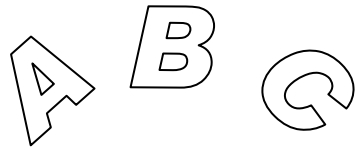
GRADE SHEET QUIZ

No.	Date	Assignment	Score	Decimal	Percent	Grade	Class Total	Decimal	Percent	Class Grade	Parent Signature
1											
2											
3											
4											
5											

Using the grade sheet above, determine this student's final grade based on his individual scores.

Student's Grades

Number	Date	Assignment	Score
1.	9/5	Basic Facts Quiz	21/25
2.	9/7	Chapter 1 Test	92/100
3.	9/9	Chapter 1 Homework	48/52
4.	9/16	Class Project	41/50
5.	9/19	Chapter 2 Quiz	29/35



Grade Sheet Lesson Teacher Tips

Lesson Description: The Grade Sheet Lesson is a resource that enables students to track their grade in a class. It is also a tool used to communicate student progress to the home. Finally, it provides content practice in fractions, decimals, and percents.

Math Content: Fractions, Decimals, and Percents

The Grade Sheet Lesson includes:

* 2 Grade Sheet forms to track up to 30 grades in any grading period
* 1 assignment sheet with 3 sets of fictitious grades that can be used to learn the Grade Sheet
* 2 quizzes that can be administered to your class in order to assess understanding
* 2 answer keys for the Grade Sheet assignments and the Grade Sheet quizzes
* 1 Grade Sheet Teacher Tips sheet

Materials Needed: None

Suggested Grade Level: 5th - 12th

Teacher Tips:

* The most common error made by students is not rounding decimals to the nearest hundredth.
* You may need to alter the letter grade on the practice sheets or quizzes if your grading scale is different from the one used here.
* The parent signature box is optional, but I require it as proof that parents know class grades.
* I subtotal ten homework scores before students enter a homework score on their Grade Sheet. This keeps the amount of entries to a reasonable number while still providing the relevant information.
* For the Grade Sheet to be most effective, make it a part of the culture of your class. Share it with parents at Back-to-School Night, allow class time to enter grades, check frequently for parent signatures, and collect at times. I collect mine at mid-quarter and at the end of the quarter and grade them, comparing them to my own computer gradebook.

Testimonial:

One of the first things I do each year with my students is teach them how to use my Grade Sheet. The students complete two or three practice Grade Sheets and then take a quiz to prove their ability to use this tool. For the remainder of the year, each time I give the students a grade they must enter it onto their Grade Sheet, calculate their new cumulative grade in my class, and then have their parent sign it. After a few assignments they will fill out their Grade Sheets with little prompting. I rarely hear parents say that they weren't aware of their child's grades!!

Most parents see and sign their child's Grade Sheet 10-15 times per quarter and are continually updated with their child's progress. The Grade Sheet also brings ownership of their grades to the students. As a math teacher I love to see the students learning the effect of each assignment on their cumulative grade. "I only need 5 more points for a B." or "This assignment really brought up my grade." are common types of comments I hear as students earnestly enter each grade to see its effect. In the past, students have often had trouble making the connection between their individual efforts and their final grade.

Who Has

Cards

Who Has Cards

Card Set 1 - Integers

Integer Cards Master Problem List

I have -3. Who has 12 - (-7)?

I have 19. Who has 32 x (-3)?

I have -96. Who has -12 - 20?

I have -32. Who has -8 + (-15)?

I have -23. Who has 42 ÷ (-6)? **5**

I have -7. Who has -50 ÷ (-10)?

I have 5. Who has 20 + (-18)?

I have 2. Who has 25 x (-2)?

I have -50. Who has 15 + 18?

I have 33. Who has -81 ÷ 9? **10**

I have -9. Who has 100 - (-20)?

I have 120. Who has -20 - (-5)?

I have -15. Who has 12 + (-16)?

I have -4. Who has -10 - (-11)?

I have 1. Who has 120 ÷ 3? **15**

I have 40. Who has -12 x 5?

I have -60. Who has 62 + 30?

I have 92. Who has -6 x (-3)?

I have 18. Who has 5 - (-9)?

I have 14. Who has 12 x 4? **20**

I have 48. Who has 62 ÷ 2?

I have 31. Who has -80 + 60?

I have -20. Who has 17 - (-12)?

I have 29. Who has -19 ÷ 1?

I have -19. Who has 32 + (-16)? **25**

I have 16. Who has -3 x 13?

I have -39. Who has 22 ÷ (-11)?

I have -2. Who has -7 x 5?

I have -35. Who has -15 - 3?

I have -18. Who has 9 x (-4)? **30**

I have -36. Who has 17-5?

I have 12. Who has -30 + (-22)?

I have -52. Who has 100-30?

I have 70. Who has -24 ÷ (-6)?

I have 4. Who has 15 + (-25)? **35**

I have -10. Who has 90 ÷ (-2)?

I have -45. Who has 8 x 9?

I have 72. Who has -16 + (-40)?

I have -56. Who has -11 x (-4)?

I have 44. Who has 24 ÷ (-8)? **40**

I have -3.

Who has 12 - (-7)?

Integers © DigitalLesson.com

I have -23.

Who has 42 ÷ (-6)?

Integers © DigitalLesson.com

I have 19.

Who has 32 x (-3)?

Integers © DigitalLesson.com

I have -7.

Who has -50 ÷ (-10)?

Integers © DigitalLesson.com

I have -96.

Who has -12 - 20?

Integers © DigitalLesson.com

I have 5.

Who has 20 + (-18)?

Integers © DigitalLesson.com

I have -32.

Who has -8 + (-15)?

Integers © DigitalLesson.com

I have 2.

Who has 25 x (-2)?

Integers © DigitalLesson.com

I have -50.

Who has 15 + 18?

Integers © DigitalLesson.com

I have -15.

Who has 12 + (-16)?

Integers © DigitalLesson.com

I have 33.

Who has -81 ÷ 9?

Integers © DigitalLesson.com

I have -4.

Who has -10 - (-11)?

Integers © DigitalLesson.com

I have -9.

Who has 100 - (-20)?

Integers © DigitalLesson.com

I have 1.

Who has 120 ÷ 3?

Integers © DigitalLesson.com

I have 120.

Who has -20 - (-5)?

Integers © DigitalLesson.com

I have 40.

Who has -12 x 5?

Integers © DigitalLesson.com

I have -60.

Who has 62 + 30?

Integers © DigitalLesson.com

I have 48.

Who has 62 ÷ 2?

Integers © DigitalLesson.com

I have 92.

Who has -6 x (-3)?

Integers © DigitalLesson.com

I have 31.

Who has -80 + 60?

Integers © DigitalLesson.com

I have 18.

Who has 5 - (-9)?

Integers © DigitalLesson.com

I have -20.

Who has 17 - (-12)?

Integers © DigitalLesson.com

I have 14.

Who has 12 x 4?

Integers © DigitalLesson.com

I have 29.

Who has -19 ÷ 1?

Integers © DigitalLesson.com

I have -19.

Who has 32 + (-16)?

Integers © DigitalLesson.com

I have -35.

Who has -15 - 3?

Integers © DigitalLesson.com

I have 16.

Who has -3 x 13?

Integers © DigitalLesson.com

I have -18.

Who has 9 x (-4)?

Integers © DigitalLesson.com

I have -39.

Who has 22 ÷ (-11)?

Integers © DigitalLesson.com

I have -36.

Who has 17-5?

Integers © DigitalLesson.com

I have -2.

Who has -7 x 5?

Integers © DigitalLesson.com

I have 12.

Who has -30 + (-22)?

Integers © DigitalLesson.com

I have -52.

Who has 100-30?

Integers © DigitalLesson.com

I have -45.

Who has 8 x 9?

Integers © DigitalLesson.com

I have 70.

Who has -24 ÷ (-6)?

Integers © DigitalLesson.com

I have 72.

Who has -16 + (-40)?

Integers © DigitalLesson.com

I have 4.

Who has 15 + (-25)?

Integers © DigitalLesson.com

I have -56.

Who has -11 x (-4)?

Integers © DigitalLesson.com

I have -10.

Who has 90 ÷ (-2)?

Integers © DigitalLesson.com

I have 44.

Who has 24 ÷ (-8)?

Integers © DigitalLesson.com

Who Has Cards

Teacher Tips

(1 of 2)

Lesson Description: Who Has Cards is an activity that requires students to solve 40 mental math problems in a matter of minutes as they take part in this fun review activity. Each student is given one or more cards with a mental math problem and an answer to another problem. One student starts by reading his "Who Has…?" card and then the student with the answer on his card will say, "I have ___." and then read the problem on his card. The activity continues until all 40 cards have been completed. This activity is perfect for reviewing a concept that has been taught recently.

Math Content: Integer Operations, Percent of a Number, Fractions, and Create Your Own

Time Required: 10 minutes as a review during any class period

Who Has Cards includes:

* 4 Who Has Cards Master Problem List pages
* 20 Who Has Cards Card pages
* 2 Who Has Cards Teacher Tips pages
* 1 Who Has Cards Cover Sheet **27 pages in all!**

Materials Needed: None

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Who Has Cards is a quick, fun activity that reinforces mathematical learning and strengthens the mental math skills of students. My students enjoyed competing to see which class could complete the card set in the shortest amount of time. Who Has Cards is a terrific filler activity and a great change to the everyday routine of the math classroom.

Teacher Tips:

* Who Has Cards can be printed on regular copy paper or card stock. You may want to use colored paper and some teachers may choose to laminate the cards to make them last longer. Of course the other option is to just copy off the five sheets each time you want to use the Who Has Cards and just consider it a disposable activity.
* I recently played with three classes using the same set of Who Has Cards copied on regular copy paper. At the end of the day I still had all 40 cards. They were a little crumpled, but that actually makes them easier to count and distribute.
* If you plan on playing with multiple classes during one school day, plan to keep an extra set or two of each Who Has Cards activity on hand. That way you are covered in case a card from the set ends up missing.
* When you cut the individual cards from the card sheets you can line up all five sheets and cut them all at once.

Who Has Cards

Teacher Tips

(2 of 2)

Teacher Tips (continued):

* **Most importantly**, students should know the math skills covered in each card set very well before they use the activity. Otherwise the activity will get bogged down and students will lose interest.
* It is helpful to review a few key ideas before using each card set in order to facilitate student success. For example, prior to using the Integers card set I reminded students of a few key ideas including the fact that subtracting a negative number is the same as adding a positive number. That way, when they heard subtracting a negative they were able to process it faster.
* I look at the card of a student nearby and choose that student to begin the activity. He reads **ONLY** his math question to begin the activity. The activity is over when this same student answers the last question.
* After choosing the student to begin the Who Has Cards activity, I locate that problem on the master problem list so that I can follow the progress of the activity and keep it from going off course if someone speaks up with an incorrect answer. At times I have to redirect the course of the activity by calling on a student with the correct answer.
* I ask all students (even if their card or cards have been played) to do the math for every problem. If a student has not answered a problem within about 10 or 15 seconds after it is read, I allow a student with his hand in the air to answer that question. Then the student with the correct answer card will still have to read their card, which includes the next Who Has question.
* I prefer students to do the math work for this activity mentally, but you may choose to allow your students to have paper and pencil in front of them to help as needed.
* Using the templates provided, it is easy to create your own set of Who Has Cards. All you need is 40 math facts or vocabulary words that you would like students to review. The blank card sheets and a blank problem list are included in this activity.

Remember to keep a master copy so that you can reuse it later!

Middle School Math Treasures Newsletter:
To receive DigitalLesson.com's Middle School Math Treasures newsletter please visit our website at www.DigitalLesson.com and enter your e-mail address in the subscription box . You will then become eligible to receive new lesson updates, math resources and ideas, and a **free printable math game** with **each** newsletter. You may unsubscribe at any time using the link in our newsletter.

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Mark

Digital Lesson.com Presents

Marvelous Middle School Math

Geometry 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, *Geometry Activities*, in your classroom. Please e-mail us with any comments at digitallesson@yahoo.com.

A publication of Digital Lesson.com

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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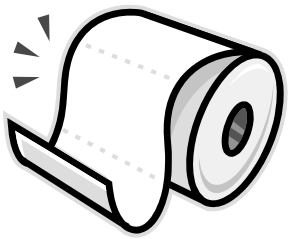


Toilet Paper Geometry

Toilet Paper Trivia

What did people use before toilet paper?

People of many cultures and social classes have used a number of different things in place of the rolls of toilet paper that we use today. Things they used include newsprint, straw, hay, grass, corn cobs, leaves, sand, pages from books, coconut shells, lace, rocks, a sponge on a stick, snow, and tundra moss.

Important Dates in Toilet Paper History

1391 - First toilet paper invented
1857 - First toilet tissue
1890 - First toilet paper on a roll
1942 - First soft toilet paper; two-ply

Toilet Paper Facts

Two-ply toilet paper is not twice as thick as one-ply toilet paper. One-ply is made of #13 thickness paper while two-ply is made of two layers of #10 thickness paper.

The size of a sheet of toilet paper can vary but the standard size is 4.5 inches by 4.5 inches. Some manufacturers have come out with "cheater sheets" that are as small as 4 inches by 3.8 inches and use about 15% less paper.

The average person uses 8.6 sheets of toilet paper per trip, 57 sheets per day, and 20,805 sheets per year. (I wonder how these statistics were compiled?)

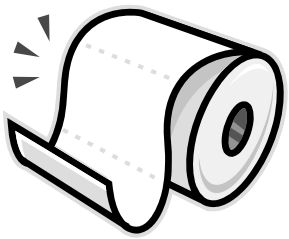
With over 6 billion people living on earth it is estimated that people need to produce 83,048,116 rolls of toilet paper each and every day, 30,600,000,000 rolls per year and 2.7 rolls per second.

Toilet paper may be quilted or rippled, perfumed, colored or patterned, medicated , include added aloe, and more. There are many different options available in a roll of toilet paper. Some toilet paper includes designs that range from cartoon characters to pictures of unpopular political leaders.

Differences in opinions on how to install a roll of toilet paper (with the toilet paper sheets hanging next to the wall or away from the wall) have caused disagreements in households.

When it comes to using toilet paper some people are "folders" and some are "scrunchers."

Resources used to compile this page:
www.toiletpaperworld.com
http://komar.cs.stthomas.edu/qm425/01s/Tollefsrud3.htm
http://en.wikipedia.org/wiki/Toilet_paper



Toilet Paper Geometry

Teacher Tips

(1 of 2)

Lesson Description: Toilet Paper Geometry is a math project that requires students to find the surface area and volume of a roll of toilet paper. Students unwind the roll of toilet paper, place it into the form of one or more rectangles, and calculate the total surface area of the roll. Then they determine how many rolls of toilet paper it would take to cover a basketball court, a football field, and a baseball diamond. Students also calculate the volume of the toilet paper in two different ways (by finding the volume of a cylinder and a rectangular prism) and compare their results.

Math Content: Surface Area**,** Area of Rectangles, Volume of Cylinders and Rectangular Prisms,

Time Required: 1-2 Class Periods

Toilet Paper Geometry includes:

* 2 Toilet Paper Geometry student worksheets
* 2 Toilet Paper Geometry student worksheet Answer Keys
* 1 Toilet Paper Geometry toilet paper trivia sheet
* 2 Toilet Paper Geometry Teacher Tips pages
* 1 Toilet Paper Geometry Cover Sheet **8 pages in all!**

Materials Needed: Rolls of toilet paper (with packaging information removed), rulers

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Toilet Paper Geometry is a chance for students to take an everyday household object (toilet paper) and have it become the basis for an interesting project involving surface area and volume. Middle school students are always telling stories about whose house got toilet papered over the weekend. Students have an inherent interest in toilet paper. Teachers can also take the opportunity to compare unit prices, number of sheets, etc. between toilet paper brands.

Teacher Tips:

* Keep the written packaging information in order to verify the accuracy of student area calculations. When I designed this lesson I used a roll of Kirkland Signature Quilted Bath Tissue, 2-ply, 425 sheets, 53.1 sq. ft. (4.9 sq. m.) per roll, with each sheet 4.5 in. x 4.0 in. (11.43 cm x 10.16 cm). The roll (from Costco) was individually wrapped and all of the above information was on the plastic wrap that covers the roll.
* Before distributing the rolls of toilet paper to each group be sure to write down which brand each group receives. Copy the vital measurements from the rolls beforehand. Do not pass out the toilet paper rolls with this information still on the packaging. You want the students to see how close they can get to the package information.
* Have students work in groups of two to four people on this project.
* You may want to have all students working on the exact same brand of toilet paper roll or you can have several different brands being worked on in each class.

The Royal

Reward

The Royal Reward

Group Geometry Project

King Euclid is a man who is very fond of geometry, especially polygons. After conquering the neighboring kingdom of Ignorance he decides to reward the greatest knights and ladies of his kingdom. He divides a large rectangular piece of land into smaller plots of land, shaped like polygons, and awards them to his top knights and a few prominent noble ladies.

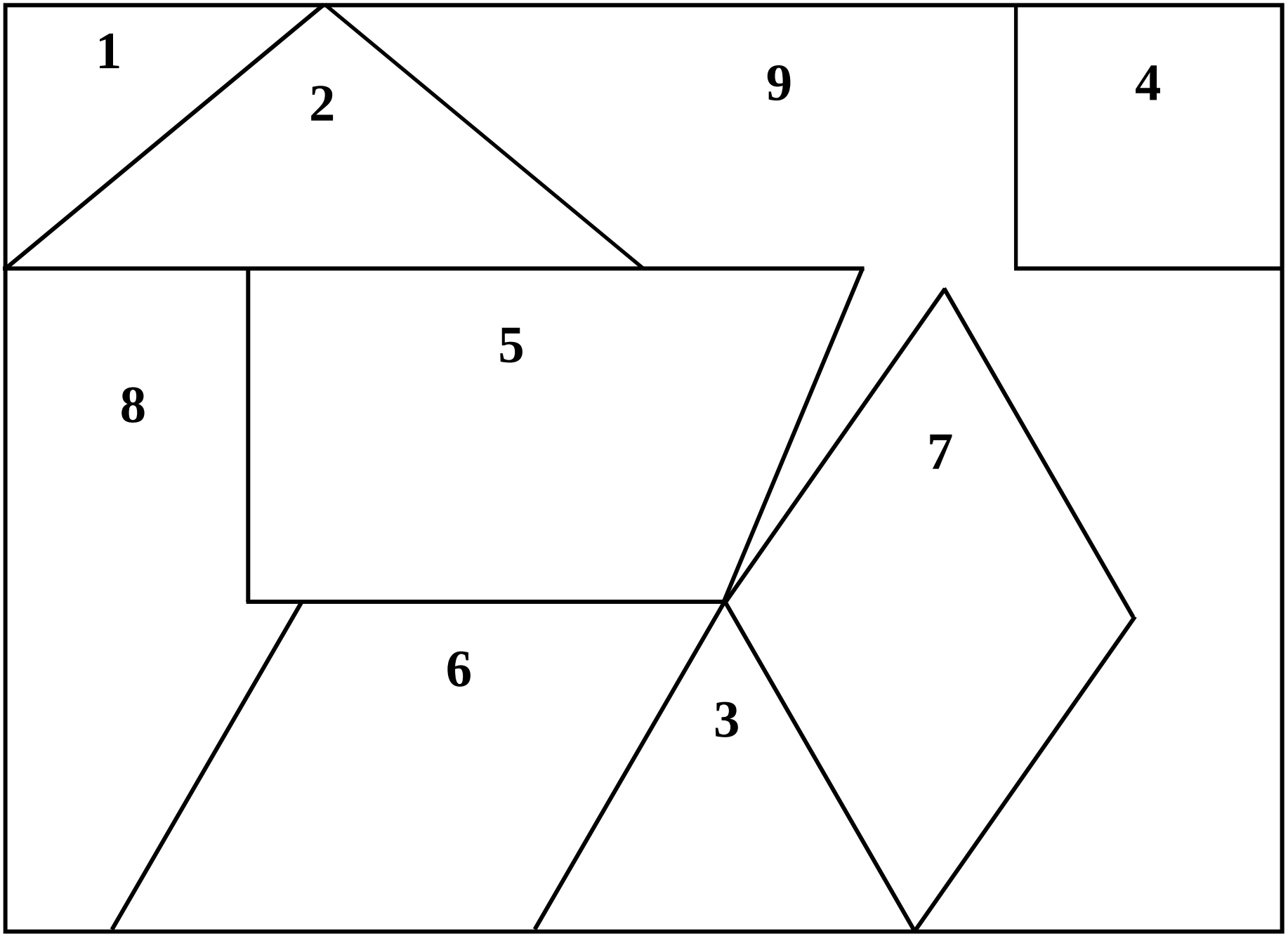
Those who are to receive land from the king for their support in the war against Ignorance include Sir Fibonacci, Lady Andrini, Sir Pascal, Sir Galileo, Sir Escher, Lady Burns, Sir Bernoulli, and Sir Pythagoras. The king decides to keep the largest plot of land. Before giving the remainder of the land to his loyal royal subjects King Euclid creates the Royal Reward Chart. Complete this chart and label the Royal Land Map in order to help the king to decide who will be the new owner for each piece of land.

If you are successful in this venture you will not only learn a great deal of geometry and become very wise, but King Euclid has promised to recommend that you receive three segments with three intersections. Of course he may recommend one segment and two arcs, a curve, one segment and one arc, or even the dreaded three segments with two intersections, depending upon the quality of your service.

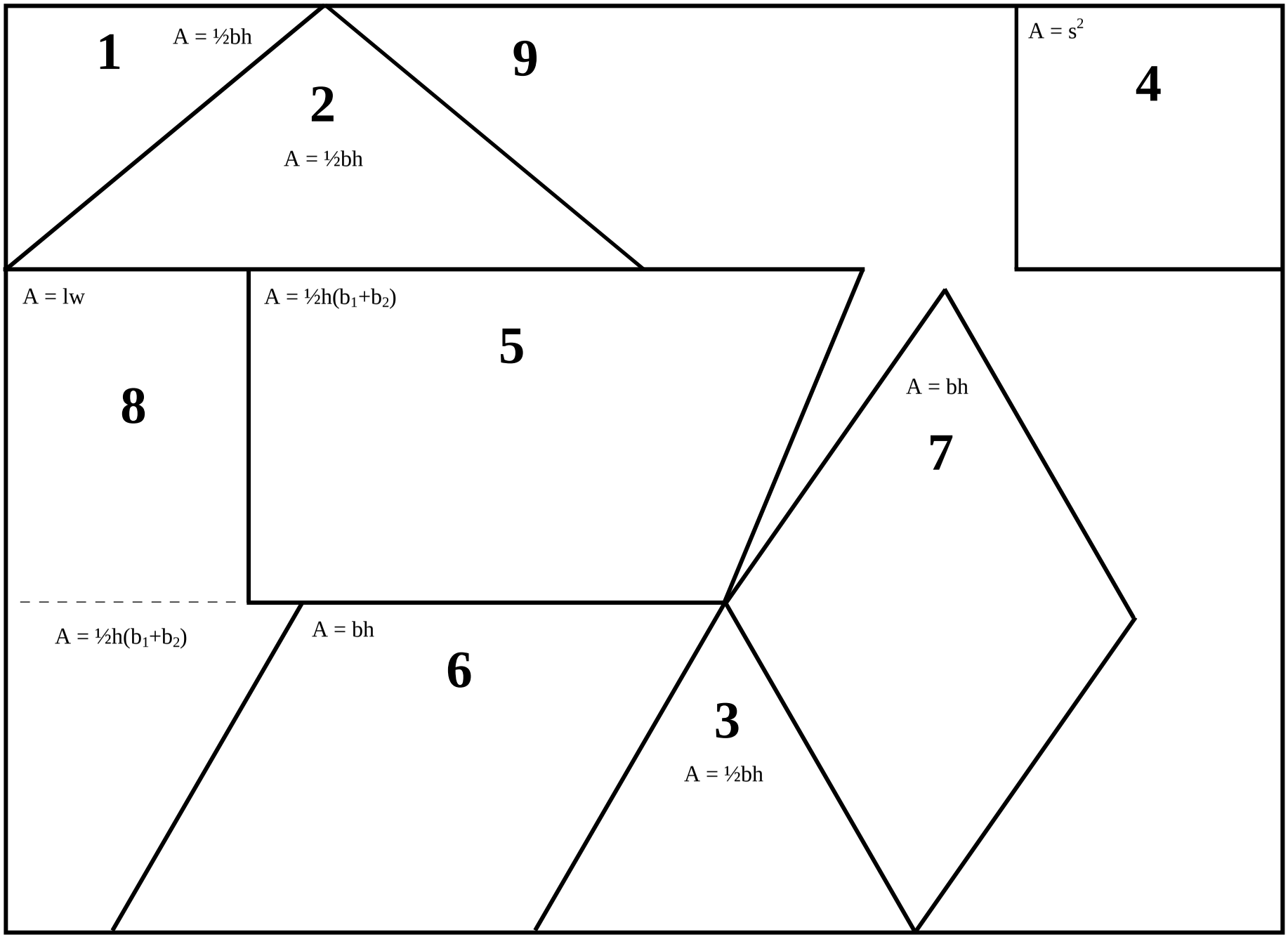
As you complete the chart and the map:

1. Measure and then label each of the angles for each piece of land on the Royal Land Map. Include this data on your chart.
2. Measure, and then label (in kilometers) each boundary line of each plot of land. The scale being used on the Royal Land Map is 1 centimeter (cm) = 1 kilometer (km). Place the boundary lengths on the inside of each polygon next to the corresponding segment. Measurements are only necessary on one side of a segment if two owners share the exact same length boundary. Include this data on your chart.
3. Label each piece of land with the name of the polygon that **best** describes it. Place the label a little below the center of the polygon (and in parentheses).
4. On your Royal Reward Chart calculate the sum of the angle measures and the perimeter of each piece of land. Pay attention to any patterns that you discover.
5. Use the Royal Land Map Area Worksheet and the area formulas given to find the approximate area of each piece of land. Record these area measurements on your chart.
6. After completing the Royal Reward Chart, King Euclid decides to reward the largest remaining piece of land to the noble that has served the king for the longest period of time. Each noble, in turn, will receive his or her piece of land according to the amount of time he or she has served the king. Using the **perimeter data** that has been collected, the king asks you to notify each noble and tell them which plot of land they have been given.
7. Lady Burns has served the king for the longest period of time, followed in order by Sir Fibonacci, Lady Andrini, Sir Pythagoras, Sir Escher, Sir Bernoulli, Sir Galileo, and finally Sir Pascal, who has only served the king for a very short period of time. On the Royal Land Map write the name of the noble that will receive each piece of land above the polygon label in the appropriate polygon.

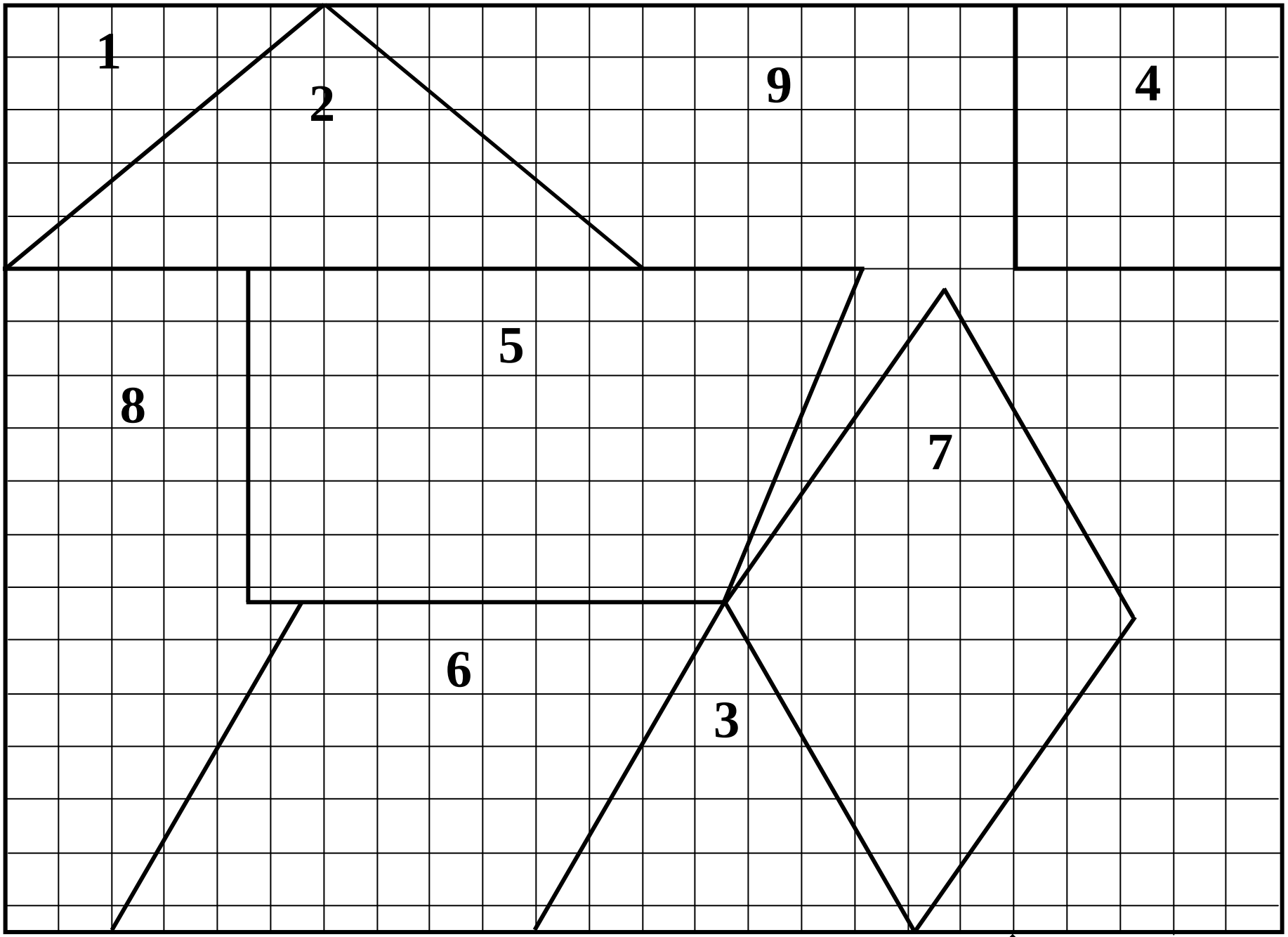
Royal Land Map



Royal Land Map Area Worksheet



Royal Land Map



The Royal Reward Chart

#	Polygon Name (specific)	Angle Measures (small to large)	Sum of Angle Measures (degrees)	Boundary Lengths (km) (small to large)	Perimeter (km)	Rank	Area (km^2)	Rank
1								
2								
3								
4								
5								
6								
7								
8								

The Royal Reward

Interior Angles of Polygons

King Euclid notices a pattern in the sum of the interior angles of a polygon. What pattern does he notice? You have already determined the sum of the interior angles of triangles, quadrilaterals, and hexagons. What will the sum of the interior angles of a pentagon be? An octagon? A nonagon? If you do not see the pattern, draw these polygons using straight line segments and measure their interior angles to determine the sum. Once you discover the pattern use it to develop a formula for finding the sum of the interior angles of a polygon with x sides. Then use this formula for the final three polygons!

Polygon	Number of Sides	Sum of Interior Angles
Triangle		
Quadrilateral		
Pentagon		
Hexagon		
Heptagon		
Octagon		
Nonagon		
Decagon		
Hendecagon		
Dodecagon		
Any Polygon	x	
Icosagon	20	
Pentacontagon	50	
Hectogon	100	

The Royal Reward

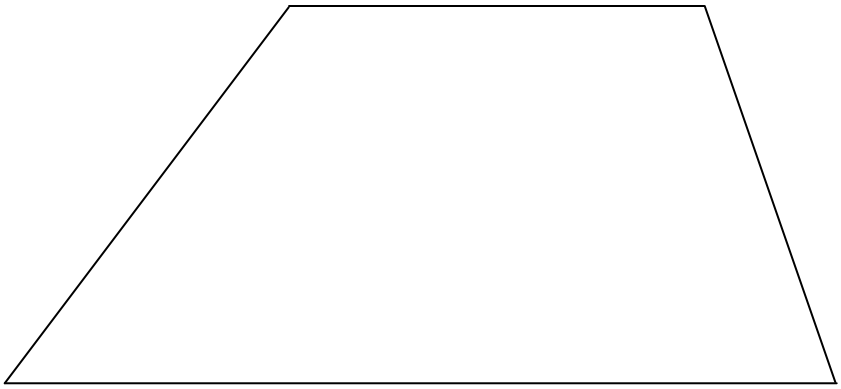
_____

_____

_____

The Royal Reward - Quiz A

Use the scale map of a plot of land below to complete the quiz. Label the measures of the polygon and place the answers in the answer blanks below. The map scale is 1 cm = 1 km. Show all work for numbers 2, 4, and the extra credit problem. Use the back of the paper if necessary.



1) List the measures of the angles, in order, from least to greatest.

_____, _____, _____, _____

2) What is the sum of the interior angle measures of this polygon? _____

3) List the measures of each segment, in order, from least to greatest. Give answers in kilometers.

_____, _____, _____, _____

4) What is the perimeter of this polygon? _____

5) What is the area of this polygon (in square kilometers)? _____

6) What is the name of the polygon above? _____

Extra Credit: If the cost of fencing is 5.7 rolems per kilometer, how much would it cost to build a fence around this plot of land?

_____

The Royal Reward

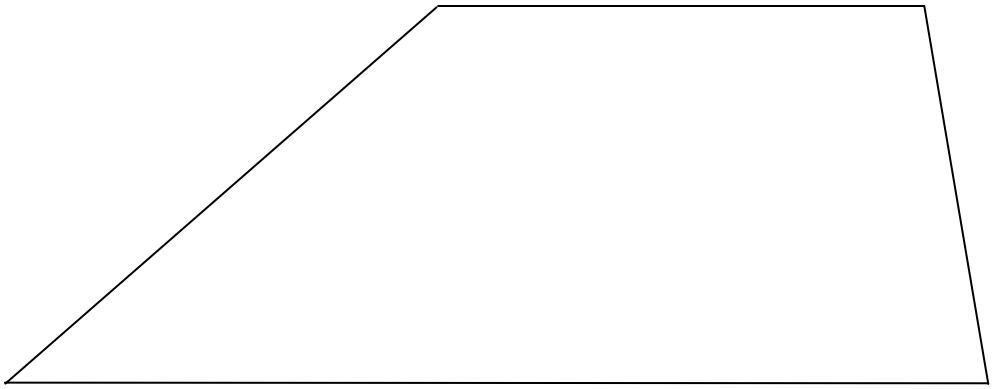
_____

_____

_____

The Royal Reward - Quiz B

Use the scale map of a plot of land below to complete the quiz. Label the measures of the polygon and place the answers in the answer blanks below. The map scale is 1 cm = 1 km. Show all work for numbers 2, 4, and the extra credit problem. Use the back of the paper if necessary.



1) List the measures of the angles, in order, from least to greatest.

_____, _____, _____, _____

2) What is the sum of the interior angle measures of this polygon? _____

3) List the measures of each segment, in order, from least to greatest. Give answers in kilometers.

_____, _____, _____, _____

4) What is the perimeter of this polygon? _____

5) What is the area of this polygon (in square kilometers)? _____

6) What is the name of the polygon above? _____

Extra Credit: If the cost of fencing is 5.7 rolems per kilometer, how much would it cost to build a fence around this plot of land?

_____

Cereal Box

Surface Area

Cereal Box Surface Area

Cereal Box Surface Area

Directions:

1. Calculate the area of each section of the box using the data on your cereal box net drawing and the table below. Let the longest side equal length. (Round area answers to the nearest hundredth.)
2. Label the area of each section on your cereal box and on the net on your worksheet.
3. Find the surface area of the entire box.

Section Number	Section Length	Section Width	Section Area
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
		Cereal Box Surface Area:	

Cereal Box Surface Area

_____

_____

_____

Cereal Box Volume and Weight

Cereal Box Volume

To find the volume of a box of cereal (also known as a rectangular prism) just multiply the area of the base (length times width) by the height. The formula is $V = l \cdot w \cdot h$.

Use your cereal box dimensions to find its volume. (Round the volume to the nearest hundredth.)

Length: _____ Width: _____ Height: _____ Volume = _____

Cereal Box Weight

Look on the cereal box to find the weight of the cereal in ounces. Weight = _____

Ratio of Cereal Weight to Volume in Comparison to Other Brands

	Cereal Brand	Weight	Volume	Ratio (weight/volume)
You	_____	_____	_____	_____

Now compare the data with that of four other groups in your classroom.

1)	_____	_____	_____	_____
2)	_____	_____	_____	_____
3)	_____	_____	_____	_____
4)	_____	_____	_____	_____

Cereal Box Mathematics Scavenger Hunt

Find at least three **other** examples of mathematics on your cereal box.

1. _____

2. _____

3. _____

Cereal Box Surface Area

Teacher Tips

(1 of 2)

Lesson Description: Cereal Box Surface Area is a group project in which students create a net of a rectangular prism from a cereal box and then use it to determine the surface area and volume of the box. Students also find the weight of the cereal and use it to determine weight to volume ratios. Finally, students complete a quick mathematical scavenger hunt on their cereal box. The finished cereal box projects are perfect for classroom display.

Math Content: Surface Area, Volume, Measurement, Ratios, Rectangular Prism, Fractions, Decimals, Net of a Rectangular Prism, Converting Fractions to Decimals

Time Required: 1-2 Class Periods

Cereal Box Surface Area includes:

* 3 Cereal Box Surface Area student worksheets
* 3 Cereal Box Surface Area student worksheet Answer Keys
* 2 Cereal Box Surface Area Teacher Tips pages
* 1 Cereal Box Surface Area Cover Sheet **9 pages in all!**

Materials Needed: Empty cereal boxes (one for each group), rulers, markers

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

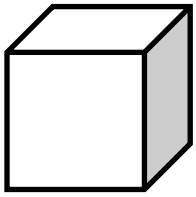
Cereal Box Surface Area is a group project that puts surface area and volume into a context that students can relate to. Whether it's Lucky Charms or Raisin Bran, virtually all students eat cereal. Breakfast will never be the same again! This project will help students see mathematics everywhere in the world around them. The project itself is packed with powerful math and will make the concepts of surface area and volume tangible for your students.

Teacher Tips:

* Have students display their work on the cereal box as well as their worksheets. One way to do this is shown on the answer key for the cereal box net. To show students the format you prefer you can either draw a diagram on the board or (if you like the model given) hand out the answer key as a sample page.
* If the inside of the box is printed, you can attach a sheet of paper with student work to the net.
* All flaps on the cereal box will not be perfect rectangles. Have students estimate the area of these sections by using a reasonable value for each length and width.
* As the teacher, you may choose to only complete the cereal box and the first two worksheets on calculating the surface area of the box. The third worksheet is optional.
* Cereal is not sold by volume but by weight. On the volume worksheet students find the ratio of weight to volume. Students can discuss what this ratio tells us. What factors might determine the weight to volume ratio? (one cereal is lighter, one box is smaller, etc.)

Squares

Project



SQUAREA

(Area and Volume)

_____
_____
_____

Note: All answers should include appropriate units such as square inches ($in.^2$) or cubic feet ($ft.^3$).

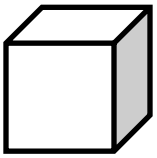
I. SQUARE FOOT

1. Cut out a square foot.
2. Draw square inches on your square foot.
3. How many square inches are in a square foot? _____

II. AREA TRACING/DRAWING

1. Trace or draw at least five objects on your square foot and color them.
2. Label each object and write its estimated area **on** your square foot.

Object	Area	Object	Area
A) _____	_____	D) _____	_____
B) _____	_____	E) _____	_____
C) _____	_____		

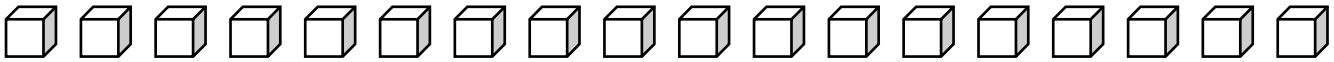


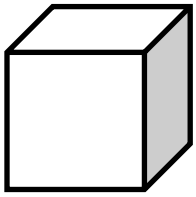
III. WHITE BOARD/CHALK BOARD

1. Use your square foot to estimate the area of one white board in square feet.
   L = _____ W = _____ A = _____
2. Estimate the area of the white board in square inches.
   Equation: _____ A = _____

IV. CLASSROOM FLOOR

1. Use your square foot to estimate the area of the classroom floor in square feet.
   L = _____ W = _____ A = _____
2. Estimate the area of the classroom floor in square yards.
   Equation: _____ A = _____
3. What would be the cost of carpeting the classroom at $25 per square yard?
   Equation: _____ C = _____





SQUAREA TEACHER TIPS

(Area and Volume)

Lesson Description: SQUAREA (a hybrid word I created which stands for "Square Area") is a hands on math project that helps students to discover area, volume, and surface area in a very concrete, visual manner. Students measure objects in a classroom, create square feet, draw square inches, construct cubic feet, construct square yards and cubic yards, and investigate the surface area of a cube.

Math Content: Area, Volume, and Surface Area **Time Required:** about 2 class periods

The SQUAREA Project includes:

* 2 SQUAREA Project worksheets
* 2 SQUAREA Project worksheet answer keys
* 1 SQUAREA Teacher Tips page

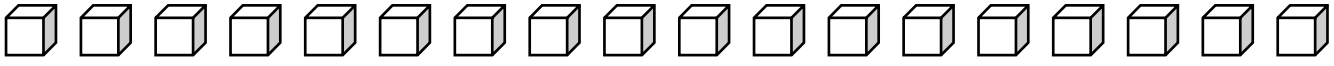
Materials Needed: Construction paper, tape **Suggested Grade Level:** 5^{th} - 8^{th}

Teacher Tips:

* Construction paper should be used for this project. Students need to carefully measure the paper, draw guide lines, and cut off enough in order to create their square.
* When students draw their square inches on their square feet I usually have them do this lightly in pencil first, using a ruler. Many later outline their square inches with a black marker and ruler.
* Have the students draw and color the objects on their square feet **over** the square inch markings. This contrast makes it easier for the students to count the square inches.
* Teach students to estimate the area of objects that include partial squares. I encourage students to draw or trace objects that are irregular in shape.
* I find it easier to collect and grade page 1 and the square foot before completing page 2.
* It will take 162 square feet in order to create 27 stackable cubic feet that can be used to create your cubic yard. If you do not have this many students you can either cut out extra square feet (that have not been divided into square inches) or just model the answer for the class.
* Use a lot of clear tape to tape the six square feet together to create your cubic feet. Have students put their names on the front of their square feet since they will be taped together.
* Stack 27 cubic feet together to create a cubic yard. You can place them on tables in the center of the room for a nice Open House visual.

Testimonial:

Since I developed this project I have used it several times with 6^{th} and 7^{th} grade students. The way in which it allows them to actively learn the concepts of area, volume, and surface area is truly remarkable. The students are able to visualize the concepts of a square inch, a square foot, and a square yard. They work cooperatively with others to incorporate their personal square foot with others to create a cubic foot. Then they combine these with the cubic feet from other classes to construct a cubic yard. I often have this cubic yard on display at Open House for the parents to see.

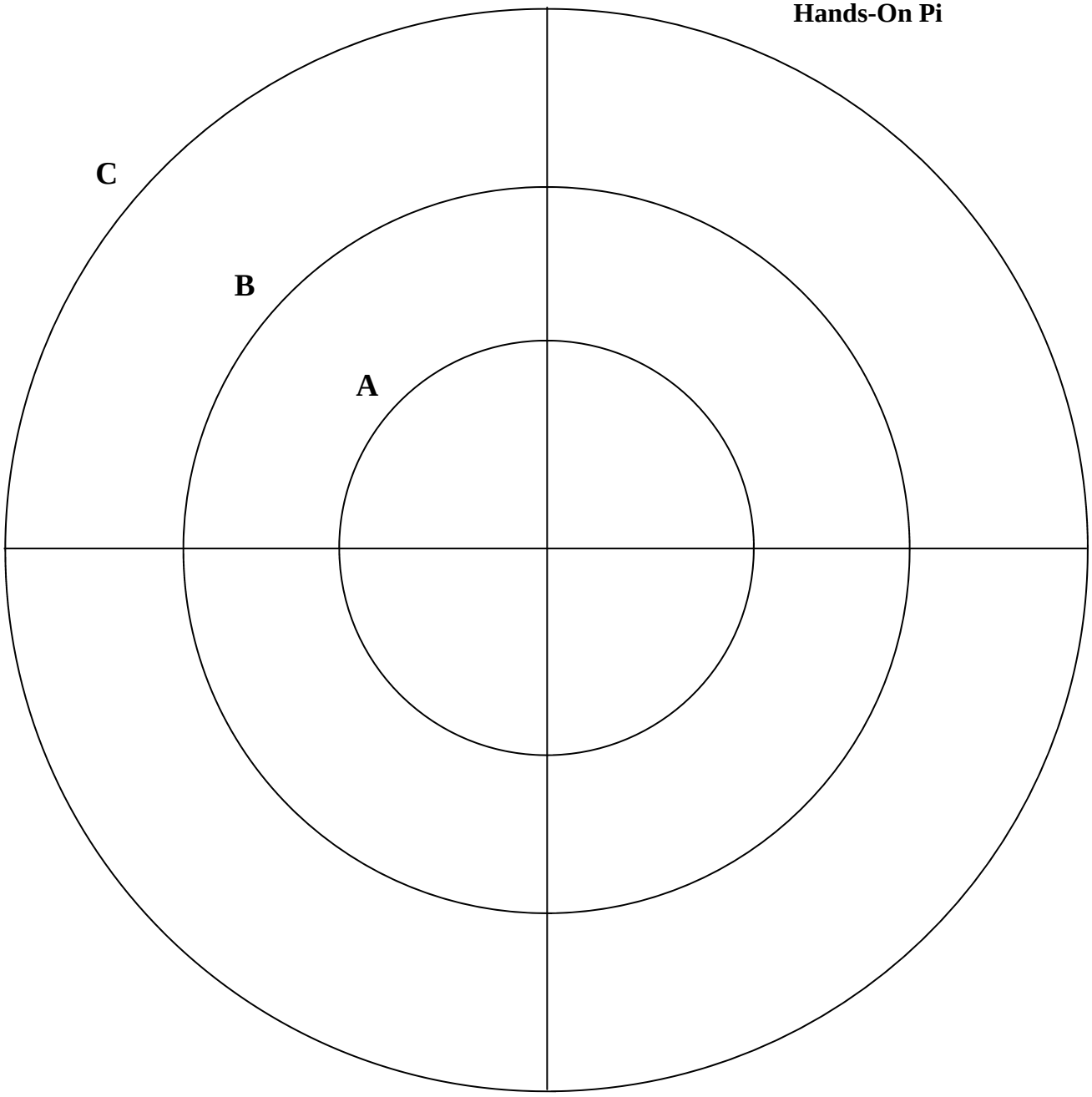


Discovering

Pi Day

Discovering Pi

Hands-On Pi



Use **string** and a **ruler** to measure in millimeters. Round the division answer to the **hundredths** place.

Circle A: Circumference: _____ Diameter: _____ Circumference ÷ Diameter = _____

Circle B: Circumference: _____ Diameter: _____ Circumference ÷ Diameter = _____

Circle C: Circumference: _____ Diameter: _____ Circumference ÷ Diameter = _____

π Discovering Pi

_____

_____

_____

Pi Basics

Pi is a number that expresses the constant ratio of the circumference of a circle to its diameter. The Greek letter π is used to represent this ratio. Pi is an infinite decimal. Since its digits never repeat in a pattern and never end it is called an irrational number. The decimal 3.14 and the fraction 22/7 are frequently used approximations of pi.

Ancient civilizations discovered the concept of pi thousands of years ago. Since then people have worked hard to calculate as many digits of pi as they were able. In the eighteenth and nineteenth centuries pi was successfully calculated to hundreds of digits. In the twentieth century, thanks to computers, pi has been calculated to billions and even trillions of digits.

Pi Day is often celebrated on March 14 (3.14) with some celebrations beginning at 1:59 (3.14159). On Pi Day students can participate in a number of pi-related activities. Enter "pi" or "Pi Day" into an internet search engine and you will find pi history, pi jokes, pi poems, pi facts, and other pi activities. Bring some in to share with your class!

One pi joke by John Evans goes like this:

Q: What do you get if you divide the circumference of a jack-o-lantern by its diameter?

A: _____

While it is interesting to know that the **circumference of a circle divided by its diameter always equals pi**, there are several practical uses for pi. Pi can be used to find the circumference and the area of a circle. It is also used in more advanced mathematical studies.

Pi is used to find the circumference of a circle. The formula for the circumference of a circle is $C=2\pi r$ or $C=\pi d$, where r is the radius of the circle and d is the diameter of the circle. These two formulas are similar since two times the radius is equal to the diameter. Using 3.14 for pi, what would be the approximate circumference of a circle with a diameter of 5 feet? Show your equation and answer on the line that follows.

_____

Pi is also used to find the area of a circle. The formula for the area of a circle is $A=\pi r^2$. Using 3.14 for pi, what is the approximate area of a circle with a radius of 4 inches? Show your equation and answer on the line that follows.

_____

The first 100 digits of pi are 3.14159 26535 89793 23846 26433 83279 50288 41971 69399 37510
58209 74944 59230 78164 06286 20899 86280 34825 34211 70679

Now that you've had a **piece of pi** you can share some with others! Share some of the pi jokes, songs, facts or history that you have found in your research of pi.

π

π Discovering Pi

Teacher Tips

(1 of 2)

Lesson Description: Discovering Pi is a lesson designed to give students a hands-on experience that will help them truly grasp the concept of pi. The students use string and a ruler to measure the circumference and diameter of three different circles. They then calculate the ratio of circumference to diameter, perhaps not realizing that they are really calculating pi. Students also read and complete the Pi Basics sheet. Finally, if you celebrate Pi Day on March 14th, have students share pi jokes, pi songs, pi facts, and pi history before EATING PIE. Of course students love this last part!!

Math Content: Pi, Area of a Circle, Circumference of a Circle, Millimeter Measurement

Time Required: 1-2 Class Periods (Celebrate Pi Day on March 14th!!)

Discovering Pi includes:

* 1 Discovering Pi Hands-On worksheet and 1 Hands-On answer key
* 1 Discovering Pi Basics sheet and 1 Basics answer key
* 2 Discovering Pi Teacher Tips pages
* 1 Discovering Pi Cover Page

Materials Needed: String, Metric Rulers, Pie (optional), and Pi Day research, jokes, songs, etc.

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

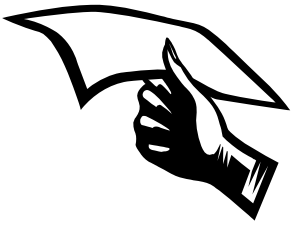
Pi Day (March 14) was one of the biggest hits with my students last year! We learned about pi, told pi jokes, sang pi songs (that's a first in my math class!), and learned pi facts and pi history. Best of all, WE ATE PIE!! The students learned how to find the circumference and area of a circle. They also learned where pi comes from. Most importantly, we created a special day to have fun while we were learning. I believe that many of my students will remember March 14th in a special way from now on.

Teacher Tips:

* Have students complete the Hands-On Pi worksheet the day before Pi Day. Then have them do the Pi Basics worksheet for homework. Also, tell them in advance if you will give extra credit for Pi Day jokes, songs, facts, history, etc.
* Use string that does not fray or come apart if at all possible on the Hands-On Pi worksheet. Teach students to mark the string and then measure it using their ruler.
* Try the Hands-On Pi worksheet measurements yourself, ahead of time. You will be better prepared to help the students and to anticipate measurement questions. Make sure students understand that each centimeter on the ruler is actually 10 millimeters and that these measurements are done in millimeters. Help them to see that when they divide the circumference by the diameter they should have gotten close to pi (3.14). Discuss the fact that their calculations will not be exact, or even the same as another student's, since the measurements are not exact.

Paper

Portal



Paper Portal

Challenge - Teacher Notes

Portal Definition

When using this activity with your students it is important to explain to them the definition of the word portal. Dictionary.com defines portal as "a door, a gate, or entrance, esp. one of imposing appearance, as to a palace." The main idea is that a portal is a large opening to walk through.

Paper Portal Challenge

Paper Portal is an activity in which the teacher challenges the students to cut a hole in a single sheet of 8 ½" x 11" paper that is big enough to walk through.

Paper Portal Procedure

1. Introduce the challenge above. You might cut a small hole in a piece of paper to dramatize the difficulty of cutting a hole in the paper big enough to walk through.
2. Give students a period of time (possibly at home) to try to find a solution to the challenge.
3. Discuss any student solutions and whether or not they believe this challenge can be met.
4. Pass out the Paper Portal template and explain to students how to correctly cut the template.
5. Allow them to cut out their own Paper Portal.

Paper Portal Template Cutting Instructions

1. Fold the Paper Portal template in half along the longest line segment on the paper.
2. You will only be cutting along each solid line on the template except for where you see the arrows.
3. Cut **from the fold** to the end of each line segment without an arrow.
4. On the rays (line segments with arrows) cut **from the edges** of the folded paper to the endpoint of each ray. The arrows indicate that the paper should be cut from the edges. The arrows are used because the printer will not print all the way to the edge of the paper.
5. Finally, cut the solid black line along the fold. **Very Important**: Do not cut the fold on the very end of each side of the paper. This will ruin your paper portal. There is no black line segment in these locations.
6. Unfold the paper and you will have a portal opening big enough to walk through!!

Paper Portal

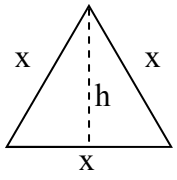
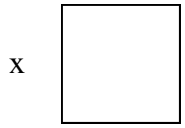
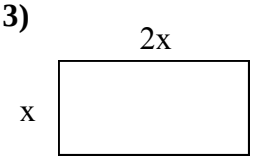
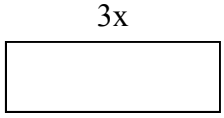
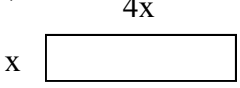
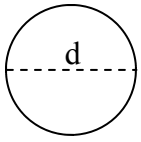
_____

_____

_____

Perimeter and Area

Use your Paper Portal, a tape measure, and mathematical reasoning to complete the chart below. First, identify the value of each variable. Then write equations for the perimeter and area of each polygon using variables. Use these equations to find the perimeter (or circumference) and area of each polygon (or circle). Finally, try to generalize a rule for finding the largest area when given a fixed perimeter. Round longer decimal answers to the nearest hundredth.

Polygon Dimensions (and circle)	Perimeter and Area Equations (using variables)	Perimeter of Polygons (and circle)	Area of Polygons (and circle)
1) 	x = ___ h = ___ P = _____ A = _____	P = _____	A = _____
2) 	x = _____ P = _____ A = _____	P = _____	A = _____
3) 	x = _____ P = _____ A = _____	P = _____	A = _____
4) 	x = _____ P = _____ A = _____	P = _____	A = _____
5) 	x = _____ P = _____ A = _____	P = _____	A = _____
6) 	d = ___ r = ___ C = π d A = π r^2	C = _____	A = _____

Paper Portal

Teacher Tips

(1 of 2)

Lesson Description: Paper Portal is a geometry lesson that begins with a fascinating challenge: Can students cut a hole in a single sheet of 8 ½" x 11" paper that is big enough to walk through? After students are shown the solution to this challenge the remainder of the lesson involves an investigation of the different polygon and circle areas that may be found using a fixed perimeter (the paper portal).

Math Content: Perimeter, Area, Measurement, Comparing the Areas of Different Figures with a Fixed Perimeter, Writing Perimeter and Area Equations with Variables

Time Required: 1 Class Period

Paper Portal includes:

* 1 Paper Portal Challenge Teacher Notes
* 1 Paper Portal Activity Template
* 1 Paper Portal Perimeter and Area worksheet
* 1 Paper Portal Perimeter and Area worksheet Answer Key
* 2 Paper Portal Teacher Tips pages
* 1 Paper Portal Cover Page

Materials Needed: scissors (1 per group), tape measures (1 per group)

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Paper Portal is an activity that begins with a fascinating challenge for your students. Can they cut a hole in a single sheet of paper big enough to walk through? After letting them work on this problem for a few days you can reveal the intriguing solution. Then students use their Paper Portal to conduct a hands-on investigation of the areas of different shapes that can be made with a fixed perimeter. Learning and fun come together in this activity!

Teacher Tips:

* Have the students work in groups of three or four to complete the Perimeter and Area worksheet. This way they can have a few students form (and hold) the figures and another student do the measuring.
* Make sure students understand that the value of x on each problem on the worksheet is different. Some students may assume that each x has the same value.
* Do not expect students to get the same answers that are on the answer key. **The answer key is intended as only as an approximate guide.** Student answers should be fairly close to the answers on the key, but will vary due to differences in measurement. However, the key relationship between fixed-perimeter figures and their respective areas should become apparent. **In general, the closer a fixed-perimeter figure gets to becoming a circle the bigger its area will be.**

Digital Lesson.com Presents

Marvelous Middle School Math

Statistics, Data Analysis, and Probability 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. It specializes in providing instant, inexpensive, and engaging math lessons and projects to enhance the middle school math program. Also included on the site are other math resources tailored to 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, *Statistics, Data Analysis, and Probability Activities*, in your classroom. Please e-mail us with any comments at digitallesson@yahoo.com.

A publication of Digital Lesson.com

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.

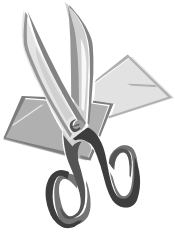
Wishing you inspiration and motivation to be the best math teacher you can be!

Mark P. Tully

Table of Contents

Rock, Paper,

Scissors



Rock, Paper, Scissors

_____

_____

_____

Theoretical and Experimental Probability

Background Information

Rock, Paper, Scissors is a game of chance that can be used to make decisions such as "Who gets the last piece of pizza?" or " Who has to take out the garbage?". Some people have even created a sport out of Rock, Paper, Scissors (RPS) and hold tournaments complete with prize money. Others will play RPS just for the fun of it. However you have played it, RPS is known by just about everyone.

Theoretical Probability of Rock, Paper, Scissors

Person A Choice	Person B Choice	Winner
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

In the chart above list all of the possible combinations that can be chosen by persons A and B as well as the winner of each RPS game. Determine the theoretical probability of each person winning the game and of a tie. Round to the nearest percent. Is RPS a fair game? How do you know?

P (A wins) = _____ (_____ %) P (B wins) = _____ (_____ %) P (tie) = _____ (_____%)

Experimental Probability of Rock, Paper, Scissors

Individual Data (playing against partner)

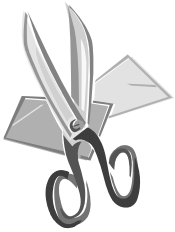
Wins _____ (_____ %) Losses _____ (_____ %) Ties _____ (_____ %)

Classroom Data (record all games played)

Wins _____ (_____ %) Losses _____ (_____ %) Ties _____ (_____ %)

How did the theoretical probability of RPS compare to the experimental probability? _____

_____



Rock, Paper, Scissors

_____

_____

_____

Rock, Paper, Scissors for Three

Creating a Fair Game

Use the chart below to determine all the possible outcomes when a three-person version of Rock, Paper, Scissors (RPS) is played. Use R (rock), P (paper), and S (scissors) to complete the chart. Then, find the theoretical probability of each player winning. Round to the nearest percent. A tree diagram is a useful tool to help make an organized list of all the outcomes.

Player A wins if all three players display the same hand sign.
Player B wins if all three players display different hand signs.
Player C wins if two players display the same hand sign.

Possible Outcomes	Winner	Possible Outcomes	Winner
1) ____ ____ ____	____	15) ____ ____ ____	____
2) ____ ____ ____	____	16) ____ ____ ____	____
3) ____ ____ ____	____	17) ____ ____ ____	____
4) ____ ____ ____	____	18) ____ ____ ____	____
5) ____ ____ ____	____	19) ____ ____ ____	____
6) ____ ____ ____	____	20) ____ ____ ____	____
7) ____ ____ ____	____	21) ____ ____ ____	____
8) ____ ____ ____	____	22) ____ ____ ____	____
9) ____ ____ ____	____	23) ____ ____ ____	____
10) ____ ____ ____	____	24) ____ ____ ____	____
11) ____ ____ ____	____	25) ____ ____ ____	____
12) ____ ____ ____	____	26) ____ ____ ____	____
13) ____ ____ ____	____	27) ____ ____ ____	____
14) ____ ____ ____	____		

P (A wins) = ____ (_____ %) P (B wins) = ____ (_____ %) P (C wins) = ____ (_____%)

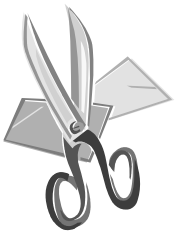
Is the game above fair? _____ Why? _____

Fill in the spaces below to make this a fair game.

Player A scores _____ point(s) if all three players display the same hand sign.
Player B scores _____ point(s) if all three players display different hand signs.
Player C scores _____ point(s) if two players display the same hand sign.

Play RPS twenty-seven times and keep track of your points. Discuss the results. Is the game fair?

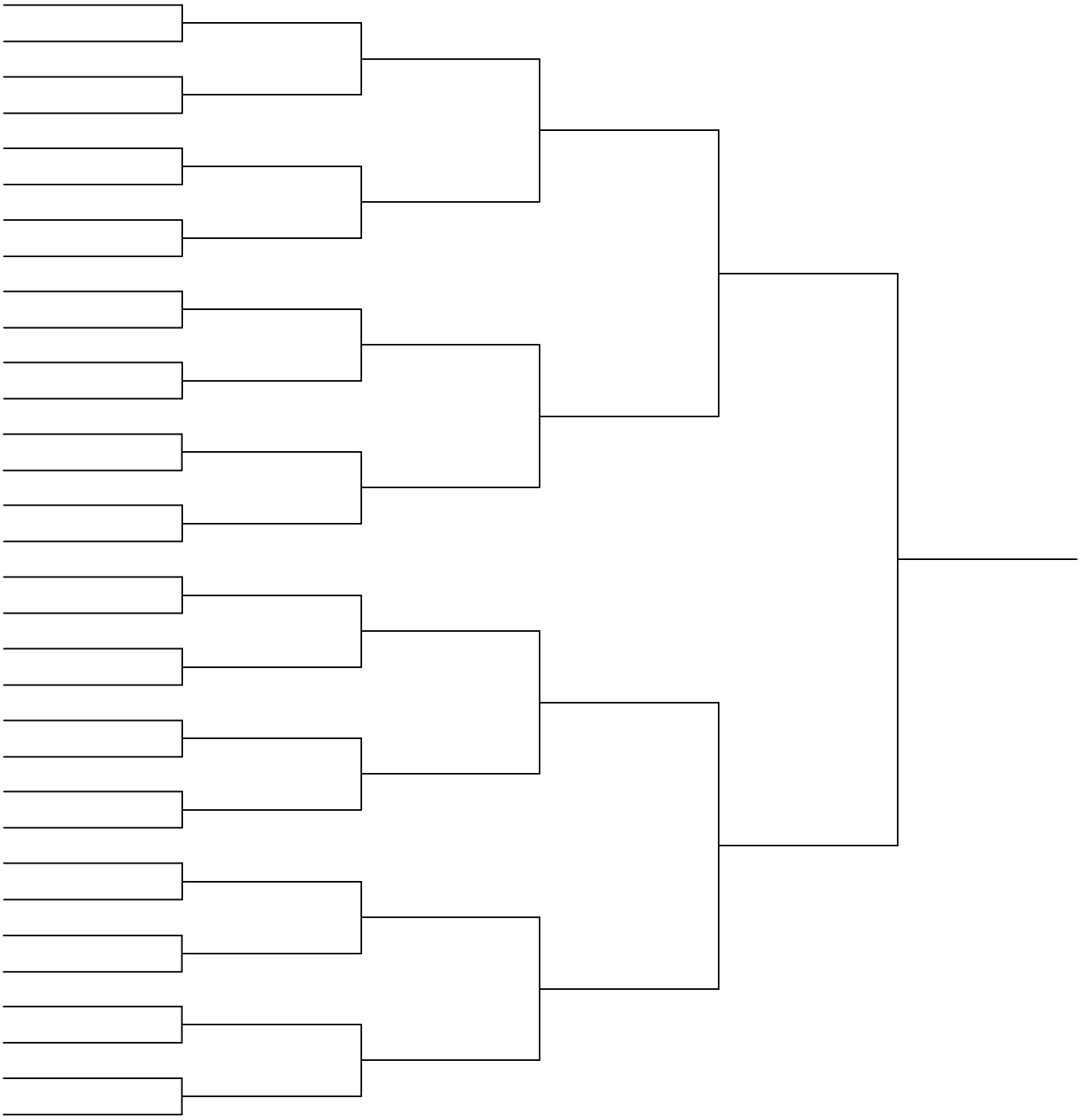
Player A total points: _____ Player B total points: _____ Player C total points: _____



Rock, Paper, Scissors

Rock, Paper, Scissors Tourney

FIRST ROUND SECOND ROUND QUARTERFINALS SEMIFINALS FINALS CHAMPION



Likely

Letters

Likely Letters

Statistics and Probability Project

Whether you are watching the game show Wheel of Fortune or playing Hangman with a friend, it helps to know which letters have the highest probability of use in words. During this project you will conduct an experiment and collect statistical data to discover which letters are the most commonly used in written English language.

Probability, or the likelihood that a specific event will occur, can be determined theoretically or experimentally. Theoretical probability is a ratio that compares the number of specific outcomes to the total number of outcomes possible. For example, to calculate the probability of rolling the number 2 on a number cube, divide 1 (the number of specific outcomes that are a 2) by 6 (the number of total possible outcomes) to determine the theoretical probability of 1/6 or about 16.7%. Theoretical probability can only be determined by mathematical calculation.

Experimental probability is based on performing an actual experiment to collect data. To determine the experimental probability simply divide the number of times that an actual event occurs by the number of times that the experiment is done. For instance, if you flip a coin and it lands on tails 27 out of 50 times, then the experimental probability of getting tails is 27/50 or 54%.

If we took the 26 letters of the alphabet and placed them in a hat and then asked you to choose one without looking, the theoretical probability of choosing each letter would be 1 out of 26 or about 3.8%. However, if we choose a letter at random out of a book or other written material, does each letter still have an equal probability of being chosen? Explain.

_____

_____

To find the probability of choosing any letter in the alphabet (at random) out of a book or other written source, would you use theoretical or experimental probability? Why?

_____

_____

To find the experimental probability of each letter in the alphabet being used, you will collect 100 letters randomly by selecting a small reading passage and then recording your data on the following page. Use 100 consecutive letters. Do not skip around on the page.

Before beginning, **predict** what you think the **top five most-used letters** will be.

1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐

Likely Letters

_____

_____

_____

Data Entry Sheet

Using the 100 letters from your randomly selected reading passage, fill in the individual data in the chart below. Then enter the data for your group. Finally, enter the data for the entire class.

	Individual			**Group**			**Class**		
Letter	Number In Sample	% of **__100__** Letters	Letter Rank	Number In Sample	% of _____ Letters	Letter Rank	Number In Sample	% of _____ Letters	Letter Rank
A									
B									
C									
D									
E									
F									
G									
H									
I									
J									
K									
L									
M									

Likely Letters

Teacher Tips

(1 of 3)

Lesson Description: Likely Letters is a statistics and probability project that requires students to use experimental probability to determine the letters with the highest frequency of use in written English. The students differentiate between theoretical and experimental probability, make predictions, collect and organize data, and analyze their results to discover which letters of the alphabet are used the most.

Math Content: Statistics; Probability; Predicting; Collecting, Organizing, and Analyzing Data; Drawing Conclusions based on their data

Time Required: 1-2 Class Periods

Likely Letters includes:

* 2 Likely Letters assignment sheets
* 2 Likely Letters Data Entry Sheets
* 3 Likely Letters Teacher Tips pages
* 1 Likely Letters Cover Page

Materials Needed: Reading materials (books, magazines, etc.) for data collection

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Likely Letters is a lesson that makes statistics and data collection relevant to the students. Most students have watched Wheel of Fortune or played the game Hangman. Both games require a knowledge of letters that are likely to be used in the unknown words. This gives purpose to the data collection. You can also add suspense to the assignment by posting a covered list of the most frequently used letters that will only be revealed after the students complete their investigation.

Teacher Tips:

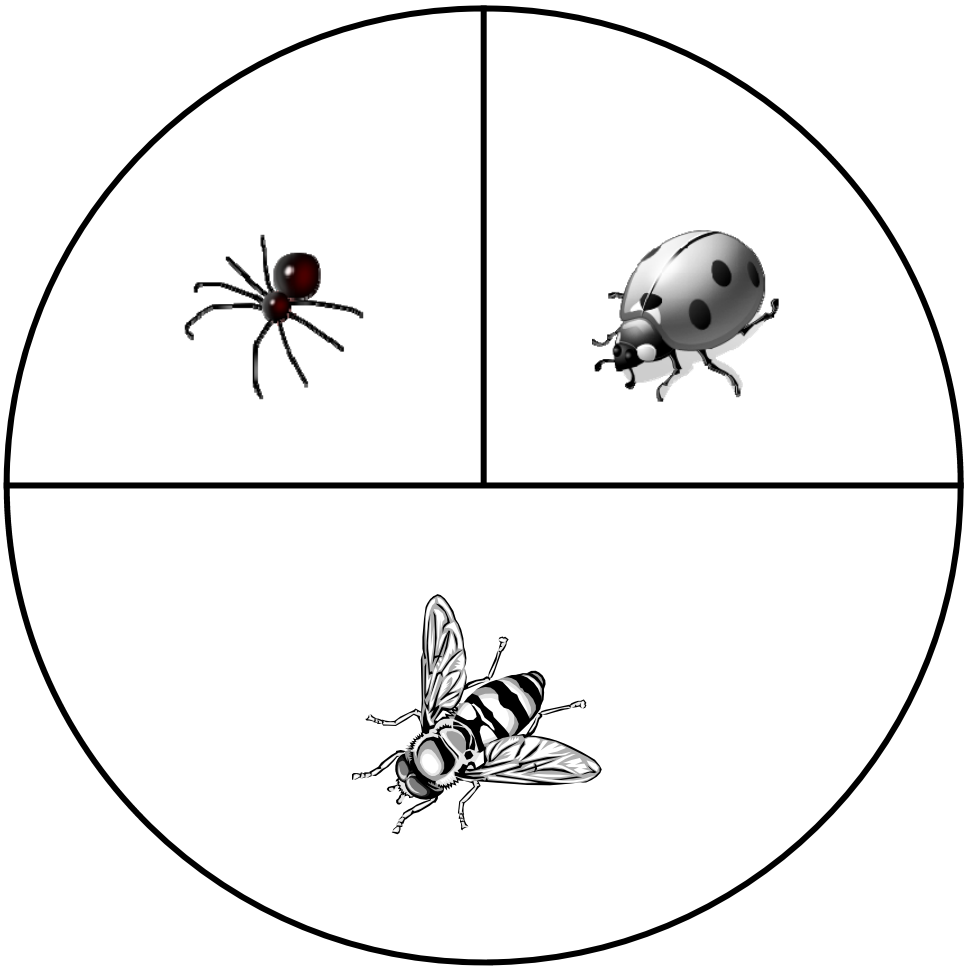
* On the Data Entry Sheet the students will write in the number of each letter found in their written English sample of 100 letters.
* Make sure that students understand how to fill in the total number of letters in their collected data where it says **"Percent of _____ Letters"** in the middle column of their data sheet. The number **100** has already been filled in under the "Individual" column since each student is recording the data for 100 letters. If there are three other students in their group then **400** would be written under the "Group" column. Finally, if the number of students in the class is 32, then **3200** would be written in under the "Class" column.
* Students will calculate the "Percent of _____ Letters" column by taking the number of each letter that they have recorded (from the first column under each heading) and dividing it by the total number of letters recorded. Have students convert the decimal to a percent and **round the percent probability on their data entry sheets to the nearest tenth** of a percent.

Super

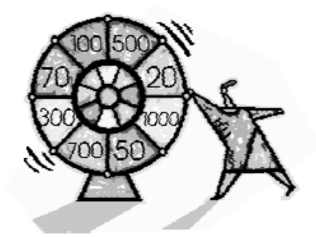
Spinners

Super Spinners

Bugs Spinner



	Theoretical Probability		Experimental Probability			Difference
Outcome	Fraction	Percent	Tally	Fraction	Percent	Percent
						
						
						



Super Spinners

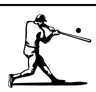
____

____

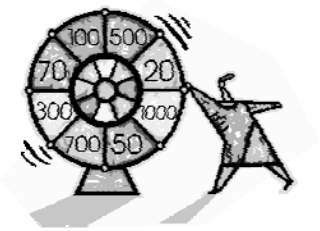
____

Experimental Probability Data

	Individual Data		Class Data		Complete Data	
Outcome	Fraction	Percent	Fraction	Percent	Fraction	Percent
						
						
						

	Individual Data		Class Data		Complete Data	
Outcome	Fraction	Percent	Fraction	Percent	Fraction	Percent
						
						
						

	Individual Data		Class Data		Complete Data	
Outcome	Fraction	Percent	Fraction	Percent	Fraction	Percent
						
						
						
						



Super Spinners

Teacher Tips

(1 of 2)

Lesson Description: Super Spinners is a hands-on activity that requires students to analyze three themed spinners in order to compare the theoretical probability of each spinner outcome with the experimental probability from their trials. Students then collect and analyze data from their entire class (and possibly multiple classes) to draw conclusions about the accuracy of experimental probability data in relation to the number of trials completed.

Math Content: Theoretical (or Mathematical) Probability, Experimental Probability, Collecting Data, Analyzing Data, Fractions, Percents, Frequency Tables, Using Mathematical Charts, and Drawing Conclusions Based Upon Collected Data

Time Required: 1-2 Class Periods

Super Spinners Probability Activity includes:

* 3 Super Spinners student worksheets
* 3 Super Spinners student worksheet Answer Keys
* 1 Super Spinners Experimental Probability Data worksheet
* 2 Super Spinners Teacher Tips pages
* 1 Super Spinners Cover Sheet **10 pages in all!**

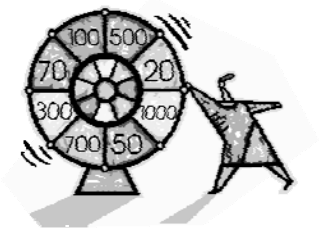
Materials Needed: Paper Clips

Suggested Grade Level: 5th - 8th

Teacher Testimonial: Super Spinners is an enjoyable, active way for students to internalize the concepts of Theoretical and Experimental Probability. The themed spinners allow students to spin for spiders, sports figures, and cell phones instead of less exciting outcomes like numbers or colors. As students collect the whole class data and the complete data from multiple classrooms they should clearly see that the Experimental Probability tends to move closer and closer to the Theoretical Probability as the number of trials increases.

Teacher Tips:

* Since the Super Spinners activity focuses on Theoretical Probability and Experimental Probability, it is important that students understand the difference at the start of the lesson.
* Theoretical Probability is the mathematical chance that something should happen. Experimental Probability is the result obtained by actually completing a number of trials of an event. For example, if a spinner section takes up one half of a circle, then the Theoretical Probability would be 1/2 or 50%. However, upon completing a certain number of spins, a student may come up with an Experimental Probability that differs (but is usually close to) the Theoretical Probability.
* To have students use the spinners, provide them with a paper clip and show them how to hold their pencils straight up in the center of the circle and then spin the paper clip with their finger.



Super Spinners

Teacher Tips

(2 of 2)

Teacher Tips (continued):

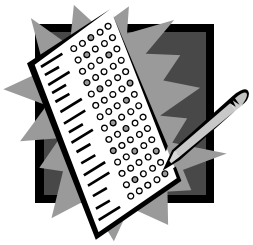
* If a paper clip ends up in two sections it should be counted in the section with more than half of the paper clip. If the paper clip is exactly in the center of two sections the students should spin again. You might also require that the paper clip travels around the circle at least one time on each spin.
* For the Experimental Probability data collection, I recommend having each student spin 50 times for each spinner that you use. This number gives enough trials to allow for meaningful conclusions and it is easily translated into a percent.
* There are three themed spinners provided for this activity. You might do the first "Bugs Spinner" as a whole class activity and then assign the other two as classwork/ homework.
* (Optional) Once individual students have collected their data you may want to compile all of the data for each spinner on the board and have students use calculators to add up the class data. Then, if you have completed this activity with other classes, you can gather all of the data together. Use the Experimental Probability Data student worksheet to track this data. Usually, the more data that is collected the closer that the Experimental Probability will be to the Theoretical or Mathematical Probability.
* Answer keys are provided for each themed spinner worksheet. The Theoretical Probability answers are correct. However, remember that the Experimental Probability answers provided are just a sample of the data that students might collect. Finally, the Difference (Percent) column measures the variation from the Theoretical Probability.
* Notice that the total of the positive and negative percent differences should always equal zero. If you flip a coin 100 times and get 54% heads (+4% from the Theoretical Probability) then you will get 46% tails (-4% from the Theoretical Probability).
* As a final activity you might have students write a paragraph or two explaining the difference between Theoretical and Experimental Probability and having them analyze their data to see if the Experimental Probability got closer to the Theoretical Probability as the Class Data and the Complete Data (multiple classes) were compiled.

Middle School Math Treasures Newsletter:
To receive DigitalLesson.com's Middle School Math Treasures newsletter please visit our website at www.DigitalLesson.com and enter your e-mail address in the subscription box . You will then become eligible to receive new lesson updates, math resources and ideas, and a **free printable math game** with **each** newsletter. You may unsubscribe at any time using the link in our newsletter.

Enjoy your activity!!
Mark

Quirky

Quiz



Quirky Quiz

_____

_____

_____

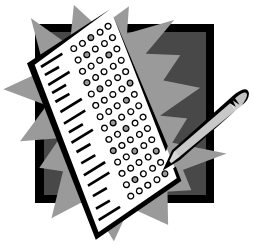
Multiple Choice Quiz

Complete the multiple choice quiz below. There are no problems to solve or questions to answer.

Simply select A, B, C, or D for each of the ten items below.

Place the correct letter in the answer column.

	Answer Column	Correct Answer
1) ……..	_____	_____
2) ……..	_____	_____
3) ……..	_____	_____
4) ……..	_____	_____
5) ……..	_____	_____
6) ……..	_____	_____
7) ……..	_____	_____
8) ……..	_____	_____
9) ……..	_____	_____
10) ……..	_____	_____



Quirky Quiz

_____

_____

_____

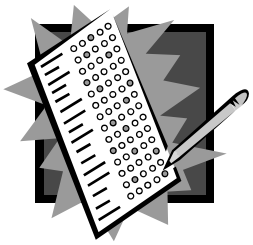
Multiple Choice Quiz Probability 1

For each quiz below list the possible answer combinations and the probability of that combination, assuming that the student has no knowledge of the subject. Round to the nearest tenth of a percent.

One-Problem Quiz	Combinations	Probability	Percent
	1) Correct (C)	1/4	25%
	2) Incorrect (I)	3/4	75%
		4/4	100%

Two-Problem Quiz	Combinations		Probability	Percent
	1) C	C	1/4 * 1/4 = 1/16	6.25%
	2) C	I	1/4 * 3/4 = 3/16	18.75%
	3) I	C	3/4 * 1/4 = 3/16	18.75%
	4) I	I	3/4 * 3/4 = 9/16	56.25%
			16/16	100%

Three-Problem Quiz	Combinations	Probability	Percent
Combinations	1) ____ ____ ____	____ ____ ____ = _____	_____
	2) ____ ____ ____	____ ____ ____ = _____	_____
	3) ____ ____ ____	____ ____ ____ = _____	_____
	4) ____ ____ ____	____ ____ ____ = _____	_____
	5) ____ ____ ____	____ ____ ____ = _____	_____
	6) ____ ____ ____	____ ____ ____ = _____	_____
	7) ____ ____ ____	____ ____ ____ = _____	_____
	8) ____ ____ ____	____ ____ ____ = _____	_____
		/	%



Quirky Quiz

_____

_____

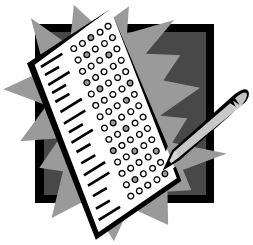
_____

Multiple Choice Quiz Probability 2

For each quiz below list the possible answer combinations and the probability of that combination, assuming that the student has no knowledge of the subject. Round to the nearest tenth of a percent.

Four-Problem Quiz

	Combinations	Probability	Percent
1)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
2)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
3)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
4)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
5)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
6)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
7)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
8)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
9)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
10)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
11)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
12)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
13)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
14)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
15)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
16)	____ ____ ____ ____	____ ____ ____ ____ = _____	_____
		/	%



Quirky Quiz

_____

_____

_____

Multiple Choice Quiz Probability 3

For each quiz below list the possible answer combinations and the probability of that combination, assuming that the student has no knowledge of the subject. Round to the nearest tenth of a percent if possible or to the leading non-zero digit. A few problems have been completed showing the use of exponents.

Five-Problem Quiz	Combinations	Probability	Percent
1) All Correct (C)	C*C*C*C*C	1/4*1/4*1/4*1/4*1/4 = 1/1024	0.1%
2) All Incorrect (I)	I*I*I*I*I	3/4*3/4*3/4*3/4*3/4 = 243/1024	23.7%

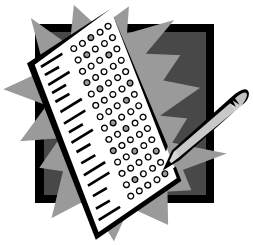
Six-Problem Quiz	Combinations	Probability	Percent
1) All Correct (C)	C*C*C*C*C*C	$(1/4)^6 = 1/4096$	0.02%
2) All Incorrect (I)	_____	_____	_____

Seven-Problem Quiz	Combinations	Probability	Percent
1) All Correct (C)	_____	_____	_____
2) All Incorrect (I)	I^7	$(3/4)^7 = 2187/16384$	13.3%

Eight-Problem Quiz	Combinations	Probability	Percent
1) All Correct (C)	_____	_____	_____
2) All Incorrect (I)	_____	_____	_____

Nine-Problem Quiz	Combinations	Probability	Percent
1) All Correct (C)	_____	_____	_____
2) All Incorrect (I)	_____	_____	_____

Ten-Problem Quiz	Combinations	Probability	Percent
1) All Correct (C)	_____	_____	_____
2) All Incorrect (I)	_____	_____	_____



Quirky Quiz

Quirky Quiz Class Statistics

Student Quiz Scores

Student Quiz Scores	Tally	Class Frequency
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

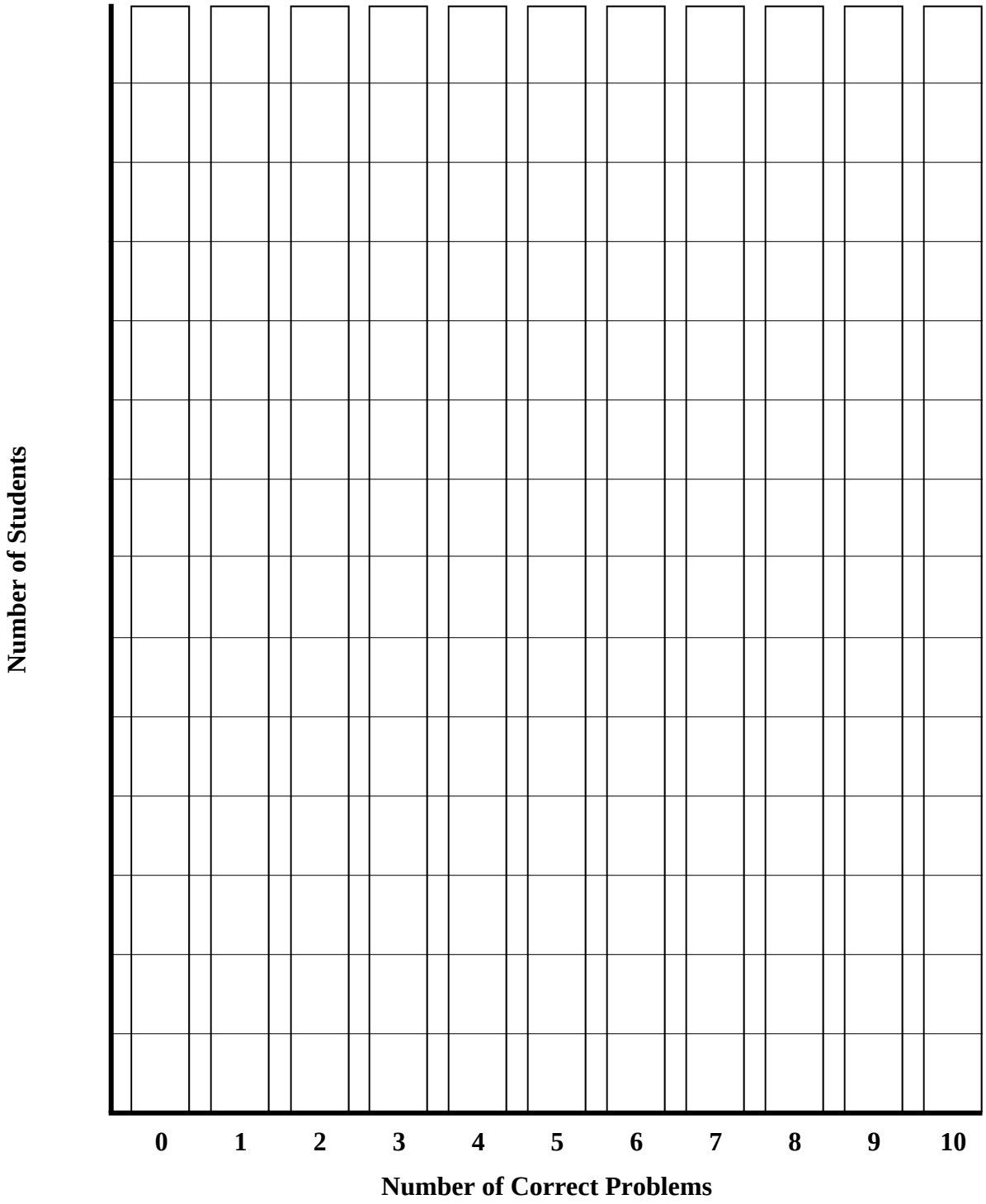
Number of Students Who Got Each Problem Correct

Quiz Item Number	Tally	Class Frequency
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Quirky Quiz

Quiz Results Bar Graph 1

Student Quiz Scores



The Big

Event

The Big Event

_____

_____

_____

Statistics Project - 1

Have you ever stopped to consider all of the details that must be taken care of in order to put on a big event like a concert? It may surprise you! There are many potential sources on income but also many expenses that must be considered when organizing an event of this size.

The Big Event: In a group of three or four students, plan a realistic event to take place on your campus at a location chosen by your teacher. You will visit this location to determine the number of seats available and to discuss the sources of income and the expenses that will be a part of your event. Your goal is to make the maximum profit possible as a young entrepreneur. You will present your proposal to the class. Each student is required to turn in a unique project at the due date.

Type of Event: _____

Other Students in Group: _____

Seating Chart: Your group must determine the number of seats available for The Big Event and how much seats in the different sections will cost. Use these numbers to calculate the total income from ticket sales. We will assume that ALL tickets are sold. A color-coded seating chart with a price key will be included with your project.

Income and Expenses: Brainstorm ways to make money at your event (income) and the costs associated with putting on your event (expenses). You will do some research later to help you assign realistic numbers to the income sources and expenses.

Without giving away too many ideas, income might come from selling sodas at the event while hiring security guards might be an expense. Be creative and think through this event completely. Do not leave out obvious expenses or miss opportunities to make more income. Remember, the goal is to make the highest profit possible by maximizing income and minimizing expenses.

Sources of Income: _____

Expenses: _____

Income and Expense Numbers: After making your seating decisions and brainstorming the other sources of income and expense, get together in your group to determine reasonable numbers for these sources of income and expense. This may require a little research on your part. See your teacher if you have questions.

Income and Expense Statements, Graphs, and Written Analysis: Once you have determined the income and expense numbers you are ready to complete the assignments listed on the next page. The Income and Expense Statement should clearly show how your group arrived at each number. For example if you listed $500 for sodas you might explain that you sold 250 sodas at $2 each. Make sure to completely label and color your graphs and to include a well-written analysis of your Big Event.

The Big Event

Teacher Tips

(1 of 2)

Lesson Description: The Big Event is a hands-on group project that allows students the freedom to creatively plan a major campus event, taking into account all of the sources of income and expense involved. They design seating charts, create income and expense statements, estimate costs, and make graphs (line, bar, circle, and picto-) to visually show the mathematical results of their planning. Finally, they analyze their project in writing.

Math Content: Statistics, Line Graphs, Bar Graphs, Circle Graphs, Pictographs, Income and Expense Statement, Estimating, Real-life Problem Solving Application, Writing about Mathematics

Time Required: About 3 Class Periods plus Homework

The Big Event includes:

* 2 Big Event assignment sheets
* 1 Big Event Teacher Project Notes
* 2 Big Event Teacher Tips pages
* 1 Big Event Grading Rubric
* 1 Big Event Cover Page

Materials Needed: None

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

The Big Event was a big hit with my students. They enjoyed working in groups on a problem that was a little bit outside of the box. They have to determine the type of event, the seating charts, seat prices, sources of income, expenses, and actual costs before completing their assignment. Many students got excited about the math because they were planning a concert by their favorite group or a movie premier complete with movie stars. Their imaginations provided a backdrop for the mathematics that was used in the project.

Teacher Tips:

* This project assumes that students have been taught how to make a frequency table, line graph, bar graph, circle graph, and pictograph or that the teacher will cover this material during the project. The Big Event is designed primarily as an application project, not a skill-teaching project. You will most likely still have to discuss the concepts of income, expenses, and profit with the students and give guidance on the Income and Expense Statement.
* For this project I allow students to choose their groups. This makes it more likely that the type of event will be agreed upon easily and that students with similar interests will use their imaginations to create an outstanding event.

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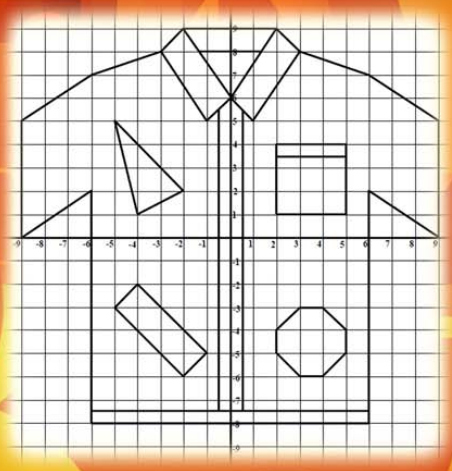
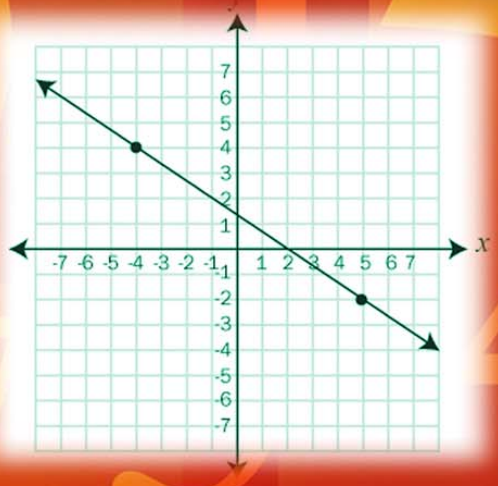
Marvelous Middle School Math

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.

A publication of Digital Lesson.com

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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Table of Contents

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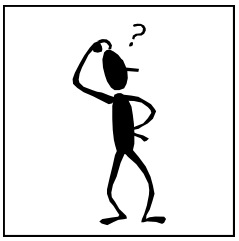
the Point?

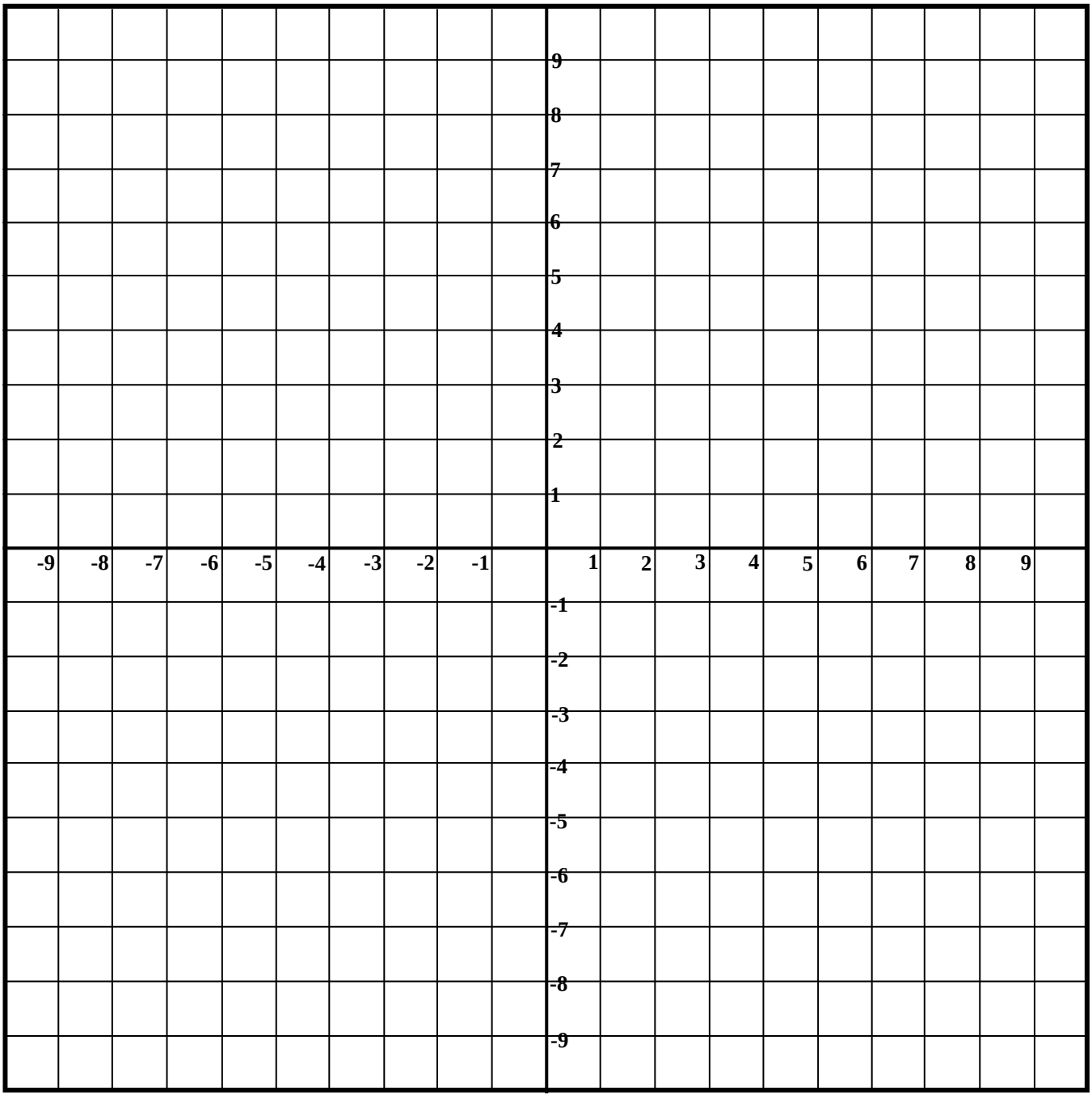


What's the Point?

 # 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**

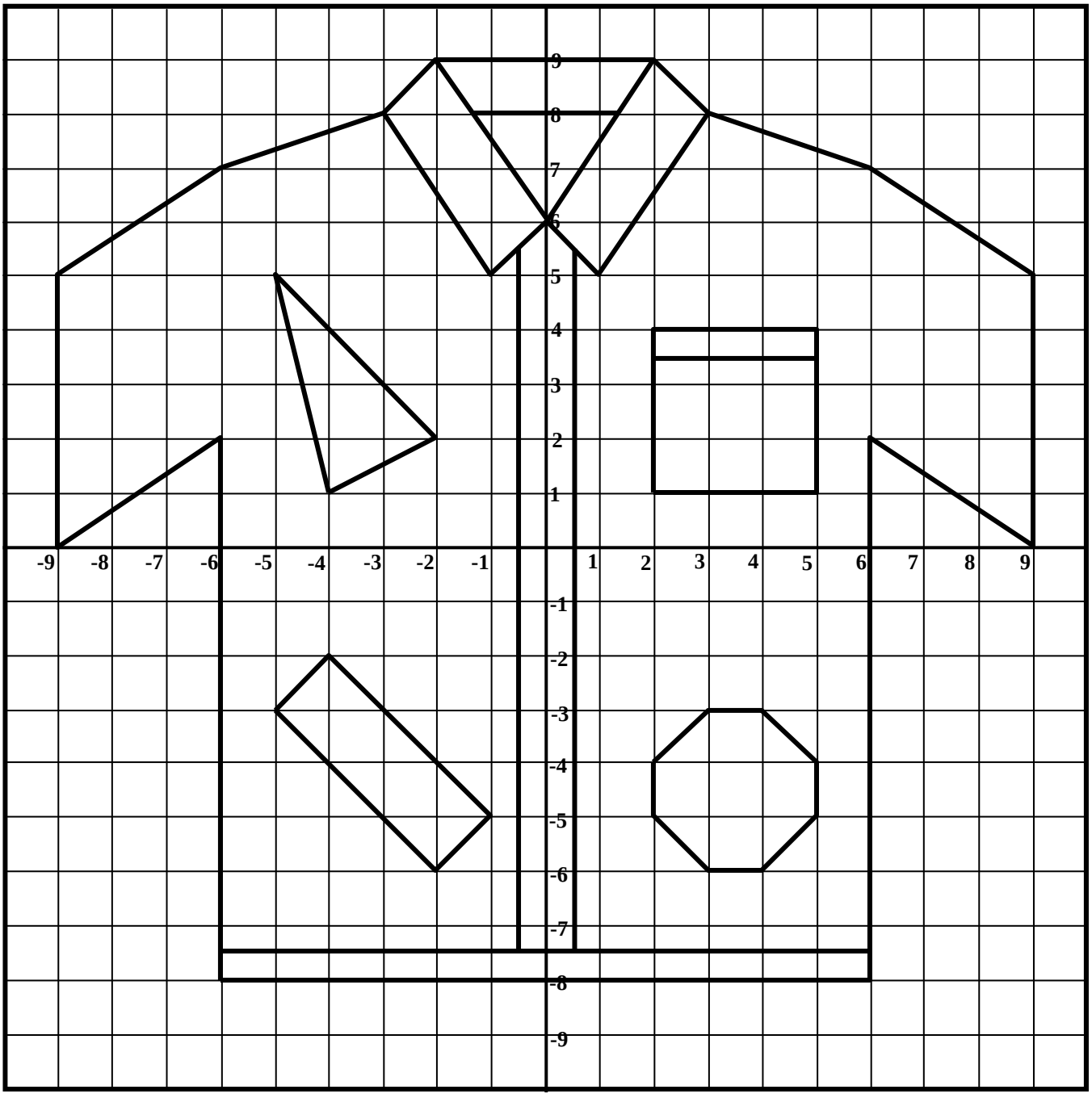


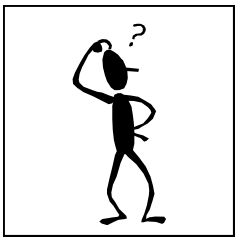
What's the Point?

 # 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?

Create Your Own!

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

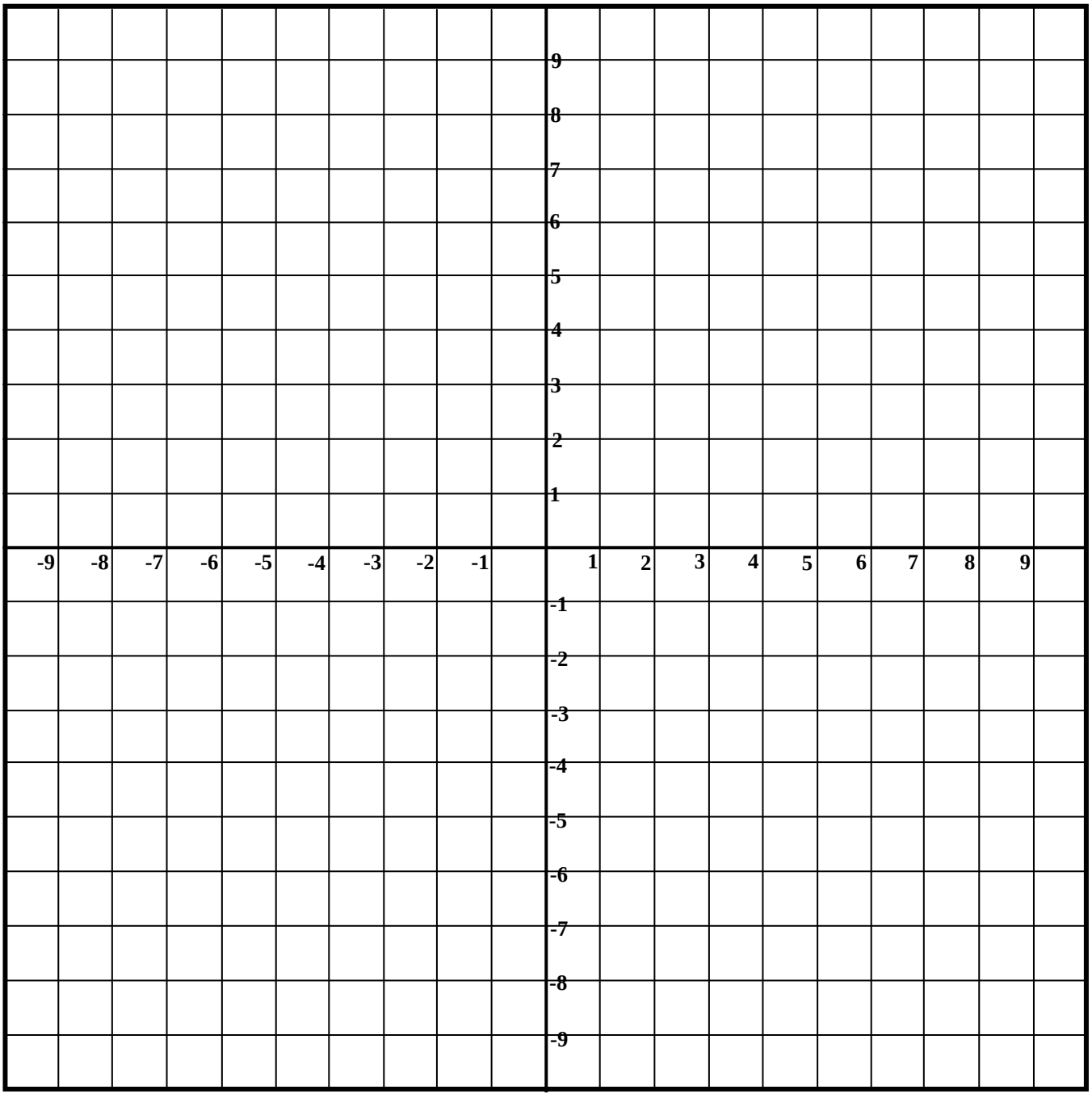
Start_____

_____

_____

_____

_____ **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

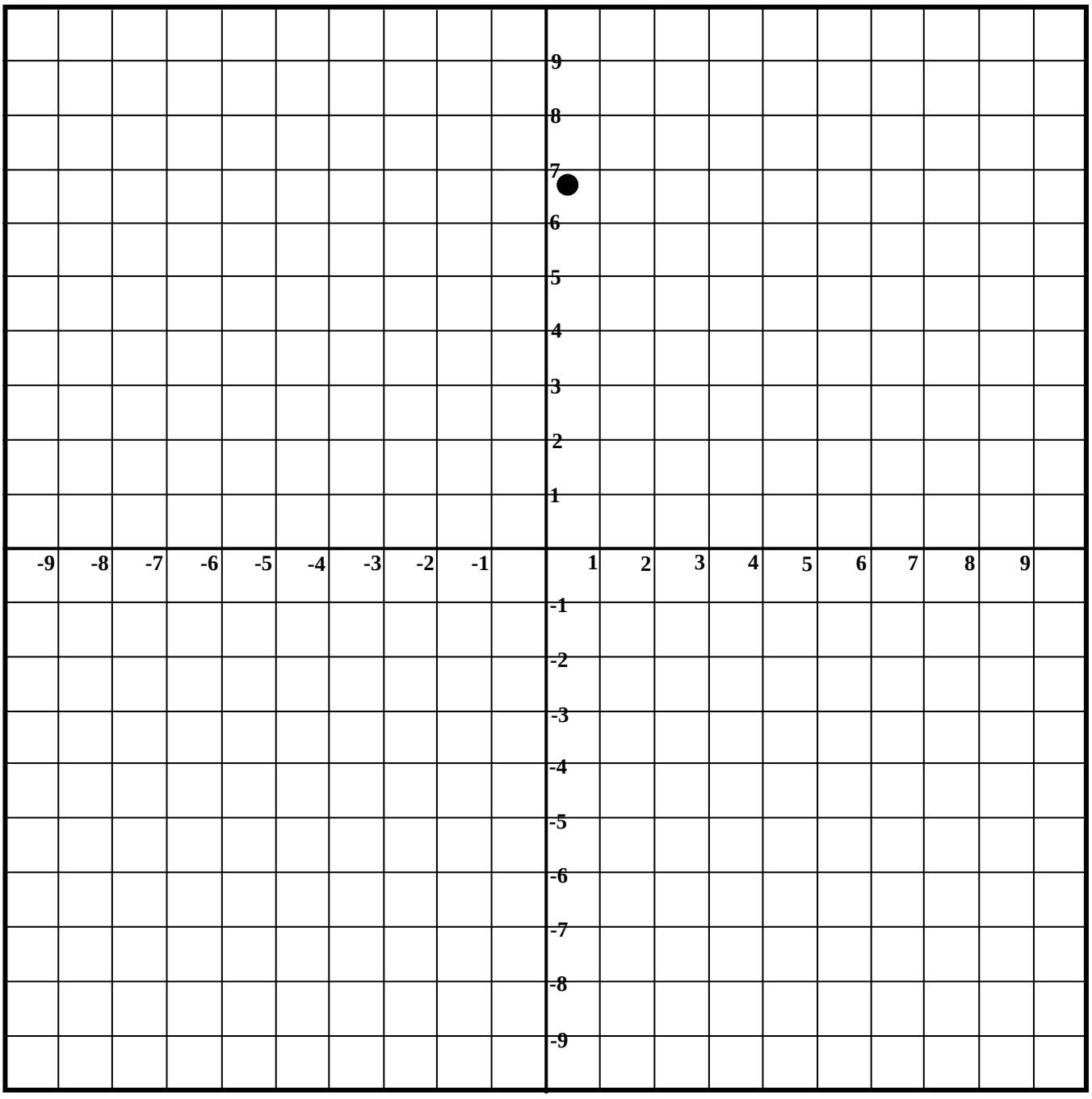
Point?

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**

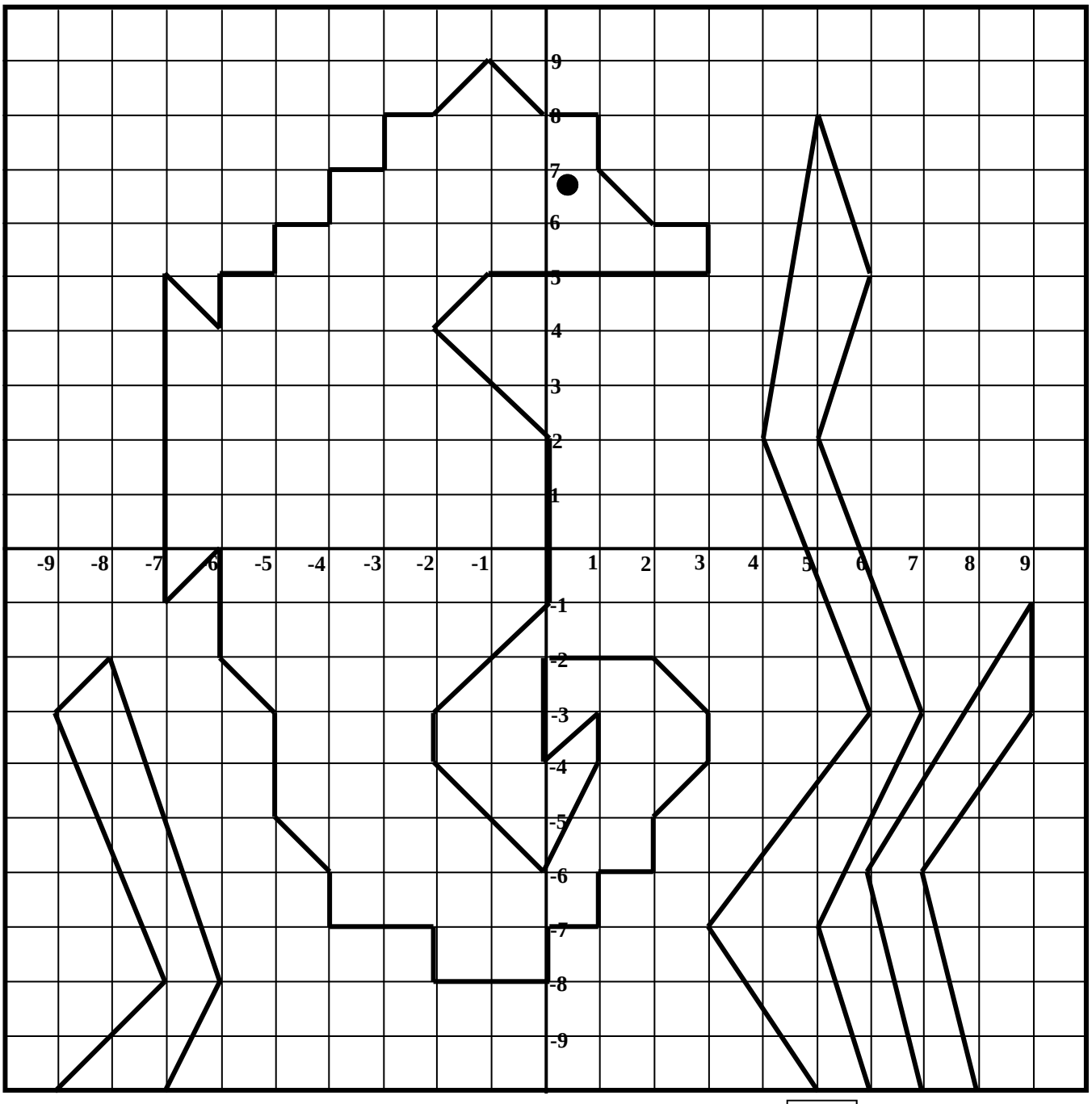


What's the Point?

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?

_____

_____

_____

Create Your Own!

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

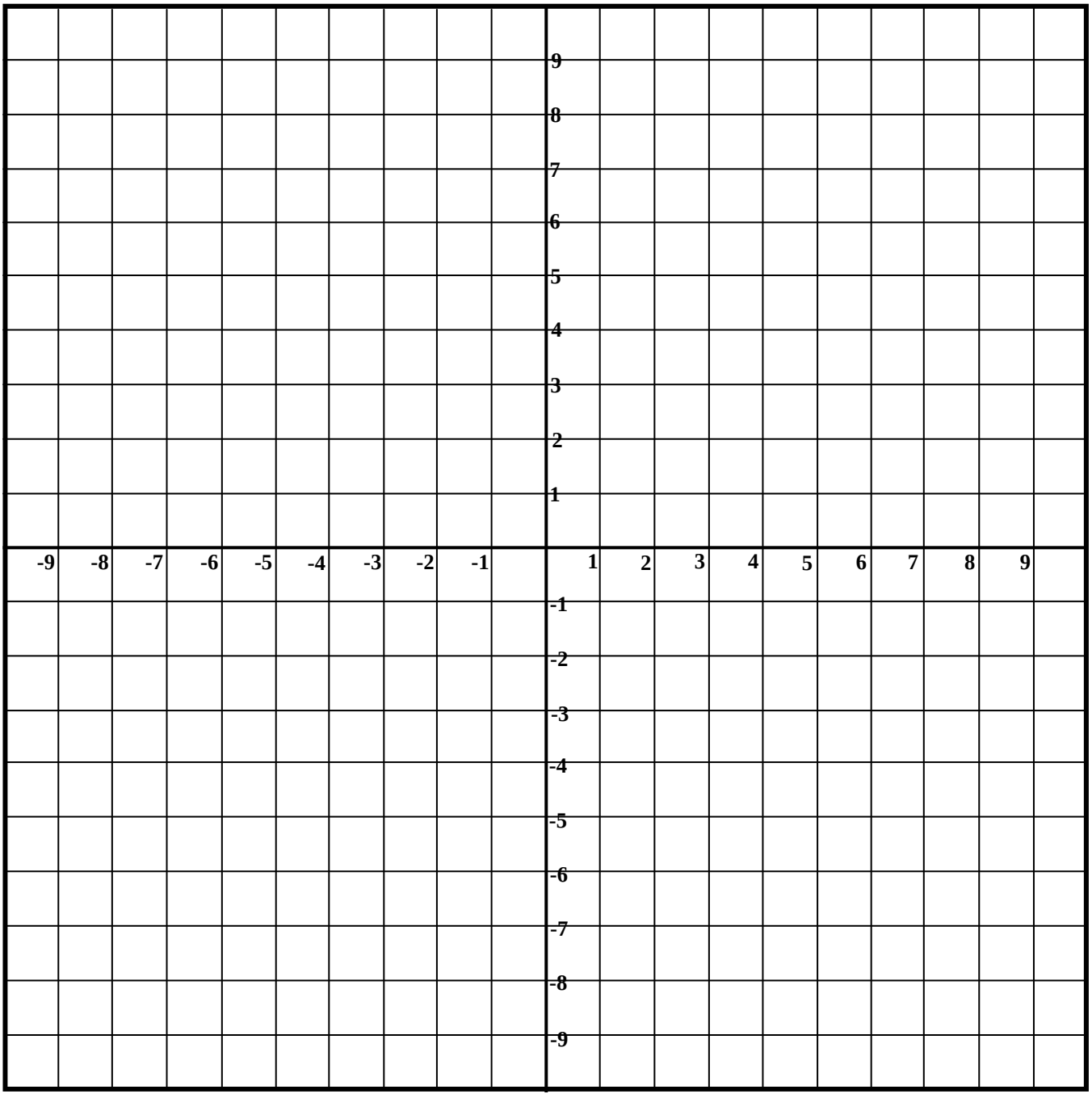
Start_____

_____

_____

_____

_____ **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

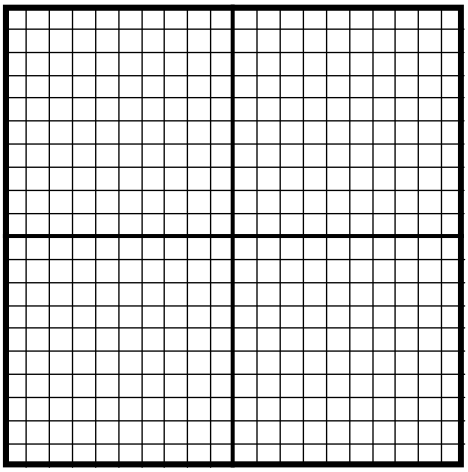
Equations

Graphing Equations

Graphing Equations 1

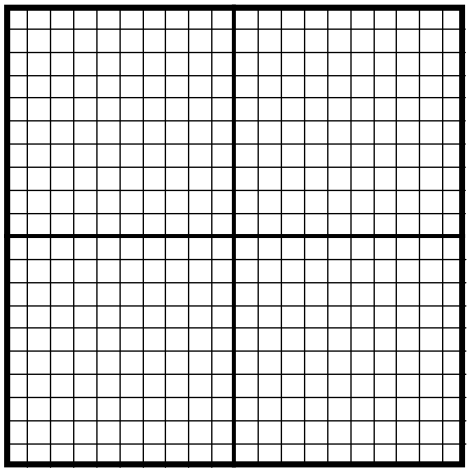
1) $y = 2x^2 - 3$

x	y



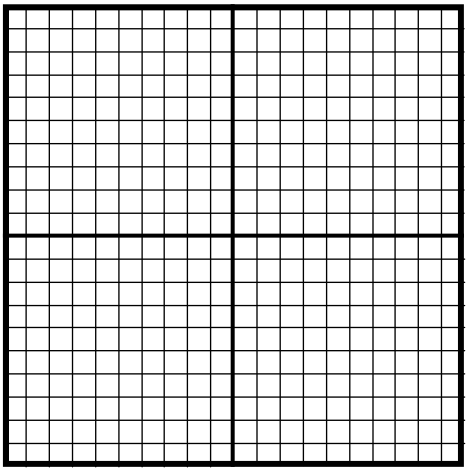
2) $y = 2x + 3$

x	y



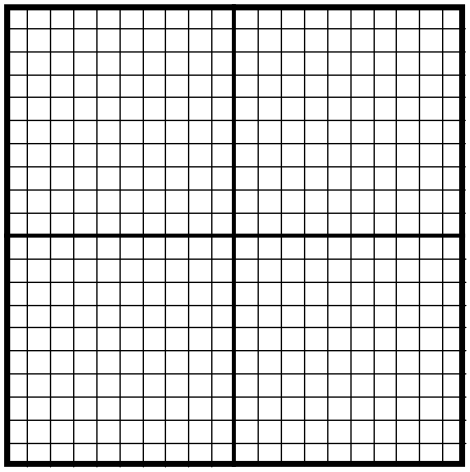
3) $y = -3|x| + 2$

x	y



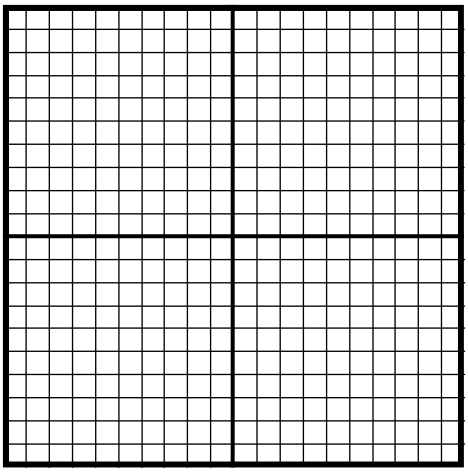
4) $y = -x^2 + 5$

x	y



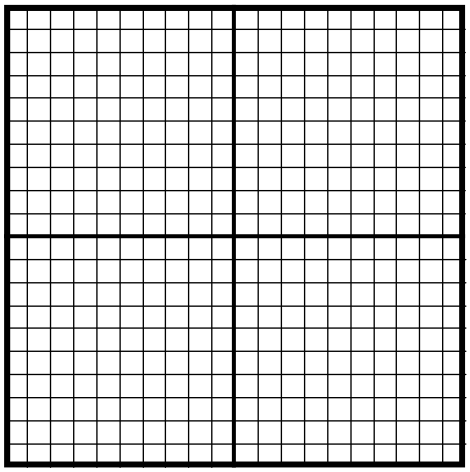
5) $y = -3x + 1$

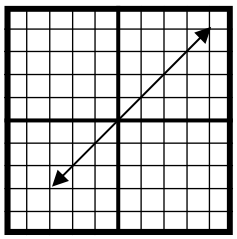
x	y



6) $y = |x| - 4$

x	y





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

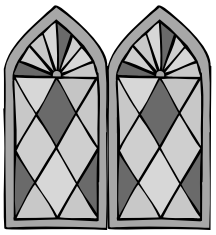
Teacher Testimonial: Graphing Equations is a lesson that allows students to discover several different types of functions as they use t-tables to find solutions for each equation. This lesson is a perfect extension activity to use after students have been taught to graph linear equations. Students discover 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 = ¼ x - 6 y = ½ x - 3	y = -x - 9 y = -2x + 8 y = - ⅓ x - 3 y = - ¼ x + 5 y = -2x y = -x + 12

x = _____ y = _____ y = _____ y = _____

x	y

x	y

x	y

x	y

x = _____ y = _____ y = _____ y = _____

x	y

x	y

x	y

x	y

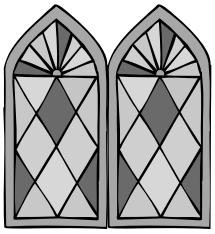
x = _____ y = _____ y = _____ y = _____

x	y

x	y

x	y

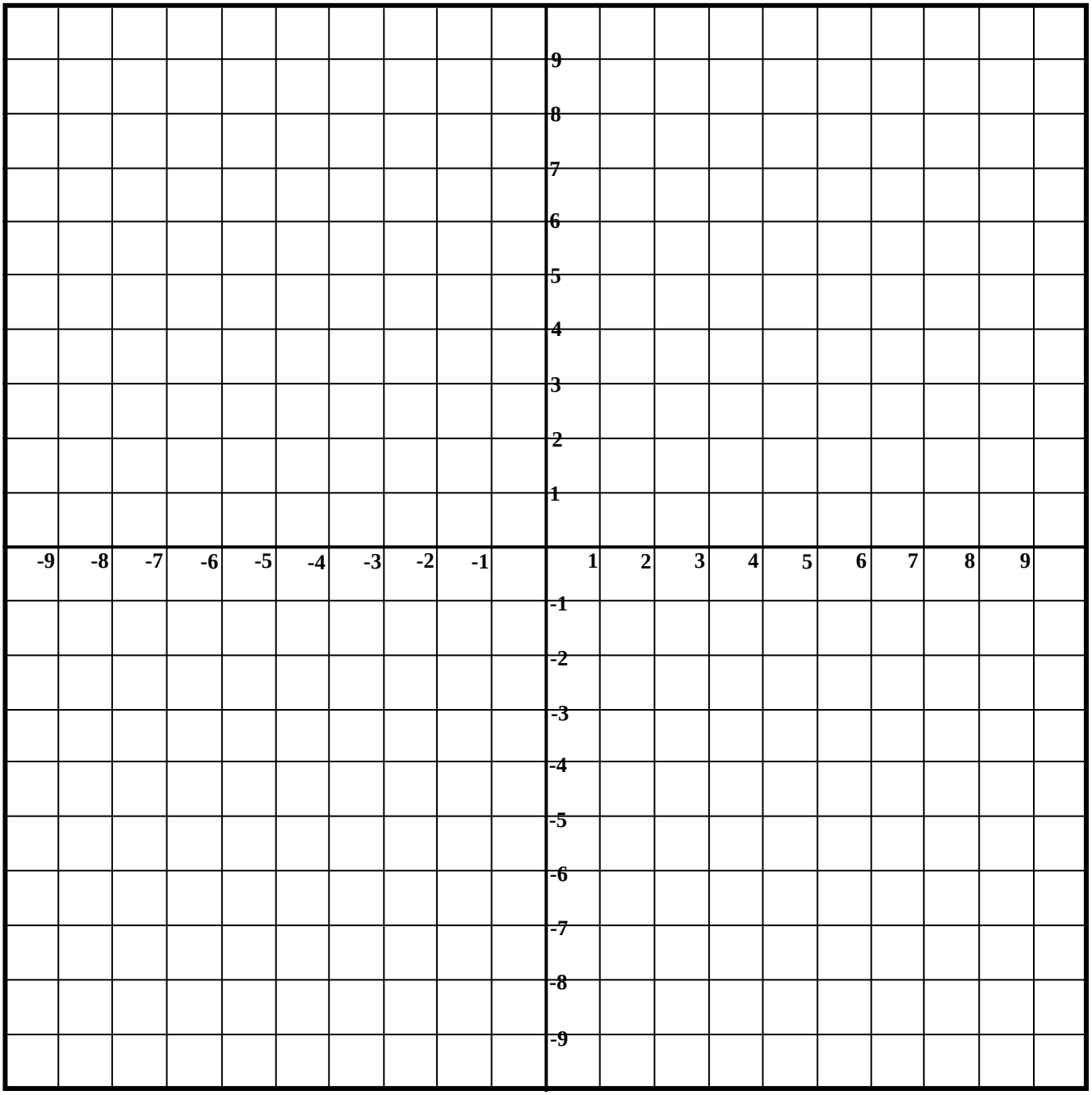
x	y

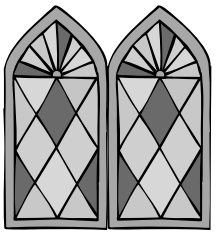


Stained Glass Window

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

_____

_____

_____

Systems of Equations 2

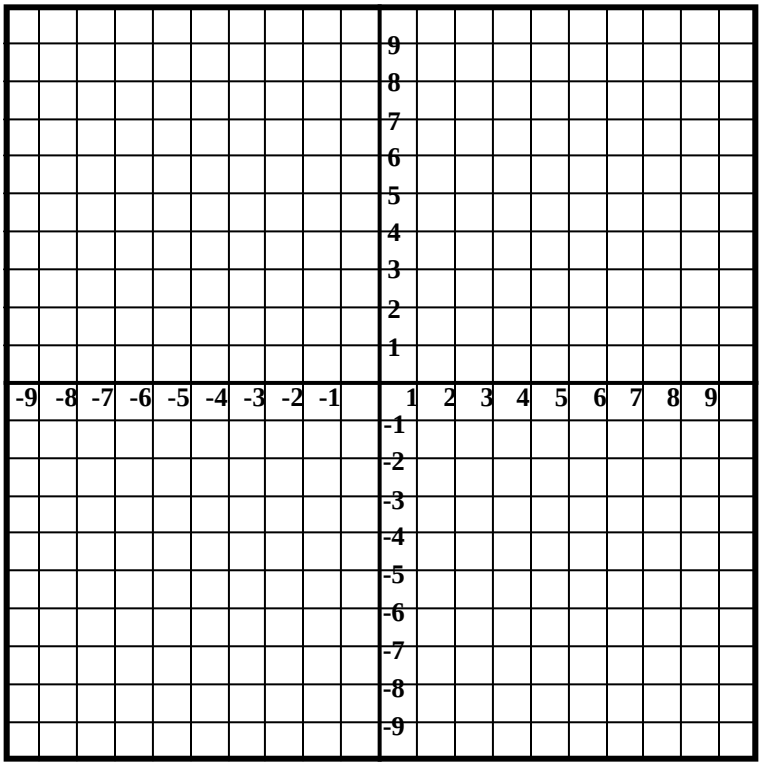
Directions: Read each set of words below, write the corresponding equations, and use the t-table to graph at least five ordered pairs that are solutions to each equation. Then graph these points and draw the line that represents all of the solutions for each equation. Finally, write the slope, y-intercept, 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:	(Let x = Joe's age) (Let y = Sally's age) Equation:

x	y

Slope _____

y– intercept _____



x	y

Slope _____

y– intercept _____

Solution: (____, ____)

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.

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

y = 3x - 15

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

Slope **__3__**

y– intercept **_-15_**

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

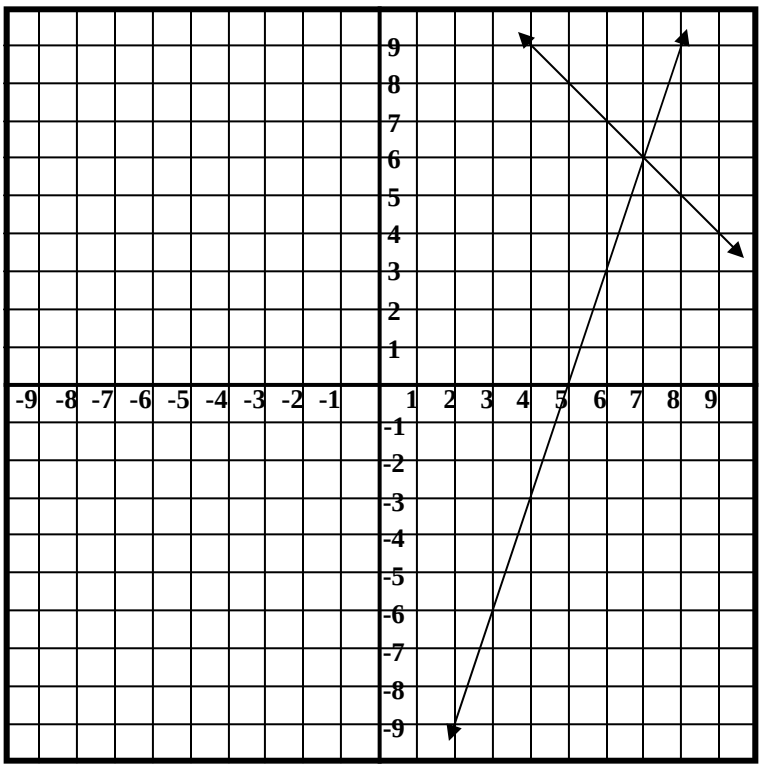
(Let x = Joe's age) (Let y = Sally's age)
Equation:

x + y = 13

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

Slope **__-1__**

y– intercept **_13_**



Solution: (7, 6)

Graphing Systems of Equations

_____

_____

_____

Systems of Equations

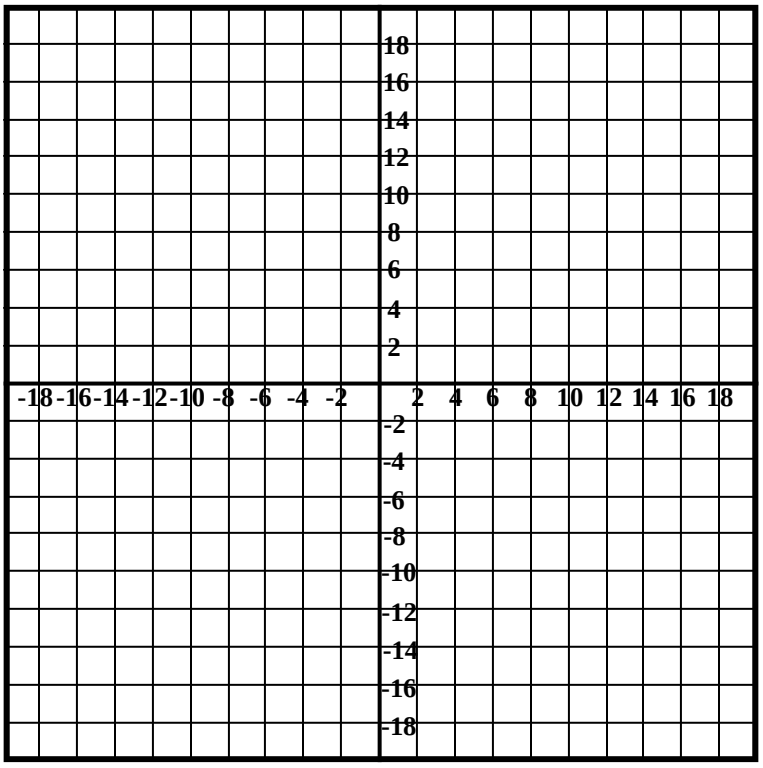
Directions: Read each set of words below, write the corresponding equations, and use the t-table to graph at least five ordered pairs that are solutions to each equation. Then graph these points and draw the line that represents all of the solutions for each equation. Finally, write the slope, y-intercept,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

Words:	Words:
(Let x = _____) (Let y = _____) Equation:	(Let x = _____) (Let y = _____) Equation:

x	y

Slope _____

y– intercept _____



x	y

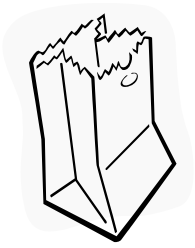
Slope _____

y– intercept _____

Solution: (____, ____)

It's In

The Bag!

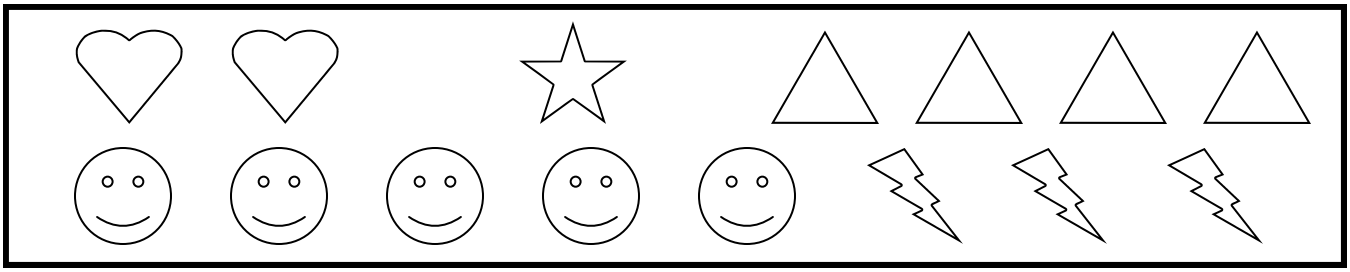


It's In The Bag!

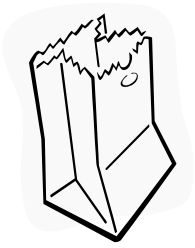
Descriptions and Algebraic Equations

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

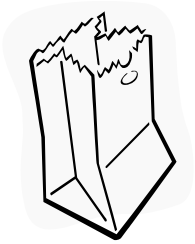
Student Who Created This Bag: _____

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.

Digital Lesson.com Presents

Marvelous Middle School Math

Money Math Activities

By Mark P. Tully

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

Table of Contents

Money Math

Stock Market Contest

Money Math

Stock Market

The Basics (1 of 2)

Why Invest in Stocks?

People invest in the stock market in order to get a return on their money. By investing in a company with excellent future growth prospects, individuals hope to increase the size of their assets in order to fund their retirement or other expenses. Stocks have traditionally provided a better return than parking your money in a savings account.

When you own stock in a company, you are actually a part-owner of that company. You may become an owner of McDonalds, Starbucks, eBay, Amazon.com, or any other publicly traded company. When you own the stock of a company you have the right to vote on certain company issues and you may also share in the profits of your company if they pay a dividend. A dividend is a portion of the profits of a company that are distributed to the shareholder for each share owned. Most stocks are traded on either the New York Stock Exchange (NYSE) or the NASDAQ market.

Supply and Demand in the Stock Market

The price of a stock is determined by supply and demand. When a company is doing well and its future outlook is bright, many investors may want to buy the stock and demand for the stock will increase. Since there are a limited number of shares available, the price will rise. Often times those who follow the company will see the price rising and will want to purchase the stock to get in on the action. This pushes the price even higher.

If the company reports problems or company earnings decline, investors often sell their stock and take their money elsewhere. In such cases, demand decreases while the supply of available shares will increase. The price naturally will fall. This often leads to further selling as other investors watch the price fall and decide to get out. The price falls even further.

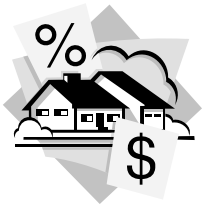
Risk and Reward in the Stock Market

You could have bought eBay stock in 2001 at a split-adjusted price of under $20.00 per share. At the time of this writing eBay was trading at about $80.00 per share. Therefore, an investment of $2,000.00 (100 shares) in 2001 would have been worth about $8,000 in July of 2004. A return of $6,000, or 300%, in 3 years is terrific! However, many people who had heard of eBay chose not to buy the stock in 2001. Investing would be simple if we could see the future.

The truth is that investing in the stock market is risky business. Sure, companies like eBay show us the profit that can be made when we choose to invest in a company that skyrockets in price. The other side of the coin is that many people invest in companies whose stocks earn a smaller profit, stay about the same price, or even lose money. If a company goes bankrupt your shares of stock in that company could become worthless. Even professionals are often unsuccessful in picking which stocks will rise in price. High risk stocks may offer a great potential reward, but you may also suffer a great loss.

Money Math

Stock Market



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_____

Ticker Symbols

Below is a list of ticker symbols that are used when searching for the price of a share of stock. Ticker symbols with 1-3 characters represent companies listed on the New York Stock Exchange (NYSE). Four characters are used for symbols listed on the NASDAQ stock exchange. Identify the company represented by each stock market ticker symbol.

1. EBAY _____
2. WMT _____
3. DELL _____
4. NFLX _____
5. YHOO _____
6. COST _____
7. BKS _____
8. FDX _____
9. HD _____
10. DIS _____
11. F _____
12. AAPL _____
13. T _____
14. K _____
15. AMZN _____
16. SBUX _____
17. PEP _____
18. SPLS _____
19. GE _____
20. NKE _____
21. MSFT _____
22. XRX _____
23. GOOG _____
24. MCD _____
25. INTC _____
26. AMZN _____
27. TWX _____
28. KO _____
29. NOK _____
30. IBM _____
31. ZQK _____
32. GPS _____
33. LUV _____
34. VZ _____
35. HOG _____
36. JNJ _____
37. YUM _____
38. ANF _____
39. UPS _____
40. WEN _____
41. HSY _____
42. PZZA _____
43. BBY _____
44. AXP _____
45. TGT _____

Money Math

Stock Market

_____

_____

_____

Company Spotlight

1. Company Name: _____

2. What is the ticker symbol for this company? _____

3. Does this company primarily provide a product or service?_____

4. In a short paragraph, describe the product or service provided by this company? _____

_____

_____

_____

5. Last Trade: _____

6. 52-Week Range: _____

7. Average Volume: _____

8. Price/Earnings Ratio (P/E): _____

9. Earnings Per Share (EPS): _____

10. Why did you decide to invest in this company? Be specific and give more than one reason.

_____

_____

_____

_____

Contest Rules

The Stock Market Contest Rules

* You have **$10,000** to invest in two stocks that you will track throughout the contest.

* You must spend at least $9,900 including commissions (have less than $100 remaining).

* You must spend at least $2,000 on each of the two stocks.

* Once you have made your stock purchases (Part I of the Stock Picks sheet) complete an extra copy for the teacher.

* There is no trading for other stocks during this contest. You must keep the stocks you pick to start with, so choose carefully!

* A good website that you may use in your stock research is http://finance.yahoo.com. Enter the ticker symbol of your stock to find the information you need. Use the Symbol Lookup feature if you do not know the ticker symbol.

* You will check and record your stock performances on their Stock Performance Line Graphs and on your Stock Picks recording sheets.

* **Prizes** will be awarded for the **Top Stock Pickers**.

.

Money Math
Stock Market

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Stock Picks (2 of 2)

III. Final Stock Sales:

Date: _____

	Company Name	Ticker Symbol	Price	# of Shares	
1)	_____	_____	_____ x	_____	= _____
2)	_____	_____	_____ x	_____	= _____

Commission ($15.00 each trade) - _____

Remaining Cash (see above) + _____

Total Cash _____

Final Investment Profit or Loss:

Total Cash - Beginning Cash = Profit (Loss)

_____ - _____ = ☐

IV. Stock Performance:

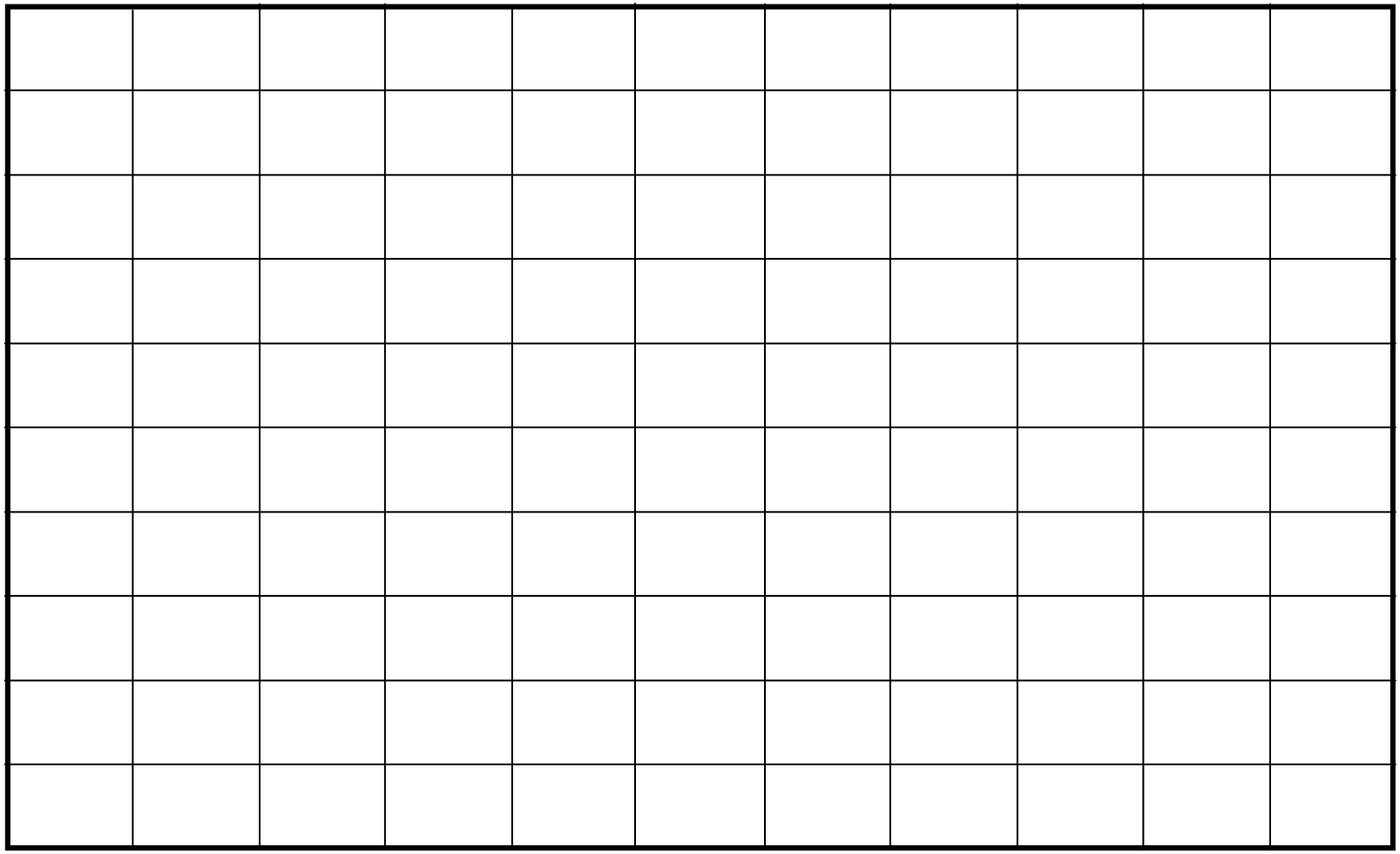
	Company Name	Buy Day Price	Sell Day Price	Percent Change
1)	_____	_____	_____	_____
2)	_____	_____	_____	_____

V. Comparison to Benchmark:

1)	S & P 500 Stock Index (^SPX)	_____	_____	_____

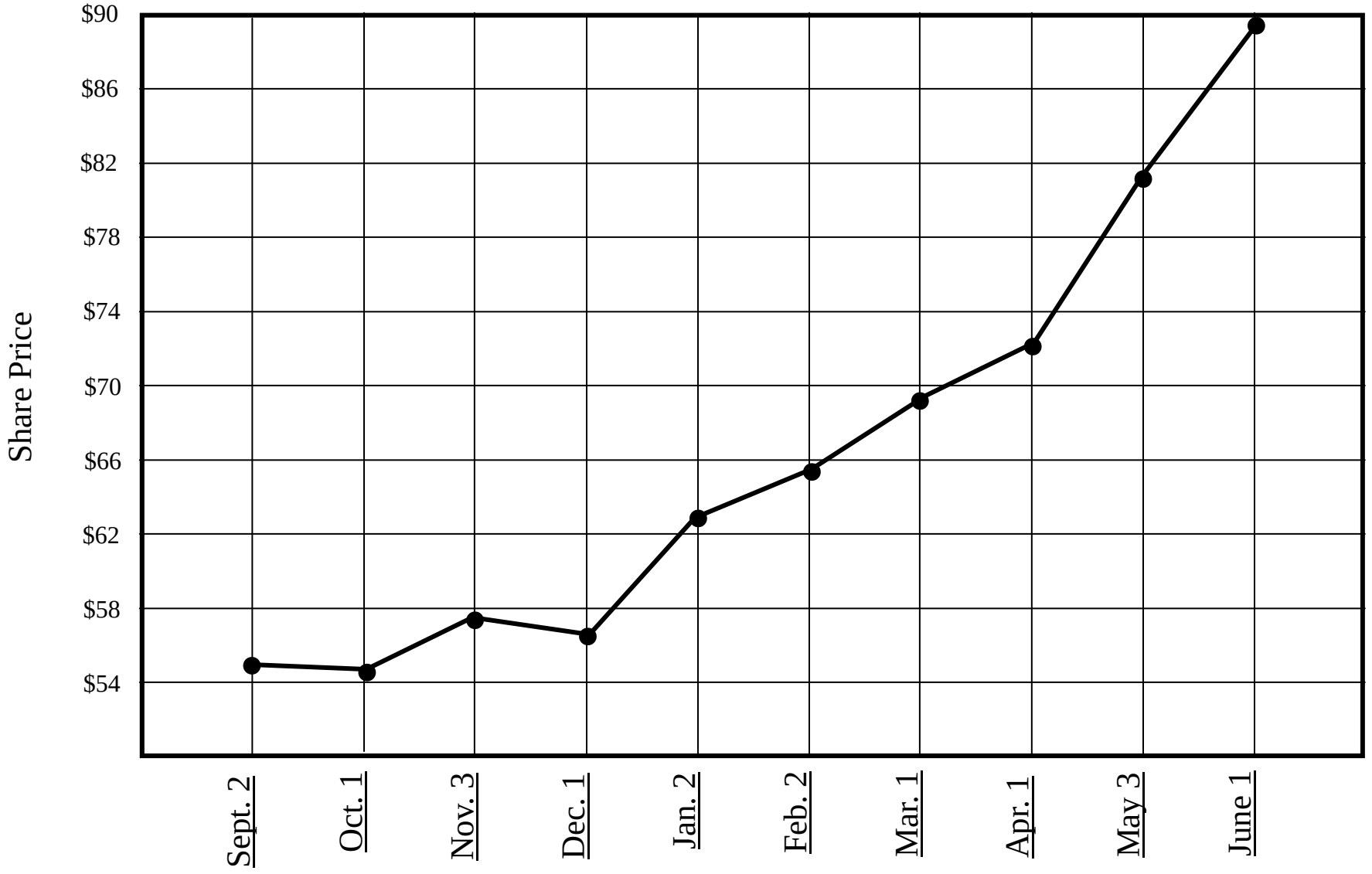
Stock Performance Line Graph

Company Name _____ Dates: From _____ to _____



Stock Performance Line Graph - Sample Key

Company Name _____**eBay**_____ Dates: From __**9/2/2003**__ to _**6/1/2004**_



Money Math

Stock Market

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_____

Performance Evaluation

Answer the following questions to help you evaluate the performance of the stocks, mutual funds, or ETFs that you chose to invest in.

1. How did each of your investments perform compared to the S&P 500 index? _____

   _____

   _____

2. What reasons can you identify to explain the performance of each investment? _____

   _____

   _____

   _____

3. What have you learned about investing in the stock market? Be specific and discuss at least 3 lessons learned. _____

   _____

   _____

   _____

4. If you were going to invest again would you do anything differently? Would you invest in the same stocks? Are there any other specific stocks you might invest in? Why?_____

   _____

   _____

   _____

   _____

   _____

Money Math
Stock Market

Teacher Tips

(1 of 3)

Lesson Description: The Stock Market Contest is designed to teach students the basics of investing in the stock market. Students read two pages for basic background knowledge, choose two companies to invest in, track and graph their stocks using the worksheets provided, and reflect upon the learning that has taken place during the year. Students may work individually or in groups of two. Promote this fun and educational contest with your students and award prizes to the top investors.

Math Content: Percents, Decimals, Line Graphs

Time Required: 1-2 hours spent in class and at home throughout the year

Stock Market includes:

* 2 Stock Market Basics sheets
* 1 Stock Market Ticker Symbols sheet and 1 Answer Key
* 1 Stock Market Company Spotlight and 1 sample Company Spotlight
* 2 Stock Picks recording sheets and 1 Stock Market Contest Rules sheet
* 2 Stock Performance Line Graphs (one not labeled) and 1 Sample Graph
* 1 Stock Market Performance Evaluation sheet
* 3 Stock Market Teacher Tips sheets

Materials Needed: None

Suggested Grade Level: 5th - 8th +

Teacher Testimonial:
The Stock Market lesson teaches students the mechanics of stock market investing and allows them to watch, track, graph, and evaluate their investment choices. Students enjoy investing in some of their favorite companies and I try to reward those whose stocks have outperformed the rest.

Teacher Tips:

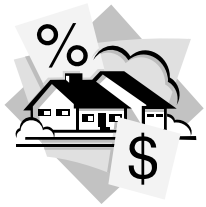
* The Stock Market lesson is designed to be used at the beginning, middle, and end of the year.
* Use all of the components of the Stock Market lesson or just choose the parts that seem most useful to you.
* Use the Stock Market Basics pages to provide investment background as necessary.
* The Stock Market Ticker Symbols sheet is a fun activity that will introduce students to the idea of representing company stocks with ticker symbols. I usually allow students to work in groups to try and figure out the name of the company from its symbol. Many of the companies can be guessed from their symbols. I then allow students to share their answers and I reveal to them any that they cannot figure out (or give them hints). This activity is optional but the students have always enjoyed it. Use this activity after The Basics pages.

Money Math

Classroom Money System

Money Math

Class Money System



Money System

Teacher Notes

I use a money system in my classroom as part of my classroom management system. The money system helps motivate the students, is used to teach math concepts in a realistic context, and instills in the students some of the financial foundations that they will need to be successful in life. The students receive a monthly salary for their job (being a math student). The first month I tell them that they will receive a salary of $3,700 per month, which they are pretty excited about. Then they discover that they will have to pay $1,036 in federal and state income taxes (28%), rent of $600 per month (perhaps sharing an apartment), and $64 for utilities (probably on the low side, but it makes my numbers work).

This leaves them with **$2,000 a month** to save and later spend. In subsequent months I just pay them $2,000 a month and remind them of the other costs. Adjust these numbers as you see fit. Note: I write them a check for their salary (which they will deposit) and have them write me checks for the other three expenses reviewed above. More about that later in the checking segment of the money system.

There are many ways that students can earn money. I pay students for good grades on tests or quizzes, excellent citizenship, class participation, student of the month, working diligently in class, classroom jobs, bringing in class supplies, and so on. I am sure that you will think of additional reasons to reward students with class cash.

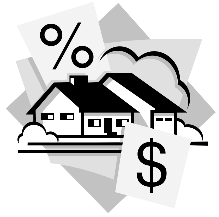
The key to a successful classroom money system is giving students meaningful opportunities to spend the money that they have earned. If students are not excited about some of the ways that they can spend their money then the system will not be nearly as effective or enjoyable. Use your imagination and your particular circumstances to devise opportunities for the students to spend their money. Some possible student spending opportunities include homework, bathroom, and late passes (limited number), school supplies (if available), candy, entry into a raffle or contest (such as a basketball shot with prizes), special privileges, early lunch, small auctions, and a final End-of-the-Year Auction (see details about this auction later in this packet). I also pay students for their Stock Market profits and Real Estate investments. These lessons are or will soon be available on Digital Lesson.com.

I use mainly $50 and $100 bills, although I have included $500 bills in this packet, because the students respond more to the idea of larger amounts of money. By the end of the year, counting $20,000 in monthly salaries, most students end up with between $25,000 and $40,000. If students have participated in bringing in auction items, the final End-of-the-Year Auction is a blast!!

Protect your money from being copied. I recommend using a unique stamp, with a different color ink, to differentiate your money. Stamp your money on the right side of the bill and explain that unstamped money is worthless. Have the Treasurer (see Classroom Jobs later in this packet) cut and stamp your money before using it. I also recommend using a different color paper for the $50, $100 and $500 bills. You can change the picture on the bills also if you desire.

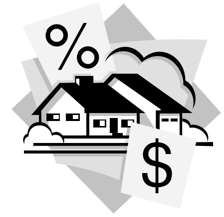
Finally, two sets of money templates are included in this packet. One set of bills is called "**Class Cash**" and the other set is called "**Math Money**". Choose the one you like best.

500 **Class Cash** 500



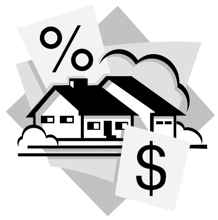
500 **Five Hundred** 500

500 **Class Cash** 500



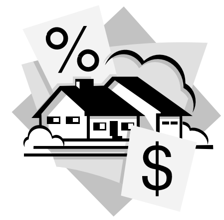
500 **Five Hundred** 500

500 **Class Cash** 500



500 **Five Hundred** 500

500 **Class Cash** 500

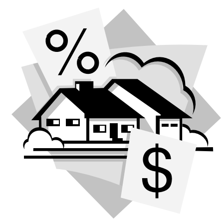


500 **Five Hundred** 500

500 **Class Cash** 500

500 **Five Hundred** 500

500 **Class Cash** 500



500 **Five Hundred** 500

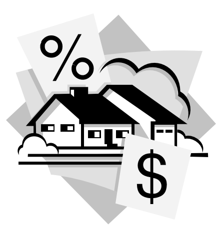
500 **Class Cash** 500

500 **Five Hundred** 500

500 **Class Cash** 500

500 **Five Hundred** 500

500 **Class Cash** 500

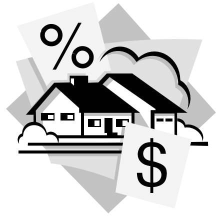


500 **Five Hundred** 500

500 **Class Cash** 500

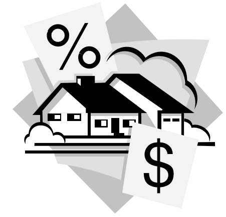
500 **Five Hundred** 500

100 Math Money 100



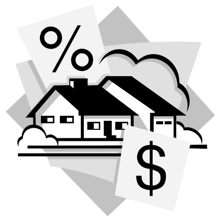
100 One Hundred 100

100 Math Money 100



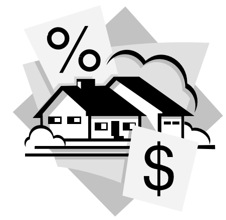
100 One Hundred 100

100 Math Money 100



100 One Hundred 100

100 Math Money 100

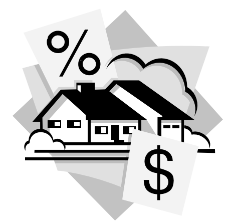


100 One Hundred 100

100 Math Money 100

100 One Hundred 100

100 Math Money 100



100 One Hundred 100

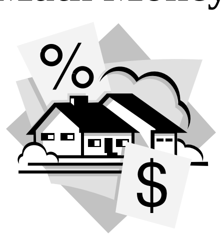
100 Math Money 100

100 One Hundred 100

100 Math Money 100

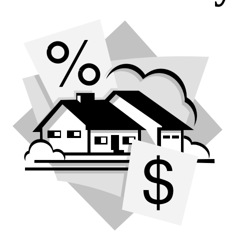
100 One Hundred 100

100 Math Money 100



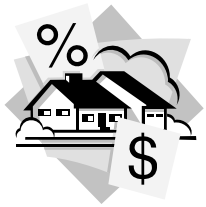
100 One Hundred 100

100 Math Money 100



100 One Hundred 100

Money Math
Class Money System



Classroom Checks

Teacher Notes

Checks and a Check Register to use within the classroom are included in our classroom money system packet. A **Sample Check Register** is also included. Copy them and use them with the class.

The students are encouraged to use checks to pay for any major expenses or if they do not have any cash on hand. After teaching students how to write out checks, they can use them to pay another student or to pay the teacher for any purchase.

I start out the year, as discussed briefly in the Money System Teacher Notes, **writing each student a check for $3,700** for their first month's salary. Then I have students write me a check for federal and state taxes (just have students make out one check to the IRS) for $1,036 (28%), a check for $600 for rent, and a check for $64 for utilities. This leaves them with $2,000 and an eye-opening understanding that you do not get to keep all the money that you make. You may also want to briefly discuss taxes at this point

Helpful Hint: If you fill in their paychecks, without name, before you copy them off, then you can just have the students fill in their names and write out the remaining three checks on the same sheet of paper before handing them in. This avoids the time and mess of cutting all of the checks up. Just give them to the bankers (see Classroom Jobs) to deposit. After the first month I just pay the students $2,000 per month and remind them of the other costs that have been paid "automatically". Sometimes I will wait and pay the students their salaries every 2-3 months (with one check) in order to decrease the bankers' paperwork.

Pass out the Check Register and the Sample Check Register when you give the students their first monthly paycheck. Teach them how to record their deposits and withdrawals on the Check Register and have them keep these sheets in their notebooks. Remind students to record all of their transactions during the year, including cash deposits. Make extra Check Register sheets available as needed.

Create a Bank Book for each class (3-ring notebook) with a page for each student. Put the student Check Register sheets in alphabetical order. The bankers will record any deposits and withdrawals made by a student in this book. Remind them that if a student writes a check to another student, the money amount should be subtracted from the account of the student who wrote the check and added into the account of the person who received the check. The student Check Register and the official bank Check Register should always be the same if the student is keeping track of his transactions. Keep careful track of the official Bank Book!

Class Cash that is deposited into the bank should be returned to the teacher by the bankers to be used again.

Do Not Allow students to use their Class Cash or Class Checks to buy items from other students or to make other transactions outside of the classroom. This could end up causing problems and bringing up questions of fairness.

______________________ (Print Name) **0001**

______________________ (Class) ____________20______

PAY TO THE ORDER OF ____ **$** [ ]

____ DOLLARS

Financial Foundations Bank
P.O. Box 1
Any City, USA

FOR ______________________ ______________________________

______________________ (Print Name) **0001**

______________________ (Class) ____________20______

PAY TO THE ORDER OF ____ **$** [ ]

____ DOLLARS

Financial Foundations Bank
P.O. Box 1
Any City, USA

FOR ______________________ ______________________________

______________________ (Print Name) **0001**

______________________ (Class) ____________20______

PAY TO THE ORDER OF ____ **$** [ ]

____ DOLLARS

Financial Foundations Bank
P.O. Box 1
Any City, USA

FOR ______________________ ______________________________

______________________ (Print Name) **0001**

______________________ (Class) ____________20______

PAY TO THE ORDER OF ____ **$** [ ]

____ DOLLARS

Financial Foundations Bank
P.O. Box 1
Any City, USA

FOR ______________________ ______________________________

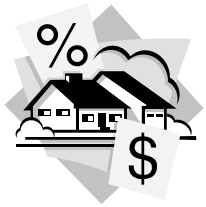
Name ___________________ **Check Register** Class ___________________

Check #	Date	Description of Transaction	Withdrawal		Deposit		Balance	

Name ________________ ***Sample Check Register*** Class _____________

Check #	Date	Description of Transaction	Withdrawal		Deposit		Balance	
	9/30	September Paycheck			3,700	00	3,700	00
							3,700	00
	10/2	Federal and State Taxes (28%)	1,036	00			1,036	00
							2,664	00
001	10/5	Monthly Rent	600	00			600	00
							2,064	00
002	10/8	Utilities	64	00			64	00
							2,000	00
	10/15	Garage Sale Profit			217	00	217	
							2,217	00

Money Math
Class Money System



Classroom Jobs

Teacher Notes

I assign classroom jobs each semester. Students fill out the Classroom Job Application (see next page) and turn it in to the teacher by a certain date. Late applications are only considered if a position has not been filled by another application or if those applications turned in on time are not satisfactory. I tell students that the neatness and completeness of the application will be the difference in otherwise equally qualified candidates. Second semester I try to give priority to those students without a job during the first semester.

The jobs that I have made available in my classroom include Chief Executive Officer (CEO), Chief Financial Officer (CFO), Banker, Treasurer, Attendance, Points Person, Teachers Assistant, File Clerk, Paper Passer, Custodian, Stock Broker, Librarian, and Real Estate Agent. The number positions for each job, monthly salary, and basic responsibilities are listed below to serve as a resource. Of course you should add or subtract job positions and adjust salaries to accommodate your own classroom.

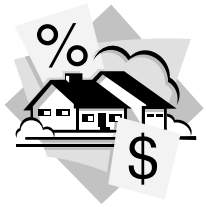
Job Title	# of Positions	Monthly Salary	Responsibilities
CEO	1	$1,000	Oversees all classroom employees.
CFO	1	$1,000	Oversees Bankers, Treasurers, and money.
Banker	2	$1,200	Keeps classroom bank book.
Treasurer	2	$700	Stamp and cut classroom money.
Attendance	1	$700	Take attendance sheet to clip each day.
Points Person	1	$1,000	Records classroom points for teacher.
Teachers Assist.	2	$500	Assist teacher in errands or tasks.
File Clerk	2	$1,000	File tests and quizzes in file cabinet.
Paper Passer	2	$700	Pass out papers for teacher.
Custodian	2	$700	Pick up trash off of the floor.
Stock Broker	2	$700	Help students look up stocks at computer.
Librarian	2	$1,000	Put away books at the end of the period.
Real Estate Agent	2	$1,000	Sell real estate and record transactions.

You may want to have some sort of Performance Review before paying a full salary to the classroom employees. Some students apply for jobs and then never end up doing them. Perhaps the CEO could complete a short form on each employee or the students could turn in a self-evaluation.

I choose new jobs at the semester and usually pay the employees their total salary near the end of their job term (usually about four months). Thus, I would pay the Treasurers $2,800 ($700 x 4 months) at the end of their job.

These jobs allow the students to earn classroom money for in-class privileges and to spend at the class auction that I hold at the end of the school year. See the auction information later in this packet. The jobs also give students the experience of filling out applications, assuming responsibilities, and working to complete their assigned duties.

Money Math
Class Money System



End-of-the-Year Auction

Teacher Notes

At the end of the year each of my classes has an auction to give the students a chance to spend the classroom money that they have earned throughout the year. (I try to give them other opportunities to spend their money during the year also, because students often need some immediate gratification as well.) (Students can also bring in items from home for small auctions during the year, if desired.)

Each class holds their own auction, bidding only on those items that have been donated specifically for the auction of that particular class. If a higher value item has been donated generally I allow all of the students, in any class, a chance to bid on the item on a day before the main auction.

We collect items for the End-of-the-Year Auction throughout the year, relying on the donations of parents, businesses, and the students themselves. I pass out a letter about the auction at Open House (see sample letter on the next page) and make copies of these letters available to students during the year. Make sure that these letters are on official school stationary in order to create a greater impact. I require a signed parent form for all donations brought from home. I also pay the students with class money for auction items that they bring in or donations they attract. Participation is key!

Another great idea that I have heard teachers use is to have students write letters to businesses at the beginning of the school year explaining our classroom money system and inviting the businesses to donate an item for our auction. Imagine the packages that might arrive at the school and the excitement that could be created! Then, find a place to store the items until the end of the year.

Some of the auction items donated in my classes this year were a Kit-Cat clock, gift certificates from Starbucks, Baskin Robbins, Jamba Juice, Burger King, etc., giant candy bars, games, CDs, DVDs, watches, movie tickets, and more. In short, anything appropriate that a middle school student would like is acceptable.

Before the auction I make sure that <u>all money has been banked</u> and that the bankers have notified each student with the money amount that is in their account. The bankers also keep track of the money spent during the auction, subtracting the amounts spent, and making sure that no student bids more than the amount that they actually have.

During the auction I start with the most expensive or most in-demand items and work my way toward the less expensive items. In this way students don't end up waiting for that big item at the end, lose the bidding, and end up with nothing.

Bidding is done silently. I simply hold up an auction item and state the starting bid. Students that are interested raise their hand and keep it up as the bid price continues to climb. As the bid increases hands will begin to go down until only one is left--the winner. This method avoids a lot of chaos.

Finally, remind students that if they get the item they want it is OK to spend their whole savings if necessary. At the end of the auction their hard-earned classroom money will be <u>worthless</u>.

Money Math

Class Money System

Teacher Tips

Lesson Description: The Classroom Money System is a fun, educational way to help manage a classroom and at the same time provide students with foundational experiences of applying for jobs, holding a job, saving money, spending money, and using a checking account.

Math Content: Money Skills

Time Required: To be used throughout the school year

The Classroom Money System includes:

* 7 Class Cash pages including **two** sets of class money and Money System Teacher Notes
* 4 Check pages including classroom checks, check registers, and Checking Teacher Notes
* 2 Classroom Jobs pages including a job application and Classroom Jobs Teacher Notes
* 2 Auction pages including Sample Auction Letter and Auction Teacher Notes
* 1 Classroom Money System Teacher Tips page
* 1 Classroom Money System Cover Sheet **17 pages in all!!**

Materials Needed: Colored paper (recommended)

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

The Classroom Money System is part of a classroom management system that helps motivate students, reinforce math concepts in a realistic context, and instill in the students some of the financial foundations needed for success in life. The students enjoy having jobs, earning money, and especially spending money in classroom situations and at the much anticipated End-of-the-Year Auction.

Teacher Tips:

The Teacher Tips are all included in the Teacher Notes presented within this packet.

Middle School Math Treasures Newsletter:

To receive Digital Lesson.com's Middle School Math Treasures newsletter please visit our website at www.digitallesson.com and enter your e-mail address in the subscription box . You will then become eligible to receive new math resources, ideas, and activities that are included in each newsletter. You may unsubscribe at any time using the link in our newsletter.

Enjoy your lesson!
Mark

Money Math

Tipping

Money Math
Tipping

I. The Basics: When dining at a sit-down restaurant, it is customary to leave a tip for the waiter who has served you during the meal. Traditionally, this tip is understood to be 15%. For superior service a diner may tip 20% or more and inferior service may lead to a tip of 10% or less.

Remember that waiters depend on tips for a large part of their income. They often make a minimum hourly wage, with the majority of their pay coming from tips.

Since most people do not carry a calculator when they go out to eat, it is helpful to know how to figure out a tip using mental math. Suppose that a restaurant bill, for a family of four, was $29.82 before tax.

Estimate a 10% tip mentally:
It is actually quite easy to determine 10% of the bill. Since tips do not need to be exact numbers, first round $29.82 off to $30.00. To find 10% of this number, simply move the decimal point one place to the left. What you are actually doing is dividing the number by 10. Thus, 10% of $30.00 is $3.00.

Estimate a 15% tip mentally:
To find a 15% tip, take the amount of a 10% tip and add another 5% (half of the 10% amount) to this amount. In the above example, 10% of a $30.00 meal is $3.00. Another 5% of $30.00 would be half of $3.00, or $1.50. Adding 10% ($3.00) and another 5% ($1.50) gives you a total of 15% or $4.50.

Estimate a 20% tip mentally:
To find a 20% tip simply figure 10% of the bill and then double that amount. Since 20% is twice as much as 10%, it follows that a 20% tip will be twice as much as a 10% tip. In like manner, a 30% tip can be found by determining a 10% tip and then multiplying this amount by three.

II. Work through the following example using the “tips on tips” above.

The Johnson family had dinner at a fancy restaurant. Before taxes, the bill was $118.64. In the space below round off the bill and then determine an appropriate estimate for a 10% tip, a 15% tip, and a 20% tip.

Round off the bill.	10% Tip	15% Tip	20% Tip

Money Math
Tipping

Page 3 - The Waiter

Jon Bell is a waiter at The Royal Crown, a popular five-star restaurant. This first-class restaurant serves expensive meals and Jon was thrilled to have gotten a job there. He knows that 15% of a meal at The Royal Crown will earn him significantly more money than 15% of a meal at his former restaurant, The Burger Barn. Jon is paid $5 per hour plus tips.

On a recent 4-hour evening shift at The Royal Crown, Jon served the following tables. Use mental math to estimate the tip he received from each party he served. Then calculate his total tip earnings that night. He leaves 10% of his tip for the busboys and takes home the rest.

Table Number	**Bill before tax**	**% Tip**	**Tip Amount ($)**
Table 1	$84.32	20%	_____
Table 2	$99.75	15%	_____
Table 3	$63.60	15%	_____
Table 4	$77.89	10%	_____
Table 1	$109.72	15%	_____
Table 2	$53.42	20%	_____
Table 3	$87.91	5%	_____
Table 4	$47.59	15%	_____
Table 2	$36.24	15%	_____
Table 4	$132.14	20%	_____

Total amount of tips earned by Jon: _____

Less 10% of tips left for busboys: _____

Jon's take home tip total: _____

Including tips, about how much did Jon make per hour that evening? _____

Money Math
Tipping

Teacher Tips

Lesson Description: Tipping is a lesson designed to teach students how to mentally compute common tips (10%, 15%, and 20%) that are traditionally left when dining in a restaurant. It teaches students how to figure these tips, presents them with realistic restaurant tipping exercises, and looks at the earnings of a waiter working an evening shift at a first-class restaurant.

Math Content: Mental Math, Percents

Time Required: 1 class period or homework assignment

Tipping includes:

* 3 Tipping worksheets
* 3 Tipping worksheet Answer Keys
* 1 Tipping Teacher Tips page

Materials Needed: None

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Teaching students mathematics in a practical context, such as leaving an appropriate tip at a restaurant, will increase the financial literacy and life skills of students. Student number sense will also increase as they mentally calculate 10, 15, and 20 percent tips. As we have discussed high school and college jobs, many students are surprised to see the potential earning power of a waiter at a nice restaurant. For all of these reasons, Tipping is a lesson that will serve your students well.

Teacher Tips:

* Review and discuss Tipping page 1 with students.
* As an extension activity, have the students find the total cost of a meal with tax and tip.
* Make the lesson relevant to students by discussing their experiences in restaurants with waiters. Have they experienced terrible or excellent service? Discuss tips.

Middle School Math Treasures Newsletter:

To receive Digital Lesson.com's Middle School Math Treasures newsletter please visit our website at www.digitallesson.com and enter your e-mail address in the subscription box . You will then become eligible to receive new math resources, ideas, and activities that are included in each newsletter. You may unsubscribe at any time using the link in our newsletter.

Enjoy your lesson!
Mark

Money Math

Making Change

Money Math

Making Change

The Basics

The Basics:

Whenever you purchase an item or group of items, and pay with cash, you will probably receive change. People often receive incorrect change and may not even realize it. In order to become a confident consumer, it is important to understand how to mentally calculate the change that you should receive. There are several ways to do this. One method of calculating change is explained here.

First, add the number of dollars to the purchase price that are required to equal one dollar less than the amount you give to the cashier. Then, calculate the number of cents that must be added to the cents of the purchase price to make the final dollar. Finally, add these two amounts together.

For example, let's say you go to the supermarket and spend $12.43. You give the cashier a $20 bill. In order to calculate your change figure out how many dollars you would add to $12 to get one less than $20, or $19. The answer is $7. Then calculate the number of cents that need to be added to 43 cents to make the final dollar. The answer is 57 cents. Therefore, the change that you will receive from a $20 bill, when you spend $12.43, is $7.57.

Purchase Price	Size Bill Paid With	Dollars To Add	Cents To Add	Change Received
$8.71	$10.00	1	29	$1.29
$14.26	$20.00			
$3.59	$10.00			
$17.38	$20.00			

Money Math

Making Change

_____

_____

_____

Changing Speed (1 of 2)

For each purchase price below determine the change that should be received.

	Purchase Price	Size Bill	Change		Purchase Price	Size Bill	Change
1.	$7.18	$10	_____	11.	$6.09	$10	_____
2.	$5.42	$20	_____	12.	$18.63	$20	_____
3.	$16.89	$20	_____	13.	$2.48	$5	_____
4.	$1.24	$5	_____	14.	$15.22	$20	_____
5.	$12.91	$20	_____	15.	$18.97	$20	_____
6.	$9.56	$20	_____	16.	$0.19	$10	_____
7.	$0.72	$1	_____	17.	$8.76	$10	_____
8.	$14.14	$20	_____	18.	$3.82	$20	_____
9.	$8.51	$10	_____	19.	$11.11	$20	_____
10.	$3.37	$5	_____	20.	$9.21	$10	_____

Bonus Buy: $873.56 $1,000 _____

Money Math
Making Change

Teacher Tips

Lesson Description: Making Change is a lesson designed to teach students how to mentally compute the correct change that should be returned after a purchase. It explains how to compute change mentally and includes two speed drills (called "Changing Speed") to reinforce this concept.

Math Content: Mental Math, Decimals, Money

Time Required: Part of 1 class period or 1 homework assignment

Tipping includes:

* 1 Making Change basics worksheet and 1 Making Change basics answer key
* 2 Making Change speed drills and 2 Making Change speed drill answer keys
* 1 Making Change Teacher Tips page

Materials Needed: None

Suggested Grade Level: 5th - 8th

Teacher Testimonial:

Teaching students mathematics in a practical context, such as calculating the correct change expected after a purchase, will increase the financial literacy and life skills of students. Student number sense will also increase as they mentally calculate the correct change. We have all had experiences with employees incorrectly returning change to us. IT PAYS to be able to calculate correct change mentally!

Teacher Tips:

* Review and discuss the Making Change basics page with students.
* Use one or both of the speed drills to complete your lesson. Award speed prizes if you want.
* Make the lesson relevant to students by discussing their experiences in receiving change. Have they ever gotten too little back? Too much back?
* There is more than one way to compute change. Discuss others ways as needed.

Middle School Math Treasures Newsletter:

To receive Digital Lesson.com's Middle School Math Treasures newsletter please visit our website at www.digitallesson.com and enter your e-mail address in the subscription box . You will then become eligible to receive new math resources, ideas, and activities that are included in each newsletter. You may unsubscribe at any time using the link in our newsletter.

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Mark

Digital Lesson.com Presents

Marvelous Middle School Math

Fantastic Middle School Math Games

By Mark P. Tully

Fantastic Middle School Math Games

Target Number, Capture the Quads, Function Factory, Fraction Golf, Pico Fermi Bagel, Pest Patrol, The Inner Circle, Get There First, 25 or Bust!, Math Bingo, Finding Factors, and Mathegories Overhead Version

Printable game sheets included!

About the Author

Fantastic Middle School Math Games was written and compiled by Mark Tully. Mark is currently a mathematics teacher at Oak Middle School in the Los Alamitos Unified School District, Los Alamitos, California. He has been teaching for 26 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. It offers engaging, standards-based math lessons, projects, and games to enhance your middle school math program. Also included on the site are free printable math games, Mathegories (Jeopardy-style) PowerPoint games, math articles, and other math resources tailored to the middle school math teacher.

Mark also publishes the ***Middle School Math Treasures*** newsletter. To receive Digital Lesson.com's Middle School Math Treasures newsletter please visit our website at www.digitallesson.com and enter your e-mail address in the subscription box . You will then become eligible to receive new math resources, ideas, and activities that are included in each newsletter. You may unsubscribe at any time using the link in our newsletter.

We would love to hear about your experiences using this book, ***Fantastic Middle School Math Games***, in your classroom. Please e-mail us with any comments at digitallesson@yahoo.com.

Enjoy!

Mark Tully
www.DigitalLesson.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 games in this book strive to place mathematics into an active context that is inherently interesting. The games are fun and include meaningful mathematics that will challenge students.

Instant

The lessons, projects, and games at Digital Lesson.com are instantly available. Upon receipt of payment a link to your lesson, project, or game is automatically sent to you via e-mail. Save the 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, projects, and games are included. I have seen far too many great ideas for lessons on the internet that would take hours of time and effort to format before they would be ready to use. 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 I have seen and received over the years leave it up to teachers to use trial and error before they are able to teach the lesson effectively. The tips will immediately empower the teacher to teach the lesson more effectively.

Standards Based

Finally, the math lessons, projects, and games 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 an excellent math teacher!

Mark P. Tully
Founder, DigitalLesson.com

Fantastic Middle School Math Games

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