



PowerHour

:making minutes count



BOYS & GIRLS CLUBS
OF AMERICA

ROSS®

RECHARGED FOR THE 21ST CENTURY



Activity Book:
3-5 Math

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SECTION 1: INTRODUCTION

Program Overview

Power Hour: Recharged for the 21st Century: Elementary Edition is designed to develop the abilities young people need most in order to be college- and career-ready in the 21st century – including skills such as collaboration, knowledge construction, accessing and analyzing information, critical thinking and problem-solving, effective written and verbal communication.

The recharged Power Hour program enables Club members to develop many of these skills through intensive homework assistance that matches the rigor of today's homework trends. Most importantly, the new version of Power Hour embraces technology not as a tool to be used occasionally for completing homework, but as the centerpiece of engaging activities youth complete in each after-school session. Members use technology to enhance their learning and work collaboratively with their peers and Club staff to develop academically.

Power Hour also includes an extensive focus on the reading and mathematics skills that students need for success after high school, and this Lesson Guide directly addresses that need. Based on the Common Core State Standards – a set of clear, consistent guidelines for what every student should know and be able to do in math and language arts from kindergarten through grade 12 – the lessons included here provide review, practice and reinforcement for youth in essential reading and math skills.

Through their participation in the Power Hour program, Club youth will be more prepared than ever to enter the workforce and higher-education institutions with the skills needed to compete globally and to experience success in their academic and vocational pursuits.

SECTION 1: INTRODUCTION

The Power Hour Lesson Guide

The purpose of this Power Hour Lesson Guide is to give Club staff, volunteers, peer mentors and other tutors easy-to-use lessons for reinforcing essential reading and math skills in Club youth.

- Lessons can be completed in 25 to 30 minutes.
- Tutors can work with youth individually or in small groups
- Each lesson can be completed with a minimum of preparation.
- Tutors do not need prior knowledge of the subject in order to facilitate a lesson.
- Individual lessons are designed for youth in grades K-2 or in grades 3-5 and can be used with members in any of those grade levels.
- The content of a lesson may present new learning for members at the lower end of the grade spectrum, or it may offer practice and reinforcement for youth in higher grades.
- Lessons often feature an engaging game to provide skill practice or reinforcement.

SECTION 1: INTRODUCTION

Facilitating the Lessons

The following are some simple guidelines for using the lessons effectively with youth.

1. **Become familiar with the lesson format.** Each lesson is structured for ease of use, featuring three simple steps:



GET READY – a brief review of a specific topic youth are learning about in school



GET SET – a guided practice to give youth a chance to check their understanding



AND GO! – a game or independent practice in which youth try the skill on their own

2. **Select an appropriate lesson.** The lessons do not have to be completed in any particular order, but because topics and skills are sequenced from basic to more advanced skills, an order is recommended. There are several options for selecting a lesson:

- Match the lesson to the topic or skill members are working on currently in school.
- Talk to members about areas where they are having trouble or need help, and select a lesson that most closely fits their needs.
- Select an earlier lesson that focuses on basic skills, if you have a mixed group or are unsure about the skill level of members. Choose a lesson at a level where members can work with some success and then move gradually to the next level of difficulty.

3. **Prepare for the lesson.** Once you've selected a lesson, follow these steps to get started:

- Download the lesson materials.
- Complete the basic preparations (such as making copies or gathering materials).
- Read through the lesson quickly to become familiar with the content and process.

4. **Lead the lesson.** In leading the lesson, keep in mind the following:

- Keep the lesson simple, focusing on the one or two skills being reviewed.
- Allow members to complete the independent practice or game on their own.
- Encourage more advanced members to help younger peers or those who need help.

SECTION 1: INTRODUCTION

Facilitating the Lessons, cont.

5. **Check for understanding.** At the end of each lesson:

- Check to make sure members understand the concepts and are able to do the skills.
- Walk them through the lesson again if they need additional reinforcement.
- Encourage them to access one of the websites listed (“Additional Resources”) so they can practice on their own through a fun game.
- Take note of where members succeed or need more practice so you can select future lessons to give them more practice or challenge.

SECTION 1: INTRODUCTION

General Tutoring Guidelines

The Resource Guide for PowerHour: Recharged for the 21st Century (Elementary Edition) includes detailed guidelines for using volunteers in the program – including what to look for in volunteers, where to find volunteers, strategies for engaging volunteers, interview and assessment techniques and peer-to-peer tutoring (see “PowerHour Staff and Volunteers”).

The following general guidelines are designed to help you in preparing potential tutors to work with Club members in reading and mathematics. You may want to use these guidelines in a formal training session with tutors or have an informal conversation with them.

Know yourself: the role of the tutor is to provide experience, guidance and encouragement, but you’re not expected to have all the answers.

- Have a clear idea of your own strengths and limitations and what skills or knowledge you can offer as a tutor.
- Don’t be afraid to show that you don’t know something. You can refer members to other sources, including their teacher. You also can model how to solve a problem – showing that you are in a learning process as well.

Know your members: by getting to know individual members, you can discover their strengths and challenges in learning.

- Listen closely to members so you can help them work out the real problem. Read the signals (when they are comfortable, uncomfortable, enjoying themselves) to see how engaged they are and to see if they really understand something.
- Take short breaks when needed. If members seem bored, it may mean they’re having a hard time and would rather do something else.

Build trust and safety: if members feel safe not to succeed at first, they’ll see that learning is a process that often involves unsuccessful tries.

- Be aware that all learners are different. Do not try to change the member’s style; since you are the more experienced person, it is your job to adjust or adapt.
- Do not tease or make jokes at the member’s expense. Your job is to support and encourage the member to do his or her best.
- Be a good listener and a positive role model.

SECTION 1: INTRODUCTION

General Tutoring Guidelines, cont.

- Give positive feedback but don't exaggerate their accomplishments. If they are incorrect, say so supportively ("No, that's not right, but it's a good guess").
- Celebrate members' achievements.

Teach members how to learn: by building confidence and competence, you help members strengthen the ability to learn on their own.

- Make things easy for members to understand. Give different examples or think of alternative ways to explain something.
- Use reflective questions that will help them think through the problem and be self-directed (such as "How do you think we can find an answer to this?"). Partner with them to assist them in finding the answers themselves.
- Build on what members know ("What are some things you already know about this?"). Help them find a connection between new learning and something they know. If they need to repeat a lesson, do it as often as necessary – but use less support with each repetition. This provides scaffolding for members to move to the next level.
- Do not do the work for them; this does not teach or help them.

SECTION 1: INTRODUCTION

Tips for Mathematics Tutors

Keep it simple. Be aware of how a member is being taught math, and don't teach strategies and shortcuts that conflict with the approach the teacher is using. If math makes you nervous, try not to communicate this to members. Share only what is helpful, not harmful.

Connect math to life. Explore math in everyday life. When members realize that math is all around them, they begin to relax and see its meaning in their lives.

Check for understanding. Ask members to explain their problem-solving process so you can understand their reasoning.

Model mathematical thinking. Be a problem solver, pose questions and find solutions. Talk about how things are alike and different and explain your thinking.

Ask guiding questions. When helping members with math concepts, ask questions to guide them through the process, such as "Where do you begin?" or "What do you need to find out?" These kinds of questions encourage members to think on their own and identify the process needed to solve the problem.

Lead by example. Let members know that you were once a student who struggled sometimes. If you encounter a stumbling block during a lesson, lead by showing members how to overcome it. (For example, you might say, "I remember getting stuck with this kind of problem. Let's take a look at the textbook and see what it says.")

Let members do their own work. If you do a problem for them, even just a little, you send the message that members aren't able to do it. This does more harm than good.

SECTION 1: INTRODUCTION

Tips for Mathematics Tutors, cont.

Teach vocabulary. When members learn math vocabulary, it can help them understand the concepts. Even if a member is unable to recall how to solve a particular problem, the vocabulary associated with it can give insight to solving it.

Use diagrams. Math is a complex subject to learn and should be approached with drawings and diagrams to promote understanding (for example, “Can you show me in a drawing how you got this answer?”)

Sources:

U.S. Department of Education. (2003, May). Homework tips for parents. Office of Intergovernmental and Agency Affairs. Retrieved from <https://www2.ed.gov/parents/academic/involve/homework/homeworktips.pdf>

Palumbo, D. (2009, February 24). Five simple tutoring techniques for teaching math. Retrieved from <http://www.homeworkhelptoday.com/2009/02/five-simple-math-tutoring-techniques-for-teaching-math/>.

SECTION 2

Lessons Correlated to Common Core State Standards

In 2010, states across the country adopted a set of high-quality academic standards in mathematics and English language arts/literacy designed to outline skills young people should be able to master by the end of each grade. The lessons in this guide have been specifically designed to meet the more rigorous academic needs of students in Clubs across the country, and the following chart details which standard each lesson is designed to address.

Standards for Mathematical Content and Practice (3-5): Operations and Algebraic Thinking			
CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
3.OA.1	Interpret products of whole numbers.	Lesson 1 – Same But Different	recognizing area; understanding area measurement; relating area to multiplication and addition; using formulas to state relationship between length, width and area
3.OA.3	Use multiplication and division within 100 to solve word problems.	Lesson 6 – Express Yourself	using operations, expressions and equations

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
3.OA.4	Determine the unknown whole number in a multiplication or division equation with three numbers.	Lesson 1 – Same But Different	recognizing area; understanding area measurement; relating area to multiplication and addition; using formulas to state relationship between length, width and area
		Lesson 6 – Express Yourself	using operations, expressions and equations
		Lesson 7 – Snare	using operations, expressions and equations
		Lesson 8 – The Great Macaroni Plot	collecting information; graphing data on a line plot
		Lesson 10 – Function Machine	understanding patterns; seeing relationships between numbers; using functions
3.OA.6	Understand division as an unknown-factor problem.	Lesson 1 – Same But Different	recognizing area; understanding area measurement; relating area to multiplication and addition; using formulas to state relationship between length, width and area
		Lesson 6 – Express Yourself	using operations, expressions and equations
		Lesson 7 – Snare	using operations, expressions and equations
		Lesson 8 – The Great Macaroni Plot	collecting information; graphing data on a line plot
		Lesson 10 – Function Machine	understanding patterns; seeing relationships between numbers; using functions

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
3.OA.7	Fluently multiply and divide within 100.	Lesson 7 – Snare	using operations, expressions and equations
		Lesson 8 – The Great Macaroni Plot	collecting information; graphing data on a line plot
		Lesson 10 – Function Machine	understanding patterns; seeing relationships between numbers; using functions
4.OA.1	Interpret a multiplication equation as a comparison.	Lesson 6 – Express Yourself	using operations, expressions and equations
		Lesson 7 – Snare	using operations, expressions and equations
		Lesson 8 – The Great Macaroni Plot	collecting information; graphing data on a line plot
		Lesson 10 – Function Machine	understanding patterns; seeing relationships between numbers; using functions
4.OA.4	Find all factor pairs for a whole number in the range 1-100. .	Lesson 7 – Snare	using operations, expressions and equations
		Lesson 10 – Function Machine	understanding patterns; seeing relationships between numbers; using functions

Standards for Mathematical Content and Practice (3-5): Measurement and Data

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
3.MD.2	Measure and estimate volumes and masses of objects using standard units.	Lesson 8 – The Great Macaroni Plot	collecting information; graphing data on a line plot
		Lesson 9 – How Big is Your Hand?	understanding measurement in terms of length, area and volume; understanding the role of measurement in answering questions and solving problems
3.MD.3	Draw a scaled picture graph and scaled bar graph to represent a data set with several categories.	Lesson 1 – Same But Different	recognizing area; understanding area measurement; relating area to multiplication and addition; using formulas to state relationship between length, width and area
		Lesson 8 – The Great Macaroni Plot	collecting information; graphing data on a line plot
		Lesson 9 – How Big is Your Hand?	understanding measurement in terms of length, area and volume; understanding the role of measurement in answering questions and solving problems

Standards for Mathematical Content and Practice (3-5): Measurement and Data

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
3.MD.4	Generate measurement data; show the data by making a line plot.	Lesson 8 – The Great Macaroni Plot	collecting information; graphing data on a line plot
		Lesson 9 – How Big is Your Hand?	understanding measurement in terms of length, area and volume; understanding the role of measurement in answering questions and solving problems
3.MD.5	Recognize area as an attribute of plane figures and understand concepts of area measurement.	Lesson 1 – Same But Different	recognizing area; understanding area measurement; relating area to multiplication and addition; using formulas to state relationship between length, width and area
		Lesson 9 – How Big is Your Hand?	understanding measurement in terms of length, area and volume; understanding the role of measurement in answering questions and solving problems
		Lesson 11 – Don't Fence Me In	understanding relationship between area and perimeter
		Lesson 12 – Creating Shapes	understanding and measuring area and perimeter
3.MD.6	Measure areas by counting unit squares.	Lesson 1 – Same But Different	recognizing area; understanding area measurement; relating area to multiplication and addition; using formulas to state relationship between length, width and area
		Lesson 11 – Don't Fence Me In	understanding relationship between area and perimeter
		Lesson 12 – Creating Shapes	understanding and measuring area and perimeter

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
3.MD.8	Solve real-world and mathematical problems involving perimeters.	Lesson 11 – Don't Fence Me In	understanding relationship between area and perimeter
		Lesson 12 – Creating Shapes	understanding and measuring area and perimeter
4.MD.2	Use the four operations to solve word problems involving distances, volume and mass.	Lesson 9 – How Big is Your Hand?	understanding measurement in terms of length, area and volume; understanding the role of measurement in answering questions and solving problems
		Lesson 11 – Don't Fence Me In	understanding relationship between area and perimeter
		Lesson 12 – Creating Shapes	understanding and measuring area and perimeter
4.MD.3	Apply the area and perimeter formulas for rectangles in real-world and mathematical problems.	Lesson 11 – Don't Fence Me In	understanding relationship between area and perimeter
4.MD.4	Make a line plot to display a data set of measurements.	Lesson 8 – The Great Macaroni Plot	collecting information; graphing data on a line plot
5.MD.3	Recognize volume as attribute of solid figures; understand concepts of volume measurement.	Lesson 9 – How Big is Your Hand?	understanding measurement in terms of length, area and volume; understanding the role of measurement in answering questions and solving problems
5.MD.4	Measure volumes by using unit cubes, cubic cm, cubic in, cubic ft, and improvised units.	Lesson 9 – How Big is Your Hand?	understanding measurement in terms of length, area and volume; understanding the role of measurement in answering questions and solving problems
5.MD.5	Relate volume to operations of multiplication/addition; solve real world problems involving volume.	Lesson 9 – How Big is Your Hand?	understanding measurement in terms of length, area and volume; understanding the role of measurement in answering questions and solving problems

Standards for Mathematical Content and Practice (3-5): Number and Operations in Base Ten

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
3.NBT.3	Multiply one-digit whole numbers by multiples of 10 using strategies based on place value.	Lesson 2 – What Do Numbers Mean?	understanding place value and the decimal system
		Lesson 3 – High, Middle, Low	using place value to compare numbers; exploring relative size of numbers
4.NBT.1	Recognize that digit in one place represents ten times what it represents in place to its right.	Lesson 2 – What Do Numbers Mean?	understanding place value and the decimal system
		Lesson 3 – High, Middle, Low	using place value to compare numbers; exploring relative size of numbers
4.NBT.2	Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form.	Lesson 2 – What Do Numbers Mean?	understanding place value and the decimal system
		Lesson 3 – High, Middle, Low	using place value to compare numbers; exploring relative size of numbers
5.NBT.1	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.	Lesson 2 – What Do Numbers Mean?	understanding place value and the decimal system
		Lesson 3 – High, Middle, Low	using place value to compare numbers; exploring relative size of numbers
5.NBT.2	Explain patterns in the number of zeros or the product when multiplying by powers of 10.	Lesson 2 – What Do Numbers Mean?	understanding place value and the decimal system
		Lesson 3 – High, Middle, Low	using place value to compare numbers; exploring relative size of numbers

Standards for Mathematical Content and Practice (3-5): Number and Operations - Fractions

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
3.NF.1	Understand a fraction $\frac{1}{b}$ as quantity formed by 1 part when a whole is partitioned into b equal parts.	Lesson 4 – Finding Fractions	understanding, comparing and creating fractions
		Lesson 5 – Dare to Compare	understanding fractions and decimals; converting fractions to percentage
3.NF.3	Explain equivalence of fractions; compare fractions by reasoning about their size.	Lesson 4 – Finding Fractions	understanding, comparing and creating fractions
		Lesson 5 – Dare to Compare	understanding fractions and decimals; converting fractions to percentage
4.NF.5	Express a fraction with denominator 10 as an equivalent fraction with denominator 100.	Lesson 5 – Dare to Compare	understanding fractions and decimals; converting fractions to percentages
4.NF.6	Use decimal notation for fractions with denominators 10 or 100.	Lesson 5 – Dare to Compare	understanding fractions and decimals; converting fractions to percentages
4.NF.7	Compare two decimals to hundredths by reasoning about their size.	Lesson 5 – Dare to Compare	understanding fractions and decimals; converting fractions to percentages

POWER HOUR

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LESSONS - 3-5 MATH

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SECTION 3

Vocabulary Words for 3-5 Math Lessons

Pour Hour Lesson	Word	Definiton
Lesson 1 – Same But Different	Rectangle	a flat shape with four straight sides (and all inside angles are right angles)
	Length	the distance from one end of something to another (or from one point to another)
	Width	the distance from one side of something to the other side
	Area	the amount of space inside the edges of a flat two-dimensional shape
	Formula	a special type of equation that shows the relationship between different things
Lesson 2 – What Do Numbers Mean?	Digit	a symbol used to make numbers (0, 1, 2, 3 and so on are the ten digits we use in numbers)
	Place value	the value of the digit based on where it is in the number (ones column, tens column, etc.)
	Decimal system	the number system we use every day, based on 10 digits (0, 1, 2, 3, 4, 5, 6, 7, 8, 9)
	Ones column	the column in a number that shows 0 to 9 (in the number 24, 4 is in the ones column)
	Tens column	the column in a number that shows 10 to 99 (in the number 56, 5 is in the tens column)
	Hundreds column	the column in a number that shows 100 to 999

Pour Hour Lesson	Word	Definiton
Lesson 2 – What Do Numbers Mean?	Thousands column	the column in a number that shows 1000 to 9999
Lesson 3 – High, Middle, Low	Place value	the value of the digit based on where it is in the number (ones column, tens column, etc.)
	Relative size	the size of a thing compared to the size of another thing
Lesson 4 – Finding Fractions	Fraction	a part of a whole that is divided into many equal parts
Lesson 5 – Dare to Compare	Fraction	a part of a whole that is divided into many equal parts
	Decimal	based on 10; numbers we use are decimal numbers because they are based on 10 digits
	Numerator	the top number in a fraction that says how many parts of a whole we have
	Denominator	the bottom number in a fraction that says how many parts the whole is divided into
	Percent	parts per 100, represented by the symbol %
Lesson 6 – Express Yourself	Operation	a familiar mathematical process such as addition, subtraction, multiplication and division (expressed by the symbols +, -, x, and ÷)
	Expression	a numerical statement that involves only numbers and operation symbols
	Equation	a true mathematical statement saying that two numbers or expressions are equal (sometimes called a “number sentence”)
	Word statement	a mathematical expression in words (a word statement for the expression $7 + 5$ is “add seven and five”)

Pour Hour Lesson	Word	Definiton
Lesson 7 – Snare	Operation	a familiar mathematical process such as addition, subtraction, multiplication and division (expressed by the symbols +, -, x, and ÷)
	Equation	a true mathematical statement saying that two numbers or expressions are equal (sometimes called a “number sentence”)
Lesson 8 – The Great Macaroni Plot	Data	a collection of facts (such as numbers or measurements)
	Sample	a small selection taken from a larger group to help us learn something about the larger group
	Line plot	a graph that uses points and lines to present information in a picture
	Range	the difference between the highest and lowest numbers in a group of numbers
	Mean	the total number of data collected divided by the number of samples, also called the “average”
	Median	the midpoint in a selection of sample data
Lesson 9 – How Big is Your Hand?	Size	how big something is
	Length	the distance from one end of something to another (or from one point to another)
	Area	the amount of space inside the edges of a flat two-dimensional shape
	Volume	the amount of space a solid three-dimensional object takes up
	Estimate	to find a value that is close enough to the right answer, using thought or calculation

Pour Hour Lesson	Word	Definiton
Lesson 10 – Function Machine	Function machine	a make-believe device that does secret operations (like multiplication) on numbers
	Input	a number we put into the function machine
	Outputs	the numbers that result when the function machine performs an operation on the input
	Function	a special relationship where each input has a single output
Lesson 11 – Don't Fence Me In	Area	the amount of space inside the edges of a flat two-dimensional shape
	Perimeter	the distance around the outside edges of a flat two-dimensional shape
Lesson 12 – Creating Shapes	Figure	a standard geometric shape (such as a square, rectangle or triangle)
	Area	the amount of space inside the edges of a flat two-dimensional shape
	Perimeter	the distance around the outside edges of a flat two-dimensional shape
	Square unit	a unit used to measure area; each side of the square measures one unit

Lesson: Area

Same But Different

Time: 25 minutes

Objective: Creating rectangles and measuring their area demonstrates the formula for multiplication: length times width equals area ($l \times w = a$). In this lesson, members create rectangles with given lengths and widths, record the measurements and develop multiplication equations to calculate the area of the rectangles. Each member uses 36 centimeter cubes to create as many rectangles as he/she can. By using the centimeter cubes, members are able to identify the dimensions of many different rectangles simply by counting the cubes.

Materials

- White board
- Dry-erase markers
- Measuring blocks
- Centimeter cubes (one set of 36 cubes per pair)
- Centimeter graph/grid paper

Additional Resources

[Finding the Area and Perimeter of Rectangles](#)

[Area Shape Game](#)

[Party Designer](#)

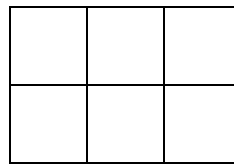


GET READY

5 min

1. **SAY:** Let's review how you find the area of a rectangle. Remember that the area of a shape is the amount of space inside it.
2. **DEMONSTRATE:** the process using blocks to create a rectangle:

$l = \text{length} = 3 \text{ blocks}$



$w = \text{width} = 2 \text{ blocks}$

3. **ASK:** What's the length of this rectangle?
Answer: **three blocks**
4. **ASK:** What's the width of the rectangle?
Answer: **two blocks**
5. **ASK:** If you count the total blocks, what is the area?
Answer: **six blocks**
6. **SAY:** There's a quicker way to find the area of the rectangle, and that is to multiply the number of blocks in the row by the number of blocks in the column.
7. **ASK:** So, if you multiply the number of blocks in the row here by the number of blocks in the column, what do you get?
Answer: **three times two = six**



GET SET

10 min

- SAY:** Now you're going to practice on your own. Use the small blocks to create as many rectangles as you can. Each small block represents a centimeter (cm).
- SAY:** After you create each rectangle, record its length and width.
- DO:** Draw a chart like this on the white board:

Rectangle		
Length (cm)	Width (cm)	Area (cm ²)

- ASK:** After you record the length and width, how do you find the area?
Answer: **multiply the length (l) times the width (w) to get the area (a)**
- SAY:** After you calculate the area, record it on your chart.
- WAIT:** Give members 10 minutes to create rectangles and record their dimensions.



AND GO!

10 min

- SAY:** Now we're going to write formulas for rectangles. A formula is a way of stating the relationship between things – like the relationship between length, width and area.
- SAY:** Use the formula $l \times w = a$ to describe the following rectangles:
 - $l = 2, w = 8, a = ?$
 - $l = 3, w = 5, a = ?$
 - $a = 12, l = 3, w = ?$
- WRITE:** Draw the following rectangles on the white board:
 - A – 6 rows, 4 columns
 - B – 4 rows, 6 columns
 - C – 6 rows, 6 columns
- SAY:** Now write formulas for these three rectangles. Answers: **A) $4 \times 6 = 24$; B) $6 \times 4 = 24$; C) $6 \times 6 = 36$**
- ASK:**
 - What surprises, if any, did you find when you were making your rectangles?
 - Where there any rectangles you could not make using all 36? Why?
 - How does making rectangles help you with multiplication?
- CHECK FOR UNDERSTANDING:** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Lesson: Patterns

Function Machine

Time: 25 minutes

Objective: Mathematics is, among other things, the study of patterns. Patterns help us understand all aspects of mathematics, because they organize geometric shapes, mathematical operations, data collection and mathematic procedures. One mathematical procedure is the function – a relation in which two pair of numbers are linked so one value in one pair that is associated with the value in the other pair. For example, 2 is linked to 4 with the function $+2$, and 3 with 5 and 11 with 13 and so on. In this lesson, members practice mathematical operations and find relationships between numbers using a made-up device called a “Function Machine.”

Materials

- White board
- Dry-erase markers
- Transparencies & Projector
- Pens/pencils

Preparation

Create an overhead transparency of “Sample Function Machine.” Make copies of “Find the Function” (one per pair).

Additional Resources

[Multiplication and Division Activities](#)



GET READY

5 min

1. **SAY:** We’re going to practice math functions with something called a “Function Machine.” This is a make-believe device that does secret operations on numbers. Those secret operations are called functions. For every number we put into the Function Machine, it will put out a new number.
2. **SAY:** Imagine a secret box where a number is put in and another number comes out. No matter what number goes in, the number that comes out always has the same relationship.
3. **ASK:** If we put in a 2 and a 4 comes out, put in 30 and 60 comes out, put in 11 and 22 comes out what is going on in the box? Answer: **every number that goes in is multiplied by two**
4. **SAY:** Numbers entered into the machine are called inputs and numbers that come out of the machine are called outputs.
5. **DO:** Show the overhead transparency of the “Sample Function Machine.”
6. **ASK:** What’s the machine doing to the input number? Answer: **it is adding 3; the function is $+3$**



GET SET

10 min

1. **DISTRIBUTE:** Give members a copy of “Find the Function.”
2. **DO:** Ask members to work in pairs to find the function for each of the machines on the top half and then figure out what the machines on the bottom are doing and complete the tables. Answer: **The three on the top half are $+4$, -9 and -4 . The three on the bottom are -7 , -14 and $+4$**



AND GO!

10 min

1. **DO:** Have members create three of their own function machines.
2. **INSTRUCT** them, when they are finished, to exchange with a partner and discover the functions.
3. **ASK:** What is the fewest number of input-output numbers required to discover function?
4. **CHALLENGE** members to create a function machine that includes more than one operation.
5. **CHECK FOR UNDERSTANDING.** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Sample Function Machine

Input	Output
1	4
2	5
3	6
4	7
5	8

Find the Function

Find the function for each of these three machines.

Input	Output
14	18
15	19
34	38
45	49
49	53

Input	Output
22	13
26	17
39	30
48	39
50	41

Input	Output
19	15
27	23
32	28
33	29
36	32

What is the machine doing? Complete the table.

Input	Output
19	
21	14
	23
40	33
46	

Input	Output
	15
41	
52	38
53	
	40

Input	Output
16	
18	22
	23
38	42
40	

Lesson: Problems

Don't Fence Me In

Time: 25 minutes

Objective: Using real-world problems – such as creating a fenced-in area – is a good way to help children appreciate the relationships between area and perimeter. In this lesson, members create an imaginary fenced-in area for animals and, as they do, learn about shapes and area.

Materials

- White board
- Dry-erase markers
- Graph paper (1 cm)
- Meter stick
- String
- Pens/pencils
- Tape

Preparation

Cut several pieces of string to 40 centimeters (one per pair) and another piece of string to 40 meters.

Additional Resources

[Area Shape Game](#)



GET READY

5 min

1. **SAY:** Today, we're going to imagine that we're building a fenced-in area for animals. We have just 40 meters of fencing to work with, so our perimeter will have to be 40 meters. We'll use a piece of string that is 40 centimeters long to model the actual fence.
2. **DO:** Show members the 40-centimeter piece of string.
3. **SAY:** Examine the piece of string and imagine that it is 40 meters long.
4. **DO:** Take members outside and have them use the 40-meter string to get an idea of how much area can be contained by it.
5. **SAY:** Our job is to use the string to create possible enclosures for the animals.



GET SET

5 min

1. **SAY:** You'll work in pairs to design your animal enclosure. Before you begin, decide what animal you're designing the area for.
2. **DISTRIBUTE:** Give each pair a 40-centimeter piece of string and one-centimeter grid paper.
3. **EXPLAIN** the instructions for the activity:
 - Use your piece of string to represent 40 meters of fencing.
 - Arrange the string on the grid paper to form enclosures of different shapes.
 - Each shape must have a perimeter of 40 centimeters (representing 40 meters).
 - Make some shapes with curved edges and some with straight edges.
 - Figure out what shape of enclosure provides the greatest area for the animal.



AND GO!

15 min

1. **INSTRUCT** members to draw their shapes on the grid paper, find the area of each and select the one they wish to choose for their animal.
2. **WAIT:** Give members 10 minutes to draw and measure their shapes.
3. **DO:** Have members share their drawings and place them on the white board.
4. **ASK:**
 - How did you figure the area of each shape?
 - Did you have a problem figuring the areas with curved edges? How did you solve it?
 - Which kinds of shapes have the largest area? The smallest area?
 - What have you discovered about creating areas with a fixed amount of fencing?
5. **CHECK FOR UNDERSTANDING:** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Lesson: Shapes

Creating Shapes

Time: 25 minutes

Objective: A shape is defined by its figure, its area and/or its perimeter. Figures can be described as standard geometric shapes such as squares, rectangles and triangles. Area, the region inside of the structure, is measured in squares such as square centimeters. Perimeter, the distance around the structure, is described in linear measurement such as centimeters or kilometers.

Materials

- White board
- Dry-erase markers
- Piece of string
- 5x5 (25 dot) geoboard dot paper (or actual geoboards)

Preparation

Cut several pieces of string to 40 centimeters (one per pair) and another piece of string to 40 meters.

Additional Resources

- [2D Shapes Jeopardy](#)
- [Shapes/Geometry](#)
- [2D and 3D Shape Sort Factory](#)



GET READY

5 min

1. **SAY:** Let's review area and perimeter.
2. **ASK:** What is area? Answer: **the space inside a shape or structure**
3. **ASK:** What is perimeter? Answer: **the distance around the edge of the structure**
4. **WRITE:** Draw a 5 x 5 (25-dot) figure on the white board to introduce the working area.
5. **DISTRIBUTE:** Give members geoboard dot paper and have them make the smallest squares they can.
6. **DO:** Have one member draw that same small square on the figure on the white board.
7. **SAY:** This square is what we're calling one square unit. You're going to draw different shapes on the dot paper and figure out how to calculate the area of the shape and its perimeter – by using this unit of measure.
8. **DO:** Have members to construct a 2 x 2 square (using the unit of measure just identified) on their dot papers and calculate the area of that square. Answer: **the area is 4**



GET SET

5 min

- DO:** Have members work in pairs to make a variety of shapes on the dot paper.
- INSTRUCT** them to include shapes with half units and figure out a way to calculate the area.
- ASK:**
 - How did you figure out the areas of the shapes?
 - Were some shapes difficult to calculate? What kinds of shapes? How did you do it?
 - What was the largest shape you could show on your dot paper? What was its area?
 - What is the smallest shape and what was its area?



AND GO!

15 min

- CHALLENGE** members to discover if there is a relationship between the area of a figure and its perimeter.
- INSTRUCT** them to examine figures with areas from 1 to 16.
- ASK:**
 - What are all the possible perimeters for each area?
 - Will you find more perimeters possible with larger areas?
 - What are the possible perimeters of a shape with an area of 1?

- WRITE:** Draw charts on the white board like the ones below and ask members to record their information on charts like this.

Area	Perimeter
1	
2	
3	
4	
5	
6	
7	
8	

Area	Perimeter
9	
10	
11	
12	
13	
14	
15	
16	

- ASK:**
 - What did you find out about geoboard shapes and their possible areas and perimeters?
 - What can you discover from our chart of possible perimeters?
 - Why are there no odd number perimeters?
- CHECK FOR UNDERSTANDING:** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Lesson: Place Value

What Do Numbers Mean?

Time: 25 minutes

Objective: In our number system, the value or worth of an individual digit depends on its place or location in the number. Each place has a value of 10 times the place to its right. Our system, called the decimal system, works the same way to the right of the decimal point, but here each digit's value is 10 times smaller than the digit to the left.

Materials

- White board
- Dry-erase markers
- Deck of cards

Preparation

Make copies of "Place-Value Game Board" (one per member). Remove face cards from the card decks (use only number cards and aces, which count as ones in this lesson).

Additional Resources

- [Place Value Hockey](#)
- [Counting Tens and Ones](#)
- [Number Sense: Tens](#)



GET READY

7 min

1. **SAY:** Let's review place value:

- Our numbers are all composed of nine digits: 0,1,2,3,4,5,6,7,8,9.
- In this system, called the decimal system, the amount that the digit represents depends upon its location, or place in the number. That's why it's the place value of the digit.
- In a number, each place has a value 10 times the place to its right.

2. **WRITE:** Draw this chart on the white board to summarize:

millions	hundred thousands	ten thousands	thousands	hundreds	tens	ones

3. **REVIEW** the different place values, writing in the different numbers as you explain:

- The number 9 stands for nine of something—objects, ideas, countries, etc.
- In the number 29, the number 9 is in the ones column; it also means nine of something.
- In the number 92, the number 9 is in the tens column; it means 9×10 or 90 of something.
- In the number 945, the 9 is in the hundreds column; means 9×100 or 900 of something.
- In the number 9,876, the 9 is in the thousands column, so it means 9×1000 or 9000.

4. **DO:** Ask members to add digits to the place-value chart and read the numbers they represent.



GET SET

8 min

- WRITE** these numbers on the white board.

7 8 6	8 7 6 5	1 2 436	2 01
9 07 656	41 6 831	78 5 4 0	6 3 94
4 321	4 5 942	323 2 4 5	3 4

- DO:** Have members identify the value of the digits in bold.
- WRITE** these groups of numbers on the white board one at a time, and have members add the missing numbers.

53 483				
50 000	3 000	?	80	3

746 087					
700 000	?	6 000	000	80	7

?					
600 000	80 000	0000	700	30	9

209 327					
?	00 0000	9 000	300	20	7



AND GO!

10 min

- SAY:** Now you're going to use strategy and knowledge to play a place value game to create the largest number you can.
- DISTRIBUTE:** Give members a deck of cards, a pen or pencil and a "Place Value Game Board."
- EXPLAIN** how to play the game:
 - Shuffle the deck and turn all the cards face down in a pile.
 - Members take turns drawing cards.
 - Each time a member gets a new number, he or she writes it in one of the digit positions.
 - The goal is to make the five-digit number as big as possible.
 - Members continue to draw until all five place values have been filled in.
 - Members read the number aloud.
 - The winner of the game is the player who creates the largest number.
- DO:** Play several rounds until members are comfortable with place value.
- DISCUSS** game strategy by asking: What place value position is the most important in creating the largest number?
- CHECK FOR UNDERSTANDING.** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Place Value Game Board

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

Lesson: Comparing Numbers High, Middle, Low

Time: 25 minutes

Objective: This game emphasizes place value to hundred and relative comparisons. It reinforces place-value concepts and reinforces the measurement standards in grades 3-5. Here, members explore the relative size of numbers.

Materials

- White board
- Dry-erase markers

Preparation

Cut index cards in half and number them 0 to 9 (one set per pair or team).

Game Strategy Tips:

Although the cards cannot be moved, the decision about high, middle and low can be changed when the player's turn comes. For example, if the player/team has the number 876, and they think it will be high – but the person or team right before says “high,” then he/she might have a nine. Any number with a nine can be high, so the player/team may want to change to “middle.”

Additional Resources

[Place Value Hockey](#)

[Counting Tens and Ones](#)

[Number Sense: Tens and Ones](#)



GET READY

5 min

1. **SAY:** Today we're going to take a look at comparing numbers – which are bigger and which are smaller.
2. **ASK:** Which is bigger, an elephant or a golden retriever? Answer: **elephant**
3. **ASK:** Which is bigger, a golden retriever or a mouse? Answer: **golden retriever**
4. **SAY:** So the golden retriever is both bigger and smaller – bigger than some animals and smaller than some animals.
5. **ASK:** Which is bigger, 100 or 10?
6. **ASK:** Which is bigger, 10 or 1?
7. **SAY:** The number ten, then, is both bigger and smaller.



GET SET

5 min

1. **WRITE:** Draw a chart like the one below on the white board.

Hundreds	Tens	Ones
9	2	7
0	3	8
1	2	3
4	5	6
9	3	0
8	7	6
8	6	7

2. **ASK:**

- Which is the largest number?
Answer: **930**
- Which is the smallest number?
Answer: **38**
- Which is bigger? 876 or 867?
Answer: **876**
- Why?
Answer: **It has a greater number in tens place**



AND GO!

15 min

1. **SAY:** You're going to play a game where you use strategy and knowledge of place value to create a winning high, middle or low number.
2. **EXPLAIN** the rules of the game.
 - The game can be played in pairs, with three players or in teams.
 - One member shuffles the cards and deals three to each player (or team).
 - Each player (or team) begins with three cards (the tenth card will not be used).
 - Each player (or team) thinks of a three-digit number using the numbers on the cards.
 - Players decide privately whether their number will be the high, middle or low number.
 - When all players have arranged their cards, they place them face down in front of them.
 - The cards cannot be rearranged after they are placed down.
 - Starting with the person who shuffled the cards, each player (or team) declares whether they think the number they have will be the high, middle or low.
 - The cards are turned over and compared.
 - Players with correct predictions get a point.
3. **ASK:** What have you learned about place value and relative size?
4. **CHECK FOR UNDERSTANDING.** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Lesson: Fractions

Finding Fractions

Time: 25 minutes

Objective: This lesson reinforces and extends member’s knowledge of fractions as parts of a whole. Using various lengths of paper, members create fractions for each whole. The purpose of the lesson is to create fractional parts to discover that fractions are relative numbers depending on the size of the whole piece. Using “benchmark” fractions (familiar common fractions such as $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{3}$), members compare fractions within the same whole piece.

Materials

- White board
- Dry-erase markers
- Adding Machine Paper (1 roll)
- Tape
- Colored Markers

Preparation

Make copies of “Finding Fractions” (one per member).

Additional Resources

- [Vector Kids: Fractions](#)
- [Fraction Flags](#)
- [Equivalent Fractions Bingo](#)



GET READY

7 min

1. **DISTRIBUTE:** Give members a variety of lengths of adding-machine tape.
2. **DO:** Have members fold their piece of tape in the middle so that each length is the same.
3. **DO:** Have them smooth the fold, then open the tape.
4. **ASK:** How many sections is your tape is folded into?

Answer: **two, these are halves**

5. **DO:** Have members refold the tape again, fold it in half and then open it.
6. **ASK:** Now how many sections does the tape have?

Answer: **four, these are fourths**

7. **SAY:** Fractions are made when we have a whole that’s divided into many equal parts.
8. **WAIT:** Give members the chance to create other lengths of tape with folds that make two, four or eight sections (to make halves, fourths or eighths).
9. **DO:** Place tape lengths on the wall or white board so members can remove them in order to compare with other strips.



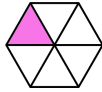
GET SET

8 min

- WRITE:** Draw a circle with a line down the middle and one half shaded.



- ASK:** When a whole is divided into two equal parts, what is each part?
Answer: **one half**
- WRITE:** Draw a six-sided figure with one section shaded.



- ASK:** When a whole is divided into six equal parts, what is each part? **one sixth**
- WRITE:** Draw a circle with five parts and shade two of the parts.



- ASK:** When the whole has five equal parts and two parts are shaded, what do we call the shaded part? Answer: **two-fifths**
- WRITE:** Draw a rectangle on the board divided into seven equal parts, with three shaded.



- ASK:** When there are seven equal parts to a whole and three are shaded, what is the shaded part? Answer: **three-sevenths**
- WRITE:** these fractions on the white board: $1/2$, $1/6$, $2/5$ and $3/7$.







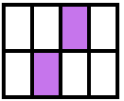







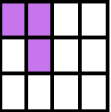
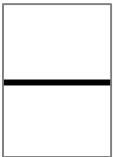


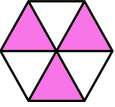





- SAY:** When we write fractions, remember that the number above the line tells how many parts we have (shaded parts). The number below the line tells how many equal parts the whole is divided into.



AND GO!

10 min

- DISTRIBUTE:** Give members copies of "Finding Fractions."
- DO:** Have them to look at the drawings and write fractions to say what part of the whole the shaded pieces are.
- WAIT:** Give members time to complete the fractions.
- ASK:**
 - What is a rule you can say about fractions? Answer: **a fraction is part of a whole**
 - Which is larger, one-half or one-fourth? Answer: **one half is larger than one-fourth**
 - Are all one-half pieces the same? Answer: **one-half of a large piece is bigger than one-half of a smaller piece**
 - Does this idea work with other things? Answer: **yes, with pizzas or objects that can be divided**
- CHECK FOR UNDERSTANDING** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

<p>a.  </p>	<p>b.  </p>	<p>c.  </p>
<p>d.  </p>	<p>e.  </p>	<p>f.  </p>
<p>g.  </p>	<p>h.  </p>	<p>i.  </p>
<p>j.  </p>	<p>k.  </p>	<p>l.  </p>

Lesson: Comparison

Dare to Compare

Time: 25 minutes

Objective: This lesson helps members see that fractions and decimals are two ways of expressing the same thing – the relationship of a part to a whole. Every fraction can be calculated by counting the number of parts of a whole – such one of two ($1/2$), one of three ($1/3$) or three of four ($3/4$). Fractions also can be expressed with decimals, which can be calculated by dividing the numerator (the number on top) by the denominator (the number on the bottom). For example, $1/2$ is equivalent to $1 \div 2 = 0.5$.

Materials

- White board
- Dry-erase markers
- Index cards
- Colored markers
- Transparencies & Projector

Preparation

Make an overhead transparency of “Fractions and Percentages.” Write each fraction and each decimal on its own index card (12 total).

Additional Resources

[Learn about Decimals](#)

[Fractions and Decimals Games](#)



GET READY

7 min

1. **SAY:** Let’s review what you know about fractions. Remember that fractions represent equal parts of a whole – or a part-to-whole relationship.
2. **WRITE:** Draw a square on the white board, with a line vertically through the center of the square.
3. **ASK:** What fractions does this represent?
Answer: $1/2$ and $1/2$
4. **WRITE:** an equation showing two halves added to equal the whole: $1/2 + 1/2 = 2/2$ or 1.
5. **SAY:** Sometimes it’s easier to convert fractions into decimals. For example, if you have five pennies, you wouldn’t say you have $5/100$ dollars – it would be easier to understand if you converted the amount to 0.05, which can be easily understood as 5 cents.
6. **ASK:** How can you express the part-to-whole relationship of the square using decimals.
Answer: the square drawing showing 0.5 and 0.5 ($0.5 + 0.5 = 1$)
7. **SAY:** One way of thinking about fractions is as division problems. You can express a fraction in decimals by dividing the numerator of a fraction (top number) by the denominator (bottom number.) For example, $1/2$ is the same as $1 \div 2 = 0.5$.
8. **SAY:** Remember that fractions and decimals are two ways of expressing parts of a whole.



GET SET

3 min

1. **SAY:** You're going to play a game to match fractions with decimals that are equal to them.
2. **EXPLAIN** the rules of the game:
 - Members can play individually or in pairs.
 - After the cards are shuffled, each player gets three cards.
 - The remaining cards are placed face-down in a pile.
 - Each player turns over one card and places it face-up beside the face-down pile.
 - The fractions or decimals on the two face-up cards are the target cards.
 - Beginning with the one who draws the larger number, players take turns drawing from the face-down deck.
 - If the player holds a card whose value is between or equal in value to one of the target numbers, the card is placed on either of the two face-up card piles.
 - If the player does not hold a card that is between or equal in value to one of the target numbers, the player must draw from the face-down pile.
 - The player may then play *any* card to either side of the pile.
 - Play continues until one player is out of cards.



AND GO!

15 min

1. **DO:** Show the overhead transparency “Fractions and Percentages” and tell members that they can use it as a reference during the game.
2. **WAIT:** Give members 15 minutes to play the game.
3. **SAY:** Every decimal fraction also can be converted to percentages if you multiply it by 100. For example, what percentage do we get by multiply 0.5×100 ?

Answer **50 percent, which is equivalent to $1/2$ or 0.05**
4. **CHALLENGE:** members to convert the decimal fractions to percentages.
5. **CHECK FOR UNDERSTANDING:** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Fractions and Percentages

$1/10$	$1/8$	$1/5$	$1/4$	$1/3$	$3/8$
0.10	0.125	0.20	0.25	0.33	0.375

$2/5$	$1/2$	$3/5$	$2/3$	$3/4$	$4/5$
0.40	0.50	0.60	0.67	0.75	0.80

Lesson: Expressions

Express Yourself

Time: 25 minutes

Objective: In this lesson, members practice using operations, expressions and equations. An operation is a familiar mathematical process such as addition, subtraction, multiplication and division (+, -, ×, ÷). An expression is a numerical statement that involves only numbers and operation symbols; examples includes $6 + 3$, $45 - 27$, $8 \times 5 - 2$. An equation is a statement saying that two numbers or expressions are equal. Examples include $7 + 2 = 11 - 5$ or $40 \div 5 = 8$.

Materials

- White board
- Dry-erase markers
- Transparencies & Projector
- Tape
- Markers

Preparation

Make an overhead transparency of “Warm-Up Equations.” Make a copy of “Round #1: True-False,” “Round #2: Find the Unknown” and “Round #3: Fill-in-the-Blanks” (one per pair) and post on the wall.

Additional Resources

- [Equation Games](#)
- [Matching Math](#)



GET READY

5 min

1. **DO:** Show the overhead transparency, “Warm-Up Equations.”
2. **DO:** Have members begin by solving the simple equations.



GET SET

5 min

1. **CHALLENGE** members to turn the following statements into expressions:
 - subtract four from nine Answer: $9 - 4$
 - multiply seven by five Answer: 7×5
 - add eight and seven and then multiply by two Answer: $(8 + 7) \times 2$
 - multiply four by six and then divide by eight Answer: $(4 \times 6) \div 8$
2. **DO:** Have members turn these expressions into equations (solve them):
 - subtract four from nine Answer: $9 - 4 = 5$
 - multiply seven by five Answer: $7 \times 5 = 35$
 - add eight and seven and then multiply by two Answer: $(8 + 7) \times 2 = 30$
 - multiply four by six and then divide by eight Answer: $(4 \times 6) \div 8 = 3$
3. **DO:** Ask members to turn the following expressions into word statements:
 - $7 + 5$ Answer: **add seven and five**
 - $8 - 6$ Answer: **subtract six from eight**
 - $18 \div 3$ Answer: **divide 18 by three**
 - 10×8 Answer: **multiply 10 by eight**



AND GO!

15 min

1. **SAY:** You're going to break into pairs and play a math challenge to practice operations and solving equations.
2. **DO:** Call attention to the sheets you have posted on the wall
3. **EXPLAIN** the challenge:
 - In round #1 (True-False), members mark the true equations with a "T" and mark the incorrect expressions with an "F."
 - In round #2 (Find the Unknown), members write in the correct operations symbols (+, -, ×, ÷) to make a true equation.
 - In round #3 (Fill-in-the-Blanks), members use only the digits 1 to 9 to make three equations that are all true. Each digit may be used only one time.
4. **WAIT:** Give members time to complete the challenge.
5. **REVIEW:** Make sure their responses are correct (see "Answer Key").
6. **CHECK FOR UNDERSTANDING:** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Warm-up Equations

1. $7 + 4 = \bigcirc$

2. $9 - 8 = \bigcirc$

3. $6 + 15 = \bigcirc$

4. $11 + 4 = \bigcirc$

5. $\bigcirc + 3 = 5$

6. $\bigcirc - 6 = 1$

7. $\bigcirc - 32 = 11$

8. $\bigcirc - 3 = 5$

9. $\bigcirc + 9 = 18$

10. $\bigcirc - 8 = 4$

11. $5 \times \bigcirc = 10$

12. $6 \times \bigcirc = 18$

13. $12 \div \bigcirc = 3$

14. $\bigcirc \div 9 = 1$

15. $\bigcirc \div 3 = 7$

16. $\bigcirc \div 5 = 4$

17. $\bigcirc \times 8 = 56$

18. $\bigcirc \div 3 = 7$

Round #1: True - False

$$7 + 5 = 12$$

$$8 \times 5 = 5 \times 8$$

$$3 \times 5 \times 2 = 30$$

$$8 - 6 = 14$$

$$8 \times 8 = 64$$

$$19 - 19 = 0$$

$$18 \div 3 = 21$$

$$12 \div 3 = 4$$

$$5 \times 5 = 2 \times 5 + 3 \times 5$$

$$10 \times 8 = 80$$

$$6 \times 4 = 24 \div 1$$

$$9 \times 0 = 9$$

Round #2: Find the Unknown

$$6 \underline{\quad} 1 \underline{\quad} 3 \underline{\quad} 10 = 11$$

$$4 \underline{\quad} 2 \underline{\quad} 3 \underline{\quad} 6 = 5$$

$$1 \underline{\quad} 8 \underline{\quad} 9 \underline{\quad} 4 = 0$$

$$3 \underline{\quad} 4 \underline{\quad} 6 \underline{\quad} 2 = 40$$

$$12 \underline{\quad} 4 \underline{\quad} 5 \underline{\quad} 2 = 16$$

$$5 \underline{\quad} 7 \underline{\quad} 7 \underline{\quad} 7 = 4$$

Round #3: Fill in the Blanks

$$\underline{\hspace{2cm}} - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}} - \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

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Lesson: Operations Snare

Time: 25 minutes

Objective: In this lesson, members use number lines and number cubes to practice addition, subtraction and multiplication. Members use their knowledge of operations to strategically add, subtract or multiply the numbers rolled so they can fill in as many numbers as possible on the number line. If they roll a 3 and a 5, for example, they can add them to get 8, subtract 3 from 5 to get 2 or multiply them to get 15. They will discover that some numbers cannot be created by using only two 1-6 number cubes.

Materials

- White board & Dry-erase markers
- 1-36 number line
- 2 1-36 number cubes
- 20-25 counters per member
- Transparencies & Projector

Preparation

Make an overhead transparency of "Possible Results."

Additional Resources

- [Calculator Chaos](#)
- [Mixed Math Mahjong](#)
- [Operation Snowman](#)



GET READY

5 min

1. **SAY:** Today we're going to practice basic mathematical operations.
2. **WRITE** the following equations on the white board and have members solve them:
 - $6 \bigcirc 4 = 10$
Answer: $6 + 4 = 10$
 - $5 \bigcirc 2 = 3$
Answer: $5 - 2 = 3$
 - $(5 \bigcirc 1) \bigcirc 6 = 10$
Answer: $(5 - 1) + 6 = 10$
 - $(5 \bigcirc 2) \bigcirc (2 \bigcirc 1) = 4$
Answer: $(5 - 2) + (2 - 1) = 4$
3. **ASK:** What operations could you fill in to make these equations true?
 - $6 \bigcirc 6 = 36$
Answer: $6 \times 6 = 36$
 - $5 \bigcirc 4 = 1$
Answer: $5 - 4 = 1$
 - $6 \bigcirc 3 = 3$
Answer: $6 - 3 = 3$
 - $6 \bigcirc 3 = 18$
Answer: $6 \times 3 = 18$

**GET SET**

5 min

1. **DO:** Call attention to the number lines, number cubes and markers and tell members that they are going to play a game.
2. **EXPLAIN** the game:
 - All players roll a number cube to see who goes first (highest roll).
 - The first player (or pair) begins by rolling both number cubes (like dice).
 - Using the two numbers on the cubes rolled (the number “snared”), the player can add them, subtract the smaller from the larger or multiply them.
 - The player then uses the “snared” number to cover one number on the number line.
 - Players take turns rolling the cubes and snaring numbers.
 - After 15 turns, the winning player is the one who has covered the most numbers.

**AND GO!**

15 min

1. **SAY:** As you play the game, think about which numbers are easier to cover and which numbers are harder to cover. Think about strategies you could use if a number combination can cover more than one number. For example, 6 and 6 would allow you to cover 12 or 36, 4 and 5 would allow you to cover

2. **DO:** Show the overhead transparency, “Possible Results.”
3. **SAY:** You can refer to this as you play. It lists possible results for each number. For example, there is only one way to get the number 36 – if you roll two sixes, you can multiply them.
4. **DISCUSS** the results of the game after members have finished.
5. **SAY:** You can see that with two number cubes, there is no way to create: 13, 14, 17, 19, 21, 22, 23, 25, 26, 27, 28, 31, 32, 33, 34 and 35.
6. **ASK:** What would happen if we added a third cube?

Answer: we could create more numbers; the number 13, for example, could be created with a 6, 6 and 1

7. **ASK:** What would happen if we added a 0 to the number line? How many ways can zero be created?

Answer: if 0 is added, any number can be multiplied by it to get 0

8. **CHECK FOR UNDERSTANDING:** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Possible Results

Number	1	2	3	4	5	6	7	8	9	10	11	12	15	16	18	20	24	30	36
Ways	4	6	5	6	4	5	3	3	3	2	1	2	1	1	1	1	1	1	1

Lesson: Data

The Great Macaroni Plot

Time: 25 minutes

Objective: Amounts of materials collected often vary from sample to sample. Creating a line plot provides a way to see the data graphically and analyze it. In this lesson, members measure the number of macaroni pieces in 10 samples, plot the information on two axes and then calculate the mean (the total number divided by the number of samples, commonly called the average) and the median (the midpoint in a selection of samples).

Materials

- White board
- Dry-erase markers
- Bags of small, dry elbow macaroni
- Very small paper clips
- Pens/pencils
- Paper

Additional Resources

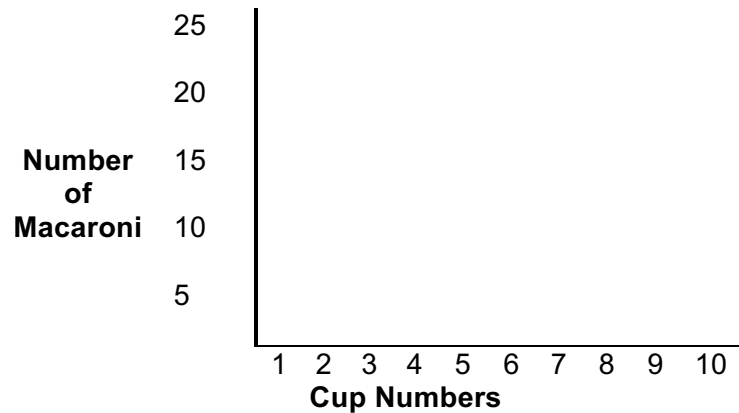
[Create Line Plots](#)



GET READY

5 min

1. **SAY:** Today we're going to practice using line plots.
2. **SAY:** A line graph has an X- and a Y-axis, and it uses points and lines to present information graphically.
3. **SAY:** You're going to practice making a line plot by counting and recording the number of macaroni in ten different samples.
4. **DO:** Show the format for a line plot on the white board, demonstrating how to record data.



5. **SAY:** For example, if cup number 1 has 25 pieces of macaroni in it, you place a mark at the point where the 1 and the 25 intersect. This is a line plot.



GET SET

10 min

1. **DO:** Call attention to the number lines, number cubes and markers and tell members that they are going to play a game.
2. **EXPLAIN** the game:
 - All players roll a number cube to see who goes first (highest roll).
 - The first player (or pair) begins by rolling both number cubes (like dice).
 - Using the two numbers on the cubes rolled (the number “snared”), the player can add them, subtract the smaller from the larger or multiply them.
 - The player then uses the “snared” number to cover one number on the number line.
 - Players take turns rolling the cubes and snaring numbers.
 - After 15 turns, the winning player is the one who has covered the most numbers.



AND GO!

10 min

1. **ASK:**
 - What can you learn from examining your line plot?
 - What is the most macaroni collected in one cup? What is the least?
 - What is the most likely number of macaroni collected in one cup? The least likely?
 - What is the difference, called the range, between the most and least collected?
2. **SAY:** There are two ways to think about the “average” number of macaroni in your samples – the mean and median.
3. **ASK:**
 - How do you calculate the mean?
Answer: **total number of macaroni divided by 10 (samples)**
 - How do you calculate the median?
Answer: **write numbers in order; pick the one in the middle**
4. **DO:** Have members to calculate the mean and the median for their collection samples.
5. **ASK:** What do the mean and the median tell you about your samples? What have you learned about collecting samples?
6. **CHECK FOR UNDERSTANDING:** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Lesson: Estimation

How Big Is Your Hand?

Time: 25 minutes

Objective: Members begin to make sense of the concepts of large and small and the role of measurement in answering questions and solving problems. They learn that measurement of an object can involve three characteristics: length, area and volume. Using metric measures, they practice determining length (one-dimensional, measured in cm), area (two-dimensional, measured by square units, cm^2), and volume (three-dimensional, measured in liters, milliliters).

Materials

- White board
- Dry-erase markers
- Large plastic jar
- Measuring cup
- Water
- 3-D object
- Graph paper
- Metric rulers
- Transparencies & Projector

Preparation

Make a transparency of Chart Samples.

Additional Resources

[Math Measurement Games](#)



GET READY

5 min

1. **SAY:** We're going to look at different ways of measuring and measurement instruments.
2. **ASK:**
 - What do we mean by size?
 - How can we describe size?
 - What do we mean when we say something is big or small?
3. **SAY:** We know that length measures in one dimension – how far from end to end or one point to another. Area measures in two dimensions – the size of a surface or how much space is inside the edges of a flat object like a square. And volume measures in three dimensions – the amount of space an object occupies.
4. **SAY:** We're going to use several different measuring instruments to practice measuring so we can answer three questions:
 - How long is your hand?
 - How much space does it cover?
 - How much water does it replace?



GET SET

5 min

1. **DO:** Have members estimate who has the largest and smallest hands based on length, area and volume.
2. **WRITE:** Draw a chart like the Chart 1: Estimations that lists the names of members in each category.



AND GO!

15 min

1. **INSTRUCT** members to use the metric ruler to measure the length of one hand from the tip of the middle finger to the base of their palm.
2. **DO:** Place the Chart Samples on the projector and have members record the results on a new chart similar Chart 1: Estimations.
3. **INSTRUCT** members to use the centimeter-squared paper to measure area, placing their hands on the paper and drawing around it.
4. **DO:** Have them count the number of squares, estimating the partial ones along the edges.
5. **DO:** Have them record their results on a new chart similar to Chart 2: Measuring Results, using length and centimeters.
6. **INSTRUCT** members to follow these steps for measuring volume:
 - Fill the jar with water deep enough to hold your hand without overflowing.
 - Mark the water level on the outside of the jar.
 - Insert your hand into the water up to the wrist, mark the new water level.
 - Fill the measuring cup with water and record the level.
 - Pour the water into the jar until it rises to the level when hand was in the water.
- Record the water level in the measuring cup.
- Subtract the new amount from the original amount.
- This is the volume of your hand in milliliters (ml).
7. **DO:** Have members record their results on a new chart similar to Chart 2: Measuring Results, using area and cm^2 .
8. **WRITE:** Draw a new chart similar to Chart 3: Totaling Results and poll members to find the top three in each.
9. **ASK:**
 - How close were the estimates to the measured results?
 - Was there a difference in the difference depending on what was being measured?
 - Was anyone listed in all three measurement?
 - What did you discover about the value of estimates?
10. **CHECK FOR UNDERSTANDING:** If members have trouble with the concepts, walk them through the lesson again or help them access one of the additional resources listed.

Chart Samples

Chart 1: Estimations

Estimated Length		Estimated Area		Estimated Volume	
Longest	Shortest	Largest	Smallest	Greatest	Least
<i>Robert</i>	<i>Jan</i>	<i>Curtis</i>	<i>Deanna</i>	<i>Davey</i>	<i>Shonda</i>

Chart 2: Measuring Results

Measuring Length		Measuring Area		Measuring Volume	
Name	Length (cm)	Name	Area (cm ²)	Name	Volume (ml)
Robert	19.5	Curtis	19.5	Davey	19.5
Jan	12.5	Deanna	12.5	Shonda	12.5

Chart 3: Totaling Results

Length (cm)		Area (cm ²)		Volume (ml)	
Longest	Shortest	Largest	Smallest	Greatest	Least