



PowerHour

:making minutes count



BOYS & GIRLS CLUBS
OF AMERICA

ROSS®

RECHARGED FOR THE 21ST CENTURY



Activity Book:
High School

POWER HOUR

RECHARGED FOR THE 21ST CENTURY

LESSON GUIDE: HIGH SCHOOL

Important Guidelines for Photocopying

Limited permission is granted free of charge to photocopy all pages of this guide that are required for use by Boys & Girls Club staff members. Only the original manual purchaser/owner may make such photocopies. Under no circumstances is it permissible to sell or distribute on a commercial basis multiple copies of material reproduced from this publication.

Copyright © 2016 Boys & Girls Clubs of America

All rights reserved. Printed in the United States of America. Except as expressly provided above, no part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without written permission of the publisher.

Boys & Girls Clubs of America
1275 Peachtree St. NE
Atlanta, GA 30309-3506
404-487-5700 | www.bgca.org

Table of Contents

Introduction

- 5 Program Overview
- 6 The Power Hour Lesson Guide
- 7 Facilitating the Lessons
- 9 General Tutoring Guidelines
- 11 Common Core State Standards

High School: Reading Lessons

- 27 Identifying Text Evidence
- 34 Determining the Main Idea
- 39 Analyzing Directions and Following Precise Steps
- 46 Determining the Meaning of Words and Phrases
- 51 Determining the Text Structure
- 58 Understanding Point-of-view
- 59 Point-of-view Sentences
- 64 Presenting Topics in Visual Form
- 69 Evaluating an Argument
- 76 Compare and Contrast a Topic in Various Texts
- 82 Narrating Various Perspectives
- 87 Acting Out Descriptive Words
- 90 Comparing Themes in Song Lyrics and Poems

High School: Math Lessons

- 97 Probability: Using Random Samples
- 100 Estimating Populations Using Ratio and Proportion
- 103 Using Equations in Problem Solving
- 107 Using Models to Understand Proportion
- 112 Calculating the Volume of a Pyramid
- 117 Solving Word Problems
- 121 Using Exponents and Ratios
- 126 Calculating Volume Ratio
- 131 Understanding Scale and Proportion
- 135 Creating Line Graphs
- 139 Creating Curve Graphs
- 143 Mathematics Skills Review

INTRODUCTION

Program Overview

Power Hour: Recharged for the 21st Century: Secondary 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

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 6-8 or in grades 9-12 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 2

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:



Learn It! – a brief review of a specific topic youth are learning about in school



Try It! – a guided practice to give youth a chance to check their understanding



Apply It! – an independent practice in which youth apply 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.

SECTION 2

Facilitating the Lessons, cont.

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.

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 3

General Tutoring Guidelines

The Resource Guide for Power Hour: Recharged for the 21st Century (Secondary 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 “Power Hour 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. In the “Additional Resources” section of this guide, you’ll find specific strategies to give tutors working with members: “Tips for Reading Tutors” and “Tips for Mathematics Tutors.”

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.

SECTION 3

General Tutoring Guidelines, cont.

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.
- ✔ 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 4

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.

Reading Standards for Informational Text (9-12): Key Ideas and Details			
CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RI.9-10.1 RI.11-12.1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.	Lesson 1 – Identifying Text Evidence	interpreting a text; citing text evidence to support an interpretation
RI.9-10.2 RI.11-12.2	Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary.	Lesson 2 – Determining the Main Idea	identifying central idea of a text; summarizing the main idea of a text
		Lesson 7 – Presenting Topics in Visual Form	determining main idea; translating written info into visual form
RI.9-10.3 RI.11-12.3	Analyze how author unfolds an analysis or series of ideas or events, including order in which points are made, how they are introduced and developed, and the connections drawn between them.	Lesson 3 – Analyzing Directions and Following Precise Steps	following directions; maintaining precise order

Reading Standards for Informational Text (9-12): Craft Structure

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RI.9-10.4 RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.	Lesson 4 – Determining Meaning of Words and Phrases	learning new words; distinguishing denotation and connotation; using descriptive words
		Lesson 11 – Acting Out Descriptive Words	understanding word meaning and choice; enhancing comprehension by visualizing deeper meaning; using descriptive words
RI.9-10.5 RI.11-12.5	Analyze and evaluate effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.	Lesson 5 – Determining Text Structure	finding text structure; seeing overall organization of a text
RI.9-10.6 RI.11-12.6	Determine an author’s point of view or purpose in a text and analyze how an author uses rhetoric to advance that point of view or purpose.	Lesson 6 – Understanding Point of View	determining an author’s perspective; identify words or phrases that indicate perspective

Reading Standards for Informational Text (9-12): Integration of Knowledge and Ideas

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RI.9-10.7 RI.11-12.7	Analyze various accounts of a subject told in different media or formats.	Lesson 7 – Presenting Topics in Visual Form	determining main idea; translating written info into visual form
		Lesson 8 – Evaluating an Argument	recognizing an author’s argument; identifying an author’s supporting evidence; evaluating multiple sources of information
		Lesson 10 – Narrating Various Perspectives	identifying different perspectives; analyzing accounts different media
		Lesson 12 – Comparing Themes in Song Lyrics and Poems	identifying similar themes in various formats
RI.9-10.8 RI.11-12.8	Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient.	Lesson 8 – Evaluating an Argument	recognizing an author’s argument; identifying an author’s supporting evidence
RI.9-10.9 RI.11-12.9	Analyze seminal U.S. documents of historical and literary significance (e.g., Washington’s Farewell Address, the Gettysburg Address, Roosevelt’s Four Freedoms speech, King’s “Letter from Birmingham Jail”), including how they address related themes and concepts.	Lesson 9 – Compare and Contrast a Topic in Various Texts	comparing and contrasting; evaluating primary and secondary sources

Reading Standards for Literacy in History and Social Studies (9-12): Key Ideas and Details

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RH.9-10.2 RH.11-12.2	Determine central ideas or information of primary/secondary source; provide accurate summary of how key events or ideas develop over course of a text.	Lesson 2 – Determining the Main Idea	identifying the central idea of a text; summarizing the main idea of a text

Reading Standards for Literacy in History and Social Studies (9-12): Craft and Structure

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RH.9-10.5 RH.11-12.5	Analyze how text uses structure to emphasize key points or advance analysis.	Lesson 5 – Determining the Main Idea	finding text structure; seeing overall organization of a text
		Lesson 6 – Understanding Point of View	determining an author’s perspective; identify words or phrases that indicate perspective
RH.9-10.6 RH.11-12.6	Compare point of view of two or more authors for how they treat the same or similar topics, including details they include and emphasize in their accounts.	Lesson 10 – Narrating Various Perspectives	identifying different perspectives; analyzing accounts in different media

Reading Standards for Literacy in History and Social Studies (9-12): Integration of Knowledge and Ideas

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RH.9-10.5 RH.11-12.5	Assess extent to which reasoning and evidence support author’s claims.	Lesson 8 – Evaluating an Argument	recognizing an author’s argument; identifying an author’s supporting evidence; evaluating multiple sources of information
RH.9-10.6 RH.11-12.6	Compare and contrast treatments of same topic in primary/secondary sources.	Lesson 9 – Compare and Contrast a Topic in Various Texts	comparing and contrasting; evaluating primary and secondary sources

Reading Standards for Literacy in Science and Technical Subjects (9-12): Key Ideas and Details

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RST.9-10.3 RST.11-12.3	Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks.	Lesson 3 – Analyzing Directions and Following Precise Steps	following directions; maintaining precise order

Reading Standards for Literacy in Science and Technical Subjects (9-12): Craft and Structure

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RST.9-10.6 RST.11-12.6	Analyze the author’s purpose in providing an explanation, describing a procedure or discussing an experiment in a text.	Lesson 6 – Understanding Point of View	determining an author’s perspective; identify words or phrases that indicate perspective

Reading Standards for Literacy in Science and Technical Subjects (9-12): Integration of Knowledge and Ideas

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
RST.9-10.7 RST.11-12.7	Translate quantitative or technical information expressed in words into visual form; translate information expressed visually or mathematically into words.	Lesson 7 – Presenting Topics in Visual Form	determining the main idea; translating written information into visual form
RST.9-10.8 RST.11-12.8	Assess extent to which reasoning and evidence support author’s claims.	Lesson 8 – Evaluating an Argument	recognizing an author’s argument; identifying an author’s supporting evidence; evaluating multiple sources of information

Reading Standards for Literacy in History and Social Studies (9-12): Craft and Structure

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
6.RP.1	Understand concept of ratio and use ratio language to describe relationship between two quantities.	Lesson 9 – Geometry, Ratio and Proportion	describing the relationship between the circumference and the diameter of a circle
6.RP.2	Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.	Lesson 4 – Ratios and Proportional Relationships	using ratio reasoning and geometry to solve a problem
		Lesson 9 – Geometry, Ratio and Proportion	describing the relationship between the circumference and the diameter of a circle
6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.	Lesson 9 – Geometry, Ratio and Proportion	describing the relationship between the circumference and the diameter of a circle
7.RP.2a	Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether graph is a straight line through the origin.	Lesson 4 – Ratios and Proportional Relationships	using ratio reasoning and geometry to solve a problem
7.RP.2b	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	Lesson 10 – Integers, Modeling and Graphing	describing the real world using integers

Reading Standards for Literacy in Science and Technical Subjects (9-12):
The Number System

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
6.NS.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.	Lesson 10 – Integers, Modeling and Graphing	describing the real world using integers
6.NS.5a	Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and 0 is its own opposite.	Lesson 10 – Integers, Modeling and Graphing	describing the real world using integers
6.NS.5c	Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.	Lesson 10 – Integers, Modeling and Graphing	describing the real world using integers

Reading Standards for Literacy in History and Social Studies (9-12): Expressions and Equations

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
6.EE.1	Write and evaluate numerical expressions involving whole-number exponents.	Lesson 1 – Basic Expressions	applying and extending knowledge of arithmetic operations to expressions
6.EE.2	Write, read, and evaluate expressions in which letters stand for numbers.	Lesson 1 – Basic Expressions	applying and extending knowledge of arithmetic operations to expressions
		Lesson 7 – Expressions and Equations	solving one-variable expressions and equations; using properties of operations to generate equivalent expressions; solving problems using expressions and equations
6.EE.2c	Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).	Lesson 7 – Expressions and Equations	solving one-variable expressions and equations; using properties of operations to generate equivalent expressions; solving problems using expressions and equations
7.EE.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	Lesson 1 – Basic Expressions	applying and extending knowledge of arithmetic operations to expressions
		Lesson 7 – Expressions and Equations	solving one-variable expressions and equations; using properties of operations to generate equivalent expressions; solving problems using expressions and equations
7.EE.2	Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.	Lesson 1 – Basic Expressions	applying and extending knowledge of arithmetic operations to expressions
		Lesson 7 – Expressions and Equations	solving one-variable expressions and equations; using properties of operations to generate equivalent expressions; solving problems using expressions and equations

Reading Standards for Literacy in Science and Technical Subjects (9-12): Geometry

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
6.G.1	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.	Lesson 3 – Shapes and Solids	solving real-world problems involving 2-D shapes and 3-D solids
		Lesson 4 – Ratios and Proportional Relationships	using ratio reasoning and geometry to solve a problem
7.G.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	Lesson 3 – Shapes and Solids	solving real-world problems involving 2-D shapes and 3-D solids

Reading Standards for Literacy in Science and Technical Subjects (9-12): Statistics and Probability

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
6.SP.1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.	Lesson 2 – Probability, Modeling and Graphing	developing knowledge of statistical variability
		Lesson 5 – Statistics and Probability	analyzing relationships between dependent and independent variables; investigating chance processes with probability models
		Lesson 11 – Modeling and Graphing	investigating patterns of data with multiple variables
		Lesson 12 – Data Collection and Graphing	developing a poll; collecting, visualizing, describing and explaining the data

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
6.SP.4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots	Lesson 11 – Modeling and Graphing	making inferences about events using line graphs; investigating patterns of data with multiple variables
		Lesson 12 – Data Collection and Graphing	developing a poll; collecting, visualizing , describing and explaining the data
6.SP.5a	Summarize numerical data sets in relation to their context by reporting the number of observations.	Lesson 12 – Data Collection and Graphing	developing a poll; collecting, visualizing , describing and explaining the data
		Lesson 11 – Modeling and Graphing	investigating patterns of data with multiple variables
6.SP.5b	Summarize numerical data sets in relation to their context by describing the nature of the attribute under investigation, including how it was measured and its units of measurement.	Lesson 12 – Data Collection and Graphing	developing a poll; collecting, visualizing , describing and explaining the data
7.SP.1	Understand that statistics can be used to gain information about a population by examining population sample; generalizations about a population from sample are valid if sample is representative of population. Understand that random sampling tends to produce representative samples and support valid inferences.	Lesson 5 – Statistics and Probability	analyzing relationships between dependent and independent variables; investigating chance processes with probability models
		Lesson 11 – Modeling and Graphing	investigating patterns of data with multiple variables
7.SP.2	Use data from random sample to draw inferences about population with an unknown characteristic. Generate multiple samples (or simulated samples) of same size to gauge variation in estimates or predictions.	Lesson 11 – Modeling and Graphing	investigating patterns of data with multiple variables

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
7.SP.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.	Lesson 12 – Data Collection and Graphing	developing a poll; collecting, visualizing , describing and explaining the data
7.SP.4	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	Lesson 12 – Data Collection and Graphing	developing a poll; collecting, visualizing , describing and explaining the data
7.SP.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring.	Lesson 2 – Probability, Modeling and Graphing	developing knowledge of statistical variability
		Lesson 11 – Modeling and Graphing	developing a poll; collecting, visualizing , making inferences about events using line graphs
7.SP.6	Approximate probability of a chance event by collecting data on chance process that produces it and observing its long-run relative frequency, and predict approximate relative frequency given the probability.	Lesson 5 – Statistics and Probability	analyzing relationships between dependent and independent variables; investigating chance processes with probability models
8.SP.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	Lesson 2 – Probability, Modeling and Graphing	developing knowledge of statistical variability
		Lesson 12 – Data Collection and Graphing	developing a poll; collecting, visualizing , describing and explaining the data

Standards for Mathematical Content and Practice (9-12): Ratios and Proportional Relationships

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
6.RP.1	Understand concept of ratio; use ratio language to describe ratio relationship between two quantities.	Lesson 7 – Using Exponents and Ratios	using exponents and ratio reasoning to solve problems
6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.	Lesson 7 – Using Exponents and Ratios	using exponents and ratio reasoning to solve problems
6.RP.3b	Solve unit rate problems including those involving unit pricing and constant speed.	Lesson 6 – Solving Word Problems	solving standard rate, time and distance situations

Standards for Mathematical Content and Practice (9-12): Expressions and Equations

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
7.EE.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate.	Lesson 6 – Solving Word Problems	solving standard rate, time and distance situations
7.EE.4	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.	Lesson 6 – Solving Word Problems	solving standard rate, time and distance situations

Standards for Mathematical Content and Practice (9-12): Geometry and Modeling

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
7.G.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	Lesson 8 – Calculating Volume Ratio	applying geometric concepts in modeling situations

Standards for Mathematical Content and Practice (9-12): Expressions and Equations

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
8.EE.7	Solve linear equations in one variable.	Lesson 6 – Solving Word Problems	solving standard rate, time and distance situations

Standards for Mathematical Content and Practice (9-12): Algebra

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
A-CED.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	Lesson 3 – Using Equations in Problem Solving	understanding an equation is a statement of equality between two expressions; creating equations that describe numbers or relationships
A-REI.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	Lesson 3 – Using Equations in Problem Solving	understanding an equation is a statement of equality between two expressions; creating equations that describe numbers or relationships

Standards for Mathematical Content and Practice (9-12): Geometry and Modeling

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
G-MG.2	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).	Lesson 5 – Calculating the Volume of a Pyramid	explaining volume formulas and using them to solve problems
G-MG.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).	Lesson 9 – Understanding Scale and Proportion	linking mathematics to everyday decisions
		Lesson 4 – Using Models to Understand Proportion	linking mathematics to everyday decisions; applying geometry concepts in modeling situations
6.RP.3b	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	Lesson 5 – Calculating the Volume of a Pyramid	explaining volume formulas and using them to solve problems

Standards for Mathematical Content and Practice (9-12): Statistics and Probability

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
S-ID.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).	Lesson 1 – Using Random Sampling	summarizing, representing and interpreting data on a single variable
		Lesson 10 – Creating Line Graphs	using statistics appropriate for the data
S-ID.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	Lesson 1 – Using Random Sampling	summarizing, representing and interpreting data on a single variable
		Lesson 10 – Creating Line Graphs	using statistics appropriate for the data
S-IC.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	Lesson 2 – Estimating Populations Using Ratio and Proportion	making inferences and justifying conclusions from sample surveys, experiments and observation
		Lesson 11 – Creating Curve Graphs	representing data with a variety of plots

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
S-IC.2	Decide if a specified model is consistent with results from a given data-generating process.	Lesson 2 – Estimating Populations Using Ratio and Proportion	making inferences and justifying conclusions from sample surveys, experiments and observation
S-IC.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	Lesson 2 – Estimating Populations Using Ratio and Proportion	making inferences and justifying conclusions from sample surveys, experiments and observation
		Lesson 11 – Creating Curve Graphs	representing data with a variety of plots
7.SP.1	Understand that statistics can be used to gain information about a population by examining population sample; generalizations about population from sample are valid if the sample is representative. Understand that random sampling tends to produce representative samples and support valid inferences.	Lesson 11 – Creating Curve Graphs	representing data with a variety of plots
7.SP.2	Use data from random sample to draw inferences about population with unknown characteristic. Generate multiple samples (or simulated samples) of same size to gauge variation in estimates or predictions.	Lesson 11 – Creating Curve Graphs	representing data with a variety of plots

Standards for Mathematical Content and Practice (9-12): Mathematics Overview

CCS #	Common Core Standard	Power Hour Lesson	Lesson Content
	Found throughout all Common Core Standards topics	Lesson 12 – Mathematics Skills Review	analyzing and applying math concepts and skills

HIGH SCHOOL

READING LESSONS

Identifying Text Evidence

TIME: 25 minutes

OBJECTIVE: In order to answer questions about a text, summarize it, or draw inferences from it, readers need to be able to cite evidence to back up their interpretations. This involves more than randomly selecting sentences; readers must select and interpret the most relevant information to back up their understanding of what they've read. In this lesson, members first review their understanding of text evidence and discuss its importance in providing an answer to a question and then use text evidence to support their side of a debate about a passage.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper

VOCABULARY

- **Text evidence** – details or facts in the text that support the author's argument
- **Main idea** – what a piece of writing is mostly about (same as the central idea)
- **Argument** – the main statement of a text or the point the author is trying to argue

PREPARATION

Make copies of "Worst Game Ever" and "Prove It" (one per member).

ADDITIONAL RESOURCE(S)

[Reading Comprehension Exercise and Quizzes](#)



LEARN IT

3 minutes

- 1. ASK:** When a detective tries to solve a crime, what does he or she *use* to figure out what happened?
Answer: **pictures, clues, blood, items at the crime scene, comments made by witnesses**
- 2. SAY:** All of the answers you just gave are called evidence. Evidence is anything from pictures, statements or objects that help form a conclusion. In using evidence, the detective is analyzing all resources to form an accurate reason for the crime.
- 3. ASK:** How do readers use evidence when answering a question?
Answer: **readers use specific parts of a text to prove their point or answer a question; this is called text evidence**
- 4. ASK:** What steps does a reader take to use text evidence when answering a question?
Answer/write the steps: **read the text, read the questions, re-read the text and highlight or underline parts of the text that help answer the question**
- 5. SAY:** Today we're going to practice using strong text evidence by participating in a debate. In preparation for the debate, you will determine which statements in the text are important to use as text evidence to prove your point. Similar to a detective, you will be analyzing the text and choosing which parts help you come to a conclusion.



TRY IT

7 minutes

1. **DO:** Distribute copies of “Worst Game Ever?” to all members.
2. **DO:** Give members five minutes to read the passage.
3. **ASK:** What is the passage about? Can you summarize it in a few sentences that highlight the main idea? What sentence helped you understand the reading?
Answer: *the passage is about the game E.T. and how it was poorly created even though a lot of money was spent to make it a game consumers would purchase; it is said that it caused the video game industry to crash due to its lower-than-expected sales*



APPLY IT

15 minutes

1. **ASK** members to form two small groups.
2. **SAY:** One group (side) will argue *in favor of* the video game and the other *against* the video game. In your groups, reread the text to find specific sentences that support your point. You may underline or highlight sentences as you re-read the text and prepare for the debate.
3. **DO:** Distribute copies of “Prove It” and assign each group a side.
4. **DO:** Give members five minutes to work in their groups. Remind them to highlight sentences that will help them with their argument in their debate.
5. **DO:** Instruct members to sit opposite each other. Choose a group to start the debate, reminding them to use their text evidence notes to help prove their side.
6. **DO:** Switch to the other team and allow them time to debate their point.
7. **ASK** members to vote on which side is the winning team.
8. **CHECK FOR UNDERSTANDING:** If members have trouble identifying text evidence, guide them through the lesson again or help them access the additional resource listed.

Worst Game Ever? By Donzo Mortini

E.T. the Extra-Terrestrial is a video game that came out for the Atari 2600 game system in 1982. It was based on a very popular film of the same name. It cost over 125 million dollars to make. Star programmer Howard Scott Warshaw created it with consultation from Steven Spielberg. And it is widely considered to be one of the worst video games ever created. The massive failure of *E.T.* and its effects on Atari is an often-mentioned reason for the video game industry crash of 1983.

It was July 27th, 1982. Howard Scott Warshaw was hot off the success of his most recent game, *Raiders of the Lost Ark*. He received a call from Atari C.E.O. Ray Kassar. Atari had bought the rights to make a video game version of Spielberg's movie, *E.T. the Extra-Terrestrial*, which had just been released in June. Kassar told Warshaw that Spielberg had specifically asked for Warshaw to make the game. Warshaw was honored, but there was one huge problem. Atari needed the game finished by September 1st in order to start selling it during the Christmas season.

It had taken Warshaw six months to create *Raiders of the Lost Ark*. The game he made prior to that took him seven months. He was expected to create *E.T.* in around five weeks. Warshaw just did not have enough time to program the game properly, but he accepted the challenge anyway and production began. Spielberg wanted Warshaw to create a simple maze game, similar to *Pac-Man*, but Warshaw had a bigger vision. He wanted players to explore different environments in a 3D world. Warshaw followed his vision.

Atari anticipated that the game would be a huge success. Usually companies like Atari have people test games before releasing them. If there is something that testers really dislike, programmers can fix it before the public gets a chance to play. Atari decided to skip testing due to time limitations. They wanted the game released during the holiday season. It was: *E.T.* was released in December of 1982.

The game sold very well at first. It was a hot holiday item. Unfortunately, Atari overestimated how many they would sell. They made 5 million copies and they only sold 1.5 million. Most people who played the game hated it. The graphics were bad. Game play was awkward. Players got stuck in holes that they couldn't escape. A short time limit made the game difficult to explore and frustrating to play. Some people who stuck with the game grew to like it, but it wasn't the mainstream success that Atari had hoped it would be.

Too many copies of the game sat on store shelves. One employee remembers the game being discounted five times, from \$49.95 to less than a dollar. Many people returned the game. Atari was left with millions of unsold copies. In September of 1983, a newspaper in New Mexico reported that between 10 and 20 semitrailer truckloads of Atari products were crushed and buried at a landfill in Alamogordo. Perhaps a million or more copies of *E.T.* were buried in the desert. When word got out, the drop site had to be covered with cement to prevent scavenging.

Atari lost over \$100 million on *E.T.* The game was so bad that it was said to have affected Atari's reputation. The video game industry soon fell into a deep depression. In 1983 the industry made \$3.2 billion. By 1985 profit fell to just over \$100 million. This was almost a 97% drop. Many critics believe that Atari's blunder on *E.T.* was one of the causes leading to this depression. *E.T. the Extra-Terrestrial* will long be remembered as one of the worst video games ever made, if not one of the causes of the decline of the entire video game industry.

Source: EReadingworksheets.com, <http://www.ereadingworksheets.com/reading-comprehension-worksheets/nonfiction-reading-test-6-worst-game-ever.pdf>, 2010.

Determining the Main Idea

TIME: 25 minutes

OBJECTIVE In order to comprehend a passage fully, readers need to know the central idea – the main idea or point the author is communicating. In this lesson, members first review what the main idea is and practice identifying the main idea in several short articles. They then determine the main idea of a longer text, give a summary of the central idea and, finally, write their own sentence that summarizes the main idea.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper

VOCABULARY

- **Main idea** – what a piece of writing is mostly about (same as the central idea)
- **Summary** – the main idea and important details of a passage in a concise form

PREPARATION

Make copies of “Finding the Main Idea” and “Write and Share It!” (one per member).

ADDITIONAL RESOURCE(S)

[Reading Comprehension Exercise and Quizzes](#)



LEARN IT

3 minutes

1. **ASK:** What do we mean when we use the terms “central idea” or “main idea?”
Answer: **central idea is the same as main idea and it is what the whole text is about**
2. **SAY:** Central idea and main idea are the same thing – they describe what the text is about and the focus of the writing.
3. **SAY:** What are some ways writers let their readers know what the main is in their piece?
Answer: **writers include details that help highlight the main idea of the piece; characters focus on the main idea; the main idea is discussed throughout the piece**
4. **SAY:** Today we’re going to practice finding the main idea as a whole group and then in pairs. First, we will read a short piece together and figure out what we think the main idea is of the piece. Then, you will work in pairs to read facts about three different historical figures and write a sentence summarizing the main idea.



TRY IT

7 minutes

1. **DO:** Distribute copies of “Finding the Main Idea.”
2. **DO:** Give members five minutes to read the passages and write the main idea.
3. **ASK:** Now that you have read the passages, can you tell me what you thought was the main idea? Was there a sentence you read that helped you understand the reading?
Answer: **the main idea of the first passage is a few small changes can save a lot of water in the home; the main idea of the second passage is The Irish came to the United States in great numbers**



APPLY IT

15 minutes

1. **ASK** members to form pairs.
2. **DO:** Distribute copies of “Write and Share It!”
3. **SAY:** With your partner, read over the facts written on your sheet. Discuss what you think the main idea should be based on the facts and the idea they all focus on.
4. **DO:** Give members 10 minutes to work together.
5. **ASK** pairs to share their sentences and discuss similarities or differences between the main idea sentences.
6. **CHECK FOR UNDERSTANDING:** If members have trouble identifying the main idea, guide them through the lesson again or help them access the additional resource listed.

Finding the Main Idea

Directions: Read the short passages below and write the main idea.

As important as water conservation is, it is also very easy. A few simple habits can significantly reduce the water consumption of a household. One way to save water is to turn off the faucet when brushing your teeth. Also, don't allow faucets to drip; one drip can waste a large amount of water over a short period of time. Baths require less water than showers, so by taking a bath instead of a shower, you can reduce the amount of water your home uses. In the kitchen, running a dishwasher when it is completely full, rather than half full, can save up to 20 gallons a day. These simple changes will save water and save money.

The main idea of this article is:

Irish immigration to the U.S. began during the early development of the American colonies. It is estimated that 200,000 Irish came to the U.S. in the 17th and 18th centuries. The numbers swelled from 1820 to 1850 to almost 2 million Irish immigrants. Most of these were fleeing the potato famine from 1845 and 1852. Steady numbers continued to arrive during the late 19th and 20th centuries. Today, over 36 million Americans claim some level of Irish ancestry.

The main idea of this article is:

Source: K12reader.com, <http://www.k12reader.com/main-idea/paragraphs-2-main-idea>, 2012.

Write and Share It!

Directions: Below are facts about various historical figures. Read through them and determine a main idea that summarizes the person.

Main Idea #1 Facts: Jane Addams

- In Chicago, Jane Addams responded to the needs of the community by creating a home and child care facility for young working women in need.
- Jane Addams challenged laws both city-wide and state-wide that caused unfairness towards immigrants.
- Jane Addams worked tirelessly to change societal beliefs that immigrants were to be separated from the main stream life of Americans.

Main Idea #2 Facts: Cesar Chavez

- As a child, Cesar worked in fields with his family within poor conditions such as corrupt bosses, low to no pay and racism.
- When older, Cesar joined the Community Service Organization and after witnessing more injustice in the fields, he organized strikes for the farm workers to stand up for themselves.
- After refusing to limit pesticides on fruits, Cesar started an international boycott of fruits until conditions were improved for the workers.

Main Idea #3 Facts: Nelson Mandela

- In 1948, after the National Party of South Africa was elected and began the formal system of segregation called Apartheid, Nelson Mandela led a political group to boycott unfair policies.
- During a trial for treason, Mandela stated, "I have cherished the ideal of a democratic and free society in which all persons live together in harmony and with equal opportunities." He was then sentenced to life in prison.
- Despite being offered an early release from prison in exchange for agreeing with the political party, Mandela would not take the deals as he would not stand for the injustice still going on. He remained in prison for almost three decades.

Source: History.com, <http://www.history.com/topics>.

Analyzing Directions and Following Precise Steps

TIME: 25 minutes

OBJECTIVE In this lesson, members discover the importance of following directions and maintaining their precise order. To do this, members engage in an activity that, in order to be successful, requires specific directions to be followed. They then read about a natural disaster and must order the steps that led to the event.

MATERIALS

- White board
- Dry-erase markers
- Paper (8.5" x 11")
- Kraft paper
- Markers

VOCABULARY

- **Sequencing** – arranging events or details in a particular order

PREPARATION

Make copies of “Sample Illustrations” (one to show members), “Origami Hat Instructions” (one per member) and “Write and Share It!” (one per pair or small group).

ADDITIONAL RESOURCE(S)

[Reading Comprehension Exercise and Quizzes](#)



LEARN IT

3 minutes

1. **ASK:** What is the most important thing to do when giving someone directions?
Answer: **to be specific, give the person details, do not miss any of the steps in the directions**
2. **SAY:** When giving directions, it is incredibly important to be specific and make sure that all of the steps are included.
3. **ASK:** Have you had an experience when you were given directions – to go someplace or to complete a task – and the directions weren't very clear? What happened?
Answer: **it was confusing; got lost; didn't turn out as expected**
4. **SAY:** Today we're going to practice following precise steps by making something out of Origami, the Japanese art of folding paper to make an object like a hat or star.



TRY IT

5 minutes

1. **DO:** Distribute copies of "Origami Hat Instructions" and a piece of paper to each member.
2. **DO:** Give members a few minutes to fold and create the Origami hat.
3. **ASK:** What did you notice about the directions? What was most helpful? What would have happened if any of the steps had been left off of the directions?
Answer: **the directions were easy to follow and in order; it was most helpful that there were pictures; if any of the steps had been left off, it wouldn't have looked like a hat**

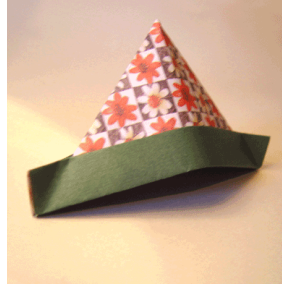


APPLY IT

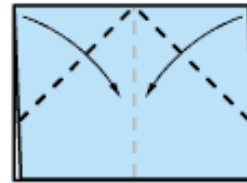
17 minutes

1. **ASK** members to form pairs.
2. **DO:** Distribute copies of “Write and Share It!” and Kraft paper and markers to all pairs.
3. **SAY:** With your partner, choose one of the natural disasters. Read through the description a few times to understand the steps leading up to the disaster. Make sure to underline the steps as you read. Once you have figured out the steps, illustrate them any way you like.
4. **DO:** Show “Sample Illustrations” as examples of ways to illustrate the steps.
5. **DO:** Give members ten minutes to work together.
6. **DO:** Remind them that each step needs to be included in the proper order – the right sequencing – for the description to be accurate.
7. **ASK** members to share their illustrations and decide whether the illustrations are clear and include all the steps leading up to the disaster.
8. **CHECK FOR UNDERSTANDING:** If members have trouble identifying the steps in each natural disaster, read through the descriptions and underline the steps that lead up to the disaster with them. Or help them access the additional resource listed.

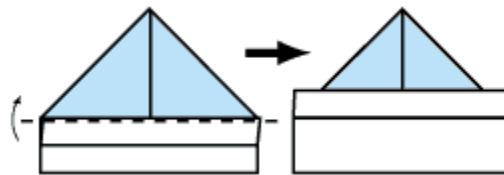
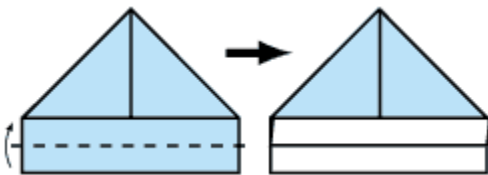
Origami Hat Instructions



1. Start with a rectangular piece of paper, white side up. Fold the top down to the bottom edge. Crease well. Fold the paper in half and open.

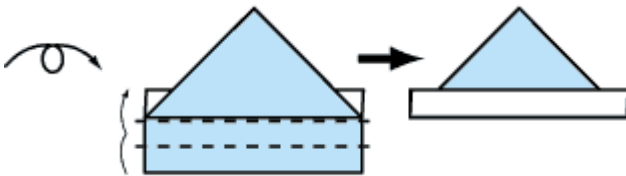


3. Fold the top corners down to the centre line.



4. Fold the bottom edge (uppermost layer only) up to the base of the triangles.

5. Fold this part up once again, and crease well.



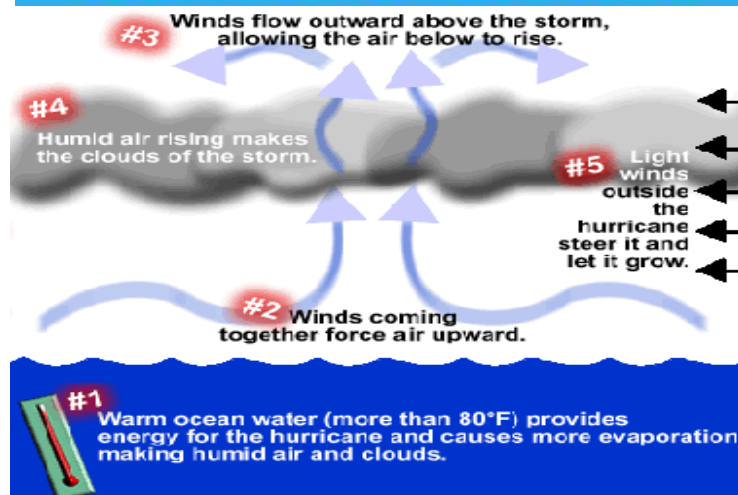
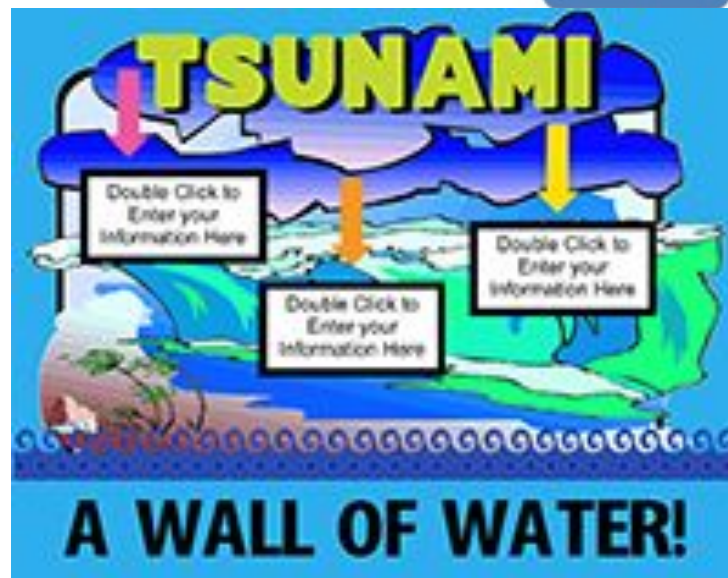
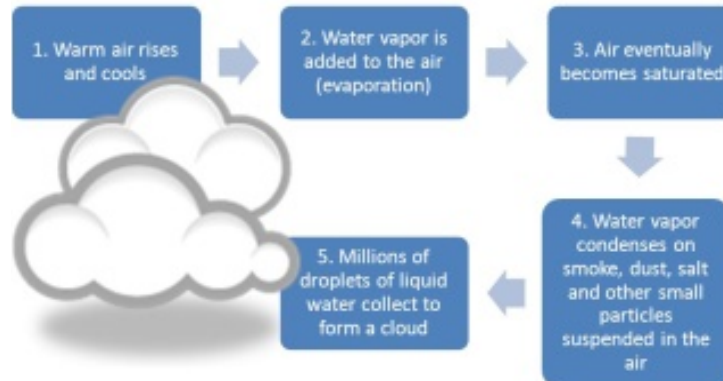
6. Turn model over, and repeat step 4 & 5 on the other side.

7. Open out the hat to shape it. Your hat is now finished!

Source: Origami-Fun.com, <http://www.origami-fun.com/origami-hat>.

Sample Illustrations

How Does a Cloud Form?



Write and Share It!

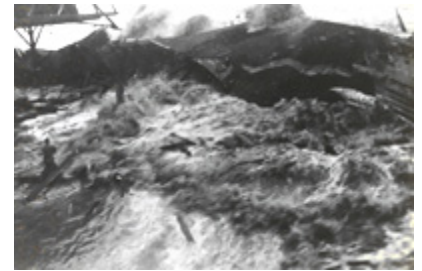
Directions: Below are descriptions of three different natural weather disasters. Choose one and write down the steps that lead up to the disaster in order. Then illustrate the steps in order.

Tsunamis

Source: The Federal Emergency Management Agency (FEMA)

A tsunami (*soo-nahm-ee*) is a series of huge waves that happen after an undersea disturbance, such as an earthquake or volcano eruption. *Tsunami* is from the Japanese word for “harbor wave.”

The waves travel in all directions from the area of disturbance, much like the ripples that happen after throwing a rock in a pond. The waves may travel in the open sea as fast as 450 miles per hour. As the big waves approach shallow waters along the coast they grow to a great height and smash into the shore. They can be as high as 100 feet. They can cause a lot of destruction on the shore. They are sometimes mistakenly called “tidal waves,” but tsunamis have nothing to do with the tides.



Tornadoes

By Ann Marie Imbornoni

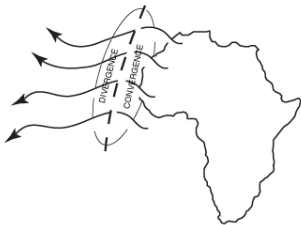
A tornado is a dark funnel-shaped cloud made up of violently rotating winds that can reach speeds of up to 300 m.p.h. The diameter of a tornado can vary between a few feet and a mile, and its track can extend from less than a mile to several hundred miles. Tornadoes generally travel in a northeast direction (depending on the prevailing winds) at speeds ranging from 20-60 m.p.h.

Tornadoes are most often spawned by giant thunderstorms known as “supercells.” These powerful, highly organized storms form when warm, moist air along the ground rushes upward, meeting cooler, drier air. As the rising warm air cools, the moisture it carries condenses, forming a massive thundercloud, sometimes growing to as much as 50,000 ft. in height. Variable winds at different levels of the atmosphere feed the updraft and cause the formation of the tornado’s characteristic funnel shape.

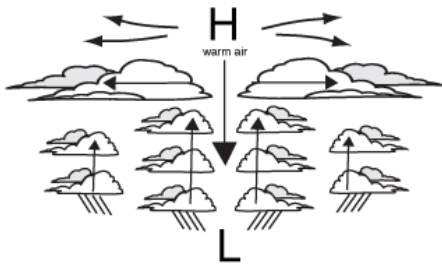
Hurricanes

by Mel Goldstein, Ph.D.

The hurricane story begins with a cluster of thunderstorms set off in the tropics, usually by some type of surface convergence. These initial squalls frequently develop in western Africa and move westward into the Atlantic. The organized area of convection then releases heat, which lowers the pressure. The lower pressure forces more air to converge and, as it comes together, the air is forced to rise. This rising motion causes more huge thunderstorms that release more heat and reduce the pressure even more. That, in turn, allows more air to converge near the ground.



When a disturbance forms with a well-defined circulation but winds under 39 mph, the system is called a *tropical depression*. When the wind reaches 39 to 73 mph, the system is called a *tropical storm*. When the wind exceeds 73 mph, the circulation is classified as a *hurricane*.



Hurricane development.

A hurricane's circulation covers an area of about 300 to 700 miles. Moisture spirals into the center along *spiral rain bands*. The heaviest rain and the most violent weather will occur within these precipitation bands. The winds gradually increase toward the center of the hurricane. The highest winds are found in the *eye wall*, where towering clouds extend up to 50,000 feet and higher. The most destructive portion of the hurricane occurs in the eye wall.

Source: Infoplease.com, <http://www.infoplease.com/weather>.

Determining Meaning of Words and Phrases

TIME: 25 minutes

OBJECTIVE: In this lesson, members determine the meaning of words and discover how changing a word can make a sentence more meaningful. Members begin by reviewing the difference between denotation and connotation and revise sentences to make them more descriptive. They then create sentences for other members to act out using descriptive words.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper

VOCABULARY

- **Denotation** – the dictionary definition of the word; the literal meaning
- **Connotation** – the extra sense that the word implies; feelings associated with the word

PREPARATION

Make copies of “Connotation Revision Page” (one per member) and “Act it Out!” (one per pair or small group).

ADDITIONAL RESOURCE(S)

[Connotation and Denotation Explanation and Exercises](#)



LEARN IT

5 minutes

- 1. ASK:** What is the difference between the denotation and connotation of a word?
Answer: the denotation of a word is its definition as found in a dictionary and the connotation are the feelings associated with the word
- 2. SAY:** There are times when an author needs to include the denotation, or definition of a word, in order for the reader to understand what they are reading. There are times when the author specifically uses a connotation in their writing.
- 3. ASK:** Why would an author include a connotation of a word?
Answer: the author would use word connotations to give the reader a feeling about a person or situation; connotations help evoke emotion and make the reader have feelings about what they are reading
- 4. SAY:** I'll give an example of denotation and connotation using the word *happy*. The denotation or definition for *happy* is feeling or showing pleasure of contentment. Some connotations for the word *happy* are cheerful, joyful, glad or pleased. As you can see, the connotations I gave for the word *happy* are more descriptive than just the definition.
- 5. ASK:** What are the denotations and connotations for the following words?
 - a. Sad:** *means* to have sorrow or unhappy feelings; *connotations:* depressed, miserable, dismal
 - b. Mad:** *means* to be upset; *connotations:* furious, enraged, fuming
 - c. Hurt:** *means* to cause or be in physical pain; *connotations:* injure, damage, anguish
 - d. Silly:** *means* to be foolish or lacking sense; *connotations:* foolish, mindless, outrageous
 - e. Smart:** *means* to have excellent intelligence; *connotations:* bright, intelligent, astute
- 6. SAY:** As you can see, connotations of words are more descriptive and result in a more exciting sentence or piece to read.



TRY IT

5 minutes

1. **SAY:** Next we're going to practice reading a short passage and changing words to have a stronger connotation or feeling.
2. **DO:** Distribute copies of "Connotation Revision Page" to each member. Read through the short passage together.
3. **ASK** members to take a few minutes to reread the passage to themselves, changing words as they read to have a more descriptive connotation.
4. **DO:** Review the passage together, asking members to say out loud words they changed to different, more descriptive words.



APPLY IT

15 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Distribute copies of "Act it Out!" to each team.
3. **SAY:** Read the sentences and revise them to be more descriptive. You may change any of the words to a connotation of that word. You can also add words to the sentences if you'd like to make them more descriptive. Once complete, you will read your sentence aloud and someone else will act out your sentence. So make them really descriptive!
4. **GIVE:** members 10 minutes to work together. Remind them that a connotation is a variation of the word that is more descriptive and evokes stronger emotions from the reader.
5. **ASK** each member to read aloud a sentence; as he/she does, ask another member to act out the new sentence.
6. **ASK:** How did the different connotations change the meaning of the sentences?
7. **CHECK FOR UNDERSTANDING:** If members have trouble coming up with connotations, you may offer suggestions or use a thesaurus. You may also help them access the additional resource listed.

Connotation Revision Page

Directions: Read the passage below for meaning. Then reread it and change words to have a stronger connotation to make the sentence more descriptive.

It was a hot day. The sun was shining and the insects were humming. He located the tracks and began to follow them. The tracks went up a small hill. He walked up the hill, prepared to shoot at any second. Something made a noise in the bushes and he stopped to listen. He pointed, but did not shoot. A squirrel climbed up a tree, stopped to look at him for a second, and then climbed out of sight.

He breathed heavily for a moment, and then looked back at the tracks, which went into the underbrush up ahead. He walked toward the bushes and then knelt down to see where the tracks went. He found himself looking into the eyes of a big snake. The snake stuck out its tongue, and then crawled away. He began to crawl through the bushes, following the tracks.

Source: Readwritethink.org,
http://www.readwritethink.org/files/resources/lesson_images/lesson80/connotation_revision.pdf, 2003.

Act it Out!

Directions: Below are sentences that need to be revised to be more descriptive. Use connotations to make any of the words in the sentence more meaningful.

1. The boy walked across the room.

2. The girl talked to her friend before she drove to the store.

3. He picked up his backpack and went into class.

4. Before she got ready for the party, she made a cake for her friend.

5. As he sat waiting for the bus, he looked at his watch. It had only been 5 minutes.

6. The salesperson went up to the girl to see if she wanted to try the perfume.

Determining the Text Structure

TIME: 25 minutes

OBJECTIVE: Text structure is the way in which information in a text is organized. Recognizing the text structure helps readers understand the text better because they know why the author structures writing in a particular way to emphasize certain points. In this lesson, members first review their understanding of text structures and read through examples of each type. They then practice by reading short passages and determining the structure of the passage.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper

VOCABULARY

- **Nonfiction** – a type of writing that tells about real-life people, places, events or things
- **Fiction** – a type of writing that tells a made-up story
- **Text Structure** – how the information in a written text is organized
- **Sequence** – the following of one thing after another in time or space

PREPARATION

Make copies of “Finding Text Structure in Movie Reviews” and “Discovering Text Structure” (one per member). Write these descriptions on the white board:

- **Description:** focuses on descriptive details to help readers visualize what they are reading;
- **Sequence:** lists events in chronological order from beginning to end;
- **Compare/contrast:** looks at similarities and differences in ideas or events;
- **Cause and effect:** shares events and the reasons (causes) they happened; and
- **Problem solution:** explains a specific problem and how it is resolved.

ADDITIONAL RESOURCE(S)

[Reading Comprehension Exercise and Quizzes](#)



LEARN IT

5 minutes

1. **ASK:** What is the difference between a nonfiction text and a fiction text?
Answer: nonfiction means that the text is true and based on facts; a fiction text is a story or narrative that is made up rather than factual
2. **SAY:** We're going to focus on nonfiction passages and how they are structured. We'll look at a variety of nonfiction examples and determine how the text is organized.
3. **SAY:** When you read a nonfiction piece such as a magazine article or video game review, the author has decided ahead of time how to share that information with you. They think about how they will write their piece by organizing the information by comparing items, putting the information in an order from start to finish or writing a description. This is called text structure or how the writing is organized.
4. **SAY:** What's the difference between the way a movie review is written and an article about a war and the specific dates when it occurred?
Answer: a movie review is describing the movie whereas an article about a war is put in an order that lists specific dates
5. **SAY:** Today we're going to practice determining text structure in nonfiction texts by reading through various movie summaries. There are five ways in which a text can be structured:
 - a. **Description:** focuses on descriptive details to help readers visualize the passage;
 - b. **Sequence:** lists events in chronological order from beginning to end;
 - c. **Compare/contrast:** looks at similarities and differences in ideas or events;
 - d. **Cause and effect:** shares events and the reasons (causes) they happened and



TRY IT

7 minutes

1. **DO:** Distribute copies of “Finding Text Structure in Movie Reviews.”
2. **DO:** Give members three or four minutes to read the reviews.
3. **SAY:** Now that you’ve read these for meaning, we’re going to reread them and, this time, think about how the text is structured. Remember the five structures we talked about.
4. **ASK** members to identify the text structure for each review:
 - Divergent: compare/contrast since the reviewer compares the movie and the book
 - Up: description since the reviewer describes the plot and uses details
 - Jaws: problem/solution since the reviewer explains the problem, the shark and how the main characters go about solving their problem
 - The Impossible: cause and effect since the review describes how the main characters come up with a solution to their problem, the tsunami
 - Forrest Gump: sequence since the review put events of the movie in sequential order



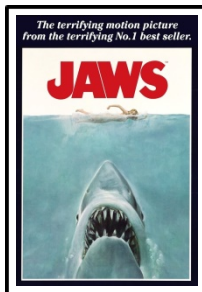
APPLY IT

13 minutes

1. **DO:** Put members into groups or partners. Distribute copies of “Discovering Text Structure” to each member.
2. **SAY:** Now you are going to practice what we’ve reviewed by reading through each passage and deciding which way you think the text was structured.
3. **GIVE:** Members ten minutes to work together. Remind them to refer back to the white board for descriptions of each of the possible text structures.
4. **ASK** members to share their response and reasons they chose the text structure they did:
 - a. Why Do We Have Schools?
Answer: **cause and effect**
 - b. Milestones
Answer: **sequence**
 - c. The Perfect Pizza!
Answer: **description**
 - d. Attendance
Answer: **problem and solution**
 - e. Are Charter Schools Harder Schools?
Answer: **compare and contrast**
5. **CHECK FOR UNDERSTANDING** If members have trouble identifying text structures, guide them through the lesson again or help them access the additional resource listed.

Finding Text Structure in Movie Reviews

Directions: below are reviews of five well-known movies. Read through the reviews and decide how the text was structured: description, sequence, compare/contrast, cause & effect or problem & solution.



Divergent

Review by Karissa Kroll

In both the book and movie, fear plays a huge role. Even from the beginning, the initiates are told they will become factionless if they cannot be tough enough for Dauntless. This already sets fear into the characters. Fear comes even more into play when the initiates must go through simulated fear landscapes and face their biggest fears. Facing fears and being strong enough to do so plays a huge role. In both the book and the movie, Tris remains the same strong-spirited, brave, and tough soul. As a reader of the book or a watcher of the movie, you develop a relationship with Tris and just want everything to work out for her. Tris is a symbol of the book, meaning you think of Tris when you hear "Divergent".

Up

Review by Claudio Carvalho

Carl Fredrickson is a little boy and a dreamer who idolizes the adventurer Charles Muntz. When he meets Ellie, who also worships Muntz, they become close friends. However Charles Muntz falls into disgrace, accused of forging the skeleton of the monster of Paradise Falls. He travels in his blimp to South America to bring the monster back alive but is never seen again. Eventually Carl grows up and marries Ellie. They promise each other that they would travel together to Paradise Falls and build a house there. Many years later, Ellie dies and Carl, who's lonely, refuses to move from their house despite the offers of the owner of a construction company. When Carl accidentally hits a worker that damaged his mailbox, he is sentenced to move to a retirement home. However, he uses many balloons to float his house in order to travel to Paradise Falls. Adventure ensues.

Jaws

Review by Sami Al-Taher

The peaceful community of Amity Island is being terrorized. There is something in the sea that is attacking swimmers. They can no longer enjoy the sea and the sun as they used to, and the spreading fear is affecting the numbers of tourists that are normally attracted to this island. After many attempts the great white shark won't go away and sheriff Brody, with friends Hooper and Quint decide to go after the shark and kill it.

The Impossible

Review by Peter Brandt Nielsen

A British family on Christmas holiday at a beach resort in Thailand is torn apart when a deadly tsunami devastates the area. The film follows the seriously wounded Maria and her eldest son Lucas as they struggle to safety, not knowing whether Maria's husband and their two younger sons are dead or alive.

Forrest Gump

Review by Kathryn Logue


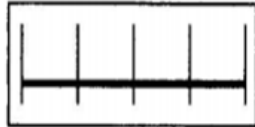
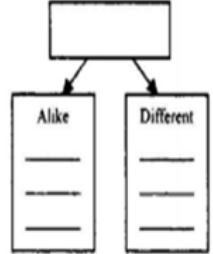
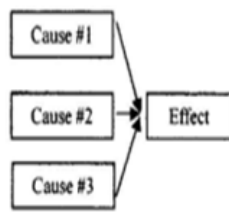

The movie Forrest Gump follows the life events of a man who shares the name as the title of the film. Gump faces many tribulations throughout his life, but he never lets any of them interfere with his happiness. While several less than ideal things occur during Gump's life, he manages to turn each setback into something good for him, such as when he finally gets his braces off he discovers that he is capable of running faster than most other people. This skill allows Gump to not only escape his bullies while he is a child in Greenbow, but also to gain a football scholarship, save many soldiers' lives and become famous for his ability. While Gump eventually achieves the majority of the things he hoped to throughout the movie, it proved a much more difficult task to win the heart of his life-long friend Jenny Curran. The movie is centered on Forrest Gump and the incidences that occur during his life, but during each period in his lifetime he thinks back of Jenny and how important she is to him.

Sources:

<https://prezi.com/wxvfomku28ue/divergent-book-and-movie-comparison-and-contrast/>
<http://www.imdb.com/title/tt1049413/plotsummary>

Discovering Text Structure

Directions: Read each passage. On a white board, write down what you think the text structure is using the five options shown below.

	Sequence	Compare and Contrast	Cause and Effect	Problem and Solution
	<p>Time Line</p> 			

1. Why Do We Have Schools? Education in our society serves many purposes, but there are three main functions. First, students learn skills that will help prepare them for society. Writing, reading, and mathematics are essential in today’s workplace and many people learn these skills in school. Second, schools serve communities. Whether by functioning as polling locations during elections, or providing safe havens for students in temporary living situations, public schools add value to communities. Third, public schools provide a structured environment for children to engage in productive activities during many days of the year while their adult caretakers may be working. In other words, public schools also provide day care. These are three of the primary reasons why we have schools in our society.

2. Milestones: In 1821 the first public high school in the United States was started in Boston. By 1900, 31 states required children to attend school from the ages of 8 to 14. As a result, by 1910 72 percent of American children attended school. Half the nation’s children attended one-room schools. In 1918, every state required students to complete elementary school. In 1954, the Supreme Court in *Brown v. Board of Education* unanimously declared that separate facilities were unconstitutional and desegregation began.

3. The Perfect Pizza! If you ask me, the perfect pizza has a thin crust, but not too thin. Even though I'm from Chicago, I prefer the New York style crust. Your perfect pizza might have tomato sauce on it, but mine has pesto on top of the crust. On the pesto I'd like to see lots of cheese: a full layer of shredded mozzarella and Romano cheese, and on top of the shredded mozzarella, I'd like to see some slices of fresh mozzarella. Now you might think I'm crazy for this one, but I'd really like to see some goat cheese in the crust. To top it all off, I'd like to see it polka-dotted with pepperoni slices. Now that's what I call a pizza pie.

4. Attendance: Having good attendance is important because attendance determines the school's funding. Some students have poor attendance, and the school has tried many ways of addressing this: teachers have talked to parents on the phone and the school has mailed letters. Yet, some students still maintain poor attendance. Next, the staff will attempt to schedule parent/teacher/administrator conferences with students who are habitually absent. Hopefully, this will help more students get to school every day.

5. Are Charter Schools Harder Schools? These days, students and their caretakers have more choices when it comes to selecting a public school. In addition to the traditional neighborhood schools, Charter schools have popped up in major cities across the country. Both charter schools and neighborhood schools fill traditional roles like providing instruction, serving lunch and other meals, and administering the state tests. But charter schools and neighborhood schools differ in many important ways. One key difference is the amount of time students spend in school. In Chicago, students who attend neighborhood schools do so for around 180 days in a year, and each day is slightly over six hours long. On the contrary, students who attend charter schools do so for around 200 days in a year, and most charter school days are over eight hours long. While both neighborhood and charter schools provide free public education to students meeting enrollment criteria, students who attend charter schools spend much more time in class.

Source: EReadingworksheets.com, <http://www.ereadingworksheets.com/text-structure-worksheets/text-structure-worksheet-6.pdf>.

Understanding Point of View

TIME: 25 minutes

OBJECTIVE: Determining the author’s viewpoint helps strengthen readers’ understanding of what they are reading. In this lesson, members focus on point-of-view and how to determine the author’s point of view on a topic. They review the meaning of point of view, where it can be found and how to tell what an author’s perspective is.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils

VOCABULARY

- **Opinion** – a statement that cannot be proved; someone’s own belief
- **Point of view** – who is telling or narrating a story; the viewpoint the author uses to let readers know what takes place
- **Perspective** – the “lens” through which readers learn about characters, events or facts

PREPARATION

Make copies of “Point-of-View Sentences” and “Point-of-View Articles” (one per member).

ADDITIONAL RESOURCE(S)

[Point-of-View Exercise and Quizzes](#)



LEARN IT

5 minutes

1. **ASK:** Pretend that a law was just created that said each person shall receive a brand new car, smart phone and \$1,000 on their 16th birthday! However, the law also says that you are also *required* to work three jobs and go to school in order to receive these gifts. What would you think of this new (fake) law?
2. **SAY:** This is a fake law however, you had some really strong opinions about it! By giving your reaction to this idea, you shared your opinion on the matter.
3. **ASK:** What are your reasons for thinking this is either a great idea or a horrible one?
4. **SAY:** By sharing your opinion and the reasons you think that way about the matter, you are sharing your point-of-view – your perspective on something and feelings about an idea.
5. **ASK:** What's an example of how writers use their point-of-view in their writing?
Answer: newspaper articles, magazine articles and many books have a strong opinion about a topic since the author feels a certain way about the subject matter
6. **SAY:** Authors use certain words to give the reader an idea of how they're feeling. For example, the author will use strong, emotional words such as *ecstatic, devastated, outraged or proud* in their writing. These words are like little clues that give the reader a hint as to the author's point-of-view. This also helps you, the reader, understand the text better.
7. **SAY:** Today we're going to practice how to determine point-of-view using a variety of sentences that give clues to the author's point-of-view about a subject.



TRY IT

5 minutes

1. **DO:** Distribute copies of “Point-of-View Sentences” to all members.
2. **SAY:** I am going to read these sentences aloud and we are going to determine the author’s point-of-view. Give a thumbs up if you think the author likes the subject or a thumbs down if you think they author does not like the subject.
3. **DO:** Read through the sentences, pausing each time to give the members a minute to put a thumbs up (likes the subject) or thumbs down (does not like the subject) on how the author feels about the subject and to say which words helped them figure it out (refer to “Point-of-View Sentences – Answers” for possible responses).



APPLY IT

15 minutes

1. **ASK** members to form pairs.
2. **DO:** Distribute copies of “Point-of-View Articles” to each member.
3. **SAY:** Now you are going to practice what we’ve reviewed by reading through each passage and deciding the author’s point-of-view.
4. **GIVE:** Members 10 minutes to work together. Remind them to think about key words that give them an idea of how the author feels about the subject.
5. **ASK** members to share their responses and reasons they decided on the point-of-view.
6. **CHECK FOR UNDERSTANDING:** If members have trouble determining point of view, guide them through the lesson again or help them access the additional resource listed.

Point-of-View Sentences

Directions: Listen as each sentence is read aloud. Decide whether you think the author likes the subject matter or does not like it. Give a thumbs up if you think they like it or a thumbs down if you think they do not like it. Feel free to underline words that helped you make your decision.

1. I am devastated at the news that summer break, filled with endless sunshine and blissful days, is being shortened to only a week!

How does the author feel about losing summer break?

2. I was shocked to learn that my brilliant principal was retiring early since he helped me become more confident in myself.

How does the author feel about their principal?

3. To say I was thrilled was an understatement! A bonus from my boss was just the icing on the cake after a long day.

How does the author feel about their bonus?

4. In my opinion, you should never go into the woods by yourself. Danger lurks everywhere!

How does the author feel about the woods?

5. Most people feel that dogs are man's best friend, however, I strongly believe that those filthy animals only bark loudly and jump on you instead of being friendly towards you.

How does the author feel about dogs?

Point-of-View Sentences (Answer Key)

NOTE: words that help determine the author's point-of-view are underlined

1. I am devastated at the news that summer break, filled with endless sunshine and blissful days, is being shortened to only a week!

How does the author feel about losing summer break?

The author is upset about losing summer break. He/she uses words with positive connotations such as *endless sunshine* and *blissful days*.

2. I was shocked to learn that my brilliant principal was retiring early since he helped me become more confident in myself.

How does the author feel about their principal?

The author is sad that the principal is retiring. He/she uses words with positive connotations such as *brilliant* and *confident* in the description.

3. To say I was thrilled was an understatement! A bonus from my boss was just the icing on the cake after a long day.

How does the author feel about their bonus?

The author is happy about the bonus.

4. In my opinion, you should never go into the woods by yourself. Danger lurks everywhere!

How does the author feel about the woods?

The author does not like the woods.

5. Most people feel that dogs are man's best friend, however, I strongly believe that those filthy animals only bark loudly and jump on you instead of being friendly towards you.

How does the author feel about dogs?

The author does not like dogs. He/she uses words with negative connotations to describe dogs, such as *filthy*.

2. Milestones: In 1821 the first public high school in the United States was started in Boston. By 1900, 31 states required children to attend school from the ages of 8 to 14. As a result, by 1910 72 percent of American children attended school. Half the nation's children attended one-room schools.

In 1918, every state required students to complete elementary school. In 1954, the Supreme Court in *Brown v. Board of Education* unanimously declared that separate facilities were unconstitutional and desegregation began.

3. The Perfect Pizza! If you ask me, the perfect pizza has a thin crust, but not too thin. Even though I'm from Chicago, I prefer the New York style crust. Your perfect pizza might have tomato sauce on it, but mine has pesto on top of the crust. On the pesto I'd like to see lots of cheese: a full layer of shredded mozzarella and Romano cheese, and on top of the shredded mozzarella, I'd like to see some slices of fresh mozzarella. Now you might think I'm crazy for this one, but I'd really like to see some goat cheese in the crust. To top it all off, I'd like to see it polka-dotted with pepperoni slices. Now that's what I call a pizza pie.

4. Attendance: Having good attendance is important because attendance determines the school's funding. Some students have poor attendance, and the school has tried many ways of addressing this: teachers have talked to parents on the phone and the school has mailed letters. Yet, some students still maintain poor attendance. Next, the staff will attempt to schedule parent/teacher/administrator conferences with students who are habitually absent. Hopefully, this will help more students get to school every day.

5. Are Charter Schools Harder Schools? These days, students and their caretakers have more choices when it comes to selecting a public school. In addition to the traditional neighborhood schools, Charter schools have popped up in major cities across the country. Both charter schools and neighborhood schools fill traditional roles like providing instruction, serving lunch and other meals, and administering the state tests. But charter schools and neighborhood schools differ in many important ways. One key difference is the amount of time students spend in school. In Chicago, students who attend neighborhood schools do so for around 180 days in a year, and each day is slightly over six hours long. On the contrary, students who attend charter schools do so for around 200 days in a year, and most charter school days are over eight hours long. While both neighborhood and charter schools provide free public education to students meeting enrollment criteria, students who attend charter schools spend much more time in class.

Source: EReadingworksheets.com, <http://www.ereadingworksheets.com/text-structure-worksheets/text-structure-worksheet-6.pdf>.

Presenting Topics in Visual Form

TIME: 25 minutes

OBJECTIVE: In this lesson, members take information that has been written and put it in a visual form (such as a poster). Members also work together to generate a list of ways to express written information visually. This strengthens their presentation skills and helps them learn alternate ways to share their knowledge.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Poster board
- Markers

VOCABULARY

- **Key words** – important words in a text that give clues as to what it is about
- **Main idea**– what a piece of writing is mostly about (same as the central idea)

PREPARATION

Make copies of “Drone Delivery” and “MyPlate – A Symbol for Healthy Eating” (one per member).

ADDITIONAL RESOURCE(S)

[Reading Comprehension and Quizzes](#)



LEARN IT

3 minutes

1. **ASK:** What are examples of ways people share information?
Answer: **text, email, phone call, TV, discussion, poster, magazine**
2. **ASK:** What are examples of time when you had to share information you learned to your classmates? How did you get the information across to classmates so they understood?
Answer: **a presentation, poster, PowerPoint, website, paper**
3. **SAY:** When we're asked to share information, whether it's to our friends or in a class, we have to do so in a way that others will understand. Today we'll practice sharing information from an article we read.
4. **ASK:** What are some examples of ways to visually share information?
Answer: **poster, PowerPoint presentation, cartoon, drawing, diagram, chart, graph**



TRY IT

7 minutes

1. **DO:** Distribute copies of "Drone Delivery" to all members.
2. **DO:** Give members five minutes to read the article.
3. **ASK:** What is the main idea of this article?
Answer: **Amazon tested delivery of items using a drone; while it worked in rural, open areas, Amazon is concerned with deliveries to populated areas with lots of obstacles**
4. **ASK** members to reread the article and underline key words and phrases that helped them determine the main idea of the article.
5. **DO:** Review members' highlighted phrases.



APPLY IT

15 minutes

1. **ASK** members to form pairs.
2. **DO:** Distribute copies of “MyPlate – A Symbol for Healthy Eating” to members.
3. **DO:** Allow 10 minutes for members to read the article with a partner and highlight important words and phrases.
4. **ASK** members to present the information on a poster in a way that teaches the group the most important facts.
5. **SAY:** The poster can be designed in any way you’d like as long as it shares the most important information; it also should be clear and easy to follow.
6. **ASK** members to share their posters.
7. **CHECK FOR UNDERSTANDING:** If members have trouble identifying important information or presenting topics in visual form, guide them through the lesson again or help them access the additional resource listed.

Drone Delivery

Amazon Drone Delivers Popcorn and Fire TV to its First Customer

By Meera Dolasia

In 2013, Jeff Bezos, the CEO and founder of Amazon Inc., made headlines when he proclaimed that within a few years, the company would deploy unmanned drones to deliver packages within 30 minutes after an order was placed. Since Amazon Prime Air was unveiled the night before “Cyber Monday,” skeptics dismissed it as a publicity stunt designed to draw attention to the company. It turns out they were wrong.

On December 7, 2016, Amazon revealed that it had completed its first Prime Air delivery in Cambridge, UK. The package, containing a bag of popcorn and an Amazon Fire TV, were loaded on to the unmanned vehicle from a local fulfillment center and delivered to a two-story farmhouse several miles away – all within 13 minutes after the items were bought!

The company also announced that the service is now available within the five-square-mile radius of the Cambridge area, seven days a week during daylight hours. The sparsely populated rural area, with few dozen residents scattered amidst vast swaths of farmland and fields, is perfect for testing the drones.

Unfortunately, even if the trial is wildly successful, many challenges still remain before drone delivery becomes a reality for most of us. While the octocopters may do fine in rural areas, they remain untested in crowded urban cities where they would encounter obstacles like buildings or trees. There is also fear that the autonomous flying vehicles could injure people as they descend to drop their packages. The drones and their cargo are also susceptible to being taken down by vandals.

Source: DogoNews.com, <https://www.dogonews.com/2016/12/22/amazon-drone-delivers-popcorn-and-fire-tv-to-its-first-customer>, 2016.

MyPlate – A Symbol for Healthy Eating



MyPlate is the model for healthy eating in the United States. Experts at the USDA, the agency in charge of nutrition, created the colorful plate to help people remember to:

- Eat a variety of foods.
- Eat less of some foods and more of others.

The plate features four sections — vegetables, fruits, grains, and protein — plus a side order of dairy in blue. The big message is that fruits and vegetables take up half the plate, with the vegetable portion being a little bigger than the fruit section. The plate is divided so the grains section is bigger than the protein section. Why? Because nutrition experts recommend you eat more vegetables than fruit and more grains than protein foods.

The divided plate also aims to discourage super-big portions, which can cause weight gain.

What's a Grain Again?

You know what fruits and vegetables are. But here's a reminder about what's included in the three other food groups: protein, grains, and dairy:

- **Protein:** Beef; poultry; fish; eggs; nuts and seeds; beans and peas, split peas, lentils, and even tofu and veggie burgers. Protein builds up, maintains, and replaces tissues in the body.
- **Grains:** Bread, cereal, rice, tortillas, and pasta. Whole-grain products such as whole-wheat bread, oatmeal, and brown rice are best because they have more [fiber](#) and help you feel full.
- **Dairy:** Milk, yogurt, cheese, and fortified soy milk. The dairy circle could be a cup of milk, but you also can get dairy from yogurt or cheese. Choose low-fat or nonfat dairy most of the time.

The plate can be used for breakfast, lunch, and dinner. That may make you wonder: *Do I really have to eat vegetables with breakfast?* The answer is no, but aim to eat a variety of food groups at each meal. And if your breakfast doesn't include a veggie, consider a vegetable at snack time. (Yes, healthy, portion-controlled snacks are still OK.)

The plate also shows how to balance your food groups. There's a reason the protein section is smaller: You don't need as much from that group. Eating more fruits and vegetables will help you eat fewer [calories](#) overall, which helps you keep a healthy weight. Eating fruits and veggies also gives you lots of [vitamins](#) and [minerals](#).

Source: KidsHealth.org, <http://kidshealth.org/en/kids/pyramid.html>, 2016.

Evaluating an Argument

TIME: 25 minutes

OBJECTIVE: In this lesson, members evaluate arguments made in various articles. They assess whether the argument being made is valid or invalid based upon the points made. Members also choose a side to an argument and debate their side using reasons from the articles.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper

VOCABULARY

- **Argument** – the main statement of a text or the point the author is trying to argue
- **Point of view**– who is telling or narrating a story; the viewpoint the author uses to let readers know what takes place
- **Reasoning** – the process an author uses to form conclusions or make an argument

PREPARATION

Make copies of “Should Animals be Held in Captivity?” “Why Zoos Matter” and “The Reality of Zoos” (one per member).

ADDITIONAL RESOURCE(S)

[Practice Evaluating Arguments and Reasoning](#)



LEARN IT

3 minutes

1. **ASK:** Can you think of a time when you really felt strongly about something but had to convince a parent or friend to believe in your point?
Answer: **convincing parents to let you stay up later; asking to see a movie; convincing someone to go somewhere with you; asking to hang out with a friend after school**
2. **ASK:** What do you have to do to convince someone to believe in your side of the discussion, especially if they do not see it the same way you do?
Answer: **make a strong case in favor of your side by providing points to back you up**
3. **SAY:** When you're having an argument or trying to convince someone of your point, you try to persuade that person to take your side. When authors do this, they include reasons and evidence to support their points. This helps the reader understand their point of view and possibly agree with them, especially if they've included examples and facts.
4. **SAY:** We'll take a look at a few short examples and decide whether or not the author made a strong point in their argument. In doing so, we are evaluating the author's claim and deciding if it is valid. If we do not think it is a strong point, we would say it's invalid.



TRY IT

5 minutes

1. **DO:** Read aloud one of the arguments on "Valid or Invalid?"
2. **ASK** members to decide whether the author makes a valid argument with good reasons or an invalid argument with little reasoning to support it.
3. **DO:** Repeat with one or two more arguments on "Valid or Invalid?" giving members a chance to decide on the argument and say why they think it is valid or invalid.
4. **SAY:** Now you are going to have a chance to decide your side of an argument on whether animals should be kept inside of zoos or allowed to stay in their natural habitat.



APPLY IT

17 minutes

1. **DO:** Distribute copies of “Should Animals be Held in Captivity?” to members.
2. **ASK** members to read the article and, as they do, to start to form an opinion of whether animals should or should not be in zoos.
3. **ASK** members to decide which side they would like to be on – in *favor* of animals being kept in zoos or *against* animals being kept in zoos.
4. **DO:** Give each side the appropriate article: those in *favor* of zoos will read “Why Zoos Matter” and those *against* zoos will read “The Reality of Zoos.”
5. **SAY:** As a group, read through the new article you’ve received and underline points that will help in your case either for or against zoos. Then, write down key points you will use in a debate about animals being in zoos.
6. **DO:** Give groups 10 minutes to read and highlight points they will use in the debate.
7. **DO:** Begin the debate when groups are ready. Remind members to use the points they have written to back up their side of the argument.
8. **CHECK FOR UNDERSTANDING:** If members have trouble identifying important information for making a point in an argument, guide them through the lesson again or help them access the additional resource listed.

Valid or Invalid?

Directions: read through each short text. Decide whether the author made a strong and valid point that includes good reasons to believe their argument. If you do not think the author included many points to support their argument, write invalid on the line. Discuss with your group why you chose valid or invalid.

1. Each day, students should eat a healthy breakfast before going to school. A healthy breakfast will provide the right amount of nutrition needed to focus on what is being taught and give them the energy needed to get through the morning until lunch. Without breakfast, students will be sluggish and tired, which will make it difficult to focus on their teachers and cause them to fall behind in their education.

2. I really think every kid should have a pet when growing up. Pets are cute and fun to have around. If you think you could be responsible for a pet, you should get one. Just ask your parent or caregiver and I'm sure they'll say yes! Who doesn't love dogs?

3. Every night before I fall asleep, I do at least 20 minutes of yoga. The stretches help me calm down and feel more relaxed. I think everyone should do this in order to have a good night's sleep.

4. In order to have more appreciation and kindness towards restaurant servers, everyone should have to work at least one month in as a waiter or waitress. Too many times, waiters are treated poorly by taking demanding orders from patrons or working really hard to accommodate the diner without receiving a tip. To appreciate the effort that goes into the long days and constant standing on your feet, everyone should be required to work in a restaurant.

5. Why would anyone want to eat pizza? Every time I've ordered a pizza, it arrives at my doorstep with lots of grease and is usually cold. Why wouldn't you want a sandwich or salad instead?

Should Animals Be Held in Captivity?

When a 350-pound Siberian tiger named Tatiana killed Carlos Sousa, it wasn't the first time that the animal had attacked someone. On Dec. 22, 2006, the animal attacked a zoo keeper, who survived. Police are investigating whether the three victims provoked the tiger to scale a 20-foot wall and jump over a moat. "If you go across a barrier at a NASCAR race and go on to the track, you get hurt," said Jack Hanna, director emeritus of the Columbus Zoo, on "Good Morning America" today.

But Adam Roberts, senior vice president of the animal protection advocacy group Born Free USA, said caging animals can create problems for both humans and the animals. "It's not good for the animals," Roberts said on "GMA" today. "It's not good for humans either. First, the animals are put in unnatural settings. They're taken out of their biological comfort zone and the way they actually live in the wild and forced into these artificial enclosures on concrete, behind bars."

Roberts argued that having animals in unnatural environments provides no educational value. "You're not getting the right education about what animals are like in the wild. That's why we believe that you should keep wildlife in the wild. That's best for animals and it's best for the people," Robert said. "We're not getting an educational benefit from zoo-going or from circus-going, and more importantly, as you unfortunately have seen recently, there is the potential for attack," he added.

But Hanna vigorously disagreed, saying millions of dollars had been spent to ensure the health of animals and education of people. "I take great offense to anyone saying there's no education done there," Hanna said. "Most of these animals live better than people in the world. You have to have the love for animals in order to save animals, and that's what we teach. ... We're doing the best we can to provide habitat for these animals." For zoos that are lacking suitable animal habitats and settings, the Association of Zoos and Aquariums and others are working to close them down, Hanna said.

But those actions haven't appeased objectors. "It's not enough to say we're pouring money into education or conservation without quantifying exactly what that means," Roberts said. "It's very easy to say we're doing it, but we have to see the results. AZA's [Association of Zoos and Aquariums] own research has suggested that we don't know whether the results on educational values of zoos are conclusive or not."

Source: Abcnews.go.com, <http://abcnews.go.com/GMA/story?id=4055821&page=1>, 2007.

Why Zoos Matter

Making a Difference – The world around us is changing fast. Species of wildlife are facing global extinction on a massive scale. About 21% of the world's mammal species, about 12% of the bird species and about 33% of all amphibian species are threatened with extinction. Cranes and cheetahs, great apes and rhinos and so many more are in trouble. Zoos are in a unique position to make a difference.

Zoos deal with living creatures. We work with an incredible variety of animals, from one-celled creatures to elephants. Our [research](#) on behavior, reproductive biology, nutrition, animal health and genetics is valuable to wildlife managers, field researchers and other scientists.

For example, the Saint Louis Zoo has been doing a mother/infant bonding study with antelope and other hoofed animals at Red Rocks for 14 years. The data we've gathered — how often and when a species typically nurses, who initiates nursing, proximity, grooming, nuzzling — has provided information to field researchers that would be hard to come by otherwise.

Connecting People to Animals – People learn at zoos. They [learn](#) in our formal classes, lectures, camps, teacher workshops, distance learning, zoo tours, overnights and outreach programs. Informally they learn from keeper chats, docent volunteers, interpreters, signage and special exhibits. Most important, they learn from observing zoo animals.

At the Saint Louis Zoo, about 450,000 children and adults participate in our formal programs, including classes and Camp KangaZoo each year. And of our 3,000,000 visitors annually, about 1.3 million interact with an educational interpreter, docent or zookeeper who provides educational experiences and information. Each year the Zoo is visited by over 1,400 school groups who come for a free field trip. Of these schoolchildren, 31% are from economically disadvantaged neighborhoods, and 17% are special needs children.

On a scale of 1 to 10, our visitors rate their experience at the Saint Louis Zoo as a 9.1

Source: STLZoo.org, <https://www.stlzoo.org/about/whyzoosmatter>, 2003-2017.

The Reality of Zoos

Many people aren't aware of the cruelty behind zoos. When I was a kid, I went to the zoo all the time with my family. I loved pandas as a kid (still do!), and I thought being able to see them in person would be neat. But once I saw them "up close and personal," I realized that the animals were miserable. It instantly became very clear to me that the animals imprisoned in zoos are sad and don't want to be kept in artificial environments, have people gawk at them, listen to children who bang on the windows of their enclosures, or have cameras flashing in their faces. To put it simply, zoos are imprisoning animals who want to be free.

Captive animals are [deprived of everything that is natural and important to them](#), and as a result, they become bored and lonely and many even suffer from a condition called "zoochosis." If you've ever witnessed a captive animal rock and sway back and forth, you've seen the disease firsthand. This condition is so rampant in zoos that some zoos give animals a mood-altering drug, such as Prozac, because the public has started to catch on.

Some animals are so unhappy that they risk their lives in desperate attempts to free themselves. At the Dallas Zoo, a gorilla named Jabari tried to escape by jumping over the walls and moats of his [enclosure](#), only to be fatally shot by police. A witness later confessed that teenagers were taunting him by throwing rocks.

Animals are unable to thrive in small enclosures, especially with unnatural weather and climates. For example, elephants typically walk up to 30 miles in just one day, but [Lucy, the lone elephant at the Edmonton Zoo](#), is locked inside a barn when the zoo is closed and during Edmonton's frigid winter months, which means she spends most of her time indoors, without much room to move. The near-constant confinement because of the harsh weather has caused Lucy to develop painful arthritis.

Source: Peta.org, <http://www.peta.org/living/entertainment/reality-zoos/>, 2013.

Compare and Contrast a Topic in Various Texts

TIME: 20 minutes

OBJECTIVE: In this lesson, members compare and contrast three versions of the Declaration of Independence. In doing so, they review their understanding of primary and secondary sources. Additionally, by evaluating the sources, members learn to compare and contrast them, which helps strengthen their comprehension skills.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper

VOCABULARY

- **Primary source** – an account that provides direct, firsthand evidence about an event, object or person; original records of political, economic or scientific or other achievements
- **Secondary source**– an account that describes, discusses, evaluates or summarizes an event, object or person by someone not directly involved (who typically used a primary source)
- **Comparing** – looking for similarities among two or more texts
- **Contrasting** – looking for differences among two or more texts

PREPARATION

Make copies of “Reviewing Primary and Secondary Sources” (one per member).

ADDITIONAL RESOURCE(S)

[Reading Comprehension Exercise and Quizzes](#)



LEARN IT

5 minutes

- 1. ASK:** Let's say you have three books in your backpack right now: an autobiography of Steve Jobs, an article about Steve Jobs inventing the iPhone and a magazine about Smartphones. Which of these three are a primary source and which are secondary sources?
Answer: **the autobiography is a primary source and the article and magazine are secondary sources**
- 2. SAY:** Primary sources are original documents or first-hand account of an event. Secondary sources are documents that are written about the original source like an article or review.
- 3. ASK:** When you read a nonfiction piece such as a newspaper article or historical document, why is it important to know whether it is a primary or secondary source?
Answer: **it's important to know what you are reading in order to tell the validity of the piece; if it's a piece written by the person, you know the information is accurate**
- 4. SAY:** It's important to recognize whether the piece is a primary source or secondary as it will let you know whether what you are reading is a direct account of an event or a retelling. The information, while it can be factual in both, needs to be evaluated in a secondary source to see if there is any missing information or misinterpreted information.
- 5. SAY:** Today we're going to practice determining which sources out of the three examples are primary and which are secondary.



TRY IT

5 minutes

1. **DO:** Distribute copies of “Reviewing Primary and Secondary Sources” to members.
2. **SAY:** These pages all focus on the Declaration of Independence.
3. **ASK** members to take a few minutes to skim read and scan the sheets to see if they can tell which are primary and secondary.
4. **ASK:** Which of these are primary and which are secondary sources?
Answer: the first one is an actual copy of the Declaration of Independence which makes it a primary source; the others are secondary sources as they depict the “Declaration” through an outside viewpoint



APPLY IT

10 minutes

1. **ASK** members to form pairs.
2. **SAY:** Now you’re going to compare and contrast the documents. You can do this any way you want – use bullet points to show how you compared/contrasted the documents or make a Venn Diagram to show what is different and what is the same.
3. **DO:** Give members 10 minutes to work together.
4. **ASK** pairs to share the similarities and differences they found.
5. **CHECK FOR UNDERSTANDING:** If members have trouble identifying the similarities and differences, guide them through the lesson again or help them access the additional resource listed.

Reviewing Primary and Secondary Sources

IN CONGRESS, JULY 4, 1776.

The unanimous Declaration of the thirteen united States of America,

When in the Course of human events, it becomes necessary for one People to dissolve the political bands which have connected them with another, and to assume among the Powers of the earth, the separate and equal Station to which the Laws of Nature and of Nature's God entitle them, a decent Respect to the Opinions of Mankind requires that they should declare the causes which impel them to the Separation. — We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. — That to secure these Rights, Governments are instituted among Men, deriving their just Powers from the Consent of the governed, — That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such Principles and organizing its Powers in such Form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient Causes; and accordingly all experienced Men have shown, that Mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long Train of abuses and usurpations, pursuing invariably the same Object evinces a design to reduce them under absolute Tyranny, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future Security. — Such has been the Patient Sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The History of the present King of Great Britain is a History of repeated injuries and usurpations, all having in direct or indirect Effect the Establishment of an absolute Tyranny over these States. To prove this, let Facts be submitted to a candid World. — He has refused his Assent to Laws, the most wholesome and necessary for the public good. — He has forbidden his Governors to pass Laws of immediate and pressing Importance, unless suspended in their Operation till his Assent should be obtained; and when so suspended, he has utterly neglected to attend to them. — He has refused to pass other Laws for the accommodation of large districts of People, unless those People would relinquish the Rights of Representation in the Legislature, a right inestimable to them and formidable to Tyrants only. — He has called together legislative Bodies at places unusual, uncomfortable, and distant from the depository of their Public Records, for the sole purpose of obtruding upon them new and oppressive Measures, which have never been so often repeated, as to have exhausted the usual patience of the People. — He has refused for a long time, after such Objections, to cause others to be elected; whereby the Legislative Powers, incapable of Annihilation, have returned to the People at large for their exercise; and the State remaining in the mean time exposed to all the Dangers of Invasion from without, and Convulsions within. — He has endeavoured to prevent the Population of these States; for that purpose obstructing the Law for Naturalization of Strangers; refusing to pass others to encourage their Migration hither, and raising the Conditions of new Appropriations of Lands. — He has obstructed the Administration of Justice, by refusing his Assent to Laws for establishing Judiciary Powers. — He has made Judges dependent on his Will alone, for the Tenure of their Offices, and the Amount and Payment of their Salaries. — He has created a multitude of new Offices, and sent hither Swarms of Officers to harass our People, and eat out their Substance. — He has kept among us, in Times of Peace, Standing Armies without the Consent of our Legislature. — He has affected to render the Military independent of and superior to the Civil Power. — He has combined with others to subject us to a Jurisdiction foreign to our Constitution, and unacknowledged by our Laws; giving his Assent to their Acts of pretended Legislation: — For quartering large Bodies of armed Troops among us: — For protecting them, by a mock Trial, from Punishment for any Murders which they should commit on the Inhabitants of these States: — For cutting off our Trade with all parts of the world: — For imposing Taxes on us without our Consent: — For depriving us in many Cases, of the Benefits of Trial by Jury: — For transporting us beyond Seas to be tried for pretended Offences: — For abolishing the free System of English Laws in a neighbouring Province, establishing therein an Arbitrary Government, and enlarging its Boundaries so as to render it at once an Example and fit Instrument for introducing the same absolute Rule into these Colonies: — For taking away our Charters, abolishing our most valuable Laws, and altering fundamentally the Forms of our Governments: — For suspending our own Legislatures, and declaring themselves invested with Powers to legislate for us in all Cases whatsoever. — He has abdicated Government here, by declaring us out of his Protection and waging War against us. — He has plundered our Seas, ravaged our Coasts, burnt our Towns, and destroyed the Lives of our People. — He is at this time transporting large Armies of foreign Mercenaries to complete the works of death, desolation and Tyranny, already begun with Circumstances of Cruelty & Rapidity scarcely paralleled in the most barbarous Ages, and totally unworthy the Head of a civilized Nation. — He has constrained our fellow Citizens taken Captive on the high Seas to bear Arms against their Country, to become the Executioners of their Friends and Brethren, or to fall themselves by their Hands. — He has incited domestic Injuries among us, and has endeavoured to bring on the Inhabitants of our States, the merciless Indian Savages, whose known Rule of Warfare, is an undistinguished Destruction of all Age, Sex and Condition. In every Stage of these Oppressions We have Petitioned for Redress in the most humble Terms: Our repeated Petitions have been answered by insult instead of Redress. — Our Representatives have been variously and artfully misrepresented by those who hold the Evil Tongue, and who have endeavoured to excite in us a jealous and uncharitable Spirit, by which they have endeavoured to bring on the able Jurisdiction over us. We have reminded them of the Circumstances of our Emigration and Settlement here. We have appealed to their native Justice and Magnanimity, and we have conjured them by the ties of our common Kindred to disavow these usurpations, which would interrupt our Connections and Correspondence. They too have been deaf to the Voice of Justice and of Concinnity. We must, therefore, acquiesce in the necessity, which denounces our Separation, and hold them, as we hold the rest of Mankind, Enemies in War, in Peace Friends.

We, therefore, the Representatives of the united States of America, in General Congress, Assembled, appealing to the Supreme Judge of the world for the Rectitude of our Intentions, do, in the Name, and by Authority of the good People of these Colonies, solemnly publish and declare, That these United Colonies are, and of Right ought to be, Free and Independent States; that they are Absolved from all Allegiance to the British Crown, and that all political Connection between them and the State of Great Britain, is and ought to be totally dissolved; and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of Right do. — And for the Support of this Declaration, with a firm reliance on the Protection of Divine Providence, we mutually pledge to each other our Lives, our Fortunes and our sacred Honors.

William Livingston
Lyman Hall
George Walton

John Hancock
John Adams
John Jay

Edward Rutledge

Thomas Mifflin
George Wythe
Richard Henry Lee

John Adams
John Jay
George Washington

Samuel Adams
John Hancock
John Jay

George Wythe
Richard Henry Lee
Thomas Jefferson
John Adams
John Jay
George Washington

John Adams
John Jay
George Washington

James Wilson
Gouverneur Morris
Benjamin Franklin
John Adams
John Jay
George Washington

John Adams
John Jay
George Washington

John Adams
John Jay
George Washington

John Adams
John Jay
George Washington

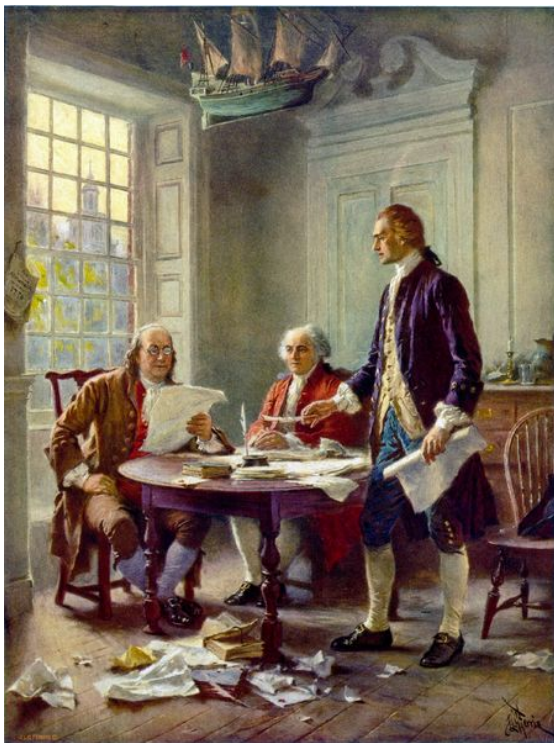
John Adams
John Jay
George Washington

Source: The Thomas Jefferson Foundation, <https://www.monticello.org/site/jefferson/images-declaration>.

Visual Representations of the Signing of the Declaration of Independence



John Trumbull's "Declaration of Independence, July 4, 1776"



Jean Leon Gerome Ferris canvas depiction: Thomas Jefferson (right), Benjamin Franklin (left), and John Adams (center) meet at Jefferson's lodgings, on the corner of Seventh and High (Market) streets in Philadelphia, to review a draft of the Declaration of Independence.

Article about the Declaration of Independence

The Declaration of Independence in Global Perspective *by David Armitage*

No American document has had a greater global impact than the Declaration of Independence. It has been fundamental to American history longer than any other text because it was the first to use the name “the United States of America”: in this sense, the Declaration was the birth certificate of the American nation. It enshrined what came to be seen as the most succinct and memorable statement of the ideals on which that nation was founded: the rights to life, liberty, and the pursuit of happiness; the consent of the governed; and resistance to tyranny. And, as the first successful declaration of independence in world history, its example helped to inspire countless movements for independence, self-determination, and revolution after 1776. One of its most enthusiastic admirers was the nineteenth-century Hungarian nationalist, Lajos Kossuth: for him, the Declaration was nothing less than “the noblest, happiest page in mankind’s history.” The Declaration was addressed as much to “mankind” as it was to the population of the colonies.

Source: Gilderlehrman.org, <https://www.gilderlehrman.org/history-by-era/road-revolution/essays/declaration-independence-global-perspective>, 2010.

Narrating Various Perspectives

TIME: 25 minutes

OBJECTIVE: In this lesson, members first view several different photo and describe the message the author is trying to convey. They then look at a famous painting and choose to describe what is happening from the perspective of one of the people in the painting. This allows them to dig deeper into hidden meaning and discover various perspectives on the same topic. As they do, they strengthen their ability to use descriptive words and meaningful comments.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper

VOCABULARY

- **Opinion** – a statement that cannot be proved; someone’s own belief
- **Point of view**– who is telling or narrating a story; the viewpoint the author uses to let readers know what takes place
- **Perspective** – the “lens” through which readers learn about characters, events or facts

PREPARATION

Make copies of “What Do You See?” and “Whose Point of View?” (one per member).

ADDITIONAL RESOURCE(S)

[Reading Comprehension Exercise and Quizzes](#)



LEARN IT

3 minutes

1. **ASK:** What do you recall about point of view and perspective? What is your perspective on whether Smartphones should be allowed in school?
2. **SAY:** Each of you has your own opinion on the subject, and how you view it is your *point-of-view*. If I gave you my opinion, I would be sharing my thoughts from *my* perspective.
3. **SAY:** Today we're going to practice sharing our perspectives of various photographs. Each one has a story to tell and a message that the photographer is trying to tell. However, there are no words, only pictures, so you will have to describe what you think the message is based on your own perspective or point-of-view.



TRY IT

7 minutes

1. **DO:** Distribute copies of "What Do You See?" to members and review the directions.
2. **ASK** members to take a minute to look at each picture and form an opinion as to what message the photographer is trying to convey.
3. **SAY:** There are no right and wrong answers since you are sharing thoughts based on your own perspectives.
4. **ASK** members to comment about the pictures and share their ideas.
5. **SAY:** You might notice that people have slightly different responses based on their own perspectives. Your own life experiences shape the way you view things in the world.



APPLY IT

15 minutes

1. **DO:** Distribute copies of “Whose Point of View?” to members.
2. **ASK** members to choose one person in the painting to use to write a narrative.
3. **SAY:** You’re going to write a short narrative or story about the day, based on the perspective of the person you chose. Consider the questions listed to help guide your narrative; you don’t need to answer the questions, just use them to guide you.
4. **DO:** Read through the directions and tell members NOT to share who they are choosing so that other members can guess who they are describing in their narratives.
5. **DO:** Give members 10 minutes to work on their narratives.
6. **ASK** members to share their stories, and remind them NOT to share the person they chose so that members can guess which person they are describing.
7. **CHECK FOR UNDERSTANDING:** Check for understanding. If members have trouble writing in perspective or understanding point-of-view, guide them through the lesson again or help them access the additional resource listed.

What Do You See?

Directions: Below are a series of thought-provoking images. Look at them and describe what you think is happening what the message is that the photographer is trying to convey.



Sources: <http://imgfave.com/collection/2057914/Thoughtful-photography>,
<http://mylifebook.com/blog/17-highly-intelligent-thought-provoking-movies/>, <http://inhabitat.com/life-preservers-for-polar-bears/>.

Whose Point of View?

Directions: Below is Georges Seurat's famous painting, "A Sunday on La Grande Jatte" also known as "Sunday in the Park with George." Look over the painting and choose a person from the canvas. You will be telling a story about their day from their point-of-view. When you've chosen a person, think about these questions: What might they be thinking? Why are they at the park? Is there anything they are worried about? Is there a reason they're at the park on that day? Include anything you think shows their point-of-view into a narrative about the person.



Source: ArtInstituteChicago.edu, <http://www.artic.edu/aic/collections/artwork/27992>.

Acting Out Descriptive Words

TIME: 25 minutes

OBJECTIVE: In this lesson, members act out emotions associated with various words. In doing so, they strengthen their understanding of word choices and the importance of using strong words to emphasize emotion in their writing. This also helps them understand meaning in their reading by visualizing a deeper meaning intended by the author.

MATERIALS

- White board
- Dry-erase markers
- Kraft paper
- Markers

VOCABULARY

- **Descriptive words** – words that modify verbs and nouns and help to explain a place or situation in a more engaging way

PREPARATION

None

ADDITIONAL RESOURCE(S)

[Synonym and Antonym Descriptive Word Practice](#)



LEARN IT

3 minutes

1. **ASK:** What is a way that you let others know how your feeling?

Answer: **through body language, tone of voice we use and words we say**
2. **SAY:** When we have an emotion to show, such as sadness, our entire body changes to show that emotion. You may notice that when you're sad, your shoulders are slumped, you might walk a little slower and have your head down. When speaking with someone, you might speak a little more quietly or with a sad tone in your voice.
3. **SAY:** How do authors show emotion in their writing?
Answer: **in the words they choose and the dialogue characters have with others**
4. **SAY:** Today, we're going to practice using strong words to show emotion.



TRY IT

5 minutes

1. **DO:** Write this list of colors on the white board: red, green, black, purple, blue.
2. **ASK:** What emotions do you associate with each of these colors.
Possible answers: **red (angry, hot), green (jealous, natural, peaceful), black (sadness), purple (royal, proud, strong), blue (calm, sad)**
3. **SAY:** As you can tell, words can evoke emotions simply because of feelings you may unconsciously associate with them.



APPLY IT

17 minutes

1. **ASK** members to form small groups.
2. **DO:** Distribute Kraft paper and markers to each group.
3. **ASK** group members to create a list of descriptive words that show emotion.
4. **DO:** Give groups five minutes to create their lists.
5. **ASK** groups to swap lists, choose a word and act out the emotion that comes to mind when they think of the word.
6. **DO:** Allow groups 10 minutes to act out the words.
7. **DO:** Circulate between groups to ensure members have chosen descriptive words.
Possible answers: **devastated, ecstatic, gloomy, exhilarated, victorious, troubled, confused, foolish, self-absorbed, confident, impulsive, surprised, concerned, irritated, unsure, hesitant**
8. **CHECK FOR UNDERSTANDING:** If members have trouble identifying descriptive words, guide them through the lesson again or help them access the additional resource listed.

Comparing Themes in Song Lyrics and Poems

TIME: 25 minutes

OBJECTIVE: In this lesson, members look for similar themes in poetry and song lyrics. By breaking down the song lyrics and poem stanzas, members discover messages and meaning within the precisely chosen words. This helps members become more aware of central themes that writers establish throughout their work.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils

VOCABULARY

- **Theme** – an idea that’s repeated through a text; the message that is the focus of the text

PREPARATION

Make copies of “Find the Theme” and “What’s the Theme?” (one per member).

ADDITIONAL RESOURCE(S)

[Reading Comprehension Review](#)



LEARN IT

5 minutes

1. **ASK:** What does it mean to be a good friend?
Answer: a good friend listens, is there for someone when they need them, and helps that person when asked
2. **ASK:** What's a movie or book about friendship? How did you know what it was about?
Answer: *Clueless*, *Mean Girls*, *Bridesmaids*, *Harry Potter*, *Charlotte's Web*; you can tell they're about friendship because the movie/book focused on the theme throughout
3. **SAY:** What you are describing is the theme of a movie or book. *Theme* is the author's message or life lesson that the story revolves around. The author does not explicitly tell the reader what the theme is but will weave it throughout the story.
4. **SAY:** Today we're going to practice identifying the theme in a song and poem. We're going to look at word choices and phrases that give a hint as to the theme or lesson of the text.



TRY IT

5 minutes

1. **DO:** Distribute copies of "Find the Theme" to members.
2. **SAY:** I am going to read these short passages aloud and we will work together to identify the theme the author is trying to create. We will share how we determined the theme and what parts helped develop the theme.
3. **DO:** Read the passages aloud and pause after each to allow members to share responses.
Answer: the *Grasshopper* passage theme is to work now and play later; the *Michael Jordan* passage theme is to never give up because persistence pays off
4. **ASK** members how they determined the theme and how the author developed it throughout the passage.



APPLY IT

15 minutes

1. **ASK** members to form pairs.
2. **DO:** Distribute copies of “What’s the Theme?” to each member.
3. **SAY:** Now you are going to practice finding theme in pairs by reading through the poem and song. As you read, look for similarities between texts; these can be similar words or phrases. As you do this, start to generate an idea of what the common theme is between both.
4. **DO:** Give members 10 minutes to work together.
5. **ASK** members to share their responses and how they determined the theme.
6. **CHECK FOR UNDERSTANDING:** If members have trouble identifying the theme, guide them through the lesson again or help them access the additional resource listed.

Find the Theme

Directions: Read through the two short passages below and try to identify the theme. Remember that theme is the lesson or message the author is trying to convey.

In a field one summer's day a Grasshopper was hopping about, chirping and singing to its heart's content. An Ant passed by, bearing along with great toil an ear of corn he was taking to the nest. "Why not come and chat with me," said the Grasshopper, "instead of toiling and moiling in that way?" "I am helping to lay up food for the winter," said the Ant, "and recommend you to do the same." "Why bother about winter?" said the Grasshopper; we have got plenty of food at present." But the Ant went on its way and continued its toil. When the winter came the Grasshopper had no food and found itself dying of hunger, while it saw the ants distributing every day corn and grain from the stores they had collected in the summer. Then the Grasshopper knew.

In his sophomore year of high school, Michael Jordan tried out for the varsity basketball team at Laney High School in Wilmington, North Carolina. But at five feet and eleven inches tall, the coach believed that Jordan was too short to play at that level, so Jordan was cut from the team. Jordan didn't let this obstacle defeat him. In fact, it pushed him to work even harder. He trained vigorously and grew another four inches the following summer. When he finally made the varsity squad, Jordan averaged 25 points a game and went on to become one of the greatest basketball players in history.

Source: EReadingworksheets.com, <http://www.ereadingworksheets.com/free-reading-worksheets/theme-worksheets/>.

What's the Theme?

Directions: Below are pieces with similar themes. The first is a famous poem by Henry Van Dyke called “A Mile with Me” and the second is a popular song by Bill Withers called “Lean on Me.” Read through both and make notes about what you find similar – a line or phrase common to both. Use these similarities to identify the common theme in these pieces.

A Mile with Me
by Henry Van Dyke

O who will walk a mile with me
Along life's merry way?
A comrade blithe and full of glee,
Who dares to laugh out loud and free,
And let his frolic fancy play,
Like a happy child, through the flowers gay
That fill the field and fringe the way
Where he walks a mile with me.

And who will walk a mile with me
Along life's weary way?
A friend whose heart has eyes to see
The stars shine out o'er the darkening lea,
And the quiet rest at the end o' the day,—
A friend who knows, and dares to say,
The brave, sweet words that cheer the way
Where he walks a mile with me.

With such a comrade, such a friend,
I fain would walk till journeys end,
Through summer sunshine, winter rain,
And then?—Farewell, we shall meet again!

Source: Allpoetry.com, <https://allpoetry.com/A-Mile-With-Me>.

Lean on Me

by Bill Withers

Sometimes in our lives we all have pain
We all have sorrow
But if we are wise
We always know that there's tomorrow

Lean on me, when you're not strong
And I'll be your friend
I'll help you carry on
For it won't be long
'Til I'm gonna need
Somebody to lean on

Please swallow your pride
If I have things you need to borrow
For no one can fill those of your needs
That you don't let show

Lean on me, when you're not strong
And I'll be your friend
I'll help you carry on
For it won't be long
'Til I'm gonna need
Somebody to lean on

If there is a load you have to bear
That you can't carry
I'm right up the road
I'll share your load
If you just call me

So just call on me brother, when you
need a hand
We all need somebody to make it
I just might have a problem that you'd
understand
We all need somebody to make it

Lean on me when you're not strong
And I'll be your friend
I'll help you carry on
For it won't be long
Till I'm gonna need
Somebody to lean on

Lean on me...

Source: AZLyrics.com, <http://www.azlyrics.com/lyrics/billwithers/leanonme.html>.

HIGH SCHOOL

MATH LESSONS

Probability: Using Random Sampling

TIME: 25 minutes

OBJECTIVE: Selecting part of a group when unable to count all members is called sampling. Samples are used by economists to uncover buying habits, by biologists to estimate the size of mammal or bird populations and by social scientists to discover facts about human behavior. In this lesson, members collect random samples to make predictions about the most frequently used letters in the English language.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Newspaper pages (or another writing source that will lie flat)

VOCABULARY

- **Random sampling** – selecting and studying part of a group when you’re unable to count all members
- **Frequency table** – a chart showing the total for each category or group of data

PREPARATION

Draw a sample frequency table on the white board:

Letter	Frequency	Percentage
A		
B		
C		

ADDITIONAL RESOURCE(S)

[Probability](#)

CAREER CONNECTION

Careers that use statistics and probability include linguist, actuary, statistician, ecologist and purchasing agent.



LEARN IT

3 minutes

1. **ASK:** Have you ever wondered how scientists can tell who will vote or how many people have cell phones or how many like chocolate chip cookies?
2. **ASK:** What is random sampling?
Answer: **selecting and studying part of a group when you're unable to count all members**
3. **SAY:** Sampling is used by economists to uncover buying habits, by biologists to estimate the size of mammal or bird populations and by social scientists to discover facts about human behavior. Random sampling of a selected portion of a larger population is used to estimate or predict the behaviors of all group members.
4. **SAY:** We're going to practice using random sampling to discover which letters show up most in written English.



TRY IT

15 minutes

1. **ASK:** Which letters do you think show up most frequently in written English?
2. **DO:** Record members' guesses on the white board.
3. **SAY:** You're going to try a random-sampling technique for identifying the most used letters on a newspaper page. You'll drop a paper clip several times and record results on a chart.
4. **ASK:** What is a frequency table?
Answer: **a frequency table is a chart showing the total for each category or group of data**
5. **DO:** Show the sample frequency table you prepared in advance.
6. **SAY:** You're going to use a frequency table like this one to show your results. You can see that the table records how often the letter shows up in your samples.
7. **DO:** Demonstrate the technique for identifying the most frequently-used letters:
 - a. Select a typical newspaper page and lay it flat on the floor.
 - b. Decide how many samples you will collect.
 - c. Collect a sample; choose a sentence with 10 to 20 words in it.
 - d. Tally how many times each letter

- appears in the sentence you chose.
- e. Record the results.
 - f. Collect another sample and record the results.
 - g. Total the results of the samples in a frequency table
8. **ASK:** Members to form pairs and complete the random-sampling experiment.



APPLY IT

7 minutes

1. **ASK** pairs to combine their results into one large frequency table, showing the letters in order from most frequent to least frequent.
2. **ASK** the group to create a bar graph to provide a visual representation of the results.
3. **ASK:** Linguists say that the most frequently used letters in English are e, t, a, o and i; how do their statistics compare with yours?
4. **CHECK FOR UNDERSTANDING:** If members have trouble using statistics and probability, guide them through the lesson again or help them access the additional resource listed.

Estimating Populations Using Ratio and Proportion

TIME: 25 minutes

OBJECTIVE: How can biologists estimate the size of populations of fish in a pond, lake or other body of water? All scientists estimate the number of things that are difficult to count by using random sampling, ratio and proportion. In this lesson, members explore this simple method for estimating the size of populations when it is not possible to find or count them all. Members collect and organize data into a table to estimate the number of beans in a container.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Bags or cups (one per pair or small group)
- Small dry beans
- Marking pens

VOCABULARY

- **Estimating** – making an approximate or rough calculation, often based on rounding
- **Mathematical model**– a created object used as a substitute for a real-life object because the model is larger, smaller or simpler than the original and therefore easier to study
- **Mathematical modeling** – using different math approaches to learn more about things in the real world that can't be studied directly or first-hand
- **Sampling** – studying data from a section of a larger group and using it to get information about the whole group
- **Proportion** – a part-to-whole comparison; the equality of two ratios, written as an equation

PREPARATION

Prepare containers of beans (one per pair or small group, plus one for demonstration). Draw a table like the one below, with rows numbered 1 – 10, on the white board:

Sample Number	Total captured and marked (N)	Total recaptured (p)	Total recaptured and marked (n)
1			
...			
10			
Total			
Average			

ADDITIONAL RESOURCE(S)

[Random Sampling: How Many Fish?](#)

CAREER CONNECTION

Careers that use ratio and proportion include field biologist, physicist, human population scientist and historian.



LEARN IT

7 minutes

1. **ASK:** Do you know how biologists estimate the size and kind of populations of fish in a pond, lake or other body of water when there are too many to count?
2. **SAY:** In this lesson, we're going to use a simple method for estimating the size of populations when it's not possible to count or locate them all. We'll use the mathematics of modeling, ratio and proportion to find answers.
3. **SAY:** The technique we're using is called the "capture-recapture" method. We're using this technique to collect data to estimate the number of beans in a container.
4. **DO:** Demonstrate the sampling technique by reaching into the container and removing a small number of beans. Count the number of beans you have removed, mark them, return them the container and mix them with the rest of the beans.
5. **DO:** Record the total number of captured and marked beans (N) on the first line of the chart (in the first column).
6. **DO:** Remove another small number of beans and count them. Record the total of the "recaptured" beans (p) on the first line of the chart (in the second column).
7. **DO:** Check for marked beans in this

group of beans and count them. Record the number of recaptured and marked beans (n) on the first line of the chart (in the third column).

8. **SAY:** This method is called "modeling." A "mathematical model" is something you create to represent another thing in the real world. "Mathematical modeling" is using different math approaches to learn more about those things in the real world that can't be studied directly or first-hand. The beans in the cup are a model for fish in a pond.



TRY IT

13 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Give each pair or small group a container of beans and a marking pen.
3. **SAY:** Think of this container of beans as a model for a lake that contains a population of fish. Don't look in the container or count the beans right now.
4. **ASK** each pair or small group to prepare a data table similar to the one you prepared.
5. **ASK** pairs or small groups to use the "capture-recapture" method you just demonstrated and record their data on the tables.
6. **SAY:** Do the method 10 times and record all the data on your data tables. When you are finished, calculate the average for all three columns.
7. **DO:** Show members how to complete the averages, if necessary, using this example:

Sample Number	Total captured and marked (N)	Total Recaptured (p)	Tagged recaptured and marked (n)
1	8	13	4
2	7	15	3
Total	15	28	7
Average	7.5	14	3.5



APPLY IT

5 minutes

1. **SAY:** Here's a formula for estimating the total number of beans in your cup:

$$\frac{\text{marked in recaptured sample}(n)}{\text{total recaptured (p)}} = \frac{\text{total number marked (N)}}{\text{total population (P)}}$$

$$\frac{3.5}{14} = \frac{7.5}{P}$$

2. **ASK:** What's another way to write this proportion?
Answer: $P = Np/n$
3. **ASK:** With this example, using the formula, what is the total number of beans in the cup?
Answer: $P = 7.5 \times 14 / 3.5$, so $P = 30$ or about 30 beans in the cup
4. **ASK** members to estimate the number of beans in their cups and, if they like, to count the beans and compare the actual results with their calculated averages.
5. **CHECK FOR UNDERSTANDING:** If members have trouble using ratio and proportion, guide them through the lesson again or help them access the additional resource listed.

Using Equations in Problem Solving

TIME: 25 minutes

OBJECTIVE: Mathematics and mathematics training are essential to many careers, because math principles are central to problem solving and decision-making. In this lesson, members work collaboratively to practice solving equations using the four operations (+, −, ×, ÷).

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Kraft paper
- Markers
- Calculators

VOCABULARY

- **Equation** –a math statement with an equal sign to show that two expressions are equal
- **Operation**– a mathematical process (addition, subtraction, multiplication, division) that combines two or more numbers

PREPARATION

Write the following steps on the white board:

- Do the operations inside of brackets, if brackets are present.
- Do the operations inside of parentheses.
- Do the multiplication and division from left to right.
- Do the addition and subtraction from left to right.

ADDITIONAL RESOURCE(S)

[Math Questions and Problems](#)

CAREER CONNECTION

Careers that use equations to solve problems include computer technician, meteorologist, statistician, air traffic control analyst, environmental mathematician, robotics engineer and cryptologist.



LEARN IT

3 minutes

1. **SAY:** Mathematics and mathematics training are essential to many careers, because math principles are central to problem solving and decision-making.
2. **SAY:** In this lesson, we'll practice using math skills and operations to solve a problem. The problem is: Create an equation that can be answered by each number from 0 to 20 using any or all of the mathematical operations (+, -, ×, ÷) and precisely four 4s. Each equation must always use all four of the 4s.
3. **ASK:** For example, to get the number 16, using four 4's, what operations can we use?
Answer: $4 + 4 + 4 + 4 (=16)$
4. **SAY:** Note that in several possible equations a decimal four may be used (0.4).



TRY IT

15 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Give each pair or small group Kraft paper and markers.
3. **ASK** them to write the numbers 0 to 20 on the Kraft paper and then record their equations next to each as they create them.
4. **SAY:** This lesson helps you practice the operations necessary for solving equations. Remember, the problem is: Using any operations you choose and precisely four 4s, create equations that can be answered by each of the numbers from 0 to 20.
5. **DO:** Call attention to the steps you've written on the white board, and suggest members use the sequence for solving the equations.
6. **SAY:** You can share your ideas and use calculators to check your equations. Note that more than one equation for a number is possible.



APPLY IT

7 minutes

1. **ASK** members to examine their equations and correct them as necessary by checking the math and the way the operations were carried out.
2. **DO:** Help members if they were not able to create an equation for a particular number. Provide clues or propose an equation (using “Problem Solving: Possible Equations”).
3. **CHECK FOR UNDERSTANDING:** If members have trouble using equations to solve problems, guide them through the lesson again or help them access the additional resource listed.

Problem Solving: Possible Equations

$$0 = 44-44$$

$$1 = (4 \div 4) \times (4 \div 4)$$

$$2 = (4 \div 4) + (4 \div 4)$$

$$3 = (4+4+4) \div 4$$

$$4 = 4 \times 4 (4-4) + 4$$

$$5 = [(4 \times 4) + 4] \div 4$$

$$6 = 4 + [(4+4) \div 4]$$

$$7 = (4+4) - (4 \div 4)$$

$$8 = 4 + 4 + 4 - 4$$

$$9 = (4+4) + (4 \div 4)$$

$$10 = (44-4) \div 4$$

$$11 = (4 \div 4) + (4 \div .4)$$

$$12 = (44 + 4) \div 4$$

$$13 = 4 + [(4 - .4) \div .4]$$

$$14 = 4 \times (4 - .4) - .4$$

$$15 = (4 \times 4) - (4 \div 4)$$

$$16 = 4 + 4 + 4 + 4$$

$$17 = (4 \times 4) + (4 \div .4)$$

$$18 = 4 + 4 + (4 \div 4)$$

$$19 = [(4 + 4) - .4] + .4$$

$$20 = 4 \times [4 + (4 \div 4)]$$

There are other possibilities, so any equation is correct if the mathematics checks.

Using Models to Understand Proportion

TIME: 25 minutes

OBJECTIVE: A volcano erupts, a tsunami engulfs a city, a spacecraft blasts into hyperspace, a giant ocean vessel hits an iceberg and sinks. In the movies, everything looks real and life-size, but it is not. Models are created in exacting detail by movie-model builders. Even today, with computers and special effects, models are still an important part of many movies. In this lesson, members compare model ships with the actual ship sizes to reinforce and extend their awareness of ratio and proportion.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Calculators

VOCABULARY

- **Mathematical model** – a created object used as a substitute for a real-life object because the model is larger, smaller or simpler than the original and therefore easier to study
- **Proportion**– a part-to-whole comparison; the equality of two ratios, written as an equation

PREPARATION

Make copies of “Scale Model Ships” (one per pair or small group).

ADDITIONAL RESOURCE(S)

[Ratios, Rates, Proportions](#)

CAREER CONNECTION

Careers that use proportion and modeling include archaeologist, general building contractor, architect, historian and model builder.



LEARN IT

5 minutes

1. **SAY:** Models, like the ones used in movies, are exact scale replicas of the real thing. When you see a huge ocean vessel like the Titanic in a movie, it's usually a model created to represent the real thing. Even though it looks real and life-size, it usually isn't.
2. **ASK:** Why do model builders have to be concerned with proportion?
Answer: models have to be historically accuracy and in correct proportion to other models in the movie
3. **SAY:** Model makers need to create models similar to the original they are modeling. This means that all parts of the model are all reduced or enlarged in the same proportion. Movie model builders must be concerned with all objects in the scene so that they are all in the same proportions.
4. **ASK:** When talking about proportion, what does the symbol $1/25$ mean?
Answer: it means that every one unit of the model is the same as 25 of the original
5. **ASK:** If a model building is 10' high, and the scale of the model is $1/25$ of the original building, how high is the actual building?
6. **DO:** Demonstrate how to calculate the size of the actual building.
Answer: the size of the actual building is 250 feet

$$\frac{1}{25} = \frac{10}{x}$$



TRY IT

15 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Give each pair or small group a copy of “Scale Model Ships.”
3. **SAY:** These are the dimensions of some model ships, including the scale or proportion of the model and the length of the model in millimeters (mm). You will use these dimensions to calculate the length of the full-size ship in meters (m). Remember that one meter (m) = 1000 millimeters (mm).
4. **ASK** members to complete the calculations to figure the length of the full-size ships.
5. **ASK** members to create a table that lists the ships in order of their lengths.



APPLY IT

5 minutes

1. **ASK** members to share their results and correct them if necessary (using “Scale Model Ships Answer Key”).
2. **ASK:** The scale models of the ships in the table are all smaller than the actual ship, but can you think of any objects whose scale models would be larger?
Answer: **bacteria, seeds, chemical atoms or molecules**
3. **CHECK FOR UNDERSTANDING:** If members have trouble using models and proportion, guide them through the lesson again or help them access the additional resource listed.

Scale Model Ships

Name of Ship	Scale	Length of model (mm)	Length of full-size ship (m)
Aircraft Carrier Saratoga	1/800	408	
Chesapeake Kayak	1/12	430	
Fishing Boat	1/38	395	
Golden Hind	1/72	360	
HMS Bounty	1/48	980	
Life Boat	1/16	305	
Mayflower	1/64	605	
Paddle Wheeler	1/80	660	
Santa Maria	1/65	560	
Titanic	1/350	798	
Tugboat	1/82	343	
Venetian Gondola	1/20	550	
Viking Ship	1/60	367	

Scale Model Ships (Answer Key)

Name of Ship	Scale	Length of model (mm)	Length of full-size ship (m)
Aircraft Carrier Saratoga	1/800	408	326.4
Chesapeake Kayak	1/12	430	5.2
Fishing Boat	1/38	395	15.0
Golden Hind	1/72	360	25.9
HMS Bounty	1/48	980	47.0
Life Boat	1/16	305	4.9
Mayflower	1/64	605	38.7
Paddle Wheeler	1/80	660	52.8
Santa Maria	1/65	560	36.4
Titanic	1/350	798	279.3
Tugboat	1/82	343	28.1
Venetian Gondola	1/20	550	11.0
Viking Ship	1/60	367	22.0

Calculating the Volume of a Pyramid

TIME: 25 minutes

OBJECTIVE: Have you ever wondered why the pyramids were built? Ever imagine just how big they are? Archaeologists who are also architects combine a love of the past with the skills of building designers to study the construction of ancient buildings and tools. In this lesson, members use the formula to calculate pyramid volume and the concepts of ratio and proportion to compare pyramids by height and volume and evaluate their relative sizes.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Calculators

VOCABULARY

- **Formula** – a special type of equation showing the relationship between different variables
- **Volume**– amount of space occupied by a three-dimensional object (measured in cubic units)

PREPARATION

Make copies of “Calculating Pyramid Volume” (one per pair or small group). Write the following formula and symbol explanations on the white board:

FORMULA: $V = 1/3Bh$

V = volume of a pyramid in cubic meters (m^3)

B = the base, which is side length (l) by width (w) in square meters (m^2)

h = the vertical height of the pyramid in meters (m)

ADDITIONAL RESOURCE(S)

[Volume of Pyramids](#)

CAREER CONNECTION

Careers that use volume, ratio and proportion include archaeologist, general building contractor, architect and historian.



LEARN IT

3 minutes

1. **SAY:** The pyramids of the ancient world inspire our imaginations, and several of them still exist today. Archaeologists have studied these buildings for years to discover their mysteries.
2. **ASK:** How can we figure out how big these buildings are?
Answer: we can use geometry to figure out the volume of the pyramid
3. **SAY:** You can use a formula to calculate the volume of some ancient pyramids. The simplest formula for calculating pyramid volume is: $V = 1/3Bh$.
4. **DO:** Call attention to the formula and symbol explanations on the white board.
5. **SAY:** We will be using the metric system because the math is easier, and you can use calculators to make the calculations.



TRY IT

12 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Distribute copies of “Calculating Pyramid Volume” to each pair or small group.
3. **SAY:** This chart shows the height and side length/width of several different pyramids.
4. **ASK** them to first calculate the *base* (m^2) and record it on the sheet and then calculate the *volume* (m^3) and record it as well.
5. **ASK** members to share their results and correct them as necessary (using “Calculating Pyramid Volume Answer Key”).



APPLY IT

10 minutes

1. **ASK:** Which pyramid is the largest?
2. **ASK** members to list the pyramids by height and by volume and then to make a bar graph that compares heights and volumes of the various pyramids.
3. **ASK:** What do the graphs show that was not evident from the raw data?
Answer: **the pyramid with the largest volume is not the tallest one**
4. **CHECK FOR UNDERSTANDING:** If members have trouble calculating pyramid volume, guide them through the lesson again or help them access the additional resource listed.

Calculating Pyramid Volume

Pyramid	Builder	Location	Height (m)	Side length/ side width (m)	Base (m ²)	Volume (m ³)
El Castillo	Toltecs	Chichen Itza, Mexico	30	55		
Temple of the Grand Jaguar	Mayans	Guatemala	65	80		
Pyramid of the Sun	Aztecs	Teotihuacan, Mexico	75	225		
Red Pyramid	Pharaoh Sneferu	Giza, Egypt	104.5	220		
Great Pyramid	Pharaoh Khufu	Giza, Egypt	139	230		
Khafre's Pyramid	Pharaoh Khafre	Giza, Egypt	143.5	215.25		

Calculating Pyramid Volume (Answer Key)

Pyramid	Builder	Location	Height (m)	Side length/ side width (m)	Base (m ²)	Volume (m ³)
El Castillo	Toltecs	Chichen Itza, Mexico	30	55	3,025	30,250
Temple of the Grand Jaguar	Mayans	Guatemala	65	80	6,400	138,667
Pyramid of the Sun	Aztecs	Teotihuacan, Mexico	75	225	50,625	1,265,625
Red Pyramid	Pharaoh Sneferu	Giza, Egypt	104.5	220	48,400	1,685,934
Great Pyramid	Pharaoh Khufu	Giza, Egypt	139	230	52,900	2,451,034
Khafre's Pyramid	Pharaoh Khafre	Giza, Egypt	143.5	215.25	46,333	2,216,262

Solving Word Problems

TIME: 25 minutes

OBJECTIVE: Many people experience anxiety when it comes to solving word problems, because they consider algebra to be an impenetrable mystery. But given the proper context and background, most people can solve many algebra problems. In this lesson, members become more comfortable with problem solving by successfully solving classic word problems involving rate, time and distance.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Calculators

VOCABULARY

- **Formula** – a special type of equation showing the relationship between different variables
- **Variable**– a symbol (such as x or y) that stands for a number we don't yet know
- **Rate**– the degree of speed or progress of a person or thing moving through space
- **Time**– the degree of speed or progress of a person or thing moving through space
- **Distance**– a measurement of how far through space something has traveled; the length between two points or objects

PREPARATION

Make copies of “Train Problem” and “Rate, Time and Distance Data” (one per member) and “Rate, Time and Distance Problems” (one per pair or small group).

ADDITIONAL RESOURCE(S)

[Practice Train Problems](#), [Math Word Problems](#)

CAREER CONNECTION

Careers that encounter problems with rate, time and distance include traffic engineer, civil engineer and airplane pilot.



LEARN IT

3 minutes

- ASK:** What happens when you hear a problem like this one: *Two trains start off from the same station and travel in opposite directions. After six hours, they are 840 miles apart. If the first train is traveling at a rate of 20 mph faster than the second train, at what speeds are the trains traveling?* Does this kind of problem scare you?
- SAY:** In this lesson, we're going to practice solving problems like these that involve rate, time and distance.
- ASK:** What is a formula?
Answer: *a formula is a special type of equation that show the relationship between different variables (and it can be expressed as words or mathematical symbols)*
- DO:** Remind the group that a variable is simply a symbol for a number we don't know yet.
- SAY:** The formulas we will use to solve problems describe the relationship among distance, speed and time.



TRY IT

10 minutes

- DO:** Distribute copies of "Rate, Time and Distance Data" to members.
- DO:** Review the "Rate, Time and Distance Data," including the abbreviations for variables:
 - r = average speed
 - t = time spent traveling
 - d = the distance traveled
- DO:** Review the formulas on "Rate, Time and Distance Data" with members:
 - distance: $d=rt$
 - average speed: $r=t/d$
 - time spent: $t=d/r$
- ASK:** What formula do we use for this problem and what is the answer: *Averaging 480 mph, how long will it take to fly 2160 miles from San Francisco to Chicago?*
Answer: $t=d/r$; 4.5 hours
- ASK:** What formula do we use for this problem and what is the answer: *The bus trip takes 20 minutes for an 8-mile trip. What is the average speed?*
Answer: $r=d/t$; 2.5 mph

6. **ASK:** What formula do we use for this problem and what is the answer: *If a bus traveling at an average speed of 46mph reaches its destination in 2 ½ hours, how far has it gone?*

Answer: $d=rt$; 115 miles

7. **DO:** Distribute copies of “Train Problem” to all members. Guide them through the solution as explained on the worksheet.



APPLY IT

12 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Distribute copies of “Rate, Time and Distance Problems.”
3. **DO:** Allow time for pairs or small groups to solve several of the problems.
4. **ASK** members to share their solutions and correct as necessary (using “Rate, Time and Distance Problems Answer Key”).
5. **CHECK FOR UNDERSTANDING:** If members have trouble solving word problems, guide them through the lesson again or help them access the additional resources listed.

Rate, Time and Distance Data

Variables

- r = average speed
- t = time spent traveling
- d = the distance traveled

Formulas

When you want to find:

- distance: $d=r \times t$
- average speed: $r=t/d$
- time spent: $t=d/r$

Data Chart

	Rate	Time	Distance
1 st Variable			
2 nd Variable			

Using Exponents and Ratios

TIME: 25 minutes

OBJECTIVE: The solar system and space are perfect models for studying ratio and proportion. The awareness of objects in space has grown with the addition of probes into the solar system and beyond, and ideas about spatial bodies change as more information becomes available. It was almost fifty years ago that humans first landed on the moon, and now we are thinking seriously of traveling to the red planet, Mars. Just how far is it? Models of the solar system can help increase our understanding. In this lesson, members use exponents to compare the relative distances of planets from the Sun and create a model to show relationships of distance

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- String
- Rulers, meters or yard sticks
- Calculators

VOCABULARY

- **Mathematical model** – a created object used as a substitute for a real-life object because the model is larger, smaller or simpler than the original and therefore easier to study
- **Exponent**– a small number placed to the upper right of a number to show the number of times the base number is multiplied by itself
- **Astronomical unit**– the distance from the center of the Sun to the center of the Earth, equal to 150 million kilometers (149.5×10^6)
- **Ratio**– the comparative value of two or more amounts (written as 3:4 or as $\frac{3}{4}$)
- **Kilometer**– standard metric unit for measuring distance, equal to approximately 0.6 miles

PREPARATION

Make copies of “Relative Distance of Planets from the Sun” (one per pair or small group).

ADDITIONAL RESOURCE(S)

[Solar System Math: Comparing Size and Distance](#)

CAREER CONNECTION

Careers that use exponents and ratio include cosmologist, astrophysicist, planetarium designer and astronomer.



LEARN IT

3 minutes

1. **ASK:** Have you ever looked up at the sky at night and wondered about what you saw? If we think about humans one day traveling to Mars, just how far is it?
2. **SAY:** Models of the solar system can increase our understanding. In this lesson, you're going to practice using exponents to compare the relative distances of planets from the Sun.
3. **SAY:** Remember that exponents are a way to simplify large numbers. The exponent indicates the number of times a number is multiplied by itself. For example:
 - 62 is $6 \times 6 = 36$
 - 84 is $8 \times 8 \times 8 \times 8 = 4,096$.
 - 55 is $5 \times 5 \times 5 \times 5 \times 5 = 3,125$
4. **SAY:** One benefit of using exponents is the ease in which we can compare numbers.
5. **DO:** Briefly review the exponents of 10:

Exponent	Number Value	Number Name
10^1	10	ten
10^2	100	one hundred
10^3	1,000	one thousand
10^4	10,000	ten thousand
10^5	100,000	one hundred thousand
10^6	1,000,000	one million
10^9	1,000,000,000	one billion



TRY IT

12 minutes

1. **DO:** Introduce the concept of astronomical unit (AU), which is equal to the distance from the center of the Sun to the center of the Earth. One AU is equal to:
150 million kilometers (149.5×10^6)
2. **SAY:** Scientists find it helpful to use AU because the distances are so large, so AUs are easier to manage than miles or kilometers. Only Earth can be assigned AU 1. Farther planets would have a greater AU than 1; closer planets would have a smaller AU than 1.
3. **SAY:** We can use ratio to calculate distances using AU as the unit of measure. Remember that "ratio" simply means the relationship between two numbers. It can be expressed as $\frac{4}{5}$ or 4 divided by 5 or $\frac{4}{5}$.
4. **ASK:** If Jupiter is 778,000,000 kilometers from the Sun, how can we calculate the distance using AU as the unit of measurement?
Answer: $778,000,000 \div 150,000,000$ (the total number of kilometers divided by the number of kilometers in one AU)
5. **ASK:** How many AU is Jupiter from the Sun?
Answer: 5.2 AU from the Sun



APPLY IT

10 minutes

6. **SAY:** The AU provides a way to express and relate distances of objects in the solar system and carry out calculations. For example, when we say that Jupiter is 5.2 AU and Earth is 1 AU from the Sun, it is easier to compare the distances of all three bodies.
 7. **ASK** members to form pairs or small groups.
 8. **DO:** Distribute copies of “Relative Distance of Planets from the Sun.”
 9. **SAY:** You’re going to first calculate the relative distances of the planets from the Sun.
 10. **DO:** Allow pairs or small groups time to complete their calculations.
 11. **ASK** members to share their calculations and correct them as necessary using “Relative Distance of Planets from the Sun Answer Key.”
1. **ASK** members to create a string model to show the distances between the planets.
 2. **SAY:** Use the relative distance (in AU) to show the relationships between the planets. You can use the string to represent the solar system and make marks or knots in the string to indicate the different planets and their positions relative to each other. If you’d like a larger model, you could lay out pieces of paper on the floor to indicate the relative distance.
 3. **SAY:** Note that the relative distances are the same no matter the size of your model. For example, the relative distance of Neptune from the Sun would be 30” or 2.5 feet; on a football field Neptune would be on the 30-yard line.
 4. **ASK** members to share their models.
 5. **CHECK FOR UNDERSTANDING:** If members have trouble using exponents and ratio, guide them through the lesson again or help them access the additional resource listed.

Relative Distance of Planets from the Sun

Planets	Average Distance from the Sun (km)	Relative Distance AU
Mercury	58.0×10^6	
Venus	108.2×10^6	
Earth	149.5×10^6	
Mars	227.9×10^6	
Jupiter	778.0×10^6	
Saturn	1.43×10^9	
Uranus	2.90×10^9	
Neptune	4.40×10^9	

Relative Distance of Planets from the Sun (Answer Key)

Planets	Average Distance from the Sun (km)	Relative Distance AU
Mercury	58.0×10^6	0.39
Venus	108.2×10^6	0.72
Earth	149.5×10^6	1.00
Mars	227.9×10^6	1.52
Jupiter	778.0×10^6	5.20
Saturn	1.43×10^9	9.52
Uranus	2.90×10^9	19.2
Neptune	4.40×10^9	30.1

Calculating Volume Ratio

TIME: 25 minutes

OBJECTIVE: Surprise is one of the engines that lead to enhanced learning. One surprise is called a “discrepant event.” A discrepant experience is something that occurs that is not expected and is puzzling. It causes the observer to wonder about why it happened as it did. In this lesson, members experience a discrepant event and use mathematics to explain the results.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Four plastic glasses
- Pitcher of water
- Marbles
- Sand (not too fine)
- Calculators

VOCABULARY

- **Discrepant event** – experience that occurs when the results are unexpected and puzzling
- **Volume** – amount of space occupied by a three-dimensional object (measured in cubic units)
- **Sphere**– a three-dimensional solid object that is perfectly round
- **Cube**– a solid shape that has six square faces all equal in size
- **Ratio** – the comparative value of two or more amounts (written as 3:4 or as $\frac{3}{4}$)
- **Equation** – a math statement with an equal sign to show that two expressions are equal
- **Formula**– a special type of equation showing the relationship between different variables

PREPARATION

Write the following equations on the white board:

- $V_{\text{cube}} = s^3$ (s = side)
- $V_{\text{sphere}} = \frac{4}{3}\pi r^3$ ($\pi=3.14$, r = radius)
- $\text{ratio} = \frac{V_{\text{sphere}}}{V_{\text{cube}}}$

ADDITIONAL RESOURCE(S)

[Calculate the Volume of a Sphere](#)

CAREER CONNECTION

Careers that use this kind of modeling include teacher and mathematician.



LEARN IT

3 minutes

1. **SAY:** In this lesson, you'll experience what is called a "discrepant" situation. This is an experience that occurs when the results are unexpected and puzzling.
2. **ASK:** What do you think will happen when we pour water into glasses filled with other materials or objects? Can we predict what will happen?
3. **SAY:** You'll calculate how much water glasses will hold – the volume – when they are already filled with marbles or sand.
4. **SAY:** Remember that volume is the measure of how much space there is within a three-dimensional object.



TRY IT

10 minutes

1. **ASK** members to form pairs or small groups.
2. **ASK** them to complete the following steps:
 - a. Fill one glass with marbles and one with sand.
 - b. Fill two glasses with water.
 - c. Estimate how much water will be left after they pour water into the "filled" glasses.
 - d. Pour the water into the "filled" glasses.
 - e. Compare the amount of water left with the original estimates.
3. **ASK** members to discuss what happened and try to explain why.



APPLY IT

12 minutes

1. **SAY:** To understand this, you first have to imagine a sphere inside of a cube – and then imagine the glass filled with the sphere-inside-the-cube shapes.
2. **SAY:** The ratio of sphere volume to cube volume will tell us how much space is available for water – and this ratio is approximately 0.52. No matter what size the cube is, the sphere inside takes up about half of the volume.
3. **SAY:** Here are the equations to calculate the volume ratio of an inside sphere to the surrounding cube:
 - a. $V_{\text{cube}} = s^3$ ($s = \text{side}$)
 - b. $V_{\text{sphere}} = \frac{4}{3}\pi r^3$ ($\pi=3.14$, $r = \text{radius}$)
 - c. $\text{ratio} = V_{\text{sphere}}/V_{\text{cube}}$
4. **DO:** Distribute copies of “Calculating Volume Ratio” to members.
5. **ASK** members to use the formulas to complete the chart.
6. **ASK:** What can you say about filling glasses with various sized round objects?
7. **CHECK FOR UNDERSTANDING:** If members have trouble calculating volume ratio, guide them through the lesson again or help them access the additional resource listed.

Relative Distance of Planets from the Sun

Planets	Average Distance from the Sun (km)	Relative Distance AU
Mercury	58.0×10^6	
Venus	108.2×10^6	
Earth	149.5×10^6	
Mars	227.9×10^6	
Jupiter	778.0×10^6	
Saturn	1.43×10^9	
Uranus	2.90×10^9	
Neptune	4.40×10^9	

Relative Distance of Planets from the Sun (Answer Key)

Planets	Average Distance from the Sun (km)	Relative Distance AU
Mercury	58.0×10^6	0.39
Venus	108.2×10^6	0.72
Earth	149.5×10^6	1.00
Mars	227.9×10^6	1.52
Jupiter	778.0×10^6	5.20
Saturn	1.43×10^9	9.52
Uranus	2.90×10^9	19.2
Neptune	4.40×10^9	30.1

Understanding Scale and Proportion

TIME: 25 minutes

OBJECTIVE: The science and art of growing small-scale versions of natural trees has been going on for more than a thousand years. Started in China and redeveloped in Japan, this science and art, called “bonsai” has the goal of creating miniature versions of nature. Bonsai can be created from most trees or shrubs. In this lesson, members develop the concept of scale by comparing natural trees and created smaller versions.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Kraft paper
- Markers
- Calculators

VOCABULARY

- **Mathematical model** – a created object used as a substitute for a real-life object because the model is larger, smaller or simpler than the original and therefore easier to study
- **Scale** – the ratio of the length in a drawing (or model) to the length of the real thing
- **Ratio**– the comparative value of two or more amounts (written as 3:4 or as $\frac{3}{4}$)

PREPARATION

Make copies of “Bonsai Trees vs. Natural Trees” (one per pair or small group).

ADDITIONAL RESOURCE(S)

[Ratios, Rates, Proportions](#)

CAREER CONNECTION

Careers that use scale and proportion include horticulturist, architect and landscape designer.



LEARN IT

5 minutes

1. **ASK:** Do you like to grow plants?
2. **SAY:** If so, nurturing miniature plants, called bonsai, might just be the thing for you. Bonsai is something that everyone can do if they have patience and the desire for perfection. The bonsai grower uses both science and art as he or she creates a small living model of a natural full-sized tree or shrub. The bonsai horticulturist hopes to develop nature in its most beautiful form.
3. **SAY:** You're going to calculate the scale of bonsai trees to their full-sized counterparts. Using the measurements in centimeters and inches for the bonsai trees – and feet and meters for the full-sized trees, you'll calculate the ratio of measurements.
4. **ASK:** For example, if the Brush Cherry tree is 50 feet high and the bonsai version is 8 inches, how do we calculate the scale of the bonsai to the natural tree?
Answer: **we make a ratio of natural height to bonsai height**
5. **ASK:** How do we figure the scale of the Brush Cherry's natural height to the bonsai height?
Answer: **we make a ratio of 50 feet to 8 inches**
 - a. $50 \text{ feet} \times 12 \text{ inches} = 600 \text{ inches}$
 - b. $600 \text{ inches} / 8 \text{ inches} = 75$
 - c. the scale is $1/75$



TRY IT

13 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Distribute copies of "Bonsai Trees vs. Natural Trees" to pairs or small groups.
3. **SAY:** Work together to find out how the bonsai forms of natural trees relate in size to the full-sized ones.
4. **ASK** members to share their calculations and correct them as necessary (using "Bonsai Trees vs. Natural Trees Answer Key").



APPLY IT

7 minutes

1. **ASK** members to use the markers and Kraft paper to create a drawing showing the heights of the bonsai trees.
2. **ASK:** How can the use of scale models help you understand the objects you are modeling?
3. **CHECK FOR UNDERSTANDING:** If members have trouble using scale and proportion, guide them through the lesson again or help them access the additional resource listed.

Bonsai Trees vs. Natural Trees

How do bonsai forms of natural trees relate in size to the full-sized ones?

Tree	Natural Height (m)	Bonsai Height (cm)	Natural Height (feet)	Bonsai Height (inches)	Scale
Brush Cherry	15	20.32	50	8	
Chinese Elm	18	25.4	60	10	
Eastern Hemlock	24	45.72	80	18	
Fig	9	73.66	30	29	
Japanese Maple	3.5	71.2	12	28	
Juniper	3	15.24	10	6	
Pitch Pine	60	35.56	200	14	
Red Cedar	24	50.8	80	20	

Bonsai Trees vs. Natural Trees (Answer Key)

Tree	Natural Height (m)	Bonsai Height (cm)	Natural Height (feet)	Bonsai Height (inches)	Scale
Brush Cherry	15	20.32	50	8	1/75
Chinese Elm	18	25.4	60	10	1/72
Eastern Hemlock	24	45.72	80	18	1/53
Fig	9	73.66	30	29	1/12
Japanese Maple	3.5	71.2	12	28	1/5
Juniper	3	15.24	10	6	1/20
Pitch Pine	60	35.56	200	14	1/171
Red Cedar	24	50.8	80	20	1/48

Creating Line Graphs

TIME: 25 minutes

OBJECTIVE: Design is often a combination of mathematical prediction, data collection and trial and error. The creation of paper helicopters has many of the same characteristics as building full-size flying machines and, through these types of activities, members develop problem solving skills. In this lesson, members explore the flight of paper helicopters by creating and testing models and by recording and graphing their behaviors.

MATERIALS

- White board
- Dry-erase markers
- Pens/pencils
- Paper
- Rulers
- Paper clips (large and small)
- Calculators
- Stop watches

VOCABULARY

- **Mathematical model** – a created object used as a substitute for a real-life object because the model is larger, smaller or simpler than the original and therefore easier to study
- **Line chart of graph** – a picture that uses lines to connect individual numeric points that represent data

PREPARATION

Make copies of “Dropcopter Template” (one per pair or small group). Make one dropcopter model (cut on solid lines, fold on dotted lines and experiment with wing position, add or subtract large or small paperclips to simulate weight).

ADDITIONAL RESOURCE(S)

[Measurement and Data](#)

CAREER CONNECTION

Careers that use line graphing include airplane designer, pilot, architect and graphic artist.



LEARN IT

2 minutes

1. **SAY:** In this lesson, you will act as airplane designers by building, flying and modifying paper helicopters – called “dropcopters.” As you do, you’ll practice and develop skills in problem solving, experimentation and data recording.
2. **SAY:** You’ll first build the dropcopters, test and record their flying characteristics, then modify them for maximum flight efficiency. When you’re finished, you’ll create graphs to demonstrate the results of the changes.
3. **DO:** Show members the dropcopter model and demonstrate how to fold it.
4. **ASK:** What characteristics of the dropcopter or drop heights do you predict will make the most efficient flying?



TRY IT

20 minutes

1. **ASK** members to form pairs or small groups.
2. **ASK** them to decide who will be the flyer, the timer and the recorder.
3. **DO:** Explain the process of the activity:
 - a. Use the “Dropcopter Template” to create a standard model.
 - b. Experiment with the paper clips to simulate weight.
 - c. Stand on a chair, drop the dropcopter, note time of flight, wing rotation and spin rate.
 - d. Test the model several times, using a constant drop height, and changing the position of the wings and the weight to establish and record baseline data.
4. **SAY:** After you create and test your standard model, modify it to change the flight time, the spin rate or spin direction. Consider changing one, some or all of these elements:
 - a. size
 - b. body shape
 - c. wing bend, width and/or length
 - d. weight position, amount
5. **SAY:** Conduct enough trials so you can be confident with the conclusions.
6. **ASK** members to visualize the results in a data table and/or line graph, where the “y” axis lists the flight time and the “x” axis indicates the trials.

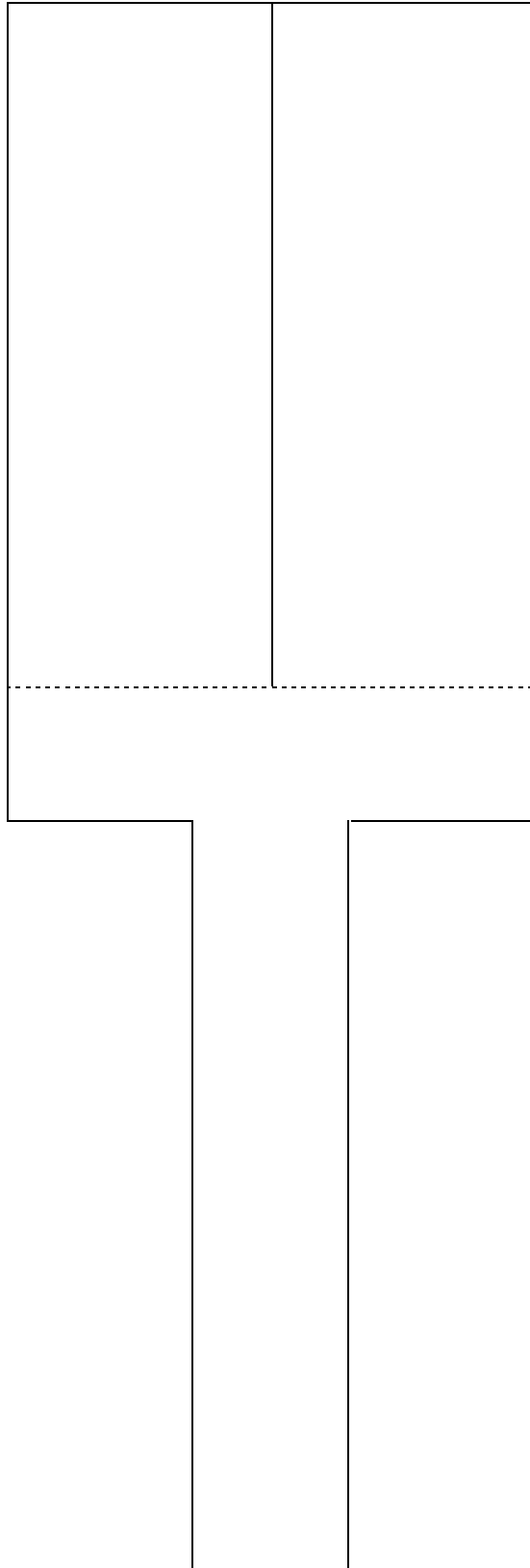


APPLY IT

3 minutes

1. **ASK** members to share their final dropcopter models and the flying results.
2. **ASK:** Which properties produce long flight times, highest spin rate and spin direction? And how do these compare to your initial predictions?
3. **ASK:** How did using a higher drop height change the results?
Answer: **the higher they are dropped, the more interesting the characteristics were**
4. **CHECK FOR UNDERSTANDING:** If members have trouble creating line graphs, guide them through the lesson again or help them access the additional resource listed.

Dropcopter Template



Creating Curve Graphs

TIME: 25 minutes

OBJECTIVE: Bacteriologists study the growth and characteristics of microorganisms, the way they interact with their environment – including human beings. They work to develop applications in industry, medicine and public health. Although some bacteria create illness and even death in people, bacteria have important roles in many natural cycles and human activities. Bacteria are one-celled organisms, which grow in number by the division of individual cells. In this lesson, members create curve graphs that model the exponential growth of bacteria.

MATERIALS

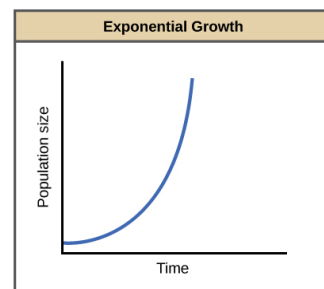
- White board
- Dry-erase markers
- Pens/pencils
- Graph paper
- Kraft paper
- Calculators

VOCABULARY

- **Doubling time** – the amount of time it takes bacteria to reproduce by splitting in half
- **Exponential growth**– the process by which population growth rate (the number of organisms added in each generation) increases as the population gets larger
- **Curve graph** – a graph that depicts data with a curved line to show how something changes or is affected by one or more conditions

PREPARATION

Make copies of “Bacterial Growth Data” (one per pair or small group). Draw a simple curve graph like the one below on the white board:



ADDITIONAL RESOURCE(S)

[Exponential and Logistic Growth](#)

CAREER CONNECTION

Careers that use exponential growth and graphing include epidemiologist, demographer, bacteriologist and statistician.



LEARN IT

5 minutes

- SAY:** Today we're going to practice making graphs to show population growth – specifically the growth of bacteria, one-celled organisms that grow in number by dividing individual cells. Like bacteriologists who study the characteristics of microorganisms, we're going to explore the growth of several types of bacteria.
- SAY:** How long it takes a bacteria population to grow depends upon factors such as temperature and nutrient supply. Bacteria reproduce by splitting in half, and the time between divisions varies according to bacterial species. This is called “doubling time.”
- ASK:** If we start with 1000 bacteria in a flask, and the doubling time is 60 minutes, how many bacteria will we have after one hour, two hours and three hours?
Answer: after one hour, there will be 2000 bacteria; after two hours, there will be 4000 bacteria; after three hours, there will be 8000 bacteria
- SAY:** This process is called “exponential growth.” The key concept of exponential growth is that the population growth rate – the number of organisms added in each generation – increases as the population gets larger.
- SAY:** We're going to be looking at two bacteria under different conditions:
 - E. coli* (*Escherichia coli*) is a common intestinal bacterium that causes sickness and is found in ground water, ground beef, fresh produce or unpasteurized milk.
 - B. anthracis* (*Bacillus anthracis*) causes anthrax, an infection that can affect skin, breathing and intestines.



TRY IT

17 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Distribute copies of “Bacterial Growth Data” to pairs or small groups.
3. **SAY:** The data shows the growth rate or doubling time for two bacteria under different conditions. Remember that doubling time is the time it takes a population to double at a constant rate of growth. The number of bacteria is 2^n where n is the number of times the population has doubled.
4. **ASK:** What do you notice about the data? What is the effect of temperature and growth medium on the doubling time of the anthrax bacterium?
Answer: **lower temperatures and growth mediums slow growth (increase doubling time)**
5. **ASK:** How many times would an anthrax bacterium double in 12 hours?
Answer: **it depends on conditions; at low temperature and low growth medium, six hours**
6. **DO:** Call attention to the graph you have drawn on the white board.
7. **SAY:** This type of graph line is often described as a “curve.” Notice that time (the independent variable) is along the “x” axis and number of bacteria (the dependent variable) is on the “y” axis.

8. **ASK** pairs or small groups to use the “Bacterial Growth Data” to create curve graphs that:

- a. compare the growth of E. coli and B. anthracis for 12 hours under optimum conditions and extend the curves to show the differences in the number of bacteria after one day;
- b. show the doubling of a bacteria n times where $n=20$, using the data to plot growth curves, showing how many anthrax bacteria come from a single bacterium under the various conditions listed on the data sheet.

9. **ASK** pairs or small groups to share their curve graphs.



APPLY IT

3 minutes

1. **ASK:** What do the graphs tell you about exponential growth of bacteria?
Answer: depending on the conditions and temperature, it can be controlled
2. **ASK:** Why don't bacteria overwhelm the planet?
Answer: **there aren't enough resources to sustain exponential growth; the ideal conditions don't exist; water purification and sewage treatment control bacteria growth**
3. **CHECK FOR UNDERSTANDING:** If members have trouble understanding exponential growth and creating curve graphs, guide them through the lesson again or help them access the additional resource listed.

Bacterial Growth Data

E. coli	
Conditions	Doubling Time (minutes)
Optimum temperature (37°C) and growth medium	20
Low Temperature (below 37°C)	40
Low Growth Medium	60
Low Temperature, Low Growth Medium	120

B. anthracis	
Conditions	Doubling Time (minutes)
Optimum temperature (37°C) and growth medium	45
Low Temperature (below 37°C)	75
Low Growth Medium	90
Low Temperature, Low Growth Medium	120

Mathematics Skills Review

TIME: 25 minutes

OBJECTIVE: Mathematics is similar to a foreign language; being able to utilize mathematics requires an ability to comprehend its language, concepts and skills. Making effective use involves awareness of the real-life or abstract context in which it is used. In this lesson, members test their knowledge of mathematical concepts and skills in a game of competition and cooperation. Members come to this activity with diverse knowledge and skills of the full scope mathematics: number systems, expressions and equations, geometry, statistics and probability, ratio and proportion and modeling and graphing, but the lesson is structured so that members work together for success.

MATERIALS

- White board
- Dry-erase markers
- Index cards
- Markers

VOCABULARY

- **Algorithm** – a way of setting out a step-by-step mathematical procedure
- **Area** – the size a surface takes up, measured in square units
- **Average** – a measure used to find the location of the middle of a data set
- **Congruent** – having the same shape and the same size
- **Decimal** – a fraction written as a decimal
- **Denominator** – the bottom number in a fraction; number of parts whole is divided into
- **Equation** – a math statement with an equal sign to show that two expressions are equal
- **Expression** – a mathematical statement made up of numbers, operations and variables
- **Formula** – a special type of equation showing the relationship between different variables
- **Fraction** – any part of a group, number or whole
- **Graph** – a picture that represents data in an organized manner
- **Inference** – the process of drawing a conclusion from one or more premises
- **Integer** – a whole number that can be positive, negative or zero
- **Inverse** – opposite in effect; the reverse of something
- **Irrational number** – a number that cannot be made by dividing two integers
- **Numerator** – number above the line in a fraction, showing number of parts of the whole

- **Percent** – the part of a whole when 100 represents all of something
- **Perimeter** – the distance around the outside of a shape
- **Probability** – a measure of how likely it is that an event will happen
- **Quadrilateral** – a flat shape with four straight sides
- **Radius** – the distance from the center to the circumference of a circle
- **Random sampling** – selecting/studying part of a group when unable to count all members
- **Ratio** – the comparative value of two or more amounts (written as 3:4 or as $\frac{3}{4}$)
- **Rational number** – a number that can be made by dividing two integers
- **Slope** – the steepness of a straight line
- **Variable** – a symbol (such as x or y) that stands for a number we don't yet know
- **Volume** – amount of space occupied by a three-dimensional object (measured in cubic units)

PREPARATION

Make copies of “Sometimes, Always, Never” (one per pair or small group). Prepare index cards with the numbers 1 to 50.

ADDITIONAL RESOURCE(S)

[S.O.S. Mathematics](#), [Fun Maths for High School](#), [Math Planet](#)



LEARN IT

3 minutes

1. **SAY:** How much mathematics do we know as a group? One way to strengthen math skills is to do a review – to see where your strengths are and where you need more work.
2. **SAY:** Today, we'll play a game and work together as teams to see how comfortable we are with mathematics. To use math in all areas of life means we have to know the language and be able to solve the problems. This cooperative game helps us strengthen our knowledge.



TRY IT

20 minutes

1. **ASK** members to form pairs or small groups.
2. **DO:** Distribute copies of “Sometimes, Always, Never” to each pair or small group.
3. **DO:** Explain the rules of the game:
 - a. Each team draws a number card.
 - b. Team members discuss the question corresponding to that number (for 30 seconds).
 - c. Team members report their answers.
 - d. The group discusses and agrees or suggests other answers.
 - e. Teams earn a point if the group agrees with their answer.
 - f. The process continues with each team drawing a number card.
 - g. The team with the most points wins.
4. **SAY:** Remember that this is a cooperative game, meaning that together you may know some or all of the answers – but no one is expected to have all the answers. Just see what happens when you put your knowledge together.
5. **DO:** Begin the game, keeping track of time for each team draw.

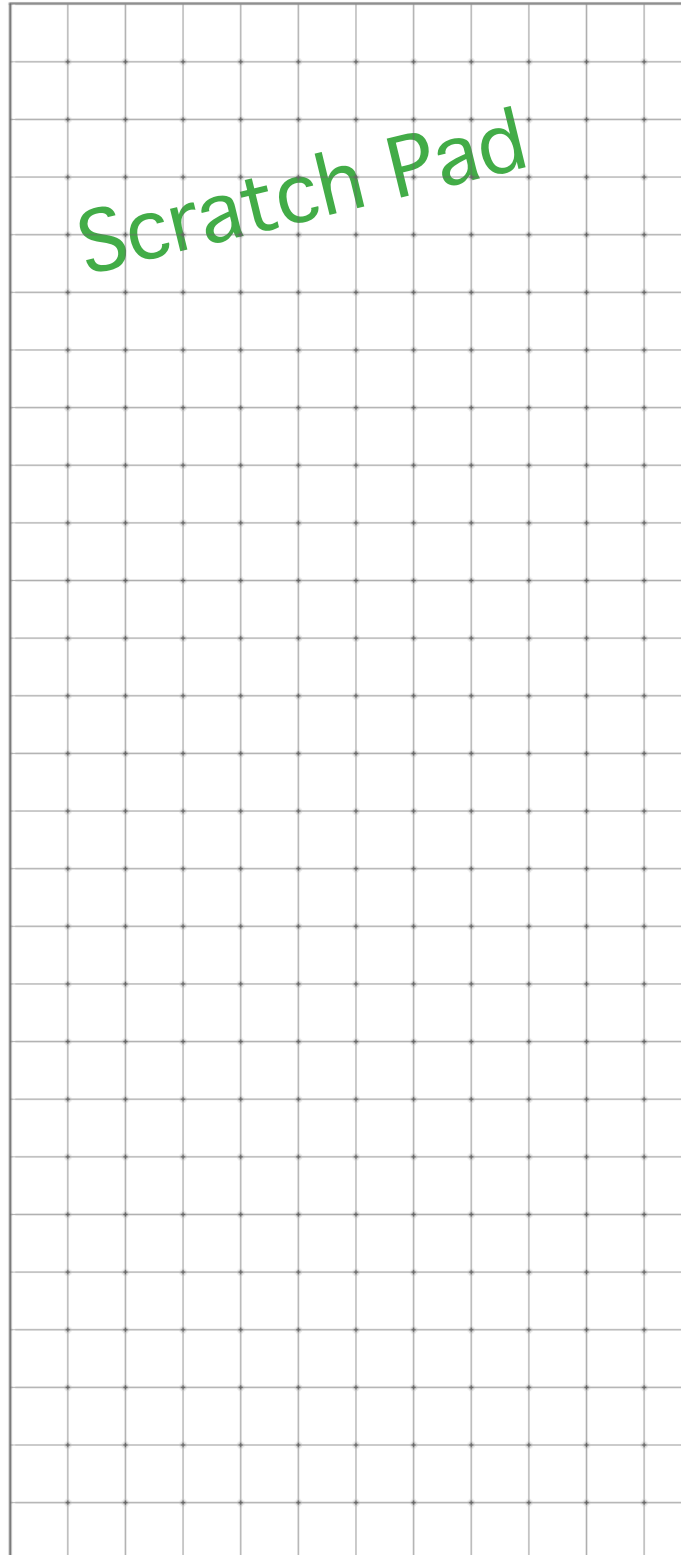




APPLY IT

2 minutes

1. **ASK:** How well do you think you did as a team? Did you find that, collectively, you knew more than you thought you did?
2. **ASK:** What are the areas you knew well? And what are the areas in which you need work?
3. **CHECK FOR UNDERSTANDING:** If members have trouble with particular math skills, help them access one of the general review websites listed in the additional resources.



Sometimes, Always, Never

Which word should go into the blank: *sometimes*, *always*, *never*? Be ready to explain your thinking.

1. Multiples of three are _____ odd numbers.
2. The probability of an event that may occur is _____ expressed as a whole number.
3. It is _____ smarter to overestimate than underestimate.
4. The inverse of subtraction is _____ division.
5. Figures with the same shape will _____ have the same perimeter.
6. The sum of an odd number of odd numbers plus an even number is _____ an even number.
7. The average of four numbers _____ equals one of the four numbers.
8. If two figures are _____ congruent, one may be moved onto the other by a reflection, turn, slide, or combination.
9. If the numerator and denominator are odd, the fraction is _____ in the lowest terms.
10. If the numerator and denominator are even, the fraction is _____ in lowest terms.
11. The area of a triangle is _____ half the area of a rectangle whose length equals the triangle's base.
12. A tall container will _____ have greater capacity than a short container.
13. If the ratio of a team's wins to losses is 2 to 3 then they _____ usually win two games for every three that they lose.
14. Quadrilaterals _____ have four 90° angles.
15. Quadrilaterals _____ have four sides.
16. The radius of a sphere is _____ twice the diameter.

17. The equation $y = mx + b$ _____ produces a straight line.
18. Equations _____ always contain an equal sign (=).
19. $n7$, $n.7$, and $n \times 7$ _____ represent a multiplication expression.
20. Variables _____ change.
21. Integers _____ include both positive and negative numbers.
22. Expressions _____ represent a mathematical calculation.
23. $t/10$ _____ represents a ratio.
24. $2(x-4) + 7(x-4)$ _____ represents an equation.
25. A ratio _____ describes the relationship between two quantities.
26. The percent of a quantity _____ means some number out of 100.
27. The standard algorithm for dividing multi-digit numbers is _____ the most efficient way.
28. Positive and negative numbers _____ describe quantities having opposite amounts or values.
29. Minus a minus number _____ equals the same number as a positive number.
30. The expression subtract x from 11 _____ is written as $11-x$.
31. Formulas can _____ be used to solve real-world problems.
32. The formula $V = lwh$ is _____ used to find the volume of pyramids.
33. A statistical question _____ anticipates variable data.
34. $x-y$ is _____ $x + (-y)$.
35. Converting a fraction to a decimal _____ requires long division.

37. The formula for the area of a circle _____ produces the precise size of the area.
38. The probability of a chance event _____ is always expressed between 0 and 1.
39. The chances of “heads” in a coin flip are _____ the same as a “tails.”
40. Numbers that are not rational are _____ called irrational.
41. Graphs and equations _____ provide the same kind of information.
42. The equations $4a + 3b = 7$ and $4a + 3b = 7$ can _____ be equal.
43. Two figures are _____ congruent if they can be matched by rotations.
44. Data is _____ represented with bar graphs.
45. The slope of a line graph _____ demonstrates the rate of change.
46. Random samples are _____ used to make inferences about a population.
47. Counting numbers are _____ the same as integers.
48. Inverse is _____ defined as opposite.
49. Congruent is _____ defined as having the same shape.
50. An irrational number is _____ one that has a decimal that does not repeat.

Sometimes, Always, Never (Answer Key)

1. Multiples of three are sometimes odd numbers.
2. The probability of an event that may occur is never expressed as a whole number.
3. It is sometimes smarter to overestimate than underestimate.
4. The inverse of subtraction is never division.
5. Geometric figures with the same shape will sometimes have the same perimeter.
6. The sum of an odd number of odd numbers plus an even number is sometimes an even number.
7. The average of four numbers never equals one of the four numbers.
8. If congruent geometric figures are always able to be moved onto the other by a reflection, turn, slide, or combination.
9. If the numerator and denominator are odd, the fraction is sometimes in the lowest terms.
10. If the numerator and denominator are even, the fraction is never in lowest terms.
11. The area of a triangle is sometimes half the area of a rectangle whose length equals the triangle's base.
12. A tall container will sometimes have greater capacity than a short container.
13. If the ratio of a team's wins to losses is 2 to 3 then they always usually win two games for every three that they lose.
14. Quadrilaterals sometimes have four 90° angles.
15. Quadrilaterals always have four sides.
16. The radius of a sphere is never twice the diameter.

17. The equation $y = mx + b$ always produces a straight line.
18. Equations always contain an equal sign (=).
19. $n7$, $n.7$, and $n \times 7$ always represent a multiplication expression.
20. Variables sometimes change.
21. Integers always include both positive and negative numbers.
22. Expressions always represent a mathematical calculation.
23. $t/10$ always represents a ratio.
24. $2(x-4) + 7(x-4)$ never represents an equation.
25. A ratio always describes the relationship between two quantities.
26. The percent of a quantity always means some number out of 100.
27. The standard algorithm for dividing multi-digit numbers is sometimes the most efficient way.
28. Similar positive and negative numbers always describe quantities having opposite amount or values.
29. Minus a minus number always equals the same number as a positive number.
30. The expression subtract x from 11 always is written as $11-x$.
31. Formulas can sometimes be used to solve real-world problems.
32. The formula $V = lwh$ is never used to find the volume of pyramids.
33. A statistical question always anticipates variable data.
34. $x-y$ is always the same as $x + (-y)$.
35. Converting a fraction to a decimal sometimes requires long division.

37. The formula for the area of a circle never produces the precise size of the area.
38. The probability of a chance event is always expressed between 0 and 1.
39. The chances of “heads” in a coin flip are always the same as a “tails.”
40. Numbers that are not rational are sometimes called irrational.
41. Graphs and equations sometimes provide the same kind of information.
42. The equations $4a + 3b = 7$ and $4a + 3b = 7$ can never be equal.
43. Two figures are always congruent if they can be matched by rotations.
44. Data is sometimes represented with bar graphs.
45. The slope of a line graph always demonstrates the rate of change.
46. Random samples are always used to make inferences about a population.
47. Counting numbers are sometimes the same as integers.
48. Inverse is always defined as opposite.
49. Congruent is never defined as having the same shape.
50. An irrational number is always one that has a decimal that does not repeat.