

**UNIT PLAN
ALGEBRAIC CONCEPTS**

**UNIT PLAN #1:
ALGEBRAIC CONCEPTS**

Grade Level: 1

General Objective: Students will be able to demonstrate and apply a knowledge of basic algebraic concepts and skills in the areas of: pattern, variables, equality, representation, and change.

Overview:

- Lesson 1: Pattern
- Lesson 2: Integrating Literature with Algebraic Concepts
(Pattern)
- Lesson 3: Equality
- Lesson 4: Variables
- Lesson 5: Representation
- Lesson 6: Change
- Lesson 7: Learning Centers/Summative Assessment

Lesson 1: Pattern

NCTM Standard:

Understand patterns, relations, and functions

- recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another.

Pennsylvania Content Standards Grade Level Benchmarks:

2.8 Algebra and Functions

- Grade 1
- A. Identify, describe, and extend patterns based on shape, size, color or sound using concrete objects.

Objective(s):

- Students will be able to identify, complete, and create patterns.
- Students will be able to demonstrate an understanding of different patterns (i.e. shapes, colors, numerals, and rhythms).

Materials:

- Audio track of “The Chicken Dance”
- Transparency depicting complete and incomplete patterns
- Overhead projector
- Patterns worksheet
- Station materials: shapes, color cards, action cards, etc.

Anticipatory Set/Introduction:

1. Teach and perform “The Chicken Dance” with the students.
2. Explain to the students that the actions performed in the dance form a pattern.

Instructional Procedures:

1. Explain to students that patterns help to organize and sort objects or actions. Objects or actions are in a sequence that repeats so it is more easily understood.
2. Display for the students an overhead transparency depicting different patterns including shapes, colors, numbers, rhythms, and noises. Students should experience completed patterns first and then incomplete patterns should be presented. In large-group instruction, students should share how to complete the patterns aloud and answers should be recorded on the transparency. Students should act out the completion of patterns that require actions or noises.

Evaluation/Assessment:

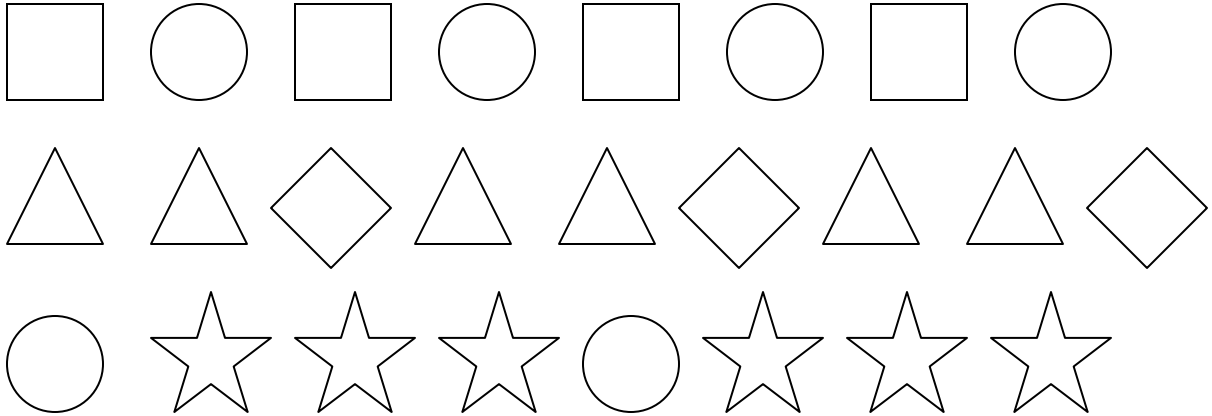
1. Students will complete a “Patterns” worksheet requiring them to complete and create different patterns.
 - To be proficient, students must complete at least 80% of the patterns on the worksheet correctly and have created one pattern with 100% accuracy.
2. Students will be placed in groups of three to four students. Each group will be given one of the following: a set of shapes (cubes, spheres, triangles), cards of varying colors,

action cards (stomp, clap, jump), or noise cards (oink, bark, meow). Students must create a pattern using the materials given. Each group will share/demonstrate their pattern with the class.

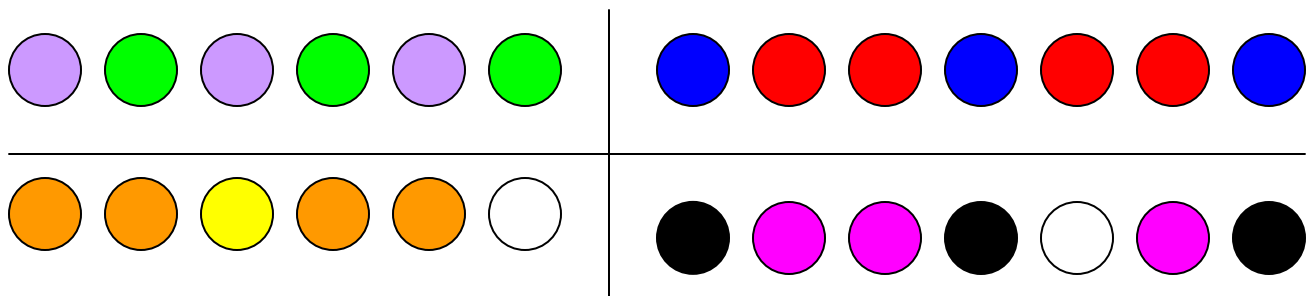
- Students will be evaluated by teacher observation. A checklist will be used rating each student's performance as satisfactory or needs improvement.

PATTERNS

SHAPES



COLORS



OTHER PATTERNS

STOMP-STOMP-CLAP-CLAP-CLAP-STOMP-STOMP

BARK-MEOW-BARK-MEOW-BARK-MEOW

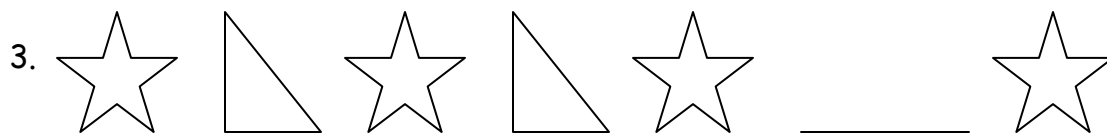
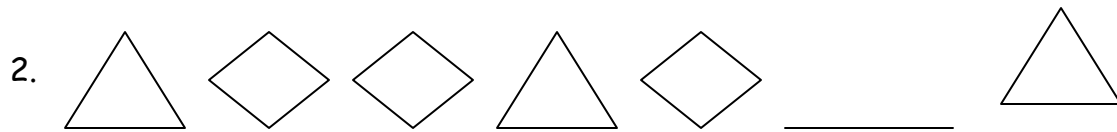
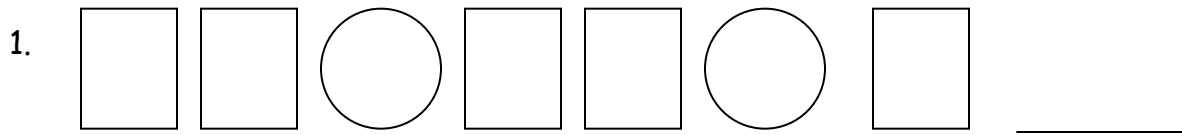
CLAP-CLAP-CLAP-JUMP-JUMP-CLAP-CLAP-CLAP

OINK-QUACK-QUACK-OINK-QUACK-QUACK

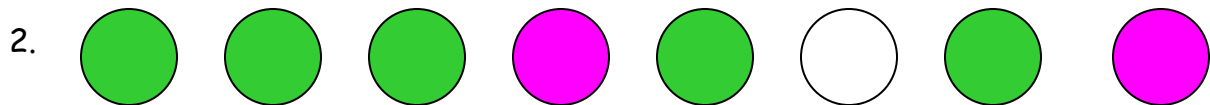
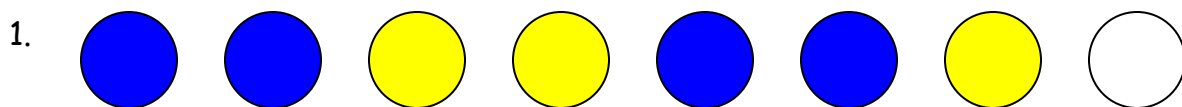
CAN WE CREATE OUR OWN ACTION OR NOISE PATTERN?

Name _____

DIRECTIONS: Draw the shape in the blank that best completes each pattern.



DIRECTIONS: Use your crayons to fill in the circle with the color that best completes the pattern.



CHALLENGE! Using shapes, colors, or both, create your own pattern in the space below.

Lesson 2: Integrating Literature with Algebraic Concepts (Pattern)

NCTM Standard:

Understand patterns, relations, and functions

- recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another.

Pennsylvania Content Standards Grade Level Benchmarks:

1.6 Speaking and Listening

- Grade 1
- A. Listen to selection of literature.

Objective(s):

- Students will be able to identify various types of patterns in a selection of literature.
- Students will be able to use algebraic reasoning to reflect changes in situations.

Materials:

- *The Very Hungry Caterpillar* by Eric Carle
- Chalkboard, whiteboard, or overhead projector with transparencies
- Drawing paper
- Crayons or colored pencils

Anticipatory Set/Introduction:

- Take a “picture walk” through *The Very Hungry Caterpillar* with students. Ask them to share their observations, ideas, and/or predictions.

Instructional Procedures:

1. Read *The Very Hungry Caterpillar* aloud to students.
2. Throughout the read-aloud, identify the different patterns in the story:
 - Cyclical patterns: night-day; the days of the week; caterpillar-butterfly
 - Patterns of food consumption by the caterpillar
 - Repeated language patterns
3. Upon completion of the book, pose the following (or similar) situation to the students:
 - What if the main character in the book was a termite instead of a caterpillar? What would be different about the story? How might the behaviors of the main character change? What effects would this have on the patterns in the story?
 - Conduct a class discussion regarding the above situation. Students should have the opportunity to share their ideas/thoughts. Draw increased attention to the idea of patterns and how they would change.

Assessment/Evaluation

- Using drawing paper, crayons, and colored pencils, the students will re-draw a specific illustration from *The Very Hungry Caterpillar*, imagining that the caterpillar is now a termite. The book should be provided to guide students’ thinking. (*Optional: Teacher or past student examples could also be provided).
 - A checklist will be used to evaluate and record student performance. The students will earn either a complete or an incomplete on this assignment.

Lesson 3: Equality

NCTM Standard:

Understand patterns, relations, and functions

- use concrete, pictorial, and verbal representations to develop an understanding of invented and conventional symbolic notations.

Apply appropriate techniques, tools, and formulas to determine measurements

- use tools to measure.

Pennsylvania Content Standards Grade Level Benchmarks:

2.1 Numbers, Number Systems and Number Relationships

- Grade 1
- C. Represent equivalent forms of a whole number using concrete objects, drawings, and word names.

Objective(s):

- Students will be introduced to the concept of equality.
- Students will be able to use manipulatives, a pan balance, and measurement skills to demonstrate a basic understanding of equality.

Materials:

- Chalkboard, whiteboard, or overhead projector with transparencies
- 5-10 pan balances
- Weighted solids: cubes, spheres, pyramids
- Manipulatives: Starbursts and Tootsie Rolls
- "Sweet Equality" worksheet

Anticipatory Set/Introduction:

1. Draw equal sign on chalkboard, whiteboard, or overhead projector.
2. Ask students what an equal sign is and what it represents.
3. Allow students to share answers. Elaborate and share until the definition of equality is established and understood by students.

Instructional Procedures:

1. Have students gather around a pan balance as a large group.
2. Use the pan balance and weighted solids to demonstrate the concept of equality. Teacher should emphasize the procedures of measuring with a pan balance.
 - Each weighted solid shape should be of a different mass. For example, the cubes have more mass than the spheres, which have more mass than the pyramids.
 - Place different combinations of shapes on each pan of the balance until equilibrium is achieved. For example students may possibly observe the following:
 - 3 cubes=5 spheres
 - 2 cubes=7 pyramids
 - 4 spheres=5 pyramids
3. Utilizing teacher observation and questioning strategies, the activity should continue until the students demonstrate a solid knowledge base in the concept of equality.

Assessment/Evaluation:

1. Students will work in groups of 3-4 to complete an activity using manipulatives to demonstrate equality.
2. Each group will have one pan balance and a set of manipulatives (Starbursts and Tootsie Rolls).
3. The students will follow the prompts on the "Sweet Equality" worksheet and record their findings to demonstrate their understanding of equality.
4. Upon completion of the activity, the worksheet will be reviewed as a large-group.
5. The worksheet will be collected as an assessment of understanding.
 - To be proficient, students must have completed the equality worksheet with at least 80% of the answers correct.

Name _____




SWEET EQUALITY

DIRECTIONS: For the problems below, use your pan balance, Starbursts, and Tootsie Rolls to fill-in-the-blank with the correct number.

1. 3 Tootsie Rolls = _____ Starbursts
2. 2 Starbursts = _____ Tootsie Rolls
3. 5 Starbursts = _____ Tootsie Rolls
4. _____ Starbursts = 10 Tootsie Rolls
5. _____ Tootsie Rolls = 6 Starbursts
6. 3 + 1 Tootsie Rolls = _____ Starbursts
7. _____ Starbursts = 11-7 Tootsie Rolls



DIRECTIONS: Read each sentence below and using your pan balance, Tootsie Rolls, and Starbursts test what the sentence says. If you find that what the sentence says is correct, circle the smiley face. If you found that what the sentence says is not correct, draw an X through the smiley face.

8. 3 Starbursts = 1 Tootsie Roll 
9. 8 Tootsie Rolls = 10 Starbursts 
10. 5 red Starbursts = 5 yellow Starbursts 

Lesson 4: Variables

NCTM Standard:

Represent and analyze mathematical situations and structures using algebraic symbols

- use concrete, pictorial, and verbal representations to develop an understanding of invented and conventional symbolic notations.

Pennsylvania Content Standards Grade Level Benchmarks:

2.2 Computation and Estimation

- Grade 1
- A. Determine the sum of 2 or 3 addends to 20 by using manipulatives, drawing pictures, and writing number sentences.

2.8 Algebra and Functions

- Grade 1
- E. Use concrete objects to show the concepts of variables and inequalities.

Objective(s):

- Students will be able to demonstrate an understanding of variables representing words in mathematical equations.
- Students will be able to replace the proper word/words in mathematical equations with representative variables.
- Students will be able to solve for variables in mathematical equations.

Materials:

- Manipulatives: gummy bears, books, paper dog bones, paper or model pumpkins, unlit birthday candles, M&Ms chocolate candies, model baseballs
- Chalkboard, whiteboard, or overhead projector with transparencies
- Group problems
- Answer sheet for group problems

Anticipatory Set/Introduction:

- Gather students informally around a table in the classroom.
- Using books as manipulatives, pose the following (or similar) situation:
 - Our classroom library had 6 books about caterpillars in it last week. This weekend, Miss Bunch bought 3 new books about caterpillars? How many books about caterpillars are now in our classroom library?

Instructional Procedures:

1. Through large-group instruction and the use of manipulatives, work through the problem posed in the introduction of the lesson.
 - Using the chalkboard or overhead projector, explain the concept of forming an equation and using a variable to identify what is being solved for in the problem. The term variable should be explained in simple terms. Emphasize that a variable should represent the word it is replacing: **b** for book. Guide the students in formulating and solving an equation for the problem, using a representative variable. Allow for student input/ideas. Remind students to properly label their final answer.
2. Using gummy bears as manipulatives, pose the following (or similar) situation:

- *Student's name* started the day with 10 gummy bears. During afternoon snack, *student's name* ate 3 gummy bears. How many gummy bears does he have left?
- Using the chalkboard or overhead projector, reiterate the concept of forming an equation and using a variable to identify what is being solved for in the problem. Ask the students to define/explain the term variable. Students should identify a variable that could be used in this problem to represent the word it is replacing: **g** is for gummy bears. Guide the students in formulating and solving an equation for the problem, using a representative variable. Allow for student input/ideas. Remind students to properly label their final answer.

Assessment/Evaluation:

1. Students will be in ability groups of three to four students. Each group will be given one problem and corresponding manipulatives.
2. Students will:
 - identify the word/words that represent what is being solved for in the problem.
 - identify a representative variable to replace the word(s) that are being solved for.
 - write an equation, including the representative variable, that could be utilized to solve the problem.
 - solve for the variable in the equation.
 - properly label the final answer.
3. Each group will choose a spokesperson to present their findings to the class.
 - Students will be evaluated by teacher evaluation. A checklist will be utilized to determine if during group work students were able to successfully complete the tasks of the assignment and demonstrate a basic understanding of variables. To be proficient, students must accurately complete at least 80% of the tasks of the group assignment.

GROUP PROBLEMS

1. My dog Sparky loves dog treats! On Saturday my mom gave him 3 treats. On Sunday I gave him 4 more treats. How many dog treats did Sparky eat this weekend?
2. *Student name's* mom wants to use pumpkins to decorate her house for Halloween. She buys 5 pumpkins to put on the front porch. Then, she buys 4 more pumpkins to decorate the back window. How many pumpkins did Sarah's mom buy in all?
3. You just celebrated your 7th birthday! There were 7 candles on your chocolate birthday cake. After you made a wish, you blew out 2 of the candles. How many candles are still lit on your cake?
4. Miss Bunch loves M&Ms. If *student name* gives Miss Bunch 4 M&Ms and *student name* gives her 8 M&Ms, how many M&Ms does she have in all?
5. Student name's dad collects autographed baseballs. Last season, he collected 2 autographed baseballs. This season he collected 6 autographed baseballs. How many autographed baseballs did he collect in the past two seasons?

Name _____



GROUP PROBLEM ANSWER SHEET

DIRECTIONS: Answer the questions below using the problem your group was given. Remember to work together!

- What are trying to find in this problem?

- What variable could you use to show that word in a different way?

- Fill-in-the blanks to write an equation you can use to solve this problem.

_____ _____ = _____

- Write the equation you wrote below. Solve the equation for the variable you chose. Remember to label your answer.

_____ _____ = _____



Lesson 5: Representation

NCTM Standard(s):

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them

- Pose questions and gather data about themselves and their surroundings.
- Represent data using concrete objects, pictures, and graphs.

Pennsylvania Content Standards Grade Level Benchmarks:

2.6 Statistics and Data Analysis

- Grade 1
- A. Gather, organize, and display real life data on a bar graph and/or pictograph using the terms most, least, same, highest, lowest, more than, and fewer than.
- B. Describe data on a given graph.

Objective(s):

- Students will be able to read and interpret a bar graph.
- Students will be able to compare and contrast the information represented on a bar graph.
- Students will be able to correctly identify the relationships between data on a bar graph.

Materials:

- Large-scale bar graph template
- Small drawing paper squares
- Crayons or colored pencils
- Chalkboard, whiteboard, or overhead projector with transparencies
- "Bars and Objects" worksheet

Anticipatory Set/Introduction:

1. Ask students to identify the common modes of transportation to school each morning. Possible answers include ride the bus, walk, or parent/guardian drop off.
2. Give each student a pre-cut paper square. Each student will draw a picture to represent how he/she gets to school each morning.

Instructional Procedures:

1. Explain the bar graph template to the students.
 - X-axis represents modes of transportation.
 - Y-axis represents the number of students that use each mode of transportation.
 - Explain bar graphs should have a title. With student input title the bar graph (i.e. "How We Get to School").
 - Explain that bar graphs help us to compare information.
2. Each student should place his/her square on the bar graph in the appropriate place: bus, walk, or parent/guardian drop-off.
3. As a whole-group, compare and interpret the data on the bar graph.
 - Record student thoughts and interpretations on the chalkboard, whiteboard, or overhead projector.
 - Encourage students to use words such as most, least, same, highest, lowest, more than, and less than when interpreting/explaining the information on the bar graph.

4. With student input, make a summary statement to finalize the interpretation of the “How We Get to School” bar graph.

Assessment/Evaluation:

- Students will complete “Bars and Objects” worksheet.
 - Collect worksheet. To be proficient, student must complete worksheet with at least 80% accuracy.

Reference(s):

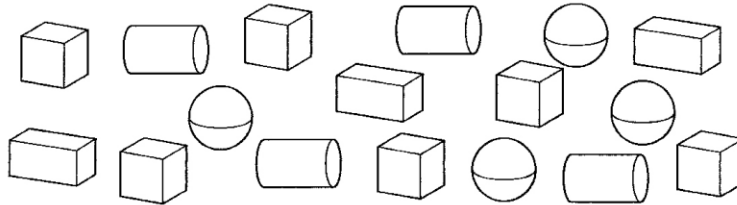
- Scott Foresman Texts On-line: First Grade Edition





Name _____

Bars and Objects

E 8-13
DATA

Use the bar graph to show how many of each object.



Kinds of Objects									
 Cubes									
 Cylinders									
 Spheres									
 Rectangular Prisms									
	1	2	3	4	5	6	7	8	9

Use your bar graph to answer the questions.

1. Which object is shown the most? _____
2. Which objects are shown the same number of times?

3. If there were 3 more spheres, how many spheres would there be on the bar graph? _____
4. Make up your own question about the bar graph.

Lesson 6: Change

NCTM Standard:

Analyze change in various contexts

- describe qualitative change, such as student's growing taller

Pennsylvania Content Standards Grade Level Benchmarks:

1.6 Speaking and Listening

- Grade 1
- Listen to selection of literature.

Objective(s):

- Given a set of data, students will be able to complete a line graph representing the information.
- Given a line graph, students will be able to analyze the change in a set of data.

Materials:

- *The Very Busy Spider* by Eric Carle
- Overhead projector
- Line graph template transparency
- *The Very Busy Spider* worksheet
- *The Very Busy Spider* worksheet transparency

Anticipatory Set/Introduction:

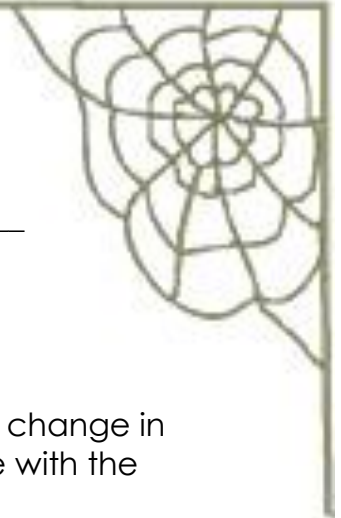
- Take a "picture walk" through *The Very Busy Spider* with students. Ask them to share their observations, ideas, and/or predictions.

Instructional Procedures:

1. Read *The Very Busy Spider* aloud.
1. Throughout the reading of the story, encourage students to notice the changes in the spider's web.
2. Use questioning strategies to ensure student comprehension of the story.
2. Conduct a discussion of the story. Direct special attention to the change in the spider's web as she encounters the different characters.
 - Allow students to participate in the discussion and to share their insights.
 - Continue the discussion until students have concluded that as each character approaches the spider, the web has grown/changed.
3. As a class, use the line graph template and overhead projector to develop a line graph depicting the change in the spiders' web throughout the book.
 - X-axis is the number of circles in the web.
 - Y-axis is the characters the spider encounters.
4. Upon completion of the graph, explain to students that line graphs show how things change over time. Give examples of data commonly represented by line graphs such as height, weight, and temperature.

Assessment/Evaluation:

- Working in partners, students will complete *The Very Busy Spider* worksheet.
 - Upon completion of the worksheet, review the answers in large-group format.
 - Record answers on *The Very Busy Spider* transparency.
 - Collect completed worksheets for assessment of understanding of analyzing change.
 - To be proficient, students must complete worksheet with at least 80% accuracy.



Name _____

The Very Busy Spider

DIRECTIONS: Study the line graph we made as a class of the change in the very busy spider's web. Fill-in-the blank in each sentence with the correct number from the graph.

1. There were _____ circles in the spider's web when the pig asked her to roll in the mud.
2. The spider had spun _____ circles into her web when the dog stopped to talk to her.
3. When the horse asked the spider if she wanted to go for a ride, she had spun _____ circles into her web.

DIRECTIONS: Study the line graph we made as a class of the change in the very busy spider's web.

4. What animal was the spider talking to when there were 5 circles in her web?

5. What animal was the spider talking to where there were the **MOST** circles in her web?

6. Had the spider spun fewer circles into her web when she was talking with the cat or the duck?

Lesson 7: Learning Centers/Final Assessment

NCTM Standards:

Understand patterns, relations, and functions

- recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another.

Apply appropriate techniques, tools, and formulas to determine measurements

- use tools to measure.

Represent and analyze mathematical situations and structures using algebraic symbols

- use concrete, pictorial, and verbal representations to develop an understanding of invented and conventional symbolic notations.

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them

- Pose questions and gather data about themselves and their surroundings.
- Represent data using concrete objects, pictures, and graphs.

Analyze change in various contexts

- describe qualitative change, such as student's growing taller

Pennsylvania Content Standards Grade Level Benchmarks:

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- Grade 1
- C. Represent equivalent forms of a whole number using concrete objects, drawings, and word names.

2.2 Computation and Estimation

- Grade 1
- A. Determine the sum of 2 or 3 addends to 20 by using manipulatives, drawing pictures, and writing number sentences.

2.6 Statistics and Data Analysis

- Grade 1
- A. Gather, organize, and display real life data on a bar graph and/or pictograph using the terms most, least, same, highest, lowest, more than, and fewer than.
- Describe data on a given graph.

2.8 Algebra and Functions

- Grade 1
- A. Identify, describe, and extend patterns based on shape, size, color or sound using concrete objects.

Objective:

- Students will demonstrate an understanding of basic algebraic concepts.

Materials:

- Materials will be identified with each learning center.

Instructional Procedures:

- Students will be in groups of 4-5.
- There will be four learning centers assessing different algebraic concepts set-up throughout the classroom.
- Groups of students will rotate through each learning center.

- Students will complete a written exercise at each learning center as a form of assessment.

Learning Center #1: Patterns

- Materials:
 - Geometric shapes (in varying colors) cut from poster board
 - Drawing paper
 - Crayons or colored pencils
 - “Identifying and Extending Patterns” worksheet
- Procedures:
 1. Students will work as a group to construct different patterns using the pre-cut geometric shapes. Each student will draw the pattern the group created on drawing paper using crayons or colored pencils.
 2. Students will work individually to complete the “Identifying and Extending Patterns” worksheet.

Learning Center #2: Representation & Bar Graphs

- Materials:
 - “Making Bar Graphs” worksheet (flower, bird, dinosaur stickers)
 - Large-scale bar graph template to correspond with worksheet
 - Crayons or colored pencils
- Procedures:
 1. As a group, students will interview one another to complete the “Making Bar Graphs” worksheet.
 2. Upon completion of the worksheet, students will use crayons or colored pencils to record their data in the appropriate place on the large-scale bar graph that corresponds with the worksheet.

Learning Center #3: Variables & Equality

- Materials:
 - “Variables” game board and spinners
 - “What Can it Be?” worksheet
- Procedures:
 1. As a group, students will play a “Variables” game using a board and two spinners. The spinners will picture object words that students may encounter when solving word problems (buttons, pizzas, dogs, etc.). Each player will have his/her own individual colored markers. The game board will have single letters pictured on it (B, P, D, etc). The student will spin a spinner and then place one of his/her markers on a letter on the board that could replace the object word the spinner landed on. For example, if the spinner stopped on buttons, the student would place his/her marker on the B on the game board. When all of the letters are marked, the student with the most of his/her colored markers on the board wins the game.
 2. Students will work individually to complete the “What Can it Be?” worksheet.

Learning Center #4: Change

- Materials:
 - “Temperature Fun” worksheet
 - “How does temperature change?” line graph worksheet (Assessment tool)

- Procedures
 1. Working individually, students will complete the “Temperature Fun” worksheet.
 2. Using the data from the “Temperature Fun” worksheet, students will work cooperatively to complete the “How does the temperature change?” worksheet.

Assessment/Evaluation:

- Each learning center will have an assessment component. The mode of the learning center assessment results will be used to determine an overall assessment score. To be proficient in algebraic concepts, students must attain an overall score of 80% or better.

Reference(s):

- Scott Foresman Texts On-line: First Grade Edition

Name _____

Identifying and Extending Patterns

P 1-1

Find the pattern. Circle what comes next.



Problem Solving *Algebra*

Find the pattern. Fill in the missing pattern on the bead.



Name _____

What Can It Be?

E 2-3
VISUAL THINKING

Add. Write the sum.

1. $3 + 0 = \underline{\quad}$ **C**

2. $1 + 1 = \underline{\quad}$ **B**

3. $2 + 3 = \underline{\quad}$ **E**

4. $2 + 2 = \underline{\quad}$ **O**

5. $7 + 1 = \underline{\quad}$ **M**

6. $3 + 4 = \underline{\quad}$ **W**

7. $4 + 2 = \underline{\quad}$ **L**

8. $7 + 2 = \underline{\quad}$ **T**

Look at the letter next to each sum.

Write the letter above the number of the sum.

Solve the riddles.

9. What has teeth but no mouth?

A $\frac{\text{C}}{3} \quad \frac{\text{E}}{4} \quad \frac{\text{M}}{8} \quad \frac{\text{W}}{2}$





10. What gets wet as it dries?

A $\frac{\text{B}}{9} \quad \frac{\text{O}}{4} \quad \frac{\text{L}}{7} \quad \frac{\text{T}}{5} \quad \frac{\text{C}}{6}$

Name _____

TEMPERATURE FUN!

DIRECTIONS: In each box below, write one sentence telling what you like to do when it is that temperature outside. Write what season you think it is when it is that temperature outside, too! There are pictures in each box to help you.

<p style="text-align: center;">65° F</p> 	<p style="text-align: center;">25° F</p> 
<p style="text-align: center;">85° F</p> 	<p style="text-align: center;">55° F</p> 



Name _____

“HOW DOES TEMPERATURE CHANGE?”

DIRECTIONS: Plot the temperatures from the “Temperature Fun!” worksheet on the line graph below. The temperatures are given to you in the table below. Remember to give your graph a title!

TEMPERATURES	
WINTER	25° F
SPRING	65° F
SUMMER	85° F
FALL	55° F

