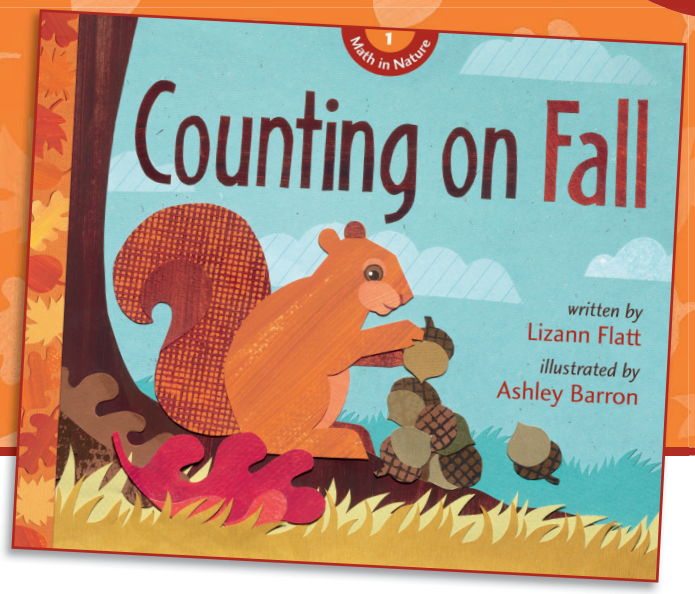
1 Math in Nature



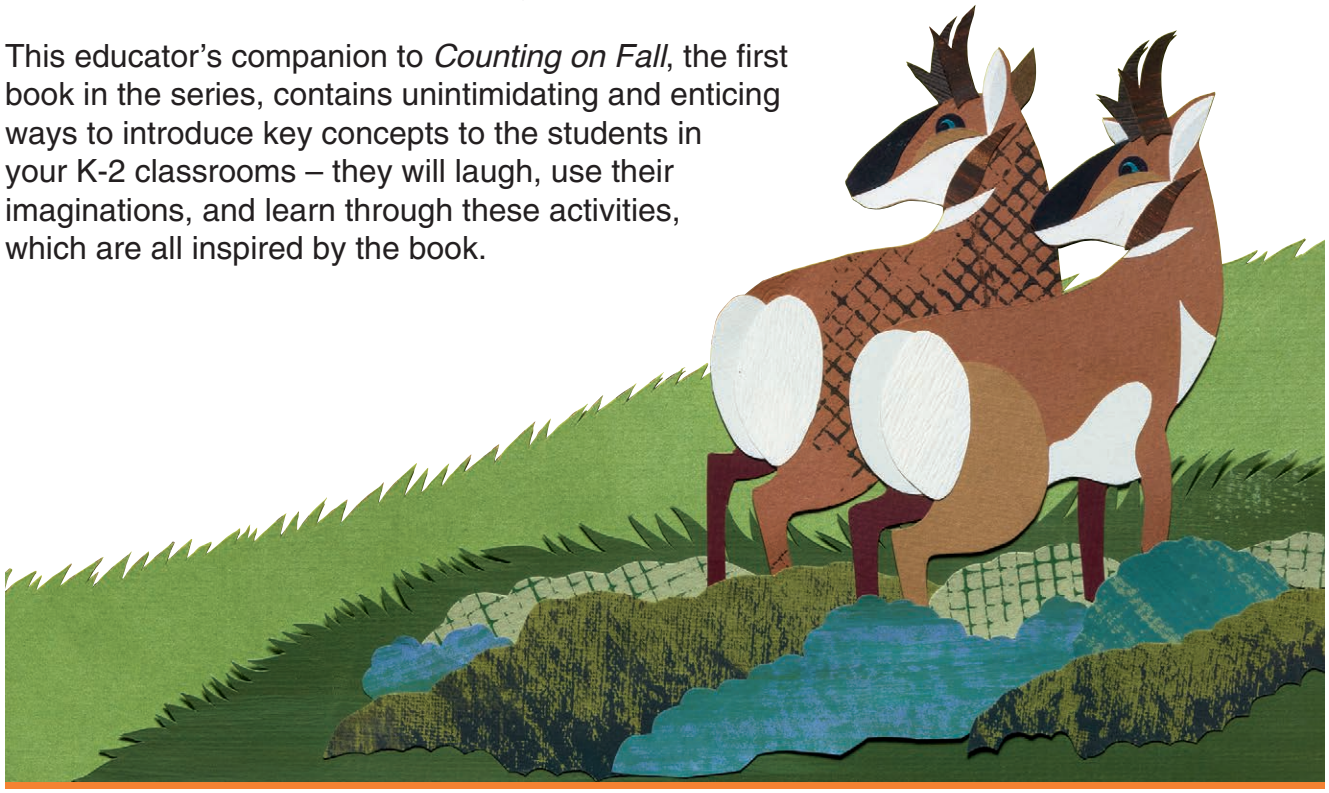
Teacher Resource Guide

for K-2 classrooms

Math in Nature: an engaging and delightful introduction to cross-curricular concepts for the primary grades

This series invites children to journey into the natural world – a world they love to discover and could explore endlessly – to find not only science, but math, language arts, and visual arts, too! Written by Lizann Flatt, a former *chickaDEE Magazine* editor and author of several children's books, and using illustrated cut-paper collage art by Ashley Barron, the Math in Nature series is a veritable cross-curricular goldmine.

This educator's companion to *Counting on Fall*, the first book in the series, contains unintimidating and enticing ways to introduce key concepts to the students in your K-2 classrooms – they will laugh, use their imaginations, and learn through these activities, which are all inspired by the book.



Changing Colors: Comparing and Sorting Activities

Every autumn, leaves fall from some types of trees. Young students know this from observation, but may not know why. The simple explanation is that, in the autumn, trees are “shutting down” for winter. Leaves are where trees create food in a chemical reaction called photosynthesis (essentially, “putting together with light”). Since there will soon be less sunlight, less water, and the temperatures will drop, the trees “rest” during the winter and survive off stored food. As such, they don’t require leaves until the days warm and grow longer in the spring.

So why do leaves change color? Chlorophyll is the main pigment in leaves, but it is not the only one. Orange and yellow pigments are also in the leaves year round, but they are masked by the presence of chlorophyll. In fall, as photosynthesis slows down and less chlorophyll is produced, the other pigments appear temporarily as the leaves begin to die and eventually fall from the trees.

Falling Leaves

What you need:

- Waxed paper
- Newspaper
- An iron and ironing board

What to do:

1. As a class, visit a deciduous tree, which loses its leaves. This is a great opportunity to explain the difference between deciduous and coniferous trees to your students.
2. Have each student choose 1 leaf and ask students to compare their leaves. How are the leaves similar? How are the leaves different? Which color is your leaf? Why do you think the leaves are different colors?
3. Explain to the children why leaves fall from the trees. You may want to monitor the tree over the whole school year, noting when all the leaves have fallen and when new leaf buds appear in the spring
4. Preserve each of the children’s leaves between 2 sheets of waxed paper, cover with newspaper, and then iron the paper to create a waxed paper “sandwich.”
5. Recreate a fall tree on a class bulletin board using the preserved leaves.
6. As a class, practice counting the leaves on the classroom tree forwards and backwards.

Curriculum: Mathematics; Science
Learning Outcomes: Comparing; Counting; Discussing Ideas; Extending Understanding, Making Connections
Grouping: Whole Class

Window Quilt

What you need:

- Leaves in a variety of shapes, sizes, and colors
- Waxed paper
- Newspaper
- An iron and ironing board
- Clear tape

What to do:

1. Follow steps 1-3 from the activity **Falling Leaves**
2. Have students design a "quilt" of leaves; they can organize their leaves in rows and columns, like the patches on a quilt. You can ask them to use a sorting strategy (all red in one row, sorting from smallest to largest). Have students tape their quilt to a classroom window.
3. Look at the rows and columns on pages 18-19 in *Counting on Fall*. Ask students to count how many rows and columns are in their window quilt.

Curriculum: Mathematics, Visual Arts
Learning Outcomes: Grouping, Sorting
Grouping: Small Groups, Whole Class

Do You See It?: Patterning and Grouping Activities

In nature, patterns often repeat: the petals of a flower, the scales on a fish, or the segments of an orange are some examples. As you work through these activities, prompt your students to think about other patterns that occur in nature.

Sounds make patterns, too. Rhyming words, for instance, repeat similar sounds, and syllables can mark out a repeating pattern in their rhythms.

Pattern Play

What you need:

- Reproducible Page 10
- 3 different colors of photocopy paper

What to do:

1. Use a variety of classroom objects to give examples of a pattern that repeats.
2. Take a close look at the rows of leaves on page 5 of *Counting on Fall*. Are they in a repeating pattern?
3. Use the reproducible provided in this guide to make different colored leaves.
4. Give 9 leaves to each student, 3 of each color.
5. Have them create a repeating pattern. For example: ABC, ABC, ABC or AAA, BBB, CCC. (For very young students use only 2 elements: ABABAB.)
6. Have the students share their pattern with another student. Were their patterns the same or different?

Curriculum: Mathematics
Learning Outcomes: Creating, Identifying, and Describing Patterns
Grouping: Individual, Partners

Word Patterns

What to do:

1. Read a few pages of *Counting on Fall* aloud, asking students to listen for repeating sounds. For example, on page 24: “aware,” “fair,” and “share.”
2. As you read, have students clap out the syllables. Help students identify instances where the number of syllables in two lines of text is the same, but where the number of words in each line is different (page 10).

Curriculum: Language Arts
Learning Outcomes: Identifying Patterns, Listening
Grouping: Whole Class

Graphic Groupings

What you need:

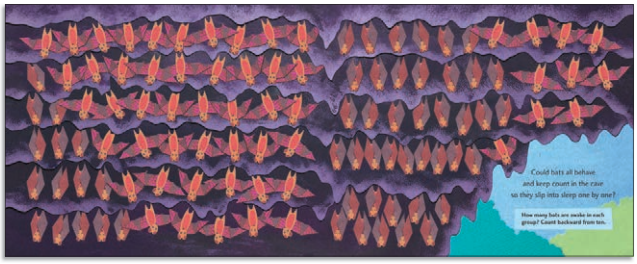
- Reproducible Page 11

What to do:

1. Review the difference between a solid color and a pattern. Have students tally how many solids and how many patterns the artist uses on pages 6-7 in *Counting on Fall*.
2. Using the reproducible provided in this guide, have students create simple bar graphs to show the results of the tally visually.

Curriculum: Mathematics, Visual Arts
Learning Outcomes: Graphing, Grouping, Recording and Organizing Data
Grouping: Individual, Partners

Batty Groups



What you need:

- 20 counters per student, 10 of each color

What to do:

1. Using the different colored counters, have students recreate one of the pattern rows on pages 20-21 in *Counting on Fall*. For example, if they recreate the fourth row on page 20, there will be 4 bats that are awake and 4 bats that are sleeping.
2. Ask the students questions related to the concepts of more or less. Are more bats awake or sleeping?
3. Repeat these steps with other rows of bats.
4. Review pages 24-25 (bears with berries) with the students to reiterate the ideas of more or less.

Curriculum: Mathematics
Learning Outcomes: Comparing Quantities
Grouping: Individual

Goose Groups

What you need:

- 10 identical counters per student

What to do:

1. Have students split their counters into 2 groups. They don't have to be even groups, but they must use all their counters. Have students share the way they split their counters with partner.

2. Look at the groupings of geese on pages 12-13 in *Counting on Fall*. As you show each of the possible groups (1 and 9, 2 and 8, 3 and 7, etc.) have students make the same groupings with their counters.

Curriculum: Mathematics
Learning Outcomes: Counting, Grouping
Grouping: Individual, Partners

Make a Good Guess: Estimating and Sequencing Activities

Research biologists use small sample sizes to estimate larger sample sizes. For example, a biologist trying to count the number of birds in a flock will often count a smaller sample (20 birds) as a reference and then will extrapolate that sample over the larger population. They will also use still images printed on paper and simple methods such as a pinprick or a black dot to help them keep track while they count. Your students will use both these techniques in this activity.

Guess-timation

What you need:

- A clear container
- Marbles, jellybeans, pennies or other identical objects
- Reproducible Page 12

What to do:

1. Ask students to guess how many objects are in the container. Ask them how they decided on that number.
2. Discuss the difference between a guess and an estimate. Estimates are made using a reference, such as a sample size. Demonstrate by showing students how much space 5 or 10 of the items take up. Would they like to revise their estimate?
3. In small groups, have students estimate the number of leaves on page 5 of *Counting on Fall*. Then have them count a small number of leaves, such as 5. How many groups of 5 might there be in the illustration?
4. Photocopy the reproducible on page X and hand out to students so they can count the exact number of leaves. Students can devise their own way of keeping track of the leaves they have already counted.
5. Compare their small group's estimate with the actual count.
6. Explain how scientists use similar methods to count large numbers of items.

Curriculum: Mathematics, Science
Learning Outcomes: Counting, Estimating
Grouping: Small Groups, Whole Class

Follow the Leader

What you need:

- Marbles or balls (utility balls, softballs) from the school gymnasium

What to do:

1. As a class, count the whales. Then, discuss sequencing. Which whale is winning the race? What do you call the whale that is number 1, 2, 3, etc. in line?
2. Let students set up their own race using marbles in the hallway or larger balls in the yard or gymnasium. As their items cross the finish line, reinforce the concept of first, second, third, etc.

Curriculum: Mathematics
Learning Outcomes: Counting, Ordering, Sequencing
Grouping: Whole Class

What's Going On?: Describing and Observing Activities

Seeds are distributed in a variety of ways in nature. The seeds of milkweed are carried by the wind. (Most students will be familiar with dandelion seeds, which are spread in a similar way.) Squirrels spread seeds (acorns) as they cache them for winter. And animals, which eat the fruit in one location and digest them in another, spread the tiny seeds of blackberries, blueberries, and other small fruits!

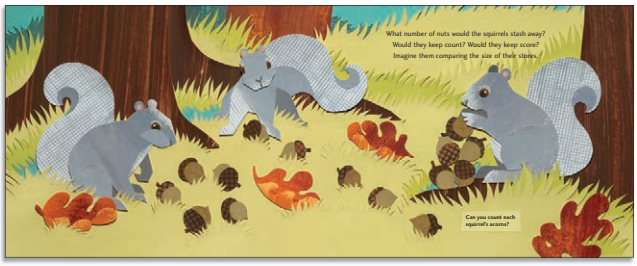
Seed Styles

What to do:

1. Show students pages 8-9 in *Counting on Fall*. Have them describe the seeds on these pages (milkweed and the berry seeds). As a reference, turn to the Nature Notes at the back of the book.
2. As a class, brainstorm the different ways that seeds are spread. How do these different techniques help plants find new places to grow?

Curriculum: Science
Learning Outcomes: Making Connections, Observation
Grouping: Whole Class

Adding Acorns



What you need:

- Reproducible Page 13
- 15 identical counters per student

1. Have students arrange their counters in 3 groups like the acorns on pages 6-7 of *Counting on Fall*
2. Have them describe the shape of each group (circle, line or row, cluster or mound).
3. Have students create larger shapes using the same number of counters. Discuss whether there are more, fewer, or the same number of counters in each grouping.
4. Have students count, tally, and graph the number of trees, leaves, squirrels, and acorns on these pages using the reproducible provided.

Curriculum: Mathematics
Learning Outcomes: Comparing, Counting, Describing, Graphing, Grouping, Recording and Organizing Data, Spatial Sense
Grouping: Individual

Do You Hear What I Hear?

What to do:

1. In partners, have students choose any page from *Counting on Fall* that contains animals. Ask them to create dialogue for the animals on the page. What are they saying? Depending on your students' writing skills, they can write their dialogue on paper in speech balloons or share their ideas orally.

Curriculum: Language Arts
Learning Outcomes: Creativity, Dialogue
Grouping: Partners

Layer It On: Composing and Creating Activities

The illustrations in this book are deceptive. At first glance, they may seem simple, yet upon closer inspection the layers, textures, and colors used make stunning collages. To create each of the illustrations in *Counting on Fall*, artist artist Ashley Barron scoured drawers and drawers of paper scraps, searching and unearthing until she found the perfect colors to bring the animals and landscapes to life.

Collage Creations

What you need:

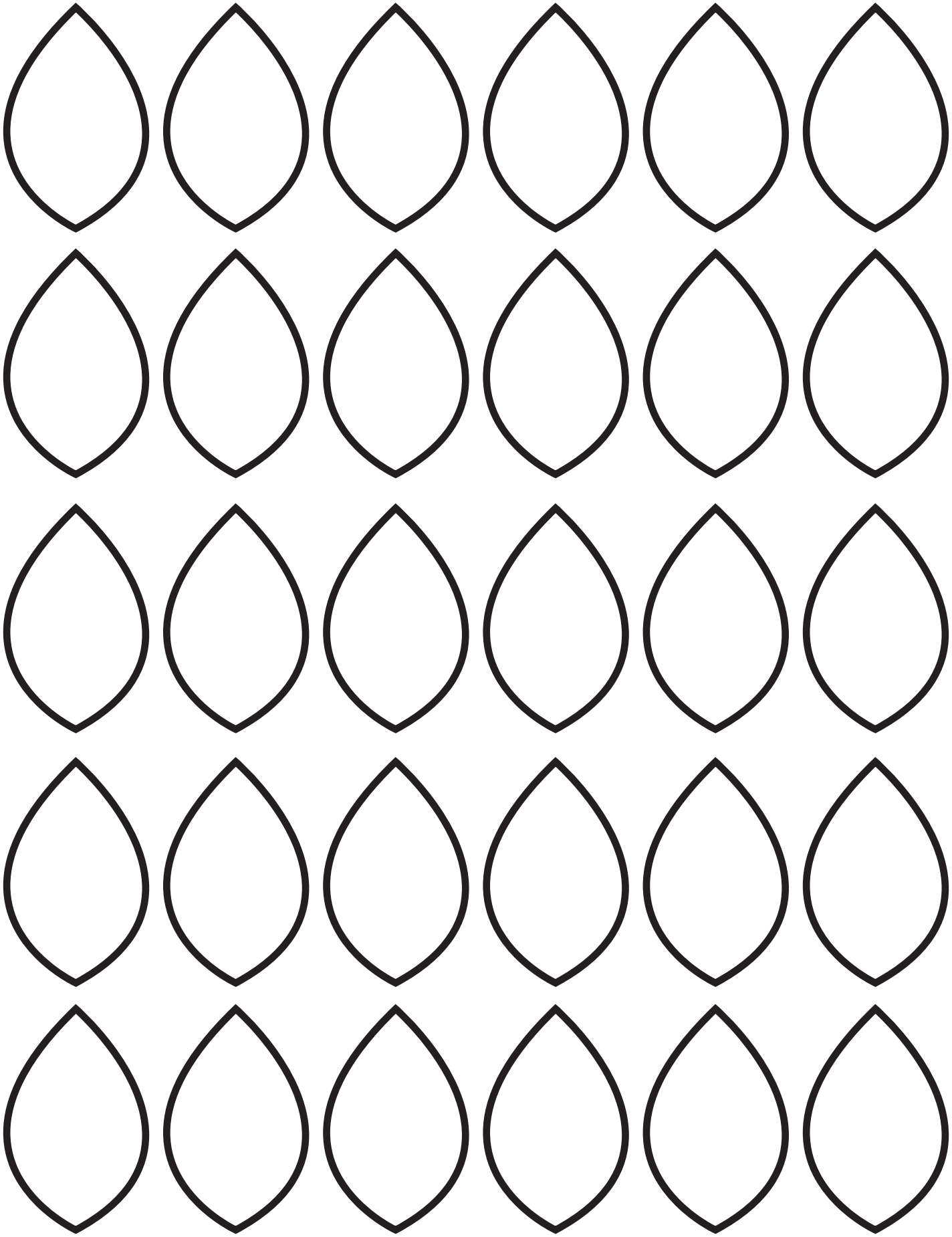
- Blank paper
- Powdered paint and water
- Paintbrushes
- Tools to add textures and patterns (combs, doilies, straws)
- Scissors
- Glue

What to do:

1. As a class, review several pages in *Counting on Fall*, but focus on the art instead of the text. Note the different patterns, colors, and shapes that the artist used.
2. Have students use the paint, tools, and their fingers to create a page with color and texture. Allow the pages to dry completely.
3. Have students cut simple shapes from their paper to make their own collages. The shapes can then be assembled and glued to a fresh sheet of paper.

Note: Depending on the age of your students, you may want to create shape templates that the students can trace before cutting. You may also want the entire class to participate in recreating one of the illustrations from the book. The squirrels on pages 6-7 or the whales on pages 10-11 are good ones to try, since they are less detailed.

Curriculum: Visual Arts
Learning Outcomes: Art Composition, Cutting, Painting
Grouping: Individual, Whole Class



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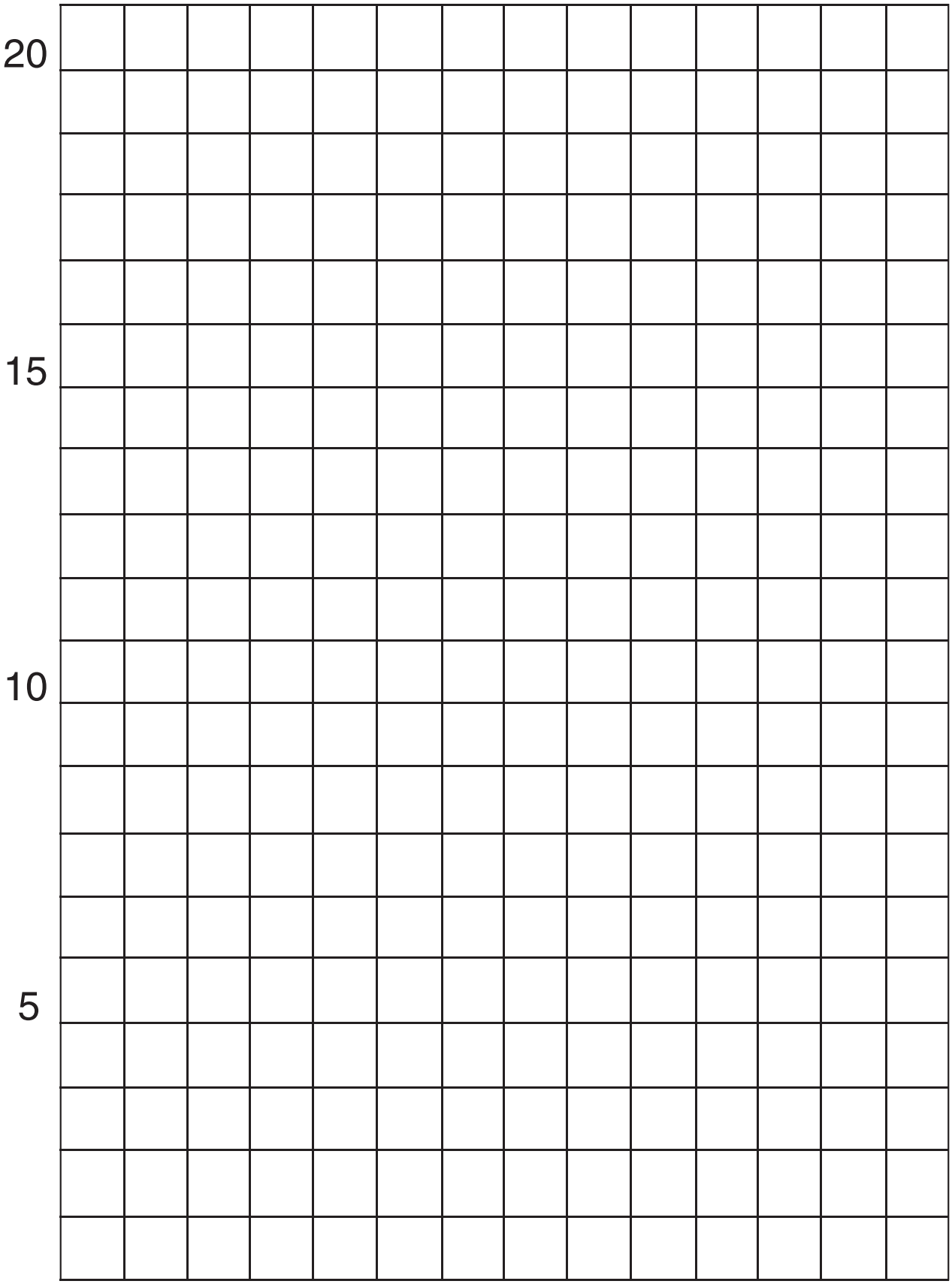

Name: _____

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15				
10				
5				
	Trees	Leaves	Squirrels	Acorns