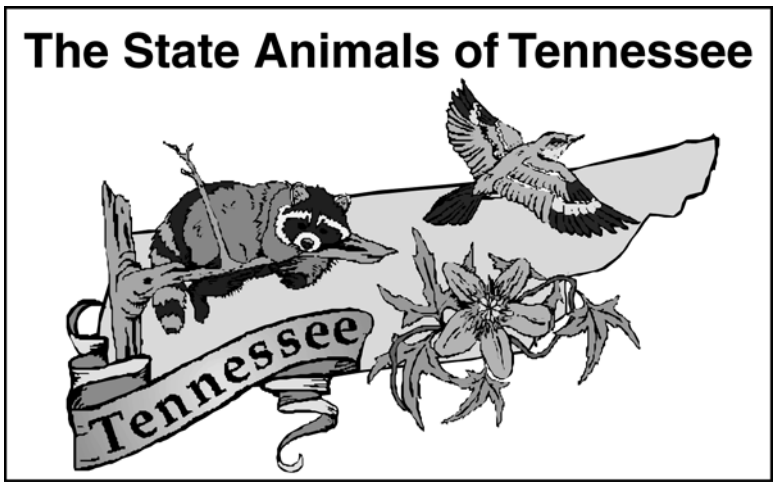
SITES-M Mathematics Challenge



Level: Kindergarten

Standard: Data, Probability and Statistics

Learning Target: Focus on Data

Grade Level Expectations

GLE 0006.5.1	Sort objects and use one or more attributes to solve problems.
GLE 0006.5.2	Re-sort objects using new attributes.

Checks for Understanding

0006.5.1	Sort objects into sets and describe how the objects were sorted.
0006.5.2	Sort objects in different ways.
0006.5.3	Count data.

SITES-M Mathematics Challenge

Grade K–Focus on Data
The State Animals of Tennessee

The purpose of the Mathematics Challenges is to provide opportunities for students to develop and demonstrate understanding of important mathematical concepts and standards. Each Challenge includes a set of tasks that require higher-order thinking skills. Because these types of tasks may be new for students and they will have varying levels of understanding, the student responses will vary. The Challenges and guiding questions were designed to help teachers plan their implementation and elicit, analyze, and act on evidence of student understanding.

You will be able to choose which Mathematics Challenge Packet to implement each month, according to the learning needs of your students and your teaching context. Each packet contains all the materials necessary to implement the Mathematics Challenge including a grade-appropriate Challenge, the Mathematics Challenge Meeting Protocol, and the Guiding Questions for Analyzing Student Responses to Mathematics Challenges.

For each Challenge, you will complete a six step process of planning, implementation, and analysis and reflection.

The Mathematics Challenge Process

Stage	Step	Task
Planning	Step 1.	Review the Mathematics Challenge Meeting Protocol
	Step 2.	Review and solve the Mathematics Challenge prior to your Professional Learning Community (PLC) meeting. Think about your responses to the guiding questions on the Meeting Protocol
	Step 3.	Hold your PLC meeting and discuss your responses to the Guiding Questions on the Meeting Protocol
Implementation	Step 4.	Implement the Mathematics Challenge with your class
Analysis and Reflection	Step 5.	For your own planning and documentation, respond to the Guiding Questions on the Analyzing Student Responses Protocol
	Step 6.	To help us improve the Challenges and to provide recommendations for teachers implementing them in future years, complete the Mathematics Challenge Feedback Log and provide copies of all student work to the Assessment Coordinator

SITES-M Mathematics Challenge

Grade K–Focus on Data
The State Animals of Tennessee

Mathematics Challenge Meeting Protocol

Each month, your Professional Learning Community will meet to discuss the implementation of one Mathematics Challenge. In preparation for your monthly meeting, please print and review this month's Mathematics Challenge, solve all tasks within the Challenge, and think about the guiding questions below. These questions will be used to facilitate a group discussion regarding the implementation of the upcoming Mathematics Challenge.

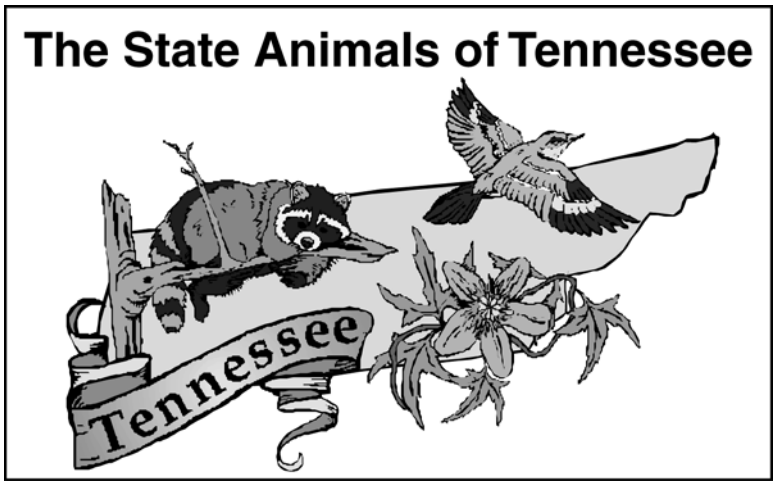
Guiding Questions for Implementing the Mathematics Challenges

1. What is the title of the Challenge that you will use this month?
2. What skills or standards is this Challenge measuring?
3. Where does this Challenge fit within your curriculum? Within which unit?
4. At what point during the unit will you administer this Challenge (e.g., At the beginning of a unit to determine what students do or do not know, at the end of a unit to assess what students have or have not learned, in the middle of a unit to determine where to go next instructionally)?
5. How will your students complete this Challenge (e.g., individually, one-on-one, in small groups, as a class)? Why?
6. Are there any prerequisite skills, common misunderstandings, or vocabulary needs that you will have to address? What are they?
7. What difficulties do you anticipate your students will have with the Challenge? How will you address them?
8. Are these skills and difficulties different for special needs students, ELL students, etc.? How? Will you do anything different for these students? What?
9. How will you evaluate student responses (e.g., grade responses with the provided rubric, scan responses to identify common mistakes/misconceptions, have students evaluate one another's responses, have students evaluate their own response)?
10. What will student responses to this Challenge tell you about student understanding?
11. How might you use this evidence of student understanding to adapt your teaching and learning?
12. What other materials, resources, or support might you need? Where can you get them?
13. How can your colleagues assist you in the analysis of student understanding?
14. What other questions or concerns do you have about this Mathematics Challenge?

After you have implemented the challenge with your class, be sure to respond to the Guiding Questions on the Analyzing Student Responses Protocol.

SITES-M Mathematics Challenge

Grade K–Focus on Data



Standard: Data, Probability, and Statistics

Learning Target: Focus on Data

Claims:
Students should understand and be able to explain or demonstrate how to:

- ✓ Count data;
- ✓ Sort objects in different ways;
- ✓ Sort objects into sets and describe how the objects were sorted.

Task Preparation:
Each student will need a copy of the Student Response Sheet and the Picture Sheet, a pencil, a pair of scissors, and glue.

If a student is unable to respond in writing, a scribe may be appointed or verbal answers may be accepted, but the responses will need to be documented for scoring.

Stimulus Cards (Drawing or Word Description):
Each student is required to have a copy of the Picture Sheet.

Manipulatives/Supplies:
Copies of the Student Response Sheet and the Picture Sheet for each student
Pencils
Scissors
Glue

SITES-M Mathematics Challenge

Grade K–Focus on Data

Cues/Directions:

Distribute student response sheets. If a student is unable to respond in writing, a scribe may be appointed or verbal answers may be accepted, but the responses will need to be documented for scoring. Students should be directed to look carefully at each figure. Allow students time to answer.

Instruct students to follow along as you read aloud and say: **The state of Tennessee has official state animals. The animals are pictured below. (TEACHER NOTE:** Have students look at the pictures of the animals. You may want to give students the opportunity to ask any questions about the animals. **)**

1. **Count all the animals. How many state animals does Tennessee have? (TEACHER NOTE:** Students should write their answers in the box.**)**

2. **The animals can be sorted in different ways. One way is pictured below. All the animals in Group 1 can do something that the animals in Group 2 cannot do. (TEACHER NOTE:** Have students look at the table.**) Tell how the animals are sorted. Group 1 has animals that can "blank" (TEACHER NOTE:** Students should write their answers in the blank.**) Group 2 has animals that cannot "blank" (TEACHER NOTE:** Students should write their answers in the blank.**)**

3. **Some of the animals are sorted into 3 different groups below. (TEACHER NOTE:** Have students look at the table.**) Tell how the animals are sorted. Group 1 has animals that "blank" (TEACHER NOTE:** Students should write their answers in the blank.**) Group 2 has animals that "blank" (TEACHER NOTE:** Students should write their answers in the blank.**) Group 3 has animals that "blank" (TEACHER NOTE:** Students should write their answers in the blank.**)**

4. **(TEACHER NOTE:** Hand out picture sheet and scissors to each student.**) Cut out the pictures on the picture sheet and sort them into 3 groups. Glue each group of pictures into one of the boxes below. (TEACHER NOTE:** Students should sort and glue their pictures into groups on the sheet.**) Tell how you sorted the pictures. The pictures in Group 1 are "blank" (TEACHER NOTE:** Students should write their answers in the blank.**) The pictures in Group 2 are "blank" (TEACHER NOTE:** Students should write their answers in the blank.**) The pictures in Group 3 are "blank" (TEACHER NOTE:** Students should write their answers in the blank.**)**

5. **Think of a way you could sort the pictures into 3 new groups. What pictures would be in one of your new groups?(TEACHER NOTE:** Students should write their answers in the box.**)**

SITES-M Mathematics Challenge

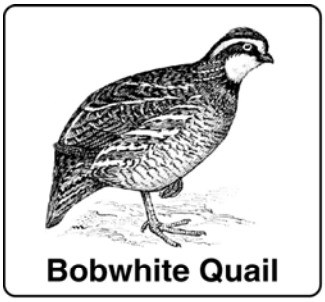
Grade K–Focus on Data

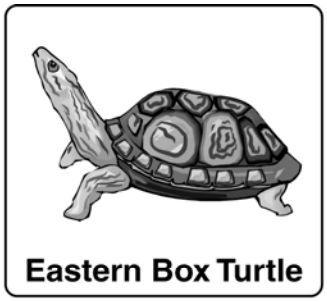
Student Response Sheet

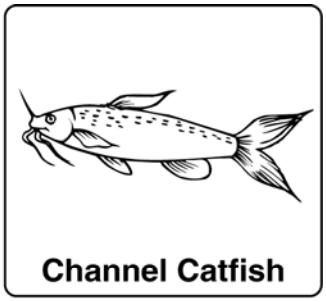
The State Animals of Tennessee

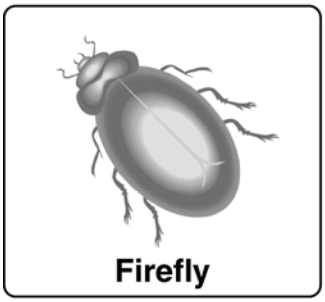
Name: _____ **Date:** _____

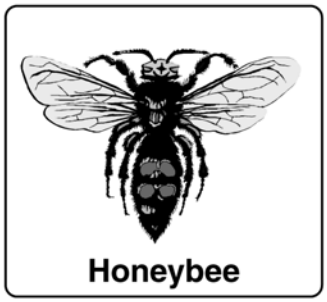
The state of Tennessee has official state animals. The animals are pictured below.

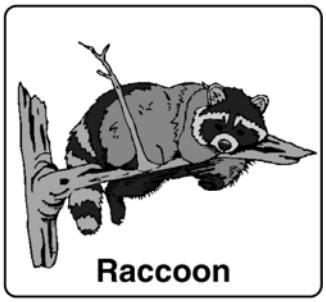


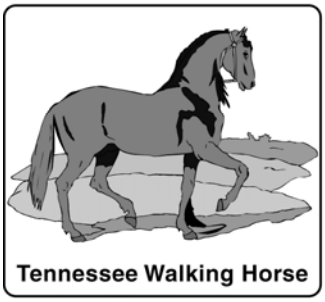


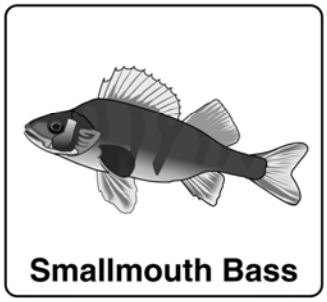


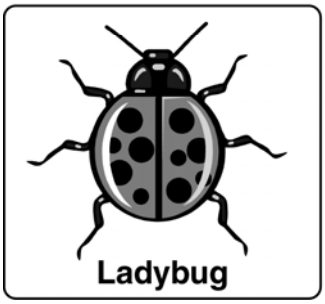


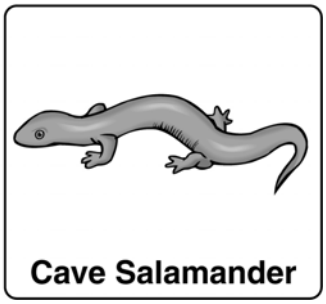




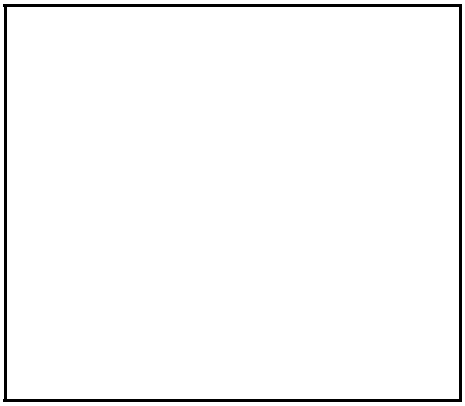








1. Count all the animals. How many state animals does Tennessee have?



2. The animals can be sorted in different ways. One way is pictured below. All the animals in Group 1 can do something that the animals in Group 2 cannot do.

Group 1	Group 2
 **Mockingbird**	 **Raccoon**
 **Bobwhite Quail**	 **Tennessee Walking Horse**
 **Honeybee**	 **Box Turtle**
 **Ladybug**	 **Cave Salamander**
 **Firefly**	 **Channel Catfish**
 **Zebra Swallowtail**	 **Smallmouth Bass**

Tell how the animals are sorted.

Group 1 has animals that can _____.

Group 2 has animals that cannot _____.

3. Some of the animals are sorted into 3 different groups below.

Group 1	Group 2	Group 3
 **Smallmouth Bass**	 **Mockingbird**	 **Raccoon**
 **Channel Catfish**	 **Bobwhite Quail**	 **Tennessee Walking Horse**

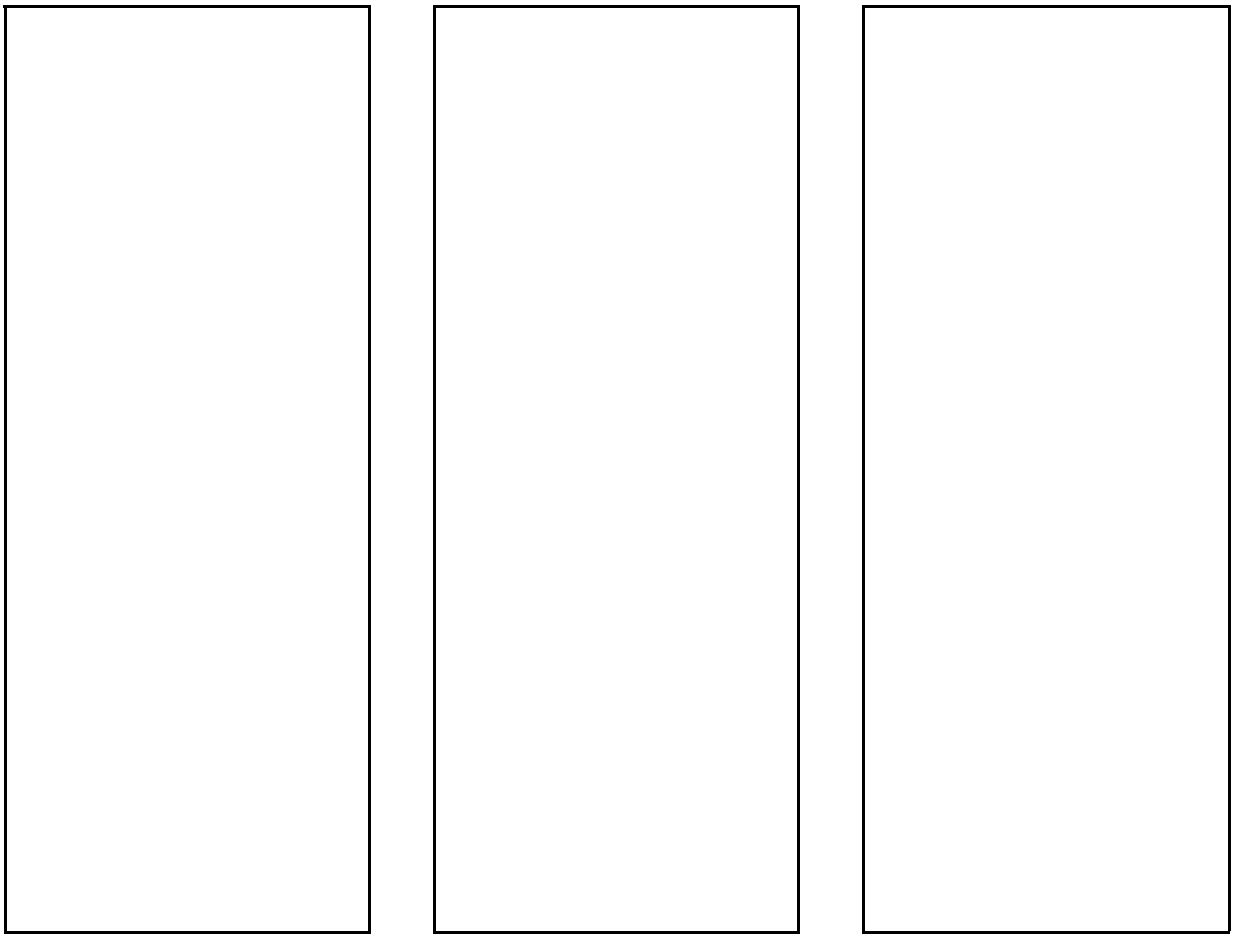
Tell how the animals are sorted.

Group 1 has animals that _____.

Group 2 has animals that _____.

Group 3 has animals that _____.

4. Cut out the pictures on the picture sheet and sort them into 3 groups. Glue each group of pictures into one of the boxes below.



Group 1 **Group 2** **Group 3**

Tell how you sorted the pictures.

The pictures in Group 1 are _____.

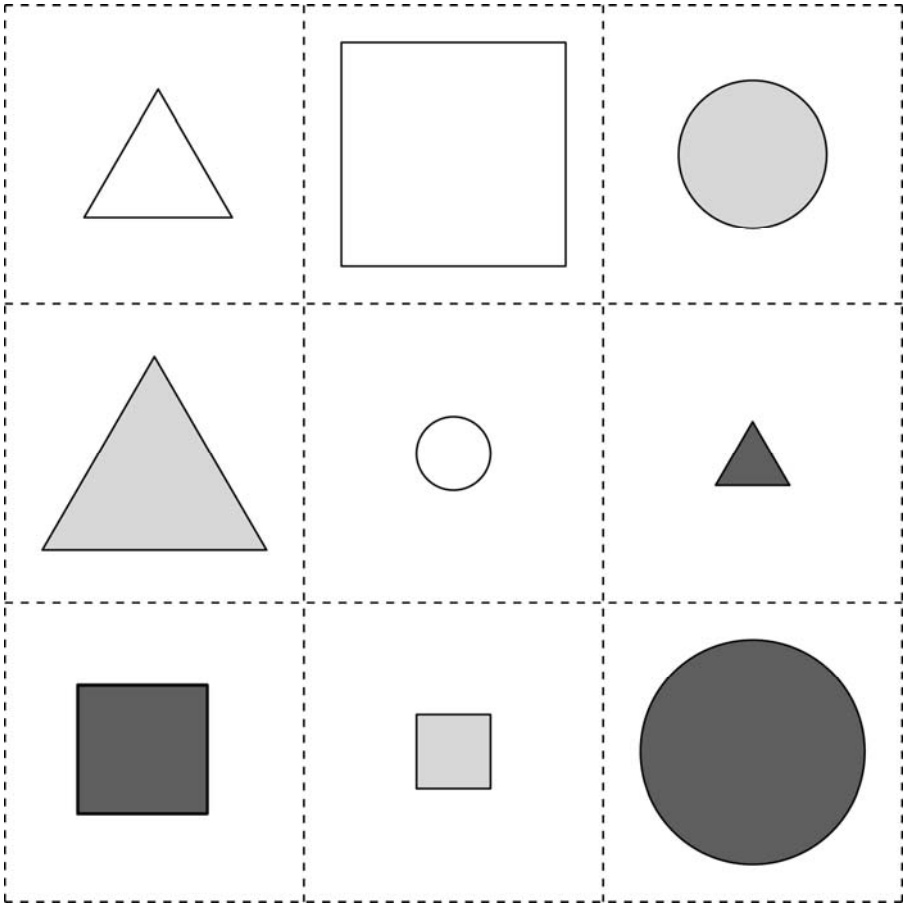
The pictures in Group 2 are _____.

The pictures in Group 3 are _____.

5. Think of a way you could sort the pictures into 3 new groups.

What pictures would be in one of your new groups?

Picture Sheet



Learning and Teaching Considerations

Task 1:

A) Be sure that students understand that the word "count" generally signifies that there is a one-to-one correspondence between the numbers and the objects. Some students who touch the pictures may skip or double-touch one or more of them.

B) Be sure that students understand that the words "how many" generally signify an amount. They should know that the number they say signifies how many or the amount of objects they are considering. They should also know that the number they end on when counting represents the total "amount" of objects. That is the concept of cardinality–the idea that number means amount.

C) Students may answer in words, symbols (digits, dots, dashes, base-10 block representations, etc.), or by using manipulatives (blocks, cubes). They may also count on their fingers, count out loud, use number lines, or touch each picture as they count. Be sure that they understand that they can get the correct answer using any of the strategies, though some are more efficient.

D) Some students may skip around as they count and lose track. Be sure that they understand the shortcoming of that strategy.

E) As they count note which picture they start with. Be sure that they understand that they can get the correct amount or number starting with any picture and counting up and down or back and forth. Students should know that the amount or number of objects is the same no matter where they start counting or how the objects are arranged.

F) If a student says or writes, "I don't know," say something positive like "Let's start with what you do know about this problem." Students often know more than they think or say, and getting them to vocalize or write about that knowledge is all they need. (That applies to the other tasks, as well.)

Task 2:

A) Be sure that students understand that the word "sorted" signifies objects grouped according to common characteristics or attributes, such as function, size, shape, or color. There is often more than one way to sort objects from a large group into smaller groups. Working with sorting/shape/attribute blocks may help.

B) Students should describe one characteristic all the animals in Group 1 have in common that all animals in Group 2 do not have in common. (The most likely characteristic is that Group 1 animals can fly or have wings, but there may be others.) Be sure that they understand that there may be other correct ways to sort the animals into the two groups.

C) Some students may have the misconception that each group into which objects are sorted must contain an equal number of objects, as in task 2. The key to sorting objects is the common characteristics or attributes, not the number of objects, unless specified.

D) If a student says or writes, "I just know," prompt him or her by saying something like "I'm glad you know, but it's important in math to be able to explain your answers so other people can understand what you're thinking." (That applies to the other tasks, as well.)

Task 3:

A) Students may describe in different ways the attributes or characteristics all animals in each group have in common. Group 1: fish, fins, gills, swim, no legs, live in water, etc. Group 2: birds, feathers, wings, fly, two legs, etc. Group 3: mammals, fur, four legs, run, walk, etc. Be sure that they understand that there are several correct ways to sort the animals into the three groups.

Tasks 4 and 5:

A) Students may describe in different ways how they sorted the shapes into three groups by distinguishing attributes or characteristics (e.g., shape, size, or color). Be sure that they understand that there are several correct ways to sort the shapes into the three groups.

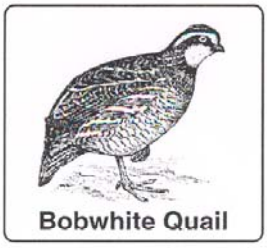
B) Be sure that students understand that a square is a special type of rectangle, with all four sides equal. Students should also know that all triangles have three sides and three angles. Working with sorting/shape/attribute blocks may help.

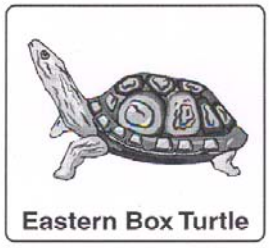
C) Be sure that students also understand that all the triangles in the Picture Sheet are a particular type, equilateral, with all three sides and angles equal. It may be helpful to students if you simultaneously refer to equilateral triangles as equal-sided triangles.

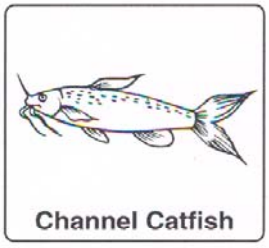
D) Some students may have the misconception that if they cut out a triangle or square and turn it sideways or upside down, it will no longer be a triangle or square, but a completely different shape. For example, they will call the triangle an upside-down triangle and the square a diamond. Working with sorting/shape/attribute blocks may help.

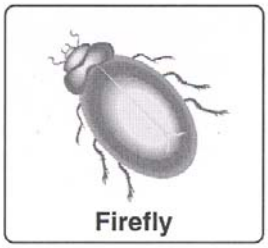
Name: ANSWER KEY Date: _____

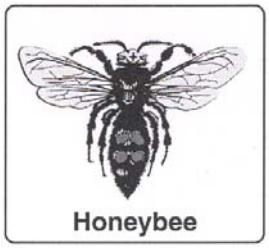
The state of Tennessee has official state animals. The animals are pictured below.

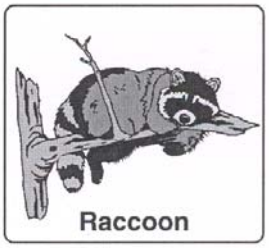

Bobwhite Quail


Eastern Box Turtle


Channel Catfish


Firefly

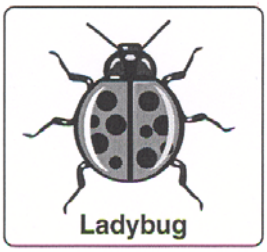

Honeybee


Raccoon

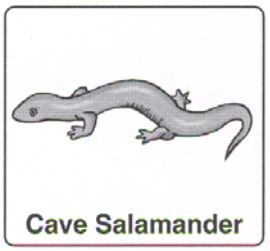

Tennessee Walking Horse


Smallmouth Bass

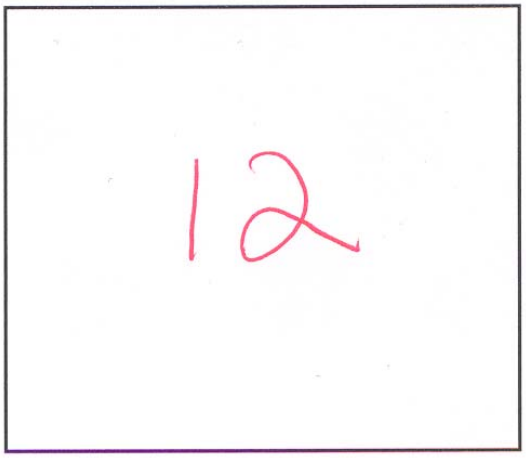

Zebra Swallowtail


Ladybug

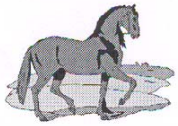

Mockingbird


Cave Salamander

1. Count all the animals. How many state animals does Tennessee have?



2. The animals can be sorted in different ways. One way is pictured below. All the animals in Group 1 can do something that the animals in Group 2 cannot do.

Group 1	Group 2
 Mockingbird	 Raccoon
 Bobwhite Quail	 Tennessee Walking Horse
 Honeybee	 Box Turtle
 Ladybug	 Cave Salamander
 Firefly	 Channel Catfish
 Zebra Swallowtail	 Smallmouth Bass

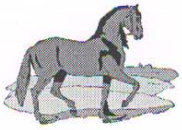
Tell how the animals are sorted.

Group 1 has animals that can FLY.

NOTE: OTHER ANSWERS MAY BE GOOD,

Group 2 has animals that cannot FLY.

3. Some of the animals are sorted into 3 different groups below.

Group 1	Group 2	Group 3
 Smallmouth Bass	 Mockingbird	 Raccoon
 Channel Catfish	 Bobwhite Quail	 Tennessee Walking Horse

Tell how the animals are sorted.

Group 1 has animals that SWIM **.**

NOTE: THERE ARE MANY DIFFERENT ANSWERS THAT WORK. SEE THE RUBRIC.

Group 2 has animals that FLY **.**

Group 3 has animals that WALK **.**

4. Cut out the pictures on the picture sheet and sort them into 3 groups. Glue each group of pictures into one of the boxes below.

NOTE: THERE ARE 3 BASIC WAYS TO SORT THE SHAPES.

BY SIZE → SMALL, MEDIUM, LARGE

BY TYPE → CIRCLE, SQUARE, TRIANGLE

BY COLOR → BLACK, WHITE, GREY

ANY OF THESE SORTINGS IS GOOD.

Group 1 **Group 2** **Group 3**

Tell how you sorted the pictures.

The pictures in Group 1 are SMALL OR CIRCLES OR WHITE.

The pictures in Group 2 are MEDIUM OR TRIANGLES OR BLACK.

The pictures in Group 3 are LARGE OR SQUARES OR GREY.

5. Think of a way you could sort the pictures into 3 new groups.

What pictures would be in one of your new groups?

THE ANSWER DEPENDS ON THE WAY THE SHAPES WERE SORTED IN TASK 4.

FOR EXAMPLE, IF THE ORIGINAL SORTING WAS BY TYPE — CIRCLE, SQUARE, TRIANGLE — THEN A RESPONSE COULD BE THAT 1 GROUP IN THE NEW SORTING MIGHT HAVE ALL THE SMALL SHAPES, OR ALL THE GREY SHAPES,

SITES-M Mathematics Challenge

Grade K–Focus on Data
Rubric

CATEGORY	4	3	2	1
Mathematical concepts	**Response shows complete understanding of the mathematical concepts used to solve the problem(s).**	**Response shows substantial understanding of the mathematical concepts used to solve the problem(s).**	**Response shows some understanding of the mathematical concepts needed to solve the problem(s).**	**Response shows very limited understanding of the underlying concepts needed to solve the problem(s), OR the response is not written.**
	Response shows evidence in ALL of the following tasks. **Task 1**. Student answers 12. **Task 2**. Student describes what all animals in group 1 have in common that the animals in group 2 do not have. **Task 3**. Student describes what all animals in each group have in common. (Note: There may be correct answers that are different from the answer sheet.) **Task 4**. Student groups the cutouts correctly by shape or size or color. **Task 5**. Student describes a grouping different from the grouping in Task 4.	Response shows evidence in only 3 or 4 of the tasks described in category 4.	Response shows evidence in only 2 of the tasks described in category 4.	Response shows evidence in only 1 or none of the tasks described in category 4.

SITES-M Mathematics Challenge

Grade K–Focus on Data
Rubric

CATEGORY	4	3	2	1
Strategy and procedures	**Student typically uses an efficient and effective strategy to solve the problem(s).**	**Student typically uses an effective strategy to solve the problem(s).**	**Student sometimes uses an effective strategy to solve the problem(s), but not consistently.**	**Student rarely uses an effective strategy to solve the problem(s).**
	Response shows evidence in both of the following tasks. **Task 1**. Student shows evidence of counting the animals. Such evidence may need to be noted by the instructor. **Task 4**. Student shows evidence of correct sorting by one attribute (shape or size or color) into 3 distinct groups. Such evidence may need to be noted by the instructor.	Response shows evidence in task 1 and some evidence of sorting in task 5.	Response shows evidence in task 1 and no evidence in task 5.	Response shows no evidence of strategy as described in category 4.

SITES-M Mathematics Challenge

Grade K–Focus on Data
Rubric

CATEGORY	4	3	2	1
Explanation and communication	**Explanation is detailed and clear; uses appropriate terminology and/or notation.**	**Explanation is clear; uses some appropriate terminology and/or notation.**	**Explanation is a little difficult to understand, but includes critical components; shows little use of appropriate terminology and/or notation.**	**Explanation is difficult to understand, is missing several components, and does not use or include appropriate terminology and/or notation.**
	Response shows evidence in ALL of the following tasks. **Task 2**. Student explains that the animals in group 1 can fly (or have wings), and the animals in group 2 cannot fly (or do not have wings). There may be other explanations of the sorting that are correct. **Task 3**. Student explains that the animals in group 1 live or swim in the water, the animals in group 2 can fly or have wings, and the animals in group 3 live on land. The categories of fish, bird, and mammal are also correct. Another sorting could be no legs, 2 legs, and 4 legs. There could be other explanations of the sorting that are correct. **Task 4**. Student explains how the pictures are sorted. The most common sorting should be by size or by shape or by color. However, there could be other sortings that may be described. **Task 5**. Student describes a different sorting.	Response shows evidence in only 3 of the explanations described in category 4.	Response shows evidence in only 2 of the explanations described in category 4.	Response shows evidence in only 1 or none of the explanations described in category 4.

SITES-M Mathematics Challenge

Grade K–Focus on Data
Rubric

CATEGORY	4	3	2	1
Mathematical accuracy	**All or almost all of the steps and solutions have no mathematical errors.**	**Most of the steps and solutions have no mathematical errors.**	**Some of the steps and solutions have no mathematical errors.**	**Few of the steps and solutions have no mathematical errors.**
	Student provides correct answers for ALL of the following tasks. **Task 1**. Student answers 12. **Task 2**. Student answers that the animals in group 1 can fly or have wings, and the animals in group 2 cannot fly or do not have wings. **Task 3**. Student answers that the group 1 animals are fish (or can swim or live in water), the group 2 animals are birds (or have wings or can fly), and the group 3 animals are mammals (or live on the ground or walk). **Task 4**. Student gives an accurate description of the 3 groups.	Student provides correct answers for only 3 of the tasks described in category 4.	Student provides correct answers for only 2 of the tasks described in category 4.	Student provides correct answer for 1 or none of the tasks described in category 4.

Scoring Notes Checklist

Task	Check Yes	Category
Task 1		
Student answers 12.		Concept
Student shows evidence of counting the animals. Such evidence may need to be noted by the instructor.		Strategy
Student answers 12.		Accuracy
Task 2		
Student describes what all animals in group 1 have in common that the animals in group 2 do not have.		Concept
Student explains that the animals in group 1 can fly (or have wings), and the animals in group 2 cannot fly (or do not have wings). There may be other explanations of the sorting that are correct.		Explanation
Student answers that the animals in group 1 can fly or have wings, and the animals in group 2 cannot fly or do not have wings.		Accuracy
Task 3		
Student describes what all animals in each group have in common. (Note: There may be correct answers that are different from the answer sheet.)		Concept
Student explains that the animals in group 1 live or swim in the water, the animals in group 2 can fly or have wings, and the animals in group 3 live on land. The categories of fish, bird, and mammal are also correct. Another sorting could be no legs, 2 legs, and 4 legs. There could be other explanations of the sorting that are correct.		Explanation
Student answers that the group 1 animals are fish (or can swim or live in water), the group 2 animals are birds (or have wings or can fly), and the group 3 animals are mammals (or live on the ground or walk).		Accuracy
Task 4		
Student groups the cutouts correctly by shape or size or color.		Concept
Student shows evidence of correct sorting by one attribute (shape or size or color) into 3 distinct groups. Such evidence may need to be noted by the instructor.		Strategy
Student explains how the pictures are sorted. The most common sorting should be by size or by shape or by color. However, there could be other sortings that may be described.		Explanation
Student gives an accurate description of the 3 groups.		Accuracy
Task 5		
Student describes a grouping different from the grouping in Task 4.		Concept
Student describes a different sorting.		Explanation

SITES-M Mathematics Challenge

Grade K–Focus on Data

Analyzing Student Responses Protocol

The purpose of the Mathematics Challenges is to provide opportunities for students to develop and demonstrate understanding of important mathematical concepts and standards. They include extended responses, open-ended tasks, and tasks that require higher-order thinking skills. Because these types of tasks may be novel for students and they will have varying levels of understanding, the student responses will vary.

The guiding questions below were designed to assist you in analyzing your class' response to the Challenge and determining appropriate next steps for your teaching and learning. Responses to these questions are for your reflection and documentation and will not be collected.

Guiding Questions for Analyzing Student Responses to the Mathematics Challenges

1. When completing the Challenge, what did your students do well? How do you know?

2. When completing the Challenge, what did your students struggle with? How do you know?

3. When your students completed the Challenge, did they implement multiple correct solutions strategies? What insightful approaches to problem solving did you observe?

4. What, if any, patterns (e.g., common errors/misconceptions) did you observe across your student responses?

5. What questions or concerns did your students have when working through this Challenge or a particular task? Are these things you should address for the class as a whole?

6. What, if any, feedback did you provide to your class? How did you provide it?

7. What did you learn about your students' mathematical understanding based on their responses to this Challenge?

Reminders:

1) After you have completed the Challenge with your class and responded to these Guiding Questions for Analyzing Student Responses, please complete the Challenge Feedback Log. A link to this Log is e-mailed to you each month. Responses will be used to improve the Challenges and to provide recommendations for teachers implementing the Challenges in future years.

2) Please provide copies of all student work to the Assessment Coordinator.