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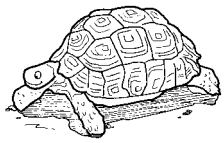
Back Talk

by Sheldon Erickson



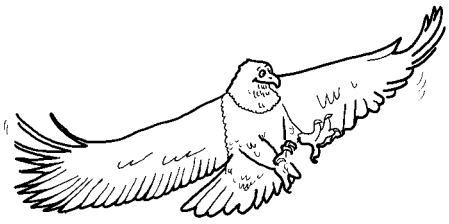
Topic
Sorting and classifying

Key Question
What system can you use to determine what animal or geometric figure label you are wearing on your back by asking the fewest questions?

Focus
Students will determine what animal or geometric figure is on their back by asking their peers yes/no questions. They will then classify the animals or geometric figures and decide upon a strategy for determining what label they are wearing by asking the fewest questions.

Guiding Documents
NCTM Standards
- *Develop and apply a variety of strategies to solve problems, with emphasis on multi-step and non-routine problems*
- *Identify, describe, compare, and classify geometric figures*

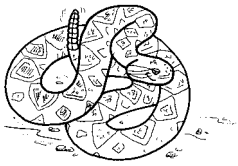
Project 2061 Benchmarks
- *Usually there is no one right way to solve a mathematical problem; different methods have different advantages and disadvantages.*
- *Similarities among organisms are found in internal anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance.*



Math
Geometry
shapes
definitions
Logic

Science
Life science
classification of animals

Integrated Processes
Observing
Classifying and sorting
Comparing and contrasting
Recording data



Materials
Paper
Tape
Scissors or paper cutter

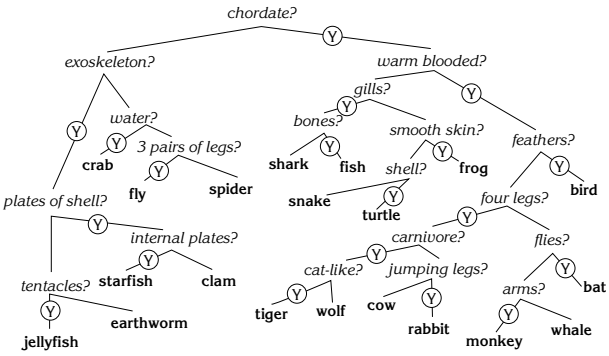
Optional:
self-adhesive copier labels (2"x 4", 10 per sheet)
chart or butcher paper
markers

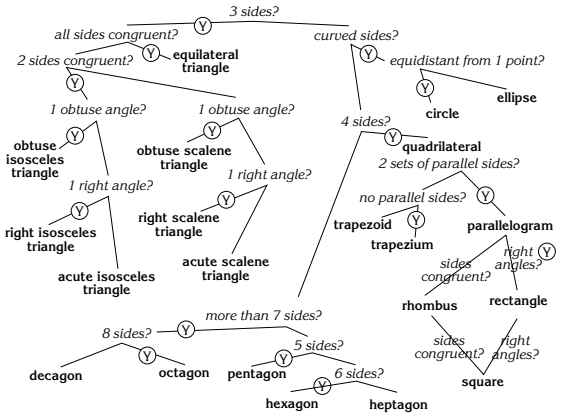
Background Information

Classification is often done with a dichotomous key. In using a dichotomous key, one chooses an attribute that divides a group into "haves" and "have nots." Using another attribute, the two subgroups are then divided again until each individual being sorted is isolated. When complete, each individual in the group is distinguished by a unique list of attributes. This method provides an efficient way of confirming what individual of the group you have by asking only yes/no questions.

In this activity students work with animals or geometric figures. The scientific classification of animals is often displayed in a tree fashion which has similarities to a dichotomous key but may not have two branches at each junction. Geometric shapes in mathematics are defined by their attributes and may be sorted with a key, though this is rarely done.

Although science and mathematics may not formally deal with these groups using dichotomous keys, they provide a vehicle by which students can compare and contrast items and better understand how they are unique. Although there are multiple ways for students to develop a key, below are two possibilities.





Management

1. Groups of four students work well for the classification part of the activity.
2. This activity can be done to emphasize either science or math content. Before doing the activity, decide what content area you want to reinforce and copy the appropriate animal labels or geometric figures labels.
3. Two sets of 20 labels for each content area are included in this activity. Copy and cut out the desired labels for each group of students, along with an extra class set to tape onto the backs of the students. If there are more than 20 students, use two sets of either the animals or the geometric figures.
4. The class set of animals or geometric figures may be copied onto self-adhesive labels to be put onto the students' backs.
5. If the class is already familiar with the terms, the teacher may choose to cut off the written portion of the labels before distributing the labels.
6. This activity assumes that students are familiar with dichotomous keys. It this is not the case, some instruction as to their construction must take place prior to the activity.

Procedure

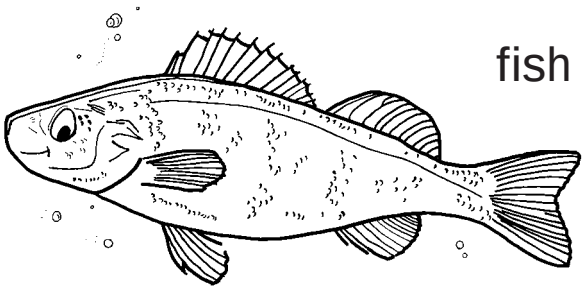
1. Explain the game to the students:
   - They will each have a label stuck to their backs. The label will have an animal or geometric figure printed on it.
   - They are to determine what animal or geometric figure is on their backs by asking only yes/no questions.
   - They are to keep track of how many questions they ask to determine what animal or geometric figure is taped to their backs.
2. Tape a label onto the back of each student.
3. Urge the students to move around the classroom asking peers yes/no questions to determine what their labels are.
4. When students have determined their labels, have them sit down and discuss the strategies they used.
5. Discuss the *Key Question*.
6. Distribute a set of labels to each group. Have them develop a system of sorting and classifying the figures. Then have them develop a dichotomous key for their classification system. They may record their solution on chart paper.
7. Have students share their systems.
8. Share how scientists or mathematicians might sort the figures, using scientific descriptions and mathematical definitions, or their relationships to each other.
9. Put new labels on the backs of students and let them play again using their system of classification. Challenge them to see if they can ask fewer questions.

Discussion

1. What strategies did you use in determining what label was on your back?
2. How do you determine what is the "best" system for sorting and classifying?
3. What do you think was the most efficient first yes/no question? Why?
4. What were some questions that proved very inefficient? Why were they inefficient?

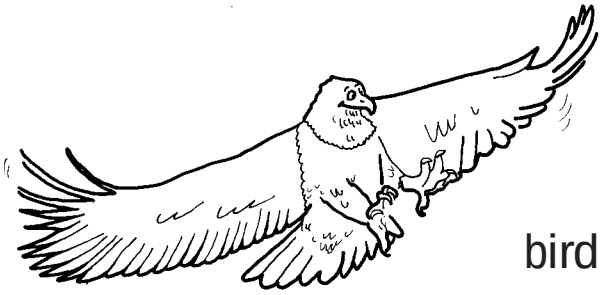
Extensions

1. Have students do a statistical study of how many questions were asked in the game at the beginning of the activity and the game at the end of the activity. Have them determine mean, median, mode, and range and decide if the classification systems helped or hindered them.
2. Have students count the number of questions required with each classification system and determine which system is the most efficient.



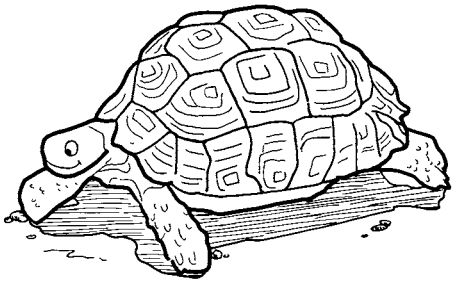
fish

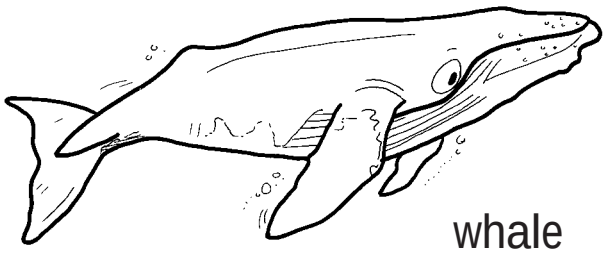
wolf



bird

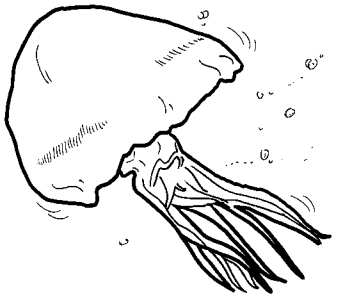
turtle



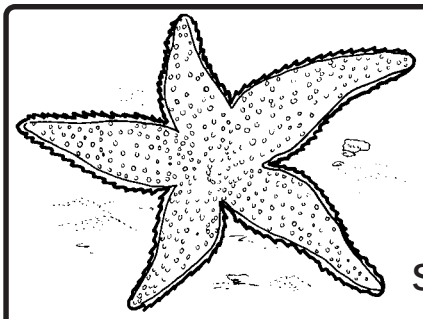


whale

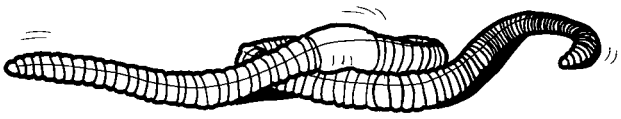
tiger



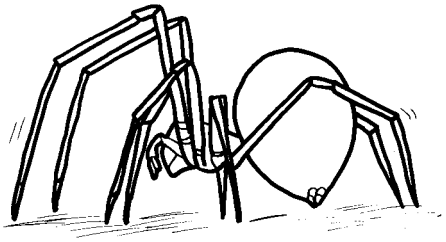
jellyfish



starfish

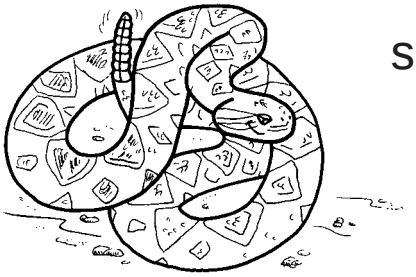


earthworm

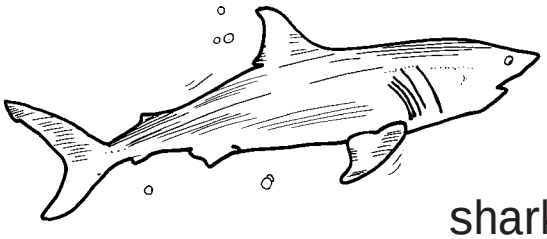


spider

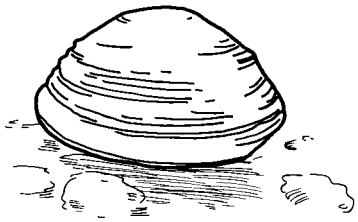
snake



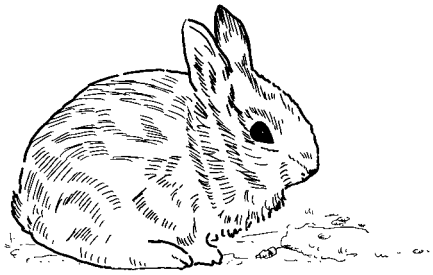
bat



shark

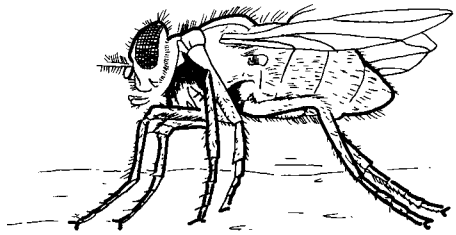


clam

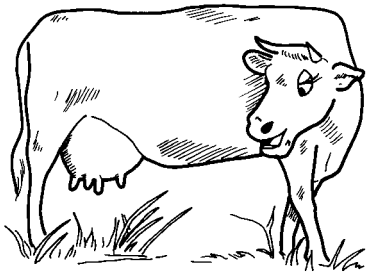


rabbit

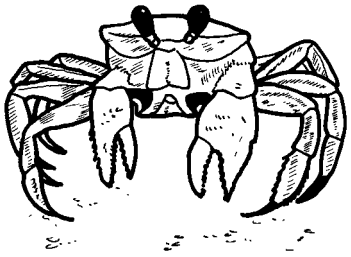
fly



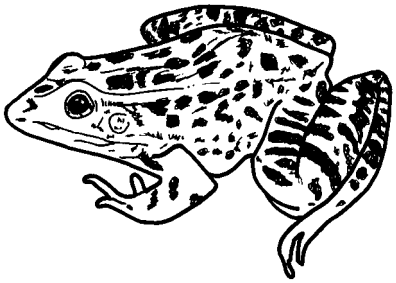
monkey



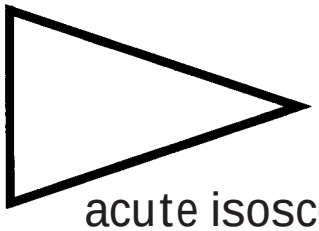
cow



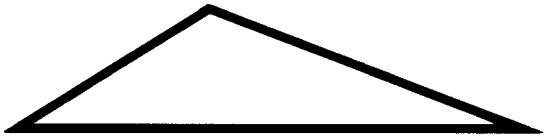
crab



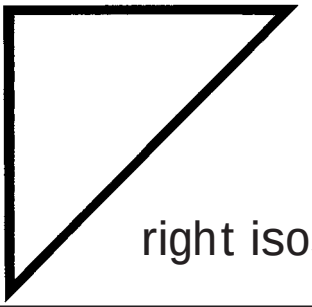
frog



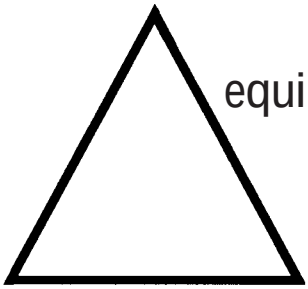
acute isosceles triangle



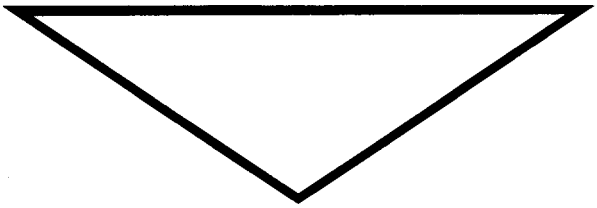
obtuse scalene triangle



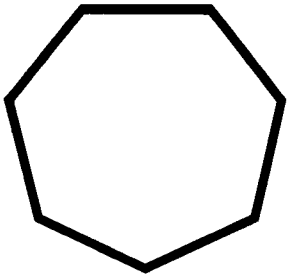
right isosceles triangle



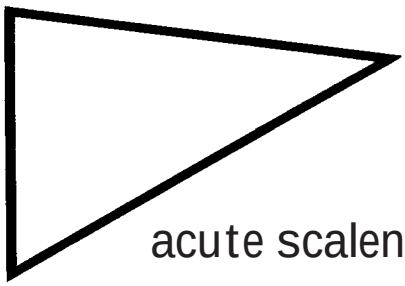
equilateral triangle



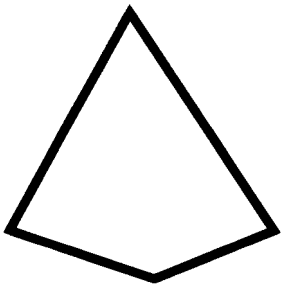
obtuse isosceles triangle



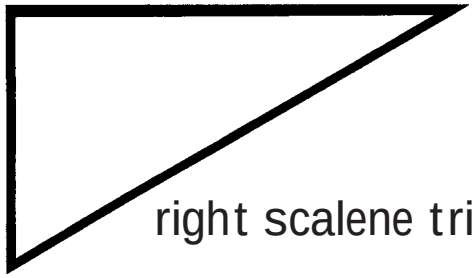
heptagon



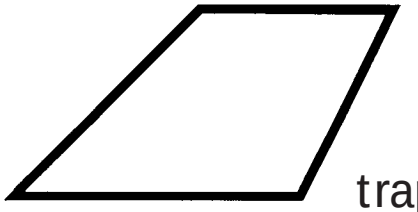
acute scalene triangle



trapezium

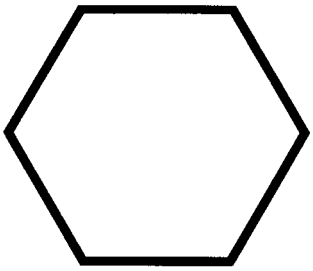


right scalene triangle



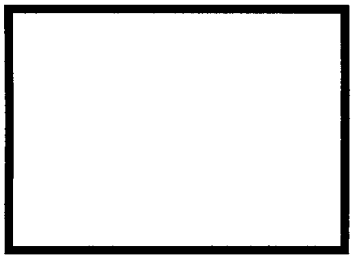
trapezoid

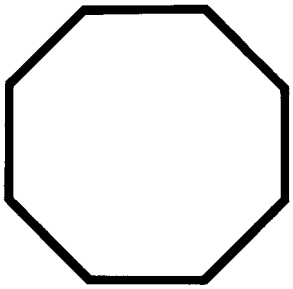
parallelogram



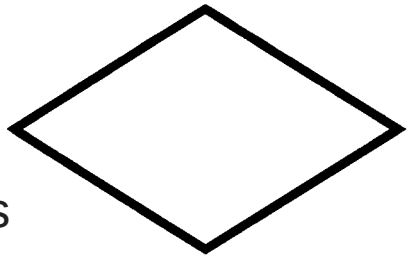
hexagon

rectangle

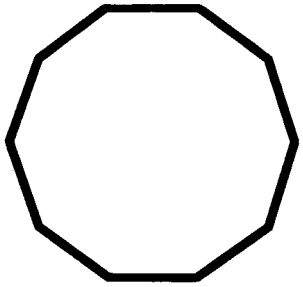




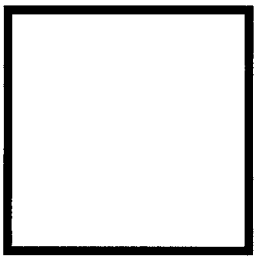
octagon



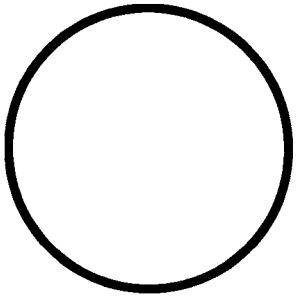
rhombus



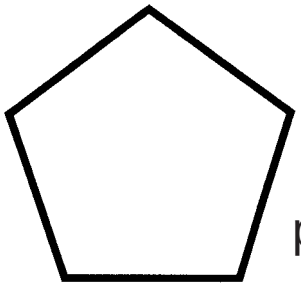
decagon



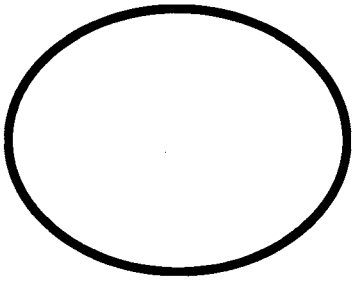
square



circle



pentagon



ellipse