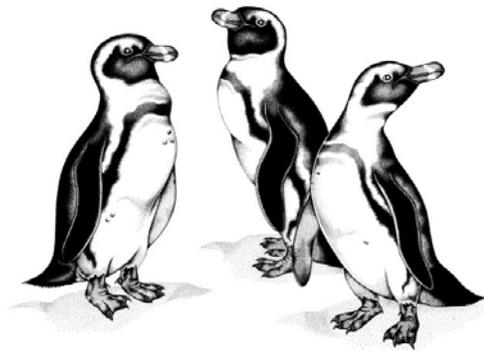# Penguin Math

**Topics**
Math, Penguins

**Grades**
PreK-2

**Site**
Indoors

**Duration**
20 minutes

**Materials**
- Penguin cards (1 set of large cards, 1 set of small cards for each student group)
- Unifex cubes
- Goldfish crackers
- Venn diagram with two string circles
- Transparency of **How Do You Measure Up?**
- Transparencies of the different penguin images (optional)
- Overhead projector (optional)
- Science notebooks or paper

**Vocabulary**
estimate, Venn diagram

**National Science Education Standards**
*Unifying Concepts and Processes* (K-4)
Systems, order and organization

*Science as Inquiry* (K-4)
Abilities necessary to do scientific inquiry

## Overview

*What kind of an animal is a penguin?  Students learn about penguin characteristics and then use penguin pictures as manipulatives to practice and reinforce various math concepts.*

## Objectives

Students will be able to:
- Sort and classify objects by attribute.
- Recognize, describe and extend patterns.
- Solve simple addition and subtraction problems.

## Background

Penguins are flightless seabirds that live in the Southern Hemisphere.  There are 17 different species of penguins.  They range in size; the largest is the Emperor penguin which grows to as tall as 115 cm (3.8 ft) and the smallest is the Little Blue penguin which grows only to 40 cm (1.3 ft).  Penguins have adapted to life at sea, especially in cold waters of the Southern Hemisphere.  Blackfooted penguins spend about 70 percent of their lives at sea where they dive for small fish.  To insulate themselves, penguins have a double layer of interlocking feathers to prevent cold water from reaching their skin.  They may have as many as 70 feathers per square-inch; this density is larger than that of any other bird.  A thick layer of subdermal fat insulates the birds from the cold seawater.  Shivering underwater helps keep the penguins warm.

Using penguin cards as manipulatives can be a compelling way to teach math concepts and integrate science.  After students learn about penguin characteristics, they can sort penguin cards by size and other attributes.  Sequencing as well as addition and subtraction can be practiced using word problems and the penguin cards.  This is a good opportunity to teach students the difference between a guess and an **estimate**.  An estimate is a number within a reasonable range.  Students should be encouraged to modify their estimates as more information is obtained.  Students can practice comparing and contrasting using the penguin cards and a **Venn diagram** as well.

## Teacher Preparation

1. Make copies of **Penguin Cards** for student groups. Each group should get a set of small cards and a set of large cards.
2. Collect materials from the list.

## Procedure

### LEARN ABOUT PENGUINS.

1. Read a book about penguins to the class (see **Resources** for ideas) or use Monterey Bay Aquarium's web cam at www.montereybayaquarium.org/efc/efc_splash/splash_cam.aspx to view Blackfooted penguins on exhibit.
2. Discuss penguin characteristics as a class. Discussion questions might include: What kind of animal is a penguin? What colors are penguins? Where do penguins live? How big are penguins?

### PRACTICE SORTING PENGUINS.

1. Give the sets of penguin cards to each student group. Solicit suggestions from the class about different ways to sort them.
2. Challenge students to sort the cards. Have students describe the criteria they used to determine which cards go together (e.g., beaks open versus beaks closed, penguin fronts versus penguin backs, large versus small).

### LOOK FOR SAME OR DIFFERENT.

1. Distribute sets of the five penguin images to each group of students.
2. Hold up a large penguin picture and ask the students to find one that matches. Ask them to explain the reason they selected the image they did. Does it match because it is the same size? In the exact same position? Is it the mirror image? With the group, determine your criteria for a "match."
3. Have students stand up and "match" the position of one of the penguins on the cards using their bodies.
4. Have one student strike a pose and ask the rest of the group to find a picture that matches or comes close.

### SORT PENGUINS WITH VENN DIAGRAMS.

1. Start with a single circle diagram. Place a number of penguin cards with the same characteristic, e.g., large size, in the circle and all the others outside of the circle. Have the students identify the characteristic all penguins in the circle have in common. Repeat using other characteristics and/or suggestions from the class.
2. Create a two-circle, non-intersecting diagram. One of the circles could be labeled "penguins facing right," the other could be labeled "penguins facing left." Have students sort the penguins into the appropriate circle. Repeat using other characteristics and/or suggestions from the class.
3. Create a two-circle, intersecting Venn diagram. One of the circles could be labeled "penguins facing right" and the other could be labeled "small penguins." Have students sort the penguins into appropriate circles with "small penguins that are facing right" placed where the two circles overlap.

## Make penguin patterns.

1. Review the concept of repeating patterns. Demonstrate a rhythmic clapping pattern, such as "Clap, Clap-Clap"; "Clap, Clap-Clap." Have the students imitate the pattern. Identify the various parts of the pattern. "Clap" is the first part of the pattern, and "Clap-Clap" is the second part of the pattern.
2. Demonstrate making a pattern with the penguin images, such as small penguin, large penguin, small penguin...what comes next?
3. Have the students make up their own patterns and demonstrate to the class.

## "Feed" the penguins and practice estimating.

1. Place a number of penguin cards on the table. Tell the students that they are going to "feed the penguins."
2. Show the students a baggie containing goldfish crackers. Ask them to estimate if there are enough crackers for each of the penguins to have a fish.
3. Ask students to count the penguins and to count the crackers. Was their estimation correct?
4. Ask students to get one goldfish cracker for each penguin and place it next to the penguin image.
5. Distribute penguin pattern cards and a baggie of goldfish crackers to each group.
6. Ask the students if they think there are enough fish for each of their penguins to have two fish? Three fish? Four fish?
7. Have the students distribute the crackers so each penguin has the same amount.
8. Pose a variety of simple math problems to the class. For example, ask students to guess how many fish they would need to feed each penguin two fish. If they had twenty fish, how many would each penguin get? Use the patterns and fish to solve the problems.

## "Hide" the penguins.

1. Use a habitat picture (find a rocky shore image in a magazine or use cutout construction paper to create rocks in water) and any of the small penguin cards.
2. Project the habitat picture on a screen (or place it on the table if in small groups). Model a problem and solution for the group. *Sample problem: There are 10 penguins total. 5 penguins are swimming in the water. 2 penguins are standing on the upper rocks. 2 penguins are standing on the lower rocks. How many penguins are hiding in the cave?*
3. Have the students make up their own "hide the penguins" problems and challenge the rest of the class to figure out the answers. They can write them in their notebooks.
4. As an extension, students can log onto the Monterey Bay Aquarium website's live penguin cam and watch a penguin feeding show at: www.montereybayaquarium.org/efc/efc_splash/splash_cam.aspx

## Are there more or less penguins?

1. Place a few penguins on one half of the overhead projector (or on the table if in small groups). Show the penguins to the students and cover them up before they have a chance to count them. Show them another amount and ask if there are more or less penguins than the first ones you showed them.
2. After students have made their guesses, show them both sets of penguins again. Have them count each group of penguins and compare.

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### CONSERVATION TIPS

Classrooms use a lot of paper! Reduce waste by using both sides of the paper before recycling. After recycling "close the loop" and buy photo-copy paper that is made from recycled materials.

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### HOW LONG (TALL) IS A PENGUIN?

1. Have students write down the number of Unifex cubes that they think will be required to measure the length of one of the large penguins.
2. Record student responses on the board or in their notebooks. How can the class or small groups determine whether the guesses are correct?

### HOW DO YOU MEASURE UP TO A PENGUIN?

1. Make a transparency of **How Do You Measure Up?** (included) and project it on a white wall in the classroom. Move the overhead projector closer or further from the wall so that the actual height of the projected Emperor penguin is 48" tall.
2. Ask the students to think about how tall they are in comparison to one of the different penguins. Are they taller or shorter? Record their responses on sticky notes next to each image.
3. Ask the students to come up one at a time and compare their height to the projected images. Use tally marks or other methods to record the number of students who are taller and shorter than the selected penguin image.
4. Compare their original responses to the actual number who are taller or shorter than the penguin image. Discuss the difference between their estimates and their findings.
5. As an extension, ask the students to use their measurements to determine whether the different penguins would fit on a shelf, in a closet, under the table, or elsewhere in the classroom. Have the students justify their answers.

## Extensions

- Use the penguin cards to practice counting by 2's, 5's or 10's.

## Resources

### Website

Monterey Bay Aquarium. [www.montereybayaquarium.org](www.montereybayaquarium.org)
Find information about the Blackfooted penguins and other animals at the Aquarium.

### Books

*Penguin Chick.* McKenzie, Michelle. Monterey Bay Aquarium Press, 2000.

*Penguins and Their Young.* Lawrence Hall of Science. 1996.

*Splash! A Penguin Counting Book.* Chester, Jonathan , and Kirsty Melville. Trycycle Press. 1997.

## Standards

### California Mathematics Standards

Grades K-2
   Number Sense
   Algebra and Functions
   Measurement and Geometry
   Statistics, Data Analysis and Probability
   Mathematical Reasoning

## Head Start Framework

### Mathematics

- Associates number concepts, vocabulary, quantities and written numerals in meaningful ways.
- Uses language to compare numbers of objects with terms such as more, less, greater than, fewer, equal to.
- Begins to use one-to-one correspondence in counting and matching objects.
- Uses standard and non-standard measures for length and area of objects.
- Begins to match, sort, put in a series and regroup objects.
- Enhances abilities to recognize, duplicate and extend simple patterns.

## Acknowledgment

Some parts of this activity are adapted from the Lawrence Hall of Science teacher's activity guide, *Penguins and Their Young*, first published in 1995.
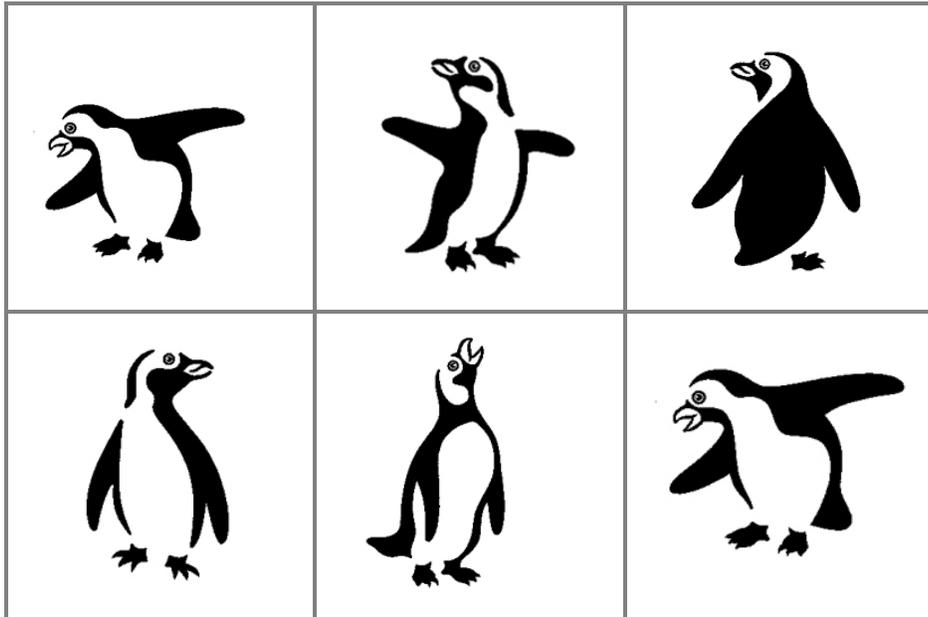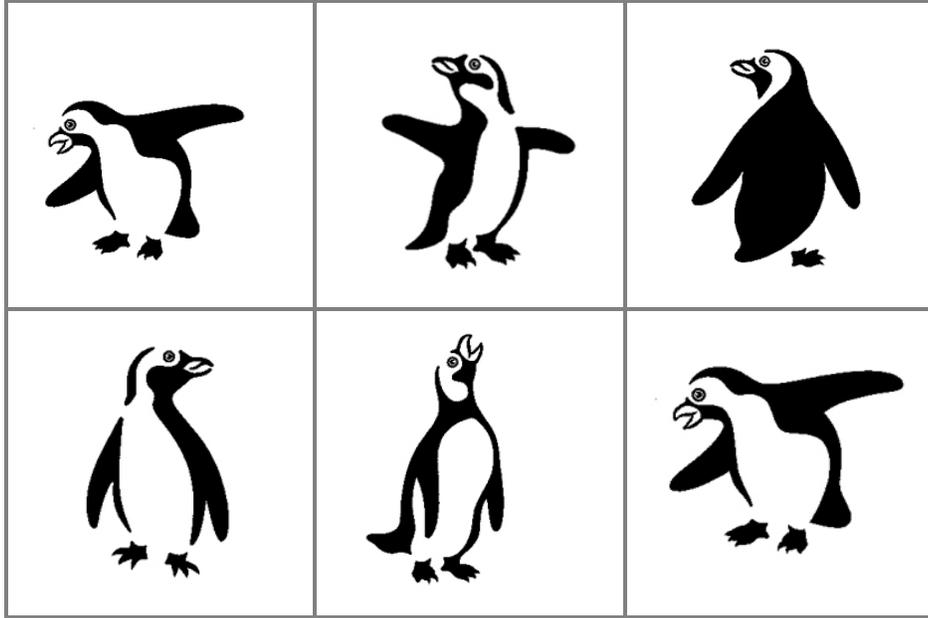
## Penguin Cards

## Penguin Cards

## How Do You Measure Up?

4 feet (120 centimeters)
**Emperor penguin**
Antarctica

3 feet (90 centimeters)
**King penguin**
Antarctica

2 feet (60 centimeters)
**Blackfooted Penguin**
South Africa

14-16 inches (35-40 centimeters)
**Little penguin (Fairy penguin)**
Australia and New Zealand