



Daisy Numbers in Nature

How tall are you? How tall is a giraffe? How about a chipmunk?
How can you know?

Explore how to measure objects with this badge. A **measurement** is the size or amount of something. You'll measure different things. You'll create your own way to measure nature, too!

Steps

1. Search for shadows
2. Sort natural objects
3. Make your own unit of measurement

Purpose

When I've earned this badge, I'll know about shadows, measurement, sorting, and estimating.



Words To Know

Cast a shadow: To block light and create a shadow.

Estimate: A number that is close to the actual number. It's a prediction or guess using information you have.

Light source: Light coming from one direction, like the sun or a light bulb.

Measurement: A number that shows the size or amount of something.

Shadow: Dark area on a light surface caused by an object blocking a source of light.

Silhouette: The outline of a shadow.

Sort: To put items in order based on something they have in common like color, shape, or size.

Unit of measure: The words we use to describe how much of something there is. In time, we use seconds, minutes, hours, days, weeks, months, and years to measure. In length, we might use inches or centimeters. These are “**standard**” units because lots of people use them.

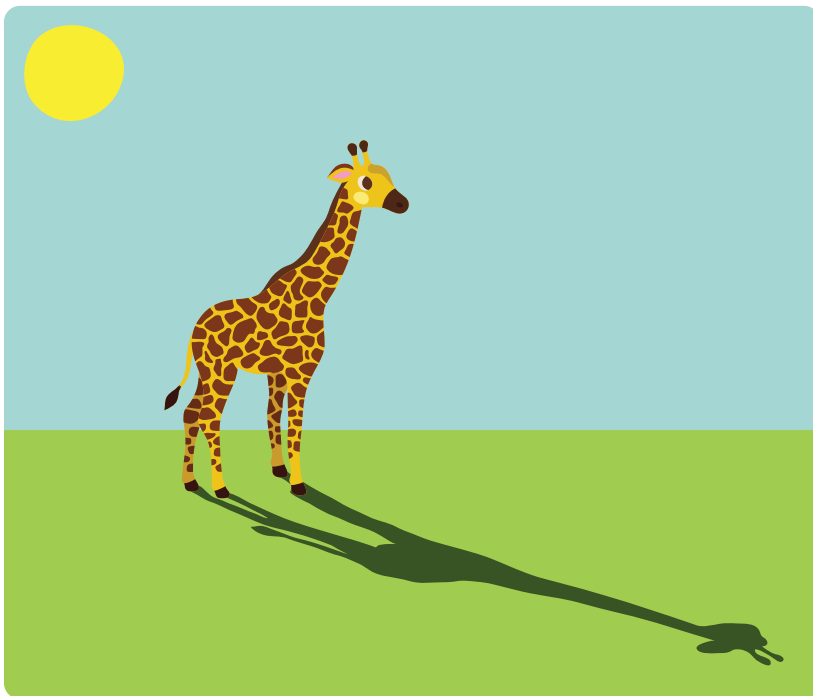
Weight: A number that tells you how heavy something is. Pounds and ounces are units of measure for weight.

Step 1: Search for shadows

A **shadow** is a dark area on a light surface. It is caused when an object blocks light.

When a tree blocks the sun, it creates a shadow. When you block the light from a lamp, you make a shadow. The sun and light bulbs are two kinds of **light sources**.

When an object blocks light, it “**casts a shadow**.” Sometimes a shadow is the same size as the object. Other times it’s not. The outline of a shadow is its **silhouette**.



Play with Shadows

Make shadow animals
with your hands!



Choices—do one:

Trace your shadow. Explore the shape and size of your shadow with a partner. Go outside or use a flashlight to make a shadow. Trace your partner's shadow with chalk or string. That's their silhouette! Have them trace yours, too. Then lie down next to it. Have your partner trace around you. Do the same for them. After, compare the silhouette and outline. Are they the same shape? Are they the same size? Why might they be different?

► **For more fun:** Color in the outlines to create pictures of you!

Create a shadow. Make a tree out of clay or a pipe cleaner. Go outside or use a flashlight to make shadows with your tree. Trace the shadow with chalk or string. That's the tree's silhouette! Lay the tree down next to its silhouette. Trace around it. Is it the same shape? Is it the same size? Why might they be different?

► **For more fun:** Color in the outlines with leaves, birds, and other natural objects!

See how shadows change. When the sun moves, shadows on the ground change size, shape, and direction. Go outside early on a sunny day. Have a partner trace the outline of your shadow with chalk or string. That's your silhouette! Go outside again later and stand in the same spot. Have your partner trace your silhouette again. How does the size and shape change? If you're indoors, you can move a flashlight around.

► **For more fun:** Color in the outlines to create pictures of you!

Sunrise



Early Afternoon



Sunset

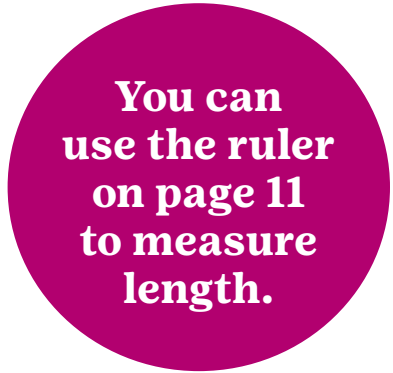


Step 2: Sort natural objects

A **measurement** is the size or amount of something. It's a number. It can show how big your shoe is. It can show how tall a tree is. It can show how hot or cold it is outside. Some measurements are an inch, a cup, a dollar, or a mile. They're also called **units of measure**.

The **weight** of something is how heavy it is. It's also a number. It can tell you how heavy a rock is. It can tell you how heavy a canoe is. Some units of measure for weight are pounds and ounces.

When you have a set of objects, you can put them in order or **sort** them. You can sort by color. You can sort by shape. You can sort by how long or short they are. You can sort by weight.



**You can
use the ruler
on page 11
to measure
length.**

Choices—do one:

Measure and sort leaves. Gather leaves of different sizes from the ground. Do not pick them off of trees or plants. Trace around a leaf. How many inches long do you think it is? Write down your guess. Then measure it with the ruler. Write down the number of inches. Repeat with two other leaves. Then put the leaves in order from shortest to tallest. Put a piece of paper on top. Rub the paper with a crayon. This should make a picture of your leaves.

► **For more fun:** Make a rubbing of both sides of your leaves.

Weigh and sort rocks. One pound is 16 ounces. An ounce is about the weight of a new pencil. Or 10 pennies. Gather some rocks. Draw

each one. Hold them in your hand. Guess how much each rock weighs. Write your guess by each drawing. Measure each rock with a scale. Write down each rock's weight by its picture. Then put your rocks in order from lightest to heaviest.

Sort any natural objects. Collect natural objects, like seashells, pine cones, or sticks. Draw each one. Then guess its length and weight. Write your guess next to your drawing. Then weigh and measure your items. Write their length and weight down, too. Sort your items by size. Then sort them by weight. How else could you sort them?



Step 3: Make your own unit of measure

We use a ruler to measure length. We use units like inches, feet, and miles. We use a clock to measure time. We use units like minutes, hours, days, weeks, months, and years. We all agree on how big or long these are. They're "**standard**" units.

Sometimes you won't have a ruler. If this happens, you can create your own unit of measure. You might use your foot, a book, or a stick.

Sometimes you just have to guess how big or heavy something is. That guess is called an **estimate**. An estimate is a number that is close to the actual number. It's a guess you make using what you know.

Choices—do one:

Measure with a natural object. Choose a natural object, like a seashell, rock, leaf, or pine needle. This is your unit of measure. It's your "ruler." Then draw an item to measure, like a table, a skateboard, or a pillow. Write down your estimate for how long it is. Then measure it with your natural object. Repeat with other items.

Measure with your body. Choose your hand, foot, or any body part as your unit of measure. Then draw what you'll measure, like a bed, pet, room, or anything you want. Write down your estimate for how long it is. Then measure it with your body part. Repeat with other items.

Measure with a group of people. Create a unit of measure for Daisies. What could be your unit of measure? A Daisy petal? Your Girl Scout vest? It's up to you! Decide on a unit of measure and draw items to measure, like a table or book. Then estimate and measure the items with your Daisy unit of measure.



Make sure to return any leaves, rocks, or other natural objects to the place you found them.

How To Measure with Any Object

Many people use inches as a unit of measure, but did you know you can measure with any object?

Here's how:

1. Choose an object. This is your unit of measure.
2. Place it on the star at the top corner of this paper.
3. Mark the other side of the object. That's your first measurement—one!
4. Move your object next to the mark. Make another mark—that's two!
5. Repeat and continue to move the object. Make a mark after each move. Stop when you reach the end of the paper.
6. Count the number of marks you made.

How many did you count?

This number is how long
your paper is in your
unit of measure.

Measure with Your Hand or Foot

Trace your hand or foot. Cut out the outline and use it as your unit of measure.

1 inch

2

3

4

5

6

7

8

9

10



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Volunteer's Guide to Daisy Numbers in Nature*

Tips and ideas to help guide your troop through this badge. *This is the second badge in the Math in Nature badge series. The order of the Math in Nature badges is: 1) Shapes in Nature, 2) Numbers in Nature, and 3) Design with Nature.*

STEP 1: Search for shadows •

30–40 minutes

Ask: Have you ever noticed your shadow or the shadow of a giant tree? What causes shadows?

Share: A **shadow** is a dark area on a light surface caused when an object blocks light. When a tree blocks the sun, it creates a shadow. When you block the light from a lamp, you make a shadow. The sun and light bulbs are two kinds of **light sources**. When an object blocks light, it “**casts a shadow**.” The outline of a shadow is its **silhouette**.

Do: Use a flashlight to show Daisies how shadows change size, shape, and direction when the light source moves. Then look at “Play with Shadows” in the Daisy Booklet. Show Daisies how to create shadows with their hands and a flashlight before they pair up to create shadow animals.

Materials: *Flashlights*

Choices—do one:

Meeting virtually? No problem! Daisies can have a family member or friend join them in-person for the activity.

● **Trace your shadow.** Have Daisies form pairs, with one standing still to cast a shadow and the other tracing the shadow. If the sun isn't bright enough or you're indoors, help Daisies to position a light source or work in groups of 3, with one holding a flashlight, one standing still to cast a shadow, and one tracing the shadow. Have them switch roles and repeat until everyone has had their shadow traced. Tell them, “Your body cast a shadow, and your partner traced your silhouette.” After, have Daisies lie down next to their silhouette for their partner to trace around them. Switch roles and repeat until everyone has had a turn. Then have Daisies compare their silhouette and outline. Ask, “What do you notice about your silhouette? Is it the same shape as you? Do you think your shadow is always the same height? What

might cause the direction or shape of it to change?” Show the illustration on page 5 of the Daisy Booklet to Daisies and explain, “The size and shape of a shadow depends on the position of the sun. At noon, the sun is directly overhead and you won't have a shadow. The closer it is to noon, the shorter your shadow becomes. Your shadow is the longest the farther away you are from noon, like during early morning and late afternoon. So, by looking at your shadow, or that of a tree, you can estimate the time of day!” **For more fun:** Daisies can color and draw inside their silhouette and outline to create pictures of themselves.

Materials: *Outdoor space OR craft or butcher paper that can contain 2 outlines of each Daisy; sidewalk chalk OR pencils and markers; flashlights or other light sources if indoors or cloudy*

● **Create a shadow.** Ask Daisies to make a tree with a pipe cleaner or clay that can stand up on its own. Have them work individually or in pairs to shine a flashlight on their tree to make a shadow. Ask them to move the flashlight around and see how the shadows change. Explain, “As you move the flashlight, the tree's shadow may get longer or shorter, disappear, or change direction. Depending on where the light comes from, a shadow will change or move, even though the object making the shadow doesn't.” Next, go outside in the sun to cast a shadow with the trees for Daisies to trace around. If you're staying indoors, Daisies can pair up to hold a flashlight and trace the tree's shadow. Tell them, “The tree cast a shadow. You traced its silhouette.” Ask Daisies to lay their tree down next to its silhouette and trace around it. Have Daisies compare their silhouette and outline. Ask, “What do you notice about the silhouette? Is it the same shape as the tree? Do you think the shadow is always the same height? What might cause the direction or shape of it to change?” Show the illustration on page 5 of the Daisy Booklet to Daisies and explain, “The size and shape of a shadow depends on the position of the sun. At noon, the sun is directly overhead and you won't have a shadow. The closer it is to noon, the shorter your shadow becomes.

*Detailed choice activities, meeting tools, and additional resources and materials can be found within the Volunteer Toolkit on my.girlscouts.org.

Your shadow is the longest the farther away you are from noon, like during early morning and late afternoon. So, by looking at your shadow, or that of a tree, you can estimate the time of day!" **For more fun:** Daisies can color and draw inside their tree's silhouette and outline to include leaves, branches, and anything else, like birds or fruit.

Materials: *Pipe cleaners or modeling clay; flashlights; chalk and a sunny day (if outdoors) OR craft or butcher paper and markers (if indoors)*

- **See how shadows change.** Have Daisies form pairs, with one standing still to cast a shadow and the other tracing the shadow. Make sure they also mark where they each stand. If the sun isn't bright enough or you're indoors, Daisies can position a light source (lamp) or work in groups of 3, with one holding a flashlight, one standing still to cast a shadow, and one tracing the shadow. Have them switch roles and repeat until everyone has had their shadow traced. Tell them, "Your body cast a shadow, and your partner traced your silhouette." After, have Daisies lie down next to their silhouette for their partner to trace around them. Switch roles and repeat until everyone has had a turn. Then have Daisies compare their silhouette and outline. Ask, "What did you notice about your silhouette? Is it the same shape as you?" Later in the meeting, have Daisies go outside (or move their light source if indoors) and repeat the shadow tracing process. Have them compare their two silhouettes. Ask them, "Did the size and shape of your shadow change?" Explain, "As the sun moves across the sky or the light source changes position, the shadows move, too! This can make the shadows change in shape, direction, and size, and even disappear! Shadows can appear smaller, larger, or the same size as the object." Show the illustration on page 5 of the Daisy Booklet to Daisies and explain, "At noon, the sun is directly overhead and you won't have a shadow. The closer it is to noon, the shorter your shadow becomes. Your shadow is the longest the farther away you are from noon, like during early morning and late afternoon. So, by looking at your shadow, or that of a tree, you can estimate the time of day!" **For more fun:** Daisies can color and draw inside their silhouettes and outlines to create pictures of themselves.

Materials: *Outdoor space OR craft or butcher paper that can contain 4 outlines of each Daisy; sidewalk chalk OR pencils and markers; flashlights or other light sources if indoors or cloudy*

STEP 2: Sort natural objects • 20–30 minutes

Ask: How do you know how heavy a rock is? How do you know how tall a tree is?

Share: A **measurement** is a number that shows the size or amount of something, like how big a shoe is, how tall a tree is, or how much flour to put in a cake. A unit is one of a measurement, like a cup or mile. These are also called **units**

of measure. The **weight** of something is how heavy it is, like a rock or a canoe. Pounds and ounces are some units of measure for weight. You can **sort** or put objects in order by color, shape, length, or weight.

Do: Point out the ruler on page 11 of the Daisy Booklet. Have Daisies practice measuring with inches as the unit of measure by measuring one of their fingers with the ruler.

Choices—do one:

- **Measure and sort leaves.** Show Daisies examples or photos of leaves, and ask, "What's the biggest leaf you've ever seen? What is the smallest?" Go outside and let Daisies each gather three leaves of different sizes from the ground (do not break anything off of plants or trees). Have Daisies draw an outline of each on a sheet of paper, and write down a guess for how many inches long each leaf is, top to bottom. Help them to measure each of their leaves with the ruler on page 11 of the Daisy Booklet and write the length next to the outline. After, ask Daisies to sort their leaves from shortest to tallest, put a piece of paper on top, and gently rub a crayon on top to make a leaf rubbing. Ask, "How close were your guesses to what you measured?" Return the leaves to the outdoors where you found them. **For more fun:** Daisies can turn the leaves over and make another rubbing of the other sides of their leaves.

Materials: *Samples or photos of leaves; leaves OR access to collect; pencils; paper; unwrapped crayons*

- **Weigh and sort rocks.** Show Daisies a new pencil and ten pennies, and ask, "Which weighs more: a pencil or ten pennies? Or do they weigh the same? How can we find out?" Show Daisies how you can hold each in a hand and compare their weight. Then weigh the items on a scale (both should be about 1 ounce or 1/16 pound). Go outside and let Daisies each gather three rocks. Have them draw each on a sheet of paper, hold it in their hand, guess how much it weighs, and write their guess by the drawing. Then have Daisies weigh each rock with a scale and write its weight by its picture. After, have Daisies sort their rocks from lightest to heaviest. Ask, "How close were your guesses to what you measured?" Return the rocks to the outdoors where you found them.

Materials: *New pencil; 10 pennies; rocks OR access to collect; scales; pencils; paper*

- **Sort any natural objects.** Show Daisies two small natural objects, and ask, "Which weighs more, or do they weigh the same? Which is longer? How can we find out?" Have Daisies measure the objects with the ruler on page 11 of the Daisy Booklet. Then hold each object in a hand, show Daisies how to compare their weight, and weigh the objects on a scale. Go outside for Daisies to each gather three natural objects from the ground (do not break anything off of plants or trees). Have them draw an outline of each on a sheet of paper, and write down a guess for the length and weight of each object. Help them to measure their objects with the ruler and

write the length next to each outline. Then help them to weigh each object with a food scale and write its weight by its outline. After, have Daisies sort their objects from shortest to tallest and lightest to heaviest. Ask, “How else could you sort the objects? If two objects are the same weight, are they the same size? If they’re the same length, are they the same weight?” Return any natural objects to the outdoors where you found them.

Materials: 2 small natural objects; natural objects OR access to collect; food scales; pencils; paper; unwrapped crayon (optional)

STEP 3: Make your own unit of measure • 20–30 minutes

Ask: In Step 2, you measured with a ruler. What would you do if you didn’t have a ruler and needed to measure how long or tall something is (its length)?

Share: You can create your own unit of measure, like a book. But we have different-sized books, so it would be hard to agree on how long a “book-long” is. Instead, we use inches, feet, yards, or miles to measure length. We agree on how long each unit is. They’re “**standard**” units. Ounces and pounds are some standard units for weight. Minutes, weeks, months, and years are some standard units for time.

Do: Explain, “When you don’t have a ruler, scale, or standard unit, you may have to **estimate** or guess how big or heavy something is using anything you know. You can estimate the length of your foot in inches because you can see your foot and you know how long an inch is.” Help Daisies to estimate the length of their foot in inches before measuring it with a ruler. Repeat estimating and measuring until Daisies are comfortable with the process. Then go over “How To Measure with Any Object” in the Daisy Booklet and demonstrate how to use a small object to measure a piece of paper.

Materials: Rulers (or page 11 of the Daisy Booklet)

Choices—do one:

● **Measure with a natural object.** Let Daisies each choose a natural object as their “ruler” and unit of measure. Have them draw it. Then ask Daisies to work together and choose something to measure, like the width of a doorway or the length of a bench. Have Daisies draw the thing they are measuring, write down their estimate for its length, measure the item with their object, and write down the measurement next to the drawing. Ask Daisies to share and compare their measurements. Ask, “Why are they all different?” Remind Daisies that natural objects are not standard units of measure. Then have them choose another thing to measure and repeat the process: draw, estimate, measure, and record. Ask, “How close were your estimates to the real length of each item? Are natural objects a good way to measure things? Can you think of a better tool?” Let Daisies share their ideas. Then explain, “Rulers include standard units of measure, like inches. These are always the same length, unlike natural

objects. A ruler is a good tool because everyone’s ruler is the same. All over the world, people agree on how long an inch is.” Return the natural objects to the outdoors where you found them.

Materials: Natural objects OR access to collect; paper; pencils

● **Measure with your body.** Explain, “Your body is a natural object! You can use body parts, like your hand, foot, any other part, or your entire body as a unit of measure.” Let Daisies each choose a body part as their “ruler” and unit of measure. Have them draw it under “Measure with Your Hand or Foot” in the Daisy Booklet (or on a sheet of paper) and cut it out. Then ask Daisies to work together and choose something to measure, like the width of a doorway or the length of a bench. Have Daisies draw the thing they are measuring, write down their estimate for its length, measure the item with their body parts, and write down the measurement next to the drawing. Ask Daisies to share and compare their measurements. Ask, “Why are they all different?” Remind Daisies that body parts are not standard units of measure. Then have them choose another thing and repeat the process: draw, estimate, measure, and record. Ask, “How close were your estimates to the real length of each item? Are body parts a good way to measure things? Can you think of a better tool?” Let Daisies share their ideas. Then explain, “Rulers include standard units of measure, like inches. These are always the same length, unlike body parts. A ruler is a good tool because everyone’s ruler is the same. All over the world, people agree on how long an inch is.”

Materials: Paper; pencils

● **Measure with a group of people.** Ask Daisies, “What’s your favorite part of being a Daisy? What objects remind you of Girl Scouts or our troop?” Remind Daisies that standard units are used to measure things because people agree on them. Show them the Girl Scout and Daisy items and have them work in small groups to choose one as their unit of measure. Have them draw it. Then ask Daisies to work together and choose something to measure, like the width of a doorway or the length of a bench. Have Daisies draw the thing they are measuring, write down their estimate for its length, measure the item with their object, and write down the measurement next to the drawing. Ask Daisies to share and compare their measurements. Ask, “Why are they all different?” Remind Daisies that different objects will find different measurements, but if more than one group chose the same object, they would have found the same measurement! Have them choose another object and repeat the process: draw, estimate, measure, and record. Ask, “How close were your estimates to the real length of each item? Are our units of measure a good way to measure things? Can you think of a better tool?” Let Daisies share their ideas. Then explain, “Rulers include standard units of measure, like inches. They’re helpful

because they are always the same length. A ruler is a good tool because everyone's ruler is the same. All over the world, people agree on how long an inch is."

Materials: *Girl Scout and Daisy-related objects, like petals, vests, sashes, badges, badge booklets, etc.; paper; pencils*