



Junior Design with Nature

Can you imagine the perfect hike and campout? Beautiful hiking trails, interesting sights, a cozy campground, and a delicious meal? Enjoying time in nature often requires planning. You might decide where you'll go, how long you'll be gone for, and what you'll bring.

In this badge, you'll use math to help you plan and organize a hike and campout. You'll think about all these things as you get ready for your hiking adventure.

Steps

1. Find your hiking pace
2. Choose a hiking trail
3. Find changes in elevation on a map
4. Decide how much food to bring
5. Pack for your adventure

Purpose

When I've earned this badge, I'll know about different types of maps. I'll know how to calculate distance, pace, elevation changes, and area.



Words To Know

Adjacent: Touching or next to.

Area: The space inside a flat shape, found by multiplying length by width.

Contour interval: The distance, or elevation change, between each contour line on a topographic map.

Contour line: A line on a topographic map that shows elevation change.

Coordinate plane: A graph with x- and y-axes.

Decline: Sloping down.

Elevation: The height above sea level.

Incline: Sloping up.

Index line: A thick contour line on a topographic map, typically every fifth line, that notes the elevation.

Sea level: Zero elevation, or the point where the ocean meets land.

Segment: A part of a whole.

Terrain: The physical features of a piece of land.

Topographic map: A map that shows a terrain's elevation, or height, above sea level.

Walking pace: How fast people usually walk.

x-axis: The horizontal, or side-to-side, part of a graph.

y-axis: The vertical, or up-and-down, part of a graph.

Types of Hikes

A loop hike is when you never retrace your steps but still end up right back where you started. The route is a circle.

An out-and-back hike is when you hike to a point, turn around, and hike back on the same trail. When planning an out-and-back hike, count each segment twice.

A lollipop hike is an out-and-back hike with a loop at the end of the “out” segment. You’d hike out on a trail, do a loop, and then hike back.

A point-to-point or through hike is like out-and-back, except you only go one way. Someone would pick you up at the end.

Step 1: Find your hiking pace

Animals walk and run at different speeds. A tortoise moves along slowly. A cheetah races past the other animals. What are the benefits and drawbacks of moving fast? What about the benefits and drawbacks of moving slow?

As animals, humans also move at different paces. A person's **walking pace** is how fast they usually walk. It takes some people about 5 minutes to walk a quarter mile, but everyone is different.

When you're planning a hike, it can be helpful to figure out your pace. With others, this can also help your group to move at a speed that's comfortable for everyone.

Choices—do one:

Calculate your pace. Find somewhere safe to walk. Then start a stopwatch and move a quarter mile along the route at your usual pace. Stop the stopwatch: how long did it take you to go a quarter mile? Multiply that time by 4 to find how long it would take for you to go a mile. If there are 60 minutes in an hour, how many miles could you go in 1 hour? How many could you go in 3 hours?

Compare human and animal paces. Imagine you're hosting the first all-species Olympics, where animals of all kinds can show off their speed! Choose some favorite animals and find out their normal pace, walking, running, or moving in any way. How fast is an elephant? What about a snail or a leopard? Compare what you find to the average walking pace for a human. You may find that some animals are very fast for short distances. Others can maintain a good speed for a longer time. If you had a marathon, who would win? The tortoise or the hare? What about a 400-meter sprint?

Calculate and compare different paces. Some people run on hiking trails. How long would it take if you wanted to skip or walk backwards? Find somewhere safe to find out! First, find your normal pace. Start a stopwatch and move a quarter mile along the route. Stop the stopwatch: How long did it take you? Do it again, this time running, skipping, or doing something else. Repeat as many times as you want in as many different ways. Then multiply each time by 4 to find your pace for a mile. If there are 60 minutes in an hour, how many miles could you go moving each way? How many miles could you go in 3 hours?

Step 2: Choose a hiking trail

Choosing where to go may be the most important part of planning your hiking adventure. Maps can help as they show all different kinds of information, from the weather to the location of forests and the height of mountains.

If you know where you want to explore, you can usually get a map of trails to help plan your trip. Hiking maps show landmarks and may even show how difficult a hike might be. They show different trails and the lengths of each segment. A **segment** is a part of a whole.

Find out

more about
different types
of hikes on
page 2!

Choices—do one:

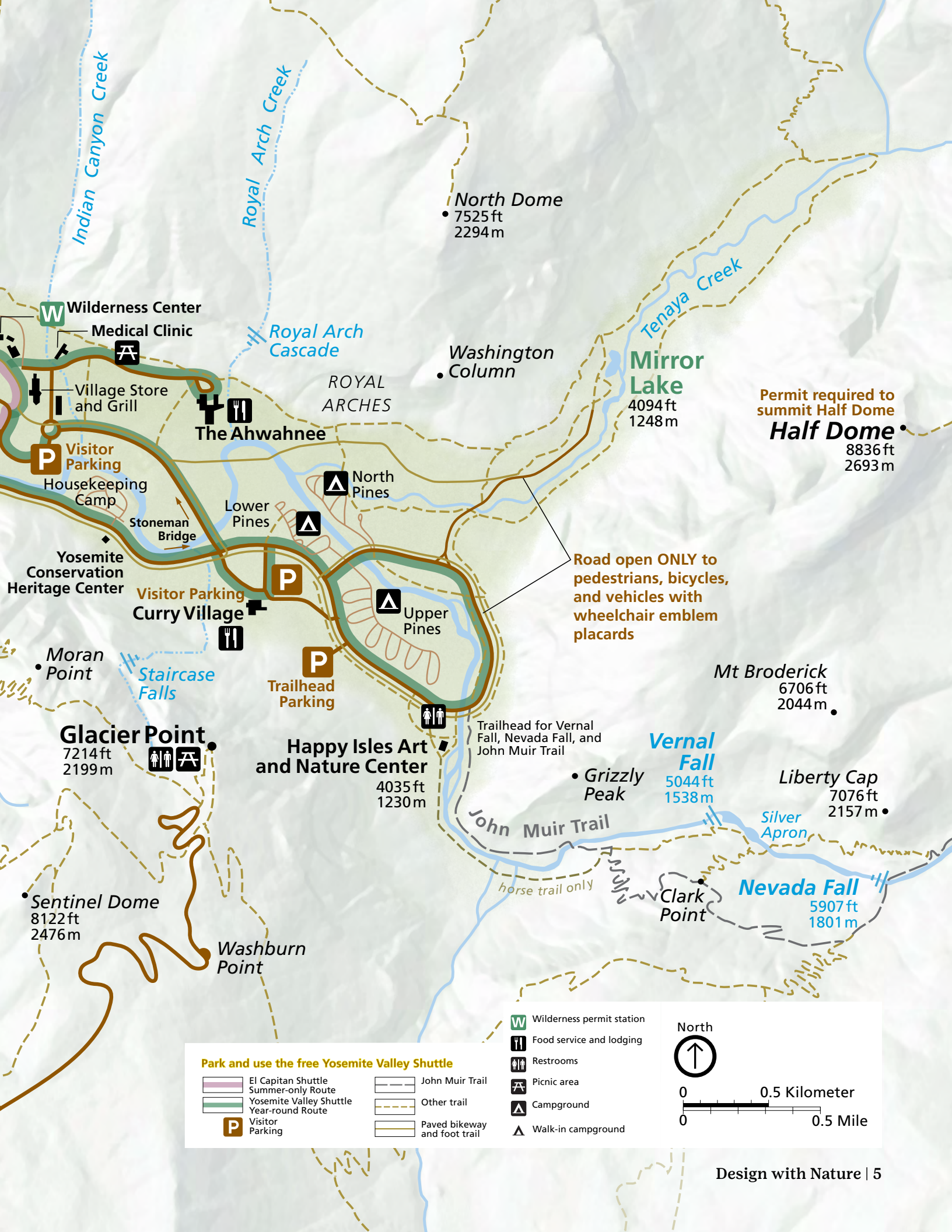
Choose a trail on a sample map. Look at the sample map on page 5. Identify landmarks to visit. Can you find a route that's about the same number of miles long as the distance you can move in 3 hours? Look for different types of hikes, like a loop, out-and-back, lollipop, or point-to-point hike.

Choose a trail on a map of your local area. Hiking near home lets you see your local area in a new way. You don't have to be in the woods to go for a hike! Use maps of your neighborhood and identify local landmarks or places to visit. Then investigate different routes. Can you find a route that's about the same number of miles long as the distance you can move in 3 hours? Then you can share your map with others and go on a hike!

Choose a trail on any map. If you could go hiking anywhere in the world, where would you go? A rainforest? A desert canyon? The Andes mountains? Find a hiking map from anywhere in the world. Identify and learn about important cultural, natural, or historical landmarks to visit. Then investigate different routes. Can you find a route that's about the same number of miles long as the distance you can move in 3 hours?

How To Choose a Hiking Trail

1. Identify any landmarks on the map. What do you want to see on your hike? How much time do you want to spend hiking?
2. Choose a starting point and find a route that is about the same number of miles long as the distance you move at your normal pace in that time. What will you visit? What direction will you go?
3. Add the lengths of **adjacent**, or touching, trail segments to calculate the hike's length.
4. Once you find a hike that's the same distance as you can hike in the time, trace it with a marker.



North Dome
• 7525 ft
2294 m

Washington
• Column

Permit required to
summit Half Dome
Half Dome •
8836 ft
2693 m

Mt Broderick
6706 ft
2044 m •

Liberty Cap
7076 ft
2157 m •

• Grizzly
Peak

Glacier Point
7214 ft
2199 m

• Sentinel Dome
8122 ft
2476 m

Washburn
Point

Happy Isles Art
and Nature Center
4035 ft
1230 m

Vernal
Fall
5044 ft
1538 m

Nevada Fall
5907 ft
1801 m

Park and use the free Yosemite Valley Shuttle

- El Capitan Shuttle
Summer-only Route
- Yosemite Valley Shuttle
Year-round Route
- Visitor
Parking

- John Muir Trail
- Other trail
- Paved bikeway
and foot trail

- Wilderness permit station
- Food service and lodging
- Restrooms
- Picnic area
- Campground
- Walk-in campground



0 0.5 Kilometer
0 0.5 Mile

Step 3: Find changes in elevation on a map

Do you hike faster going uphill or down? What if the trail is rocky? The type of terrain you're on affects how fast you move. **Terrain** is the physical features of a piece of land, like flat, steep, rocky, rolling, or wooded.

A **topographic map** shows the terrain's elevation. **Elevation** is how high a place is above sea level. **Sea level** is where the ocean meets land. Mountains have a high elevation. Beaches have a low elevation. A topographic map includes landmarks, like a regular map, but also has little lines called **contour lines** that each show elevation. The closer the lines are together, the steeper the elevation changes. The wider the lines are apart, the flatter the land. One side of the line is uphill; the other side of the line is downhill.

Elevation changes are important to know about when planning a trip. If your trail is very steep, it may take longer to hike it. Elevation changes can also cause changes in temperature and wind—both things you'd want to know!

Choices—do one:

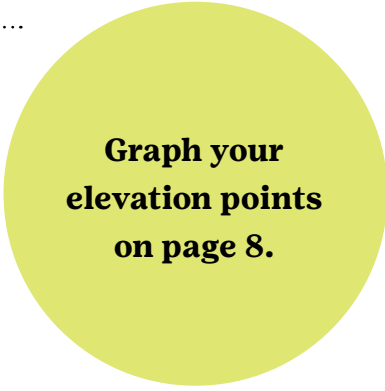
Calculate elevation changes on a sample topographic map.

Choose three points on the map on page 7. Write down each point's elevation and add them to the coordinate plane. Then, find the elevation change between each point.

Calculate elevation changes on a topographic map of your area. Find a topographic map with the route you chose in Step 2. Choose three points, find their elevations, graph them on a coordinate plane, and find the elevation change between each point.

Calculate elevation changes on any topographic map. Find a topographic map of anywhere in the world. Where will you go? What will you see? This could be the same place as Step 2 or somewhere new! Choose three points on the map and find their elevations. Graph them on a coordinate plane. Find the elevation change between each point.

► **For more fun:** Calculate your pace moving from different elevations.

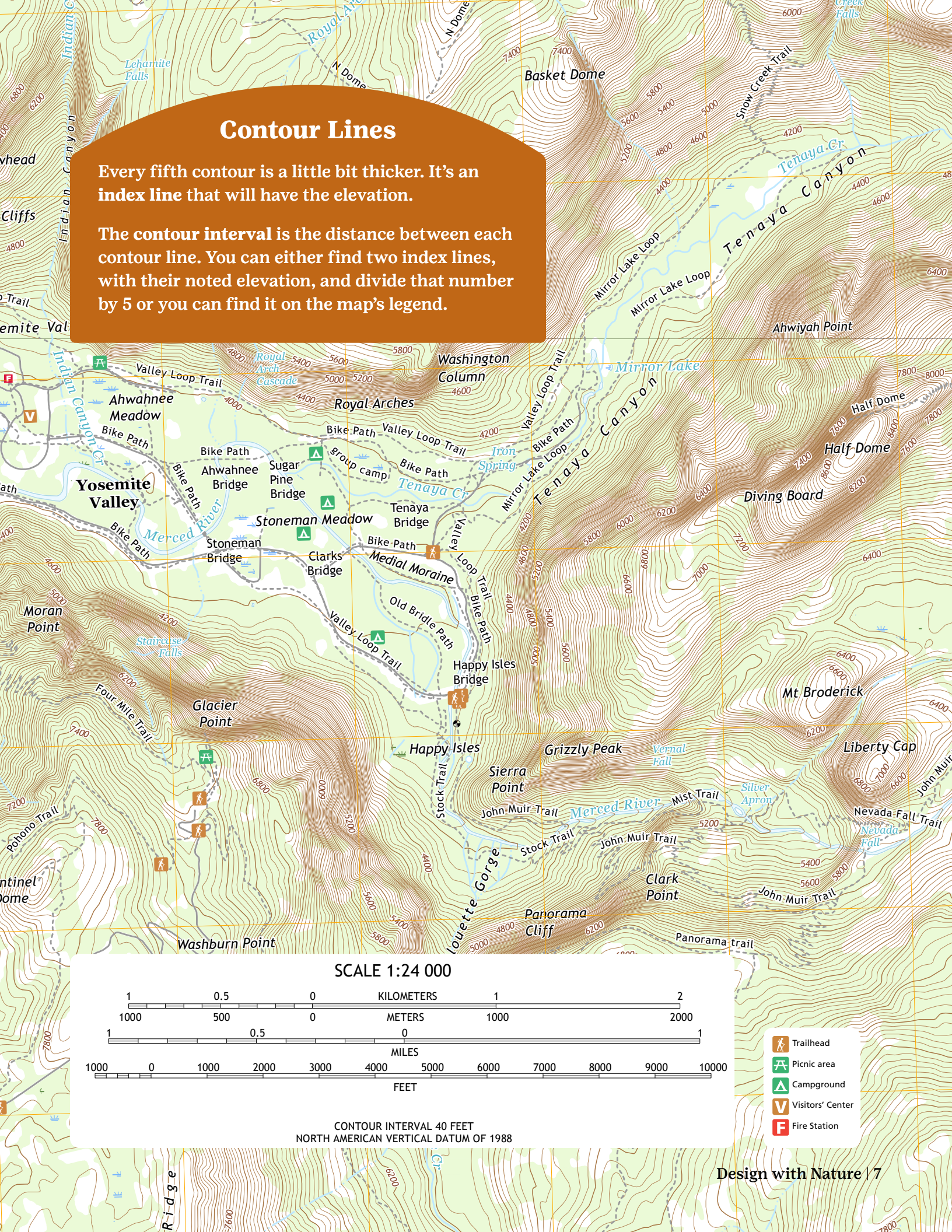


**Graph your
elevation points
on page 8.**

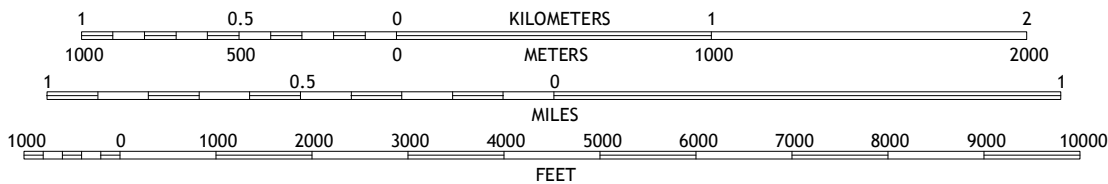
Contour Lines

Every fifth contour is a little bit thicker. It's an **index line** that will have the elevation.

The **contour interval** is the distance between each contour line. You can either find two index lines, with their noted elevation, and divide that number by 5 or you can find it on the map's legend.



SCALE 1:24 000



CONTOUR INTERVAL 40 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

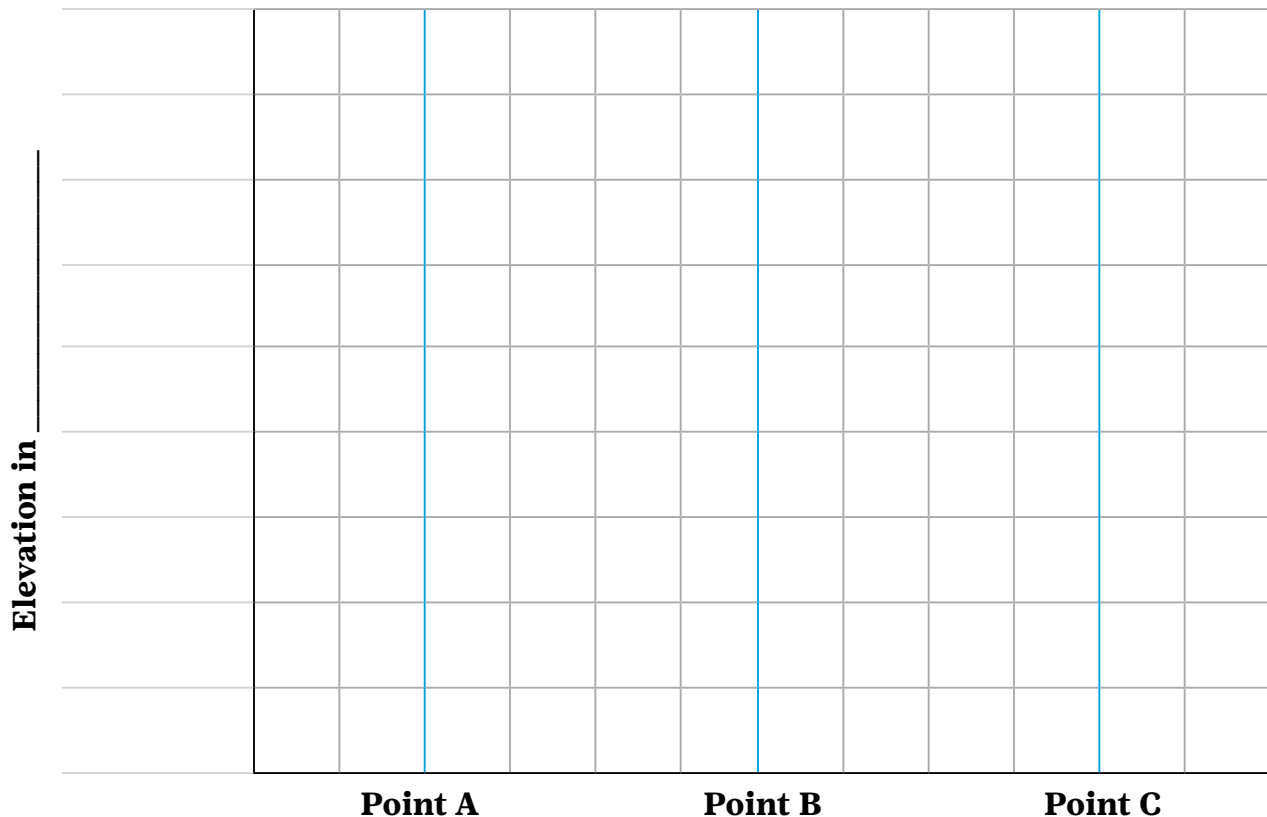
- Trailhead
- Picnic area
- Campground
- Visitors' Center
- Fire Station

How To Graph and Calculate Elevation Changes

1. Choose three points on a map and find their elevation.

Point A: _____ Point B: _____ Point C: _____

2. On the coordinate plane, add the unit of measure for elevation on the y-axis (vertical). Then graph the elevation above each point on the x-axis (horizontal).



3. Find the elevation change between each point by subtracting.

Elevation of starting point - Elevation of next point = Elevation change in feet

Elevation change from point A to point B = _____ feet or meters

Is this a: ☐ flat area ☐ steep **incline** (up slope)
☐ steep **decline** (down slope) ☐ gradual incline/decline

Elevation change from point B to point C = _____ feet or meters

Is this a: ☐ flat area ☐ steep **incline** (up slope)
☐ steep **decline** (down slope) ☐ gradual incline/decline

Step 4: Decide how much food to bring

Girl Scouts make sure to always be prepared! It's a good idea to take food with you, even on a short hike.

Foods like trail mix can help keep you energized on the hike. Trail mix is a combination of dried fruits, seeds, nuts, cereal, and anything else. If you're hiking all day, you may want lunch. And if you're camping, you might want a special treat like s'mores.

Choices—do one:

Make a snack for your hike. Use a trail mix recipe to figure out how many batches you'll need for the whole troop. Look at how many servings the recipe makes. Then calculate how much of each ingredient you'll need to feed everyone joining your adventure!

Pack lunch. For a full day of hiking, you'll need lunch. How about a sandwich and some fruit? How many loaves of bread will you need? List all the ingredients for your sandwiches. How much will you need of each ingredient? Now think about the fruit. If you choose fruit that doesn't come in an easy, single serving format like an apple, how much will you need? If you want to include something else in your menu, calculate how much of it you will need for everyone.

Enjoy your trip with a treat. As you relax around a campfire, you may want a yummy treat for yourself and the troop. Choose a recipe. How many servings does the recipe make? Figure out how many batches of the recipe and how much of each ingredient you'll need to make one portion for each person.



Important note:
Check for any food allergies and avoid those ingredients for all activity choices.

► **For more fun:**
Make the snack, lunch, or treat with your troop and enjoy!

Step 5: Pack for your adventure

If you were going camping, you'd need a tent and sleeping bags. The number of tents would depend on how big they were and how many people they could fit. Each person would need a sleeping bag. You'd also need supplies like food, water, and flashlights.

You can figure out how big your campsite needs to be by calculating the area. **Area** is the space inside of a flat object. You can calculate the area by multiplying length and width.

$$\text{Area} = \text{length} \times \text{width}$$

To make sure there's enough space in your bags or vehicle, you can find their volume.

Volume is the amount of space something takes up in three dimensions. You can calculate the volume by multiplying length and width and height.

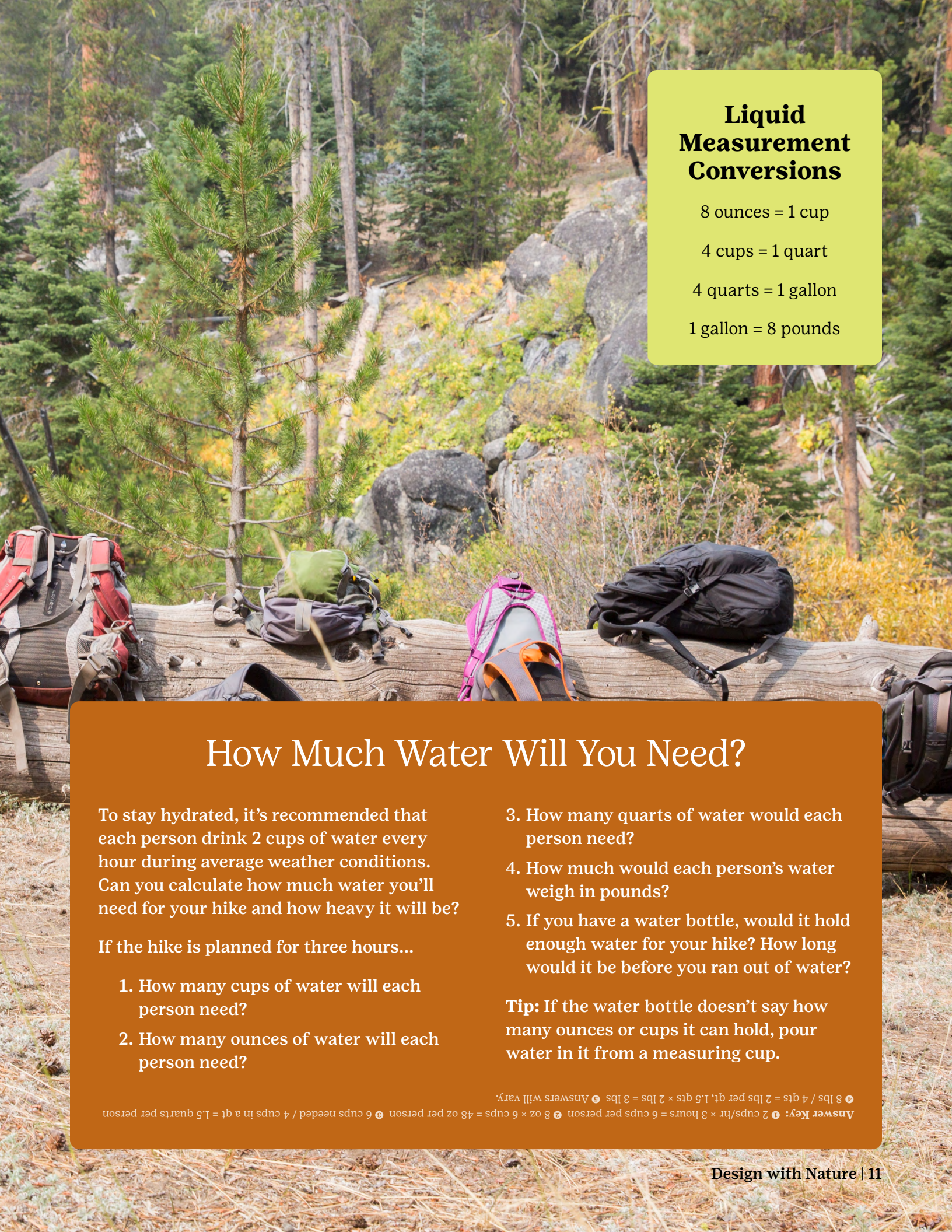
$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

Choices—do one:

.....
Pack your equipment. If you're carrying supplies, will your backpacks be big enough to fit them all? Calculate the volume of your backpack and gear to find out. First, measure and calculate the volume of your backpack. Then find the volume of each supply in the same unit of measure. Will everything fit? Pack it to see if your calculations are correct.
.....

Load your vehicle. If you're riding in a vehicle to the start of your adventure, find how many vehicles you'll need to transport people. Then, calculate the volume of each vehicle's trunk to see how much cargo it can hold. First, measure and calculate the trunk's volume. Then calculate the volume of each supply in the same unit of measure. Will all the equipment fit?
.....

Plan your campsite. Figure out how big your campsite needs to be by calculating the area of your tents and sleeping bags. How many people will fit in a tent? Measure and calculate the area of the bottom of a tent. Then find the area of a sleeping bag and pillow in the same unit of measure. Use graph paper to plan your campsite. How many tents will you need? Draw, cut out, and place rectangles to see how many tents and sleeping bags fit. Then build your campsite by pitching your tent (or outline it with masking tape), unrolling your sleeping bags (or towels!), and moving them to see if your plan works!



Liquid Measurement Conversions

8 ounces = 1 cup

4 cups = 1 quart

4 quarts = 1 gallon

1 gallon = 8 pounds

How Much Water Will You Need?

To stay hydrated, it's recommended that each person drink 2 cups of water every hour during average weather conditions. Can you calculate how much water you'll need for your hike and how heavy it will be?

If the hike is planned for three hours...

1. How many cups of water will each person need?
2. How many ounces of water will each person need?

3. How many quarts of water would each person need?
4. How much would each person's water weigh in pounds?
5. If you have a water bottle, would it hold enough water for your hike? How long would it be before you ran out of water?

Tip: If the water bottle doesn't say how many ounces or cups it can hold, pour water in it from a measuring cup.

Answer Key: ① 2 cups/hr × 3 hours = 6 cups per person ② 8 oz × 6 cups = 48 oz per person ③ 6 cups needed / 4 cups in a qt = 1.5 quarts per person ④ 8 lbs / 4 qts = 2 lbs per qt, 1.5 qts × 2 lbs = 3 lbs ⑤ Answers will vary.



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Volunteer's Guide to Junior Design with Nature*

Tips and ideas to help guide your troop through this badge. *This is the third 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: Find your hiking pace • 25–35 minutes

Ask: Would you want to be a cheetah or a turtle? What do you think are the benefits and drawbacks of moving fast? What about the benefits and drawbacks of moving slow?

Share: Animals move at many different speeds. A tortoise moves along slowly, a cheetah races past the other animals, and humans move at different paces. When you're planning a hike, it can be helpful to find your **walking pace** or how fast someone usually walks. If you're with a group, this can help you move at a speed that's comfortable for everyone.

Choices—do one:

- **Calculate your pace.** Before the activity, find a safe location and map out a quarter-mile route, like a track, neighborhood, gym, or building corridors. Choose your start and finish lines. Then take Juniors to the starting point for the activity. Have Juniors: 1) start the stopwatch, 2) walk together along the route (about 5–10 minutes), 3) check the time when they reach the finish line, and 4) write down the time. Then have them pair up to find their pace. Help them to: 1) divide the seconds by 60 to get a decimal for their quarter-mile time, 2) multiply the time by 4 to find their one-mile pace, 3) divide 60 minutes by the one-mile pace to calculate how many miles they can go in one hour, and 4) divide 180 minutes by the one-mile pace to find how many miles they can go in 3 hours. It may help to go step-by-step, writing each equation on chart paper or a whiteboard and showing how to round or simplify repeating decimals. Have Juniors compare answers. If you're meeting virtually, you can use 5 minutes to walk a quarter mile as the pace or Juniors can time themselves as they move a quarter mile before the meeting.

Materials: *Quarter-mile route in an accessible, safe place; stopwatch; chart paper or whiteboard and marker; paper; pencils; calculators (optional)*

- **Compare human and animal paces.** Have Juniors pair

up, choose some of their favorite animals, and research their walking pace. Then have them compare what they find with the average walking pace for a human (5 minutes for a quarter mile). Ask, "Are any animals very fast for short distances? Can any maintain a good speed for a longer time?" Have them calculate which of their animals would win for races like a marathon, 10,000 meters, 5,000 meters, 1,500 meters, 800 meters, or a 400-meter sprint.

Materials: *Paper; pencils; animal reference books with pace or smartphones, tablets, or laptops*

- **Calculate and compare different paces.** Using the instructions for Choice 1, have Juniors find and record their pace for a quarter mile. Then do it again, this time running, skipping, walking backwards, or doing something else, recording the group's pace for each kind of movement. Repeat as many times as time allows. If you're meeting virtually, Juniors can time themselves as they move a quarter mile each way before the meeting.

Materials: *Quarter-mile route in an accessible, safe place; stopwatch; chart paper or whiteboard and marker; paper; pencils; calculators (optional)*

STEP 2: Choose a hiking trail • 20–30 minutes

Ask: Have you ever followed a map? Where did it lead you? What did it show you?

Share: Maps can show you all different kinds of information, from the weather to the location of forests and the height of mountains. If you know where you want to explore, you can usually get a map of trails to help plan your trip. Hiking maps show landmarks and may even show how difficult a hike might be. They show different trails and a legend to explain any symbols and the scale. The scale tells you the length of the segment. A **segment** is a part of a whole.

Do: Look at the map on page 5 of the Junior Booklet. Point out some of the common features many maps have, like a

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

legend, scale, and symbols to represent landmarks, routes, and natural features. Then review “Types of Hikes” and “How To Choose a Hiking Trail” in the Junior Booklet.

Choices—do one:

- **Choose a trail on a sample map.** Have Juniors work in pairs with the map on page 5 and “How To Choose a Hiking Trail” in the Junior Booklet to identify a 3-hour hiking route. Demonstrate how to measure the distance of a hike by outlining the segments with string, cutting the string to that length, measuring the string, and using the scale to calculate the length of the trail. Encourage them to look for different hike options (described in “Types of Hikes” in the Junior Booklet) to see if they can find trail loops to maximize their 3 hours without backtracking on the same trail to get back to start or that go from point to point. Have Juniors share their route with the troop and explain why they chose them.

Materials: *Map on page 5 of the Junior Booklet; string or yarn; rulers; scissors; highlighters; pencils; paper*

- **Choose a trail on a map of your local area.** Have Juniors work in pairs with a hiking map or regular map of your local area. Demonstrate how to measure the distance of a trail by outlining the segments with string, cutting the string to that length, measuring the string, and using the scale to calculate the length of the trail. Have Juniors first identify local landmarks or places they might like to visit, such as in the woods or around town. Then help them to follow “How To Choose a Hiking Trail” in the Junior booklet to identify a 3-hour hiking route. When they’re done, encourage them to share their maps and plan a hike as a troop or with family and friends.

Materials: *Local trail map or any map of your area; string or yarn; rulers; scissors; highlighters; pencils; paper*

- **Choose a trail on any map.** Have Juniors pair up to find a hiking map of anywhere and identify a 3-hour hike. Demonstrate how to measure the distance of a trail by outlining the segments with string, cutting the string to that length, measuring the string, and using the scale to calculate the length of the trail. Have Juniors first identify important cultural, natural, or historical landmarks they might want to visit. Then help them to follow “How To Choose a Hiking Trail” in the Junior booklet to calculate distances and choose a route for their hike. Have Juniors share their route with the troop, and explain why they chose it.

Materials: *Travel books with hiking maps OR smartphones, laptops, or tablets to find trail maps; string or yarn; rulers; scissors; highlighters; pencils; paper*

STEP 3: Find changes in elevation on a map • 15–25 minutes

Ask: When you chose your hiking route, did you know if the trail was steep or flat? How would your pace change if the trail was steep or rocky?

Share: The type of **terrain** you’re on affects how fast you can go, like whether it is flat, steep, rocky, rolling, or wooded. A **topographic map** shows the terrain’s **elevation** or how high it is above **sea level**. A topographic map includes landmarks, like a regular map, but also has **contour lines** that show elevation.

Do: Look at the topographic map on page 7 of the Junior Booklet. Have Juniors: 1) find the **contour interval** (distance between each contour line) on the key or legend, 2) locate the **contour lines**, understanding that when they’re closer, the elevation is changing steeply and when they’re farther, the land is flatter—one side is uphill and the other is downhill, and 3) locate the **index lines** (thicker contour lines that occur every fifth line and show the elevation). Then review “How To Graph and Calculate Elevation Changes” in the Junior Booklet.

Choices—do one:

- **Calculate elevation changes on a sample topographic map.** Use the topographic map on page 7 of the Junior Booklet. Have Juniors follow “How To Graph and Calculate Elevation Changes” in the Junior Booklet to graph and calculate elevation changes.

Materials: *Map on page 7 of the Junior Booklet; pencils; paper; calculator (optional)*

- **Calculate elevation changes on a topographic map of your area.** Use a topographic map of your area. If possible, use one that corresponds to the map used in Step 2. Have Juniors follow “How To Graph and Calculate Elevation Changes” in the Junior Booklet to graph and calculate elevation changes. Ask Juniors to brainstorm what local landmarks they might be able to see from the higher elevations on the map.

Materials: *Topographic map that corresponds to the map used in Step 1 OR any topographic map of your area; pencils; paper; calculator (optional)*

- **Calculate elevation changes on any topographic map.** Use a topographic map from anywhere in the world. Have Juniors choose a map and follow “How To Graph and Calculate Elevation Changes” in the Junior Booklet to graph and calculate elevation changes.

Materials: *Topographic map that corresponds to the map used in Step 1 OR any topographic map; pencils; paper; calculator (optional)*

For more fun: Help Juniors calculate their pace moving from different elevations. Use the instructions in Step 1 if needed. Then ask, “How does going uphill or downhill change your pace? What’s your average going up and down on a trail?”

STEP 4: Decide how much food to bring

• 15–25 minutes

Ask: How much food will we need for the hike?

Share: It's a good idea to take food with you, even on a short hike. Food like trail mix can help keep you energized on the hike. If you're hiking all day, you may want lunch. And if you're camping, you might want a special treat like s'mores.

Choices—do one:

Important note: Check for any food allergies your troop members may have and avoid those ingredients.

- **Make a snack for your hike.** Show Juniors the trail mix or hiking snack recipe. Have Juniors calculate, based on the number of servings in the recipe, how many batches of the recipe will make enough for the whole troop. (For example, if a recipe makes 4 servings and there are 12 people, they would need to triple the recipe. $12 / 4 = 3$). Then have them calculate how much of each ingredient they will need. If needed, write out each calculation on chart paper or a whiteboard. If you brought ingredients, help Juniors make trail mix and divide an equal serving for each person (will take additional time).

Materials: *Trail mix recipe; paper; pencils; whiteboard or chart paper and marker*

- **Pack lunch.** Show Juniors the loaf of bread and have them calculate how many loaves they'd need to make sandwiches for everyone. Then have them pair up to: 1) decide what kind of sandwich to make, 2) list the ingredients, and 3) research the serving and package size of each ingredient. Then ask them to choose a fruit or veggie and calculate how many or much they'll need (if it doesn't come in an easy, single serving like an apple). Next, have them research and calculate how much they'll need of anything else, like chips or cookies. Finally, help them to create a grocery list with all the ingredients (for example: x loaves of bread, x slices of cheese, x slices of turkey, x heads of lettuce, x bottles of mustard, x apples or bunches of grapes, x large bags of chips). If you brought ingredients, help Juniors make the lunch and divide an equal serving for each person (will take additional time).

Materials: *Sample loaf of bread (or photo); laptops, smartphones, or tablets to research ingredients, serving, and package sizes; paper; pencils*

- **Enjoy your trip with a treat.** Have Juniors pair up to research and choose an easy camping dessert recipe. Using the serving sizes on the recipe for information about how many portions the recipe makes, have them figure out how many batches of the recipe and how much of each ingredient they'll need to make one portion for each person. Then have them make a shopping list. If

you brought ingredients, help Juniors make the treat and divide an equal serving for each person (will take additional time).

Materials: *Cookbooks with camping dessert recipes or laptops, smartphones, or tablets; paper; pencils*

For more fun: Help Juniors gather the ingredients and make the snack, lunch, or treat together with your troop and enjoy!

STEP 5: Pack for your adventure •

25–35 minutes

Ask: If we were going camping after our hike, what would we need to bring? What if we didn't have enough space to transport and carry equipment or set up camp? How could we plan ahead?

Share: If we were camping, we'd need tents, sleeping bags, food, water, and other supplies. We can use math to help us plan out our camping trip and make sure we have room for everything we need.

Do: Go over "How Much Water Will You Need?" in the Junior Booklet and help Juniors to calculate how much water they would need for a 3-hour hike, how much it would weigh, and if their water bottle is big enough for a 3-hour hike. If needed, write out the questions and show your calculations on chart paper or a whiteboard. Then, demonstrate how to calculate area and volume. Write the equation for area on the board or chart paper (**Area = length × width**) and have Juniors measure and calculate the area of a sheet of paper. Then write the equation for volume (**Volume = length × width × height**) and have Juniors measure and calculate the volume of a box.

Materials: *Whiteboard or chart paper and marker; box; paper; rulers; pencils; calculator (optional); water bottle (optional)*

Choices—do one:

- **Pack your equipment.** Have Juniors pair up, choose supplies and a backpack, and measure and calculate the volume of the backpack and the supplies (all in the same unit of measure, like cm or in). Remind them that volume is the length × width × height. Then have them use their measurements to place as many supplies as possible in their backpack. Remind them that some things can be attached to the outside of a backpack, too. Ask, "Did all of the supplies fit? If not, what will you leave behind?"

Materials: *Backpacks; variety of supplies for camping, like sleeping bags, water bottles, food, and flashlights (or random boxes and objects to pack); measuring tapes or rulers; paper; pencils*

- **Load your vehicle.** Show them the vehicle and ask, "How many vehicles will we need to make sure we have enough seats for everyone?" Next, have Juniors calculate the cargo or trunk space for the vehicle by measuring and calculating its volume. Remind Juniors that volume is the length × width × height. Then have them calculate the volume of different supplies in the same unit of

measure—inches, feet, or centimeters. Then have them use their measurements to place as many supplies as possible in the trunk of the vehicle. Ask, “Will all the supplies fit in the vehicles? If not, what will you leave behind?”

Materials: *Vehicle; backpacks and camping gear like sleeping bags, water bottles, food, flashlights, etc. (or random boxes and objects to pack); measuring tapes or rulers; paper; pencils*

- **Plan your campsite.** Have Juniors pair up or work in teams to measure the length and width of the floor of a tent and calculate its area (if you don’t have a tent, outline a base in masking tape). Then have them measure a sleeping bag and pillow using the same unit of measure—inches, feet, or centimeters. Ask, “How many people will fit in the tent? How many tents will we need?” Have them use graph paper to plan their campsite and check their calculations. They can even draw and cut out rectangles for each sleeping bag and pillow to move around and place in different positions. Remind Juniors to keep all the objects in the same scale. Then help Juniors to create their campsite by pitching the tent (or outline the base with masking tape), unrolling sleeping bags or towels, and moving them into the proper place to see if their calculations work in reality.

Materials: *Tent or masking tape; sleeping bag and pillow (or towels); measuring tape or ruler; graph paper; pencil; scissors (optional)*