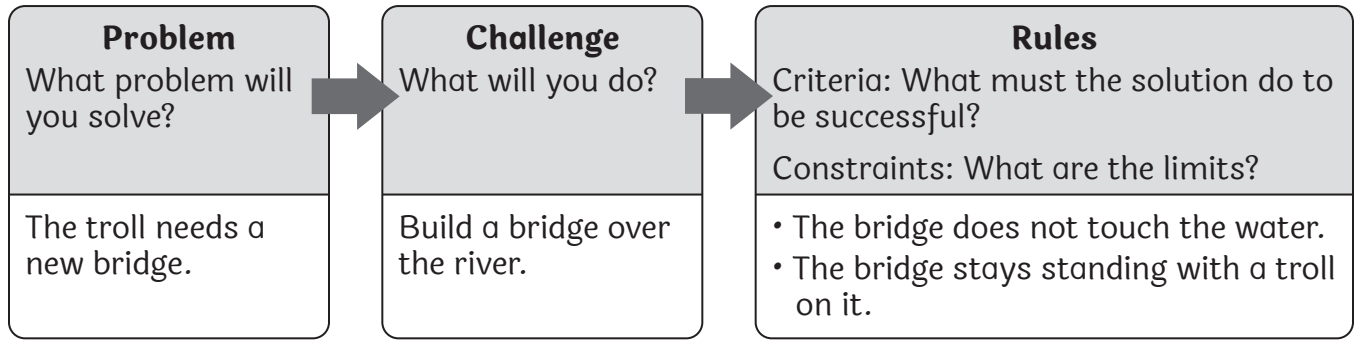


## PLOT SUMMARY:

Three goats want to cross the river to eat grass on the other side. When the troll under the bridge gets angry and smashes his own home, the goats help make things better.

## BRIDGE CHALLENGE:



## OTHER POSSIBLE PROBLEMS AND CHALLENGES:

Students can use the *Universal Challenge Pages* (pages 106–109) to create solutions to any of the problems below or problems they identify themselves.

<b>Problem</b>	Sprout the goat wants to help the troll out of the water.
<b>Possible Challenge</b>	<ul style="list-style-type: none"> <li>• Engineer a way to save the troll from the river.</li> </ul>

<b>Problem</b>	The troll needs a new home.
<b>Possible Challenge</b>	<ul style="list-style-type: none"> <li>• Add rooms under the bridge for the troll to live in.</li> </ul>

<b>Problem</b>	The goats want to get across the river.
<b>Possible Challenge</b>	<ul style="list-style-type: none"> <li>• Engineer a way for the goats to cross the river, such as a bridge, a raft or boat, a zip line, or a cable car.</li> </ul>

## MATERIALS:

**Required:** Create a “river” for students to build their bridges over. The wider the river is, the more difficult the challenge. A good size to start with is about 6–8 inches wide. If working outside, you can draw the river with chalk on a sidewalk or blacktop. If indoors, tape strips of blue paper end to end and tape them to the floor in a line. Provide each team with a small, identical wooden block or similar item for their “troll.” The heavier the weight, the more difficult the challenge will be.

**Suggested:** structural items such as wooden skewers, straws, craft sticks, cardboard, cardstock or index cards, dry spaghetti, plastic cutlery, paper or plastic cups, cardboard tubes, plastic containers, linking blocks; connectors such as paper clips, binder clips, string or yarn, rubber bands, tape

## LESSON PLAN:

1. Have students read the passage and discuss the problems they identified. Use these questions as prompts:
  - Do you know the story of the Three Billy Goats Gruff? What happens in the story? How is this story different?
  - What problems do the goats solve in this story?
  - Can you think of some other solutions to these problems?
2. Introduce the Bridge Challenge to students by reading Step 1 (page 30) together. You may want to write the rules for the challenge on the board or a chart.
3. Ask students to think about what they know about bridges that could help them in this challenge. You may want to build students’ prior knowledge by showing them pictures of different kinds of bridges, such as arch, beam, truss, and suspension bridges. Lead them to see that bridges have a base on each side that rests on the land and a span across the middle. Have students discuss the challenge and write or draw about their prior knowledge in the “What do we know about this?” section of Step 1 (page 30).
4. Give each group of students a small wooden block to be their “troll.” Tell them that they will test their bridge by placing their troll in the middle of the span. Let students know that if they want, they can draw and cut out a troll and tape it to their block. To differentiate this challenge, you could have some students test their bridges with heavier items, such as an unopened can of food or soda.
5. Show students the “river” so they can see how wide it is. Show them the available materials. As you hold up each material, prompt students to think about how they could use it. Give students a copy of Step 2 (page 31). Have them discuss their plan and then write or draw the materials they will use and what their bridge will look like. Ask them to label each base of their bridge and the span. Then give them access to the materials.

## LESSON PLAN:

6. You may want to have a conversation about what to do when a bridge fails. Remind students that when engineers are building and testing, things don't always go the way they planned. Is it okay for their bridges to break or fall down? Of course! Their bridges will probably fall down at least a few times. They just need to think about what went wrong and try another idea to make their bridge better.
7. Give students time to build their bridges. Circulate to observe and answer questions as students work on their solutions. When a team thinks their bridge is ready, give them a copy of Step 3 (page 32). Have them test their bridge by placing their troll in the middle of the bridge span. Then they should record their results and how they will improve their bridge.
8. Have students share their solutions with the class and get feedback from peers, then revise their designs and test again. Have them repeat the test-and-improve cycle until they are satisfied with their results.
9. When students have completed the challenge, have them explain their bridges to the class and demonstrate by placing their troll in the middle of their bridge span. Then have them fill out Step 4 (page 33).
10. If time, allow students to choose their own problem and testing setup and use the *Universal Challenge Pages* (pages 106–109) to complete their challenge.

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

**Directions:** Read the passage and underline the problems the characters have to face. Write and/or sketch your ideas for solutions in the margins.

## THREE GOATS

Once upon a time, there lived three goats. Sprout was the smallest goat. Flora was the biggest goat. Clover was in between.

All three goats ate sweet, green grass on the side of a hill. One day, Sprout looked up from eating grass. He saw another hill across a river.

“The grass on that hill looks so good,” he said. “I think I’ll go over there and try it!”

The little goat had to cross the river to get to the other hill. He walked along the edge of the river. He found a bridge. Trip-trap, trip-trap went his hooves as he walked onto the bridge.

When he was halfway across the bridge, he heard a booming voice! “WHO’S THAT TRIP-TRAPPING OVER MY BRIDGE?”

“I am only a little goat,” Sprout replied in a shaky voice. “I want to go across the river.”

A huge troll jumped up from under the bridge. “THIS IS MY BRIDGE!” roared the troll.

The troll jumped up and down on the bridge. It began to crack. Sprout backed away. He watched as the bridge broke and the troll fell into the water!

“I’ll save you!” called Sprout.

He ran to the river. He leaned his head toward the troll and said, “Grab my horns!”

The troll grabbed on and the strong little goat pulled him to the edge of the water. As the troll climbed out of the river, he looked sad.

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

## THREE GOATS

“I’m sorry I yelled at you. I was only trying to protect my home.” A huge tear rolled down the troll’s cheek as he said, “My home was under that bridge.”

“Oh, no!” said Sprout. He wanted to help the troll. “I will go get my big sisters. They will help.”

So little Sprout ran up the hill. He called to Clover and Flora, “Oh, sisters! Come quickly! I need your help!” He told them what had happened.

All three goats trotted down to the river. The troll was sitting with his head in his hands.

“We are sorry about your home,” said Clover.

“We will help you build a new bridge. You can build a home underneath it,” said Flora.

So Sprout, Flora, and Clover helped the troll build a new bridge. They started by building a base on each side of the river. Then they built the span across the river. They made the bridge big and strong. They left plenty of room underneath for the troll’s home.

“How can I ever thank you?” asked the troll.

“We want to go across the river,” said Sprout. “We want to eat sweet, green grass on the other side.”

“No problem!” said the troll. He let the three goats trip-trap, trip-trap carefully over his bridge to get across the river. They trotted up the hill and munched on the sweet, green grass.

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

## STEP 1: PREPARE FOR THE CHALLENGE

### What will we do?

We will build a bridge over the river.

### What are the rules?

- The bridge does not touch the water.
- The bridge stays standing with a troll on it.

### How will we know it works?

We will know our bridge works when we can put our troll on it and it stays standing.

### What do we know about this?

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

**STEP 2: BRAINSTORM, PLAN, AND BUILD**

What materials will we use to build our bridge?

What will our bridge look like?

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

**STEP 3: TEST, IMPROVE, AND SHARE**

We tested our bridge. This is what happened:

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How can we make our bridge better?

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Share the bridge with the class. Make the bridge better until it meets all the rules!



NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

**STEP 4: REFLECT**

Did our bridge touch the water?

Yes

No

Did our bridge stay standing when we put the troll on it?

Yes

No

This part was easy:

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This part was hard:

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I learned this:

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