**Lesson Four:**

**Generalization and Analysis Questions**

|  |  |
| --- | --- |
| Part | Content |
| Part 1 | Introduction to Generalization Questions |
| Part 2 | Introduction to Analysis Questions |
| Part 3 | Practice: Generalization and Analysis Questions |

# **Overview**

The purpose of this discourse lesson is to introduce generalization and analysis questions as two types of authentic questions. Generalization questions and analysis questions are two types of questions that are called high-level thinking questions. These questions create opportunities for promoting high-level thinking and reasoning during task-based mathematics discussions. The teacher will introduce students to generalization and analysis questions by building on what students already know about authentic questions. Students will also practice creating these questions in a small-group activity.

# **Objectives**

At the end of this lesson, students will be able to:

* identify generalization and analysis questions, and
* create generalization and analysis questions.

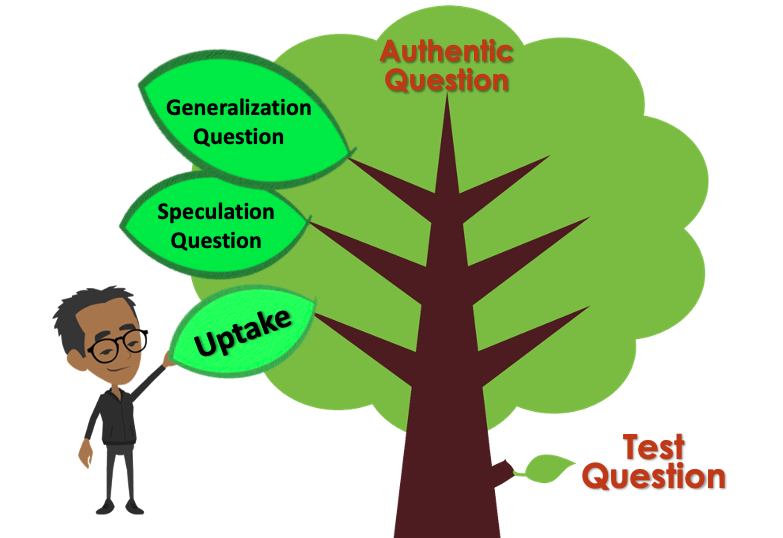
# **Materials**

Question tree

Sticky notes

### **Part 1: Introduction to Generalization Questions**

### **[Slides 3-4: Question Tree]**

Remind students about the type of authentic question introduced in the previous lessons: uptake questions and speculation questions. Uptake is when someone asks a question about what someone else already said or asked. Speculation questions are questions that require you to consider alternative possibilities. Let students know that they are going to learn about another type of authentic question called a generalization question.

A generalization question is one type of authentic question that is near the top of the tree where there are many branches and leaves because this type of authentic question stimulates rich discussions about the math problem and promotes high-level thinking.

### **[Slide 5: Generalization Questions]**

Explain that generalization questions are questions that require you tofind patterns, relationships, and general ideas by

* putting different parts together, and
* finding a general rule/theme.

Generalization questions can sound like:

* *“****What patterns or relationships*** *do you notice in this problem?”*
* *“****What*** *is the* ***general idea*** *in this math problem?”*

### **[Slide 6: Example 1]**

Remind students that we ask questions about math problems that will help us solve the problem.

Read the math problem is the purple box: Consider different rectangles that have a perimeter of 36 feet. What is the largest area that such a rectangle could have?

Then read the example conversation.

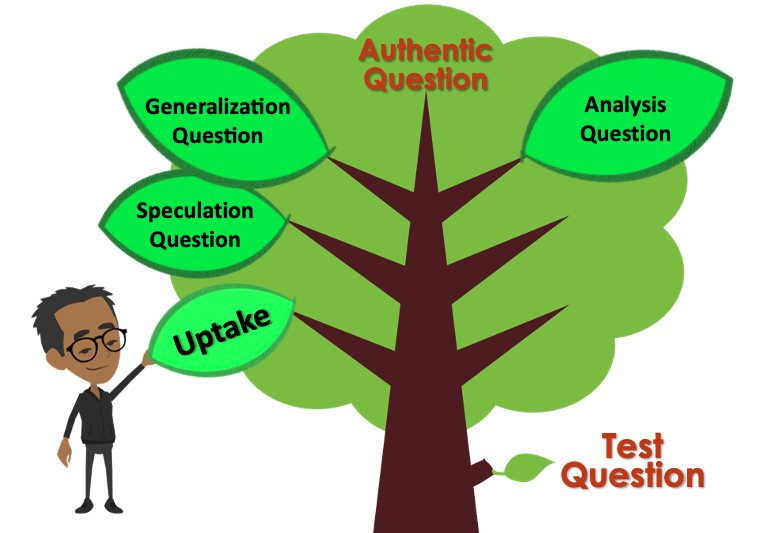
|  |  |
| --- | --- |
| Carlos | What do all rectangles have in common? |
| Catherine | All rectangles have opposite sides that are parallel and equal lengths, which means that perimeter is two times length plus width. |
| Naomi | Also, the angles inside a rectangle are all 90 degrees. |

In this example, Carlos, Catherine, and Naomi are discussing the math problem on the right. Jason starts off asking a generalization question about the math problem, **“What do all rectangles have in common?”** This generalization question asks about the characteristics that all rectangles have in common.

Catherine and Naomi answer the generalization question by providing different characteristics that all rectangles have in common and that distinguish them from other shapes. Ask students if they can think of any characteristics that all rectangles have in common (e.g., the diagonals bisect each other).

### **Part 2: Introduction to Analysis Questions**

### **[Slides 8-9: Question Tree]**

Remind students that they have now learned about three kinds of authentic questions: uptake questions, speculation questions, and generalization questions. Let students know that they are going to learn about another type of authentic question called an analysis question.

An analysis question is one type of authentic question that is near the top of the tree where there are many branches and leaves because this type of authentic question stimulates rich discussions about the math problem and promotes high-level thinking.

### **[Slide 10: Analysis Questions]**

Explain that analysis questions are questions that require you to **break down ideas** by:

* looking at different ideas in the math problem, and
* understanding how ideas relate to each other.

Analysis questions can sound like:

* *“****How do you know*** *that …?”*
* *“****Why*** *do/does …?”*

### **[Slide 11: Example 1]**

Read the math problem is the purple box: Consider different rectangles that have a perimeter of 36 feet. What is the largest area that such a rectangle could have?

Then read the example conversation.

|  |  |
| --- | --- |
| A cartoon of a child  Description automatically generated  Naomi | Why do the rectangles with similar length and width seem to have larger areas than rectangles with very different length and width? |
| Catherine | Rectangles with similar length and width are more like squares. When the sides are all the same length, the rectangle seems to have the most space inside. |

In this example, Naomi starts off asking an analysis question about the math problem, **“Why do the rectangles with similar length and width seem to have larger areas than rectangles with very different length and width?”** This analysis question requires breaking down ideas about length and width and how they are related to the area of a rectangle.

Catherine answers the analysis question by explaining why rectangles with similar length and width would have larger areas.

### **[Slides 12–14]**

**Practice: Authentic Questions and Test Questions**

### **[Instruction]**

# In this practice, a cooperative-grouping situation (3-5 students) is recommended where students can take a shared role in generating generalization and analysis questions about the math problem and practicing responding to them.

### **[Before]**

Have the students read “Jeffrey’s multiplication problem” again. Let students know that they will be focusing on asking and responding to generalization and analysis questions based on this math problem.

### **[During]**

Each small group should come up with at least two generalization questions and two analysis questions about the math problem and write their questions on sticky notes (one question on each sticky note). Students can practice responding to them to figure out whether they are good generalization and analysis questions.

### **[After]**

* Have one student from each group place their sticky notes on the Question Tree slide that is projected onto the board *or* the Question Tree poster. Students should place the notes in the appropriate location (i.e., by the speculation question leaf).
* Have students give feedback to the other groups’ questions. If repeated questions come up, cluster them into groups so that they can be addressed at the same time.
* If time permits, select one question and allow students to discuss in small groups.
* For future activities, collect all questions that were generated by students.