

Deductive Reasoning and Conditional Statements

Unit 2: Logic and Reasoning • Day 2 of 11

At a Glance

Pacing: ~45 min tasks + curated gallery walk • ~45 min consolidation (guided notes + CYU begins)

Materials: Boards and markers • Skyscraper puzzle printed or projected

Nav instrument rows active: Row 1 spiral • Row 2 (Deductive Reasoning) activates • Row 3 (Conditional Statements) activates, Basic level only

Opening move: Direct callback to the circle task failure — do this before revealing the tasks

OBJECTIVES

By the end of this lesson students can:

- Define deductive reasoning and contrast it with inductive reasoning.
- Identify the hypothesis and conclusion of a conditional statement.
- Write a conditional statement in if-then form with symbolic notation $p \rightarrow q$.
- Explain why formal logic requires more precision than everyday language.

NARRATIVE ARC

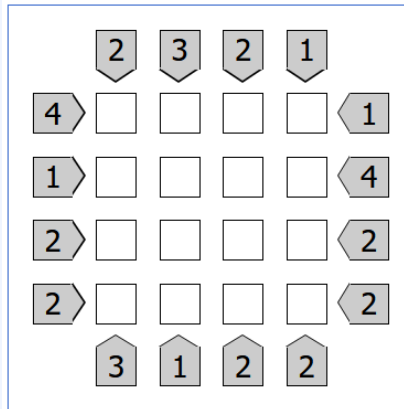
 **Narrative Arc** — Open class — before revealing the tasks

“Last class, inductive reasoning let us down. We checked five cases, felt confident, and the pattern broke. If we cannot trust patterns alone, what can we trust? You are about to use the answer. You just don’t have a name for it yet.”

TASKS

Task 1 — Skyscraper Puzzle (~25–30 min)

Project or distribute the puzzle. Give rules only — no strategy hints.



Rules to display:

- Heights range from 1 (shortest) to 4 (tallest). No two of the same height in the same row or column.
- Numbers on outside edges = how many buildings are visible from that direction. Taller buildings block shorter ones behind them.

! Critical instruction — say this before groups begin

As you place each number, write one sentence explaining why it must go there. You cannot place a number without a written reason.

Without this, groups guess and check. With it, they reason from necessity — and that is deductive reasoning before it has a name.

What to listen for: chains of reasoning: 'This column already has 3 and 4, so this cell must be 1 or 2. The visibility clue says only one building is visible from this side, so the tallest must be first — therefore this cell is 4.' Ask: 'How do you know that number belongs there?'

Extension ladder: Can they design their own solvable puzzle? What makes a puzzle have exactly one solution?

Task 2 — The Lunch Party (≈20 min)

Five women have lunch together at a circular table. Match first names with surnames.

- Ms. Osborne is sitting between Ms. Lewis and Ms. Martin.
- Ellen is sitting between Cathy and Ms. Norris.
- Ms. Lewis is between Ellen and Alice.
- Cathy and Doris are sisters.
- Betty is seated with Ms. Parkes on her left and Ms. Martin on her right.

Source: *Thinking Mathematically* by Mason, Burton, and Stacey

Answer

Alice Norris, Betty Lewis, Cathy Martin, Dorris Parkes, Ellen Martin.

*thank you to Heather Loechele for the correction.

Scaffolding: Connect to Unit 0: drawing a circular diagram is a form of organizing. Ask: 'What did drawing the circle do for you?'

If groups are stuck: 'What do you know for certain from the first clue? Write it down. What does that rule out?' Do not give the solution.

Extension ladder: Can they rewrite each clue as an if-then statement?

CURATED GALLERY WALK

During group work, identify boards to spotlight in order. Look for:

- A board with a productive error or incomplete reasoning — start here.
- A board with a correct solution and clear written justifications — end here.
- Any group that drew a circular diagram for the lunch party — highlight explicitly.

Direct student attention: 'Everyone look at this board. What did this group do here? Do you agree with their reasoning?' Move from less complete to more complete.

WHAT TO WATCH FOR

Watch for

Skyscraper puzzle: Groups guessing and checking without written justifications. Redirect: 'You placed a 3 there — write one sentence saying why it must be 3.'

Both tasks: Listen for chains of if-then reasoning. Note these groups for the gallery walk.

Language precision: Students who infer 'if it rains, we stay inside' from 'if it doesn't rain, we go outside.' Do not correct during the task — surface this in consolidation.

CONSOLIDATION

After the gallery walk, ask: how did you solve these puzzles? Was it the same kind of thinking as last class? Students will land on: you had to follow the rules, you couldn't just guess, or: if this was true, then that had to be true.

The key contrast — draw this explicitly

Inductive reasoning: observing patterns, making generalizations. Conclusions are probably true.

Deductive reasoning: if the premises are true and the structure is valid, the conclusion must be true. Not probably — must. That difference is what today is about.

Then move to guided notes. Vocabulary is genuinely new here — use guided notes. For each term, introduce the definition then ask students to find an example from the tasks before writing a geometric example.

Language precision — say this, then plant the question

Write on the board: 'If it doesn't rain, we will go outside.' Ask: what does this tell you about what happens if it does rain? Most students will say: we stay inside. Ask: does it actually say that?

Students who infer the rain case are being good conversational partners, not being sloppy. Logic does not follow conversational conventions. Frame this as a feature of the subject.

Second example: 'If you eat your vegetables, you can have dessert.' What happens logically if you don't? Nothing is guaranteed. Brief discussion.

Then write and leave unresolved: 'If a watched pot never boils, does that mean an unwatched pot must boil?' No resolution yet — returns in Lesson 2.2b and is formally named in Lesson 2.4.

DEFINITIONS AND KEY POINTS

Deductive Reasoning

The process of drawing conclusions that must follow from accepted premises and logical structure. If the premises are true and the argument is valid, the conclusion cannot be false.

Conditional Statement

An if-then statement with two parts: the hypothesis (what follows 'if') and the conclusion (what follows 'then').

$p \rightarrow q$ where p is the hypothesis/antecedent and q is the conclusion/consequent

Vocabulary note worth 60 seconds

Antecedent = 'what comes before' (same root as anterior, antebellum). Consequent = 'what follows' (Latin con + sequi). Students who know the roots can reconstruct fallacy names in Lesson 2.4 without memorizing arbitrary labels.

STUDENTS MAKE NOTES ON

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 Students make notes on:

- Definition of deductive reasoning — contrasted explicitly with inductive reasoning from Lesson 2.1
- Conditional statement: hypothesis and conclusion labeled in a geometric example; symbolic form $p \rightarrow q$
- Vocabulary: hypothesis/antecedent, conclusion/consequent with Latin roots noted
- Language precision note: everyday language allows inferences that logic does not

CONNECTION POINTS

Draws from

- Lesson 2.1: the circle task failure is the direct motivation — open with the callback
- Unit 0: organizing evidence; drawing as problem-solving (lunch party)

Feeds into

- Lesson 2.2b: the conditional statement is transformed into four forms
- Lesson 2.4: antecedent/consequent vocabulary appears in all four argument form names
- Unit 3 onward: every proof is a chain of conditional statements