Simple Inequalities

(Also available in [WeScheme](#))

Students identify solutions and non-solutions of inequalities using an interactive starter file. This lesson also reviews the `Boolean` datatype.

Lesson Goals	Students will be able to: • Describe the solution set of a simple inequality
Student-Facing Lesson Goals	• Let's find solutions and non-solutions to inequalities.
Prerequisites	• [Simple Data Types](#) • [Contracts](#)
Materials	• [PDF of all Handouts and Page](#) • [Boolean Starter File](#) • [Simple Inequalities Starter File](#) • [Lesson Slides](#) • [Printable Lesson Plan](#) (a PDF of this web page)
Supplemental Materials	• [Additional Printable Pages for Scaffolding and Practice](#)
Supplemental Resources	• [Booleans Review](#)

Key Points for the Facilitator	• A *Boolean* is just another *data type*, like Numbers or Images. But unlike those types, there are only *two* values: `true` and `false` . While simple to explain, this different behavior can be confusing for some students. • Boolean-producing functions are essentially yes-or-no questions, so the names of the functions in this lesson read like questions. • For example, `is-odd` and `is-even` are both functions that ask if a given number is odd or even. }

Glossary

Boolean :: a type of data with two values: true and false

data type :: a way of classifying values, such as: Number, String, Image, Boolean, or any user-defined data structure

equation :: a statement that two expressions are equal

inequality :: a mathematical description of the relationship between two variables or quantities, in which they are not necessarily equal

solution set :: the set of all values or coordinate pairs that will make an equation, inequality, set of equations or set of inequalities true

Booleans   *20 minutes*

Overview

While students have been cursorily introduced to the *Boolean* data type in our [Simple Data Types](#) lesson, Booleans are so different from other data types and so foundational to inequalities that this section reintroduces students to Booleans (by way of Circles of Evaluation and a starter file) in preparation for working with inequalities in the second section of the lesson.
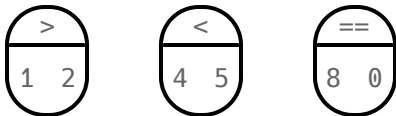
Launch

Students should be logged into [code.pyret.org (CPO)](#).

Ask students to evaluate Circles of Evaluation for simple expressions they've seen before, and ask them to convert them into code.

Then show them unfamiliar Circles of Evaluation, and ask them to hypothesize what they think they mean, what they will evaluate to, and what the code would look like.

Have students convert these Circles to code and type them in. What did they evaluate to? What do they think the outputs mean?

Values like `true` and `false` obviously aren't Numbers or Images. But they also aren't Strings, or else they would have quotes around them. We've found a *new data type*, called a *Boolean*.

Investigate

Have students open the [Boolean Starter File](#).

- Explore the five functions in this starter file: `is-odd`, `is-even`, `is-less-than-one`, `is-continent`, and `is-primary-color`
- All five functions produce *Booleans*. Through your exploration, see if you can come up with an explanation of what a *Boolean* is.

A **Boolean** is just another **data type**, like Numbers or Images. But unlike the others there are only two values: `true` and `false`.

- Turn to [Boolean Functions](#) and use the starter file to complete the questions, identifying inputs that will make each function produce `true`, and inputs that will make each function `false`.

Common Misconceptions

- Many students - especially traditionally high-achieving ones - will be very concerned about writing examples that are "wrong." The misconception here is that an expression that produces `false` is somehow *incorrect*. You can preempt this by explaining that our Boolean-producing functions *should sometimes return false*.

Synthesize

- Students will see functions on this page that they've never encountered before! But instead of answering their questions, encourage them to make a *guess* about what they do, and then type it in to discover for themselves.
- Explicitly point out that *everything they know still works!* They can use their reasoning about Circles of Evaluation and Contracts to figure things out.

Introducing Inequalities   *20 minutes*

Overview

Students discover (or expand their understanding of) inequalities by identifying solutions and non-solutions and connecting expressions to graphic representations.
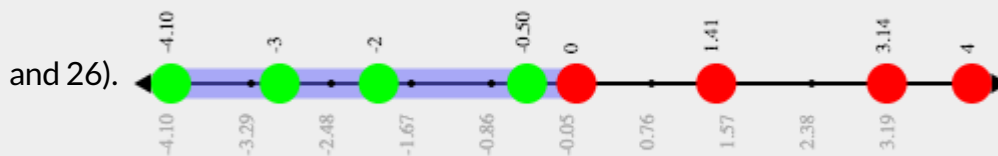
Launch

> How are equations different from inequalities?

Equations typically have finite solution sets: there's only one answer for an unknown, or perhaps several answers. *Inequalities*, on the other hand, can have *infinite* solutions. Inequality expressions divide all of the numbers in the universe into two categories: solutions and non-solutions.

It is important that students learn to recognize that there are many possible solutions and non-solutions to an inequality and are able to identify whether or not a given number is or isn't part of the solution set.

> - We are going to practice identifying whether or not a given number is part of the *solution set*.
> - Open the [Simple Inequalities Starter File](#) and click "Run".
> - Look at the graph that appears (image below), as well as the provided code (lines 10, 18,
>
> and 26).
>
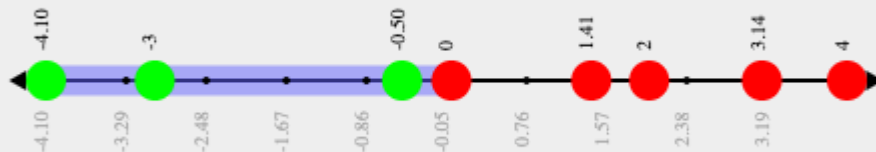>
>
> - What do you Notice? What do you Wonder?

Students might observe the following:

- This starter file includes a special `inequality` function that takes in a function *(which tests numbers in an inequality)* and a list of 8 numbers *(to test in the function)*.
- When we click "Run", we see a graph of the inequality on a number line.
- The solution set is shaded in blue.
- The 8 numbers provided in the list are shown as dots on the numberline. They will appear:
  - green *when they're part of the solution set*

- red *when they are non-solutions*

> - Look at line 18. Edit the list of values by deleting *one* of the `–` symbols.
> - Hit "Run". Examine the graph that appears (sample image below).
>
>
>
> ### Challenge yourself: Find 4 true examples and 4 false
>
> - How is this graph different from the one you first produced?

A successful input in this starter file will include 4 solutions and 4 non-solutions; in other words, the image returned will show 4 green dots and 4 red dots.

When students modify the list of numbers, they will see there are now 5 red dots and 4 green dots - along with a message that says, *"Challenge yourself: Find 4 true examples and 4 false"*.

Investigate

> - Complete Simple Inequalities with a partner, identifying solutions and non-solutions to each inequality and testing them in the Simple Inequalities Starter File.
> - For each inequality, you must find four solutions and four non-solutions.
> - Try using negatives, positives, fractions and decimals as you generate your lists.

Synthesize

- What patterns did you observe in how the inequalities worked?

Additional Exercises

- [Word Problem: is-hot](#)