



# Coding and Inequalities

[Task Description](#)

[Prior Learning and Placement of Task during Semester](#)

[Diagnostic Task & Look fors](#)

[The Task](#)

[Teacher Notes](#)

[Assessment](#)

[Additional Resources](#)



# Coding and Inequalities

## Task Description

In this task students will extend prior learning about inequalities (solving and graphing on a number line with one variable) to graphing inequalities on a Cartesian Plane with two variables. They will read code in Scratch that involves variables and inequalities to predict the outcome, and alter the code to create a new outcome.

The task is available to be used as a Desmos Activity or in slides.

*This task has been adapted from - [4 Inequality Puzzles](#)*

## Big Idea

- Inequalities are similar to equations but different
- Inequalities with two variables can be graphed on a Cartesian Plane
- There are a whole bunch of points in a certain area on a Cartesian Plane that satisfies an inequality
- Coding can be used to represent mathematical concepts

## Duration

1 or 2 periods (75 -150 minutes)

## Recommended Materials

- A device or Chromebook for each student (phones are not recommended)
- Access to any of the following applications:
  - [Google Sheets](#)
  - [Desmos](#) (free web based program, no sign in required; Students can create an account to save their work)
  - [Scratch](#) (free web based program, no sign in required; Students can create an account to save their work)

## Learning Goal(s)

- Students will read code to predict an outcome
- Students will alter code to change an outcome
- Students will learn how coding can be used to demonstrate an understanding of algebraic concepts
- Students will learn how an inequality is represented on a Cartesian Plane

## Sample Success Criteria

- I can read code to predict an outcome
- I can alter code to represent a similar mathematical situation
- I can graph an inequality using technology and explain why a region of the graph is shaded

## Overall Expectations

### **AA1. Social-Emotional Learning Skills**

develop and explore a variety of social-emotional learning skills in a context that supports and reflects this learning in connection with the expectations across all other strands

### **A1. Mathematical Processes**

apply the mathematical processes to develop a conceptual understanding of, and procedural fluency with, the mathematics they are learning

### **B1. Development of Numbers and Number Set**

demonstrate an understanding of the development and use of numbers, and make connections between sets of numbers

### **C2. Coding**

apply coding skills to represent mathematical concepts and relationships dynamically, and to solve problems, in algebra and across the other strands

### **C4. Characteristics of Relations**

demonstrate an understanding of the characteristics of various representations of linear and non-linear relations, using tools, including coding when appropriate



# Coding and Inequalities

## Social-Emotional Learning (SEL) Skills

- Recognizing and Identifying Emotions That Support Mathematical Learning
- Recognizing Sources of Stress That Present Challenges to Mathematical Learning
- Identifying Resources and Supports That Aid Perseverance in Mathematical Learning
- Building Healthy Relationships and Communicating Effectively in Mathematics
- Developing a Healthy Mathematical Identity Through Building Self-Awareness
- Developing Critical and Creative Mathematical Thinking

\* This overall expectation is to be included in classroom instruction, but not in assessment, evaluation, or reporting. See [further information](#) about approaches to instruction that support all students as they work to apply mathematical thinking, make connections, and develop a healthy identity as mathematics learners to foster well-being and the ability to learn mathematics.

## Mathematical Processes

There are opportunities for students to engage in the [mathematical processes](#) throughout this task. For example:

- **Problem Solving:** critical thinking, math identity, knowledge, collaboration, lived reality, creative thinking, confidence
- **Reasoning and Proving:** justification, algebraic reasoning, spatial reasoning, numbers, operations
- **Reflecting:** identify what is working, what isn't working, appropriate strategy
- **Connecting:** connect different mathematical concepts
- **Communicating:** share ideas, understandings and solutions, provide feedback, pose questions
- **Representing:** represent math relationships using pictures, diagrams, numbers and symbols
- **Selecting Tools and Strategies:** test, revise, confirm reasoning, remembering how they solved a problem

## Prior Learning and Placement of Task during Semester

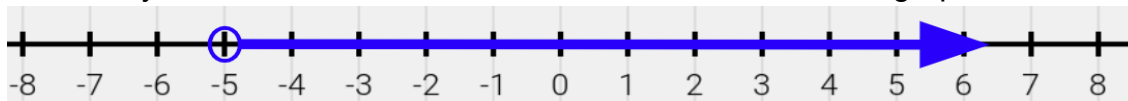
This task should come later in the semester when students have experienced some introductory coding in Scratch as well as learning around linear relations.

## Diagnostic Task & Look fors

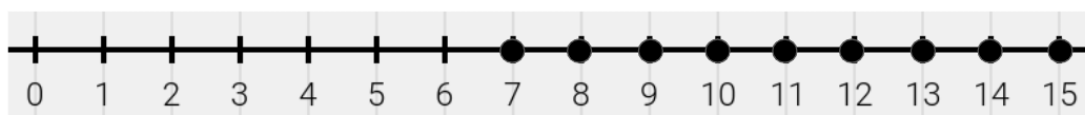
### Diagnostic Questions\*

Click [here](#) for the following questions in Google Docs. Click [here](#) for the questions in Google Slides.

1. How would you describe the numbers shown on the number line graph below?



2. The following number line graph represents the inequality  $2n > 12$ , where  $n$  is a whole number.

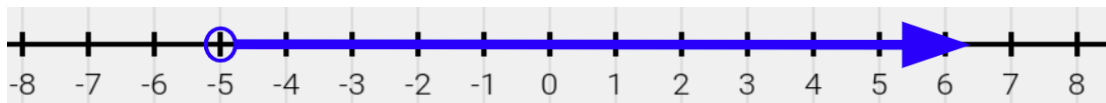


- Explain why this is the correct graph for the inequality.



## Coding and Inequalities

3. The following number line graph represents the inequality  $2x - 3 > -13$ , where  $x$  is a real number.



- Explain why this is the correct graph for the inequality.
- Test an integer, rational number and irrational number from the number line to show that the solution is true.

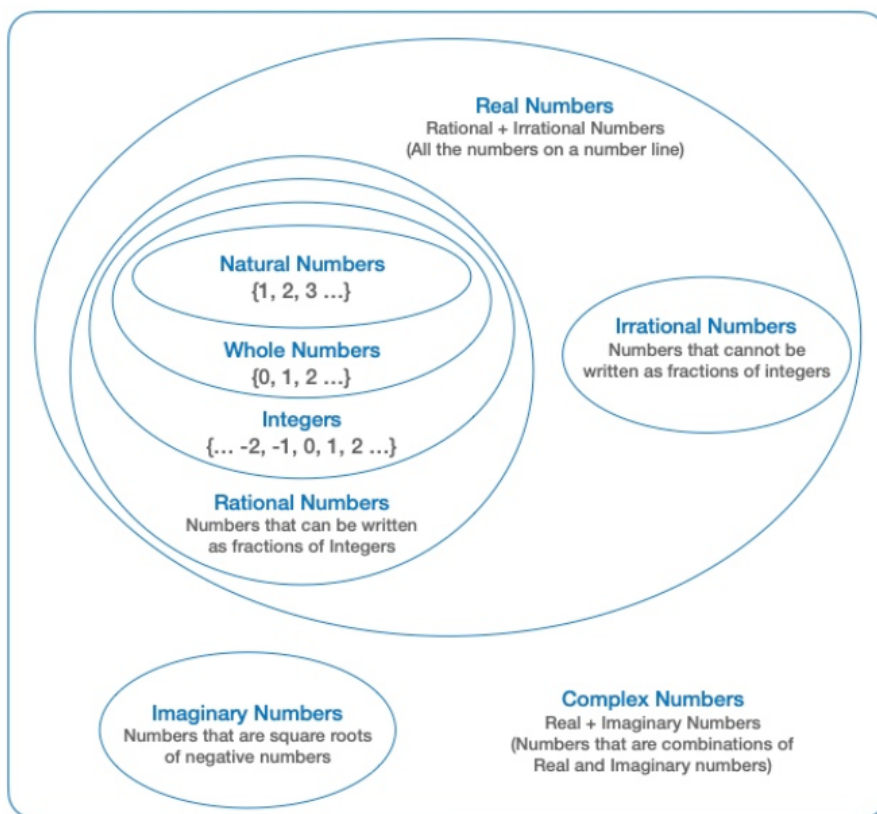
### Look Fors

- Is able to identify different types of numbers (integer, rational number, irrational) on a number line
- Can select a value from number line that holds true for an inequality and input the value for the variable to show it satisfies the inequality
- Can read the inequality symbol correctly as “greater than” or “less than”
- Has a strategy to solve an inequality (guess and check, reverse flow chart or balance)
- Can make connections between solving inequalities and solving equations
- Understands an inequality has a range of solutions, where as an equation has one solution

*\*Solving inequalities is new to the 2020 elementary math curriculum (starting in grade 4) so students may or may not have prior learning with this concept. Grade 6's will solve inequalities that involve two operations and whole numbers up to 100, and verify and graph the solutions. Grade 7's with multiple terms whereas Grade 8's will solve and graph inequalities containing integers.*

*Also, subsets of the real number system (rational numbers for grade 7 and irrational numbers for grade 8) are new to the 2020 elementary math curriculum. Students should have familiarity with describing, comparing, ordering these different types of numbers, however the terminology may not be familiar. Teachers may have to review types of numbers.*

Image from [learnx.ca](http://learnx.ca)





# Coding and Inequalities

## Task

**Introduction** - Ask students: What is an inequality and an equality? Can you think of where you may have heard these words and in what context?

*What might students say:*

*Equality - equal, fair, the same*

*Inequality - not equal, not fair*

*Contexts - gender equality/inequality, pay equality/inequality, inequalities in society (access to green space, technology, low cost housing, food)*

*In math - equal or equivalent, greater than/less than*

The task is set up as a **Desmos Activity** which you can find [here](#). Alternatively in **Google Slides** found [here](#).

The task starts with some brief learning around inequalities with 1 variable and how these are graphed on a number line vs inequalities with 2 variables and how they are graphed on a Cartesian Plane.

### Google Slides

**Inequalities and Coding**

Today we will learn:

- To use code to graph an inequality
- To use code to change an inequality
- When coding can be used to demonstrate an understanding of algebraic concepts
- How an inequality is represented on a Cartesian Plane

Where are you at today?

1. The graph shows the inequality  $x < 4$ .

2. We are a **number line** graph an inequality that involves only one variable. The graph below represents the inequality  $x < 4$ . What is the number line?

3. How does the graph of an inequality change when an inequality is written in a standard form? The graph shows the inequality  $x < 4$ . How would the graph change if the inequality was written in standard form?

4. We can graph inequalities in Desmos. To do so, we have to enter the inequality in the **quadrant calculator**.

### Desmos Screens

1. Drag the point to show h... If you'd like, say more about your response below.

2. While you wait...move th... In today's activity Inequalities and Coding, we will learn:

3. Number Lines. This number line graph represents  $\{0, 1, 2, 3, 4\}$ .

4. We use a number line to... The number line graph below represents the inequality  $x < 4$ .

5. How does the graph of t... How would the graph change for the same inequality?

6. Want to see the visual of... The graph shows the inequality  $x < 4$ .

The task then invites students to complete a number of inequality challenges using Scratch (to plot points on a grid when certain conditions are met) which requires them to read code and then modify the code to change the output. Lastly, students connect their learning about inequalities to a Desmos graph.

7. Inequalities in Scratch P... We can also use Scratch to create a number line graph.

8. Inequalities in Scratch P... How would you modify the code on this task?

9. Inequalities in Scratch P... How would you modify the code on this task?

10. Inequalities in Scratch P... Answer the following questions in the Answer Padlock on the right.

11. Inequalities in Scratch P... Click this link to access this Scratch code. Print this screen.

12. Inequalities in Scratch P... Predict how the output would look after this code.

13. Inequalities in Scratch P... Predict how the output would look after this code.

14. Inequalities in Scratch P... Predict how the output would look after this code.

15. Inequalities in Scratch P... Predict how the output would look after this code.

[illegible]





# Coding and Inequalities

## Teacher Notes

This task starts by giving students code rather than creating code. The focus is on reading, predicting and modifying. It is important for students to go through the cycle of predicting and testing, not only to help them gain an understanding of how the code works but also their understanding of the mathematical concepts. Also, predicting and testing are skills needed in any future career, and we need to work at helping students develop this as a part of their critical thinking.

If you are doing this task as a Desmos Activity: The [Teacher Pacing](#) option allows the teacher to control and limit the number of screens the students can interact with. A natural spot to have students stop is after slide 6. At this point you could facilitate a discussion around graphing inequalities before they start in Scratch. You may also want to stop after slide 7 to have a class discussion about the initial Scratch code given, and again after slide 10 once the students have had time to interact and modify the code.

The screenshot shows the Desmos Teacher Dashboard interface. At the top, there's a header with the activity name and tabs for Snapshots, Summary, Teacher, and Student. Below this is a row of slide thumbnails numbered 1 to 10. On the left, there are three icons: Anonymize, Pacing, and Pause. A red arrow points to the Pacing icon with the text: "Click here to change from your students' names to give each student the name of a mathematician." Another red arrow points to the Pause icon with the text: "Use the pause key to pause the whole class." A third red arrow points to the Pacing icon with the text: "Use the pacing key to restrict what slides the class can work at and then advance them when you/they are ready." In the center, there's a cartoon illustration of two children and the text: "Welcome to your teacher dashboard! This is where you'll find student responses as students go through the activity." Below this is a "Teacher Guide" button. A red arrow points to this button with the text: "Click here to open the teacher Guide. This guide can be printed so that you can take notes as you preview the activity and/or as students are working on it."

## Desmos Activity Teacher Dashboard

This screenshot shows how to do pacing on the Teacher Dashboard in Desmos

The screenshot shows the Desmos Teacher Dashboard with the Pacing menu open. The menu has a title "Select a new screen to change your range." and a "Restrict to Screens 1 - 5" button. There are five numbered red arrows pointing to different parts of the interface with instructions: 1. Click Pacing (points to the Pacing icon), 2. Click the slide you want to start from (points to slide 1), 3. Click the slide you want students to stop at (points to slide 5), 4. Once all students have finished this slide you may want to do some whole class discussion before allowing students to move on. (points to the "Restrict to Screens 1 - 5" button), 5. To allow students to move on click Cancel or click on new slides to create a new range. (points to the "Cancel" button).



# Coding and Inequalities

## Assessment

Reflection or Exit Card Questions

*Thinking about what we have learned through this activity...*

*What surprises you most mathematically? Why?*

*What new ideas, concepts or relationships did you better understand? Explain.*

This task can be included in the [Student Portfolio of Process Expectations](#) ([Google Slides](#))

## Additional Resources

Introduction to Scratch - See tutorials in Scratch

[Getting Started with Scratch](#)

Access: <https://scratch.mit.edu/>

[How to use Desmos](#)

[Elementary Math Curriculum - Strand C](#)