Parallel & Intersecting Lines—A Collision Course?

An Activity that Enhances Student Understanding of
How to Identify Parallel Lines, Non-parallel Lines, & Points of Intersection

Subject Area(s): math, geometry, measurement, robotics

Associated Unit: Geometric Relationships (Grade 4, NYC DOE)

Activity Title: Parallel & Intersecting Lines—A Collision Course?

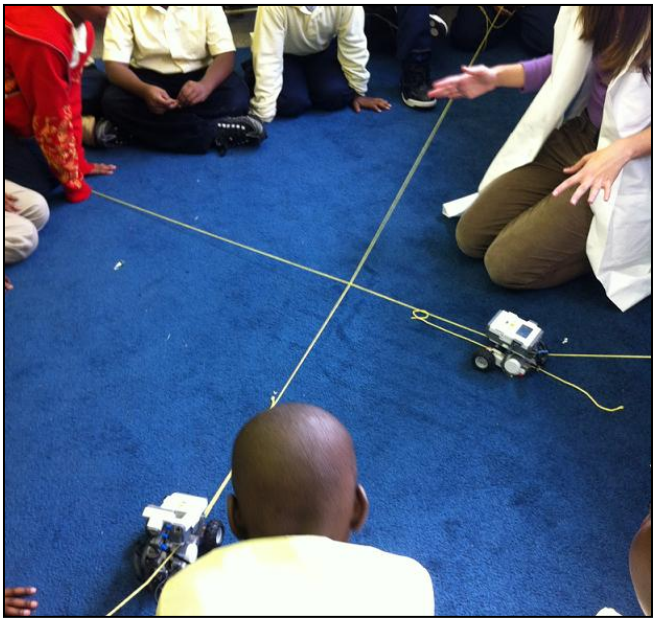

Image 1

ADA Description: Students & an instructor gather on a blue rug & inspect two robots & their intended courses.

Caption: Intersecting Lines

Image file name: ParallelLines_Image01_Intersecting-Lines.jpg

Grade Level: 4 (3-5)

Activity Dependency: None

Time Required: 45 minutes

Group Size: Whole Class

Expendable Cost per Group: US $0* — **assuming availability of NXT Robot & Wheels*

Summary

Students will solidify their understanding of different types of lines, as well as line features, specifically: parallel lines, non-parallel lines, and points of line intersection. This understanding will be developed through application of these concepts to LEGO MINDSTORMS robots, and practice identifying examples of each concept in this context. Students will identify whether or not different robot "tracks" laid down by the instructor are parallel or non-parallel, and will observe the consequences of their understanding by allowing two robots to travel simultaneously along these tracks. Robots that are on intersecting courses will face imminent collision, while robots on parallel courses will travel in safety.

This lesson will help prepare students for the geometry portion of the New York State education standards in mathematics, while simultaneously entertaining students through hands-on interaction with LEGO MINDSTORMS NXT robots.

Engineering Connection

The engineering connection of this lesson is primarily a result of the fundamental geometrical skills it builds, and the application of these skills to predict the course of objects in motion. This combination will help solidify the concepts being taught, and familiarize the students with practical application of these concepts, and why it is useful to know them.

(1) Geometrical Understanding—students will become more familiar with common geometric terms such as parallel, and intersection.

(2) Familiarity with Application of Understanding—students will apply their geometrical understanding to identify lines as parallel, or non parallel, and then observe the result when robots are set upon these lines.

Engineering Category

(#1) relates science concept to engineering

Keywords

geometry, lines, parallel, intersect, robotics, prediction

Educational Standards (New York City Public Schools)

State math: 4.G.6* Draw and identify intersecting, perpendicular, and parallel lines

Pre-Requisite Knowledge

Students should have some exposure to terms such as parallel and intersect.

Learning Objectives

After this lesson, students should be able to:

- Identify sets of parallel lines
- Identify sets of non-parallel lines as not being parallel
- Identify points of intersection in non-parallel lines
- Project the intersection points of non-parallel lines
- Understand a few reasons why the concepts of parallel & intersecting lines are important

Materials List

The entire class needs:

- 2 LEGO NXT robots
- 2 pieces of a brightly colored yarn, each approximately 1.5 feet in length
- 2 pieces of a brightly colored yarn, each approximately 6 feet in length

Introduction / Motivation

Discussion & Lecture with Students

It is important to discuss the following concepts with students before the start of the lesson:

- Parallel lines
- Non-parallel lines
- Points of line intersection

Parallel lines:
To asses and review the concept of parallel lines, first ask the students for their definitions of parallel lines. Then, illustrate the correct definition of parallel using a whiteboard or a blackboard. Draw two parallel lines, and highlight what about those two lines makes them parallel.

Non-parallel lines:
To asses and review the concept of non-parallel lines, first ask the students for their definitions of parallel lines. Then, illustrate the correct definition of parallel using a whiteboard or a blackboard. Draw two parallel lines, and highlight what about those two lines makes them parallel. Contrast this definition and visual illustration with the definition and visual illustration given previously for parallel lines.

Points of intersection:
To asses and review the concept of points of intersection, first ask the students for their definitions of this concept. Then, illustrate the correct definition by extending the lines of parallel, and non-parallel lines drawn to illustrate the previous concepts. By extending the lines, students will observe that the parallel lines never intersect, and that the non-parallel lines could be projected to result in points of intersection, if they don't intersect from the extension.

Vocabulary / Definitions

Word	Definition
Parallel Lines	Two or more lines that will not intersect as they extend infinitely
Intersection Points	The point at which two or more lines cross

Procedure

Before the Activity

- *Administer the pre-lesson assessment to the students*
- Collect the exams for later use in lesson effectiveness determination
- Discuss the concepts of (1) parallel lines, (2) non-parallel lines, and (3) points of intersection.

With the Students

PROCEDURE:

Part 1**:** *Parallel Lines*

1. Lay down the two short pieces of yarn on the floor so that they are parallel
2. Ask the students to identify the lines they make as parallel, or non-parallel, & why
3. Elect two students to overlay the two short pieces of yarn with the two long pieces so that the non-intersection of these lines is better emphasized
4. Ask the students to guess what would happen if two robots were to travel on those lines.
5. Once guesses have been taken, elect two more students to place the two NXT robots somewhere on these lines, and then allow them to drive forward continuously
6. Ask the students to discuss their observations in this group setting

Part 2: *Non-parallel Lines*

1. Lay down the two short pieces of yarn on the floor so that they are not parallel
2. Ask the students to identify the lines they make as parallel, or non-parallel, & why
3. Elect two students to overlay the two short pieces of yarn with the two long pieces so that the eventual intersection of these lines is better emphasized
4. Ask the students to guess what would happen if two robots were to travel on those lines.
5. Once guesses have been taken, elect two more students to place the two NXT robots somewhere on these lines, and then allow them to drive forward continuously
6. Ask the students to discuss their observations in this group setting

Part 3: *Student Choice*

7. Elect one student to lay down a single short piece of yarn any way they'd like.
8. Elect another student to lay down a second short piece of yarn any way they'd like.
9. Ask the students to identify the lines they make as parallel, or non-parallel, & why
10. Elect two students to overlay the two short pieces of yarn with the two long pieces so that the eventual intersection of these lines is better emphasized
11. Ask the students to guess what would happen if two robots were to travel on those lines.

12. Once guesses have been taken, elect two more students to place the two NXT robots somewhere on these lines, and then allow them to drive forward continuously

13. Ask the students to discuss their observations in this group setting.

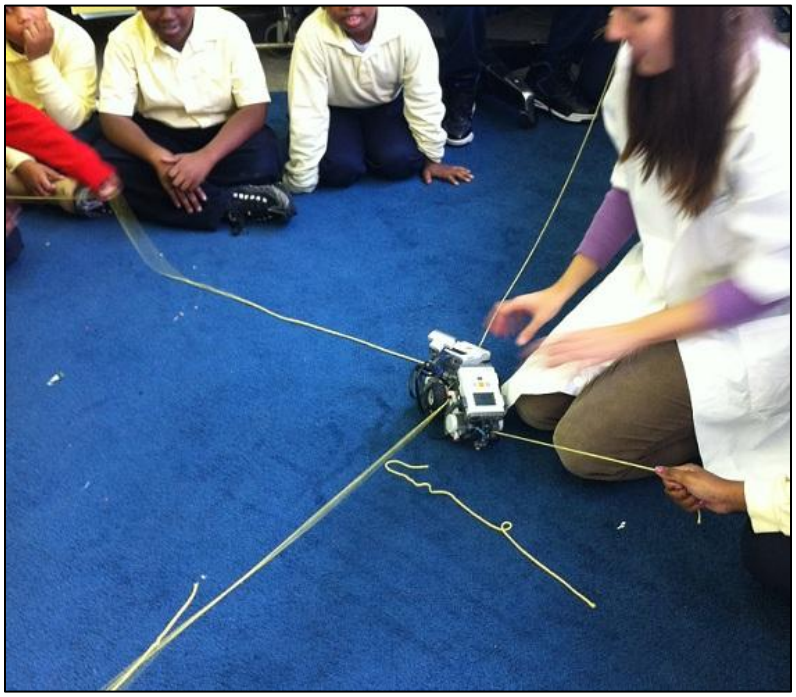

Image 2

ADA Description: Three students and a teacher can be seen observing the collision of two LEGO robots.

Caption: Collision

Image file name: ParallelLines_Image2_Collision.jpg

Attachments

None

Safety Issues

None

Troubleshooting Tips

None

Investigating Questions

- What are parallel lines?
- What are non-parallel lines?
- What are intersection points?
- How are these concepts important in everyday life?

Assessment
Pre-Lesson Assessment

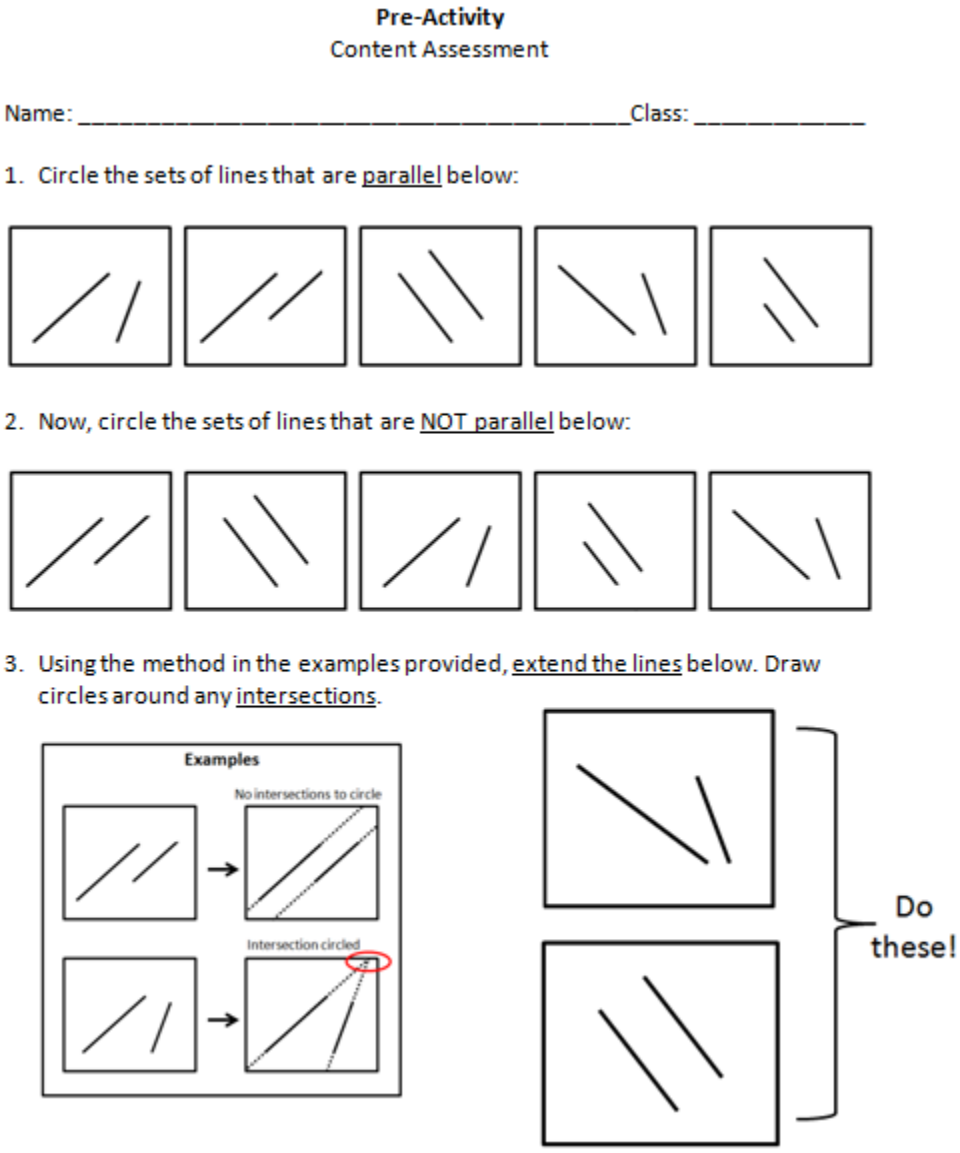

Figure 1

ADA Description: An assessment administered to students before the activity

Caption: Pre-Assessment

Image file name: ParallelLines_Figure1_Pre-Assesment.jpg

Lesson Summary Assessments

- Administration of the Post-Lesson Assessment—with questions similar to that on the Pre-Lesson Assessment—to determine student skill enhancement.

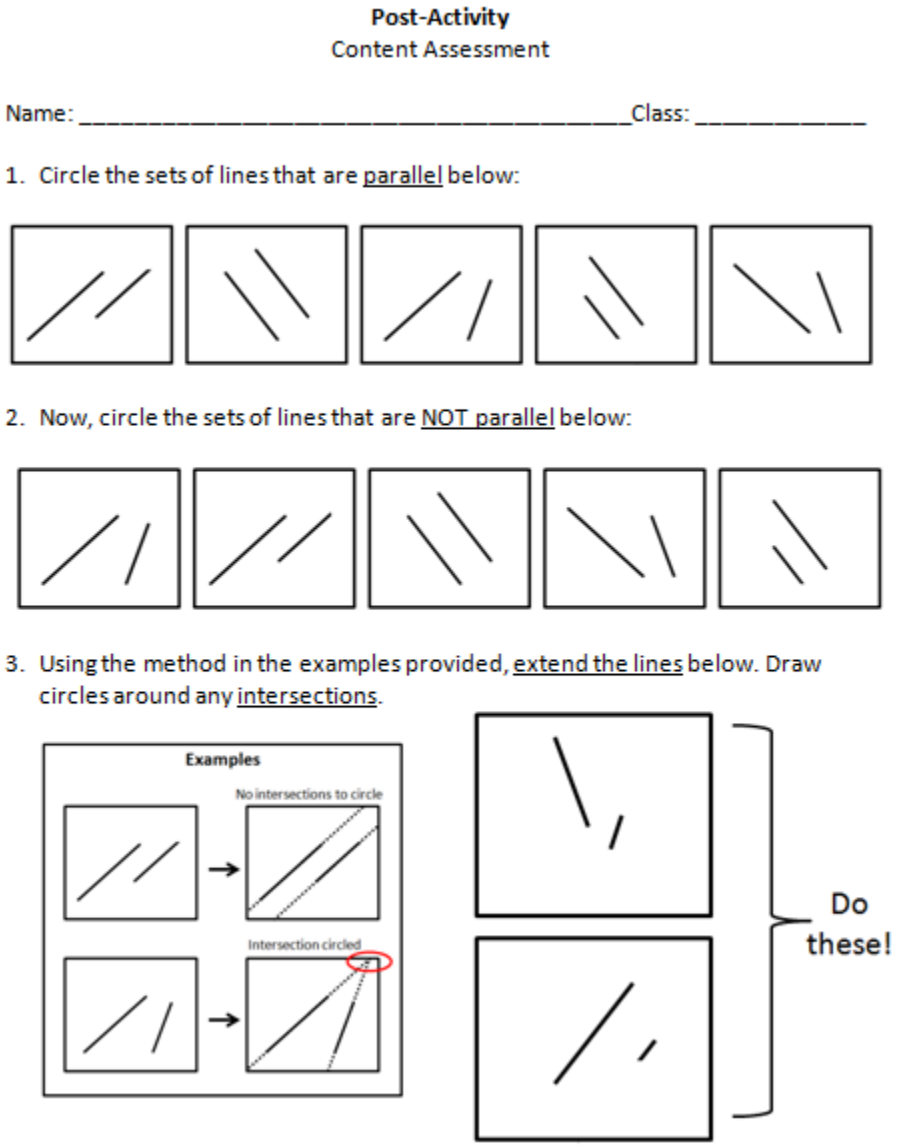

Figure 2

ADA Description: An assessment administered to students before the activity

Caption: Pre-Assessment

Image file name: ParallelLines_Figure2_Post-Assesment.jpg

Activity Extensions
None

Activity Scaling
- For lower grades, emphasize the practical portion of the activity, and place less emphasis on the initial lecture, so as to focus on the development of their perception of geometry a?s fun.
- For upper grades, during the practical application portion of the activity, invite the students to think about the connection between the robot motion, and where this might be relevant in our practical world. For example, invite them to consider how train tracks, roads, and other crossing arenas are developed.

Additional Multimedia Support
None

References
None

Other
None

Redirect URL
None

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None

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