

## Abstract:

In this lesson, we explore the equations of motion for differential drive robots. We will walk through how to derive these equations as well as talk about some of the possible wheel configurations a robot could have.

## Objective:

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

- Understand that by similarity, side ratios in right angles are properties of the angles in the triangle
- Analyze the relationship between circle circumference, speed, distance, time: linear, and angular velocity

## Standards:

Computer Science Teachers Association (CSTA):

- 3A-CS-03 Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- 3A-DA-12 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.

## Resources / Materials:

Playlist Overview: [The Robot Doctor Series](#)

Lesson Video: [Lesson 105 - Robot Motion](#)

Student Handout: [105 Student Handout](#)

Student Handout: [105 Student Handout - Modified](#)

Teacher Handout: [105 Teacher Handout - Modified](#)

Teacher Handout: [105 Teacher Handout](#)

Student Survey: <https://forms.gle/vNKUqjGNyuC2X8zNA>

(Have students complete this at the end of the lesson)

## Procedures:

1. Opening Question: **How do robots determine how far to turn their wheels to get where they want to go?**
2. Review Opening Question: Explain that robots move in different ways, but we will be looking at differential drive robots in today's video. Make sure to support/compliment student ideas about the opening question.
3. Explain that the video was created by **WQED** (Television Company) and **RobotWits** (Artificial Intelligence Company) who partnered to create the Robot Doctor educational video series.
4. Read the Abstract to the students or explain in your own words what the video will be about.
5. Prepare the room for the video by asking students to eliminate distractions (close laptops, lower blinds, put away folders, set down pencils, ect.).
6. **Show the video** to the students.
7. After the video, ask the students to share **what they liked** and **what they learned** from the video with someone beside them. Facilitate discussion, then ask for volunteers to share with the rest of the class.

\*\*\*To make improvements (add suggestions) to this lesson plan, please [CLICK HERE](#) \*\*\*

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8. Pass out the **Student Handout** to each student.
9. Discuss the first page of the student handout with the class.
10. Have the students work on the Challenge questions. They may work individually or in small groups.
11. Provide light guidance to each student on their progress with the challenge questions, if needed.
12. After the majority of the students have finished the student handout (or a majority are stuck), prepare to review the challenge questions one at a time.
13. Use the **Teacher Handout** to help students walk through each part of the Student Handout.
14. Review with the students the math concepts of speed, distance, time, and angular velocity.
15. Have the students go to this link: <https://forms.gle/vNkUqjGNyuC2X8zNA> and fill out the survey.

**Modification:**

Students will have their lesson modified according to their IEPs and individual capabilities. The **Modified Student Handout** does have an accompanying Teacher Handout. The modified handout can be substituted for the regular handout for students that are not yet ready for the regular handout.

**Enrichment:**

Students who are advanced will finish early and have extra time. They may watch other episodes of the Robot Doctor or they may assist students who are struggling with the assignment.

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