Topic: *Percentage*

Teacher: Tiffany, Alisha, Joe
Genre: Math
Grade Level: 6th
Unit: Ratios & Proportions- Percents
Duration: 90- 120 minutes

Essential Question **(Domain 1: Planning and Preparation-Component 1c: Designing Coherent Instruction)**
● What are percentages? ● How can we use visual models to interpret percent? ● How can solving percentages be applied to real world situations?
Background Knowledge
Background Summary: ● Students have been introduced to the general concept of percent as a quantity out of a hundred. **Lesson Objective:** ● Students will be able to estimate percents of a quantity using robotics. ● Given a whole and percent, student will be able to solve problems involving finding the part by using robotics.
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6th grade Math Standards **6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. **c**. Find a percent of a quantity as a rate per (e.g., of a quantity means times the quantity); solve problems involving finding the whole, given a part and the percent. **6th grade Mathematical Practice** **MP.1** Make sense of problems and persevere in solving them. Students make sense of and solve real-world and mathematical ratio, rate, and percent problems using representation , such as tape diagrams, ratios tables, the coordinate plans, and double number line diagrams. They identify and explain the correspondences between the verbal descriptions and their representation and articulate how the representation depicts the relationship of the quantities in the problem. **MP3.** Construct viable arguments and critique the reasoning of others. **MP5**. Use appropriate tools strategically. Students become proficient using a variety of representations that are useful in reasoning with rate and ratio problems, such as tape diagrams, double line diagrams, ratio tables, a coordinate plane and equations. They then use judgment in selecting appropriate tools as they solve problems **MP.6** Attend to precision. Students use precise language and symbols to describe the problem. Students learn and apply the precise definition of percent.

Vocabulary **(Domain I: Planning and Preparation - Component 1e: Demonstrating Knowledge of Students.)**	**Prep Work/Materials** **(Domain 1 Planning and Instruction-Component 1e: Designing Coherent Instruction, Domain 3 Instruction-Component 3c: Instruction Engaging Students in Learning)**	**Cross Curricular Connection** **(Domain I: Planning and Preparation - Component 1a: Demonstrating Knowledge of Content and Pedagogy, Component 1b: Demonstrating Knowledge of Students.)**
Percent **Ratio** **Unit of measurement** **Double number line** **Part to Whole** **Centimeters** **Meters**	Prep - Load programs onto the robots - Prep students about how to use the robot - Conduct experiment yourself - Provide space for the students to run program, may have to use the hall.	

	- All motors are plugged into B and C Materials - Prediction Post-it (one per group) - Robots (one per group) - Tape measure - Duck tape - Students packet - Exit Ticket	

Differentiation
(Domain I Planning and Preparation-Component 1e: Designing Coherent Instruction, Domain 3: Instruction - Component 3b: Using Question and Discussion techniques Domain 3: Instruction - Component 3c: Engaging Students in Learning)

- Bodily kinesthetic learners - Students are out of their seats and physically measuring distances that correspond with percents
- Audio and Visual learners – Visual representation of activity using robots, double number line corresponding to percents and distances, and markers. The observations/data collected throughout the activity.
- ELL/Low reader - Guided notes printed for those who require them
- Students with organizational needs- A table is provided to organize data.
- Technology- Utilizing Lego Mindstorms robot kit and digital program
- Enrichment: Students can try out other percents that are not benchmarks. They can extend this concept to find percents of any number.
- Extended time for those who require it
- Small groups according to levels, behavioral needs, and activity requirements
- Individual attention from ICT teachers and paraprofessionals.

Procedure **(Domain I Planning and Preparation-Component 1e: Designing Coherent Instruction, Domain 3: Instruction - Component 3b: Using** Question **and Discussion techniques Domain 3: Instruction - Component 3c: Engaging Students in Learning)**	**Student Engagement** **(Teacher Assessment)**
I. Opening A. Background Information 1. Students have been introduced to the general concept of percent as a quantity out of a hundred. 2. Where have you heard of/seen percents before? What is a percent? a. Percent is made up of two words: **per cent** b. Per mean each or 1. c. Cent mean 100 d. Put them together and you have "for each 100" B. Scenario 1. John and Julie are friends on a community track team. Some days during practice they would just run on the track in a non-competitive fashion. Their coach keeps track of the distance each friend runs using percentages. How can we use percentage to determine the distance each friend ran? II. Activity A. **Task One** - John's race *1. In order to answer our race question, we will be exploring the concept of percentages. In this exploration we will be using our robots. Our robots will be moving, as John and Julie did, certain percentages of the way.* 2. Students will have a handout with clear instructions. 3. The first task students will identify how far the robot will go if they went 100% of the way. a) Walk through this first part with the students, so they know how to navigate through the bot to run the correct program.	Opportunities for students to initiate higher-order questions & extend/enrich the discussion. Discussion Questions: - What were some strategies that you used to estimate to make your guesses? - How did your estimation compare to what the robot did? - How did your estimations change as you continued through the task? - How did your estimations improve? Assign jobs/roles to students in each group

b) *Here we do not know the total distance the robot can travel. To figure this out we need to use the program.*
(1) **NOTE:** Discuss with the class that everyone's total may not be the same. Discuss some reasons why that may be (human error, friction, etc.)

4. Additionally, the first task students will identify how far the robot will travel 50%, 25%, 75%, 33.3%, and 66.6% of the way.
   a) Walk through with the students what the 50% of the distance would look like and how they should be filling out the chart. Make sure the expectations are high and clearly stated. In the chart students will make a prediction, write the actual distance, and then create a bar diagram representing the distance the robot travelled. [**Note:** Teacher can walk through the first row with the class OR model it first without the class and then have the class repeat the process and complete the chart]
      (1) Students will make a prediction using a "prediction post-it" and record it on the table.
      (2) Students will then run the program.
      (3) Students will record the actual distance the robot moved on the table.
      (4) Students will model the distance travelled on the floor as a bar model.
      (5) Students will lastly write a percent statement in the last column that highlights the relationship between the percent and the whole quantity. "50% of 96 inches is 48 inches."
   b) Allow students to work in their groups to complete task one.
5. After students have finished with task one, teachers will have a discussion about the results.
   a) Sample questions:
      (1) What were some strategies that you used to estimate to make your guesses?
      (2) How did your estimation compare to what the robot did?
      (3) How did your estimations change as you continued through the task?
         (a) How did your estimations improve?
   b) **NOTE**: The answers will not be the same for all groups. Prep the students before hand so they can anticipate it.
   c) For this discussion use 96 inches as the total distance (most if not all groups should have gotten around this answer).
6. Students independently complete the check for understanding on their paper. Have students share their answer to the class and explain their reasoning.

B. **Task Two-** Julie's Race
1. Allow students to complete task two part a and b with their groups. NOTE: The distance for this race is 120 inches.
2. After the students have finished with task two, teachers will have a discussion about the results:
   a) Sample questions:
      (1) What did you notice about the statements in Part B?
      (2) How many statements had a similar result from task one and task two?
      (3) Why do you think these statements happened?
         (a) NOTE: Good opportunity to cold call since students have already written a response.

3. Students independently complete the check for understanding on their paper. Have students share their answer to the class and explain their reasoning.

C. Exit Ticket
   1. Distribute the exit ticket and give the students time to complete it.

D. Closing
   1. Close with a discussion about percentages and their importance in the real-world.
      a) How can the Coach use percentages to determine the distance Julie and John ran in their practice races?
      b) Example: Students will be able to look for the part, the whole and the percentage in problems on percentages and model the problem using a double number line

Assessment *(Formative or Summative)* (Domain 1 Planning and Instruction- Component 1e: Designing Coherent Instruction, Domain 3 Instruction- Component 3c: Engaging Students in Learning, Domain 3 Instruction- Component 3d: Using Assessment in Instruction)	**Student Engagement (Teacher Assessment)**
Students will be given an Exit Ticket with three questions. Students must answer two of the three questions.	

Additional Resources
YouTube Videos -timing

Name _____ Date_____

6th grade Math Robotics - Percentage

Today, you will be using your robots to model the races John and Julie are running. You robot is already programmed and ready to be used. The programs are called ***John*** *and* ***Julie***. The programs allow you to enter the percentage of the race the person (represented by the robot) will travel. To move the entire distance of the race, the robot would travel 100%. To begin, place the front of the robot's wheel at your group's start line.

<u>**Task 1**</u>: John's Race

<u>**Part A:**</u> Prediction Table

How far will the robot travel if it moves 100% of the way?

- *To determine this, run the program* ***John*** *at 100% distance. Round your measurement to the nearest inch. Then mark your measurement with a piece of masking tape placed directly in front of the wheels and a* ***red*** *marker on the* ***right*** *side of the measuring tape, "John: __ in. 100%" and record this* ***in the table below****.*

How far do you predict the robot to travel if it moves 50% of the distance?

- *Place your prediction sticky on your prediction and record this* ***in the table on the back of this sheet.***

- Test your hypothesis by running the program at 50% of the distance. Place a piece of masking tape directly in front of the wheels on the **right** side of the measuring tape with the percent written in red marker on the actual distance traveled and **record this in the table below.**

- Complete the table by first predicting where the robot will travel at each percent of the distance using your prediction sticky, then run and record the actual distance traveled.

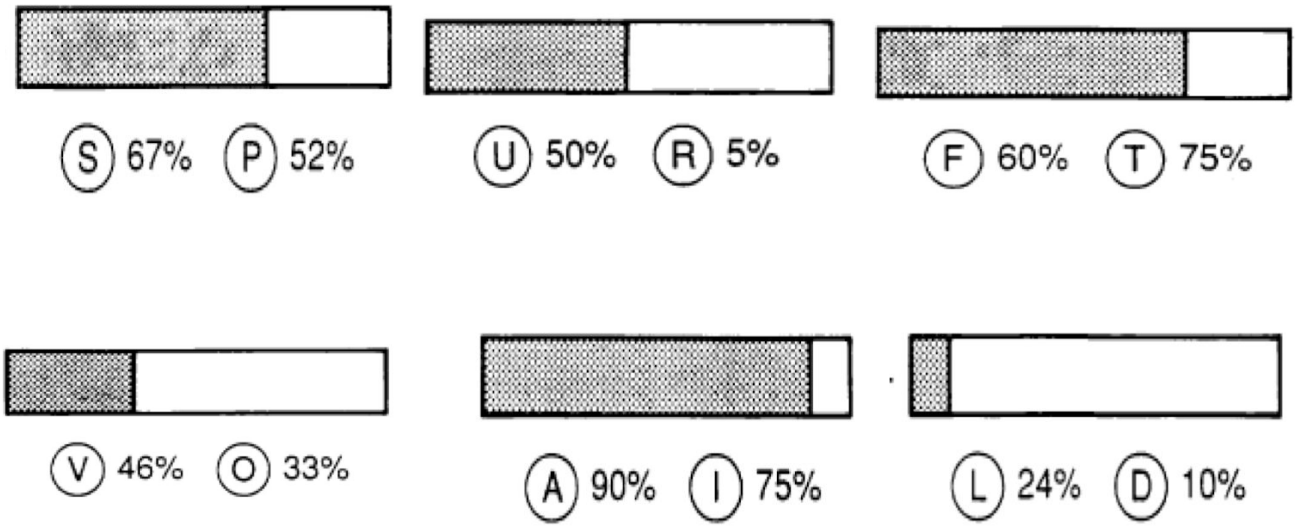
***Directions**: Use this checklist of steps to help you each time you run a new percentage & fill out a new row in the table:*

- ☐ Place prediction sticky.
- ☐ Record prediction in table.
- ☐ Run program at percentage given.
- ☐ Place tape at front of robot wheels.
- ☐ Label tape with percentage.
- ☐ Record actual distance in table.
- ☐ Complete diagram in table.
- ☐ Complete percent statement in table.

Total Distance Traveled _____ (100%)				
Percent	**Prediction** *Sticky* (value)	**Actual** *Red Marker on tape* (Value)	**Diagram**	**Percent Statement**
50%				50% of ____ is _____ .
25%				
75%				
$33.\overline{3}\%$				
$66.\overline{6}\%$				

<u>Part B:</u> Check for Understanding.

***Directions*:** Shade in the letter of percent that tells about how much of the bar is shaded.



Task 2: Julie's Race

Part A: Prediction Table

How far will the robot travel if it moves 100% of the way in the second race?

- *To determine this, run the program **Julie** at 100% distance. Round your measurement to the nearest inch. Then mark your measurement with a piece of masking tape placed directly in front of the wheels and a **blue** marker on the **left** side of the measuring tape, "John: __ in 100%" and record this **in the table below**.*

How far do you predict the robot to travel if it moves 50% of the distance?

- *Place your prediction sticky on your prediction and record this **in the table on the back of this sheet.***

- Test your hypothesis by running the program at 50% of the distance. Place a piece of masking tape directly in front of the wheels on the **left** side of the measuring tape with the percent written in blue marker on the actual distance traveled and **record this in the table below.**

- Complete the table by first predicting where the robot will travel at each percent of the distance using your prediction sticky, then run and record the actual distance traveled.

***Directions**: Use this checklist of steps to help you each time you run a new percentage & fill out a new row in the table:*

- ☐ Place prediction sticky.
- ☐ Record prediction in table.
- ☐ Run program at percentage given.
- ☐ Place tape at front of robot wheels.
- ☐ Label tape with percentage.
- ☐ Record actual distance in table.
- ☐ Complete diagram in table.
- ☐ Complete percent statement in table.

Total Distance Traveled _____ (100%)				
Percent	**Prediction** *Sticky*	**Actual** *Blue Marker on tape* (Value)	**Diagram** Total Distance Traveled_____	**Percent Statement**
50%				50% of ____ is _____ .
20%				
40%				
60%				
80%				
10%				

<u>Part B</u>: What do you notice?

Directions: Use your tables from **Task 1** and **Task 2** to fill in the statements below:

25% of 96 inches is _____in 20% of 120 inches _____in

Directions: Create a model of what you did on the floor using these statements as examples.

- What do we notice about the two statements above and their placement on the figure above?

- Are there any other statements in **Task 1** and **Task 2** that have this same relationship? List them.

- Why do you think that these statements equal the same number?

Part C: Check for Understanding.

Directions: Shade in the corresponding answer to the each percent of a quantity.

100% of 48		
50% of 48	(S) 12	(M) 24
10% of 48	(F) 4.8	(R) 48

What letter is left? _____

100% of 90		
50% of 90	(C) 4.5	(Y) 90
10% of 90	(L) 9	(D) 45

What letter is left? _____

Name _____ Date_____

6th grade Math Robotics - Percentage

Exit Ticket

Question 1: Which diagram best represents 25% of 80?

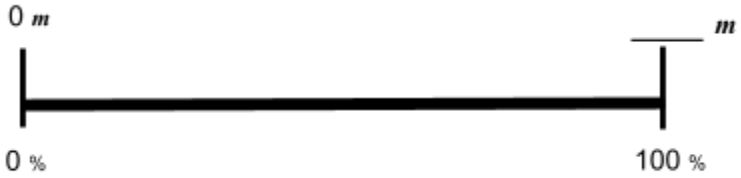
a)

b)

c)

d)

Question 2: John and Julie invited their friend Jamie to practice sprinting before their Track Meet. Jamie ran 30% of an 85-meter race. Fill in the diagram and explain your reasoning on how you did it.



Question 3: Marcus stated that 20% of 150 is 30 , Jamille stated that 25% of 120 is 30. Can both students be correct? Explain your findings.