**Tokyo 2020 ~ Be Fast or Be Last!**

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| In this lesson, students will reason about the size of decimal numbers to the thousandths and use their knowledge of place value to add and subtract them to solve real world problems. They will work collaboratively and estimate to assess reasonableness of their answers.  |

**NC Mathematics Standard(s):**

Perform operations with decimals

5.NBT.7

Compute and solve real-world problems with multi-digit whole numbers and decimal numbers.

* Add and subtract decimals to thousandths using models, drawings or strategies based on place value.
* Use estimation strategies to assess reasonableness of answers.

**Additional/Supporting Standards:**

Understand the place value system

5.NBT.3

* Write decimals using base-ten numerals, number names, and expanded form.
* Compare two decimals to thousandths based on the value of the digits in each place, using <, >, and = symbols to record the results of comparisons.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively

6. Attend to precision

**Student Outcomes:**

* I can add and subtract to thousandths using models, drawings or strategies based on place value.
* I can use estimation to assess whether my answers to addition and subtraction problems are reasonable.

**Math Language:**

**What words or phrases do I expect students to talk about during this lesson?**

decimal, decimal point, tenths, hundredths, thousandths, addition/add, subtraction/subtract, sum, difference, estimate/estimation, maximum

**Materials:**

* Stopwatch (one per pair)
* Pencil & clipboard (one per pair)
* Index cards (one per student)
* Measuring tool for meters (teacher use prior to lesson)
* Chart paper (for teacher to record responses)
* Copy of Tokyo 2020 task
* Calculator (in extension activity)
* Decimal grid models in resource link

**Advance Preparation**:

* Consider how to pair students
* Measure off a distance of 25 meters outside
* Copies of Tokyo 2020 task

**Launch:**

1. Engage (Estimated time: 25 minutes) This launch is detailed but considered crucial to student engagement and to address possible misconceptions.
2. Say: (before lesson begins - write 9.58 and 9.71 on the board) Let’s turn and talk with your neighbor/partner about these two numbers. What do you notice about them? What do you know about the values these numbers represent ? When might we use numbers like these?
3. Ask the students to share out and record on board/chart paper.

**Say:** You have probably been in some type of race before. Turn and talk to your partner/table mates about a time you were in a race. Let’s take a look at a 100 Meter run from the 2016 Summer Olympics in Rio de Janeiro Brazil.

**Say:** Pay attention to the times of the top two runners. One runner will have a time of 9.58 and one will have a time of 9.71. The first two winners are Tyson Gay with a time of 9.71 and Usain Bolt with a time of 9.58. Make a prediction of who the winner of the race will be based on these times. (for ex: choose a side of the room to move to)

Video: <https://www.youtube.com/watch?v=0PH0SV4j1Es>

(Video of 2016 Olympic 100 meter run where Usain Bolt of Jamaica breaks a world record with a time of 9.58 seconds and second place is Tyson Gay from USA with a time of 9.71 seconds. Possible video time is from 2:20 - 4:04 which is a length of 1 minute 44 seconds).

* Discuss the two times and which runner was the winner and how his time compares to the second place runner. (Possible Responses: Both were over 9 seconds and under 10 seconds, both times round to 10, Bolt will win because he has a smaller time.)

Say: We will warm up our brains with a 25 meter timed race between you and a partner (choose partners or pull sticks/choose ahead of time).

* Explain how far the race will be and how it will be timed to the hundredths. Possibly demonstrate how to operate stopwatch and show the timer under the document camera and discuss the place value of each place.

Say: What are some possible predictions of how long it will take each student? (You may want to remind them that their race is 25 meters instead of the Olympic distance of 100 meters.) Possible predictions: Students may not have good understanding of time, therefore they may give predictions ranging from seconds to minutes. Predictions may range from 5 seconds to 10 minutes.

* Record two or three predictions and discuss as a class who would be the winner based off two times given.
* Go outside and show the pre-measured distance. Remind students to work together and time each other and post the time on individual index cards. Have them draw a star by the fastest time for each pair. Have students post their cards in pairs in the class upon entering.
* Discuss some of the outcomes and how to make sure students realize that the smallest time of each pair was the fastest runner.

Say: Today we are going to discuss and use the data of race times of Olympic swimming 4 man relay teams. If you have seen any of the swimming races in the Olympic games, give a ‘chest pump’ (or other sign).

Video: USA Mens 4 x 100 Meter Medley Relay from 2016 Summer Olympics

<https://www.youtube.com/watch?v=UmIYanq5gH8>

**Explore: Part A:** Tokyo 2020 (20 minutes)

*Introduce the Task*

* Say: Today, we are going to determine a time the USA team needs to swim to win against Great Britain in the Tokyo 2020 Olympics.
* Say: Turn to a partner and read the task together. (Allow wait time for students to read the task.)
* Say: Without doing any written calculations make a prediction of the time you think Team USA’s fourth swimmer needs to swim to win the relay.
* At this time allow students time to record why they think this is a reasonable time in order for Team USA to win.
* As each set of partners are sharing and explaining their prediction, the teacher will record the times that each group predicts on chart paper. (While the tendency may be to tell the students that their prediction is or is not reasonable, please leave this to the end of this lesson: Explore: Part B)
* At this time, the students need to be engaged in the task.

 **Informal Evaluation/Observation**

As students work, ask questions that will help guide their thinking to complete the task.

* What do think of when you hear/read the word maximum?
* Why did you choose to do this step first?
* How did you come up with that value?
* How do you know that is the maximum time?
* Are you sure that this is the highest maximum time?
* What is Great Britain’s current time?
* What is USA’s present time?
* Why do you need each teams current times?
* Why does \_\_\_\_\_\_’s group have a different maximum answer than \_\_\_\_\_’s group?
* Is the time you chose to the nearest thousandths?

As students work, look for student pairs to share their responses during whole group discussion. Look for interesting methods, errors, and misconceptions ready for feedback. The teacher needs to be intentional in who is chosen so that the progression of their answers is logical.

**Discuss: Part A:** Tokyo 2020

 Bring the group back together and have selected students share their strategies for solving the task.

Possible points to address and questions to ask:

* The first group chosen needs to present their current Great Britain time.
* The second group will need to share their current USA time.
* The next group will need to share the difference between the two teams and why this is an imperative step to solving the task.
* The final group(s) chosen will share what they believe is the maximum swim time for the fourth USA swimmer in order to beat Great Britain.
* After maximum times have been shared, class discusses which time is the maximum time and why.
* What do you notice is similar/different about how the task was solved?

**Additional Activities (if needed)**

**Explore: Part B: Tokyo 2020** (Revisit students predictions from Explore: Part A)

At this time revisit the predictions that students gave in Explore: Part A to discuss the reasonableness of their predictions.

* Which predictions were reasonable/not reasonable? Explain.
* Is there a time(s) that would cause the USA to lose/win?
* Which prediction was closest to the actual answer?

**Evaluation of Student Understanding**

Formal Evaluation/Exit Ticket: The actual ticket is at the end of this lesson.



**Meeting the Needs of the Range of Learners**

**Intervention:**

* There may be students that have not conceptualized decimal place value. Support these students by providing a place value chart.
* There may be students that have difficulty determining the fastest time. Support these students by providing more real life examples/experiences. (i.e. car race, horse race, Ninja Warriors)

**Extension:**

Activity 1: What are other possible times (to the nearest tenths or hundredths) that the fourth USA swimmer could have in order to beat Great Britain?

Activity 2: From the Launch Activity, the class will take all of their index cards and put them in order from fastest to slowest times. Now, the students must create a four man relay team to represent their class in a competition with another 5th grade class. Students will next research to determine in what order the four member team will run. (i.e. 1st leg. 2nd leg, 3rd leg, anchor). To make it fun the students need come up with a team name and then carry out the plan by racing.

**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| Students may think the maximum time should be the largest time. | Teacher may refer back to the running video or to the student races/results and discuss the winning times. |
| Students may add all the times from the task together. | Teacher needs to redirect students to the number of teams in the task (2 teams) and ask the students if they have a total time for either team.  |
| Students may think that as the places are added to the right of the decimal, the value of the number increases. | Teacher will need to revisit NC.5.NBT.1 to review the place value system. |

**Solutions:**

* Great Britain’s relay time is 106.476.
* The USA’s three swimmers relay time is 80.276.
* The difference between Great Britain the USA’s times is 26.2.
* Therefore the maximum time that the fourth swimmer can swim and the USA still win the competition is 26.199. (The answer must be to the thousandth place because this is the focus of the lesson.)

**Activity Sheet**



Two years prior to the Tokyo 2020 Summer Olympics, 16 swim relay teams from around the world have been training and competing. Two such relay teams that have been preparing are Team USA and Team Great Britain. Both of these relay teams are super close to being consider the best relay swim team entering the competition. Great Britain’s four relay members’ times measured in seconds are as follows: 26.81, 26.702, 25.96, and 27.004. Three of the four USA team members have submitted their times. Their times measured in seconds are: 26.8, 26.756, and 26.72. In order for Team USA to be the best what does the maximum time in seconds (to the nearest thousandths) need to be of the fourth swimmer on the USA team? Explain how you know that your time is the best maximum time.

 

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| **Exit Ticket**Last night on Spartan: Ultimate Team Challenge, members of Team A had the following race times: 12.256, 11.8, 12.14. Members of Team B had the following race times: 12.75, 12.014, 12.6. What team won the competition and how do you know? Provide your evidence and explanation below. |

**Decimal Blackline Master Resources:**

[**https://lrt.ednet.ns.ca/PD/BLM/pdf\_files/decimals/decimal\_squares/decimal\_squares\_sets.pdf**](https://lrt.ednet.ns.ca/PD/BLM/pdf_files/decimals/decimal_squares/decimal_squares_sets.pdf)

**Additional Blackline Master Resources:**

[**https://lrt.ednet.ns.ca/PD/BLM/table\_of\_contents.htm**](https://lrt.ednet.ns.ca/PD/BLM/table_of_contents.htm)