Math Olympics

Submitted by: Beth Flanigan, Math
Willowville Elementary, Batavia, OH

Target Grade: 4th Grade Math

Time Required: 5 days, 60 minute lessons

Standards

Common Core State Standards Initiative:

- 4.NF.6: Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.

- 4.NF.7: Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.

Lesson Objectives

Students will be able to:

- Analyze data, including recorded times and distances, and convert between fractions with denominators 10 or 100 and decimals.
- Compare decimals in order to see how these relate to time (fastest, slowest, etc.).

Central Focus

Students will use the Olympics to analyze and compare fractional and decimal numbers. They will watch videos of previous Olympics and plan to host their own school Olympics. This process will involve recording and comparing time, making charts to determine winners, and competing in Olympic events.

Key terms: fraction, game, review, math, denominators, numerators, hundredths, tenths, data

Background Information

Students should be aware of fractional and decimal numbers. They should understand that both represent parts of a whole. Students should also have some experience with comparing different fraction and decimal numbers to determine if values are greater than or less than other values. Students should be aware of places in decimal numbers (tenths, hundredths, etc.). Knowledge of metric units is

also encouraged, but not necessarily required. The teacher should offer some review about relating decimals and/or fractions to practical applications, such as distance and time.

To help relate fractions and decimals, teachers can emphasize that fractions represent division (ie. 7/10 means that 7 is divided by 10). In order to use this explanation, students must know how to perform long division into decimal places. They can use long division to then show that 7/10 is 0.7:

$$
\begin{array}{r}
0 \\
10\overline{)7}
\end{array}
$$

$$
\begin{array}{r}
0. \\
10\overline{)7.0}
\end{array}
$$

$$
\begin{array}{r}
0.7 \\
10\overline{)7.0} \\
-70 \\
\hline
0
\end{array}
$$

This lesson is based on the 2018 Winter Olympics. All of the material in this lesson can be updated to reflect the most recent Olympic Games.

Misconceptions to look out for:
- Errors in converting between decimals and fractions
- Confusion about the greater time not being the winner. The competitor with the smaller time was faster and therefore won the event. However, in events measured by distance, the longer distance is often the winner.
- Confusion about time being base 60 while decimals represent a base 10 system (10ths and 100ths)
  - Make sure to state that 0.1 is $1/10^{th}$ of a second and 0.01 is $1/100^{th}$ of a second. There are ten 0.1s in one second and one hundred 0.01s in one second.

If teachers do not have 5 days to dedicate to these standards, this lesson can be shortened. The teacher can forego using real Olympic data and instead just do the classroom competition, or they can just use the Olympic data alone for students to learn how to work with decimals.

When students are learning how to use inequality symbols, it is helpful to give students an easy way to remember which sign means what. For example, you could say that the greater than and less than symbols are like alligators, and the mouth of the alligator always is open to the larger number. The alligator wants to "eat" the bigger number. You can use an image to teach this idea (Figure 1).

Figure 1 Taken from https://www.ducksters.com/kidsmath/inequalities.php

Materials

- Chart paper
- Coloring supplies
- Index cards with finishing times for events in 2018 Olympics
- Event recording sheet
- Puff Mobile Infographic (1 per group)
- Puff mobile supplies
    - Nonbendable, plastic drinking straws (3 per group)
    - Lifesavers (4 per group)
    - 1 piece of paper per group
    - Paper clips (2 per group)
    - Tape
    - Scissors
- Measuring unit taped down in hallway
- Entrance slip (1 per student)
- PowerPoint of events
- Exit ticket (1 per student)
- Team data sheet (1 per group)
- Clothes line
- Supplies for designing events:
    - Small shuffle board pieces
    - Measuring unit
    - Scooters
    - Possible access to gym

- o Timers/stopwatches
- o Construction paper
- o Markers or crayons
- Display board (see photos)
  - o Chart paper
- Medals (see photos)
- Cones
- Computers (1 per group)
- Projector or smartboard

Instruction

Day 1:

- Begin by discussing how decimals are used in daily life. Share ideas of when the students have seen decimal numbers and used them to compare things (examples: weight of fruit on a digital scale, temperature on a thermometer, time of a race, etc.). Allow groups to share together first and then share with the class and write down their thinking on chart paper.

- Next, review how to convert fractions with denominator 100 into decimals. On the board, demonstrate for the students how times can be written in both fraction and decimal format.

  - o Reflection questions: Do you prefer using fractions or decimals? Why? Which is easier to read and understand?

- Next, watch a video about the 2018 Winter Olympics. This is to give the students a quick reference to how we will see fractional values in decimal format. Focus on Ladies' Super-G times: https://www.youtube.com/watch?v=mNhZ_jw-6ek

  - o Times are shown at 1:42:10. Watch beforehand and pick out a portion of the video to show the class that includes these times.

- After watching the video students will work in a group to compile a list of events that they saw represented at the 2018 winter Olympics.

  - o Here is an overview video of the Olympics, if students need a refresher on the events: https://www.youtube.com/watch?v=jG4p8zX1yYo

- Use chart paper to discuss the different winter events as a class. With each event discuss how their scores were identified (Time, distance, etc.).

- Ask students to interpret the chart below (or a similar chart). Students should note that all times are 1 minute and 40 seconds. Have a discussion on comparing decimal values and make the connections to time. Questions to ask the students:

o Who had the fastest time? How do you know?

o How close would you say these times are?

o How much faster was the first place winner than the second place winner?

PYEONGCHANG 2018

RESULT		PARTICIPANT	
G	1:40.25	Aksel Lund SVINDAL	NOR
S	1:40.37	Kjetil JANSRUD	NOR
B	1:40.43	Beat FEUZ	SUI

Figure 2 Results of the Downhill Alpine Skiing Event in the 2018 Olympics

- Next have students practice the skill of placing times in order with a group activity. Provide each group with index cards that give the finishing times for events that took place in the 2018 Winter Olympics. Students will compare the times and rank them in order from fastest to slowest.

- Finally, have students choose an Olympic event and research the results of this event. Using chart paper, students will design a chart that lists the results for their event.

- After all groups are finished, they will do a gallery walk to write their thinking about the events they learned about today and which event would they want to compete in if they were participating in a future Olympics. They can record their answers on an index card and turn it in as an exit ticket.

Day 2:

- Begin the lesson by sharing a portion of the following video on cross country skiing or a clip from Olympics which are currently occurring:

- https://www.youtube.com/watch?v=kt0OtQqlxUU

- Students will practice comparing decimals at the beginning of each class with the daily results from an event from the previous night. The results can be posted on the board in random order or they can be on the entrance slip. Students will order times on an entrance slip with the data provided. Students will take the given data and fill out daily form with their answers (see example below).

Name _____ Room # _____MB#_____

Use the data from the **Men's 500m Speed Skating** results to rank the scores from fastest to slowest. (Your teacher will provide this data on the projector)

Fastest   Country they represented

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

Slowest

- Explain to students that some events, such as curling, are not timed but use other methods of determining the winners, such as distance. Explain how we can use our learning of measurement in metric units to help with curling. Each group will create a puff mobile that they will use in a competition with the other groups.

Directions for puff mobile:

(This will take students about 20 minutes to create and test their mobile.)

- Follow the instructions in the PBS Zoom into Engineering Puff Mobile infographic attached.
  - Reference video:
    https://tnlearn.pbslearningmedia.org/resource/phy03.sci.phys.mfe.zpuffm/designing-a-puff-mobile/
- Follow the instructions in the infographic. Students can only build their mobiles with the materials listed there.
- Allow groups to test out their puff mobile. Show students where their measuring tape is laid out on the ground on the hallway. Students are only allowed 5 puffs to move their puff mobile. They will then record the distance their puff mobile traveled.

- Finally, debrief as a class and discuss how they used their measuring knowledge to measure their puff mobile and record the comparisons between the events from the previous night.

Day 3:

- Begin by reviewing how to compare decimals. Give the students 5 decimals to order from smallest to largest, using the "<" sign.

- While students order the numbers, write the following data on the board:

<div align="center">

Speed Skating: 15.6   Ski Jump: 15.8

</div>

  - Once the students are finished and the class goes over the right ordering, ask the class who did better in the above events.
  - This question is meant to show that it is impossible to compare events that have different units of measure. The ski jump is measured in distance while the speed skating data is in time. Therefore, for the speed skating, 0.6 refers to 6/10ths of a second. However, for the ski jump, 0.8 refers to 8/10ths of a meter. Seconds cannot be compared to meters.

- Next explain that the class will be hosting their own Olympics with the following events in teams of 3-5 members:

  - Balloon Hockey – Team event

  - "Sock" Speed Skating – one member from their team will represent

  - "Curling" Shuffle board – one member from their team will represent

  - Cross Country "Gym" Skiing – one member from their team will represent

  - "Scooter" Bobsled Race – two members from their team will represent

- Take time to go over each event and how it will work, using the PowerPoint presentation. Be sure to explain the information and data that students will collect from each event.

- Break students into groups to determine the role each team member will hold. Make sure each team member has an active role in the events.

- Students will then begin to compile a list of supplies they will need for their event and a strategy for completing the event.

- Finally, at the end of class, have a discussion on how the collected data will be used to compare decimals. Give students an exit slip of various decimal numbers for them to compare and convert into fractions to check comprehensions of standard.

Day 4:

- Begin the lesson with a quick review challenging groups to order a set of decimal values on a number line as quickly as possible. Groups will be given 10 index cards with decimal values listed on them they will need to order these decimals from least to greatest in the shortest amount of time. Groups will time and record each other.

- Compare groups' times at the end of each sorting.

- Next give time for students to work on their events (either practicing or creating their materials needed for their event).

- At the end of class, have students complete the attached exit ticket.

Day 5:

- Today, students will participate in the events they have been working on during the week.
- The teacher can choose to have class outside or in the gym in order to engage in all of the events.
- After each event, record the times on chart paper. Students will chart this information on their own sheets and then order the decimals.
- Complete the 5 events in any order.
- After all events have been completed, groups will share their data and individuals will be awarded medals.

Closing ceremonies will consist of the students writing in their math journals about how our Olympic events helped us to build a deeper understanding of comparing and ordering decimals. They can share what they enjoyed and offer suggestions to the teacher about how to improve the lesson for future classes.

Differentiation

This is a largely collaborative lesson plan and students should be grouped intentionally with regards to each student having the support that they need in their groups. Give extra direction as needed when practicing ordering decimals.

Advanced Learners:

- Extend the lesson by providing challenge problems that involve fractions with denominators other than 10 and 100.

Students with disabilities

- Provide extra support during the Puff Mobile activity.
- Provide examples of different Puff Mobiles for ideas.
- Students can choose other ways to present their data, such as on digital boards.

- Use closed captioning for any videos.

English Language Learners

- Include pictures to help students understand the activities.
- Provide students with a vocab list of the key terms.
- Print copies of material in student's L1.

Assessment

Formative:

Teacher should check for understanding through class discussion. If there are any misconceptions, the teacher should ask prompting questions to allow the students to come to the correct answer on their own. Understanding may also be assessed through the journal entry.

Summative:

Students will be scored for accuracy on the exit ticket. If the teacher would like more summative assessment, a short quiz or homework assignment may be given at the end of day 5 mirroring the exit ticket.

Name _____ MB# _____

My Olympic Team Data

My team consists of:

Our Team name will be:

_____

The following team members will represent the following events:

"Sock" Speed Skating _____Back-Up_____

Curling Shuffleboard_____Back-Up_____

Cross-Country – Gym Skiing_____Back-Up _____

Scooter – Bobsled 1) _____ Back-Up _____

2) _____ Back-Up _____

Explain how you think we will use mathematics with our Olympic unit. How will decimals and fractions play a factor? List as many ways as you can. Share with your group. Each group will share out their thinking.

_____
_____
_____
_____
_____
_____
_____
_____

Name _____

Winter Olympics 2018 Score Sheet

Women's Events

Event/Date	Gold: Team/ Time	Silver: Team/Time	Bronze: Team/Time
Snowboarding Slopestyle Final (2/11)			
Free Style Skiing - Moguls Final (2/11)			
Skeleton – Final Run (2/17)			
Free Style Skiing – Halfpipe Final (2/19)			
Figure Skating- Ice Dance Short Dance Final (2/19)			
Bobsled – Women's Final (2/21)			
Short Track Speed Skating – Women's 100 meter (2/22)			
Snowboarding – Women's Big Air Finals (2/22)			
Figure Skating – Free Skate (2/22)			
Alpine Skiing – Women's Super-Combined (2/22)			

Men's Events

Event/Date	Gold: Team/ Time	Silver: Team/Time	Bronze: Team/Time
Luge – Singles Final Run (2/11)			
Skeleton Final Run (2/15)			
Bobsled – 2 man Finals (2/19)			
Freestyle Skiing – Halfpipe Final (2/21)			
Alpine Skiing – Men's Slalom (2/21)			
Cross-Country Skiing – Team Sprint (2/21)			
Short Track Speed Skating – Men's 500 meter Final (2/22)			
Short Track Speed Skating – Men's 500m Relay Final (2/22)			
Snowboarding – Men's Big Air (2/23)			
Alpine Skiing – Team Event (2/23)			
Speed Skating Men's 100m (2/23)			
Bobsled – 4-man – Final Run (2/24)			

Date: _____

Student Name: _____

Exit Slip

/1

QUESTION 1

Fill in the expression that correctly compares the values.

$\frac{3}{10}$ [_ _ _ _ _] **0.05**

| 1 | < | 2 | > | 3 | = |

/1

QUESTION 2

Choose *all* the statements that correctly describe 0.13 and 0.3.

A ☐ $0.13 < 0.3$ because $0.3 = \frac{30}{100}$ and $0.13 = \frac{13}{100}$.   **B** ☐ $0.13 < 0.3$ because 0.13 has 1 tenth and 0.3 has 3 tenths.

C ☐ $0.13 > 0.3$ because 0.13 has 3 hundredths and 0.3 has no hundredths.   **D** ☐ $0.13 > 0.3$ because there are more numbers to the right of the decimal in 0.13.

/1

1

QUESTION 3

Determine whether each inequality is true or false.

$\frac{45}{100} < \frac{5}{100}$ [   ]

$\frac{4}{10} = \frac{4}{100}$ [   ]

$\frac{5}{10} > \frac{54}{100}$ [   ]

$\frac{45}{100} < 0.5$ [   ]
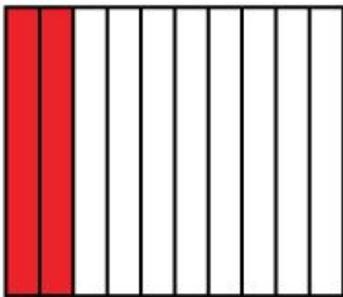
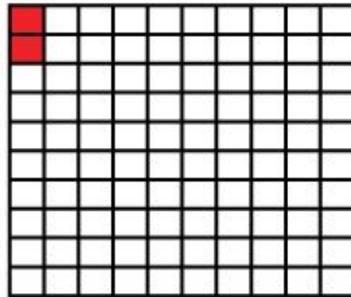| 1 | true | | 2 | false |

QUESTION 4

[   ] /1

Two models are shown.

Model 1   Model 2

What decimal does model 1 represent _____

What decimal does model 2 represent _____

What symbol would correctly compare the two models

1

Model 1 _____ **Model 2**

1

Puff Mobile

What You Need

- 3 nonbendable, plastic drinking straws
- 4 Lifesavers™
- 1 piece of paper
- 2 paper clips
- tape
- scissors

Engineering Scoop

When you blow, you create **moving air**, or wind. When wind **pushes** against an object, it can make the object **move**. Think about a **sailboat**. Wind pushes against the **sail** and makes the boat move. So a sail is one part of your car that can help it move. **Wheels** can also help your car move. Maybe you have a **bike** at home. What would happen if you took the wheels off and tried to move it? (It takes a lot of force to move something that's **rubbing** along the ground.) What **other parts** did you design to help your car move?

1 Make a **car** using only the materials on the list. Here's the catch: to make your car move, you can only **blow** on it!

2 Test it out! How **far** does your car go when you **blow once**? How many puffs does it take to make the car travel **6 feet**?

Sent in by Reba C. and Lee Anne F. of Medfield, MA

ZOOM on

Redesign your car so that it will travel the **same** distance with **fewer** puffs. What happens if you change the **size** of the car? What happens if you use **fewer materials**? Or, what happens if you add a **new material** like thread spools? Choose one thing to change (that's the **variable**) and make a **prediction**. Then **test it** and **send** your results to ZOOM.

pbskids.org/zoom

PBS KIDS

Puff Mobile

My Prediction

_____

_____

_____

What Happened

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Engineers Wanted!

Wind makes your car go—it can also **make electricity** for hundreds of homes. How? With wind farms! Wind farms use wind to produce electricity. Engineers build structures called turbines that look like pinwheels. When the wind blows, the blades of the turbine spin. Then the turbine turns a generator. The generator makes electricity. Some problems with wind farms are that they are noisy, take up a lot of space, and may look ugly. Engineers like **you** could design new turbines that are quiet and blend into their environment.

Send It to ZOOM™!
Tell us about your results at
pbskids.org/zoom/sendit

Winter Olympics

Team Balloon Hockey

- Teams will compete against other teams to score goals. One team member will be the goalie. Team members will play in socks and with use special gear that will be provided. Teams will earn points for goals.

"Sock" Speed Skating

- One individual from your team will complete 3 laps around the track wearing socks. ***Participant must wear a helmet***. Individuals will be timed with a stopwatch.

Curling- Shuffleboard

_____

- One individual from your team will compete by rolling the item across the gym floor to earn points on the set design on the gym floor. Individuals will be scored by points.

Scooter- Bobsled

- 2 team members will represent your team. ***Both members must wear a helmet.*** Members will take turns lying on scooters while the other team member pushes them around the track. Teams will be timed.

Cross- Country Gym Skiing

- One individual from your team will complete 2 laps of the course while wearing ski type shoes. Feet must stay on the floor at all times. Individuals will be timed.