

How Big Should I Be?

Proportional Reasoning

K20 Center, Kate Raymond, Nicole Shobert
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Grade Level	7th – 9th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	120 minutes
Course	Algebra 1, Middle School Mathematics		

Essential Question

How and why do animators and toy makers use proportions in their craft?

Summary

In this lesson, students explore proportions by comparing their own measurements to those of dolls and action figures. Students determine if they are proportional to small toys and figurines then calculate the dimensions of an accurate toy version of themselves. Throughout the lesson, students analyze why proportions are important and discuss how animators and toy makers use proportions to mimic and exaggerate the human figure.

Snapshot

Engage

Students watch a movie trailer and discuss the characters' physical proportions. Students also discuss the characteristics of toys, game and animated movie characters, and other depictions of humans in media.

Explore

Students measure dolls, action figures, plush toys, or figurines to determine whether these models are proportional to humans based on their measurements.

Explain

Students draw rectangles and use other methods to solve proportions.

Extend

Students calculate what a doll's measurements would be if it were proportional to their own measurements.

Evaluate

Students draw and a doll version of themselves and label it with their calculations then respond to a prompt about proportions in animated movies and videos.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

N 202: Recognize equivalent fractions and fractions in lowest terms
G203: Perform common conversions of money and of length, weight, mass, and time within a measurement system (e.g., dollars to dimes, inches to feet, and hours to minutes)

Oklahoma Academic Standards Mathematics (7th Grade)

7.GM.4.1: Describe the properties of similarity, compare geometric figures for similarity, and determine scale factors resulting from dilations.

Attachments

- Lesson Slides—How Big Should I Be_.pptx
- Model and Report Rubric—How Big Should I Be - Spanish.docx
- Model and Report Rubric—How Big Should I Be - Spanish.pdf
- Model and Report Rubric—How Big Should I Be.docx
- Model and Report Rubric—How Big Should I Be.pdf
- Toys vs. Us Comparison—How Big Should I Be - Spanish.docx
- Toys vs. Us Comparison—How Big Should I Be - Spanish.pdf
- Toys vs. Us Comparison—How Big Should I Be.docx
- Toys vs. Us Comparison—How Big Should I Be.pdf

Materials

- Lesson Slides (attached)
- Toys vs. Us Comparison handout (attached; one per student)
- Model and Report Rubric handout (attached; one per student)
- Dolls, action figures, plush toys, figurines, or other small items representative of the human body (one item per group of 2–3 students)
- Tape measures and rulers (one set per group of 2–3 students)
- Grid paper
- Blank paper
- Markers and colored pencils

15 minutes

Engage

Teacher's Note: Lesson Preparation

This lesson requires a collection of dolls, action figures, plush toys, figurines, or other small items representative of the human body. Collect enough toys so that each group of two to four students receives one.

Also consider preparing materials that students may use to create their own models. These materials could include poster board and drawing materials, clay, fabric, collage materials, etc.

Use the attached **Lesson Slides** to guide the lesson. Display **slide 5** and play the Despicable Me 4 movie trailer.

Transition to **slide 6** and introduce students to the Think-Pair-Share activity. Have students consider the following questions:

- What did you notice about the people in the movie trailer?
- Are their features realistic? Why or why not?

Instruct students to find a partner and share their responses to the questions about. Invite partners to share out the results of their discussion with the whole class.

Guide the class discussion by asking students about the proportions of the characters' physical characteristics. Encourage students to consider which other characters from animated movies, games, and toys look lifelike versus exaggerated. Ask students to consider why these proportions matter and share their responses.

30 minutes

Explore

Show the class one of the dolls, figurines, or other items you prepared. Ask the class to consider if the model looks lifelike or exaggerated, and why it looks that way. Ask whether the model looks mathematically proportional to a real person.

Move to **slide 7** and organize students into groups of two or three. Give each group a measuring tape and ruler, then invite each group to choose a toy.

Pass out one copy of the attached **Toys vs. Us Comparison** handout to each student. Have students work together to measure the toy and each group member, then have them record their measurements on the front side of their handouts. As students take measurements, remind them to be thorough and accurate and take multiple measurements as needed.

Instruct groups to discuss how they can use these measurements to compare their own proportions to the toys after all measurements have been recorded.

Teacher's Note: Guiding the Activity

At this stage of the lesson, do not directly teach students how to set up proportions. Allow them time to discuss and make their own decisions. If some groups struggle with the task, ask guiding questions like, “Let’s say you were 60 inches tall with an arm length of 20 inches. If I made a model of you that was 6 inches tall, how long would the model’s arm be?” Offer suggestions of ways they can approach the problem, but do not give students a specific equation to use.

Ask each group to prepare a claim based on their measurements. Encourage them to prepare a claim that addresses the proportions of the toy and group members and provides evidence from their data. If students need help preparing their claims, ask the prompting question, “Is your toy proportional to the members of your group?”

Teacher's Note: Modeling

Consider creating a model claim to demonstrate your expectations to students.

25 minutes

Explain

Teacher's Note: Correct Answers

The correct answers to each problem can be found in the notes of each slide.

Display **slide 8** and present the problem on the slide to students. Facilitate a whole class discussion over proportions and ratios and guide students to consider ways to solve the problem. Allow students time to solve the problem individually or as part of a group. Invite students to share out their responses.

Interpreting Student Responses

Use student responses to evaluate how they are thinking of the problem. If students arrive at the answer of 16 inches, they are thinking proportionally. If students arrive at the answer of 18 inches, they are likely adding numbers.

Move to **slide 9** and present the next problem. Allow students to work individually or in groups once more, and give them time to solve the problem. Invite students to share out their responses.

Interpreting Student Responses

If students share an answer of 4 inches, they are likely still adding numbers instead of solving the problem proportionally.

Transition to **slide 10** and distribute one piece of grid paper to each student. Direct students' attention to the slide and have them use the grid paper to draw the three rectangles described on the slide, one that is 10 by 8, another that is 20 by 16, and another that is 20 by 18. As students work, ask them to consider the following question present on the slide:

- Which rectangle looks "different" from the other two?

Once it appears that most students have finished working, invite students to share out their responses to the question.

Tell students that the standard way of testing proportionality is by setting up a pair of ratios, or fractions, in a proportion.

Display **slide 11** and have students find an Elbow Partner. Tell pairs to choose two of the rectangles from slide 10 and create a proportion to compare the two. Remind students that they should format the measurements as fractions. As students work, walk around the room and assist pairs who may need help.

Show **slide 12**. Have students find other pairs who compared the same two rectangles and review each other's methods. Allow students time to compare their methods, then invite groups to share out their observations.

Transition through **slide 13** and **slide 14** and review the cross-multiplication method for solving proportions. Point out to students that the answer is the same for both examples.

Transition through **slide 15** and **slide 16** and walk students through the dilation method for solving proportions. Point out to students that the answer is the same for both examples.

Display **slide 17** and have students return to their original data collection groups from earlier in the lesson. Have students review their process for solving the proportions on their Toys vs. Us Comparison handouts. Encourage students to use one of the methods above to check proportional relationships in their data. Once they have reviewed their math, have them review and possibly change their claims.

Invite groups to share out if they changed their claim and why.

30 minutes

Extend

Display **slide 18** and invite students to consider what a doll would like like if it were proportional to them. Tell students that this next activity challenges them to create a model doll and write a report that summarizes their findings.

Distribute one copy of the attached **Model and Report Rubric** to each student and review the expectations for the activity. Notify students that this rubric will be used to evaluate their work.

Direct students' attention to the table on the second page of their Toys vs. Us Comparison handouts. Tell students that now they should work independently to obtain the following measurements for themselves and their doll:

- Height
- Wingspan
- Forearm
- Foot

Tell students that once they have collected the measurements they should calculate new measurements for a doll proportional to their own measurements. Once students have filled in the final column of the table, direct them to respond to the prompts at the bottom of the page in a complete paragraph.

15 minutes

Evaluate

Distribute one piece of paper and markers or colored pencils to each student.

Display **slide 19** and introduce the instructions for the activity based on a modified version of the One-Pager instructional strategy. Have students create a doll version of themselves on the paper using the calculations from their handout. Remind students that the doll must be proportional to them. Encourage students to leave space at the bottom of their paper to write.

Once students have completed the drawing, display **slide 20**. Have students respond to the following prompt using a full paragraph at the bottom of their paper:

- Think about animated movies and video games. What do you think is the purpose of creating characters with accurate and inaccurate proportions?

Have students submit their papers when finished.

Resources

K20 Center. (n.d.). Elbow partners. Strategies. https://learn.k20center.ou.edu/strategy/116

K20 Center. (n.d.). One-pager. Strategies. https://learn.k20center.ou.edu/strategy/72

K20 Center. (n.d.). Think-Pair-Share. Strategies. https://learn.k20center.ou.edu/strategy/139

Illumination. (2024, January 28). *Despicable Me 4* | *Official trailer* [Video]. YouTube. https://www.youtube.com/watch?v=qQlr9-rF32A