Community Math Night: Mathematics at Work Facilitator Guide

Fall 2019

West Virginia

Community Math Night Facilitator Guide: Mathematics at Work • Fall 2019

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Writing: Theresa MacVicar, Kerry Friedman, Carmen Araoz, Megan Cox

Contributions and editing: Kristen Reed, Kate Borelli

Editorial advice: Our colleagues at the Educational Alliance, Omar and Harts Elementary Schools in West Virginia

REL APPALACHIA
Regional Educational Laboratory At SRI International

The Education alliance
Business and Community for Public Schools

Omar Elementary School

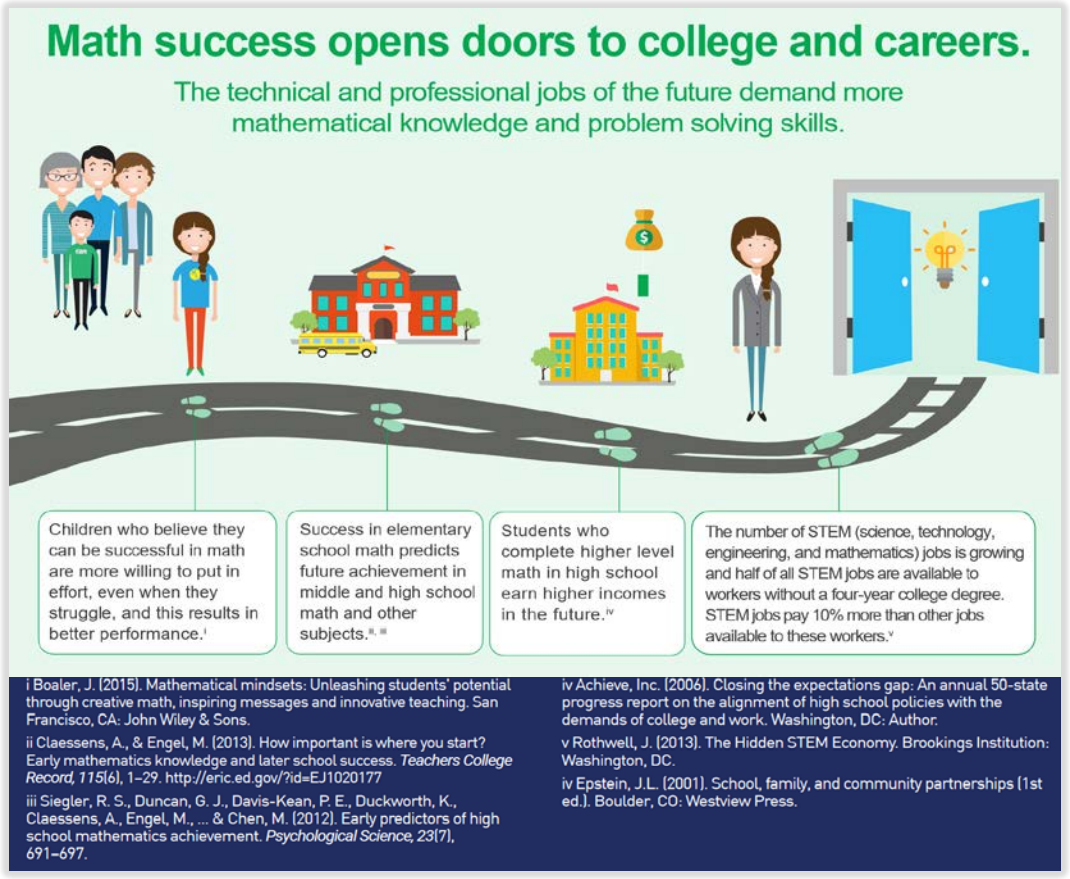
HARTS PK-8

Contents

Overview

Children's early mathematics achievement is associated with a number of success factors later in life such as getting good grades in middle school, increased likelihood of high school graduation, and increased career opportunities. At Community Math Nights, educators, children, and family members can learn and talk about mathematics, helping family members participate in their child's learning and support their child's academic success.[1] Community Math Night activities can create a shared understanding of math concepts and raise expectations for math knowledge and achievement, which promotes children's success in school.[2]

This *Community Math Night Facilitator Guide* provides all the instructions and materials needed for your Community Math Night. It is organized by activity, and for each activity you will find the purpose, a list of linked materials, and facilitator instructions. As you review the guide, you'll learn about building a strong foundation in math in elementary school, the value of engaging families in children's math learning, and math instructional strategies that are based in research.



[1] Garcia, E., & Weiss, E. (2017). *Education inequalities at the school starting gate: Gaps, trends, and strategies to address them*. Washington, DC: Economic Policy Institute

[2] DeFlorio, L., & Beliakoff, A. (2015). Socioeconomic status and preschoolers' mathematical knowledge: The contribution of home activities and parent beliefs. *Early Education and Development*, *26*(3), 319–341. https://eric.ed.gov/?id=EJ1053641

Math Night at a Glance

Complete the table below as an at-a-glance guide for your Math Night.

Date: **Location:**

Time	Activity	Location	Facilitator(s)
	Dinner (25 min)		
	Mathematics at Work (20 min)		
	Math Stations (65 min)		
	Introduction (5 min)		
	Machine Tool Technology (15 min, 5 min transition)		
	Health Sciences (15 min, 5 min transition)		
	Automotive Technology (15 min, 5 min transition)		
	Wrap-up (10 min)		

Materials at a Glance

Facilitation Materials

(In chronological order—found throughout facilitator guide)

- Slide deck to guide presentations
- Folder for each family containing:
  - Family letter
  - 3 raffle tickets
  - Feedback survey
  - "Supporting Your Child in Developing Math Skills for Future Success" infographic
- Stamps for tickets
- Instructions for each station
- Handouts for parents/facilitators with questions to prompt students to explain what they're doing, how to scaffold the activity, and prompt for additional solutions/strategies
- Student handouts for all stations
- Measurement word wall
- 2–3" wide grosgrain ribbon, at least 2 colors
- Scissors
- 1-foot rulers
- Meter sticks and/or yard sticks
- Tape measures marked in feet
- Measuring wheel (optional)
- Stethoscopes
- Stopwatch
- Counters (2 colors)
- Gear sets
- Permanent markers
- Small stickers
- Crayons
- Car gears
- Large zip-top bags

Mathematics at Work 20 minutes

Facilitator(s): _____

Purpose

Welcome families and present information on the importance of mathematics in career readiness and success.

Materials

- Mathematics at Work slides
- Folder for each family containing:
  - Family letter
  - Raffle ticket
  - Feedback survey

Background

Children's early mathematics achievement is associated with a number of success factors later in life such as getting better grades in middle school, increased likelihood of high school graduation, and better career opportunities. At this Community Math Night, educators, community members, children, and families will focus on the role of math in career readiness and success. Educators will emphasize that most occupations require significant math knowledge[3] and all workers benefit from developing the habits of mind that students can acquire through learning math. Habits of mind are ways mathematicians think about and solve problems, such as understanding patterns and relationships and visual reasoning.[4] Invited speakers from the local communities will share how they use mathematics in their everyday work.

By underscoring the critical role of math in future success and engaging participants in hands-on math activities, the Math Night can help family members recognize the importance of mathematics and participate in their child's learning.[5] The Community Math Night activities can create a shared understanding of the math concepts and raise expectations for math knowledge and achievement, which promote success in school and beyond.[6]

Facilitator Notes

1. As families come into the event, give each family a number 1–3. These numbers will tell them which station to start with.
2. Welcome families, students, and other community members to the event.

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[3] Achieve. (2013). *Advanced math equals career readiness fact sheet*. Washington, DC: Author.

[4] Cuoco, A., Goldenberg, E. P., & Mark, J. (1996). Habits of mind: An organizing principle for mathematics curricula. *Journal of Mathematical Behavior, 15*, 375–402.

[5] Garcia, E., & Weiss, E. (2017). *Education inequalities at the school starting gate: Gaps, trends, and strategies to address them*. Washington, DC: Economic Policy Institute

[6] DeFlorio, L., & Beliakoff, A. (2015). Socioeconomic status and preschoolers' mathematical knowledge: The contribution of home activities and parent beliefs. *Early Education and Development*, *26*(3), 319–341. https://eric.ed.gov/?id=EJ1053641

3. Introduce yourself, describe your role, and tell the participants that the activities will start when everyone is finished with dinner.
4. When families finish dinner, have them focus on the presenter and begin with the presentation “Mathematics at Work.” Follow the script on the slides.
5. Introduce the invited speakers. Each speaker will share a short (2-3 minute) overview of their job and how they use mathematics.

Math Stations 1 hour

Introduction to Stations 5 minutes

Facilitator(s): _____

Purpose

Provide instructions and norms for participating in the math stations

Materials

- Math station slides

Facilitator Notes

1. Tell participants they will visit three stations around the school and let them know that each station will focus on a different career area. When participants complete a station, the station facilitator will stamp their ticket and the children can submit the tickets for the raffle.
2. Provide tips for family members participating in the stations.
3. When families come in, they should have received a number from 1 to 3, which will tell them which station to start at.
4. Tell participants you will alert them every 15 minutes to remind them to go to the next station.
5. Direct participants to their first station.
6. Advise participants to return to the main room/gym/cafeteria for the wrap-up and raffle.

Station 1: Machine Tool Technology

Facilitator(s): _____

Purpose

Families and children will listen to an example of how mathematics is used in jobs in the machine tool technology field and engage in a related activity that is aligned with the West Virginia standards for measurement and data.

Materials

- Materials for each activity
- Measurement word wall
- Stamps for tickets

Background

Machine tool technicians or machinists set up, operate, and maintain a variety of digital and manual machinery. The parts, instruments, and tools they create are used to produce items such as aircraft, construction equipment, and medical devices[7]. Machine tool technology jobs include a range of activities depending on the area of specialty; however, in general, the job includes analyzing blueprints to determine the procedures and materials needed to create a machine, verifying the precision and dimensions of machines and products, monitoring machines for speed, feed rates, and amounts of materials, and measuring and positioning the materials on the machine[8]. Knowledge of and skills in algebra, geometry, physics, industrial technology, computer science, and trigonometry aid machine tool technicians in producing high-quality machines and products[9]. Fluency with conversions (e.g., from fractions to decimals, from the metric system to the imperial system) and calculating speeds (e.g., feed rate in inches per minute) helps machine tool technicians do their jobs efficiently.[10]

[7] Bridge Valley Community and Technical College. (n.d). Machine tool technology. Retrieved from https://www.bridgevalley.edu/machine-tool-technology

[8] Wallace, J. M., Stewart, G. (1991). Mathematics for the Workplace. Applications from Machine Tool Technology. Pendleton, SC: Partnership for Academic and Career Education (PACE). Retrieved from https://files.eric.ed.gov/fulltext/ED360530.pdf

[9] Ibid.

[10] English, T. (n.d). Basic math machinists need to know and tricks to help. Retrieved from http://www.manufacturinglounge.com/basic-math-machinists-need-know-tricks-help/

The activity developed for this station engages students in measuring distances around the room, solving measurement problems, and discussing their reasoning. Tasks such as the one shown below promote mathematical reasoning and problem solving and allow multiple entry points for student learning. The use of mathematical tools such as rulers, tape measures, and meter sticks, supports students' thinking and problem solving abilities. [11] In addition, activities that actively involve children in the measuring process are key to building conceptual understanding of the skills and techniques of measuring.[12] Families can practice measuring with children at home by measuring objects around the home, or by involving them in crafts or hobbies (such as sewing or woodworking) that involve measuring.

[11] Principles to actions : Ensuring mathematical success for all. Reston, VA :NCTM, National Council of Teachers of Mathematics, 2014.

[12] Hiebert, J. (1984). Why do some children have trouble learning measurement concepts?. The Arithmetic Teacher, 31(7), 19-24.

Activity: How many of me?

Facilitator(s): _____

Purpose

Students and families measure various objects to answer the question "How many of me does it take to measure…?"

Materials

- Activity instructions and family prompts
- Printed student handouts
- 2–3" wide grosgrain ribbon, at least 2 colors
- Scissors
- 1-foot rulers
- Meter sticks and/or yard sticks
- Tape measures marked with feet
- Measuring wheel (optional)

Facilitator Notes

1. Make a connection between the relevant job talk in the "Mathematics at Work" presentation and the activity. Example script: The presenter talked to you about [some of the things the presenter talked about]. Another important part of machine tool technology is measuring precisely and with different units. In this activity you will measure using different tools and units of measurement.
2. Have families cut a length of ribbon equal to their child's height. Explain that families will be using this unit (called "Jacobs" in the prompts – families will name the unit using the child's name) to measure various lengths. Point out how families can use the markings or tile pattern on the floor to help them measure straight across the room/bleachers or how they can line up their measuring tool next to the wall or bleachers to measure length or width.
3. Show families how they can use the prompts based on their child's grade level.
4. Model asking questions (e.g., How could you use your piece of ribbon to measure the length of the room/bleachers?) and point out the word wall. While families are working, clarify mathematical vocabulary as needed.
5. Model using mathematical vocabulary such as "length," but do not correct families if they use descriptive phrases instead.
6. As you circulate, ensure that students are using their measuring tools correctly (lining them up end-to-end with no gaps or overlaps, starting at 0 on rulers, measuring straight across the room/bleachers, etc.). Assist families with choosing appropriate tools and units to measure, as needed.

West Virginia Standards

Kindergarten

Cluster	**Describe and compare measurable attributes.**
M.K.14	Describe measurable attributes of objects, such as length or weight and describe several measurable attributes of a single object.
M.K.15	Directly compare two objects with a measurable attribute in common, to see which object has “more of” or “less of” the attribute, and describe the difference.

First grade

Cluster	**Measure lengths indirectly and by iterating length units.**
M.1.15	Order three objects by length and compare the lengths of two objects indirectly by using a third object.
M.1.16	Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Instructional Note: Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.

Second grade

Cluster	**Measure and estimate lengths in standard units.**
M.2.14	Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
M.2.15	Measure the length of an object twice, using length units of different lengths for the two measurements, describe how the two measurements relate to the size of the unit chosen.

Third grade

Cluster	**Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.**
M.3.23	Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Fourth grade

Cluster	**Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.**
M.4.19	Know relative sizes of measurement units within a system of units, including the metric system (km, m, cm; kg, g; l, ml), the standard system (lb, oz), and time (hr, min, sec.). Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two- column table. (e.g., Know that 1 ft is 12 times as long as 1 in. Express the length of a 4-ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...)
M.4.20	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Fifth grade

Cluster	**Convert like measurement units within a given measurement system.**
M.5.18	Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m) and use these conversions in solving multi-step, real-world problems.

Station 2: Health Sciences

Facilitator(s): _____

Purpose

Families and children will listen to an example of how mathematics is used in jobs in the health sciences field and engage in a related activity that is aligned with the West Virginia standards for Operations and Algebra and Number and Operations.

Materials

- Materials for activity
- Stamps for tickets

Background

Health Sciences encompasses a broad range of occupations including nursing, physical therapy, pharmacy, laboratory technology, audiology and veterinary science. Career opportunities in the Health Sciences field are expected to increase 18% between 2016 and 2026.[13] Practitioners in this field use a wide range of math skills every day to perform their jobs, including understanding units of measurement to take temperatures and blood pressure, conversion and proportionality to mix and dispense the correct dose of medication, and geometry to adjust patient joint movements.[14] [15]

The activity developed for this station supports students in developing proportional reasoning by using a context that generates a need for proportionality (the number of expected heartbeats in one minute, given the number counted in 15 seconds) and allowing students to draw on their background knowledge.[16] Ratios and proportions are foundational to student understanding across multiple topics in mathematics and

[13] Bureau of Labor Statistics (2019). *Occupational Outlook Handbook*. Washington, DC: Author.

[14] Raines, C. (2018). How to use math in health care careers. The Houston Chronicle. Houston, TX: Hearst. Retrieved from https://work.chron.com/use-math-health-care-careers-26310.html .

[15] Nelson, B. W., Carpenter, D. M., Dreisinger, T. E., Mitchell, M., Kelly, C. E., & Wegner, J. A. (1999). Can spinal surgery be prevented by aggressive strengthening exercises? A prospective study of cervical and lumbar patients. Archives of physical medicine and rehabilitation, 80(1), 20-25. Retrieved from https://doi.org/10.1016/S0003-9993(99)90302-7

[16] Fielding-Wells, J., Dole, S., & Makar, K. (2014). Inquiry pedagogy to promote emerging proportional reasoning in primary students. Mathematics Education Research Journal, 26, 47–77. doi:10.1007/s13394-013-0111-6

science, as well as in real-life situations, such as doubling a recipe or calculating gas mileage.[17] Families can practice proportional reasoning at home by talking about and involving children in real-life proportional situations.

[17] Dougherty, Barbara & Bryant, Diane & Bryant, Brian & Shin, Mikyung. (2016). Helping Students With Mathematics Difficulties Understand Ratios and Proportions. TEACHING Exceptional Children. 49. 96-105.

Activity: How many heartbeats?

Facilitator(s): _____

Purpose

Students and families listen to their hearts beating. They compare the number of heartbeats they count while resting to the number of heartbeats they count after doing physical activity.

Materials

- Activity Instructions and family prompts
- Stethoscope
- Stopwatch
- Counters (2 colors)

Facilitator Notes

1. Make a connection between the relevant job talk in the "Mathematics at Work" presentation and the activity. Example script: The presenter talked to you about [some of the things the presenter talked about]. Health professionals often listen to a patient's heart to check on their health. In this activity you're going to listen to your heart beating and collect some data.
2. Help family members use the stethoscopes to listen to their hearts beating. Then help each family member find their pulse. Explain that children and families may use the stethoscope, their pulse, or both to count heartbeats during the activity.
3. Show parents how they can use the prompts based on their child's grade level.
4. Model asking questions, such as "How many heartbeats did you count?"
5. As families work, answer questions about the instructions. Guide families to use developmentally appropriate strategies such as aligning counters to compare or subtract; using strategies based on place value to add, subtract, or multiply; or using the standard algorithm to perform operations.

West Virginia Standards

Kindergarten

Cluster	**Know number names and the count sequence.**
M.K.1	Count to 100 by ones and by tens.
M.K.3	Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).
Cluster	**Compare numbers.**
M.K.7	Compare two numbers between 1 and 10 presented as written numerals.
Cluster	**Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.**
M.K.9	Solve addition and subtraction word problems and add and subtract within 10 by using objects or drawings to represent the problem.

First grade

Cluster	**Represent and solve problems involving addition and subtraction.**
M.1.1	Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem).
Cluster	**Extend the counting sequence.**
M.1.9	Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.
Cluster	**Understand place value.**
M.1.11	Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.

Second grade

Cluster	**Understand place value.**
M.2.8	Compare two three-digit numbers based on meanings of the hundreds, tens and ones digits, using >, = and < symbols to record the results of comparisons.
Cluster	**Use place value understanding and properties of operations to add and subtract.**
M.2.9	Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
M.2.10	Add up to four two-digit numbers using strategies based on place value and properties of operations.

Third grade

Cluster	**Represent and solve problems involving multiplication and division.**
M.3.3	Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem).
Cluster	**Use place value understanding and properties of operations to perform multidigit arithmetic.**
M.3.11	Fluently add and subtract within 1,000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

Fourth grade

Cluster	**Use place value understanding and properties of operations to perform multi-digit arithmetic.**
M.4.9	Fluently add and subtract multi-digit whole numbers using the standard algorithm.
M.4.10	Multiply a whole number of up to four digits by a one-digit whole number; multiply two two-digit numbers, using strategies based on place value and the properties of operations; and illustrate and explain the calculation by using equations, rectangular arrays and/or area models.

Fifth grade

Cluster	**Perform operations with multi-digit whole numbers and with decimals to hundredths.**
M.5.8	Fluently multiply multi-digit whole numbers using the standard algorithm.
Cluster	**Analyze patterns and relationships**
M.5.3	Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. (e.g., Given the rule “Add 3” and the starting number 0 and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences and observe the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.)

Station 3: Automotive Technology

Facilitator(s): _____

Purpose

Families and children will listen to an example of how mathematics is used in jobs in the automotive technology field and engage in a related activity aligned with the West Virginia standards for Measurement and Data and Number and Operations in Base Ten.

Materials

- Materials for each activity
- Stamps for tickets

Background

Automotive Technicians are responsible for the service and maintenance of personal and commercial vehicles. These technicians run diagnostic tests to help pinpoint mechanical issues and make necessary repairs. They also provide services that prevent vehicle wear and tear such as oil changes, tire rotation, and replacing worn filters and belts[18]. Automotive Technicians use math in a variety of tasks they perform every day. Their work ranges from measuring the right volume of oil to calculating the horsepower of an engine. The knowledge required to work as a Machinist is similar to that needed by Automotive Technicians—they must understand conversion and work fluently with numbers because they often have to switch back and forth between two different numeric systems; the American system (based on the British foot) and the metric system (based on a 10-digit number system)[19].

Automotive Technicians also use math to understand how different parts of a vehicle work together. For example, gears often determine how much speed or force is applied when a car is in motion. Knowing the correct ratio of ring-and-pinion gears is an

[18]Bureau of Labor Statistics, U.S. Department of Labor (2019) *Occupational Outlook Handbook*, Automotive Service Technicians and Mechanics, https://www.bls.gov/ooh/installation-maintenance-and-repair/automotive-service-technicians-and-mechanics.htm.
[19]Bauholz, Henri. (2017) How do Mechanics Use Math? Scienceing.com. https://sciencing.com/mechanics-use-math-4570197.html

important skill for Automotive Technicians when diagnosing issues and making repairs[20].

The activity developed for this station engages students in an investigation using gears as concrete manipulatives. Concrete manipulatives can help students develop visual thinking, which is important to all levels of mathematics.[21] In this activity, younger students sort objects into categories, compare the categories, and notice that the group of objects can be sorted in more than one way. This helps them to build foundations for their study of statistics and probability in later grades. They also have opportunities to strengthen and apply what they are learning about addition and subtraction in this context.[22] In the activities for older students, they begin to examine the relationship between addition and multiplication, as well as factors and multiples. Exploring multiplication contexts in which two different pairs of factors result in the same product can help students see that products can be composed and decomposed in different ways. This can help them build flexible methods of computation in multiplication and division.[23] Families can support students' understanding of sorting and comparing at home by having students sort objects around the house and make comparison statements about the categories. Families can support students' understanding of factors and multiples by involving them in tasks that require multiplication and division, such as doubling or halving a recipe, calculating area, or determining the cost of *x* equal-priced items if you know the cost of one item.

[20] Kopycinski, J. (2013) Ring-And-Pinion Set-Up- Gear Talk. Four Wheeler Network.com. http://www.fourwheeler.com/how-to/transmission-drivetrain/1401-ring-and-pinion-set-up-gear-talk/

[21] Boaler, J., Chen, L., Williams, C. & Cordero, M. (2016). Seeing as Understanding: The Importance of Visual Mathematics for our Brain and Learning. J Appl Computat Math 5: 325.

[22] The Common Core Standards Writing Team. (2011b). *Progressions for the Common Core State Standards in Mathematics (draft): K–3, categorical data; grades 2–5, Measurement Data.* Retrieved from http://ime.math.arizona.edu/progressions/#products

[23] Van de Walle, J. A., Karp, K. S., & Bay-Williams, J. M. (2019). *Elementary and middle school mathematics: Teaching developmentally (10th ed.)*. NY: Pearson Education.

Activity: Gears

Facilitator(s): _____

Purpose

Students and families will explore gears of different sizes. Younger students will sort objects and make comparisons, and older students will investigate how gears work together.

Materials

- Gear sets
- Handouts
- Permanent markers
- Small stickers
- Car gears
- Pencils/pens

Facilitator Notes

1. Make a connection between the relevant job talk in the "Mathematics at Work" presentation and the activity. Example script: The presenter talked to you about [some of the things the presenter talked about]. Gears are one of the important parts on the inside of cars. They look like this [show examples of actual car gears], and we're going to use colorful plastic gears in this activity [show gears for activity]. When automotive technicians have to work on a car's gears, they need to make sure they use the right gear for the job, so they need to pay close attention to each gear's size and the number of teeth. In this activity, you may be sorting gears or investigating how different sizes of gears work together.
2. Show parents how they can use the prompts based on their child's grade level. Model asking questions, such as "How many teeth on the small gear?" Point out the "Gears Glossary" sheet.
3. As families work, answer questions about the instructions. Encourage families to discuss the patterns or relationships they notice.

West Virginia Standards

Kindergarten

Cluster	**Describe and compare measurable attributes.**
M.K.14	Describe measurable attributes of objects, such as length or weight and describe several measurable attributes of a single object.
Cluster	**Classify objects and count the number of objects in each category.**
M.K.16	Classify objects into given categories, count the numbers of objects in each category, and sort the categories by count. Category counts should be limited to less than or equal to 10. (e.g., identify coins and sort them into groups of 5s or 10s.)

First grade

Cluster	**Represent and interpret data.**
M.1.18	Organize, represent, interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category and how many more or less are in one category than in another.

Second grade

Cluster	**Use place value understanding and properties of operations to add and subtract.**
M.2.10	Add up to four two-digit numbers using strategies based on place value and properties of operations.

Third grade

Cluster	**Represent and interpret data.**
M.3.11	Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

Fourth grade

Cluster	**Gain familiarity with factors and multiples.**
M.4.4	Find all factor pairs for a whole number in the range 1–100, recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.
Cluster	**Use place value understanding and properties of operations to perform multi-digit arithmetic.**
M.4.10	Multiply a whole number of up to four digits by a one-digit whole number, multiply two two-digit numbers, using strategies based on place value and the properties of operations and illustrate and explain the calculation by using equations, rectangular arrays and/or area models

Fifth grade

Cluster	**Analyze patterns and relationships**
M.5.3	Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. (e.g., Given the rule “Add 3” and the starting number 0 and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.)
Cluster	**Perform operations with multi-digit whole numbers and with decimals to hundredths.**
M.5.8	Fluently multiply multi-digit whole numbers using the standard algorithm.

Wrap-up and Next Steps 10 minutes

Facilitator(s): _____

Purpose

Conclude the community math night.

Materials

- Feedback survey
- Raffle tickets

Facilitator Notes

1. Thank participants for engaging in the activities.
2. Explain there are many activities family and community members can participate in with children outside school to encourage interest in math and support learning. A few examples are:
   - For young children, count objects around the house and ask, how many in all?
   - Talk about and compare shapes of everyday objects.
   - Use spatial language (longer, shorter, higher, lower, closer, farther).
   - Play card games and board games that require math, including ones you make up yourself.
   - Read picture books about math.
3. Distribute the feedback survey to participants and instruct them on where to return it. Provide 5 minutes for participants to complete the survey before announcing raffle winners.
4. Call out raffle winners and distribute prizes.

Table Handouts

The following sheets will be pre-printed for the workshop. They should be printed in card stock or laminated.

Station 1: How many of me…?

Instructions

1. Cut a piece of ribbon that is equal in length to the height of the child.
2. You will call the length of ribbon by the name of the person who you measure. For example, the ribbon cut to match the height of Jacob is called “a Jacob”.
3. Use the prompts and the ribbon to measure different lengths around the room.

Family Prompts

Grades K–1

1. What are some things in this room you could use your ribbon to measure?
2. Let's use the length of your ribbon to measure the length of the room/bleachers. First, let's estimate. How many "Jacobs" do you think it will take to equal the length of the room/bleachers? How many "Jacobs" does a family member think it will take?
3. Next, use the ribbon to count how many "Jacobs" would fit across the room/bleachers. Who was closer?
4. Which do you think is longer: the length or the width of the room/bleachers? How could we measure to find out?
5. Use the ribbon to measure the width of the room/bleachers.
6. Now that you've measured the length and width of the room/bleachers, make a guess about how many "Jacobs" it would take to equal the height of the room/bleachers. How did you make your guess?

Family Prompts

Grades 2–3

1. Use your ribbon to measure the length of the room/bleachers in “Jacobs”.
2. Cut a piece of ribbon that is the equal in length to the height of a family member. Use a different color.
3. Which do you think will be greater: The number of “Jacobs” needed to measure the length of the room/bleachers or the number of “Family Members”? Why?
4. Check your prediction: Use the ribbon to measure the length of the room/bleachers in “Family Members.”
5. Compare the results to your prediction. What is surprising?
6. Discuss why the number of “Jacobs” is different than the number of “Family Members.”
7. If there is time remaining:
   a. How could we figure out the perimeter? (Note: the perimeter is the total length around the room/bleachers where the wall meets the floor.)
   b. Would you want to measure in “Jacobs” or “Family Members”? Why?
   c. Measure the width. Add length + width + length + width to calculate the perimeter.

Family Prompts

Grades 4–5

1. Use your ribbon to measure the length of the room/bleachers in “Jacobs.”
2. What’s longer: an inch or a foot? Allow your child to look at a ruler, yardstick, or tape measure to decide.
3. Estimate: about how long is a “Jacob” in inches?
4. Measure your ribbon in inches. Record your answer on the recording sheet.
5. Can you calculate the length of your ribbon in feet now that you know it in inches? Measure your ribbon in feet to check.
6. What’s longer: a meter or a centimeter? Allow your child to look at a meterstick or tape measure to decide.
7. Estimate: about how long is a “Jacob” in centimeters?
8. Measure your ribbon in centimeters and meters. Record your answers on the recording sheet.
9. Can you use the length of the room/bleachers in “Jacobs” to calculate the length of the room/bleachers in feet?
10. Which do you think will be greater: the height of the room/bleachers or the length? Why?

Station 2: How many heartbeats?

Instructions

1. Use the stethoscope to listen to your heart beating. Listen to a family member's heart beating.
2. Use your finger and find your pulse on your wrist or neck. Feel your pulse while you listen to your heartbeat. Notice that each time you feel a pulse beat on your finger, you hear two sounds through the stethoscope.
3. Use the prompts to collect and analyze data about your heart.

Family Prompts

Grades K–2

1. Let your child use the stethoscope to count the number of times their heart beats in 5 seconds.
    - Have your child tap in time with the heartbeats they hear, and count them out loud together.
2. Have your child use one color of counters to model the number in the ten frames on the “Sitting” recording sheet. Point to each counter and count them out loud together.
3. Have your child write the number.
4. Do you think you will count more or less heartbeats in the same amount of time after you move around?
5. Have your child move (hop on 1 or 2 feet, dance, wave their arms, walk around) for 15–30 seconds.
6. Have the child count the number of heartbeats in 5 seconds. What happened?
7. Have your child use a different color of counters to model the number in the ten frames on the “After Moving” recording sheet. Point to each counter and count them out loud together.
8. Have your child write the number.
9. Did you count more heartbeats when you were sitting or after you moved?
10. How many more heartbeats did you count? Allow your child to use the counters to find the answer.

Family Prompts

Grades 3–4

1. Let your child use the stethoscope to count the number of times their heart beats in 15 seconds.
2. Record the number of heartbeats on the recording sheet.
3. How many total heartbeats would you expect to count if you counted for 15 more seconds? Why?
4. Explain that there are 60 seconds in one minute.
5. Could you figure out how many heartbeats you would expect to count in 1 minute?
6. Let your child use repeated addition or multiplication to determine the number of heartbeats they would count in 1 minute.
7. Have your child count the number of heartbeats in 1 minute.
8. Are the number you calculated and the number you counted close? Are they exactly the same? Why might they be different?
9. Do you think you will count more or less heartbeats in 1 minute after you move around? How many?
10. Have your child move (hop on 1 or 2 feet, dance, wave their arms, walk around) for 15–30 seconds.
11. Have your child count the number of heartbeats in 1 minute.
12. Did you count more heartbeats when you were sitting or after you moved?
13. How many more heartbeats did you count?

Family Prompts

Grade 5

1. Let your child use the stethoscope to count the number of times their heart beats in 15 seconds.
2. Record the number of heartbeats on the recording sheet.
3. Could you figure out how many heartbeats you would expect to count in 1 minute?
4. Hint: it may help to divide 60 by 15.
5. Write an addition equation, like 15 + 15 + 15 + 15 = 60, to tell how many heartbeats you would count in 1 minute.
6. Write a multiplication equation, like $4 \times 15 = 60$, to tell how many heartbeats you could count in 1 minute.
7. Have your child count the number of heartbeats in 1 minute.
8. Is the number you calculated close to the number you counted? Are they exactly the same? Why might they be different?
9. Do you think you will count more or less heartbeats in 1 minute after you move around? How many?
10. Have your child move (hop on 1 or 2 feet, dance, wave their arms, walk around) for 15–30 seconds.
11. Have your child count the number of heartbeats in 1 minute.
12. Did you count more heartbeats when you were sitting or after you moved? When was your heart beating faster?
13. How many more heartbeats did you count?
14. Collect the same data for another family member, or compare with someone else at your table. Whose heart was beating faster when you were both sitting? Whose heart was beating faster after you moved?

Station 3: Gears!

Instructions

1. Choose a gear and point to a tooth. Use the Gears Glossary to help if you are unsure.
2. Set up a gear train using two or more gears. Spin one of the gears and watch what happens.
3. Use the prompts to analyze the set of gears.

Family Prompts

Grades K–1

1. What are some ways you could sort the gears? How do you think an automotive technician might sort them?
2. Sort the gears based on size. How many groups?
    a. How many small gears?
    b. How many medium gears?
    c. How many large gears?
    d. Are there more small gears or medium gears? How many more?
    e. Are there more large gears or medium gears? How many more?
    f. Count the teeth on a small gear. Use the sticker as the starting point. How many teeth?
    g. Count the teeth on a medium gear. Use the sticker as the starting point. How many teeth?
    h. Count the teeth on a large gear. Use the sticker as the starting point. How many teeth?
3. Sort the gears based on color. How many groups?
    a. Ask questions about these groups like those in Step 2. (e.g., How many yellow? How many more yellow than blue?)

Family Prompts

Grades 2–3

1. Set up the gears as shown on the recording sheet. Be sure to match up the arrows and stars as shown.
2. Count the teeth on each gear and record the numbers in the table.
3. Attach sticky arrows to each gear to mark the starting point.
4. Count the number of full rotations (spins) each gear makes until each gear is back at its starting point. Record the numbers.
5. Use repeated addition to write an addition equation for each gear. Add the number of teeth together as many times as you rotated the gear (e.g., 8 + 8 + 8 = 24).
6. If you spin the small gear 5 times, will the arrows match up? How did you decide? Spin to check.
7. Repeat for the other gear diagrams shown on the recording sheet.

Family Prompts

Grades 4–5

1. Set up the gears as shown on the recording sheet. Be sure to match up the arrows and stars as shown.
2. Count the teeth on each gear and record the numbers in the table.
3. Attach sticky arrows to each gear to mark the starting point.
4. Count the number of full rotations (spins) each gear makes until each gear is back at its starting point. Record the numbers.
5. For each gear, multiply the number of teeth by the number of rotations. What do you notice?
6. Spin the small gear 5 times. What do you notice?
7. If you spin the small gear 12 times, will the arrows match up? How did you decide? Spin to check.
8. Repeat for the other gear diagrams shown on the recording sheet.

Math Night Parent Handouts

The following documents will be printed without headers so that each parent will receive a family letter and infographic.

Welcome and Goals

Supporting Your Child in Developing Math Skills For Future Success

Math success opens doors to college and careers.

The technical and professional jobs of the future demand more mathematical knowledge and problem solving skills.

Children who believe they can be successful in math are more willing to put in effort, even when they struggle, and this results in better performance.[i]

Success in elementary school math predicts future achievement in middle and high school math and other subjects.[ii, iii]

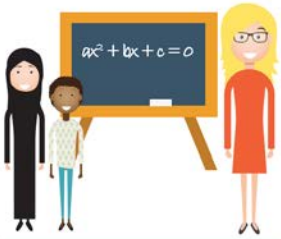
Students who complete higher level math in high school earn higher incomes in the future.[iv]

The number of STEM (science, technology, engineering, and mathematics) jobs is growing and half of all STEM jobs are available to workers without a four-year college degree. STEM jobs pay 10% more than other jobs available to these workers.[v]

Families can support children in developing math skills for the future by[iv]:

praising effort and modeling positive math attitudes.

encouraging children to seek help and try new strategies when they are stuck.



confronting stereotypes about who is good at math.

i Boaler, J. (2015). Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching. San Francisco, CA: John Wiley & Sons.

ii Claessens, A., & Engel, M. (2013). How important is where you start? Early mathematics knowledge and later school success. *Teachers College Record, 115*(6), 1-29. http://eric.ed.gov/?id=EJ1020177

iii Siegler, R. S., Duncan, G. J., Davis-Kean, P. E., Duckworth, K., Claessens, A., Engel, M., ... & Chen, M. (2012). Early predictors of high school mathematics achievement. *Psychological Science, 23*(7), 691-697.

iv Achieve, Inc. (2006). Closing the expectations gap: An annual 50-state progress report on the alignment of high school policies with the demands of college and work. Washington, DC: Author.

v Rothwell, J. (2013). The Hidden STEM Economy. Brookings Institution: Washington, DC.

iv Epstein, J.L. (2001). School, family, and community partnerships (1st ed.). Boulder, CO: Westview Press.

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Take-Home Letter

Dear family,

Thank you for coming to support your young mathematicians' learning. The math seed you plant now will blossom and help them to succeed in life whatever path they choose.

We have chosen these games and activities so you can play them with your children. Sometimes you will lead, sometimes they will lead, but always you will be working together. Sometimes the activities may seem more like regular life than math class. We did that on purpose to show you how math really does relate to your daily life and fun activities that you want to do with your children anyway.

We encourage you to do math at home or wherever you are with your children. Every week make sure you are doing activities that involve math: count, sort, compare, measure, and make patterns and designs. For example:

- Ask your children to count things like tiles, packages, and cars.
- At least once a week play card games and board games.
- Sing songs together in the car or at home.
- Ask your children to sort the cutlery into categories at home after doing the dishes.
- Look for patterns or shapes on your way to school or in the way food is organized in the supermarket.
- Involve your children in measuring when you cook.

As you know, children love repetition, so you can probably do the same activities a few times before your child loses interest.

Please contact us if you have any questions!

Table Materials

The following handouts will be printed for the workshop, as they require special instructions for printing and cutting and color.

Measurement Word Wall

length

width

height

longer

taller

wider

shorter

How many of me?
(Grades 2–3)

The first ribbon I cut is _____.
(color)

This ribbon is called 1 _____.
(name of the person you measured)

The length of this room is _____ _____.
(number) (unit name)

The second ribbon I cut is _____.
(color)

This ribbon is called 1 _____.
(name of the family member you measured)

I think it will take more _____
(name of unit)
to measure the length of the room.

The length of this room is _____ _____.
(number) (family member unit name)

How many of me?
(Grades 2–3)

The first ribbon I cut is _____.
(color)

This ribbon is called 1 _____.
(name of the person you measured)

The length of the bleachers is _____ _____.
(number) (unit name)

The second ribbon I cut is _____.
(color)

This ribbon is called 1 _____.
(name of the family member you measured)

I think it will take more _____
(name of unit)
to measure the length of the bleachers.

The length of the bleachers is _____ _____.
(number) (family member unit name)

How many of me?
(Grades 4–5)

The ribbon I cut is 1 _____.
(name of the person you measured)

The length of this room is _____ _____.
(number) (unit name)

Customary Units (feet and inches)

1 foot = 12 inches

	Length (inches)	Length (feet)
Length of my ribbon		
Length of the room		

Metric Units (meters, centimeters, millimeters)

100 centimeters = 1 meter
1 centimeter = 10 millimeters

	Length (centimeters)	Length (meters)
Length of my ribbon		
Length of the room		

How many of me?

Grades 4–5

The ribbon I cut is 1 _____.
(name of the person you measured)

The length of the bleachers is _____ _____.
(number) (unit name)

Customary Units (feet and inches)

1 foot = 12 inches

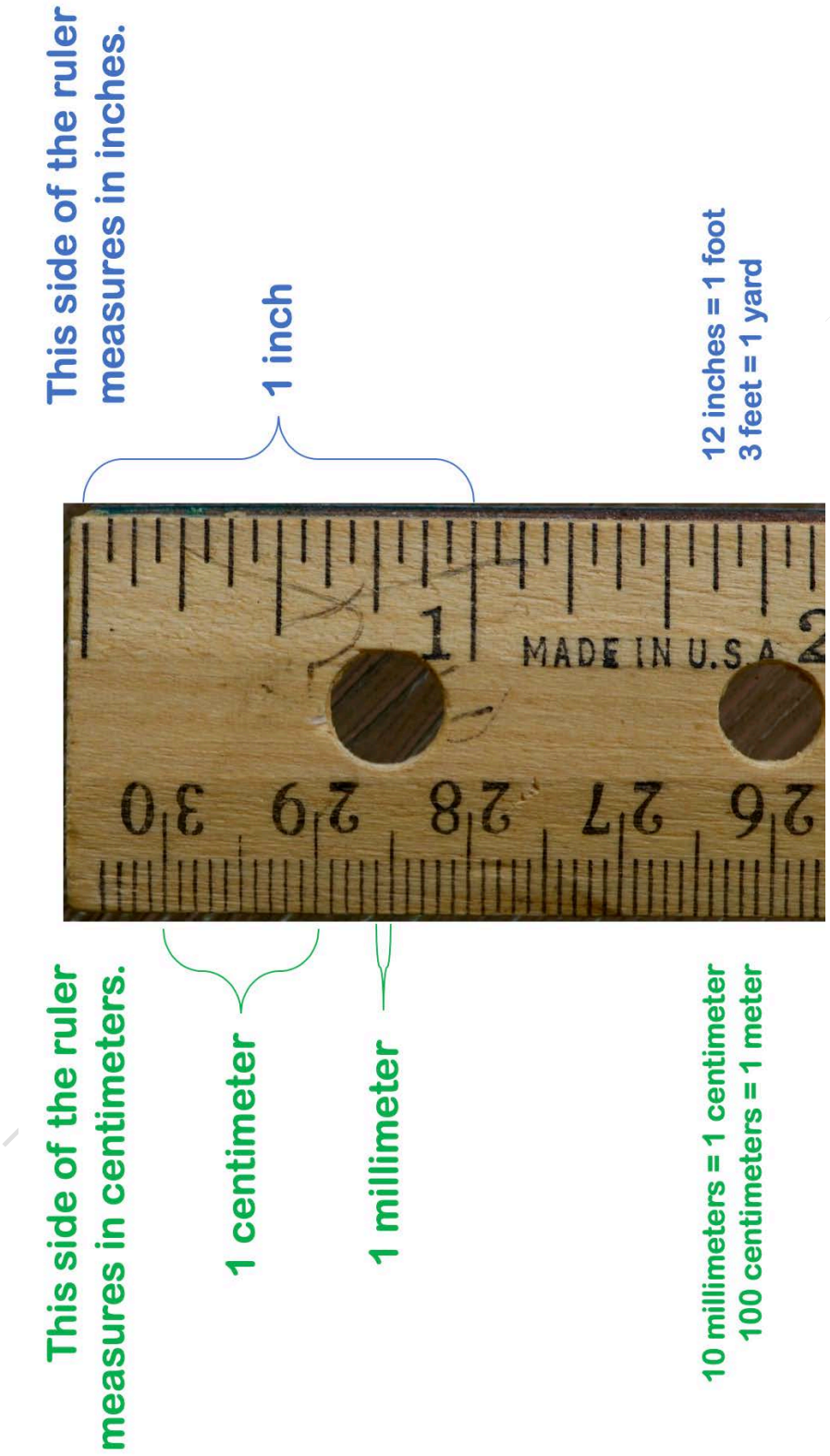
	Length (inches)	Length (feet)
Length of my ribbon		
Length of the bleachers		

Metric Units (meters, centimeters, millimeters)

100 centimeters = 1 meter
1 centimeter = 10 millimeters

	Length (centimeters)	Length (meters)
Length of my ribbon		
Length of the bleachers		

Measurement Reference Sheet



How many heartbeats?

Grades K–2

Sitting

I counted _____ heartbeats.

How many heartbeats?

Grades K–2

After Moving

I counted _____ heartbeats after moving.

How many heartbeats?

Grades 3–4

Sitting:

I counted _____ heartbeats in 15 seconds.

Time (seconds)	Number of Heartbeats
15	

After Moving:

I counted _____ heartbeats in 60 seconds.

I counted more heartbeats when I was _____.
(sitting or moving)

How many more? _____

How many heartbeats?

Grade 5

Sitting:

I counted _____ heartbeats in 15 seconds.

I can find the number of heartbeats I would expect to count in 1 minute by adding:

I can find the number of heartbeats I would expect to count in 1 minute by multiplying:

I counted _____ heartbeats in 60 seconds.

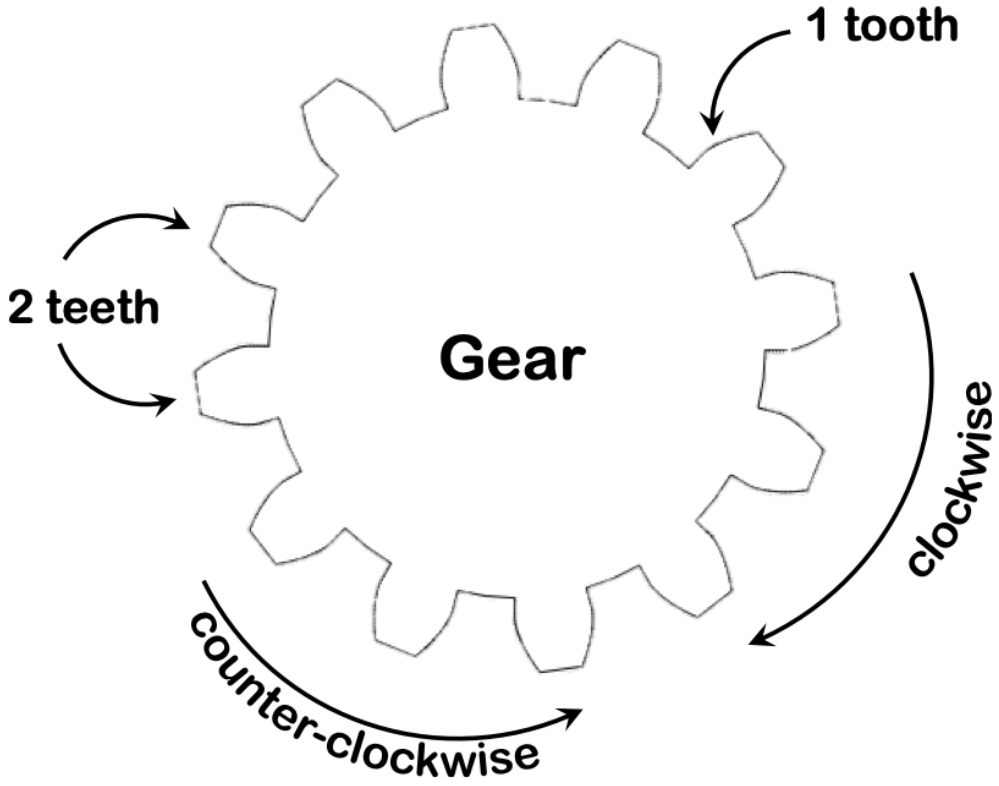
After Moving:

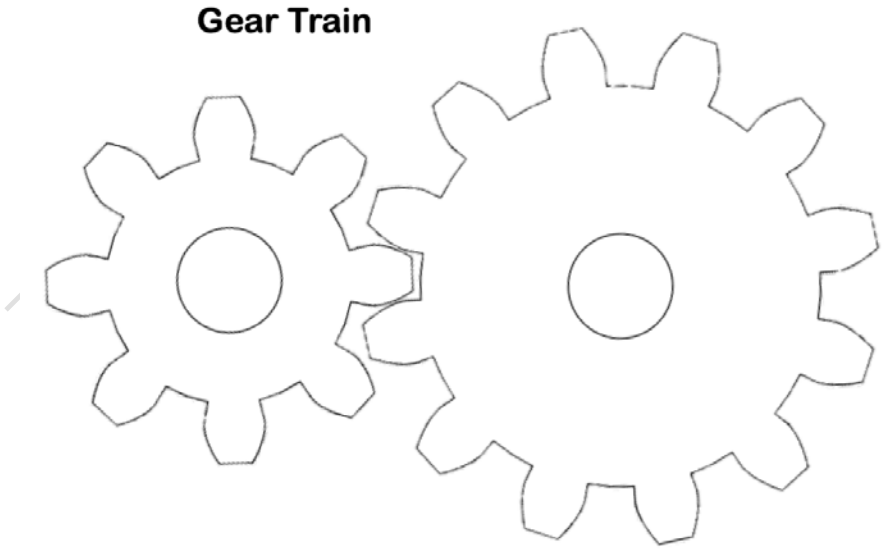
I counted _____ heartbeats in 60 seconds.

I counted more heartbeats when I was _____.
(sitting or moving)

My heart was beating faster when I was_____.
(sitting or moving)

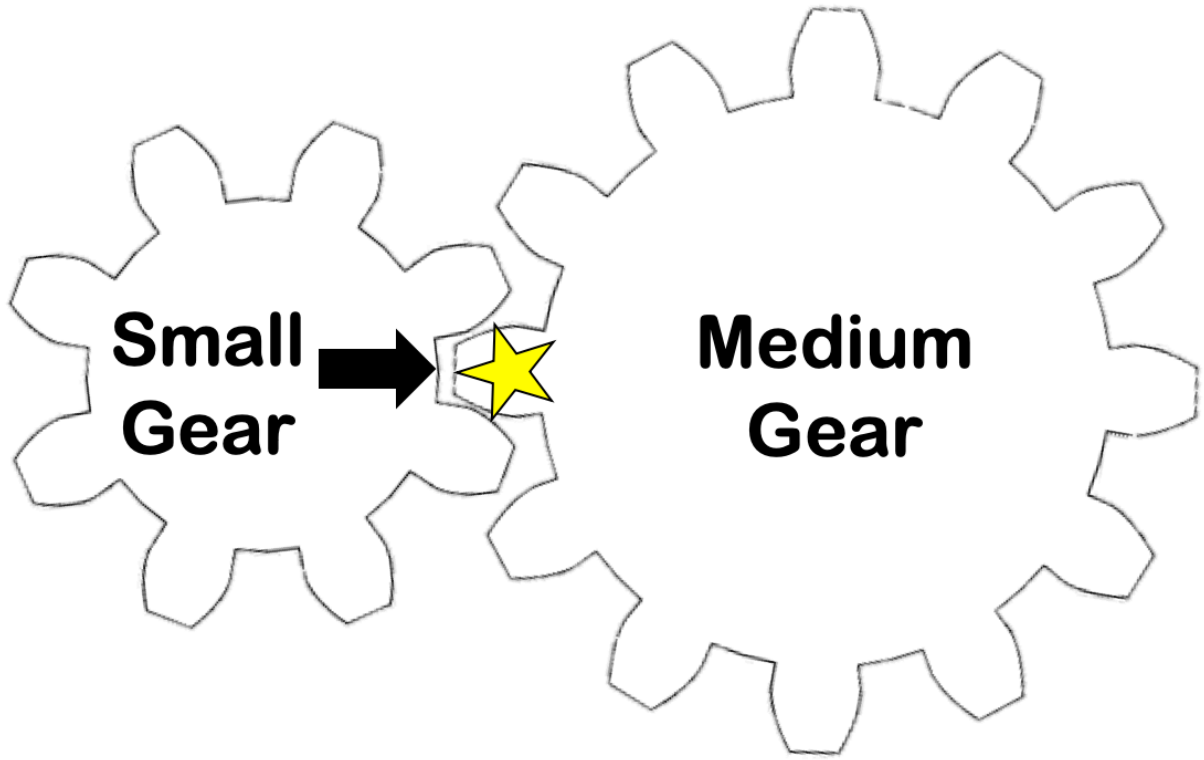
Gears Glossary





Gears!

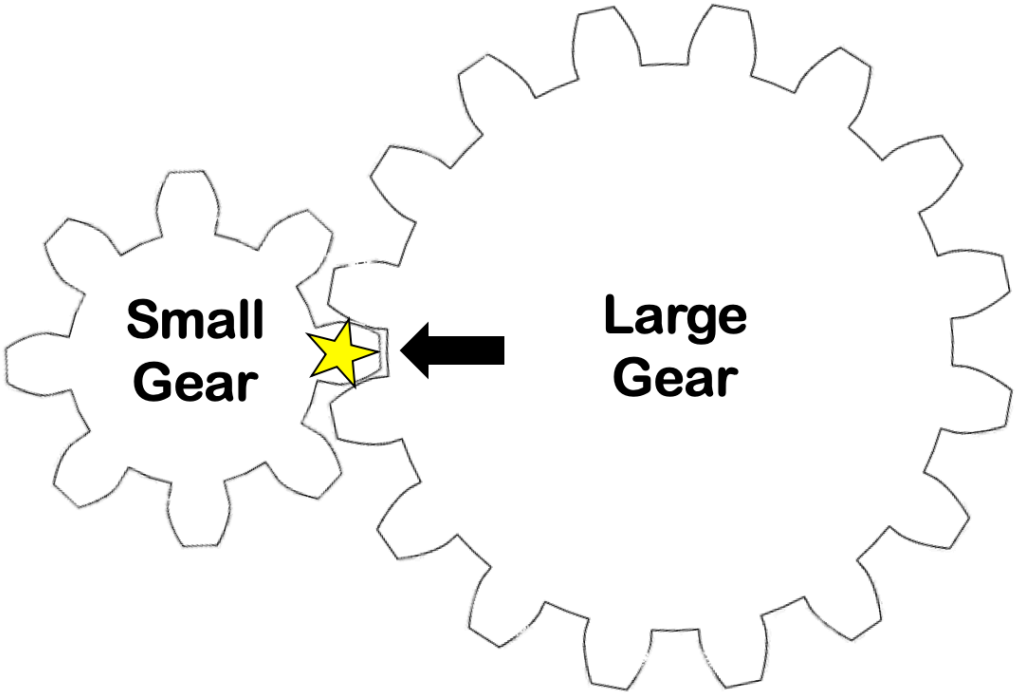
Grades 2–3



	Number of Teeth	Number of Rotations	Addition Equation (add the number of teeth together as many times as you rotated the gear)
Small Gear			_____ + _____ + _____ = _____ (teeth) (teeth) (teeth)
Medium Gear			_____ + _____ = _____ (teeth) (teeth)

Gears!

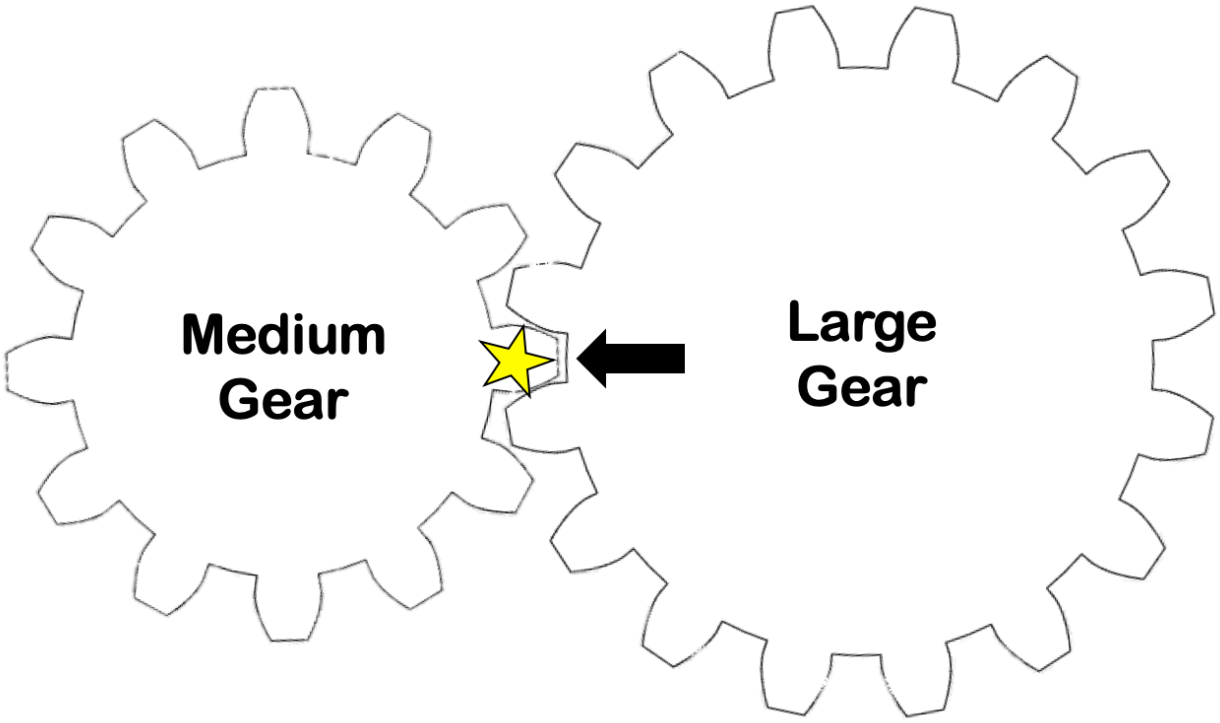
Grades 2–3 (continued)



	Number of Teeth	Number of Rotations	Addition Equation (add the number of teeth together as many times as you rotated the gear)
Small Gear			
Large Gear			

Gears!

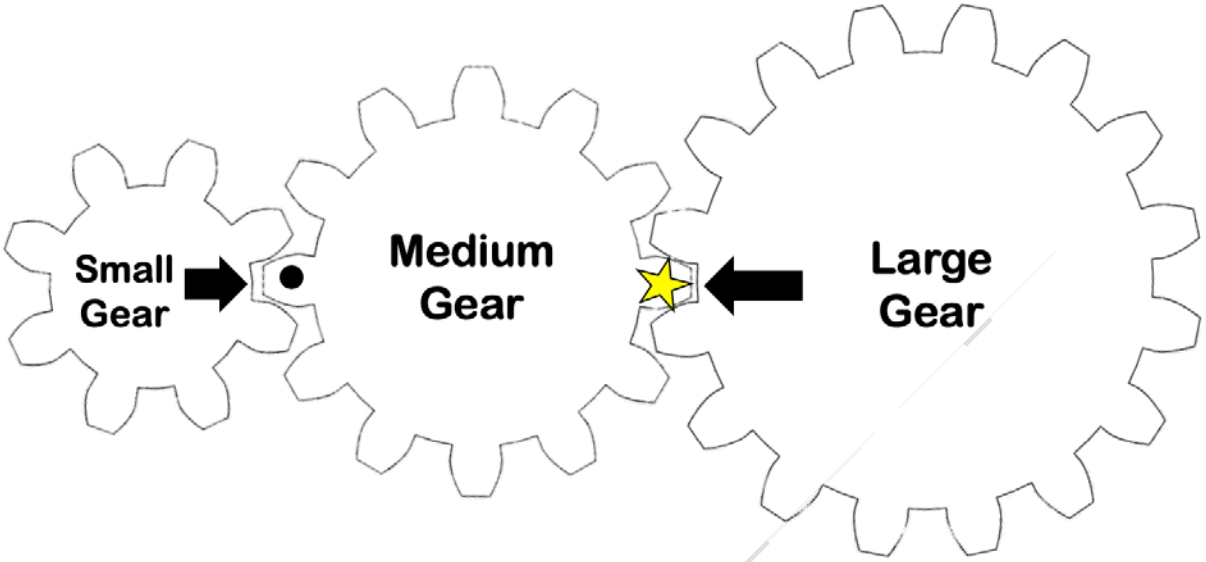
Grades 2–3 (continued)



	Number of Teeth	Number of Rotations	Addition Equation (add the number of teeth together as many times as you rotated the gear)
Medium Gear			
Large Gear			

Gears!

Grades 2–3 (continued)

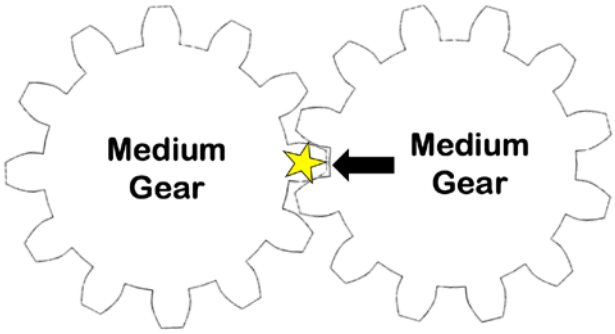


Be sure to line up the arrows, dot, and star!

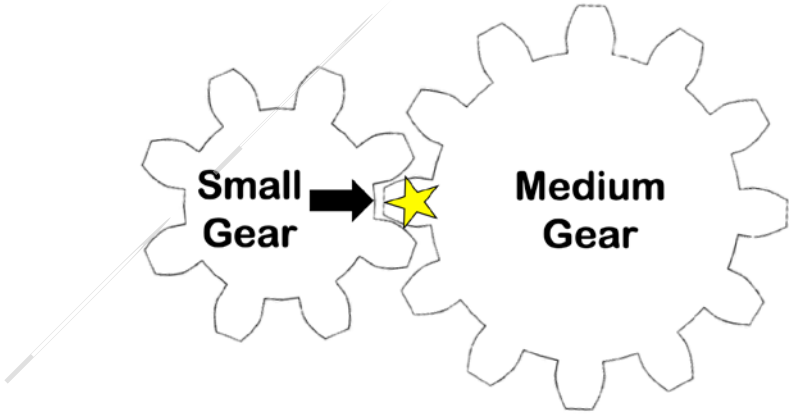
	Number of Teeth	Number of Rotations	Addition Equation (add the number of teeth together as many times as you rotated the gear)
Small Gear			
Medium Gear			
Large Gear			

Gears!

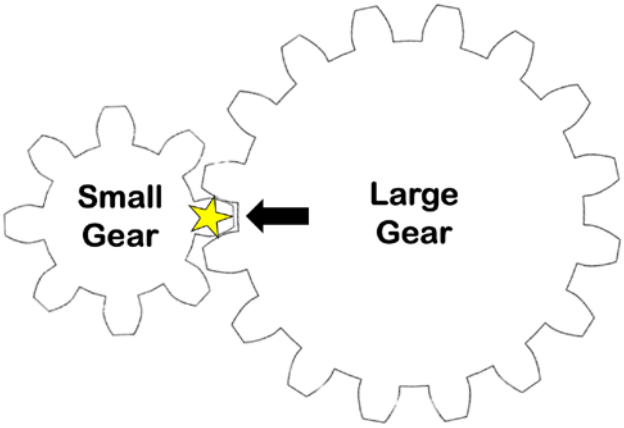
Grades 4–5



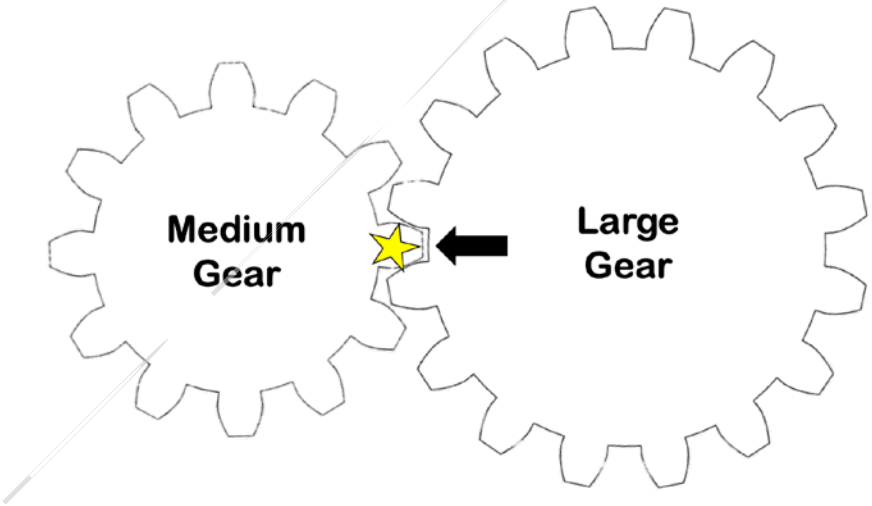
	Number of Teeth	Number of Rotations	Multiplication Equation
Medium Gear			_____ × _____ = _____ (teeth) (rotations)
Medium Gear			_____ × _____ = _____ (teeth) (rotations)



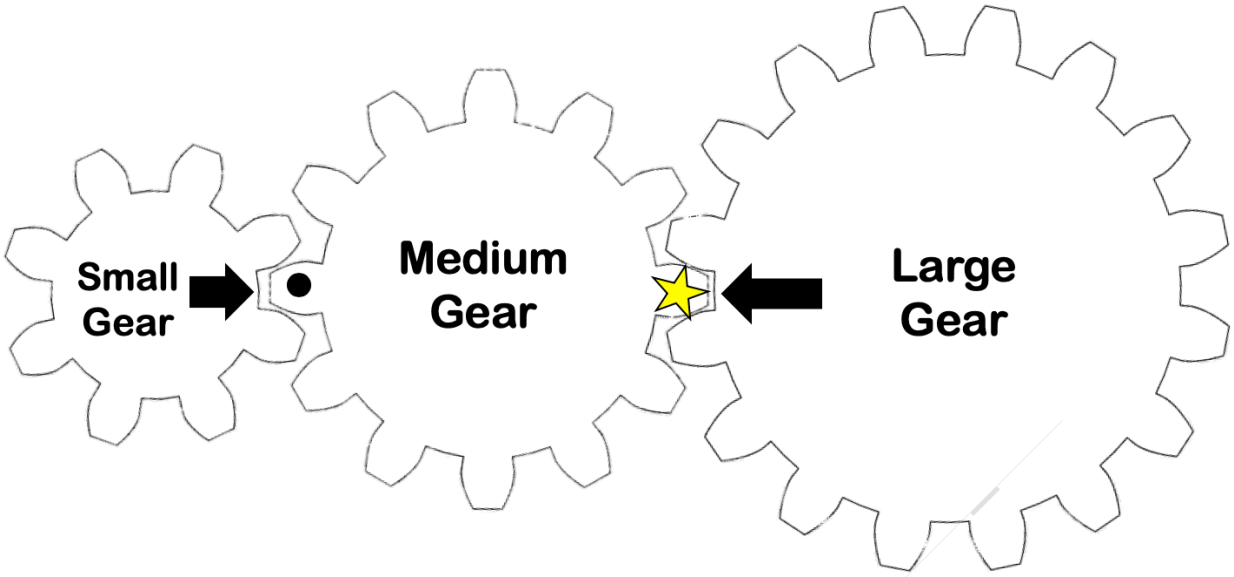
	Number of Teeth	Number of Rotations	Multiplication Equation
Small Gear			_____ × _____ = _____ (teeth) (rotations)
Medium Gear			_____ × _____ = _____ (teeth) (rotations)



	Number of Teeth	Number of Rotations	Multiplication Equation
Small Gear			_____ (teeth) × _____ (rotations) = _____
Large Gear			_____ (teeth) × _____ (rotations) = _____



	Number of Teeth	Number of Rotations	Multiplication Equation
Medium Gear			_____ (teeth) × _____ (rotations) = _____
Large Gear			_____ (teeth) × _____ (rotations) = _____



	Number of Teeth	Number of Rotations	Multiplication Equation
Small Gear			_____ (teeth) × _____ (rotations) = _____
Medium Gear			_____ (teeth) × _____ (rotations) = _____
Large Gear			_____ (teeth) × _____ (rotations) = _____

Raffle Tickets

Student Name:		
Station 1	Station 2	Station 3

Student Name:		
Station 1	Station 2	Station 3

Student Name:		
Station 1	Station 2	Station 3

Student Name:		
Station 1	Station 2	Station 3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