Poll on Sub-Claims

Please choose which best describes you:

- ❑ I have seen and used the PARCC Sub-Claims.
- ❑ I have seen the PARCC Sub-Claims.
- ❑ I have heard about the PARCC Sub-Claims.
- ❑ This is my first exposure to the PARCC Sub-Claims.

PARCC Math Sub-Claims C & D
High School

February 6, 2018

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What is your role?

Please choose which role best describes you:

- ❑ Teacher
- ❑ Instructional Coach
- ❑ School Administrator
- ❑ District Administrator
- ❑ Other (type role in the chat box)

Goals

1. Understand the importance of Math Practices 3, 4, and 6 in PARCC Sub-Claims C & D.
2. Learn how to create engaging, rigorous math tasks

Claims Structure*:
Mathematics – High School

Master Claim: On-Track for college and career readiness. The degree to which a student is college and career ready (or "on-track" to being ready) in mathematics. The student solves grade-level /course-level problems in mathematics as set forth in the Standards for Mathematical Content with connections to the Standards for Mathematical Practice.

Sub-Claim A: Major Content[1] with Connections to Practices
The student solves problems involving the Major Content[1] for her grade/course with connections to the Standards for Mathematical Practice.

21 – 30 points

Sub-Claim B: Additional & Supporting Content[2] with Connections to Practices
The student solves problems involving the Additional and Supporting Content[2] for her grade/course with connections to the Standards for Mathematical Practice.

14 – 21 points

Sub-Claim C: Highlighted Practices MP.3 and 6 with Connections to Content (expressing mathematical reasoning)
The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.

14 points

Sub-Claim D: Highlighted Practice MP.4 with Connections to Content (modeling/application)

The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), *engaging particularly in the Modeling practice*, and where helpful making sense of problems and persevering to solve them (MP. 1),reasoning abstractly and quantitatively (MP. 2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).

18 points

Total Exam :

81 points[3]

Christopher N. Ruszkowski
Secretary-Designate of Education

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18 points

Total Exam :

81 points[3]

Christopher N. Ruszkowski
Secretary-Designate of Education

Sub-Claim C

Sub-Claim C: Highlighted Practices MP.3,6 with Connections to Content[3] (expressing mathematical reasoning)
The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.

14 points

SMP #3: Constructing viable arguments and critiquing the reasoning of others

SMP #6: Attend to precision

Sub-Claim C Example

A cyclist is training for a long-distance race and increases the distance the cyclist rides each day. On the first day of training, the cyclist rides 5km. Each day, the distance increases by 25% during the first 15 days.

- Write an equation that can be used to find the total distance the cyclist rode after *n* days. Explain how you determined your equation. Determine the total distance the cyclist rode during the training after riding on day 15.
- Enter your equation, your explanation, and your answer in the space provided.

SMP 3: Constructing Viable Arguments and Critiquing Reasoning of Others

- To truly practice this math practice, students must:
  - Use assumptions/prior results to develop arguments.
  - Make conjectures and use logical reasoning to analyze their conjectures.
  - Recognize and use counter examples
  - Justify conclusions with mathematical ideas.
  - Identify and explain flaws in arguments.
  - Use questions to clarify reasoning.

Incorporating sentence stems to help students engage in SMP 3

- Suggested sentence stems
  - The mathematical evidence I used to support my solution was ____.
  - I agree with ____ because____.
  - I didn't understand why you____.
  - I disagree with ____ because ____.
  - I wonder why you____.
  - What if you had____?
  - How did you get _____?
  - I know this is true because_____.
  - A way I can test this to see if it true is to_____.

-From Small (2017)

SMP 6: Attending to Precision

To truly engage in this math practice, students must:

- Use vocabulary precisely.
- Have clear explanations and definitions.
- State the meaning of symbols they chose.
- Calculate accurately.
- Label units of measure/axes appropriately.

SMP 3 & 6
Planning and Delivery

When designing a task, keep in mind:

- Multiple entry points that encourage varied approaches and representations.
- Embedded structures for students to ask questions of each other and have time to discuss/share/compare thinking.
- Opportunities to use math concepts correctly and vocabulary appropriately.
- Providing experiences for students to use clear and concise notation to record their work.

-Adapted from Ramirez (2011)

SMP 3 & 6
Planning and Delivery

To further develop Math Practices 3 & 6 within students, teachers need to:

- Provide time for student-to student discourse.
- Consistently model use of correct content vocabulary.
- Encourage students to use precise math vocabulary in discussions/writings.
- Make sure students identify symbols, quantities, and units in a clear manner.

-Adapted from Ramirez (2011)

Sub-Claim C Example

The point (2,-3) is on a circle, which is centered on the point (-1,1). Is the point (√7,-1) on the circle, inside the circle, or outside the circle. Justify your response.

Sub-Claim D

Sub-Claim D: Highlighted Practice MP.4 with Connections to Content (modeling/application)

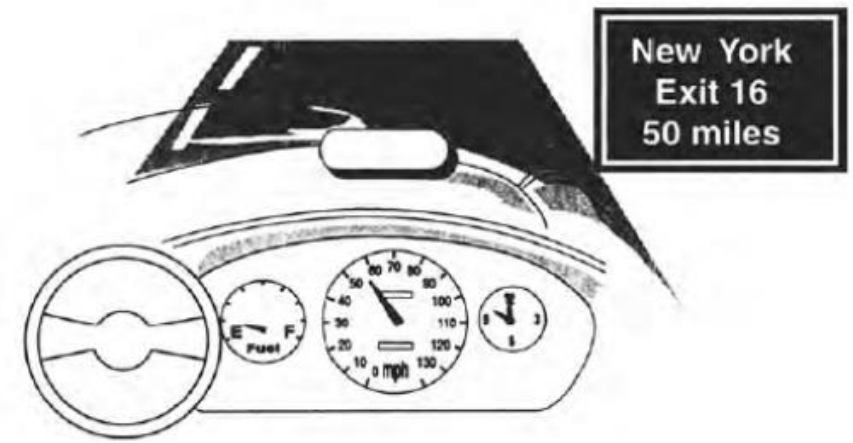
The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), *engaging particularly in the Modeling practice*, and where helpful making sense of problems and persevering to solve them (MP. 1),reasoning abstractly and quantitatively (MP. 2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).

SMP 4: Model with Mathematics

Sub-Claim D Example

Suppose you are driving on the New Jersey Turnpike to go to a new job interview in New York at 11:30am. You know that you can average 55 mph on the turnpike. You must drive 50 miles to the exit you must use; it will take about 25 minutes of driving to get to the location of your appointment after you leave the turnpike. You also know that the gas tank holds 20 gallons and that you get about 18 miles per gallon on the highway.

Based on this information and the information in the picture, do you need to stop and buy gas on the way to New York? If you do stop to buy gas, remember it will take some time to do so. Will you make it to your appointment early, on time, or late? If early or late, about how early or late would you expect to be? Justify your answers carefully.



Fuel gauge shows gas tank is $\frac{1}{8}$ full.

If you would like to, enter your justification (1–2 sentences) in the chat box.

-Adapted From Danielson and Marquez (2016).

SMP 4: Modeling with Mathematics

Modeling **the** Math

A 600 liters pool is emptied at a rate of 20 liters per minute. Sketch a graph to model this scenario.

Modeling **with** Math

A cell tower signal is able to reach within a 15 kilometer radius to the location of the tower. Engineers placed a signal booster on the tower to reach a greater radius.

Create a mathematical model to calculate the difference in area the signal previously could reach and the area that the signal currently reaches.

SMP 4: Modeling with Mathematics

Students engaged in this math practice:

- Apply mathematics to society and the workplace.
- Make assumptions and approximations, realizing revisions may be needed later.
- Identify relationship between important quantities using tools.
- Check if their solution is reasonable in the context of the situation.
- Improve the model to fit the needs of the task.

SMP 4
Planning and Delivery

A task that engages students in Math Practice 4:

- Includes contextual situations where students can use expressions and equations in their viable argument.

- Allows students to use numerical counterexamples to identify errors in algebraic manipulation.

Adapted from Illustrative Mathematics

SMP 4
Planning and Delivery

To further develop SMP 4 within students, teachers need to:

- Support students to see the importance of connecting the context, equations, tables, and/or graph.
- Emphasize sense making between a context, symbols, and quantities in an equation.
- Provide multiple opportunities for students to use models during math exploration.

-Adapted from Ramirez (2011)

Goals

1. Understand the importance of Math Practices 3, 4, and 6 in PARCC Sub-Claims C & D.
2. Learn how to create engaging, rigorous math tasks

Integrating SMPs in Math Class

Modifying Tasks

Rich math tasks involve:

- Accessibility to All Learners
- Real-Life Application
- Multiple Approaches/Entry Points
- Collaboration/Discussion
- Engagement/Creativity
- Opportunities for Extension

Integrating SMPs in Math Class

Modifying Tasks (Example of Sub-Claim C)

How can we modify this task?

MODELING WITH MATHEMATICS A population y of coyotes in a national park triples every 20 years. The function $y = 15(3)^x$ represents the population, where x is the number of 20-year periods.

a. Graph the function. Describe the domain and range.

b. Find and interpret the y-intercept.

c. How many coyotes are in the national park in 40 years?

-From Big Ideas Math

Integrating SMPs in Math Class

Suggested Steps (Sub-Claim C)

1. What is the learning target?
2. Read the evidence statement.
3. Look at PARCC released items.
4. Make the task engaging.
5. Make the task open ended.
6. Provide multiple entry points.
7. Ensure students justify their reasonable answers. (SMP 3&6)

Integrating SMPs in Math Class

Modifying Tasks (Example of Sub-Claim C)

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-From Big Ideas Math

Integrating SMPs in Math Class

Modifying Tasks (Example of Sub-Claim C)

A park ranger determines the population of bison in a national park can be modeled by using the formula $\boldsymbol{f(t) = 1{,}200(0.5)^t}$ *where* $\boldsymbol{f(t)}$ represents the population after $\boldsymbol{t}$ years.

A student claims: "Based on the formula, after 2 years, the population of bison will die. Since 0.5 is half, the population decreases by half of the original value each year. Since 0.5 and 0.5 will equal 1, the population dies out in two years."

PART A: Explain why the student's claim is or is not a valid way to predict the population.

PART B: Modify the formula to represent the predicted population in $\boldsymbol{m}$ months, and use the modified formula to predict the population after 40 months.

Integrating SMPs in Math Class

Modifying Tasks (Example of Sub-Claim C)

In the national forest, two species populations are introduced, bison and Scale tree. After the first decade, the number of bison and Scale trees are each 50. For the following five decades, the population of both species increased according to the corresponding rules.

Bison: the population increases by 50 every decade

Scale tree: the population triples every decade

PART A: Complete the table below to show the population size for each species throughout the six decades

Decade	Bison	Scale Tree
1	50	50
2		
3		
4		
5		
6		

PART B: Based on the data, a park ranger proposes population growth for both species is linear. Determine whether the claim made by the park ranger is correct, for each species. If it is not correct, explain why and describe a more appropriate model.

Integrating SMPs in Math Class

Modifying Tasks (Example of Sub-Claim D)

How can we modify this task?

24. MODELING WITH MATHEMATICS Telecommunication towers can be used to transmit cellular phone calls. A graph with units measured in kilometers shows towers at points (0, 0), (0, 5), and (6, 3). These towers have a range of about 3 kilometers.

a. Sketch a graph and locate the towers. Are there any locations that may receive calls from more than one tower? Explain your reasoning.

b. The center of City A is located at (−2, 2.5), and the center of City B is located at (5, 4). Each city has a radius of 1.5 kilometers. Which city seems to have better cell phone coverage? Explain your reasoning.

-From Big Ideas Math

Integrating SMPs in Math Class

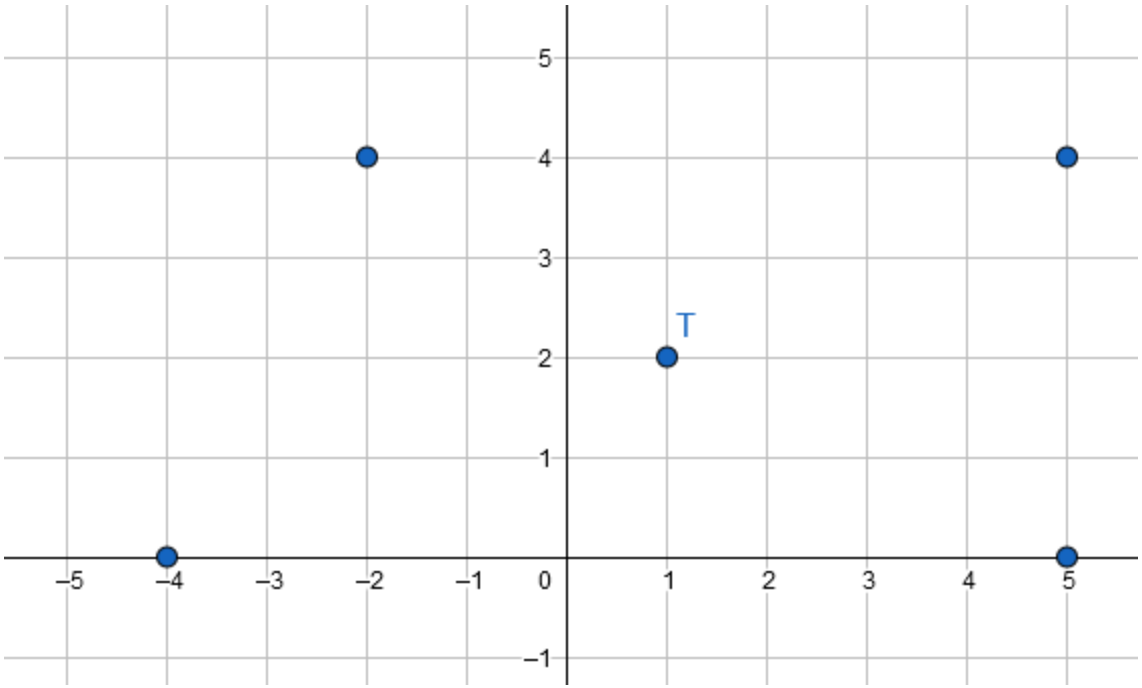
Suggested Steps (Sub-Claim D)

1. What is the learning target?
2. Read the evidence statement.
3. Look at PARCC released items.
4. Make the task engaging.
5. Make the task open ended.
6. Provide multiple entry points.
7. Ensure students model with mathematics (SMP 4)

Integrating SMPs in Math Class

Modifying Tasks (Example of Sub-Claim D)

The area around a town is indicated in the graph. Each unit represents 5 kilometers. A transmitter tower is located at point T which transmits a signal with a radius of 7 kilometers. The town has a population density of 64 people per square kilometer. How many kilometers should the transmitter boost its signal to reach the entire town? Round your answer to the nearest hundredths of kilometers.



Integrating SMPs in Math Class

Modifying Tasks (Example of Sub-Claim D)

A transmitter tower transmits a signal with a radius of 7 kilometers. The area in which the tower transmits has a population density of 64 people per square kilometer. An engineer wants to boost the signal to reach the entire city, with a population of 200,000. How many kilometers must the radius of the signal be increased to reach the entire city. Round your answer to the nearest hundredths of kilometers.

Reflection of the learning goals

1. Understand the importance of Math Practices 3, 4, and 6 in PARCC Sub-Claims C & D.
2. Learn how to create engaging, rigorous math tasks

Next Steps

Feedback Survey:
https://www.surveymonkey.com/r/subclaimcdhs

PARCC:

Released items should be available from the Spring 2017 PARCC. You can access them by visiting the following link: https://parcc-assessment.org/released-items/

Math and Science Bureau:

http://webnew.ped.state.nm.us/officesandprograms/math-science/

Archive:

http://webnew.ped.state.nm.us/officesandprograms/math-science/parcc/

References

- Danielson, C., & Marquez, E. (2016). *Performance tasks and rubrics for high school mathematics: meeting rigorous standards and assessments* (2nd ed.). Retrieved September 18, 2017.
- Galasso, S. (2016, June 17). Digging Deeper into SMP 3 – Construct Viable Arguments and Critique the Reasoning of Others – Achieve the Core Aligned Materials. Retrieved September 08, 2017, from https://achievethecore.org/aligned/digging-deeper-into-smp-3-construct-viable-arguments-and-critique-the-reasoning-of-others/
- Galasso, S. (2016, June 29). Digging Deeper into SMP 4 – Model with Mathematics – Achieve the Core Aligned Materials. Retrieved September 08, 2017, from https://achievethecore.org/aligned/digging-deeper-into-smp-4-model-with-mathematics/
- Illustrative Mathematics (2014, February 12). *Standards for Mathematical Practice: Commentary and Elaborations for 6–8.*Tucson. AZ.
- Kanold, T. (2018, January 10). *What are the vital teacher and student learning behaviors of the CCSS?* Lecture presented at 2011 NCSM Summer Leadership Academy, Atlanta, GA.
- Mateas, Victor . "Debunking Myths about the Standards for Mathematical Practice." *Nctm.org*, 2 Sept. 2016, www.nctm.org/Publications/Mathematics-Teaching-in-Middle-School/2016/Vol22/Issue2/Debunking-Myths-about-the-Standards-for-Mathematical-Practice/. Accessed 11 Sept. 2017.
- Ramirez, N. G. (2011, June 22). *The Standards for Mathematical Practice: Student and Teacher Actions and Related Questions* [List of student and teacher actions to engage in the Standards for Mathematical Practice.]. NCSM 2011 Summer Leadership Academy, Atlanta, GA.
- Small, M. (2017). *Teaching mathematical thinking: tasks and questions to strengthen practices and processes*. Retrieved September 7, 2017.

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