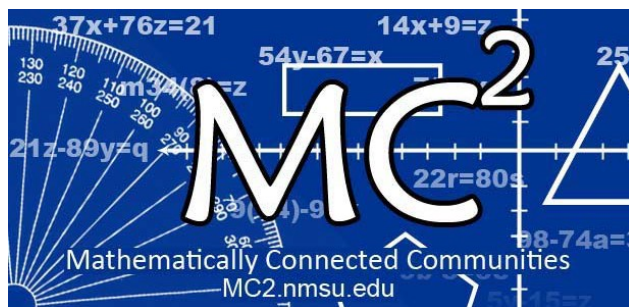


Mathematically Connected Communities



PARCC PBA Practice Test Items Algebra II - Mathematics

Excerpted 1/2015 from
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Mathematical Practice Questions for MC² Thinking Protocol

Follow the process below in working with the PARCC practice items found in this packet:

1. Choose items from this packet that relate to math concepts studied in the current or previous curriculum units during your math instruction. Each item may be used as a practice item worksheet.
2. Choose a set of **Thinking/Writing Prompts** below based on the math practice the class is working to develop.
3. Add the prompts to the practice item worksheet or display the prompts for the students to respond to.
4. Continue using the same set of prompts for an extended period of time so children develop competence and confidence in describing their mathematical thinking related to the math practice.

The questions below were intentionally not included on each MC² PARCC practice item worksheet in this packet. These are intended to help students move beyond “answer getting” to fully making sense of test item questions and their own mathematical thinking.

Thinking/Writing Prompts to Promote Mathematical Practices

Math Practice 1: Make sense of problems and persevere in solving them.

1. What do you know about the problem?
2. What questions do you have?
3. Explain your reasoning or thinking in solving the problem.

Math Practice 3: Construct viable arguments and critique the reasoning of others.

1. What are the assumptions, definitions, and previous knowledge to help in thinking about this problem?
2. What are some possible conjectures that you have about the problem?
3. Explain your mathematical argument so that somebody else can make sense of your thinking.

Math Practice 4: Model with mathematics.

1. What are the important quantities in the problem that are needed to solve it?
2. What mathematical operation(s) or representation(s) will you use to solve the problem?
3. Explain how you know your answer makes sense in the context of the situation.

Math Practice 6: Attend to precision.

1. What are the important units in the problem? (What are we measuring or counting?)
2. What relationship between the units/quantities do you need to know in order to solve the problem?
3. Use appropriate and precise mathematical language, units, labels and computations to clearly describe your mathematical reasoning

Algebra II PARCC PBA Sample Assessment Item #1 (non-calculator): Standard A-REI.2

1. What is the solution to the equation $-\sqrt{x+10} = -7$?

Enter your answer in the box.

⊖					
⊙	⊙	⊙	⊙	⊙	⊙
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

2. Solve the equation $27^x = 9^{x-3}$ for x .

Enter your answer in the box.

⊖					
•	•	•	•	•	•
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

Algebra II PARCC PBA Sample Assessment Item #3 (non-calculator): Standard N-CN.2

3. Which expressions are equal to a real number?

Select **all** that apply.

A $(-4i)^{11}$

B $(-3i)^{12}$

C $(2 + 3i)^2$

D $(4 + 5i)(4 - 5i)$

E $(6 + 8i)(8 + 6i)$

Algebra II PARCC PBA Sample Assessment Item #4 (non-calculator): Standard A-REI.4b-2

4. Which equation has non-real solutions?

A $2x^2 + 4x - 12 = 0$

B $2x^2 + 3x = 4x + 12$

C $2x^2 + 4x + 12 = 0$

D $2x^2 + 4x = 0$

Algebra II PARCC PBA Sample Assessment Item #5 (non-calculator): Standard A-SSE.2-3

5. Which expression is equivalent to $a^2x^2 - 2cx^2 + a^2y - 2cy$?

A $(x^2 - y)(a^2 - 2c)$

B $(x^2 - y)(a + c)$

C $(x^2 + y)(a^2 - 2c)$

D $(x^2 + y)(a + c)$

Algebra II PARCC PBA Sample Assessment Item #6 (non-calculator): Standard N-CN.1

6. Which statements are true?

Select **all** that apply.

A $\sqrt{-4} = 2$

B $\sqrt{-4} = 2i$

C $\sqrt{4i} = 2i$

D $2(i^2)^2 = 2$

E $2i^3 = -2i$

Algebra II PARCC PBA Sample Assessment Item #7 (non-calculator): Standard A-REI.4b-2

7. Which expression is equivalent to $(\sqrt[3]{27})^4$?

A 12

B 9^2

C 81^4

D $27^{\frac{3}{4}}$



8. Functions f and g are defined below.

$$\begin{cases} f(x) = \frac{1}{2x} \\ g(x) = x^2 \end{cases}$$

The graphs of $y = f(x)$ and $y = g(x)$ intersect at point P .

Determine the x -coordinate of P . Round your answer to the nearest tenth.

Enter your answer in the box.

⊖						
•	•	•	•	•	•	•
0	0	0	0	0	0	0
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9



9. During a 1-year period, a population of tropical insects grew according to the model $P = P_0(1.46)^t$, where P is the population, P_0 is the initial population, and t is time in years. Which equation can be used to model the approximate weekly growth rate? (Assume 52 weeks in a year.)
- A $P = P_0(1.0073)^{52t}$
- B $P = P_0(1.0088)^{52t}$
- C $P = P_0(1.0281)^{52t}$
- D $P = P_0(1.0371)^{52t}$



10. What are the solutions to the equation $2x^2 - x + 1 = 0$?

- Ⓐ $\frac{1}{4} - \frac{\sqrt{5}}{4}$ and $\frac{1}{4} + \frac{\sqrt{5}}{4}$
- Ⓑ $\frac{1}{4} - \frac{\sqrt{7}}{4}$ and $\frac{1}{4} + \frac{\sqrt{7}}{4}$
- Ⓒ $\frac{1}{4} - \left(\frac{\sqrt{7}}{4}\right)i$ and $\frac{1}{4} + \left(\frac{\sqrt{7}}{4}\right)i$
- Ⓓ $\frac{1}{4} - \left(\frac{\sqrt{5}}{4}\right)i$ and $\frac{1}{4} + \left(\frac{\sqrt{5}}{4}\right)i$



11. Part A

A bank offers a savings account that accrues simple interest annually based on an initial deposit of \$500. If $S(t)$ represents the money in the account at the end of t years and $S(5) = 575$, write a function that could be used to determine the amount of money in the account over time. Show your work or explain your reasoning.

Enter your equation and your reasoning in the space provided.



11. Part B

Another bank offers a savings account that accrues compound interest annually at a rate of 3%.

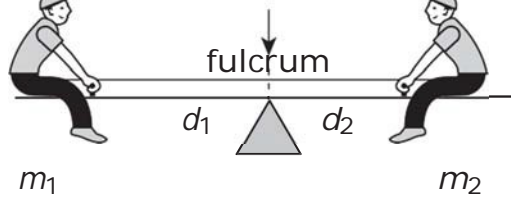
What is the initial amount needed in this account so that this account will have the same amount of money as the account in Part A at the end of 10 years? Show your work or explain your reasoning.

Enter your answer and your reasoning in the space provided.



12. Part A

Two children sit on a seesaw, as illustrated. The mass, in kilograms, of the first child is m_1 and the mass, in kilograms, of the second child is m_2 . In the diagram, d_1 and d_2 represent the distance, in feet, from the fulcrum (the balance point) to each child. The total distance between the children is 10 feet.



For a seesaw to be balanced, $m_1d_1 = m_2d_2$. Use the information in the table to write the function $f(x)$ that allows you to determine m_1 , the mass of the first child.

m_2	d_1	d_2
40	$10 - x$	x

Enter your function in the space provided. Enter **only** your function.



12. Part B

Determine the inverse function $f^{-1}(x)$ to model the distance, d_2 , based on the mass of the first child. Show your work.

Enter your answer and your work in the space provided.



Algebra II PARCC PBA Sample Assessment Item #13 (Calculator Part): Standard HS.D.3-6

Use the information provided to answer Part A and Part B for question 13.

An athletic shoe company is designing a new running shoe. The sole of the shoe is designed with 5.0 millimeters of tread on the heel area and 4.0 millimeters of tread on the front-foot area.

To test the durability of the shoe, the designers gave test shoes to 9 people who run every day. After one week of use, the tread was measured to see how much was remaining. The results of the test are shown in the table.

Tread Remaining after One Week

Runner	Tread Thickness - Heel (millimeters)	Tread Thickness - Front-Foot (millimeters)
A	4.83	3.90
B	4.84	3.91
C	4.79	3.86
D	4.82	3.87
E	4.80	3.87
F	4.76	3.84
G	4.79	3.86
H	4.77	3.85
I	4.82	3.88



13. Part A

Create one model for the tread thickness of the heel and one model for the tread thickness of the front-foot that can be used to determine the length of time the tread of the shoes will last under daily use. Describe how you determined your models and state any assumptions you made. Use the models to determine the number of weeks the shoes will last.

Enter your models, your description, and your answer in the space provided.

13. Part B

Based on your models from Part A, describe how the company could modify the thickness of the tread so that the tread on the entire shoe lasts about the same amount of time. Justify your description.

Enter your description and your justification in the space provided.



Algebra II PARCC PBA Sample Assessment Item #14 (Calculator Part): Standard HS.C.5.11

14. Let $f(x) = ax^2$ where $a > 0$, and let $g(x) = mx + b$ where $m > 0$ and $b < 0$.

The equation $f(x) = g(x)$ has n distinct real solution(s). What are **all** the possible values of n ? Justify your answers.

Enter your answers and your justification in the space provided.



Algebra II PARCC PBA Sample Assessment Item #15 (Calculator Part): Standard HS.C.17.2

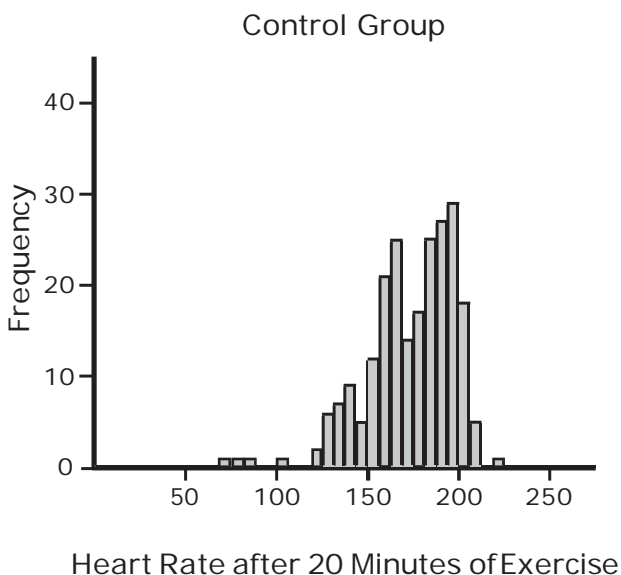
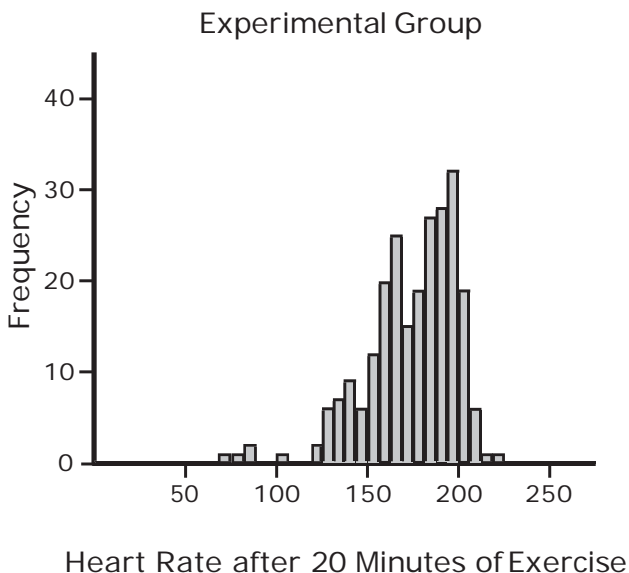
- 15.** For a statistics project, a group of students decide to collect data in order to approximate the percent of people in the town who are left-handed. They ask every third student entering the school cafeteria whether he or she is left-handed or right-handed. What type of method did this group use? Explain which population the group can draw a conclusion about based on their method. Suggest a better method that would allow the students to draw a conclusion about all the residents in their town.

Enter your answers and your explanation in the space provided.



16. Part A

The histograms show the distribution of heart rates of randomly selected adult males between the ages of 40 and 45 after 20 minutes of continuous exercise. The adult males were randomly assigned to use either a new elliptical machine (Experimental Group) or a traditional treadmill machine (Control Group).





16. Part A Continued

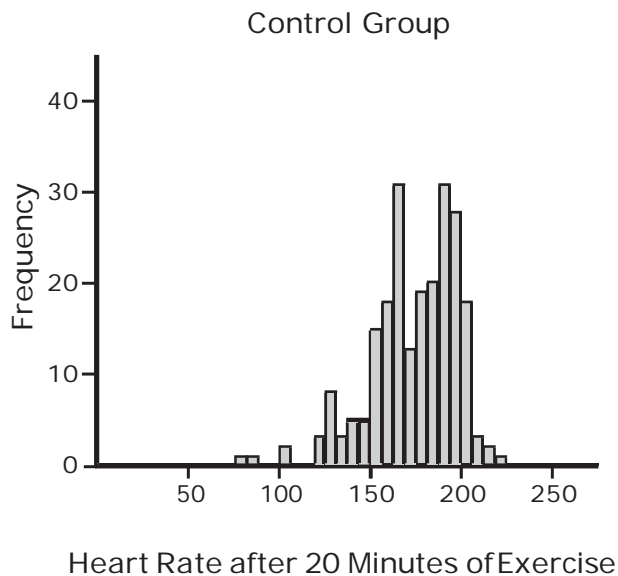
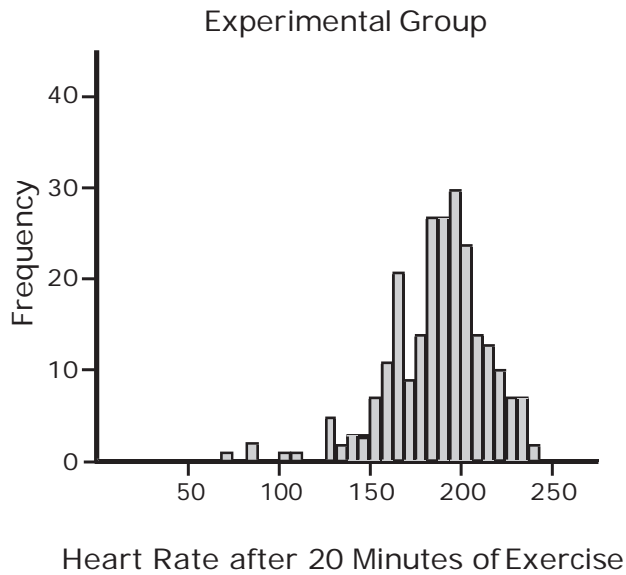
What conclusion about the difference between the distributions of the heart rates for these two groups can be drawn? Justify your answer.

Enter your answer and your justification in the space provided.



16. Part B

After the participants worked out three times per week for four weeks solely on their assigned machines, participants' heart rates were collected again after 20 minutes of continuous exercise. The data are shown in the histograms.





16. Part B Continued

What conclusion about the difference between the distributions of the heart rates for the two groups can be drawn? Justify your answer.

If the target heart rate range for adult males aged between 40 and 45 after 20 minutes of exercise is around 175 beats per minute, what recommendation would you make in terms of which machine to use? Justify your answer.

Based upon these data, what conclusion about exercise machines in general can be made?

Enter your answers and your justification in the space provided.



Algebra II PARCC PBA Sample Assessment Item #17 (Calculator Part): Standard HS.D.2-13

- 17.** The heights of the male students at a college are approximately normally distributed. Within this curve, 95% of the heights, centered about the mean, are between 62 inches and 78 inches. The standard deviation is 4 inches. Use this information to estimate the mean height of the males. Approximate the probability that a male student is taller than 74 inches. Explain how you determined your answers.

Enter your answers and your explanation in the space provided.



Use the information provided to answer Part A and Part B for question 18.

A city plans to implement a composting program. In the composting program, food waste will be collected from residents and sent to one of these compost collection sites.

Composting Program

Collection Site	Distance from City Center (miles)	Fee (dollars per ton)
FW Processing	12	50
Hayward Ecology	60	36
Jasper Organics	70	45
Northwestern Recycling	95	40
Milton Recycling	26	65

- Operating the trucks used to transport the waste costs \$1.25 per mile driven.
- Each truck can hold 20 tons of waste.



18. Part A

Based on the given information, determine which composting collection site is cheapest. Describe the steps used to determine which composting site is cheapest and explain any assumptions made. Create a model that can be used to find the total cost of disposing food waste based on the number of tons of composting with the cheapest composting program. Describe the steps used to create your model.

Enter your answer, model, explanation, and assumptions in the space provided.

18. Part B

During the previous year, the city sent 290,000 tons of waste to landfills. The cost of disposing waste at a landfill is \$75 per ton.

This year, the composting program will send 10% of the waste to composting sites instead of sending the waste to landfills. Determine the amount of money the city will save in waste disposal costs based on 290,000 tons of waste using the composting site you chose in Part A.

Show the process you used to determine your answer.

Enter your answer and your work in the space provided.



19. The polynomial $p(x) = 2x^3 + 13x^2 + 17x - 12$ has $(x + 4)$ as a factor. Factor the polynomial into three linear terms. Describe the steps you would use to sketch the graph of the function defined by this polynomial. Identify all intercepts and describe the end behavior of the graph.
- Enter your factored polynomial, your description, and your answers in the space provided.

Algebra II PARCC PBA Sample Assessment Item #20 (Calculator Part): Standard HS.C.9.2

Use the information provided to answer Part A and Part B for question 20.

The function f is defined as $f(x) = x^2 - 4x$.

Additional Computer-Based Algebra II PBA Practice Items

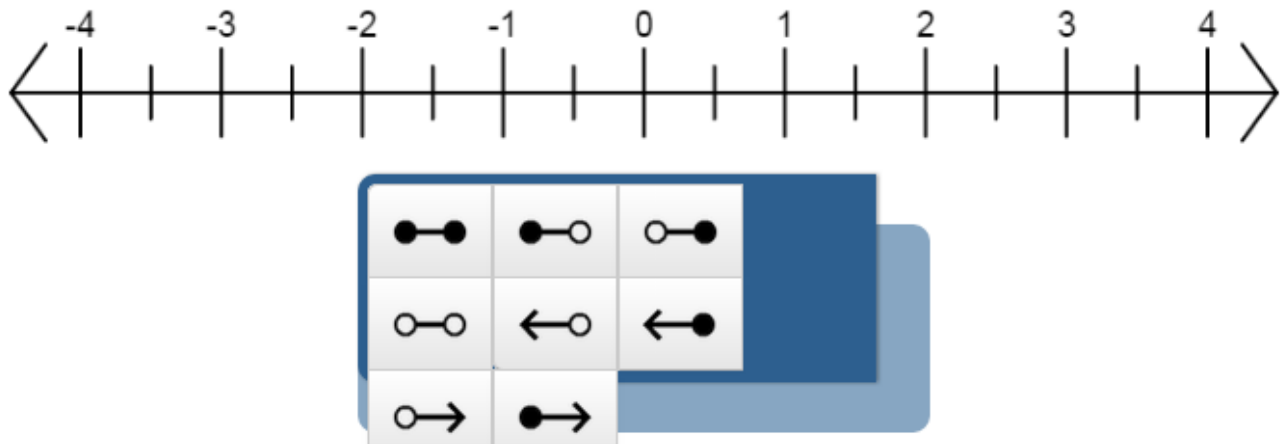
COMPUTER-BASED PRACTICE TEST

Algebra II PARCC PBA Sample Assessment Item #2 (non-calculator): Standard A-Int.1

2. Solve $\sqrt{x^2 - 4x + 4} = x - 2$.

Graph your solution.

Select a solution set indicator. Drag the points on the indicator to the appropriate locations on the number line.



COMPUTER-BASED PRACTICE TEST

Algebra II PARCC PBA Sample Assessment Item #5 (non-calculator): Standard A-SSE.2-3

5. The expression $x^4 - 81$ can be rewritten in this form where a , b , and c are real numbers:

$$(x^2 + a)(x + b)(x + c)$$

What are the values of a , b , and c ?

Enter your answers in the boxes.

$a =$

$b =$

$c =$