



pennsylvania
DEPARTMENT OF EDUCATION

**The Pennsylvania System of School
Assessment
Mathematics
Item and Scoring Sampler
2016–2017
Grade 7**

INFORMATION ABOUT MATHEMATICS

Introduction 1

 General Introduction 1

 Pennsylvania Core Standards (PCS). 1

 What Is Included 1

 Purpose and Uses. 1

 Item Format and Scoring Guidelines 1

 Item Alignment 2

 Testing Time and Mode of Testing Delivery for the PSSA. 2

 Mathematics Reporting Categories 2

 General Description of Scoring Guidelines for Mathematics Open-Ended Questions 4

 Item and Scoring Sampler Format 5

 Grade 7 Formula Sheet. 6

Mathematics Test Directions 8

PSSA MATHEMATICS GRADE 7

Multiple-Choice Items 9

Open-Ended Question 25

 Item-Specific Scoring Guideline 26

Mathematics—Summary Data 38

INTRODUCTION

General Introduction

The Pennsylvania Department of Education provides districts and schools with tools to assist in delivering focused instructional programs aligned with the Pennsylvania Core Standards (PCS). These tools include Academic Standards, Assessment Anchor documents, assessment handbooks, and content-based item and scoring samplers. This Item and Scoring Sampler is a useful tool for Pennsylvania educators in preparing local instructional programs. It can also be useful in preparing students for the statewide assessment.

Pennsylvania Core Standards (PCS)

This sampler contains examples of test questions that are aligned to the new Pennsylvania Core Standards-based 2013 PSSA Assessment Anchors and Eligible Content. The Mathematics, Reading, and Writing PSSA transitioned to PCS-based operational Mathematics and English Language Arts assessments starting with the spring 2015 PSSA administration.

The 2013 PCS-aligned Assessment Anchor and Eligible Content documents are posted on this portal:

- www.education.pa.gov [Hover over “K–12,” select “Assessment and Accountability,” and select “Pennsylvania System of School Assessment (PSSA).” Then select “Assessment Anchors” from the “Other Materials” list on the right side of the screen.]

What Is Included

This sampler contains test questions (items) that have been written to align to the Assessment Anchors that are based on the Pennsylvania Core Standards (PCS). The test questions provide an idea of the types of items that will appear on an operational, PCS-based PSSA. Each sample test question has been through a rigorous review process to ensure alignment with the Assessment Anchors.

Purpose and Uses

The items in this sampler may be used as examples for creating assessment items at the classroom level, and they may also be copied and used as part of a local instructional program.¹ Classroom teachers may find it beneficial to have students respond to the open-ended item in this sampler. Educators can then use the sampler as a guide to score the responses either independently or together with colleagues within a school or district.

Item Format and Scoring Guidelines

The multiple-choice (MC) items have four answer choices. Each correct response to an MC item is worth one point.

Each open-ended (OE) item is designed to take approximately ten to fifteen minutes to complete. During the administration of the PSSA, students are given additional time as necessary to complete the test items. Each OE item in mathematics is scored using an item-specific scoring guideline based on a 0–4-point scale. In this sampler, every item-specific scoring guideline is combined with examples of student responses that represent each score point to form a practical, item-specific scoring guide.

This sampler also includes the *General Description of Scoring Guidelines for Mathematics Open-Ended*

¹ The permission to copy and/or use these materials does not extend to commercial purposes.

Questions that students will have access to during a PSSA mathematics administration. The general description of scoring guidelines can be distributed to students for use during local assessments and can also be used by educators when scoring local assessments.²

Item Alignment

All PSSA items are aligned to statements and specifications included in the *Assessment Anchors and Eligible Content Aligned to the Pennsylvania Core Standards*. The mathematics content, process skills, directives, and action statements included in the PSSA mathematics questions align with the Assessment Anchor Content Standards. The Eligible Content statements represent the limits of the content of the mathematics questions.

Testing Time and Mode of Testing Delivery for the PSSA

The PSSA is delivered in traditional paper-and-pencil format as well as in an online format. The estimated time to respond to a test question is the same for both methods of test delivery. During an official testing administration, students are given additional time as necessary to complete the test questions. The following table shows the estimated response time for each item type.

Mathematics Item Type	MC	OE
Estimated Response Time (minutes)	2	10 to 15

Mathematics Reporting Categories

The Assessment Anchors are organized into four classifications as listed below.

A = Numbers and Operations

B = Algebraic Concepts

C = Geometry

D = Data Analysis and Probability

These four classifications are used throughout the grade levels. In addition to these classifications, there are five Reporting Categories for each grade level. The first letter of each Reporting Category represents the classification; the second letter represents the Domain as stated in the Common Core State Standards for Mathematics. Listed below are the Reporting Categories for Grade 7.

A-N = The Number System

A-R = Ratios and Proportional Relationships

B-E = Expressions and Equations

C-G = Geometry

D-S = Statistics and Probability

² The permission to copy and/or use these materials does not extend to commercial purposes.

INFORMATION ABOUT MATHEMATICS

Examples of multiple-choice and open-ended items assessing these categories are included in this booklet.

General Description of Scoring Guidelines for Mathematics Open-Ended Questions

4: The response demonstrates a *thorough* understanding of mathematical concepts and procedures required by the task.

The response provides correct answer(s) with clear and complete mathematical procedures shown and a correct explanation, as required by the task. Response may contain a minor “blemish” or omission in work or explanation that does not detract from demonstrating a *thorough* understanding.

3: The response demonstrates a *general* understanding of the mathematical concepts and procedures required by the task.

The response and explanation (as required by the task) are mostly complete and correct. The response may have minor errors or omissions that do not detract from demonstrating a *general* understanding.

2: The response demonstrates a *partial* understanding of the mathematical concepts and procedures required by the task.

The response is somewhat correct with *partial* understanding of the required mathematical concepts and/or procedures demonstrated and/or explained. The response may contain some work that is incomplete or unclear.

1: The response demonstrates a *minimal* understanding of the mathematical concepts and procedures required by the task.

0: The response has no correct answer and *insufficient* evidence to demonstrate any understanding of the mathematical concepts and procedures required by the task for that grade level.

Response may show only information copied from the question.

Special Categories within zero reported separately:

BLK (blank) Blank, entirely erased, or written refusal to respond

OT Off task

LOE Response in a language other than English

IL Illegible

Item and Scoring Sampler Format

This sampler includes the test directions and scoring guidelines that appear in the PSSA Mathematics assessments. Each multiple-choice item is followed by a table that includes the alignment, the answer key, the depth of knowledge (DOK) level, the percentage³ of students who chose each answer option, and a brief answer option analysis or rationale. The open-ended item is followed by a table that includes the item alignment, DOK level, and mean student score. Additionally, each of the included item-specific scoring guidelines is combined with sample student responses representing each score point to form a practical, item-specific scoring guide. The *General Description of Scoring Guidelines for Mathematics Open-Ended Questions* used to develop the item-specific scoring guidelines should be used if any additional item-specific scoring guidelines are created for use within local instructional programs.

Example Multiple-Choice Item Information Table

Item Information	
Alignment	Assigned AAEC
Answer Key	Correct Answer
Depth of Knowledge	Assigned DOK
p-value A	Percentage of students who selected each option
p-value B	Percentage of students who selected each option
p-value C	Percentage of students who selected each option
p-value D	Percentage of students who selected each option
Option Annotations	Brief answer option analysis or rationale

Example Open-Ended Item Information Table

Alignment: Assigned AAEC

Depth of Knowledge: Assigned DOK

Mean Score

³All *p*-value percentages listed in the item information tables have been rounded.

Grade 7 Formula Sheet

2016

Grade 7

Formulas that you may need to work questions on this test are found below. You may refer back to this page at any time during the mathematics test.

You may use calculator π or the number 3.14.

Simple Interest

$$I = Prt$$

A graphic of a circle with the radius labeled R.

$$C = 2\pi r$$

$$A = \pi R^2$$

A graphic of a triangle with the base labeled B and the height labeled H.

$$A = \frac{1}{2}bh$$

A graphic of a square with one side labeled S.

$$A = S^2$$

A graphic of a rectangle with the length labeled L and the width labeled W.

$$A = LW$$

$$P = 2L + 2W$$

A graphic of a parallelogram with the base labeled B and the height labeled H.

$$A = bh$$

A graphic of a trapezoid with the height labeled H, the top labeled B_1 , and the bottom labeled B_2 .

$$A = \frac{1}{2}H(b_1 + b_2)$$

A graphic of a rectangular prism with the length labeled L, the width labeled W, and the height labeled H.

$$V = LWH$$

$$SA = 2LW + 2LH + 2WH$$

A graphic of a polygonal prism with the width labeled W.

INFORMATION ABOUT MATHEMATICS

$V = Bw$, where B = area of the base

$SA = Pw + 2B$, where P = perimeter of base

On the following pages are the mathematics questions.

MATHEMATICS TEST DIRECTIONS

You may not use a calculator for question 1. You may use a calculator for all other questions on this test.

Directions for Multiple-Choice Questions:

Some questions will ask you to select an answer from among four choices.

For the multiple-choice questions:

First solve the problem on scratch paper.

Choose the correct answer and record your choice in the answer booklet.

If none of the choices matches your answer, go back and check your work for possible errors.

Only one of the answers provided is the correct response.

Directions for Open-Ended Questions:

Some questions will require you to write your response.

For the open-ended questions:

These questions have more than one part. Be sure to read the directions carefully.

You cannot receive the highest score for an open-ended question without completing all tasks in the question. For example, if the question asks you to show your work or explain your reasoning, be sure to show your work or explain your reasoning in the space provided.

If the question does **not** ask you to show your work or explain your reasoning, you may use the space provided, but only those parts of your response that the question specifically asks for will be scored.

Write your response in the appropriate location within the response box in the answer booklet. Some answers may require graphing, plotting, labeling, drawing, or shading. If you use scratch paper, be sure to transfer your final response and any needed work or reasoning to the answer booklet.

On the following pages are the mathematics questions.

MULTIPLE-CHOICE ITEMS

Question 1 in this sampler is to be solved without the use of a calculator.

1. Subtract: $-10 - 21$

A. -31

B. -11

C. 11

D. 31

Item Information	
Alignment	A-N.1.1.1
Answer Key	A
Depth of Knowledge	1
p-value A	57% (correct answer)
p-value B	11%
p-value C	23%
p-value D	9%
Option Annotations	A. correct B. $10 + -21$ C. $-10 + 21$ D. $10 + 21$

A calculator is permitted for use in solving questions 2–17 in this sampler.

2. Laura has a board that measures $6 \frac{11}{12}$ feet in length. She will cut the board into pieces that are each $\frac{11}{12}$ foot long. How many full pieces can Laura cut from her board, and how much of her board will be remaining?
- A. Laura can cut the board into 6 pieces with nothing remaining.
 - B. Laura can cut the board into 6 pieces with $\frac{11}{12}$ foot remaining.
 - C. Laura can cut the board into 7 pieces with $\frac{1}{12}$ foot remaining.
 - D. Laura can cut the board into 7 pieces with $\frac{1}{2}$ foot remaining.

Item Information	
Alignment	A-N.1.1
Answer Key	D
Depth of Knowledge	2
p-value A	16%
p-value B	19%
p-value C	22%
p-value D	43% (correct answer)
Option Annotations	A. thinks $6 \frac{11}{12} = \frac{66}{12}$ B. removes the whole number part from the length of the board C. converts $6 \frac{11}{12}$ to an improper fraction by doing $6 \times 11 + 12$ D. correct

3. The gas tank in Phil’s car was $\frac{1}{8}$ full. He put more gasoline in the car’s gas tank. The number line below shows how full the car’s gas tank was before and after Phil put in more gasoline.

A number line is shown. The numbers below the number line are 0, the fraction $\frac{1}{8}$, the fraction $\frac{1}{4}$, the fraction $\frac{3}{8}$, the fraction $\frac{1}{2}$, the fraction $\frac{5}{8}$, the fraction $\frac{3}{4}$, the fraction $\frac{7}{8}$, 1. Above the number line is a ray starting at the fraction $\frac{1}{8}$ and extending to the fraction $\frac{3}{4}$.

Which equation represents the change in the amount of gasoline in the car’s tank?

- A. $\frac{1}{8} + \frac{2}{4} = \frac{3}{4}$
- B. $\frac{1}{8} + \frac{5}{8} = \frac{3}{4}$
- C. $\frac{1}{8} + \frac{3}{4} = \frac{7}{8}$
- D. $\frac{1}{8} + \frac{3}{4} = \frac{4}{12}$

Item Information	
Alignment	A-N.1.1.2 A-N.1.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	12%
p-value B	66% (correct answer)
p-value C	16%
p-value D	6%
Option Annotations	A. adds the numerators and keeps the smaller denominator B. correct C. adds the starting and ending fractions D. adds the starting and ending fractions by adding their numerators and denominators

4. For a science experiment, Annie removes a cold liquid from a refrigerator and measures its temperature every $\frac{1}{2}$ minute. Annie finds that the temperature increases by $1\frac{3}{4}$ degrees Fahrenheit ($^{\circ}\text{F}$) between each measurement for three minutes. What is the rate per minute of the temperature increase?
- A. $\frac{7}{8}$ $^{\circ}\text{F}$ per minute
 - B. $1\frac{1}{4}$ $^{\circ}\text{F}$ per minute
 - C. $2\frac{1}{4}$ $^{\circ}\text{F}$ per minute
 - D. $3\frac{1}{2}$ $^{\circ}\text{F}$ per minute

Item Information	
Alignment	A-R.1.1.1
Answer Key	D
Depth of Knowledge	2
p-value A	29%
p-value B	15%
p-value C	16%
p-value D	40% (correct answer)
Option Annotations	A. divides the given rate by 2 B. subtracts $\frac{1}{2}$ from the given rate C. adds $\frac{1}{2}$ to the given rate D. correct

5. Clark and Phil are each running to raise money. The amount of money (y), in dollars, they each raise is based on the distance (x), in miles, they each run. Clark has an initial donation that he has received regardless of how many miles he runs. The graphs shown below model the amount of money each will raise based on the distance they each run.

Two coordinate grids are shown. The title of the first coordinate grid is Clark’s Running Donations. The title of the second coordinate grid is Phil’s Running Donations. The label to the left of each y -axis is Amount of Money (dollars). The numbers to the left of each y -axis are 0, 10, 20, 30, 40, 50, 60, 70, 80. The label below each x -axis is Distance (miles). The numbers below each x -axis are 0, 1, 2, 3, 4, 5, 6, 7, 8. The first coordinate grid has a ray starting at $(0, 15)$ and passes through the point $(3, 30)$. The second coordinate grid has a ray starting at $(0, 0)$ and passes through the point $(4, 30)$.

What is the unit rate for the person for whom the amount of money and the number of miles are proportionally related?

- A. \$5.00 per mile
- B. \$7.50 per mile
- C. \$15.00 per mile
- D. \$30.00 per mile

Item Information	
Alignment	A-R.1.1.2 A-R.1.1.3
Answer Key	B
Depth of Knowledge	2
p-value A	23%
p-value B	54% (correct answer)
p-value C	16%
p-value D	7%
Option Annotations	A. chooses Clark’s unit rate but does not realize Clark’s quantities are not proportionally related B. correct C. picks Clark’s y -intercept D. picks the first value with integer coordinates for Phil

6. Joe has a picture that measures 8 centimeters by 12 centimeters. He creates four enlargements of the picture. The table below shows the width and the length of each enlargement.

Joe's Picture Enlargements

Width (cm)	Length (cm)
10	15
12	18
20	30
25	37.5

What is the constant of proportionality between the width and the length of the pictures?

- A. 0.5
- B. 1.2
- C. 1.5
- D. 2.5

Item Information	
Alignment	A-R.1.1.3
Answer Key	C
Depth of Knowledge	1
p-value A	15%
p-value B	12%
p-value C	54% (correct answer)
p-value D	19%
Option Annotations	A. solves $(15 - 10)/10$ B. uses ratio of first two values in either column (12/10 or 18/15) C. correct D. uses ratio of first and last values in either column (25/10 or 37.5/15)

7. Jaya is painting her room. She mixes 2 pints of blue paint with 5 pints of red paint to get her desired color. Which equation can be used to find the number of pints of blue paint (x) Jaya should mix with 18 pints of red paint?
- A. $2/x = 18/5$
 - B. $2/5 = x/18$
 - C. $2/18 = 5/x$
 - D. $x/18 = 5/2$

Item Information	
Alignment	A-R.1.1.4
Answer Key	B
Depth of Knowledge	2
p-value A	16%
p-value B	63% (correct answer)
p-value C	12%
p-value D	9%
Option Annotations	<ul style="list-style-type: none"> A. sets up the equation $2:x$ equals to $18:5$ instead of $5:18$ B. correct C. reverses placement of 18 and x D. sets up the equation $x:18$ equals to $5:2$ instead of $2:5$

8. Ernesto made a graph of the distance (y), in miles, he can ride a bicycle in x hours. Ernesto can ride 5.5 miles in 0.5 hour. Which point on the graph represents Ernesto's rate of travel, in miles per hour?
- A. (0, 5.5)
 - B. (0, 11)
 - C. (1, 5.5)
 - D. (1, 11)

Item Information	
Alignment	A-R.1.1.5 A-R.1.1.1
Answer Key	D
Depth of Knowledge	1
p-value A	26%
p-value B	8%
p-value C	23%
p-value D	43% (correct answer)
Option Annotations	A. thinks starting at 5.5 mph B. uses wrong x -value C. thinks 5.5 mph D. correct

9. The ratio of the number of students in the chess club to the number of students on the math team is 1 : 3. The ratio of the number of students on the math team to the number of students on the quiz bowl team is 1 : 2. There are 4 students in the chess club. How many students are on the quiz bowl team?
- A. 7
 - B. 9
 - C. 12
 - D. 24

Item Information	
Alignment	A-R.1.1.6
Answer Key	D
Depth of Knowledge	2
p-value A	17%
p-value B	19%
p-value C	23%
p-value D	41% (correct answer)
Option Annotations	A. adds the ratio difference to the chess club total ($4 + 2 + 1$) B. adds the larger number to the chess club total ($4 + 3 + 2$) C. finds the math team total D. correct

10. Arnie buys $2\frac{2}{5}$ pounds of red grapes for \$1.95 per pound. He buys $2\frac{2}{5}$ pounds of green grapes for \$2.20 per pound. Which expression can be used to determine the total cost, in dollars, of the grapes Arnie buys?
- A. $2.4(1.95 + 2.20)$
 - B. $2.4 \cdot 1.95 \cdot 2.20$
 - C. $(2.4 + 2.4)(1.95 + 2.20)$
 - D. $(2.4 \cdot 2.4) + (1.95 \cdot 2.20)$

Item Information	
Alignment	B-E.2.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	52% (correct answer)
p-value B	11%
p-value C	22%
p-value D	15%
Option Annotations	<ul style="list-style-type: none"> A. correct B. multiplies all C. multiplies total weight by sum of rates D. adds product of weights and product of rates

11. An author receives \$0.75 for each hardcover book or paperback book that is sold. There were x hardcover books and 42,000 paperback books sold of her most recent book. The author received a total of \$60,000 for the book sales. The equation below can be used to determine the number of hardcover books that were sold.

$$0.75(x + 42,000) = 60,000$$

How many hardcover books were sold?

- A. 18,000
- B. 24,000
- C. 28,500
- D. 38,000

Item Information	
Alignment	B-E.2.2.1
Answer Key	D
Depth of Knowledge	1
p-value A	24%
p-value B	16%
p-value C	15%
p-value D	45% (correct answer)
Option Annotations	A. “distributes” to 60,000 B. does not distribute to 42,000 C. does not distribute to x D. correct

12. Tasha sells gift boxes and cookies at her bakery.

Gift boxes sell for \$26.00 each.

Cookies sell for \$1.50 each.

Tasha would like her total sales to be at least \$50.00 from the sale of one gift box and some cookies.

Which inequality describes all the numbers of cookies (x) that Tasha needs to sell?

- A. $x \geq 2$
- B. $x \geq 8$
- C. $x \geq 16$
- D. $x \geq 24$

Item Information	
Alignment	B-E.2.2.2
Answer Key	C
Depth of Knowledge	2
p-value A	9%
p-value B	8%
p-value C	57% (correct answer)
p-value D	26%
Option Annotations	A. solves $(26.00 + 1.50)x \geq 50.00$; rounds up B. solves $x \geq (50.00/1.50) - 26.00$; rounds up C. correct D. solves $50.00 - 26.00$

13. A stained glass window is in the shape of a regular octagon as shown below.

The graphic shows a shape with 8 sides. Dashed lines connecting opposite vertices divide the shape into 8 equal-sized triangles. One of the angles at the center of the shape is labeled X.

The window is separated into sections by drawing straight, dashed lines that intersect in the center of the octagon. What is the value of x?

- A. 22.5°
- B. 37.5°
- C. 45°
- D. 50°

Item Information	
Alignment	C-G.1
Answer Key	C
Depth of Knowledge	2
p-value A	25%
p-value B	11%
p-value C	55% (correct answer)
p-value D	9%
Option Annotations	A. divides 180 by 8 B. thinks a full circle is 300° C. correct D. thinks a full circle is 400°

14. Melinda’s candy bar is in the shape of a triangular prism. She cuts her candy bar parallel to its bottom. The dotted line in the picture below represents Melinda’s cut.

A triangular prism is shown. A dotted line representing the cut goes across the triangular face and continues across the rectangular face.

What is the shape of the cross section of Melinda’s cut?

- A. A triangle is shown.
- B. A rhombus is shown.
- C. A rectangle is shown.
- D. A trapezoid is shown.

Item Information	
Alignment	C-G.1.1.4
Answer Key	C
Depth of Knowledge	1
p-value A	21%
p-value B	3%
p-value C	47% (correct answer)
p-value D	29%
Option Annotations	A. chooses shape of the base (triangle), not the lateral face B. chooses rhombus (prisms have rectangular faces) C. correct D. chooses side face after cut

15. Two lines intersect parallel lines m and n as shown below.

Two parallel lines are shown. The top line is labeled M. The bottom line is labeled N. Two transversal lines intersect line M at the same point but intersect line N at different points, to form a triangle. The angle between line M and the left side of the triangle is labeled 48 degrees. The angle at the top of the triangle is labeled X degrees. The angle at the bottom right of the triangle is labeled 72 degrees.

What is the value of x?

- A. 24
- B. 48
- C. 60
- D. 66

Item Information	
Alignment	C-G.2.1.2
Answer Key	C
Depth of Knowledge	2
p-value A	19%
p-value B	26%
p-value C	46% (correct answer)
p-value D	9%
Option Annotations	A. solves $72 - 48$ B. thinks value is equal to the adjacent angle C. correct D. solves $90 - 72 = 18$ and then adds 18 to 48

16. The diameter of Jacob's circular tabletop is 6 feet. What is the area, in square feet, of Jacob's tabletop?
- A. 6π
- B. 9π
- C. 12π
- D. 36π

Item Information	
Alignment	C-G.2.2.1
Answer Key	B
Depth of Knowledge	1
p-value A	21%
p-value B	37% (correct answer)
p-value C	19%
p-value D	23%
Option Annotations	A. finds circumference B. correct C. finds circumference using $r = 6$ D. uses the diameter

OPEN-ENDED QUESTION

17. The table below shows the number of pencils of each color for all 25 pencils in a box. Adam's pattern starts with the number 3 and follows the rule "add 6."

Pencils in the Box

Color	Number
red	11
blue	11
green	3

The likelihood of an event occurring may be described as certain, more likely, equally likely, less likely, or impossible.

A single pencil is drawn from the box.

- A. Describe the likelihood that the pencil is a yellow pencil. Explain your reasoning.

The pencils have all been placed back in the box.

- B. Compare the likelihood of drawing a red pencil to the likelihood of drawing a blue pencil from the box. Explain your reasoning.

The original 25 colored pencils have all been placed back in the box and another 11 colored pencils have been added to the box. The new pencils are either red, blue, or green. The likelihood of drawing a green pencil is now greater than the likelihood of drawing a red pencil, but less than the likelihood of drawing a blue pencil.

- C. How many pencils of each color were added to the box? Explain how you know that your answer is the only possible outcome that meets all of the conditions.

Item-Specific Scoring Guideline

#17 Item Information

Alignment D-S.3

Depth of Knowledge 3

Mean Score 2.16

Assessment Anchor this item will be reported under:

M07.D-S.3—Investigate chance processes and develop, use, and evaluate probability models.

Specific Anchor Descriptor addressed by this item:

M07.D-S.3.1—Predict or determine the likelihood of outcomes.

Scoring Guide

Score	In this item, the student . . .
4	Demonstrates a thorough understanding of predicting or determining whether some outcomes are certain, more likely, less likely, equally likely, or impossible by correctly solving problems and clearly explaining procedures.
3	Demonstrates a general understanding of predicting or determining whether some outcomes are certain, more likely, less likely, equally likely, or impossible by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
2	Demonstrates a partial understanding of predicting or determining whether some outcomes are certain, more likely, less likely, equally likely, or impossible by correctly performing a significant portion of the required task.
1	Demonstrates minimal understanding of predicting or determining whether some outcomes are certain, more likely, less likely, equally likely, or impossible.
0	The response has no correct answer and insufficient evidence to demonstrate any understanding of the mathematical concepts and procedures as required by the task. Response may show only information copied from the question.

Top-Scoring Student Response and Training Notes

Score	Description
4	Student earns 4 points.
3	Student earns 3.0–3.5 points.
2	Student earns 2.0–2.5 points.

Score	Description
1	Student earns 0.5–1.5 points. OR Student demonstrates minimal understanding of predicting or determining whether some outcomes are certain, more likely, less likely, equally likely, or impossible.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

Top-Scoring Response

Part A (1 point):

$\frac{1}{2}$ point for correct answer

$\frac{1}{2}$ point for complete explanation

What?	Why?
impossible	<p>Sample Explanation:</p> <p>There are no yellow pencils in the box, so it is not possible to draw out a yellow pencil.</p>

Part B (1 point):

$\frac{1}{2}$ point for correct answer

$\frac{1}{2}$ point for complete explanation

What?	Why?
equally likely	<p>Sample Explanation:</p> <p>Since there is the same number of each color of pencil, both outcomes are equally likely.</p>

Part C (2 points):

1 point for correct answer

1 point for complete explanation

OR $\frac{1}{2}$ point for correct but incomplete explanation

What?	Why?
<p>9 green pencils</p> <p>AND</p> <p>2 blue pencils</p>	<p>Sample Explanation:</p> <p>Since the likelihood of drawing a green pencil is now greater than the likelihood of drawing a red pencil, there were at least 9 green pencils added ($3 + 9 = 12$; $12 > 11$). Since the likelihood of drawing a green pencil is now less likely than drawing a blue pencil, there were at least 2 blue pencils added ($11 + 2 = 13$; $13 > 12$). Since there were 11 pencils added to the box, this is the only possible answer ($9 + 2 = 11$).</p>

STUDENT RESPONSE

Online Response Score: 4 points

17. The table below shows the number of pencils of each color for all 25 pencils in a box.

Pencils in the Box

Color	Number
red	11
blue	11
green	3

The likelihood of an event occurring may be described as certain, more likely, equally likely, less likely, or impossible.

A single pencil is drawn from the box.

A. Describe the likelihood that the pencil is a yellow pencil. Explain your reasoning.

Student Response: The likelihood is impossible. It is impossible because there are no yellow pencils to begin with.

Annotation: The student has given a correct answer and a complete explanation.

The pencils have all been placed back in the box.

B. Compare the likelihood of drawing a red pencil to the likelihood of drawing a blue pencil from the box. Explain your reasoning.

Student Response: The likelihood of drawing a red and a blue pencil equally likely because they both have the same number of colored pencils.

Annotation: The student has given a correct answer and a complete explanation.

The original 25 colored pencils have all been placed back in the box and another 11 colored pencils have been added to the box. The new pencils are either red, blue, or green. The likelihood of drawing a green pencil is now **greater** than the likelihood of drawing a red pencil, but less than the likelihood of drawing a blue pencil.

- C. How many pencils of each color were added to the box? Explain how you know that your answer is the only possible outcome that meets all of the conditions.

Student Response: Red has 11 still, blue has 13 now (added 2) and, green has 12 now (added 9). I know that my answer is the only possible outcome because every other way would end up red being greater than green, green being greater than blue, or blue being less than green and red.

Annotation: The student has given a correct answer and a complete explanation.

STUDENT RESPONSE

Handwritten Response Score: 3 points

17. The table below shows the number of pencils of each color for all 25 pencils in a box. Adam's pattern starts with the number 3 and follows the rule "add 6."

Pencils in the Box

Color	Number
red	11
blue	11
green	3

The likelihood of an event occurring may be described as certain, more likely, equally likely, less likely, or impossible.

A single pencil is drawn from the box.

- A. Describe the likelihood that the pencil is a yellow pencil. Explain your reasoning.

Student Response: It would not be yellow because there isn't any in the box.

Only red, blue, and green.

Annotation: The student has given a correct answer and a complete explanation.

The pencils have all been placed back in the box.

- B. Compare the likelihood of drawing a red pencil to the likelihood of drawing a blue pencil from the box. Explain your reasoning.

Student Response: Its even, they both have 11.

Annotation: The student has given a correct answer and a complete explanation.

The original 25 colored pencils have all been placed back in the box and another 11 colored pencils have been added to the box. The new pencils are either red, blue, or green. The likelihood of drawing a green pencil is now greater than the likelihood of drawing a red pencil, but less than the likelihood of drawing a blue pencil.

- C. How many pencils of each color were added to the box? Explain how you know that your answer is the only possible outcome that meets all of the conditions.

Student Response: 0 = red

9 = green

2 = blue

It is correct because red = 11 green is bigger with 12 and blue is the most with 13.

Annotation: The student has given a correct answer and a correct but incomplete explanation (insufficient explanation of only possible outcome).

STUDENT RESPONSE

Online Response Score: 2 points

17. The table below shows the number of pencils of each color for all 25 pencils in a box.

Pencils in the Box

Color	Number
red	11
blue	11
green	3

The likelihood of an event occurring may be described as certain, more likely, equally likely, less likely, or impossible.

A single pencil is drawn from the box.

A. Describe the likelihood that the pencil is a yellow pencil. Explain your reasoning.

Student Response: There is no chance of it being yellow because there is no yellow pencil in the table.

Annotation: The student has given a correct answer and a complete explanation.

The pencils have all been placed back in the box.

B. Compare the likelihood of drawing a red pencil to the likelihood of drawing a blue pencil from the box. Explain your reasoning.

Student Response: They would be the same because in the table they are the same amount.

Annotation: The student has given a correct answer and a complete explanation.

The original 25 colored pencils have all been placed back in the box and another 11 colored pencils have been added to the box. The new pencils are either red, blue, or green. The likelihood of drawing a green pencil is now **greater** than the likelihood of drawing a red pencil, but less than the likelihood of drawing a blue pencil.

- C. How many pencils of each color were added to the box? Explain how you know that your answer is the only possible outcome that meets all of the conditions.

Student Response: The numbers you need to add are 4 blue, 0 red, 8 green because you less than the number of blue and more than red.

Annotation: The student has given an incorrect answer and an incorrect explanation.

STUDENT RESPONSE

Handwritten Response Score: 1 point

17. The table below shows the number of pencils of each color for all 25 pencils in a box.

Pencils in the Box

Color	Number
red	11
blue	11
green	3

The likelihood of an event occurring may be described as certain, more likely, equally likely, less likely, or impossible.

A single pencil is drawn from the box.

A. Describe the likelihood that the pencil is a yellow pencil. Explain your reasoning.

Student Response: it is less likely that you will draw a yellow pencil because there isn't any yellow pencil's

Annotation: The student has given an incorrect answer and a complete explanation.

The pencils have all been placed back in the box.

B. Compare the likelihood of drawing a red pencil to the likelihood of drawing a blue pencil from the box. Explain your reasoning.

Student Response: it is possible that you will draw a red & blue pencil because there are more red and blue pencil's

Annotation: The student has given an incorrect answer and an incorrect explanation.

The original 25 colored pencils have all been placed back in the box and another 11 colored pencils have been added to the box. The new pencils are either red, blue, or green. The likelihood of drawing a green pencil is now **greater** than the likelihood of drawing a red pencil, but less than the likelihood of drawing a blue pencil.

- C. How many pencils of each color were added to the box? Explain how you know that your answer is the only possible outcome that meets all of the conditions.

Student Response: There are 50 of each pencil because if you add $11 + 11 + 3 = 25 + 25 = 50$

Annotation: The student has given an incorrect answer and an incorrect explanation.

STUDENT RESPONSE

Online Response Score: 0 points

17. The table below shows the number of pencils of each color for all 25 pencils in a box.

Pencils in the Box

Color	Number
red	11
blue	11
green	3

The likelihood of an event occurring may be described as certain, more likely, equally likely, less likely, or impossible.

A single pencil is drawn from the box.

A. Describe the likelihood that the pencil is a yellow pencil. Explain your reasoning.

Student Response: 1/25

Annotation: The student has given an incorrect answer and no explanation.

The pencils have all been placed back in the box.

B. Compare the likelihood of drawing a red pencil to the likelihood of drawing a blue pencil from the box. Explain your reasoning.

Student Response: 11/14

Annotation: The student has given an incorrect answer and no explanation.

The original 25 colored pencils have all been placed back in the box and another 11 colored pencils have been added to the box. The new pencils are either red, blue, or green. The likelihood of drawing a green pencil is now **greater** than the likelihood of drawing a red pencil, but **less** than the likelihood of drawing a blue pencil.

C. How many pencils of each color were added to the box? Explain how you know that your answer is the only possible outcome that meets all of the conditions.

Student Response: I say 10 because it say 11 so you pull from the 11 you will be left with 10

Annotation: The student has given an incorrect answer and an incorrect explanation.

MATHEMATICS—SUMMARY DATA

MULTIPLE-CHOICE

Sample Number	Alignment	Answer Key	Depth of Knowledge	p-value A	p-value B	p-value C	p-value D
1	A-N.1.1.1	A	1	57% (correct answer)	11%	23%	9%
2	A-N.1.1	D	2	16%	19%	22%	43% (correct answer)
3	A-N.1.1.2 A-N.1.1.1	B	2	12%	66% (correct answer)	16%	6%
4	A-R.1.1.1	D	2	29%	15%	16%	40% (correct answer)
5	A-R.1.1.2 A-R.1.1.3	B	2	23%	54% (correct answer)	16%	7%
6	A-R.1.1.3	C	1	15%	12%	54% (correct answer)	19%
7	A-R.1.1.4	B	2	16%	63% (correct answer)	12%	9%
8	A-R.1.1.5 A-R.1.1.1	D	1	26%	8%	23%	43% (correct answer)
9	A-R.1.1.6	D	2	17%	19%	23%	41% (correct answer)
10	B-E.2.1.1	A	2	52% (correct answer)	11%	22%	15%
11	B-E.2.2.1	D	1	24%	16%	15%	45% (correct answer)
12	B-E.2.2.2	C	2	9%	8%	57% (correct answer)	26%
13	C-G.1	C	2	25%	11%	55% (correct answer)	9%

PSSA MATHEMATICS GRADE 7

Sample Number	Alignment	Answer Key	Depth of Knowledge	p-value A	p-value B	p-value C	p-value D
14	C-G.1.1.4	C	1	21%	3%	47% (correct answer)	29%
15	C-G.2.1.2	C	2	19%	26%	46% (correct answer)	9%
16	C-G.2.2.1	B	1	21%	37% (correct answer)	19%	23%

OPEN-ENDED

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	D-S.3	4	3	2.16

PSSA Grade 7 Mathematics Item and Scoring Sampler