



pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Mathematics Item and Scoring Sampler



**2023–2024
Grade 4**

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INTRODUCTION

General Introduction

The Pennsylvania Department of Education (PDE) 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 Anchors and Eligible Content (AAEC) 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 by providing samples of test item types and scored student responses. The item sampler is not designed to be used as a pretest, a curriculum, or any other benchmark for operational testing.

This Item and Scoring Sampler is available in Braille format. For more information regarding Braille, call (717) 901-2238.

Pennsylvania Core Standards (PCS)

This sampler contains examples of test questions designed to assess the Pennsylvania Assessment Anchors and Eligible Content aligned to the PCS. 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 PCS-aligned Assessment Anchors and Eligible Content documents are posted on this portal:

- www.education.pa.gov [Hover over “Data and Reporting,” select “Assessment and Accountability,” and select “PSSA-PA System of School Assessment.” Then select “Assessment Anchors/Eligible Content” on the right side of the screen.]

What Is Included

This sampler contains test questions, or test “items,” that have been written to align to the Assessment Anchors that are based on the PCS. The sample test questions model the types of items that may appear on an operational PSSA. Each sample test question has been through a rigorous review process to ensure alignment with the Assessment Anchors prior to being piloted in an embedded field test within a PSSA assessment and then used operationally on a PSSA assessment. Answer keys, scoring guidelines, and any related stimulus material are also included. Additionally, sample student responses are provided with each open-ended (OE) item to demonstrate the range of responses that students provided in response to these items.

Purpose and Uses

The items in this sampler may be used¹ as examples for creating assessment items at the classroom level. Classroom teachers may find it beneficial to have students respond to the open-ended item in this sampler. Educators may then use the sampler as a guide to score the responses either independently or together with colleagues within a school or district. This sampler also includes the *General Description of Scoring Guidelines for Mathematics Open-Ended Items* that students will have access to during a PSSA mathematics administration. The general description of scoring guidelines may be distributed to students for use during local assessments and may also be used by educators when scoring local assessments.

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 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.

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.

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

Testing Time and Mode of Testing Delivery for the PSSA

The PSSA is delivered in a 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. 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

During an official test administration, students are given as much additional time as is necessary to complete the test questions.

Mathematics Reporting Categories

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

• A = Numbers and Operations	• C = Geometry
• B = Algebraic Concepts	• 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 4.

- A-T = Numbers and Operations in Base Ten
- A-F = Numbers and Operations—Fractions
- B-O = Operations and Algebraic Thinking
- C-G = Geometry
- D-M = Measurement and Data

Examples of MC and OE items assessing these categories are included in this sampler.

Item and Scoring Sampler Format

This sampler includes the test directions and scoring guidelines that appear in the PSSA Mathematics assessments. Each MC item is followed by a table that includes the item alignment, the answer key, the depth of knowledge (DOK) level, the percentage² of students who chose each answer option, and a brief answer-option analysis or rationale. The OE item is followed by a table that includes the item alignment, the DOK level, and the 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 Items* 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. The student responses in this item and scoring sampler are actual student responses; however, the handwriting has been changed to protect the students' identities and to make the item and scoring sampler accessible to as many people as possible.

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 option A
p-value B	Percentage of students who selected option B
p-value C	Percentage of students who selected option C
p-value D	Percentage of students who selected option D
Option Annotations	Brief answer-option analysis or rationale

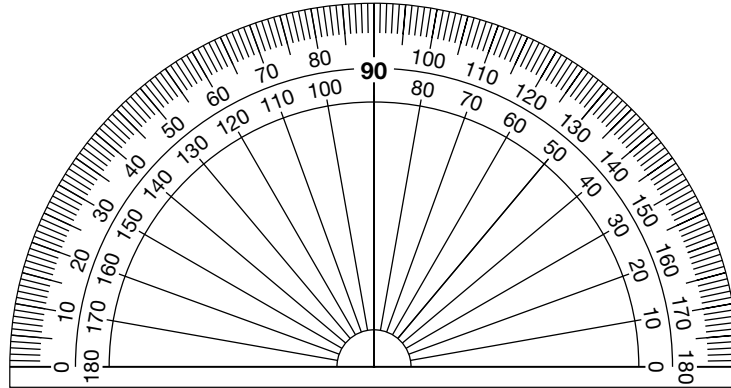
Example Open-Ended Item Information Table

Alignment	Assigned AAEC	Depth of Knowledge	Assigned DOK	Mean Score	Average Score
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² All p-value percentages listed in the item information tables have been rounded.

Grade 4 Protractor

The protractor shown below is not intended to be used to measure. It has been included as a representation of the protractors that will be provided for students when they take the test. Due to differences in printers, the protractor in this sampler may not accurately reproduce to scale.



General Description of Scoring Guidelines for Mathematics Open-Ended Items

4— The response demonstrates a *thorough* understanding of the 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. The 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.

The response may show only information copied from the question.

Special Categories within zero reported separately:

BLK (blank).....Is blank, is entirely erased, or gives a written refusal to respond

OT.....Is off-task

LOE.....Is in a language other than English

IL.....Is illegible

Grade 4 Formula Sheet

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

2023
Grade 4

Standard Conversions

- 1 yard (yd) = 3 feet (ft)
- 1 foot = 12 inches (in.)
- 1 pound (lb) = 16 ounces (oz.)
- 1 gallon (gal) = 4 quarts (qt)
- 1 quart = 2 pints (pt)
- 1 pint = 2 cups (c)

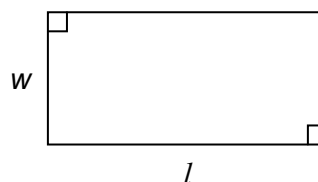
Metric Conversions

- 1 kilometer (km) = 1,000 meters (m)
- 1 meter = 100 centimeters (cm)
- 1 kilogram (kg) = 1,000 grams (g)
- 1 liter (L) = 1,000 milliliters (mL)

Time Conversions

- 1 year (yr) = 12 months (mo)
- 1 year = 52 weeks (wk)
- 1 year = 365 days
- 1 week = 7 days
- 1 day = 24 hours (hr)
- 1 hour = 60 minutes (min)
- 1 minute = 60 seconds (sec)

Rectangle



Area = length \times width

$$A = l \times w$$

Perimeter = length + length + width + width

$$P = l + l + w + w$$

MATHEMATICS TEST DIRECTIONS

On the following pages are the mathematics questions.

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

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

MULTIPLE-CHOICE ITEMS

1. Divide: $5,113 \div 3$

- A. 171
- B. 174 R1
- C. 1,701
- D. 1,704 R1

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

2. In 2010, the population of Pittsburgh was 305,704. Which expression shows the population of Pittsburgh in expanded form?
- A. $300 + 5 + 700 + 4$
 - B. $30,000 + 5,000 + 700 + 4$
 - C. $300,000 + 5,000 + 70 + 4$
 - D. $300,000 + 5,000 + 700 + 4$

3. The weights, in pounds, of four elephants are listed below.

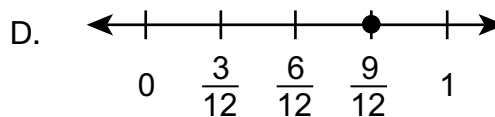
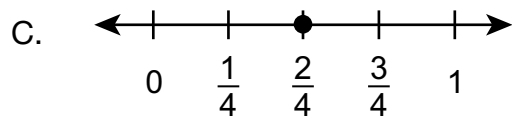
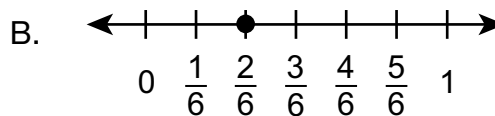
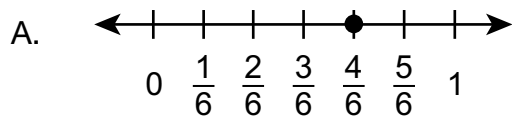
12,495 12,954 12,599 12,763

Which number sentence correctly compares the weights, in pounds, of two of the elephants?

- A. $12,495 > 12,954$
- B. $12,599 > 12,954$
- C. $12,495 = 12,954$
- D. $12,763 < 12,954$

4. A total of 4,896 people went into a football stadium. The stadium had 8 gates. The same number of people went through each gate. Which sentence describes the **closest estimate** of the number of people who went through each gate?
- A. Since $8 \times 6 = 48$, a little less than 600 people went through each gate.
 - B. Since $8 \times 6 = 48$, a little more than 600 people went through each gate.
 - C. Since $8 \times 6 = 48$, a little less than 800 people went through each gate.
 - D. Since $8 \times 6 = 48$, a little more than 800 people went through each gate.

5. Which number line shows a point that is graphed at a fraction that is equivalent to $\frac{2}{3}$?



6. Angela practiced piano and guitar each day for 5 days.

- She practiced piano for $\frac{3}{6}$ hour each day.
- She practiced guitar for $\frac{1}{6}$ hour each day.

What is the total amount of time, in hours, Angela practiced piano and guitar for the 5 days?

- A. $\frac{20}{60}$
- B. $\frac{20}{30}$
- C. $\frac{20}{12}$
- D. $\frac{20}{6}$

7. Which expression represents $1\frac{1}{3}$ written as a sum of unit fractions?

A. $\frac{1}{1} + \frac{1}{1} + \frac{1}{1} + \frac{1}{1}$

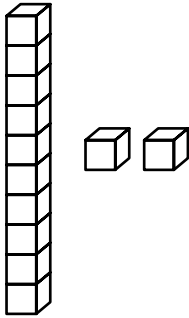
B. $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$

C. $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$

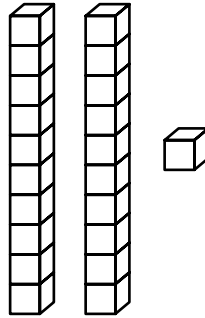
D. $\frac{1}{6} + \frac{1}{6}$

8. Saul builds a model that represents the decimal 0.12. He uses a tens rod to represent one tenth and a ones cube to represent one hundredth. Which set of blocks could be the model Saul builds?

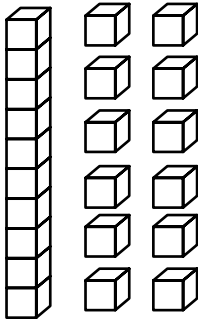
A.



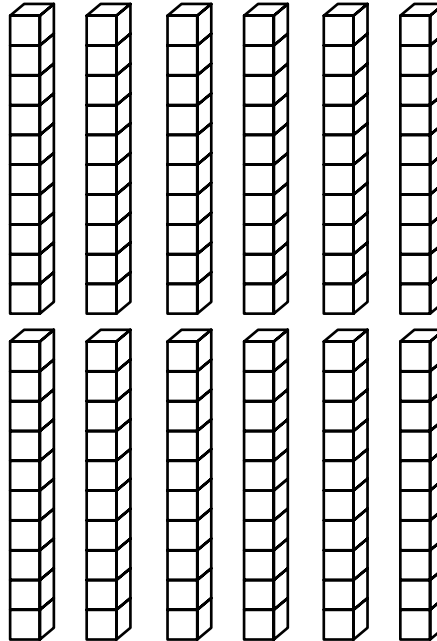
B.



C.



D.



9. A farmer owns four times as many sheep as cows. She owns two more cows than horses. When the farmer places her sheep in 3 pens, each pen holds 8 sheep. How many horses does the farmer own?
- A. 4
 - B. 8
 - C. 94
 - D. 98

Item Information	
Alignment	B-O.1.1.3
Answer Key	A
Depth of Knowledge	2
p-value A	42% (correct answer)
p-value B	29%
p-value C	19%
p-value D	10%
Option Annotations	<p>A. Correct: multiplies 3 by 8 to get 24 sheep, divides 24 by 4 to get 6 cows, and subtracts 2 from 6 to get 4 horses</p> <p>B. adds 2 to the number of cows</p> <p>C. multiplies the number of sheep by 4 and subtracts 2 from the number of cows</p> <p>D. multiplies the number of sheep by 4 and adds 2 to the number of cows</p>

10. Mr. Larson has 57 tomato plants. He wants to put them in rows with the same number of tomato plants in each row. How many rows could Mr. Larson have using all 57 tomato plants?
- A. 3
 - B. 5
 - C. 7
 - D. 12

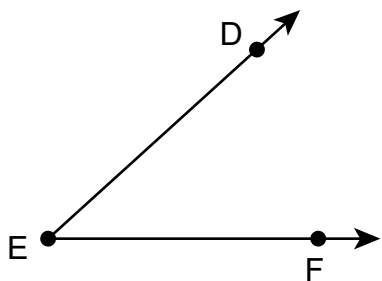
Item Information	
Alignment	B-O.2.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	53% (correct answer)
p-value B	9%
p-value C	21%
p-value D	17%
Option Annotations	<ul style="list-style-type: none">A. Correct: recognizes that 3 and 19 is a factor pair of 57B. uses the digit in the tens place as a factorC. uses the digit in the ones place as a factorD. uses $5 + 7$ as a factor

11. Hannah makes a dog-walking area in the shape of a triangle. She uses 8 feet of fencing on each side of the dog-walking area. Which term describes each angle of Hannah's dog-walking area?
- A. acute
 - B. obtuse
 - C. right
 - D. straight

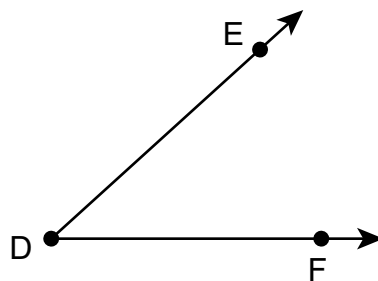
Item Information	
Alignment	C-G.1.1
Answer Key	A
Depth of Knowledge	1
p-value A	60% (correct answer)
p-value B	15%
p-value C	15%
p-value D	10%
Option Annotations	<p>A. Correct: recognizes that a triangle with three equal side lengths is an equilateral triangle and that each angle of an equilateral triangle is an acute angle</p> <p>B. thinks an obtuse triangle can have three equal side lengths</p> <p>C. thinks a right triangle can have three equal side lengths</p> <p>D. does not realize that a straight angle cannot be part of a triangle</p>

12. Which angle is obtuse and can be identified as angle DEF?

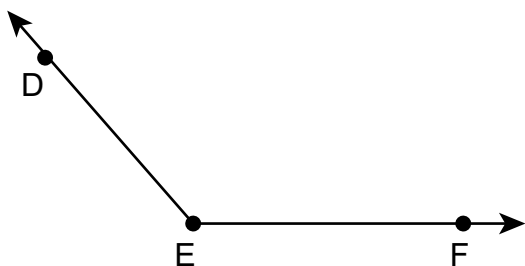
A.



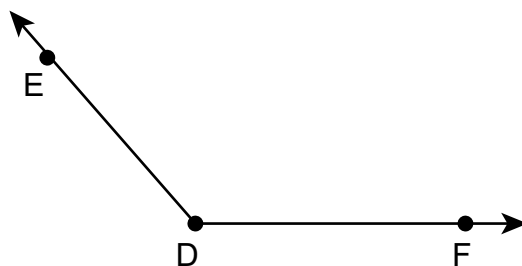
B.



C.

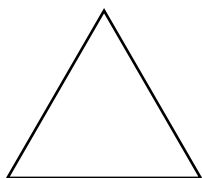


D.

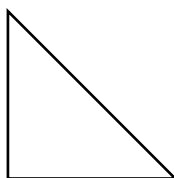


13. Which triangle **most likely** has both a right angle and a line of symmetry?

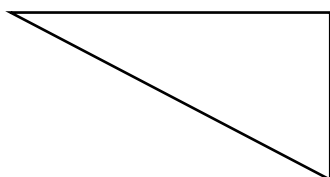
A.



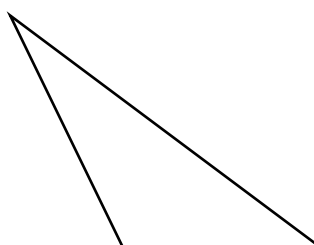
B.



C.



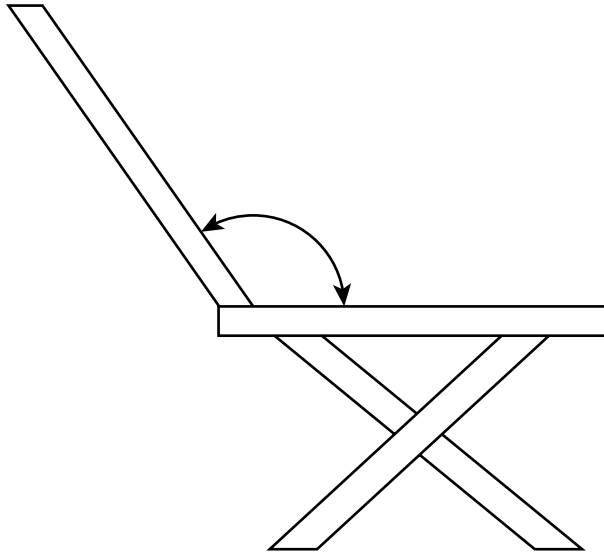
D.



14. The length of a fence is 12 **yards**. What is the length, in **feet**, of the fence?

- A. 4 feet
- B. 36 feet
- C. 120 feet
- D. 144 feet

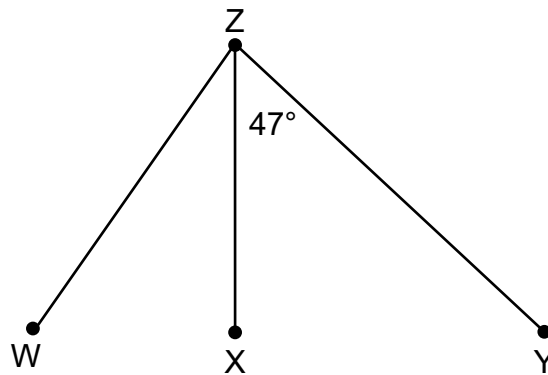
15. The seat and the back of a chair form an angle as shown below.



Using your protractor, what is the measure of the angle formed by the seat and the back of the chair?

- A. 55°
- B. 65°
- C. 125°
- D. 135°

16. In the picture shown below, the measure of angle WZY is 82° .



What is the measure, in degrees, of angle WZX?

- A. 35°
- B. 43°
- C. 129°
- D. 164°

OPEN-ENDED QUESTION

17. Three number patterns are described below.

- pattern A: Start at 10 and add 4.
- pattern B: Start at 30 and subtract 3.
- pattern C: Start at 6 and add 5.

A. What are the first four terms of pattern A?

_____, _____, _____, _____

B. What numbers are in both pattern B and pattern C? Show or explain all your work.

Go to the next page to finish question 17.



17. Continued. Please refer to the previous page for task explanation.

Another number pattern is shown below.

16, 14, 15, 13, 14, 12, 13, ____

- C.** Explain how to determine whether the next number in the pattern is even or odd.

After you have finished your work, close this booklet so your teacher will know you are finished.

