Pennsylvania PSSA 2023
Grade 5 Math

Reference Materials
Page 2

Exam & Answer Key Materials
Pages 3 - 41

Grade 5 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 5

Standard Conversions

1 mile (mi) = 1,760 yards (yd)
1 mile = 5,280 feet (ft)
1 yard (yd) = 3 feet (ft)
1 foot = 12 inches (in.)

1 ton (T) = 2,000 pounds (lb)
1 pound = 16 ounces (oz.)

1 gallon (gal) = 4 quarts (qt)
1 quart = 2 pints (pt)
1 pint = 2 cups (c)
1 cup = 8 fluid ounces (fl oz.)
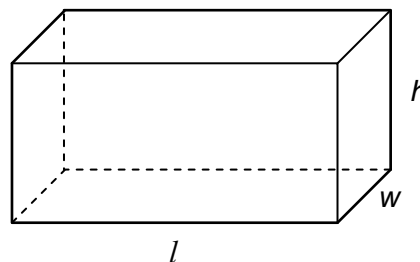
Metric Conversions

1 kilometer (km) = 1,000 meters (m)
1 meter = 100 centimeters (cm)
1 centimeter = 10 millimeters (mm)

1 kilogram (kg) = 1,000 grams (g)

1 liter (L) = 1,000 milliliters (mL)

Time Conversions

1 century = 10 decades
1 decade = 10 years (yr)
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)

Rectangular Prism

Volume = length × width × height
$V = l \times w \times h$

Volume = area of the base × height
$V = B \times h$

Volume = area of the base × width
$V = B \times w$

Volume = area of the base × length
$V = B \times l$

pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Mathematics
Item and Scoring Sampler

2023–2024
Grade 5

MATHEMATICS TEST DIRECTIONS

On the following pages are the mathematics questions.

- You may <u>not</u> 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.

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

MULTIPLE-CHOICE ITEMS

1. Subtract: 1.76 – 0.9

   A. 0.86

   B. 1.26

   C. 1.67

   D. 1.73

Item Information	
Alignment	A-T.2.1.3
Answer Key	A
Depth of Knowledge	1
p-value A	59% (correct answer)
p-value B	8%
p-value C	27%
p-value D	6%
Option Annotations	A. Correct: aligns the decimals before subtracting OR includes a 0 in the hundredths place of 0.9 and then subtracts 1.76 – 0.90 B. subtracts the 7 from the 9 C. subtracts 0.09 from 1.76 (right-aligns the numbers before subtracting) D. subtracts 0.09 from 1.76 (right-aligns the numbers before subtracting) and subtracts the 6 from the 9

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

2. The expression below represents the mass, in grams, of a mineral sample.

$$7 \times 10 + 3 \times 0.1 + 9 \times 0.001$$

What is the mass, in grams, of the mineral sample?

A. seventy and thirty-nine hundredths

B. seventy-three and nine hundredths

C. seventy-three and nine thousandths

D. seventy and three hundred nine thousandths

Item Information	
Alignment	A-T.1.1.3
Answer Key	D
Depth of Knowledge	1
p-value A	15%
p-value B	9%
p-value C	17%
p-value D	59% (correct answer)
Option Annotations	A. treats the last digit as hundredths B. uses 3 in the ones place rather than the tenths place and treats the last digit as hundredths C. uses 3 in the ones place rather than the tenths place D. Correct: recognizes that $7 \times 10 = 70$, $3 \times 0.1 = 0.3$, and $9 \times 0.001 = 0.009$; adds these values together and determines the sum is 70.309; and then uses "seventy" to represent 70 (the digits to the left of the decimal point), "and" to represent the decimal point (separates the whole part of the number from the decimal part of the number), "three hundred nine" to represent 309 (the digits to the right of the decimal point), and "thousandths" since the rightmost digit is in the thousandths place

3. Which statement correctly compares $2 \times 100 + 4 \times 1 + 5 \times 0.1$ and 204.05?

    A.   204.5 < 204.05

    B.   204.5 > 204.05

    C.   204.05 = 204.05

    D.   204.005 < 204.05

Item Information	
Alignment	A-T.1.1.4 A-T.1.1.3
Answer Key	B
Depth of Knowledge	1
p-value A	16%
p-value B	48% (correct answer)
p-value C	32%
p-value D	4%
Option Annotations	A. reverses the inequality symbol B. Correct: recognizes $2 \times 100 = 200$, $4 \times 1 = 4$, $5 \times 0.1 = 0.5$; adds these values together and determines the sum is 204.5; compares the whole-number parts (204 = 204), and then either compares 5 tenths to 0 tenths, recognizing that .5 > .0 OR writes 0.5 as 0.50 to compare the decimal parts (0.50 > 0.05) C. uses $5 \times 0.1 = 0.05$ rather than 0.5 D. uses $5 \times 0.1 = 0.005$ rather than 0.5

4. A bakery owner orders 6 cases of chocolate. Each case contains 4 blocks of chocolate. Each block weighs 13.2 pounds. How many pounds of chocolate does the bakery owner order?

    A. 58.8

    B. 83.2

    C. 103.2

    D. 316.8

Item Information	
Alignment	A-T.2.1
Answer Key	D
Depth of Knowledge	2
p-value A	13%
p-value B	11%
p-value C	8%
p-value D	68% (correct answer)
Option Annotations	A. multiplies 4 by 13.2 and then adds 6 to the product [4 × 13.2 + 6] B. multiplies 6 by 13.2 and then adds 4 to the product [6 × 13.2 + 4] C. adds 4 to 13.2 and then multiplies the sum by 6 [(4 + 13.2) × 6] D. Correct: multiplies 6 by 4 to determine that the product is 24 blocks of chocolate and then multiplies 24 by 13.2 to determine that the product is 316.8 pounds of chocolate

5. A farmer has 10 packages of corn seeds. Each package contains 300 seeds. He plants all the seeds in 20 rows with an equal number of seeds in each row. How many seeds are in each row?

    A.   150

    B.   600

    C.   1,500

    D.   60,000

Item Information	
Alignment	A-T.2.1.2 A-T.2.1.1
Answer Key	A
Depth of Knowledge	1
p-value A	62% (correct answer)
p-value B	10%
p-value C	8%
p-value D	20%
Option Annotations	A. Correct: multiplies 10 by 300 to determine that the product is 3,000 seeds and then divides 3,000 by 20 to determine that the quotient is 150 seeds in each row B. calculates 300 ÷ 10 × 20 C. calculates 30 ÷ 2 × 100 D. calculates 300 × 10 × 20

6. Which expression is equivalent to $\frac{1}{3} + \frac{1}{30} - \frac{1}{5}$?

A. $\frac{1}{3} + \frac{6}{30} - \frac{1}{30}$

B. $\frac{5}{15} - \frac{3}{15} + \frac{1}{30}$

C. $\frac{1}{30} + \frac{1}{30} - \frac{1}{5}$

D. $\frac{5}{15} + \frac{3}{15} - \frac{1}{30}$

Item Information	
Alignment	A-F.1.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	12%
p-value B	51% (correct answer)
p-value C	23%
p-value D	14%
Option Annotations	A. converts $\frac{1}{5}$ to $\frac{6}{30}$ correctly but does not keep the minus sign with the $\frac{6}{30}$ when using the commutative property to change the order of the terms
	B. Correct: converts $\frac{1}{3}$ to $\frac{5}{15}$ by multiplying both the numerator and the denominator by 5, converts $\frac{1}{5}$ to $\frac{3}{15}$ by multiplying both the numerator and the denominator by 3, and then uses the commutative property to change the order of the terms "$-\frac{3}{15}$" and "$+\frac{1}{30}$"
	C. converts $\frac{1}{3}$ to $\frac{1}{30}$ by multiplying only the denominator by 10
	D. converts $\frac{1}{3}$ to $\frac{5}{15}$ and $\frac{1}{5}$ to $\frac{3}{15}$ correctly but does not keep the minus sign with the $\frac{3}{15}$ when using the commutative property to change the order of the terms

7. Mrs. Brown has a package containing n pounds of cereal. Every day she puts $\frac{1}{8}$ pound of cereal into her son's lunchbox and $\frac{1}{8}$ pound of cereal into her daughter's lunchbox. Which expression represents the number of days Mrs. Brown can do this before she runs out of cereal?

A. $(n \times 2) \times \frac{1}{8}$

B. $(n \times 2) \div \frac{1}{8}$

C. $n \times \left(2 \times \frac{1}{8}\right)$

D. $n \div \left(2 \times \frac{1}{8}\right)$

Item Information	
Alignment	A-F.2.1
Answer Key	D
Depth of Knowledge	2
p-value A	17%
p-value B	20%
p-value C	26%
p-value D	37% (correct answer)
Option Annotations	A. doubles the amount because there are two children and multiplies by the daily amount rather than dividing by the daily amount B. doubles the amount because there are two children C. multiplies by the daily amount rather than dividing by the daily amount D. Correct: recognizes that $\frac{1}{8}$ should be multiplied by 2 before dividing the total amount by that product

8. Keira has 8 cups of juice. She pours the juice into 5 glasses, pouring the same amount of juice into each glass. How many cups of juice are in each glass?

A. $\dfrac{5}{8}$

B. $1\dfrac{3}{8}$

C. $1\dfrac{3}{5}$

D. 3

Item Information	
Alignment	A-F.2.1.1
Answer Key	C
Depth of Knowledge	1
p-value A	29%
p-value B	18%
p-value C	43% (correct answer)
p-value D	10%
Option Annotations	A. divides 5 by 8 B. writes the incorrect denominator when converting the improper fraction into a mixed number C. Correct: determines that 8 cups divided among 5 glasses results in 1 with a remainder of 3 and then writes the remainder as the fraction 3 over 5 D. subtracts 5 from 8

9. Alli and Bert each have some money. Bert has $\frac{5}{4}$ as many dollars as Alli has. Which statement about the amount of money Alli and Bert each have is true?

   A. Alli has more money than Bert has.

   B. Bert has more money than Alli has.

   C. Alli and Bert have the same amount of money.

   D. There is not enough information to compare the amount of money Alli and Bert each have.

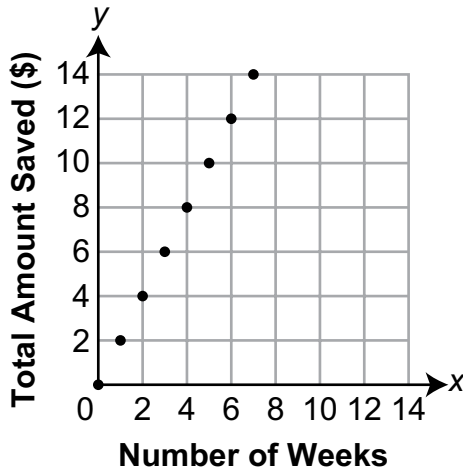| Item Information	
Alignment	A-F.2.1.3
Answer Key	B
Depth of Knowledge	2
p-value A	15%
p-value B	48% (correct answer)
p-value C	14%
p-value D	23%
Option Annotations	A. does not recognize that $\frac{5}{4}$ is greater than 1 and multiplying any number by a fraction greater than 1 will result in a product larger than either factor
	B. Correct: recognizes that $\frac{5}{4}$ is greater than 1 and that multiplying any number by a fraction greater than 1 will result in a product larger than either factor
	C. does not recognize that $\frac{5}{4}$ is greater than 1
	D. thinks it is not possible to make a comparison about the amount of money either person has since no exact values are given

10. A relay race is $\frac{1}{8}$ mile long. Each relay team has 4 members. Each team member runs the same distance. How many miles does each team member run?

A. $\frac{1}{2}$
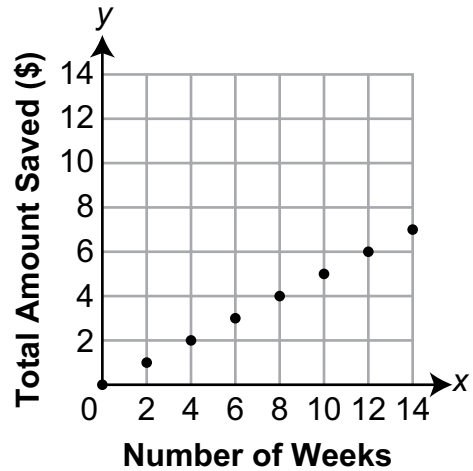
B. $\frac{1}{4}$

C. $\frac{1}{12}$

D. $\frac{1}{32}$

Item Information	
Alignment	A-F.2.1.4
Answer Key	D
Depth of Knowledge	2
p-value A	27%
p-value B	15%
p-value C	10%
p-value D	48% (correct answer)
Option Annotations	A. multiplies 4 and $\frac{1}{8}$ B. determines the fraction of the race completed by each member [i.e., finds the reciprocal of the number of team members] C. adds 8 and 4 D. Correct: recognizes that this situation represents dividing $\frac{1}{8}$ by 4, which is the same as multiplying $\frac{1}{8}$ by $\frac{1}{4}$, resulting in $\frac{1 \times 1}{8 \times 4} = \frac{1}{32}$

11. Bruce saves $1 each week. His brother Len saves $2 each week. They combine their savings each week. Which coordinate grid represents the total amount of money, in dollars, Bruce and Len save over time?

A.
Combined Savings

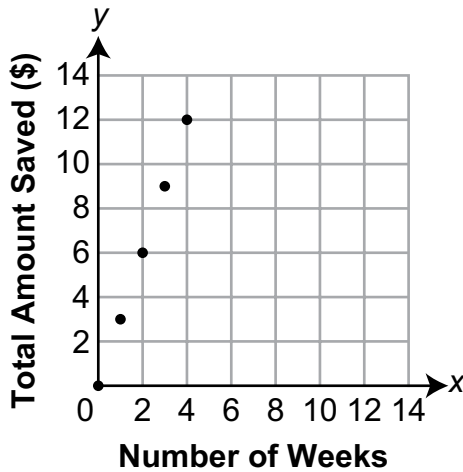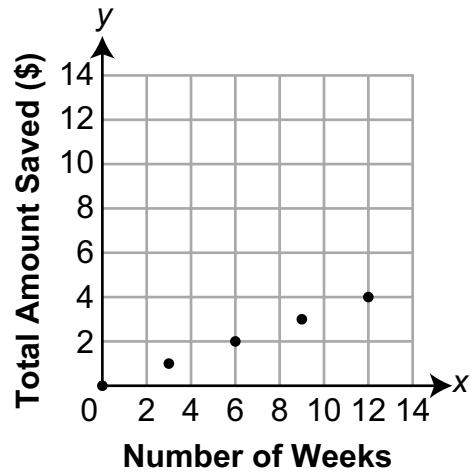Total Amount Saved ($) vs. Number of Weeks

B.
Combined Savings

Total Amount Saved ($) vs. Number of Weeks

C.
Combined Savings

Total Amount Saved ($) vs. Number of Weeks

D.
Combined Savings

Total Amount Saved ($) vs. Number of Weeks

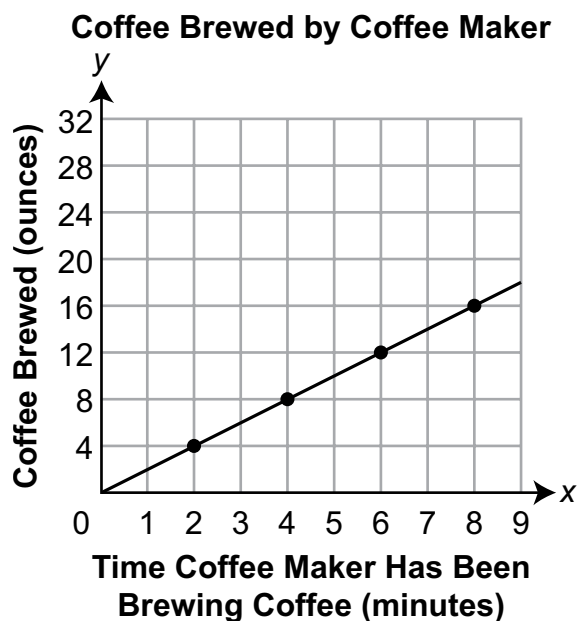| Item Information	
Alignment	C-G.1
Answer Key	C
Depth of Knowledge	2
p-value A	20%
p-value B	18%
p-value C	48% (correct answer)
p-value D	14%
Option Annotations	A. uses Bruce's savings as the *x*-coordinates and Len's savings as the *y*-coordinates B. uses Bruce's savings as the *y*-coordinates and Len's savings as the *x*-coordinates C. Correct: increases each *x*-coordinate by 1 since this represents the number of weeks and increases each *y*-coordinate by 3 since this represents the two brothers saving a total of $3 each week D. uses the weekly total savings as the *x*-coordinates and the numbers of weeks as the *y*-coordinates

12. A coordinate grid is shown below.
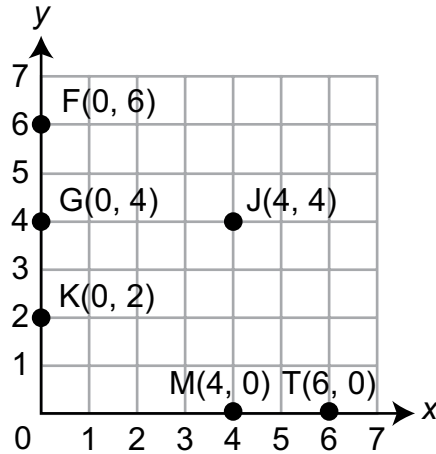
Which two points on the coordinate grid have the same *y*-coordinate?

A. point G and point K

B. point J and point M

C. point G and point J

D. point F and point T

Item Information	
Alignment	C-G.1.1.1
Answer Key	C
Depth of Knowledge	1
p-value A	17%
p-value B	13%
p-value C	53% (correct answer)
p-value D	17%
Option Annotations	A. selects two points on the *y*-axis B. selects two points with the same *x*-coordinate C. Correct: either selects two points that have the same second coordinate since the second coordinate of an ordered pair represents the *y*-coordinate OR selects two points on the same horizontal line since the *y*-coordinate represents the distance from the *x*-axis D. selects two points that have the *x*-coordinate and *y*-coordinate switched

13. The graph below represents the amount of coffee brewed (*y*), in ounces, based on the amount of time (*x*), in minutes, for which the coffee maker has been brewing coffee.

Coffee Brewed by Coffee Maker

Which ordered pair represents the number of ounces of coffee brewed when the coffee maker has been brewing coffee for 5 minutes?

A. (5, 10)

B. (5, 11)

C. (10, 5)

D. (11, 5)

Item Information	
Alignment	C-G.1.1.2
Answer Key	A
Depth of Knowledge	1
p-value A	63% (correct answer)
p-value B	19%
p-value C	12%
p-value D	6%
Option Annotations	A. Correct: recognizes that the *x*-coordinate represents the amount of time, so uses 5 as the first coordinate of the ordered pair; looks at the line directly above the 5 on the *x*-axis, sees that it is halfway between the 8 and 12 grid lines, and uses 10 as the second coordinate of the ordered pair since 10 is halfway between 8 and 12 B. selects a *y*-value that is 1 less than 12 (using a *y*-scale of 2 rather than 4) C. reverses the ordered pair D. selects a *y*-value that is 1 less than 12 (using a *y*-scale of 2 rather than 4) and reverses the ordered pair

14. Which term does **not** describe a square?

    A.   parallelogram

    B.   rectangle

    C.   rhombus

    D.   trapezoid

Item Information	
Alignment	C-G.2.1.1
Answer Key	D
Depth of Knowledge	1
p-value A	10%
p-value B	10%
p-value C	15%
p-value D	65% (correct answer)
Option Annotations	A. does not account for a parallelogram with 4 right angles and 4 equal sides OR does not recognize that a square is a parallelogram because a square has 2 pairs of parallel sides B. does not account for a rectangle with 4 equal sides OR does not recognize that a square is a rectangle because all 4 angles are right angles C. does not account for a rhombus with 4 right angles OR does not recognize that a square is a rhombus because all 4 sides are equal D. Correct: recognizes that a trapezoid has only 1 pair of parallel sides and that a square has 2 pairs of parallel sides

15. Tracy needs a **gallon** of water, but she has only **quart**-sized, **pint**-sized, and **cup**-sized containers.

- She first fills one **quart**-sized container with water.
- She then fills some **pint**-sized containers and some **cup**-sized containers with water.

How many **pint**-sized containers and **cup**-sized containers could Tracy fill to have a total of 1 **gallon** of water in all the containers?

A. 1 pint-sized container and 2 cup-sized containers

B. 2 pint-sized containers and 1 cup-sized container

C. 2 pint-sized containers and 5 cup-sized containers

D. 5 pint-sized containers and 2 cup-sized containers

Item Information	
Alignment	D-M.1.1.1
Answer Key	D
Depth of Knowledge	2
p-value A	15%
p-value B	16%
p-value C	31%
p-value D	38% (correct answer)
Option Annotations	A. thinks there are only 2 quarts in a gallon B. thinks there are only 2 quarts in a gallon and confuses cups and pints C. confuses cups and pints D. Correct: either calculates 5 pints + 2 cups = 5 pints + 1 pint = 6 pints = 3 quarts and 3 quarts + 1 quart = 4 quarts = 1 gallon OR calculates 1 gallon – 1 quart = 4 quarts – 1 quart = 3 quarts = 6 pints = 5 pints + 1 pint = 5 pints + 2 cups

16. A toy company makes solid game pieces out of plastic. Each game piece is made by connecting two right rectangular prisms as shown in the picture below.
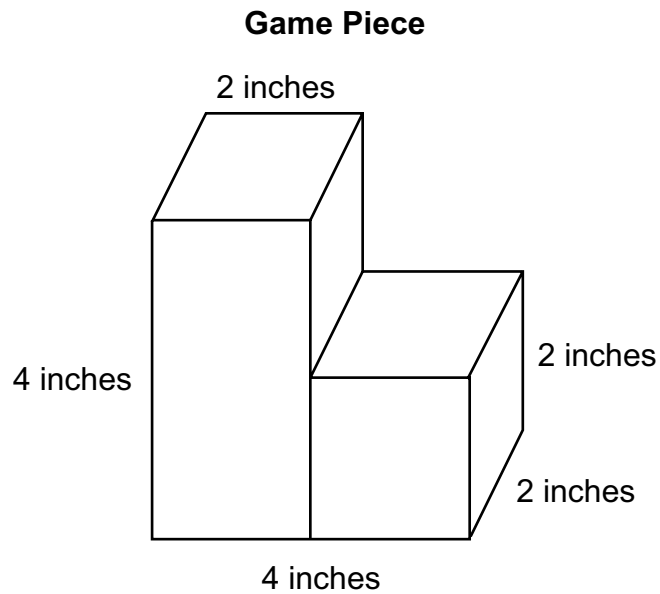
Game Piece

What is the volume, in cubic inches, of plastic needed to make each game piece?

A. 14

B. 24

C. 32

D. 48

Item Information	
Alignment	D-M.3.1.2
Answer Key	B
Depth of Knowledge	2
p-value A	31%
p-value B	40% (correct answer)
p-value C	18%
p-value D	11%
Option Annotations	A. adds the given lengths B. Correct: either recognizes that the prisms have the same width (2 inches), subtracts the length of the taller prism from the overall length to find the length of the shorter prism (4 – 2 = 2), finds the volume of each prism (2 × 2 × 4 = 16 and 2 × 2 × 2 = 8), and then adds the volumes to find the total (16 + 8 = 24) OR multiplies the overall length (4), width (2), and height (4) and then subtracts the volume of the "missing" part above the shorter prism (2 × 2 × 2 = 8), which is 32 – 8 = 24 C. multiplies the overall length (4), width (2), and height (4) but does not account for the "missing" part above the shorter prism D. multiplies 4 × 4 × 2 to find the volume of the taller prism, multiplies 4 × 2 × 2 to find the volume of the shorter prism, and then adds the volumes to find the total (32 + 16)

OPEN-ENDED QUESTION

17. Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

A. Write a numerical expression with at least one operation symbol to represent the total amount of time Patrick has spent at basketball practice the past 6 weeks.

The expression below represents the number of points Patrick scored in his last basketball game.

$$2 \times (4 + 3) + 3 \times (1 + 2) + 2$$

B. How many points did Patrick score in his last game? 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.

During another game, Patrick scored points by making 2-point shots and by making 3-point shots. The two expressions below represent the number of points he scored from making 2-point shots and the number of points he scored from making 3-point shots.

2-point shots: $2 \times (4 + 6)$

3-point shots: $3 \times (2 + 3)$

Patrick claims he scored twice as many points from making 2-point shots as from making 3-point shots since $4 + 6$ is twice as large as $2 + 3$.

C. Explain why Patrick's claim is **not** correct even though $4 + 6$ is twice as large as $2 + 3$.

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

STOP
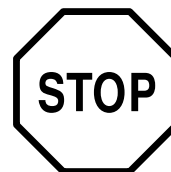
Item-Specific Scoring Guideline

#17 Item Information

Alignment	B-O.1.1.1 B-O.1.1.2	Depth of Knowledge	2	Mean Score	1.43

Assessment Anchor this item will be reported under:

M05.B-O.1—Write and interpret numerical expressions.

Specific Anchor Descriptor addressed by this item:

M05.B-O.1.1—Analyze and complete calculations by applying the order of operations.

Scoring Guide

Score	In this item, the student . . .
4	Demonstrates a thorough understanding of how to write and interpret numerical expressions by correctly solving problems and clearly explaining procedures.
3	Demonstrates a general understanding of how to write and interpret numerical expressions by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
2	Demonstrates a partial understanding of how to write and interpret numerical expressions by correctly performing a significant portion of the required task.
1	Demonstrates minimal understanding of how to write and interpret numerical expressions.
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.
1	Student earns 0.5–1.5 points. OR Student demonstrates minimal understanding of how to write and interpret numerical expressions.
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):

1 point for correct answer

OR $\frac{1}{2}$ point for correct expression as "one side" of equation (e.g., 6 × 5 = 30)

Note: No credit for "30" only

What?	Why?
6 × (2 + 3) **OR** 6 × 2 + 6 × 3 **OR** 6 × 5 **OR equivalent**	

Part B (2 points):

1 point for correct answer

1 point for correct and complete support

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

What?	Why?
25 (points)	**Sample Work:** 2 × (4 + 3) + 3 × (1 + 2) + 2 2 × 7 + 3 × 3 + 2 14 + 9 + 2 = 25 **OR** **Sample Explanation:** First, I simplified the values inside the parentheses (4 + 3 = 7 and 1 + 2 = 3). Next, I multiplied the two pairs of numbers (2 × 7 = 14 and 3 × 3 = 9). Then, I added the remaining numbers together (14 + 9 + 2 = 25). **OR equivalent**

Part C (1 point):

1 point for correct and complete explanation

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

What?	Why?
	Sample Explanation: Two-point shots equal 20 because (4 + 6) is multiplied by 2. Three-point shots equal 15 because (2 + 3) is multiplied by 3. 20 is not twice as large as 15. **OR equivalent**

STUDENT RESPONSE

Response Score: 4 points

PARTS A and B

Question 17
Page 1 of 2

Item ID | ?

Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

A. Write a numerical expression with at least one operation symbol to represent the total amount of time Patrick has spent at basketball practice the past 6 weeks.

EQ

(2+3)x6

The expression below represents the number of points Patrick scored in his last basketball game.

$$2 × (4 + 3) + 3 × (1 + 2) + 2$$

B. How many points did Patrick score in his last game? Show or explain all your work.

EQ

PEMDAS
2x(4+3)+3x(1+2)+2
2x7+3x(1+2)+2
(2x7)+3x3+2
14+(3x3)+2
(14+9)+2
(23+2)
25
Patrick scored 25 points his last game.

120 / 1000

Review/End Test | Pause | Flag | Options | Next

Part A. The student provided a correct expression [*(2+3)×6*], with the sum *(2 + 3)* representing the total amount of time spent at basketball practice each week, which is then multiplied by the number of weeks (*6*). [1 point]

Part B. The student provided the correct answer (*Patrick scored 25 points his last game.*) with correct and complete support. The work provided shows that the student used PEMDAS to determine the order of operations in solving: first parentheses [*2×(4+3)+3×(1+2)+2 . . . (2×7)+3×3+2*], then multiplication [*(2×7)+3×3+2 . . . (14+9)+2*], and finally addition [*(14+9)+2 . . . 25*]. [2 points]

PART C

Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

During another game, Patrick scored points by making 2-point shots and by making 3-point shots. The two expressions below represent the number of points he scored from making 2-point shots and the number of points he scored from making 3-point shots.

2-point shots: 2 × (4 + 6)
3-point shots: 3 × (2 + 3)

Patrick claims he scored twice as many points from making 2-point shots as from making 3-point shots since 4 + 6 is twice as large as 2 + 3.

C. Explain why Patrick's claim is **not** correct even though 4 + 6 is twice as large as 2 + 3.

EQ

Patrick's claim is not correct because you would still have to multiply 2 to the (4+6) and 3 to the (2+3). Which makes his 2-point shots: 20, and his 3-point shots: 15. 20 is not twice as many as 15.

200 / 1000

Review/End Test | Pause | Flag | Options | Back | Next

Part C. The student provided a correct and complete explanation as to why Patrick's claim is not correct. It references the multipliers [*you would still have to multiply 2 to the (4+6) and 3 to the (2+3)*], evaluates the expressions to get 20 and 15 (*Which makes his 2-point shots: 20, and his 3-point shots: 15*), and then makes a correct comparison between the two point totals (*20 is not twice as many as 15*). [1 point]

STUDENT RESPONSE

Response Score: 3 points

17. Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

> **A.** Write a numerical expression with at least one operation symbol to represent the total amount of time Patrick has spent at basketball practice the past 6 weeks.
>
> $$6\,(2 \times 3) = 30 \text{ hours}$$

Part A. The student provided an incorrect answer in the form of an equation [*6(2 × 3) = 30 hours*] rather than an expression. The left side of the equation provided is incorrect: the student used a multiplication sign inside of the parentheses rather than an addition sign. The right side of the equation (*30 hours*) shows the correct total amount of time but does not match the expression on the left side, which has a value of 36. [0 points]

> The expression below represents the number of points Patrick scored in his last basketball game.
>
> $$2 \times (4 \overset{7}{+} 3) + 3 \times (1 \overset{3}{+} 2) + 2 = 25$$
>
> **B.** How many points did Patrick score in his last game? Show or explain all your work. Patrick scored 25 points at his last game.
>
> What I did was when I saw the parenthezes I knew they came first. 4+3=7 and 1+2=3. So then I made my own equation to make it easier for me to understand.
>
> The equation was 2×7 + 3×3 + 2. Then I did 2 × 7 and 3 × 3 because in order of operation ~~multiplication and division go first~~ but in this case it's ~~sonly~~ only multiplication. So 2×7=14 and 3×3=9. So now you add The numbers you add are 14+9=23. Then finally you add 2 which gets you to 25 so patrick scored a total of 25 points at his last game.
>
> Equation
> 2×7+3×3+2= 14+9= 23+2 =25 points

Part B. The student provided a correct answer (*25 points*) with correct and complete support. The student explained how the order of operations was used to calculate the given expression's total (*I saw the parethenzes I knew they came first. 4 + 3 = 7 and 1 + 2 = 3. So then I made my own equation to make it easier for me . . . 2 × 7 + 3 × 3 + 2. Then I did 2 × 7 and 3 × 3 because in order of operation multiplication and division go first but in this case it's only multiplication. So 2 × 7 = 14 and 3 × 3 = 9. So now you add . . . 14 + 9 = 23. Then finally you add 2 which gets you to 25*). [2 points]

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

During another game, Patrick scored points by making 2-point shots and by making 3-point shots. The two expressions below represent the number of points he scored from making 2-point shots and the number of points he scored from making 3-point shots.

$$\text{2-point shots: } 2 \times (4 + 6) = 20$$

$$\text{3-point shots: } 3 \times (2 + 3) = \frac{15}{5}$$

Patrick claims he scored twice as many points from making 2-point shots as from making 3-point shots since 4 + 6 is twice as large as 2 + 3.

C. Explain why Patrick's claim is **not** correct even though 4 + 6 is twice as large as 2 + 3.

> Patrick is not correct because even though 4+6 is greater than 2+3, your not looking at the actual answer. With the 2 point shots he got more points than 3 point shots but it isn't twice as many. 2 point shots equal 20 points and 3 point shots equal 15 points. When you subtract 20-15 it equals 5. That is not twice as many. Twice as many would be if you did 20-10 because 10+10=20. So Patrick isn't correct because the total points in general don't add up to be twice as many

Part C. The student provided a correct and complete explanation as to why Patrick's claim is not correct. It references the multipliers (*2 point shots* and *3 point shots*), evaluates the expressions to get 20 and 15 (*2 point shots equal 20 points and 3 point shots equal 15 points*), and then makes a correct comparison between the two point totals (*With the 2 point shots he got more points than 3 point shots but it isn't twice as many. . . . When you subtract 20 – 15 it equals 5. That is not twice as many*). [1 point]

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

STOP
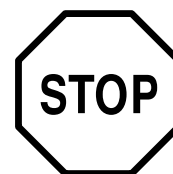
STUDENT RESPONSE

Response Score: 2 points

PARTS A and B

Line Guide | Item ID | ?

Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

A. Write a numerical expression with at least one operation symbol to represent the total amount of time Patrick has spent at basketball practice the past 6 weeks.

EQ

2x3+6=12

The expression below represents the number of points Patrick scored in his last basketball game.

$$2 \times (4 + 3) + 3 \times (1 + 2) + 2$$

B. How many points did Patrick score in his last game? Show or explain all your work.

EQ

2 x (4 + 3) + 3 x (1 + 2) + 2
2 x 7 + 3 x (1 + 2) + 2
2 x 7 + 3 x 3 + 2
14 + 3 x 3 + 2
14 + 9 + 2
23 + 2 = 25

110 / 1000

Review/End Test | Pause | Flag | Options | Next

Part A. The student provided an incorrect answer in the form of an equation (*2×3+6=12*) rather than an expression. The left side of the equation provided is incorrect: the student switched the multiplication sign and the addition sign and did not include grouping symbols around the 2 and 3. [0 points]

Part B. The student provided a correct answer (*25*) with correct and complete support. The work provided shows the student used the order of operations correctly to calculate the given expression's total: first parentheses [$2 \times (4 + 3) + 3 \times (1 + 2) + 2 \rightarrow 2 \times 7 + 3 \times (1 + 2) + 2$], then multiplication ($2 \times 7 + 3 \times 3 + 2 \rightarrow 14 + 3 \times 3 + 2$), and finally addition ($14 + 9 + 2 \rightarrow 23 + 2 = 25$). [2 points]

PART C

Question 17
Page 2 of 2

Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

During another game, Patrick scored points by making 2-point shots and by making 3-point shots. The two expressions below represent the number of points he scored from making 2-point shots and the number of points he scored from making 3-point shots.

2-point shots: 2 × (4 + 6)
3-point shots: 3 × (2 + 3)

Patrick claims he scored twice as many points from making 2-point shots as from making 3-point shots since 4 + 6 is twice as large as 2 + 3.

C. Explain why Patrick's claim is **not** correct even though 4 + 6 is twice as large as 2 + 3.

EQ

he did not solve 4 + 6.

23 / 1000

Review/End Test   Pause   Flag   Options   Back   Next

Part C. The student provided an incorrect explanation (*he did not solve 4 + 6*) that did not include referencing the multipliers, evaluating the expressions to get 20 and 15, or making a comparison between the two point totals. [0 points]

STUDENT RESPONSE

Response Score: 1 point

17. Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

A. Write a numerical expression with at least one operation symbol to represent the total amount of time Patrick has spent at basketball practice the past 6 weeks.

$$2 \times 3 = \underline{\quad} \qquad \underline{\quad} \times 6 = \underline{\quad}$$

> Part A. The student provided an incorrect answer ($2 \times 3 =$ _____ _____ $\times 6 =$ _____). [0 points]

The expression below represents the number of points Patrick scored in his last basketball game.

$$2 \times (4 + 3) + 3 \times (1 + 2) + 2$$

B. How many points did Patrick score in his last game? Show or explain all your work.

$2 \times (4+3) + 3 \times (1+2) + 2$

$2 \times 7 \quad + 3 \times (1+2) + 2$

$2 \times 7 \quad + 3 \times 3 + 2$

$14 \quad + 3 \times 3 + 2$

$17 \quad \times 3 + 2$

$51 + 2 = 53$

$\overset{2}{1}7 \\ \times\ 3 \\ \overline{51}$

53 points

> Part B. The student provided an incorrect answer (*53 points*) with correct but incomplete support. The work shown included some calculations completed correctly using the order of operations, with parentheses first [*2 × (4 + 3) + 3 × (1 + 2) + 2 . . . 2 × 7 + 3 × 3 + 2*] and the first multiplication step (*2 × 7 + 3 × 3 + 2 → 14 + 3 × 3 + 2*). The student's next step then incorrectly added 14 and 3 rather than multiplying the 3 × 3. [0.5 points]

Go to the next page to finish question 17.

GO ON ⟶

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

During another game, Patrick scored points by making 2-point shots and by making 3-point shots. The two expressions below represent the number of points he scored from making 2-point shots and the number of points he scored from making 3-point shots.

2-point shots: 2 × (4 + 6)   20

3-point shots: 3 × (2 + 3)   15

Patrick claims he scored twice as many points from making 2-point shots as from making 3-point shots since 4 + 6 is twice as large as 2 + 3.

C. Explain why Patrick's claim is **not** correct even though 4 + 6 is twice as large as 2 + 3.

because 15 is only 5 away from 20 and 15 is not twice as small as the number 20.

Part C. The student provided a correct but incomplete explanation as to why Patrick's claim is not correct. The student evaluated the expressions to get 20 and 15 in the given information section (2-point shots: 2 × (4 + 6) *[=] 20* and 3-point shots: 3 × (2 + 3) *[=] 15*) and then made a correct comparison between the two point totals (*because 15 is only 5 away from 20 and 15 is not twice as small as the number 20*); however, the student did not reference the multipliers 2 and 3. [0.5 points]

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

STOP
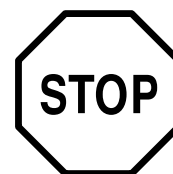
STUDENT RESPONSE

Response Score: 0 points

PARTS A and B

Question 17
Page 1 of 2

Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

A. Write a numerical expression with at least one operation symbol to represent the total amount of time Patrick has spent at basketball practice the past 6 weeks.

EQ

$2 \times 3 \div 6 = 36$

The expression below represents the number of points Patrick scored in his last basketball game.

$$2 \times (4 + 3) + 3 \times (1 + 2) + 2$$

B. How many points did Patrick score in his last game? Show or explain all your work.

EQ

$2 \times (4 + 3) + 3 \times (1 + 2) + 2$
$4 + 3 \times 1 + 2 \times 2 + 3 = 14$

32 / 1000

Review/End Test   Pause   Flag   Options   Next

Part A. The student provided an incorrect answer in the form of an equation ($2 \times 3 \div 6 = 36$). The left side of the equation provided is incorrect: the student used a multiplication sign between 2 and 3 rather than an addition sign, did not put grouping symbols around the 2 and 3, and then divided the total by 6 rather than multiplying the total by 6. The right side of the equation (*36*) does not match the expression on the left side, which has a value of 1. [0 points]

Part B. The student provided an incorrect answer (*14*) with incorrect support. The student rewrote the given expression and then incorrectly reordered the expression ($4 + 3 \times 1 + 2 \times 2 + 3$), resulting in an incorrect answer of 14. [0 points]

PART C

Every week, Patrick attends basketball practice for 2 hours on Tuesday and 3 hours on Thursday. Patrick has been attending practice for 6 weeks.

During another game, Patrick scored points by making 2-point shots and by making 3-point shots. The two expressions below represent the number of points he scored from making 2-point shots and the number of points he scored from making 3-point shots.

2-point shots: $2 \times (4 + 6)$

3-point shots: $3 \times (2 + 3)$

Patrick claims he scored twice as many points from making 2-point shots as from making 3-point shots since 4 + 6 is twice as large as 2 + 3.

C. Explain why Patrick's claim is **not** correct even though 4 + 6 is twice as large as 2 + 3.

Patrick's is not correct because 2 x 4 + 6 = 14 and 3 x 4 + 6 = 18
add that that together and you get 18.

106 / 1000

Review/End Test | Pause | Flag | Options | Back | Next

Part C. The student provided an incorrect explanation (*Patrick's is not correct because 2 × 4 + 6 = 14 and 3 × 4 + 6 = 18 add that that together and you get 18*). The student has incorrectly calculated the total points for 2-point shots by not distributing the 2 to both the 4 and the 6. The expression for the 3-point shots is also incorrectly rewritten (using 4 + 6 rather than 2 + 3) and incorrectly calculated (not distributing the 3 to both numbers). The student did not make any references to the multipliers and did not make a comparison between the two point totals. [0 points]

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-T.2.1.3	A	1	59%	8%	27%	6%
2	A-T.1.1.3	D	1	15%	9%	17%	59%
3	A-T.1.1.4 A-T.1.1.3	B	1	16%	48%	32%	4%
4	A-T.2.1	D	2	13%	11%	8%	68%
5	A-T.2.1.2 A-T.2.1.1	A	1	62%	10%	8%	20%
6	A-F.1.1.1	B	2	12%	51%	23%	14%
7	A-F.2.1	D	2	17%	20%	26%	37%
8	A-F.2.1.1	C	1	29%	18%	43%	10%
9	A-F.2.1.3	B	2	15%	48%	14%	23%
10	A-F.2.1.4	D	2	27%	15%	10%	48%
11	C-G.1	C	2	20%	18%	48%	14%
12	C-G.1.1.1	C	1	17%	13%	53%	17%
13	C-G.1.1.2	A	1	63%	19%	12%	6%
14	C-G.2.1.1	D	1	10%	10%	15%	65%
15	D-M.1.1.1	D	2	15%	16%	31%	38%
16	D-M.3.1.2	B	2	31%	40%	18%	11%

Open-Ended

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	B-O.1.1.1 B-O.1.1.2	4	2	1.43