

Grade 5
Mathematics MCA-III
Item Sampler Teacher Guide

Grade 5 Mathematics MCA Item Sampler Parent/Teacher Guide



The purpose of the Item Samplers is to familiarize students with the online MCA test format. The Item Samplers contain multiple choice items (MC) and technology enhanced items (TE).

This guide includes:

- A snapshot of each item
- Benchmark and examples from the Minnesota Academic Standards for Mathematics
- Item specifications (Content limits contained in the item specifications are intended for use by item developers. They should not be construed as instructional limits.)
- Vocabulary
- Depth of Knowledge (DOK) - see more detail below
- Calculator designation (CL = calculator allowed; NC = no calculator)
- Correct answer
- Table of rationales (explanations for why a student might choose each incorrect answer option, e.g., mixed up addition and subtraction, used incorrect place value, etc.)
- Notes on grade expectations for some items

Cognitive Complexity/Depth of Knowledge (DOK)

Cognitive complexity refers to the cognitive demand associated with an item. The level of cognitive demand focuses on the type and level of thinking and reasoning required of the student on a particular item. Levels of cognitive complexity for MCA-III are based on Norman L. Webb's Depth of Knowledge¹ levels.

Level 1 (recall) items require the recall of information such as a fact, definition, term or simple procedure, as well as performing a simple algorithm or applying a formula. A well-defined and straight algorithmic procedure is considered to be at

¹ Webb, N. L. *Alignment of science and mathematics standards and assessments in four states* (Research Monograph No. 18). Madison: University of Wisconsin – Madison, National Institute for Science Education, 1999.

this level. A Level 1 item specifies the operation or method of solution and the student is required to carry it out.

Level 2 (skill/concept) items call for the engagement of some mental processing beyond a habitual response, with students required to make some decisions as to how to approach a problem or activity. Interpreting information from a simple graph and requiring reading information from the graph is a Level 2. An item that requires students to choose the operation or method of solution and then solve the problem is a Level 2. Level 2 items are often similar to examples used in textbooks.

Level 3 (strategic thinking) items require students to reason, plan or use evidence to solve the problem. In most instances, requiring students to explain their thinking is a Level 3. A Level 3 item may be solved using routine skills but the student is not cued or prompted as to which skills to use.

Level 4 (extended thinking) items require complex reasoning, planning, developing and thinking, most likely over an extended period of time. Level 4 items are best assessed in the classroom, where the constraints of standardized testing are not a factor.

Technology Enhanced Items

There are several types of technology enhanced items. To respond to these questions, students may be required to type a number into a blank, select their answer choice(s), or select and drag. When typing an answer into a blank, the test engine allows students to type in numbers, the division bar ($/$), decimal points, and negative signs (in certain grades only). The test engine does not allow students to type in other characters, symbols, or letters of the alphabet.

Grade 5 Mathematics MCA Item Sampler
Answer Key

Item #	Correct Answer	Item Type	Benchmark	Calculator
1	A	MC	5.1.1.2	CL
2	N/A	TE	5.1.1.4	CL
3	A	MC	5.1.2.4	CL
4	C	MC	5.2.1.1	CL
5	D	MC	5.2.1.2	CL
6	A	MC	5.2.3.1	CL
7	A	MC	5.3.1.2	CL
8	B	MC	5.3.2.1	CL
9	C	MC	5.3.2.4	CL
10	N/A	TE	5.3.1.1	NC
11	D	MC	5.1.1.1	NC
12	B	MC	5.1.2.1	NC
13	B	MC	5.1.2.2	NC
14	N/A	TE	5.1.2.3	NC
15	B	MC	5.1.2.5	NC
16	B	MC	5.1.3.1	NC
17	B	MC	5.1.3.2	NC
18	D	MC	5.3.1.1	NC
19	N/A	TE	5.3.1.1	NC
20	D	MC	5.1.1.4	CL
21	B	MC	5.1.2.3	CL
22	C	MC	5.1.3.4	CL
23	N/A	TE	5.2.1.1	CL
24	C	MC	5.2.2.1	CL
25	B	MC	5.2.3.3	CL
26	N/A	TE	5.3.2.1	CL
27	C	MC	5.3.2.2	CL
28	D	MC	5.4.1.1	CL
29	B	MC	5.4.1.2	CL
30	N/A	TE	5.1.2.1	CL
31	N/A	TE	5.2.3.2	CL
32	N/A	TE	5.3.1.1	CL

Question Number 1

Jan has 500 pieces of paper. She prints as many copies as possible of a 16-page report. How many pieces of paper are left?

- A. 4
- B. 9
- C. 25
- D. 31

Benchmark: 5.1.1.2

Consider the context in which a problem is situated to select the most useful form of the quotient for the solution and use the context to interpret the quotient appropriately.

For example: If 77 amusement ride tickets are to be distributed equally among 4 children, each child will receive 19 tickets, and there will be one left over. If \$77 is to be distributed equally among 4 children, each will receive \$19.25, with nothing left over.

Item Specifications

- Dividends may not be more than 4 digits
- Divisors may not be more than 2 digits
- Fractional remainders are not required to be given in lowest terms
- Items may require interpretation of when decimals should be rounded (e.g., with money)
- Vocabulary allowed in items: remainder, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: A

A	Correct. $500/16 = 31$ remainder 4.
B	Divided $500/16 = 31.25$ and used 25, then subtracted 16 to get 9 papers left.
C	Divided $500/16 = 31.25$ and used 25 for number of papers left (remainder).
D	Found the number of reports (quotient) instead of the number of papers left (remainder); $500/16 = 31$ R 4.

Question Number 2

A theater sold 1,500 tickets. There were 852 adult tickets and the rest were child tickets. Each adult ticket was \$7.00 and each child ticket was \$3.50. How much money was made in ticket sales?

Enter your answer in the box.

\$

Benchmark: 5.1.1.4

Solve real-world and mathematical problems requiring addition, subtraction, multiplication and division of multi-digit whole numbers. Use various strategies, including the inverse relationships between operations, the use of technology, and the context of the problem to assess the reasonableness of results.

For example: The calculation $117 \div 9 = 13$ can be checked by multiplying 9 and 13.

Item Specifications

- Solutions are less than 1,000,000
- Multiplication is limited to no more than three-digit numbers by no more than three-digit numbers
- Division is limited to no more than four-digit numbers by no more than two-digit numbers
- Fractional remainders are not required to be given in lowest terms
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer:

This is a technology-enhanced item. The correct answer is shown. A student must type the correct answer in the box to receive 1 point. The question can be answered as a whole number as shown or as 8232.00.

A theater sold 1,500 tickets. There were 852 adult tickets and the rest were child tickets. Each adult ticket was \$7.00 and each child ticket was \$3.50. How much money was made in ticket sales?

Enter your answer in the box.

\$

Note: The allowable characters that can be entered in the answer box are digits 0-9, fraction bar (/) and decimal point (.). Students cannot enter a comma in numbers with more than 3 digits. Familiarity with calculators will help the students with this concept.

Notes on grade expectations: Student should subtract to find number of child tickets sold, then multiply to find total amount made in ticket sales.

$$1,500 - 852 = 648 \text{ child tickets}$$

$$852 \times \$7 + 648 \times \$3.5 = 8,232.$$

Question Number 3

Lydia used $\frac{1}{25}$ of her notebook paper. What decimal amount did she use?

- A. 0.04
- B. 0.4
- C. 1.25
- D. 2.5

Benchmark: 5.1.2.4

Recognize and generate equivalent decimals, fractions, mixed numbers and improper fractions in various contexts.

For example: When comparing 1.5 and $\frac{19}{12}$, note that $1.5 = 1\frac{1}{2} = 1\frac{6}{12} = \frac{18}{12}$, so $1.5 < \frac{19}{12}$.

Item Specifications

- Denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 25, 50 and 100
- Mixed numbers are less than 10
- Vocabulary allowed in items: place value, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: A

A	Correct. $\frac{1}{25} = 0.04$
B	Mixed up decimal place. 0.4.
C	Put numerals from fraction into decimal format; 1.25.
D	Inverted fraction and mixed up decimal place; $\frac{25}{10} = 2.5$.

Notes on grade expectations: Student could find equivalent of $\frac{1}{25}$ or $\frac{4}{100}$, then write as a decimal. Or student could divide 1 by 25.

Question Number 4

At a movie store, Erin pays a monthly fee and is charged for each movie she rents. The table shows the monthly cost when Erin rents different numbers of movies.

Monthly Cost

Number of Movies	Total Cost (dollars)
6	33
8	39
10	45

How much is the monthly fee that Erin pays?

- A. \$3
- B. \$6
- C. \$15
- D. \$18

Benchmark: 5.2.1.1

Create and use rules, tables, spreadsheets and graphs to describe patterns of change and solve problems.

For example: An end-of-the-year party for 5th grade costs \$100 to rent the room and \$4.50 for each student. Know how to use a spreadsheet to create an input-output table that records the total cost of the party for any number of students between 90 and 150.

Item Specifications

- In a growing pattern, 3 applications of the rule must be shown, though not necessarily consecutively
- In a table or graph, 3 input-output pairs must be given; pairs are not required to be consecutive
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 3

Calculator: CL

Answer: C

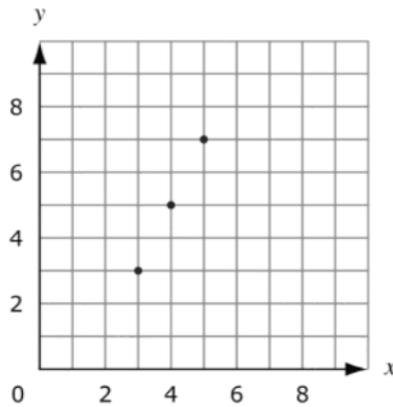
A	Found the charge per movie instead of the monthly fee.
B	Found the change in the output column (the amount charged for every 2 movies).
C	Correct.
D	Found sum of monthly fee and charge per movie.

Notes on grade expectations: This item is DOK 3 because the student has all of the skills that are needed but is not prompted about the components of the solution or told which skills to use. Solving the item requires analysis of the cost structure in the table

and requires more than just finding the next row in the table, total cost for a given number of movies, or the equation. The pattern must be broken down into two components: the fixed part and the variable part (fee per movie). Student can find the difference between terms in the second column of the table and see that for each additional movie, the total cost increases by \$3. To find the monthly fee, use any line from the table. Example: $6 \times 3 + \underline{\quad} = 33$. The monthly fee is \$15.

Question Number 5

Three points are shown on a grid.



Which rule was used to plot the points?

- A. $y = x$
- B. $y = x + 2$
- C. $y = \frac{1}{2} \times x + 3$
- D. $y = 2 \times x - 3$

Benchmark: 5.2.1.2

Use a rule or table to represent ordered pairs of positive integers and graph these ordered pairs on a coordinate system.

Item Specifications

- Scale increments on grids are limited to 1, 2 and 5
- Rules may be expressed using variables
- Vocabulary allowed in items: ordered pair, graph, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: D

A	Used the point (3, 3) to find $y = x$ and disregarded other points.
B	Found change between points as up 2 right 1 (or 2/1, or 2) then used the 2 in the incorrect part of the equation.
C	Found change between points as right 1 up 2 (or 1/2) instead of up 2 right 1 (or 2/1, or 2).
D	Correct. Change between points is up 2 right 1 (or 2/1, or 2).

Notes on grade expectations: Student should choose any two points and find the vertical and horizontal difference between the y -values, then use that to find the rule. Or substitute two points into the answer options to find which equation is true for both points.

Question Number 6

Which value makes the equation $5 \times b + 15 = 30$ true?

- A. $b = 3$
- B. $b = 9$
- C. $b = 10$
- D. $b = 75$

Benchmark: 5.2.3.1

Determine whether an equation or inequality involving a variable is true or false for a given value of the variable.

For example: Determine whether the inequality $1.5 + x < 10$ is true for $x = 2.8$, $x = 8.1$, or $x = 9.2$.

Item Specifications

- Allowable symbols: $<$ and $>$
- Items must not have context
- Vocabulary allowed in items: inequality, and vocabulary given at previous grades

DOK: 2

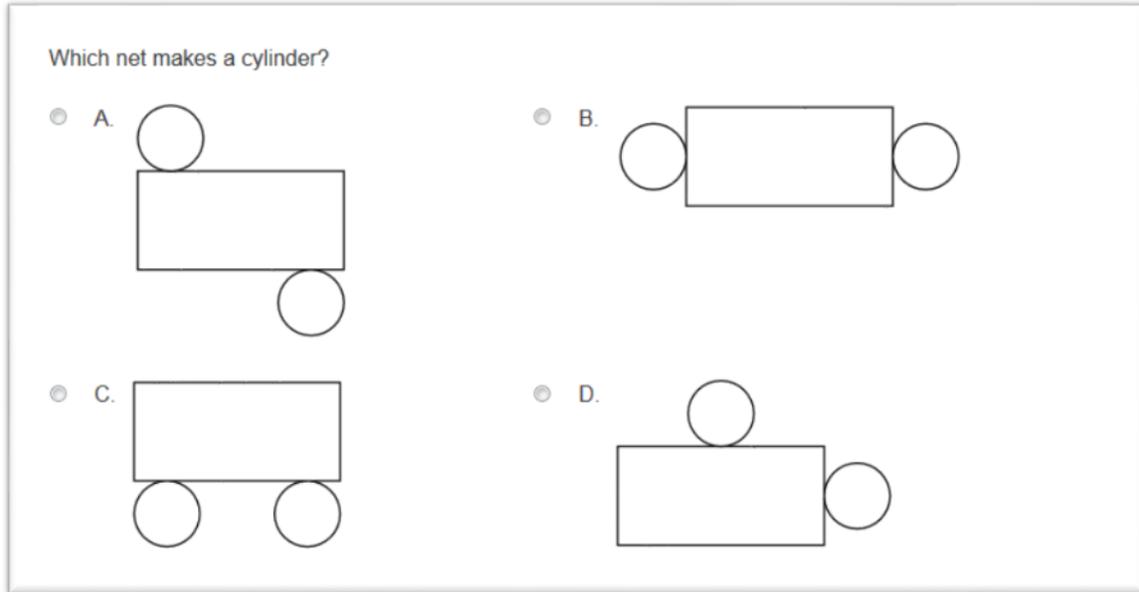
Calculator: CL

Answer: A

A	Correct. $5 \times 3 + 15 = 30$
B	Mixed up subtraction with addition; found the value that makes $5b - 15 = 30$ true.
C	Mixed up multiplication with addition; found the value that makes $5 + b + 15 = 30$ true.
D	Mixed up multiplication with division; found the value that makes $b/5 + 15 = 30$ true.

Notes on grade expectations: Student should substitute the values into the equation to see which value makes the equation true.

Question Number 7



Benchmark: 5.3.1.2

Recognize and draw a net for a three-dimensional figure.

Item Specifications

- Vocabulary allowed in items: net, cylinder, cube, prism, pyramid, edge, face, base, three-dimensional, triangular, rectangular, and vocabulary given at previous grades

DOK: 1

Calculator: CL

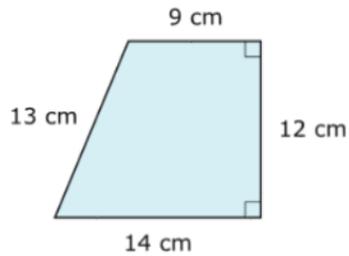
Answer: A

A	Correct.
B	This net will not form a cylinder.
C	This net will not form a cylinder.
D	This net will not form a cylinder.

Notes on grade expectations: Student should recognize two-dimensional shapes from previous grades. In grade 5, students are expected to know how to create three-dimensional figures from two-dimensional shapes. Two circles and a rectangle are used to form a net of a cylinder. Students must understand which placement of these shapes will “fold” into a cylindrical figure.

Question Number 8

A trapezoid is shown.



What is the area of the trapezoid?

- A. 48 cm^2
- B. 138 cm^2
- C. 168 cm^2
- D. 173 cm^2

Benchmark: 5.3.2.1

Develop and use formulas to determine the area of triangles, parallelograms and figures that can be decomposed into triangles.

Item Specifications

- Vocabulary allowed in items: formula, and vocabulary given at previous grades

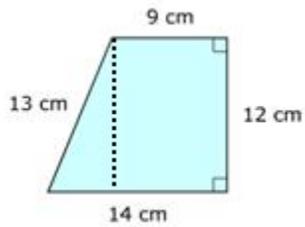
DOK: 2

Calculator: CL

Answer: B

A	Summed all side lengths instead of finding area; $9 + 12 + 14 + 13 = 48$.
B	Correct. $9 \times 12 + \frac{1}{2} \times 12 \times 5 = 138$.
C	Found area of large rectangle without subtracting area of right triangle. $14 \times 12 = 168$.
D	Found area of large rectangle, then made a mistake in finding area of right triangle; $9 \times 12 + 5 \times 13 = 173$.

Notes on grade expectations: Student should break the quadrilateral into a triangle and a rectangle, finding the area of each part, then summing to find the total area. The formulas for the area of a rectangle and the area of a triangle are given on the grade 5 formula sheet. Area of triangle = $\frac{1}{2}(12 \times 5)$ or 30; area of rectangle = 9×12 or 108; 30 and 108 sum to 138.



Question Number 9

A rectangular prism has a height of h cm. The area of its base is B cm². How much does the volume of the prism increase when the height is increased by 1 cm?

- A. 1 cm³
- B. $h + 1$ cm³
- C. B cm³
- D. $B + 1$ cm³

Benchmark: 5.3.2.4

Develop and use the formulas $V = \ell wh$ and $V = Bh$ to determine the volume of rectangular prisms. Justify why base area B and height h are multiplied to find the volume of a rectangular prism by breaking the prism into layers of unit cubes.

Item Specifications

- The definition of B as the area of the base must be given
- Vocabulary allowed in items: volume, base, height, and vocabulary given at previous grades

DOK: 2

Calculator: CL

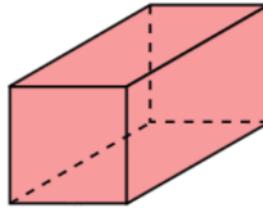
Answer: C

A	Found the increase in height, not the increase in volume.
B	Found the new height instead of the new volume; $h + 1$ is the new height.
C	Correct. New Volume = $B(h + 1)$ or $Bh + B$ which is the original volume $+B$.
D	Added 1 cm ³ for the additional layer (height). Each layer has volume of B , not 1.

Notes on grade expectations: The base has a height of 1. It is 1 layer. If another layer is added, then the area of the base is 2 times as high, or $2B$ or $B + B$, therefore, the volume is increased by B .

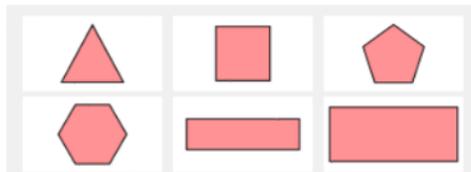
Question Number 10

A square prism is shown.



Show all the faces of the prism that are needed to create a net.

Drag the shapes into the box.



Benchmark: 5.3.1.1

Describe and classify three-dimensional figures including cubes, prisms and pyramids by the number of edges, faces or vertices as well as the types of faces.

Item Specifications

- Prisms and pyramids are limited to triangular, rectangular, pentagonal, hexagonal and octagonal
- Vocabulary allowed in items: cube, prism, pyramid, cone, cylinder, edge, face, base, three-dimensional, triangular, rectangular, and vocabulary given at previous grades

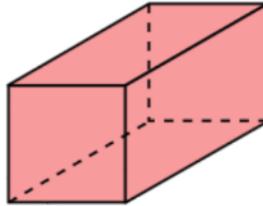
DOK: 2

Calculator: NC

Answer:

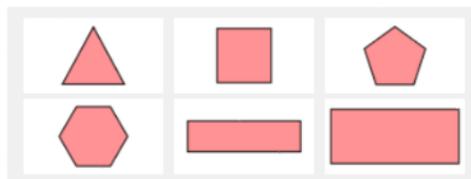
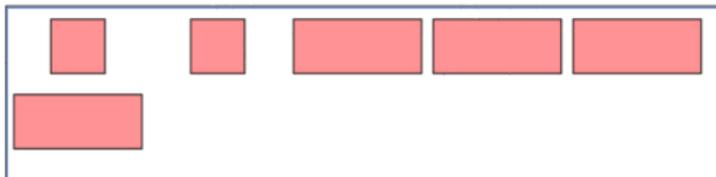
This is a technology-enhanced item. The correct answer is shown. A student must move all the necessary shapes into the box in order to receive 1 point.

A square prism is shown.



Show all the faces of the prism that are needed to create a net.

Drag the shapes into the box.



Question Number 11

Divide.

$$2,564 \div 8$$

A. 32 r4

B. 308

C. $320 \frac{1}{5}$

D. 320.5

Benchmark: 5.1.1.1

Divide multi-digit numbers, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal.

For example: Dividing 153 by 7 can be used to convert the improper fraction $\frac{153}{7}$ to the mixed number $21 \frac{6}{7}$.

Item Specifications

- Dividends may not be more than 4 digits
- Divisors may not be more than 2 digits
- Fractional remainders are not required to be given in lowest terms
- Allowable division notation: \div , fraction bar
- Vocabulary allowed in items: remainder, and vocabulary given at previous grades

DOK: 1

Calculator: NC

Answer: D

A	Missed ones place. $2,564/8 = 320 \text{ R } 4$, not 32 R 4.
B	When dividing, subtracted 2,400 from 2,500 incorrectly to get 0, then completed division of 64 by 8.
C	Wrote remaining decimal incorrectly.
D	Correct.

Question Number 12

Which number has a 5 in the ten-thousandths place?

- A. 0.20815
- B. 0.30256
- C. 0.40571
- D. 0.50098

Benchmark: 5.1.2.1

Read and write decimals using place value to describe decimals in terms of groups from millionths to millions.

For example: Possible names for the number 0.0037 are:

37 ten thousandths

3 thousandths + 7 ten thousandths;

a possible name for the number 1.5 is 15 tenths.

Item Specifications

- Vocabulary allowed in items: place value, and vocabulary given at previous grades

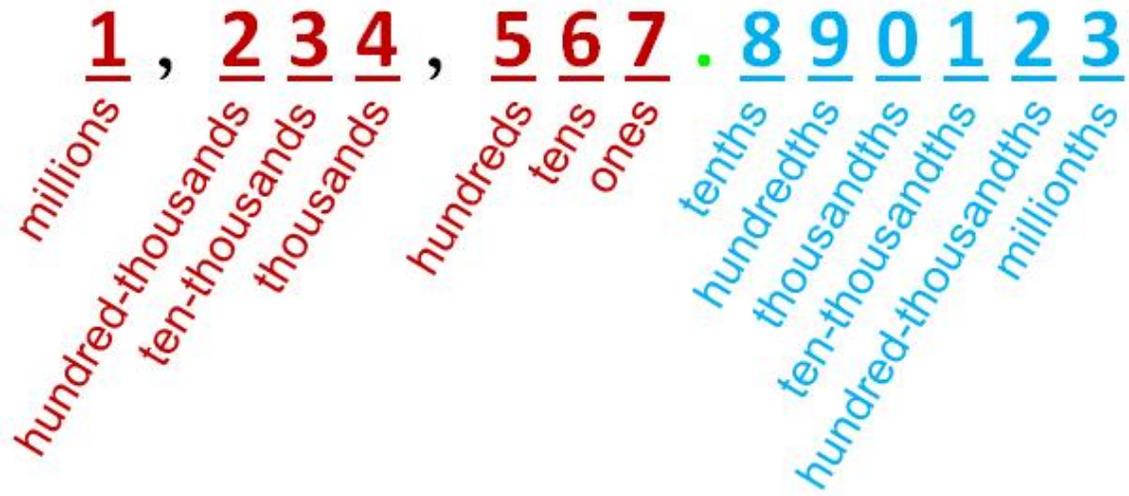
DOK: 1

Calculator: NC

Answer: B

A	The 5 is in the hundred thousandths place, not the ten-thousandths place.
B	Correct.
C	The 5 is in the thousandths place, not the ten-thousandths place.
D	The 5 is in the tenths place, not the ten-thousandths place.

Notes on grade expectations: Student should know the following place values.



Question Number 13

Johan's race time was 45.03 seconds. Kyle's race time was 0.1 second less than Johan's time. What was Kyle's race time?

- A. 44.03 seconds
- B. 44.93 seconds
- C. 45.13 seconds
- D. 45.14 seconds

Benchmark: 5.1.2.2

Find 0.1 more than a number and 0.1 less than a number. Find 0.01 more than a number and 0.01 less than a number. Find 0.001 more than a number and 0.001 less than a number.

Item Specifications

- Vocabulary allowed in items: place value, and vocabulary given at previous grades

DOK: 2

Calculator: NC

Answer: B

A	Subtracted 1.0 instead of 0.1.
B	Correct. $45.03 - 0.1 = 44.93$.
C	Added 0.1 to 45.03 instead of subtracting.
D	Added 0.11 instead of subtracting 0.1

Question Number 14

Put the numbers in order from least to greatest.
Drag each number into the inequality.

< < < <

$\frac{5}{8}$	0.85	$\frac{5}{10}$
0.05	$\frac{1}{5}$	

Benchmark: 5.1.2.3

Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.

For example: Which is larger 1.25 or $\frac{6}{5}$?

Another example: In order to work properly, a part must fit through a 0.24 inch wide space. If a part is $\frac{1}{4}$ inch wide, will it fit?

Item Specifications

- Denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 15, 16 and 20
- Mixed numbers are less than 10
- Vocabulary allowed in items: place value, and vocabulary given at previous grades

DOK: 1

Calculator: NC

Answer:

This is a technology-enhanced item. The correct answer is shown. A student must drag all five numbers into the correct boxes in order to receive 1 point.

Put the numbers in order from least to greatest.
Drag each number into the inequality.

< < < <

0.05 < $\frac{1}{5}$ < $\frac{5}{10}$ < $\frac{5}{8}$ < 0.85

|

Notes on grade expectations: Students know from previous years that the inequality symbol “points” to the number of lesser value. In this item, the student is directed to put the numbers in order from least to greatest. Student will likely convert fractions to decimals to simplify comparisons.

$$\frac{5}{8} = 0.625$$

$$\frac{5}{10} = 0.50$$

$$\frac{1}{5} = 0.20$$

Question Number 15

What is 0.45831 rounded to the nearest thousandth?

- A. 0.45
- B. 0.458
- C. 0.459
- D. 0.4583

Benchmark: 5.1.2.5

Round numbers to the nearest 0.1, 0.01 and 0.001.

For example: Fifth grade students used a calculator to find the mean of the monthly allowance in their class. The calculator display shows 25.80645161. Round this number to the nearest cent.

Item Specifications

- Numbers can be given up to millionths
- Vocabulary allowed in items: place value, and vocabulary given at previous grades

DOK: 1

Calculator: NC

Answer: B

A	Truncated at the hundredths place instead of rounding to the nearest thousandth.
B	Correct. Rounded to 0.458 because number in ten thousandths place is less than 5.
C	Rounded up to 0.459 instead of rounding down to 0.458.
D	Rounded to the nearest ten thousandth instead of the nearest thousandth.

Question Number 16

Add.

$$45.908 + 3.26$$

A. 46.234

B. 49.168

C. 49.24

D. 78.508

Benchmark: 5.1.3.1

Add and subtract decimals and fractions, using efficient and generalizable procedures, including standard algorithms.

Item Specifications

- Addends, minuend and subtrahend denominators are limited to 2, 3, 4, 5, 6, 8, 10 and 12
- Mixed numbers are less than 10
- Items do not require conversion between fractions and decimals
- Items must not have context
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 1

Calculator: NC

Answer: B

A	Lined up addition incorrectly or added 0.326 instead of 3.26.
B	Correct.
C	Dropped 0 from first number then added 45.98 to 3.26.
D	Lined up addition incorrectly or added 32.6 instead of 3.26.

Notes on grade expectations: The most common errors in multi-digit addition/subtraction involve place value. Students must correctly align the numbers by place value before adding, and then remember to regroup as necessary.

Question Number 17

A fraction model is shown.

What is represented by the model?

A. $\frac{2}{1} - \frac{3}{5}$
 B. $\frac{2}{3} - \frac{3}{8}$
 C. $\frac{2}{3} - \frac{1}{5}$
 D. $\frac{3}{8} - \frac{7}{24}$

Benchmark: 5.1.3.2

Model addition and subtraction of fractions and decimals using a variety of representations.

For example: Represent $\frac{2}{3} + \frac{1}{4}$ and $\frac{2}{3} + \frac{1}{4}$ by drawing a rectangle divided into 4 columns and 3 rows and shading the appropriate parts or by using fraction circles or bars.

Item Specifications

- Addends, minuend and subtrahend denominators are limited to 2, 3, 4, 5, 6, 8, 10 and 12
- Mixed numbers are less than 10
- Items do not require conversion between fractions and decimals
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 1

Calculator: NC

Answer: B

A	Used shaded/unshaded to create fractions instead of shaded/total.
B	Correct. $\frac{2}{3} - \frac{3}{8} = \frac{7}{24}$.
C	Incorrectly interpreted subtrahend; mistook $\frac{3}{8}$ for $\frac{1}{5}$.
D	Used middle strip minus bottom strip to create fractions.

Notes on grade expectations: Students practice modeling fractions in many different ways in previous grades. This item uses fraction strips to show $\frac{2}{3} - \frac{3}{8} = \frac{7}{24}$. For each strip, find the ratio of shaded parts to total parts.

Question Number 18

How many edges does a hexagonal prism have?

- A. 6
- B. 8
- C. 12
- D. 18

Benchmark: 5.3.1.1

Describe and classify three-dimensional figures including cubes, prisms and pyramids by the number of edges, faces or vertices as well as the types of faces.

Item Specifications

- Prisms and pyramids are limited to triangular, rectangular, pentagonal, hexagonal and octagonal
- Vocabulary allowed in items: cube, prism, pyramid, cone, cylinder, edge, face, base, three-dimensional, triangular, rectangular, and vocabulary given at previous grades

DOK: 1

Calculator: NC

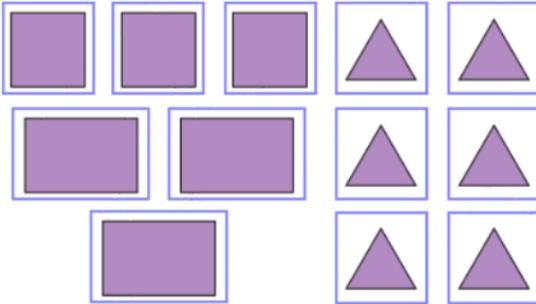
Answer: D

A	Used a hexagon (6 edges) instead of a hexagonal prism (18).
B	May have counted 6 for the hexagon plus 2 for the bases.
C	Counted only 2 sets of 6 edges or mixed up hexagonal prism with hexagonal pyramid (12 edges).
D	Correct. Each hexagonal base has 6 edges and the body of the prism has 6 edges for $6 \times 3 = 18$.

Question Number 19

Which shapes are needed to make a rectangular pyramid?

Select the shapes you want to choose.



Benchmark: 5.3.1.1

Describe and classify three-dimensional figures including cubes, prisms and pyramids by the number of edges, faces or vertices as well as the types of faces.

Item Specifications

- Prisms and pyramids are limited to triangular, rectangular, pentagonal, hexagonal and octagonal
- Vocabulary allowed in items: cube, prism, pyramid, cone, cylinder, edge, face, base, three-dimensional, triangular, rectangular, and vocabulary given at previous grades

DOK: 1

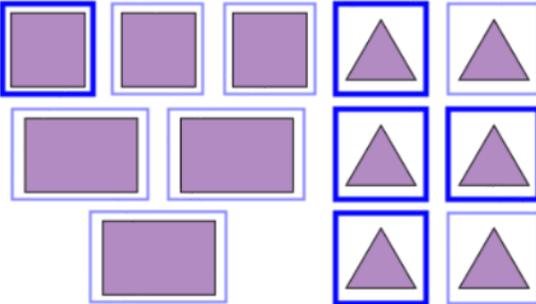
Calculator: NC

Answer:

This is a technology-enhanced item. The correct answer is shown. A student must select the correct five shapes in order to receive 1 point.

Which shapes are needed to make a rectangular pyramid?

Select the shapes you want to choose.



Question Number 20

A bookcase has 4 shelves. The bottom shelf has 10 books. Each of the other shelves has 5 more books than the shelf below it. How many books are in the bookcase?

- A. 25
- B. 40
- C. 55
- D. 70

Benchmark: 5.1.1.4

Solve real-world and mathematical problems requiring addition, subtraction, multiplication and division of multi-digit whole numbers. Use various strategies, including the inverse relationships between operations, the use of technology, and the context of the problem to assess the reasonableness of results.

For example: The calculation $117 \div 9 = 13$ can be checked by multiplying 9 and 13.

Item Specifications

- Solutions are less than 1,000,000
- Multiplication is limited to no more than three-digit numbers by no more than three-digit numbers
- Division is limited to no more than four-digit numbers by no more than two-digit numbers
- Fractional remainders are not required to be given in lowest terms
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 1

Calculator: CL

Answer: D

A	Used 5 as the book count for the other 3 shelves; $10 + 5 + 5 + 5 = 25$.
B	Used 10 as the book count for all 4 shelves; $10 + 10 + 10 + 10 = 40$.
C	Increased book count by 5 starting with the third shelf instead of the second shelf; $10 + 10 + 15 + 20 = 55$.
D	Correct. $10 + 15 + 20 + 25 = 70$.

Question Number 21

Five points are shown on a number line.

Between which 2 points is $\frac{7}{16}$ located?

A. *J* and *K*

B. *K* and *L*

C. *L* and *M*

D. *M* and *N*

Benchmark: 5.1.2.3

Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.

For example: Which is larger 1.25 or $\frac{6}{5}$?

Another example: In order to work properly, a part must fit through a 0.24 inch wide space. If a part is $\frac{1}{4}$ inch wide, will it fit?

Item Specifications

- Denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 15, 16 and 20
- Mixed numbers are less than 10
- Vocabulary allowed in items: place value, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: B

A	$\frac{7}{16} = 0.4375$ which is not between 0.3 (<i>J</i>) and 0.4 (<i>K</i>).
B	Correct. $\frac{7}{16} = 0.4375$ which is between 0.4 (<i>K</i>) and 0.5 (<i>L</i>).
C	$\frac{7}{16} = 0.4375$ which is not between 0.5 (<i>L</i>) and 0.6 (<i>M</i>).
D	$\frac{7}{16} = 0.4375$ which is not between 0.6 (<i>M</i>) and 0.7 (<i>N</i>).

Question Number 22

Jill is $48\frac{5}{8}$ inches tall. Lei is 47.5 inches tall. What is the difference in their heights?

- A. 0.125 inch
- B. 1.08 inches
- C. 1.125 inches
- D. 1.62 inches

Benchmark: 5.1.3.4

Solve real-world and mathematical problems requiring addition and subtraction of decimals, fractions and mixed numbers, including those involving measurement, geometry and data.

For example: Calculate the perimeter of the soccer field when the length is 109.7 meters and the width is 73.1 meters.

Item Specifications

- Addends, minuend and subtrahend denominators are limited to 2, 3, 4, 5, 6, 8, 10 and 12
- Mixed numbers are less than 10
- Fractions and decimals may be used within the same item
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: C

A	Subtracted fractions only; $\frac{5}{8} - \frac{4}{8} = \frac{1}{8}$.
B	Wrote $48\frac{5}{8}$ as 48.58; subtracted $48.58 - 47.5 = 1.08$.
C	Correct. $48\frac{5}{8} - 47\frac{4}{8} = 1\frac{1}{8}$
D	Mixed up decimal place; subtracted $48.625 - 47.005 = 1.62$.

Question Number 23

Which tables follow the rule $y = 2 \times x$?

Select the tables you want to choose.

x	y
4	6
8	10
16	18

x	y
3	6
5	10
8	16

x	y
1	2
7	14
12	24

x	y
10	5
20	10
30	15

Benchmark: 5.2.1.1

Create and use rules, tables, spreadsheets and graphs to describe patterns of change and solve problems.

For example: An end-of-the-year party for 5th grade costs \$100 to rent the room and \$4.50 for each student. Know how to use a spreadsheet to create an input-output table that records the total cost of the party for any number of students between 90 and 150.

Item Specifications

- In a growing pattern, 3 applications of the rule must be shown, though not necessarily consecutively
- In a table or graph, 3 input-output pairs must be given; pairs are not required to be consecutive
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer:

This is a technology-enhanced item. The correct answer is shown. A student must select all the correct tables in order to receive 1 point.

Which tables follow the rule $y = 2 \times x$?

Select the tables you want to choose.

x	y
4	6
8	10
16	18

x	y
3	6
5	10
8	16

x	y
1	2
7	14
12	24

x	y
10	5
20	10
30	15

Notes on grade expectations: Rules for the given tables are:

$$y = 2 + x$$

$$y = 2x$$

$$y = 2x$$

$$2y = x \text{ or } y = \left(\frac{1}{2}\right)x$$

Question Number 24

An expression is shown.

$$4 + 3 \times (6 + 10) \div 2$$

What is the value of the expression?

- A. 16
- B. 26
- C. 28
- D. 56

Benchmark: 5.2.2.1

Apply the commutative, associative and distributive properties and order of operations to generate equivalent numerical expressions and to solve problems involving whole numbers.

For example: Purchase 5 pencils at 19 cents and 7 erasers at 19 cents. The numerical expression is $5 \times 19 + 7 \times 19$ which is the same as $(5 + 7) \times 19$.

Item Specifications

- Expressions may not contain nested parentheses
- Items must not have context
- Vocabulary allowed in items: expression, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: C

A	Mixed up order of operations; distributed 3 to 6, but not to 10, then found $(4 + 18 + 10)/2$.
B	Performed operations from left to right instead of using order of operations (Parentheses, Exponents, Multiplication, Division, Addition, Subtraction)
C	Correct.
D	Added 4 and 3 as first step. Addition should be the last step for this calculation.

Notes on grade expectations: Students should know the distributive property from previous grades. Order of operations is a fifth grade topic. The order in which operations must be performed to get the correct answer is:

Parentheses

Exponents

Multiplication/**D**ivision in the order it appears from left to right

Addition/**S**ubtraction in the order it appears from left to right

If the distributive property is not used, then the order of operations would dictate the following series of steps to simplify the expression:

$$\begin{aligned}4 + 3(6 + 10)/2 &= 4 + 3(16)/2 \\ &= 4 + 48/2 \\ &= 4 + 24 \\ &= 28\end{aligned}$$

If the distributive property is used, the following steps are required to simplify the expression:

$$\begin{aligned}4 + (18 + 30)/2 &= 4 + 9 + 15 \\ &= 28\end{aligned}$$

or

$$\begin{aligned}4 + (18 + 30)/2 &= 4 + 48/2 \\ &= 4 + 24 \\ &= 28\end{aligned}$$

Question Number 25

What is the value of $4 \times k + 6 \times (j - 2)$ when $k = 3$ and $j = 5$?

- A. 26
- B. 30
- C. 40
- D. 108

Benchmark: 5.2.3.3

Evaluate expressions and solve equations involving variables when values for the variables are given.

For example: Using the formula, $A = \ell w$, determine the area when the length is 5, and the width 6, and find the length when the area is 24 and the width is 4.

Item Specifications

- Items must not have context
- Vocabulary allowed in items: expression, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: B

A	Used 3 for j instead of k and used 5 for k instead of j ; $4 \times 5 + 6(3 - 2) = 26$.
B	Correct. $12 + 6 \times 3 = 30$
C	Distributed 6 to 5, but not to -2; $12 + 6 \times 5 - 2 = 40$.
D	Used incorrect order of operations; $4 \times (3 + 6)(5 - 2) = 108$.

Question Number 26

A triangle has a height of 25 feet. The length of its base is 12 feet. What is the area of the triangle?

Enter your answer in the box.

square feet

Benchmark: 5.3.2.1

Develop and use formulas to determine the area of triangles, parallelograms and figures that can be decomposed into triangles.

Item Specifications

- Vocabulary allowed in items: formula, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer:

This is a technology-enhanced item. The correct answer is shown. A student must type the correct answer in the box in order to receive 1 point.

A triangle has a height of 25 feet. The length of its base is 12 feet. What is the area of the triangle?

Enter your answer in the box.

square feet

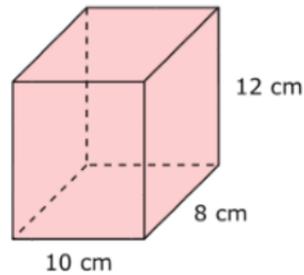
Notes on grade expectations: Grade 5 students should know how to calculate the areas of triangles. Student should use formula for area of triangle:

$$\begin{aligned} A &= \frac{1}{2}bh \\ &= \frac{1}{2}(12)(25) \\ &= 150 \end{aligned}$$

Note: The allowable characters that can be entered in the answer box are digits 0-9, fraction bar (/) and decimal point (.). Students cannot enter a comma in numbers with more than 3 digits. Familiarity with calculators will help the students with this concept.

Question Number 27

Amy covers the box shown with paper.



What is the surface area of the box?

- A. 180 sq. cm
- B. 296 sq. cm
- C. 592 sq. cm
- D. 960 sq. cm

Benchmark: 5.3.2.2

Use various tools and strategies to measure the volume and surface area of objects that are shaped like rectangular prisms.

For example: Use a net or decompose the surface into rectangles.

Another example: Measure the volume of a cereal box by using a ruler to measure its height, width and length, or by filling it with cereal and then emptying the cereal into containers of known volume.

Item Specifications

- When finding surface area, a graphic of the prism or net must be given
- When finding surface area, dimensions of figures are whole numbers
- Surface areas and volumes are no more than 360
- Vocabulary allowed in items: surface area, volume, net, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: C

A	Added edge lengths then multiplied by 6; $(10 + 8 + 12) \times 6 = 180$.
B	Found area of each unique side without doubling it; $(10 \times 8 + 8 \times 12 + 12 \times 10) = 296$.
C	Correct. $2(10 \times 8 + 8 \times 12 + 12 \times 10) = 592$
D	Found volume instead of surface area; $10 \times 8 \times 12 = 960$.

Notes on grade expectations: Students should be familiar with prisms from previous grades. Grade 5 students should calculate the area of each face of the prism, and then sum them to find the surface area.

Question Number 28

Anya listed the prices of meals on a menu.

\$14.85 \$10.75 \$8.50 \$12.45 \$9.20

What is the mean price of the meals?

- A. \$6.35
- B. \$8.50
- C. \$10.75
- D. \$11.15

Benchmark: 5.4.1.1

Know and use the definitions of the mean, median and range of a set of data. Know how to use a spreadsheet to find the mean, median and range of a data set. Understand that the mean is a "leveling out" of data.

For example: The set of numbers 1, 1, 4, 6 has mean 3. It can be leveled by taking one unit from the 4 and three units from the 6 and adding them to the 1s, making four 3s.

Item Specifications

- When finding mean, data sets contain, at most 10 numbers
- When finding median, data sets contain, at most 15 numbers
- Numbers are less than 300
- Vocabulary allowed in items: mean, median, range, minimum, maximum, and vocabulary given at previous grades

DOK: 2

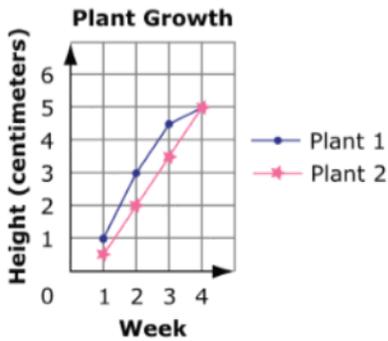
Calculator: CL

Answer: D

A	Found range instead of mean.
B	Found middle number in unordered list.
C	Found median instead of mean.
D	Correct. $(14.85 + 10.75 + 8.50 + 12.45 + 9.20)/5 = 11.15$

Question Number 29

Maria recorded the heights of 2 plants for 4 weeks.



How much did plant 2 grow from week 1 to week 2?

- A. 1 cm
- B. $1\frac{1}{2}$ cm
- C. 2 cm
- D. $4\frac{1}{2}$ cm

Benchmark: 5.4.1.2

Create and analyze double-bar graphs and line graphs by applying understanding of whole numbers, fractions and decimals. Know how to create spreadsheet tables and graphs to display data.

Item Specifications

- Double-bar graphs have no more than 9 categories
- Line graphs have no more than 10 data points
- Scales are in increments of $\frac{1}{2}$, 1, 2, 4, 5, 10, tenths if in decimal form or must be consistent with real world applications
- Vocabulary allowed in items: double-bar graph, line graph, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer: B

A	Found average weekly growth of plant 1.
B	Correct $2 - 0.5 = 1.5$
C	Found growth of plant 1.
D	Found growth of plant 2 over entire 4-week period.

Question Number 30

Which numbers or expressions represent the value of a decimal that is five hundred-thousandths more than seventy-three and two hundred six thousandths?

Select the numbers or expressions you want to choose.

- 73.265
- 73.2065
- 73.20605
- $70 + 3 + 0.2 + 0.06 + 0.0005$
- $70 + 3 + 0.2 + 0.006 + 0.00005$
- $7 \times 10 + 3 \times 1 + 2 \times 0.1 + 6 \times 0.01 + 5 \times 0.0001$
- $7 \times 10 + 3 \times 1 + 2 \times 0.1 + 6 \times 0.001 + 5 \times 0.00001$

Benchmark: 5.1.2.1

Read and write decimals using place value to describe decimals in terms of groups from millionths to millions.

For example: Possible names for the number 0.0037 are: 37 ten thousandths
3 thousandths + 7 ten thousandths;
a possible name for the number 1.5 is 15 tenths.

Item Specifications

- Vocabulary allowed in items: place value, and vocabulary given at previous grades

DOK: 2

Calculator: CL

Answer:

This is a technology-enhanced item. The correct answer is shown. A student must choose all 3 correct answers in order to receive 1 point.

Which numbers or expressions represent the value of a decimal that is five hundred-thousandths more than seventy-three and two hundred six thousandths?

Select the numbers or expressions you want to choose.

- 73.265
- 73.2065
- 73.20605
- $70 + 3 + 0.2 + 0.06 + 0.0005$
- $70 + 3 + 0.2 + 0.006 + 0.00005$
- $7 \times 10 + 3 \times 1 + 2 \times 0.1 + 6 \times 0.01 + 5 \times 0.0001$
- $7 \times 10 + 3 \times 1 + 2 \times 0.1 + 6 \times 0.001 + 5 \times 0.00001$

Question Number 31

Max is 3 years older than Lisa. Jeffrey is 7 years younger than Max. The equations $x + 3 = y$ and $y - 7 = z$ represent the relationships between the children's ages.

Complete the sentences to show which child's age each variable represents.

The variable x represents the age of , in years. The variable y represents the age of , in years. The variable z represents the age of , in years.

Benchmark: 5.2.3.2

Represent real-world situations using equations and inequalities involving variables. Create real-world situations corresponding to equations and inequalities.

For example: $250 - 27 \times a = b$ can be used to represent the number of sheets of paper remaining from a packet of 250 sheets when each student in a class of 27 is given a certain number of sheets.

Item Specifications

- $<$ and $>$ symbols are allowed
- Vocabulary allowed in items: inequality, and vocabulary given at previous grades

DOK: 3

Calculator: CL

Answer:

This is a technology-enhanced item. The correct answer is shown. The answer choices for each blank are shown below the answer. A student must choose all 3 correct answers in order to receive 1 point.

Max is 3 years older than Lisa. Jeffrey is 7 years younger than Max. The equations $x + 3 = y$ and $y - 7 = z$ represent the relationships between the children's ages.

Complete the sentences to show which child's age each variable represents.

The variable x represents the age of , in years. The variable y represents the age of , in years. The variable z represents the age of , in years.

<input type="text" value="Lisa"/>	<input type="text" value="Max"/>	<input type="text" value="Jeffrey"/>
Choose...	Choose...	Choose...
Max	Max	Max
Lisa	Lisa	Lisa
Jeffrey	Jeffrey	Jeffrey

Notes on grade expectations: This item is DOK level 3 because no prompting/cueing is made as to a strategy to solve the problem. The student must understand the relationships between and among the ages and then translate that into mathematical language where they use their skills of working with variables and the properties of equality. The statement "Max is 3 years older than Lisa" is associated with the equation $x + 3 = y$ and can be translated as "Lisa's age + 3 = Max's age". From this, students can infer that x = Lisa's age and y = Max's age. The same can be done with the second equation: "Max's age – 7 = Jeffrey's age", therefore, z = Jeffrey's age. Drop-down menus are used to indicate which student's age is represented by each variable.

Question Number 32

The names of some three-dimensional figures are shown.

Drag the names into the correct order from least number of edges to greatest number of edges.

Least ←————→ Greatest

Triangular prism	Rectangular prism	Triangular pyramid	Rectangular pyramid
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Benchmark: 5.3.1.1

Describe and classify three-dimensional figures including cubes, prisms and pyramids by the number of edges, faces or vertices as well as the types of faces.

Item Specifications

- Prisms and pyramids are limited to triangular, rectangular, pentagonal, hexagonal and octagonal
- Vocabulary allowed in items: cube, prism, pyramid, cone, cylinder, edge, face, base, three-dimensional, triangular, rectangular, and vocabulary given at previous grades

DOK: 1

Calculator: NC

Answer:

This is a technology-enhanced item. The correct answer is shown. A student must move the four shapes into the correct order to receive 1 point.

The names of some three-dimensional figures are shown.

Drag the names into the correct order from least number of edges to greatest number of edges.

Least ←————→ Greatest

Triangular pyramid	Rectangular pyramid	Triangular prism	Rectangular prism
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