Grade 6 Mathematics MCA Item Sampler Teacher Guide

Overview of Item Samplers

Item samplers are one type of student resource provided to help students and educators prepare for test administration. While standardized tests are familiar to almost all students, each assessment has its own layout and ways students interact with it. The item samplers should be used to familiarize students and educators with how the content is assessed by providing examples of the format and item types students could encounter on the MCA.

Other Resources

While this Teacher Guide provides detailed information about the item samplers, the student tutorial is the resource that should be used to familiarize students and educators with the general functionality of the online test, including navigation, tools, and examples of all item types.

For further information about the student tutorial and using student resources, refer to the *Purposes of Student Resources* on the Item Samplers page of PearsonAccess Next (PearsonAccess Next > Preparing for Testing > Item Samplers). Please contact mde.testing@state.mn.us for any questions about the MCA or resources for testing.

Contents of this Teacher Guide

The Teacher Guides provide supplementary information for the items in the online item samplers, including:

- An answer key for the online item samplers*
- Item images
- Images of correct answers for technology-enhanced items or items highlighting special functionality
- Rationales for correct and incorrect answer options
- Alignment to the benchmarks from the test specifications
- Cognitive complexity (indicated as Depth of Knowledge or DOK) from the test specifications
- Calculator designation (CL = calculator allowed; NC = no calculator)
- Notes on grade expectations and/or item type information included for some items

For detailed information on benchmarks and cognitive complexity levels, see the test specifications on the MDE website (Districts, Schools and Educators > Statewide Testing > Test Specifications).

*The answer key for paper item samplers (12-point, 18-point, 24-point and braille test books) is included on the last page of this Teacher Guide. Some items on the paper item samplers appear in the online item sampler and the answer key includes information on where corresponding item information can be found in this guide.

Student Responses

Upon completion of the online item samplers, a report is displayed, which provides student responses for some item types. This report can be printed for use in conjunction with the information in this Teacher's Guide on how the student responded to those items. Note that the overall score on the report is **not** a predictor of performance on the MCA; it is simply a total of correct responses to some items.

Grade 6 Mathematics MCA Item Sampler
Online Answer Key

Section 1
10 Questions

Item #	Correct Answer	Item Type	Benchmark	Calculator
1	D	MC	6.1.1.2	CL
2	C	MC	6.1.2.1	CL
3	A	MC	6.1.2.3	CL
4	C	MC	6.1.3.3	CL
5	D	MC	6.3.1.1	CL
6	A	MC	6.3.1.3	CL
7	N/A	TE	6.3.2.3	CL
8	A	MC	6.3.3.1	CL
9	N/A	TE	6.4.1.1	CL
10	D	MC	6.4.1.3	CL

Section 2
10 Questions

Item #	Correct Answer	Item Type	Benchmark	Calculator
1	N/A	TE	6.1.1.1	NC
2	N/A	TE	6.1.3.1	NC
3	C	MC	6.1.1.7	NC
4	A	MC	6.1.3.1	NC
5	C	MC	6.1.1.3	NC
6	B	MC	6.1.1.5	NC
7	D	MC	6.2.1.1	NC
8	D	MC	6.2.1.2	NC
9	C	MC	6.2.2.1	NC
10	C	MC	6.3.2.1	NC

Section 3
13 Questions

Item #	Correct Answer	Item Type	Benchmark	Calculator
1	B	MC	6.1.1.4	CL
2	C	MC	6.1.1.6	CL
3	B	MC	6.1.2.2	CL
4	N/A	TE	6.1.2.4	CL
5	C	MC	6.2.3.2	CL
6	C	MC	6.3.1.2	CL
7	A	MC	6.3.2.2	CL

8	C	MC	6.3.3.2	CL
9	N/A	TE	6.4.1.2	CL
10	C	MC	6.4.1.4	CL
11	N/A	TE	6.2.1.2	CL
12	N/A	TE	6.1.1.4	CL
13	N/A	TE	6.2.3.1	CL

Section 1

Question 1

Which statement is true?

- A. $\frac{1}{6} = 0.16$
- B. $0.08 = \frac{4}{5}$
- C. $0.25 < \frac{1}{4}$
- D. $\frac{1}{3} > 0.3$

Benchmark: 6.1.1.2

Compare positive rational numbers represented in various forms. Use the symbols $<, = \ and \ >$.

For example: $1/2 > 0.36$.

Item Specifications

- Vocabulary allowed in items: is greater than, is less than, and vocabulary given at previous grades

DOK: 1
Calculator: CL
Answer: D

A	Assumed equivalency because the terms both use the same numbers.
B	Misinterpreted 0.08 as 0.8 which is equivalent to $4/5$.
C	May have misinterpreted inequality symbol as equal sign.
D	Correct. 0.333… is greater than 0.300.

Notes on grade expectations: Because the fraction and decimal relationships in the options include familiar numbers, students may simply use recognition or recall to choose their answer. Many grade 6 students know that the decimal form of a fraction may be found by dividing the numerator of the fraction by the denominator but do not fully grasp the meaning of a repeating decimal – other than “it goes on forever”. They may also have picked up some misconceptions about the equivalence of a rounded value to the fraction. Options A and D both have decimals that repeat but the student must take their understanding further.

Question 2

Kelly makes 12 candles in 3 hours. Lee makes 6 candles in 1 hour. What is the difference in the numbers of candles they each make in 8 hours?

- A. 2
- B. 8
- C. 16
- D. 48

Benchmark: 6.1.2.1
Identify and use ratios to compare quantities; understand that comparing quantities using ratios is not the same as comparing quantities using subtraction.
For example: In a classroom with 15 boys and 10 girls, compare the numbers by subtracting (there are 5 more boys than girls) or by dividing (there are 1.5 times as many boys as girls). The comparison using division may be expressed as a ratio of boys to girls (3 to 2 or 3:2 or 1.5 to 1).

Item Specifications

- Allowable ratio notation: $\frac{1}{4}$, 1 to 4, $1:4$, 1 out of 4
- Vocabulary allowed in items: ratio, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: C

A	Found that Kelly makes 4 candles per hour and Lee makes 6 candles per hour, then found difference: $8 - 6 = 2$.
B	Used 8 from problem.
C	Correct. Kelly: $12/3 = 4$ candles per hour, $4 \times 8 = 32$. Lee: $6 \times 8 = 48$; difference of $48 - 32 = 16$.
D	Found number of candles Lee makes in 8 hours, $6 \times 8 = 48$; ignored the number of candles Kelly makes in 8 hours.

Notes on grade expectations: The student has two ratios to work with but must put them in a form that allows the comparison to be made.

Question 3

A bottle of soap costs $3.45 for 64 ounces. What is the cost per ounce?

- A. $0.05
- B. $0.19
- C. $0.22
- D. $0.64

Benchmark: 6.1.2.3
Determine the rate for ratios of quantities with different units.
For example: 60 miles for every 3 hours is equivalent to 20 miles for every one hour (20 mph).

Item Specifications

- Allowable ratio notation: $\frac{1}{4}$, 1 to 4, $1:4$, 1 out of 4
- Rates may be expressed using the word "per"
- Vocabulary allowed in items: rate, ratio, unit rate, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: A

A	Correct. $3.45/64 \approx 0.05$
B	Inverted division $64/3.45 \approx 19$, then moved decimal point to get 0.19.
C	May have used the fact that there are 16 ounces in a pound to find $3.45/16 \approx 0.22$.
D	May have used 64 from the problem and moved the decimal point to get 0.64.

Notes on grade expectations: The context of unit cost seems straightforward but still can be difficult for 6th grade students. A very common error is illustrated in option B. When students are not familiar with the mathematical concept, they may rely on prior knowledge to make a guess such as options C and D.

Question 4

A company is printing 250 calendars. In 1 hour, 75 calendars are printed. What percent of the calendars are printed in 1 hour?

- A. 3%
- B. 3.3%
- C. 30%
- D. 33%

Benchmark: 6.1.3.3
Calculate the percent of a number and determine what percent one number is of another number to solve problems in various contexts.
For example: If John has $45 and spends $15, what percent of his money did he keep?

Item Specifications
- Percents are not less than 1
- Percents over 100 are 110, 125, 150 and 200
- Vocabulary allowed in items: percent, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: C

A	When converting decimal to percent, thought 0.3 was 3%.
B	Found number of hours to produce 250 calendars and wrote as percent; $250/75 = 3.3\ldots$
C	Correct. $75/250 = 0.3$ or 30%
D	Found number of hours to produce 250 calendars, then misplaced decimal; $3.3\ldots$

Notes on grade expectations: Because a rate is given, students may set up the proportion to calculate the number of hours to produce 250 calendars and then choose option B as the closest value to $3.333\ldots$. Another extension of this thinking is shown in option D where the student solves the incorrect proportion and then adjusts the answer to have two digits.

Question 5

The surface area of a cube is 384 square inches. What is the volume of the cube?

- A. 8 cubic inches
- B. 16 cubic inches
- C. 256 cubic inches
- D. 512 cubic inches

Benchmark: 6.3.1.1

Calculate the surface area and volume of prisms and use appropriate units, such as cm^2 and cm^3. Justify the formulas used. Justification may involve decomposition, nets or other models. *For example:* The surface area of a triangular prism can be found by decomposing the surface into two triangles and three rectangles.

Item Specifications

- Allowable notation: 3 square centimeters, 3 cm sq, 3 cm^2
- Vocabulary allowed in items: vocabulary given at previous grades

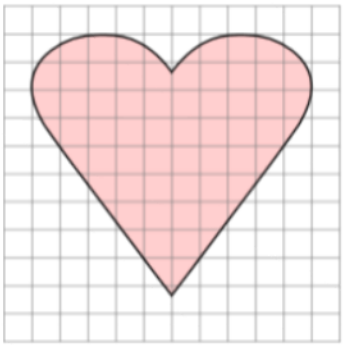
DOK: 3
Calculator: CL
Answer: D

A	Found the length of each side of the cube; did not raise 8 to the 3rd power to find volume.
B	Divided 384 by 6 to find area of each face is 64, then divided by 4 sides instead of taking square root.
C	Divided 384 by 6 to find area of each face is 64, then divided by 4 sides instead of taking square root to get 16. Squared 16 instead of cubing to find volume.
D	Correct. $384/6 = 64$ is the area of each face. Took square root to find side length of 8, then raised 8 to the 3rd power to find volume of the cube.

Notes on grade expectations: Many familiar concepts converge in this item which makes it a DOK 3 level item. The scaffolding is not done for the student. The concepts need to be recognized and then the student must apply the skills. Prior knowledge that must be accessed includes understanding the concept of surface area, knowing that a cube has 6 congruent faces, recognizing a perfect square, and calculating volume of a prism. The problem cannot be solved by simply making calculations with the numbers given.

Question 6

A heart shape is cut from a gridded piece of paper.



What is the approximate area of the heart?

- A. 50 square units
- B. 70 square units
- C. 90 square units
- D. 144 square units

Benchmark: 6.3.1.3
Estimate the perimeter and area of irregular figures on a grid when they cannot be decomposed into common figures and use correct units, such as cm and cm^2.

Item Specifications

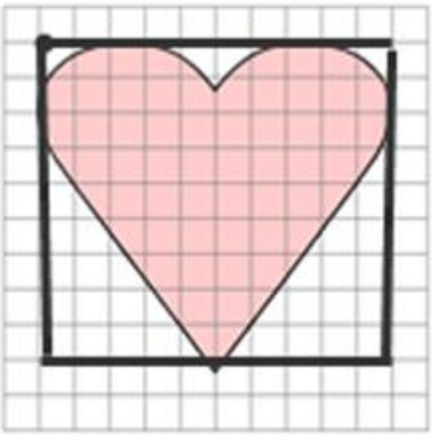
- Allowable notation: 3 square centimeters, 3 cm sq, 3 cm^2
- Vocabulary allowed in items: vocabulary given at previous grades

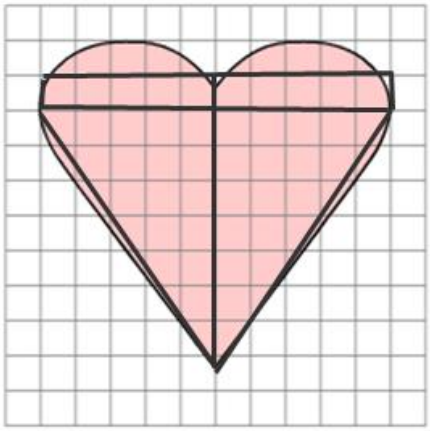
DOK: 2
Calculator: CL
Answer: A

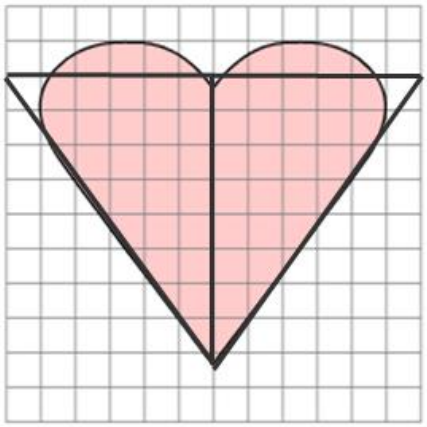
A	Correct. Rectangle around heart is 90 sq. units. About 35 squares are unshaded. $90 - 35 = 55$. The closest approximation is 50.
B	May have counted every partial square as 1 whole square.
C	A rectangle surrounding the entire heart shape is 90 square units. Did not subtract unshaded squares from 90.
D	Found area of entire grid, $12 \times 12 = 144$.

Notes on grade expectations: Students have experience decomposing figures on a grid into familiar shapes (benchmarks 4.3.2.4 and 5.3.2.1). Counting squares on the grid should be discouraged as a strategy for estimating the area. In the examples shown, students will apply counting to only a few squares.

Encourage students to try several approaches.



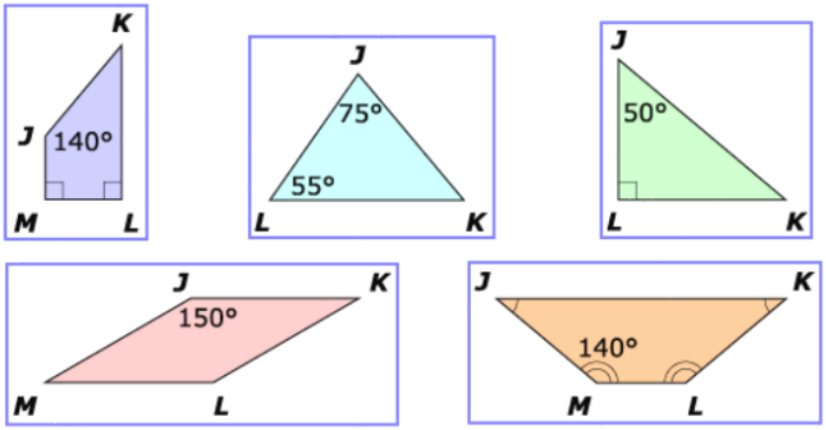




Question 7

In which shapes does the measure of $\angle K = 40^\circ$?

Select the shapes you want to choose.



Benchmark: 6.3.2.3
Develop and use formulas for the sums of the interior angles of polygons by decomposing them into triangles.

Item Specifications

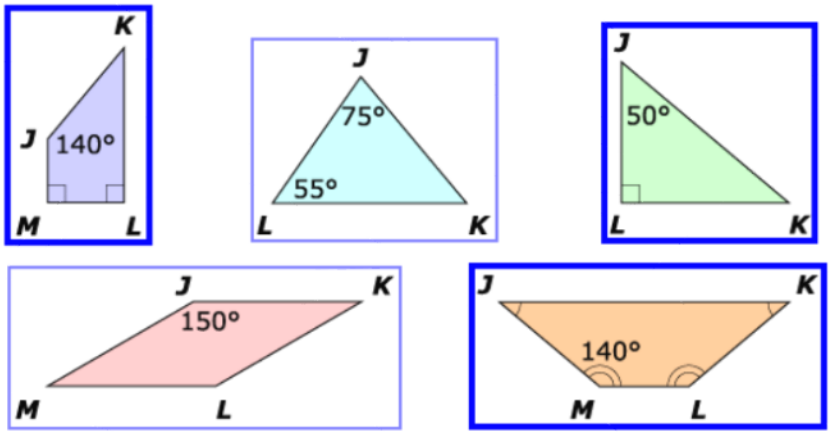
- Allowable notation: $\angle A$, $m\angle A$, ΔABC
- Vocabulary allowed in items: interior, diagonal, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer:

This is a technology-enhanced item. A student must select all three correct shapes in order to receive 1 point.

In which shapes does the measure of $\angle K = 40^\circ$?

Select the shapes you want to choose.



Purple Shape	Correct. Sum of interior angles of quadrilateral is 360. $360 - 140 - 90 - 90 = 40$
Blue Shape	Sum of interior angles of triangle is 180. $180 - 75 - 55 = 50$.
Green Shape	Correct. Sum of interior angles of triangle is 180. $180 - 50 - 90 = 40$.
Red Shape	Sum of interior angles of quadrilateral is 360. In parallelogram, opposite angles are congruent. $360 - 150 \times 2 = 60$; $60/2 = 30$
Orange Shape	Correct. Sum of interior angles of quadrilateral is 360. $360 - 140 - 140 = 80$; $80/2 = 40$

Notes on grade expectations: This item is classified as DOK 2. Students have used the right angle symbol (square in the corner) since grade 3 and know that a right angle measures 90 degrees. Solving the problem involves using skills that are familiar because of textbook problems and class examples.

Question 8

Joleen bought 12 apples. Each apple weighed 1.8 ounces. How many pounds of apples did Joleen buy?

- A. 1.35 pounds
- B. 2.4 pounds
- C. 21.6 pounds
- D. 28.8 pounds

Benchmark: 6.3.3.1
Solve problems in various contexts involving conversion of weights, capacities, geometric measurements and times within measurement systems using appropriate units.

Item Specifications
- Vocabulary allowed in items: customary, metric, capacity, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: A

A	Correct. $12 \times 1.8 = 21.6$ ounces; $21.6/16 = 1.35$ pounds
B	Mixed up the roles of 12 and 16; $1.8 \times 16/12$.
C	Found the total number of ounces but forgot to convert to pounds; $12 \times 1.8 = 21.6$.
D	Did not multiply 1.8 by 12, then multiplied 1.8 by 16 instead of dividing by 16; $1.8 \times 16 = 28.8$.

Notes on grade expectations: Students may regard this as a multiply and divide problem and lose sight of the proportional reasoning because the unit rates are not explicitly stated.

Question 9

Eli has a cube with sides numbered 1–6 and a spinner with 3 equal sections labeled A, B, and C. He rolls the cube and spins the spinner. How many outcomes are possible?

Enter your answer in the box.

Benchmark: 6.4.1.1
Determine the sample space (set of possible outcomes) for a given experiment and determine which members of the sample space are related to certain events. Sample space may be determined by the use of tree diagrams, tables or pictorial representations.

For example: A 6x6 table with entries such as $(1,1)$, $(1,2)$, $(1,3)$, …, $(6,6)$ can be used to represent the sample space for the experiment of simultaneously rolling two number cubes.

Item Specifications
- Size of the sample space will not exceed 36
- Vocabulary allowed in items: probability, outcome, tree diagram, event, random, sample space, combinations, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer:

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

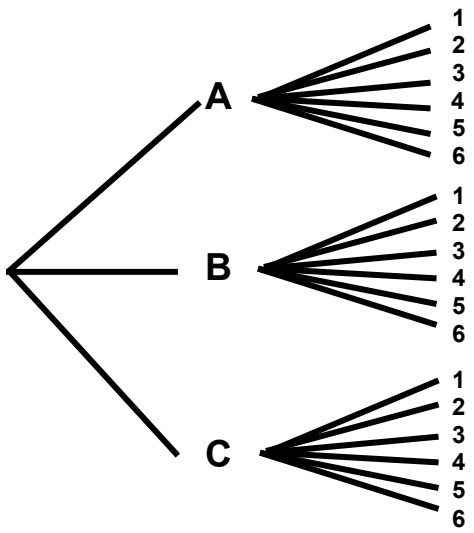
Eli has a cube with sides numbered 1–6 and a spinner with 3 equal sections labeled A, B, and C. He rolls the cube and spins the spinner. How many outcomes are possible?

Enter your answer in the box.

18

Notes on grade expectations: At first look, this seems like a simple multiplication fact. Modeling outcomes with a tree diagram gives a clear picture of the outcomes and helps show why the multiplication fact produces a correct answer. $3 \times 6 = 18$.

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 10

Four students each flipped a coin 50 times and recorded the results in the table.

Student	Heads	Tails
Mai Ka	31	19
Heather	15	35
Jose	21	29
Tyrone	20	30

Who had a relative frequency of $\frac{3}{5}$ of flipping tails?

A. Mai Ka

B. Heather

C. Jose

D. Tyrone

Benchmark: 6.4.1.3
Perform experiments for situations in which the probabilities are known, and compare the resulting relative frequencies with the known probabilities; know that there may be differences. *For example*: Heads and tails are equally likely when flipping a fair coin, but if several different students flipped fair coins 10 times, it is likely that they will find a variety of relative frequencies of heads and tails.

Item Specifications
- Vocabulary allowed in items: probability, outcome, event, theoretical, frequency, relative frequency, random, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: D

A	Mai Ka - Tails divided by total number of flips: $19/50$. $19/50 \neq 3/5$
B	Heather - Tails divided by total number of flips: $35/50 = 7/10$. $7/10 \neq 3/5$
C	Jose - Tails divided by total number of flips: $29/50$. $29/50 \neq 3/5$
D	Correct. Tyrone - Tails divided by total number of flips: $30/50 = 3/5$

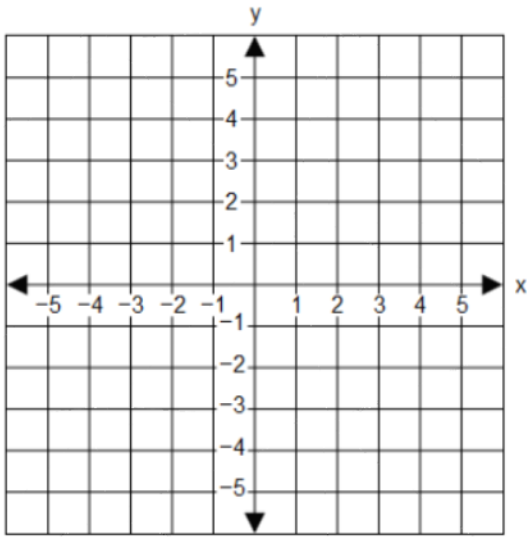
Notes on grade expectations: Stating the ratio in words helps the students understand what the numbers in the table mean.

Section 2

Question 1

Plot the point $(4, 5)$ on the coordinate grid.

Select a location on the coordinate grid to plot the point.



Benchmark: 6.1.1.1
Locate positive rational numbers on a number line and plot pairs of positive rational numbers on a coordinate grid.

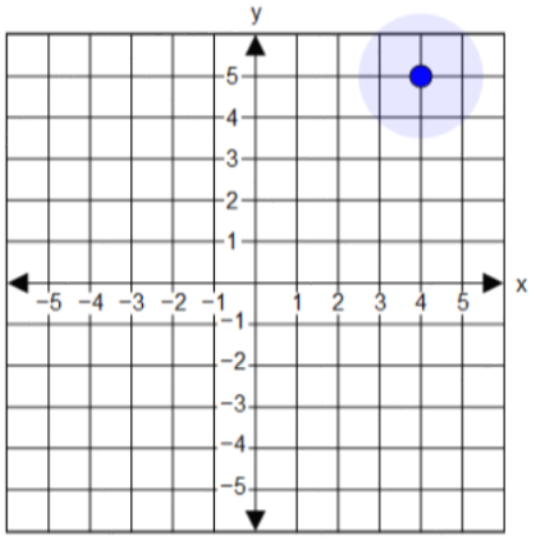
Item Specifications
- Both axes must have the same scale
- Items may require locating points on either axis
- Vocabulary allowed in items: integer, *x*-axis, *y*-axis, horizontal axis, vertical axis, rational number, coordinate grid, and vocabulary given at previous grades

DOK: 2
Calculator: NC
Answer:

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

Plot the point $(4, 5)$ on the coordinate grid.

Select a location on the coordinate grid to plot the point.



Notes on grade expectations: Plot a point 4 units to the right of 0 and 5 units up from 0.

Question 2

Complete the equation shown by placing the appropriate number into each box.

Drag a number into each box.

$$\frac{2}{5} \div \frac{3}{4} = \frac{\square}{\square}$$

1
2
3
4
5
6
8
9
10
15
20

Benchmark: 6.1.3.1
Multiply and divide decimals and fractions, using efficient and generalizable procedures, including standard algorithms.

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

DOK: 1
Calculator: NC

Answer: 8/15

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

Complete the equation shown by placing the appropriate number into each box.

Drag a number into each box.

$$\frac{2}{5} \div \frac{3}{4} = \frac{\boxed{8}}{\boxed{15}}$$

1
2
3
4
5
6
8
9
10
15
20

Notes on grade level expectations: When dividing a fraction by another fraction, invert the second fraction and change division to multiplication:

$$\frac{2}{5} \div \frac{3}{4} = \frac{2}{5} \times \frac{4}{3} = \frac{8}{15}$$

Question 3

Which is equivalent to 4^3?

- A. 12
- B. 48
- C. 64
- D. 81

Benchmark: 6.1.1.7
Convert between equivalent representations of positive rational numbers.

For example: Express $10/7$ as: $(7+3)/7 = 7/7 + 3/7 - 1\,3/7$.

Item Specifications

- Conversions are limited to within a representation (e.g., $7/4 = 1¾$ and $3^2 = 3 \cdot 3$, not $0.5 = 1/2$)
- Vocabulary allowed in items: exponent, integer, and vocabulary given at previous grades

DOK: 1
Calculator: NC
Answer: C

A	Multiplied 4×3 instead of raising 4 to the 3rd power.
B	Used $4^3 = 4 \times 4 \times 4$, but multiplied $4 \times 4 \times 3$ instead resulting in 48.
C	Correct. $4 \times 4 \times 4$
D	Mixed up the base and the exponent and found 3^4 instead of 4^3.

Notes on grade level expectations: A. Students associate the absence of an operation symbol with multiplication and multiply 4×3. B. Attempted to do calculation with 4 and 3. D. Confused the base and exponent resulting in $3 \times 3 \times 3 \times 3$. When students first encounter powers they can easily confuse the base (factor) and the exponent. The notation is different than they have seen previously and the smaller size of the numeral for the exponent may add to the mystery. They may think that the absence of an operation symbol means to multiply and choose option A, or confuse the base and the exponent resulting in option D.

Question 4

Divide.

$$1\frac{1}{10} \div 1\frac{1}{5}$$

- A. $\frac{11}{12}$
- B. $\frac{25}{33}$
- C. $1\frac{8}{25}$
- D. $1\frac{1}{2}$

Benchmark: 6.1.3.1
Multiply and divide decimals and fractions using efficient and generalizable procedures, including standard algorithms.

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

DOK: 2
Calculator: NC
Answer: A

A	Correct. $1\frac{1}{10} \div 1\frac{1}{5} = \frac{11}{10} \div \frac{6}{5} = \frac{11}{10} \times \frac{5}{6} = \frac{55}{60} = \frac{11}{12}$
B	Inverted both fractions instead of just the second one. $1\frac{1}{10} = \frac{11}{10}$ and $1\frac{1}{5} = \frac{6}{5}$ so inverting both results in $\frac{10}{11} \times \frac{5}{6} = \frac{50}{66} = \frac{25}{33}$
C	Switched division symbol to multiplication, but did not invert second fraction. $\frac{11}{10} \times \frac{6}{5} = \frac{66}{50} = 1\frac{16}{50} = 1\frac{8}{25}$
D	Divided mixed fractions in parts: whole $1/1 = 1$, fraction $\frac{1}{10} \div \frac{1}{5} = \frac{1}{10} \times \frac{5}{1} = \frac{5}{10} = \frac{1}{2}$ to get 1 ½.

Notes on grade expectations: Division with fractions often becomes an attempt to remember a rule for manipulation of numbers. When the student divides the whole numbers, then the numerators, and then the denominators, the result is option D. Students often recognize they should express mixed numerals in fractional (improper) form and then may just multiply and get option C or invert both numbers and get option B. This item did not include the option when students invert the first number instead of the second number. As common as that error is, this item pushes the student to try something else.

Question 5

Riley has 200 stamps.

- 35% are from Europe.
- 10% are from Asia.
- 20% are from Australia.

The rest of the stamps are from North America. How many of Riley's stamps are from North America?

A. 35

B. 65

C. 70

D. 130

Benchmark: 6.1.1.3
Understand that percent represents parts out of 100 and ratios to 100.
For example: 75% corresponds to the ratio 75 to 100, which is equivalent to the ratio 3 to 4.

Item Specifications

- Allowable notation: 25%, $\frac{1}{4}$, $1:4$
- Percents must be between 1 and 100, inclusive
- Vocabulary allowed in items: percent, ratio, and vocabulary given at previous grades

DOK: 2
Calculator: NC
Answer: C

A	Found 35% are from North America, then used 35 as answer; or took 35% of 100 which is 35.
B	Added percentages to get 65% but did not subtract from 100%, then use 65 as answer; or took 65% of 100 which is 65.
C	Correct. $100\% - 35\% - 10\% - 20\% = 35\%$. $0.35 \times 200 = 70$
D	Added percentages to get 65% but did not subtract from 100%. 65% of 200 = 130

Question 6

What is the prime factorization of 630?

- A. $2 \times 3 \times 5 \times 7$
- B. $2 \times 3^2 \times 5 \times 7$
- C. $2 \times 3^2 \times 35$
- D. $2 \times 5 \times 7 \times 9$

Benchmark: 6.1.1.5
Factor whole numbers; express a whole number as a product of prime factors with exponents.

For example: $24 = 23 x 3$ (two cubed times three)

Item Specifications
- Prime factors are not greater than 13
- Numbers being factored are less than 1,000
- Vocabulary allowed in items: prime factor, prime factorization, exponent, power, base, and vocabulary given at previous grades

DOK: 1
Calculator: NC
Answer: B

A	Missed a 3. $2 \times 3 \times 5 \times 7 = 210$, not 630.
B	Correct.
C	Did not finish factoring. 35 is not a prime number, it factors into 5×7.
D	Did not finish factoring. 9 is not a prime number, it factors into 3×3 or 3^2.

Notes on grade expectations: When the answer options are presented, students are inclined to simplify the expressions shown and choose the answer that matches the number to be factored. Presenting this item first without options allows the student to focus on prime factorization. Asking why students choose incorrect options will make them aware of misconceptions.

Question 7

An equation is shown.

$$j = 7k + 5$$

When the value of *k* increases by 2, by what amount does the value of *j* increase?

- A. 2
- B. 9
- C. 12
- D. 14

Benchmark: 6.2.1.1
Understand that a variable can be used to represent a quantity that can change, often in relation to another changing quantity. Use variables in various contexts.
For example: If a student earns $7 an hour in a job, the amount of money earned can be represented by a variable and is related to the number of hours worked, which also can be represented by a variable.

Item Specifications

- Allowable multiplication notation: 3*x*, *xy*, $3 \cdot 4$, 3(4)
- Equations will not contain exponents
- Vocabulary allowed in items: evaluate, and vocabulary given at previous grades

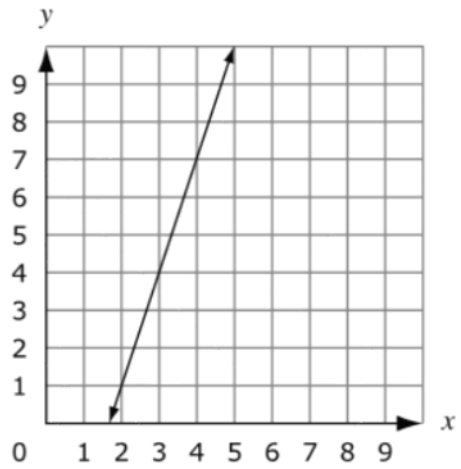
DOK: 2
Calculator: NC
Answer: D

A	Used the increase in the value of *k* without multiplying by 7.
B	Used 7 as the value of *k*, then added 2; $7 + 2 = 9$.
C	Added the numerals in the equation; $7 + 5 = 12$.
D	Correct. When *k* increases by 1, *j* increases by 7. So 2*k* will result in $(2 \times 7)j$.

Notes on grade expectations: This question is not about solving the equation. Instead, the focus is on how a quantity changes in relation to another quantity. This is a preliminary exploration of "rate of change".

Question 8

A graph is shown.



What is the equation of the line on the graph?

A. $y = x - 1$

B. $y = x + 3$

C. $y = 3x + 1$

D. $y = 3x - 5$

Benchmark: 6.2.1.2
Represent the relationship between two varying quantities with function rules, graphs and tables; translate between any two of these representations.
For example: Describe the terms in the sequence of perfect squares
t = 1, 4, 9, 16, ... by using the rule t = n 2 for n = 1, 2, 3, 4, ...

Item Specifications

- Allowable multiplication notation: 3*x*, *xy*, $3 \cdot 4$, 3(4)
- Equations will not contain exponents
- Vocabulary allowed in items: translate, function, coordinate grid, and vocabulary given at previous grades

DOK: 2
Calculator: NC
Answer: D

A	Tested some points from the graph in $y = x - 1$. $(2, 1)$ is on this line, but $(3, 4)$ is not.
B	Tested some points from the graph in $y = x + 3$. $(4, 7)$ is on this line, but $(3, 4)$ is not.
C	No points from the graph are on $y = 3x + 1$. This line is parallel to the graphed line.
D	Correct. Successfully tested some points $[(2, 1), (3, 4)]$ from the graph in $y = 3x - 5$.

Question 9

Simplify.

$$4\left(\frac{1}{2}+\frac{3}{8}\right)-\frac{5}{8}\bullet 2$$

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

Benchmark: 6.2.2.1
Apply the associative, commutative and distributive properties and order of operations to generate equivalent expressions and to solve problems involving positive rational numbers.
For example:

$32/15 \times 5/6 = 32 \times 5/15 \times 6 = 2 \times 16 \times 5/3 \times 5 \times 3 \times 2 = 16/9 \times 2/2 \times 5/5 \times 16/9$

.
Another example: Use the distributive law to write:

$1/2 + 1/3(9/2 - 15/8) - 1/2 + 1/3 \times 9/2 - 1/3 \times 15/8 = 1/2 + 3/2 - 5/8 = 2 - 5/7 = 13/8$

.

Item Specifications

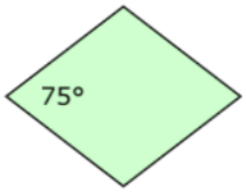
- Allowable multiplication notation: 3*x*, *xy*, $3 \cdot 4$, 3(4)
- Items must not have context
- Vocabulary allowed in items: order of operations, simplify, and vocabulary given at previous grades

DOK: 1
Calculator: NC
Answer: C

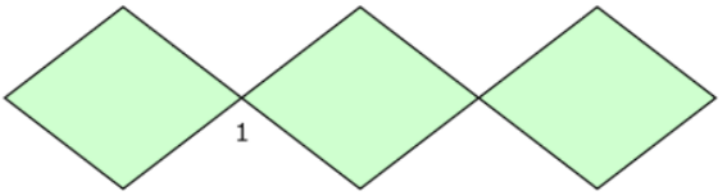
A	Distributed 4 to $1/2$ only; should have also distributed it to $3/8$. (Incorrect order of operations.)
B	Made a calculation error.
C	Correct. $4(4/8 + 3/8) - 10/8 = 4(7/8) - 10/8 = 28/8 - 10/8 = 18/8 = 22/8 = 21/4$
D	Did not multiply $5/8$ by 2 before subtracting it from $28/8$; subtracted first, then multiplied result by 2. (Incorrect order of operations.)

Question 10

A rhombus is shown.



The rhombus is used to make a design.



What is $m\angle 1$?

- A. 15°
- B. 75°
- C. 105°
- D. 150°

Benchmark: 6.3.2.1
Solve problems using the relationships between the angles formed by intersecting lines.
For example: If two streets cross, forming four corners such that one of the corners forms an angle of 120°, determine the measures of the remaining three angles.
Another example: Recognize that pairs of interior and exterior angles in polygons have measures that sum to 180 degrees.

Item Specifications

- Allowable notation: $\angle A$, $m\angle A$, ΔABC
- Vocabulary allowed in items: intersecting, vertical, adjacent, complementary, supplementary, straight, hypotenuse, leg, and vocabulary given at previous grades

DOK: 2
Calculator: NC
Answer: C

A	Subtracted 75 from 90 to get 15.
B	Mixed up the 75-degree angles and the 105-degree angles in the green rhombus.
C	Correct. Pairs of interior and exterior angles in polygons have measures that sum to 180 degrees. $180 - 75 = 105$
D	Multiplied 75 degrees by 2 to get 150.

Section 3

Question 1

Which is equivalent to 1.4%?

- A. $\frac{1}{80}$
- B. $\frac{7}{500}$
- C. $1\frac{1}{4}$
- D. $1\frac{4}{10}$

Benchmark: 6.1.1.4
Determine equivalences among fractions, decimals and percents; select among these representations to solve problems.
For example: If a woman making $25 an hour gets a 10% raise, she will make an additional $2.50 an hour, because $2.50 is $1/10$ or 10% of $25.

Item Specifications

- Allowable notation: 50%, ¼ , 0.95, $0.\overline{25}$
- Percents must be between 1 and 100, inclusive
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 1
Calculator: CL
Answer: B

A	Mixed up 1.4% with 1 ¼%, then made the fraction 1.25/1000 which is equivalent to 1/80.
B	Correct. 1.4% equals the decimal 0.014 which is equal to 14/1000 which equals 7/500.
C	Made fraction by putting 1 over 4 instead of 0.04 over 100 and kept the whole number 1.
D	Ignored percent symbol, using 1.4 instead of 0.014. Made 1.4 into the mixed number 1 4/10.

Question 2

What is the greatest common factor of 48 and 64?

- A. 2
- B. 8
- C. 16
- D. 24

Benchmark: 6.1.1.6
Determine greatest common factors and least common multiples. Use common factors and common multiples to calculate with fractions and find equivalent fractions.
For example: Factor the numerator and denominator of a fraction to determine an equivalent fraction.

Item Specifications
- Vocabulary allowed in items: greatest common factor, least common multiple, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: C

A	Chose the least common factor instead of the greatest.
B	Chose a common factor of 48 and 64, but it is not the greatest common factor.
C	Correct. $48 = 2 \times 2 \times 2 \times 2 \times 3$ and $64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$
D	Chose a factor of 48 that is not a factor of 64.

Question 3

A paint color is made using 4 drops of red and 5 drops of blue for each 5 gallons of paint. How many gallons of paint are being colored when 45 drops of color are used?

- A. 9
- B. 25
- C. 45
- D. 81

Benchmark: 6.1.2.2
Apply the relationship between ratios, equivalent fractions and percents to solve problems in various contexts, including those involving mixtures and concentrations.
For example: If 5 cups of trail mix contains 2 cups of raisins, the ratio of raisins to trail mix is 2 to 5. This ratio corresponds to the fact that the raisins are $2/5$ of the total, or 40% of the total. And if one trail mix consists of 2 parts peanuts to 3 parts raisins, and another consists of 4 parts peanuts to 8 parts raisins, then the first mixture has a higher concentration of peanuts.

Item Specifications

- Allowable ratio notation: $\frac{1}{4}$, 1 to 4, $1:4$, 1 out of 4, 25%
- Rates may be expressed using the word "per"
- Vocabulary allowed in items: ratio, percent, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: B

A	Divided 45 by 9, but did not multiply by 5.
B	Correct. 9 drops for 5 gallons is equivalent to 45 drops for 25 gallons.
C	Multiplied 5 by 9.
D	Multiplied 9 by 45, then divided by 5 instead of $5 \times 45/9$.

Question 4

Conor reads 3 pages every 4 minutes. At this rate, how many pages can he read in 30 minutes?

Enter your answer in the box.

Benchmark: 6.1.2.4
Use reasoning about multiplication and division to solve ratio and rate problems.
For example: If 5 items cost $3.75, and all items are the same price, then 1 item costs 75 cents, so 12 items cost $9.00.

Item Specifications

- Allowable ratio notation: ¼, 1 to 4, 1:4, 1 out of 4
- Rates may be expressed using the word "per"
- Vocabulary allowed in items: rate, ratio, 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.

Conor reads 3 pages every 4 minutes. At this rate, how many pages can he read in 30 minutes?

Enter your answer in the box.

22.5

Notes on grade expectations: Students often mistakenly think the answer cannot be a fractional part and round the answer to a whole number. In this example, the student is asked about rate and the answer should be in decimal form.

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 5

A phone company uses the equation $y = 0.15x + 10$ to find *y*, the monthly charge for a customer sending *x* text messages. How many text messages are sent if the monthly charge is $77.50?

- A. 10
- B. 21
- C. 450
- D. 506

Benchmark: 6.2.3.2
Solve equations involving positive rational numbers using number sense, properties of arithmetic and the idea of maintaining equality on both sides of the equation. Interpret a solution in the original context and assess the reasonableness of results.
For example: A cellular phone company charges $0.12 per minute. If the bill was $11.40 in April, how many minutes were used?

Item Specifications

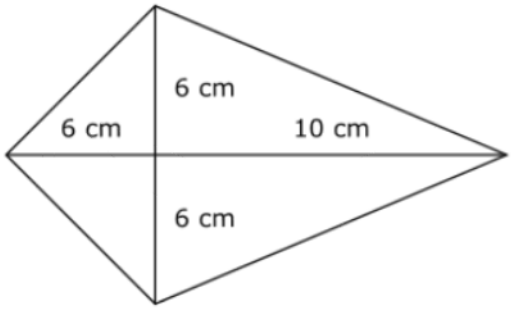
- Allowable multiplication notation: 3*x*, *xy*, $3 \cdot 4$, 3(4), x^2
- Vocabulary allowed in items: reasonable, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: C

A	Used 10 from the equation.
B	Substituted 77.5 for *x* and solved for *y* instead of doing the opposite.
C	Correct. $77.5 = 0.15x + 10$; 67.5 = 0.15*x*; *x* = 450
D	Divided 77.50 by 0.15 before subtracting 10; $(77.50/0.15) - 10 \approx 506$.

Question 6

A scale drawing of a kite is shown.



What is the area of the kite?

- A. $28\ \text{cm}^2$
- B. $60\ \text{cm}^2$
- C. $96\ \text{cm}^2$
- D. $192\ \text{cm}^2$

Benchmark: 6.3.1.2
Calculate the area of quadrilaterals. Quadrilaterals include squares, rectangles, rhombuses, parallelograms, trapezoids and kites. When formulas are used, be able to explain why they are valid.
For example: The area of a kite is one-half the product of the lengths of the diagonals, and this can be justified by decomposing the kite into two triangles.

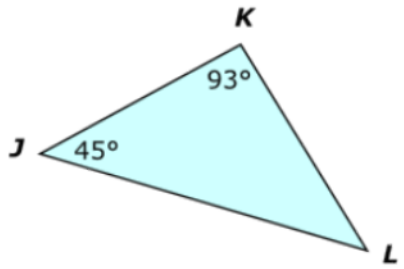
Item Specifications
- Congruent side marks (hash marks) may be used
- Allowable notation: 3 square centimeters, 3 cm sq, 3 cm^2
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: C

A	Added all the labeled lengths; $6 + 6 + 6 + 10 = 28$.
B	Multiplied 6×10 and found area of right two triangular sections but missed area of left two triangular sections.
C	Correct. $1/2 \times (6 + 6) \times (6 + 10) = 96$
D	Found area of rectangles with the labeled side lengths instead of triangles; $6 \times 10 + 6 \times 10 + 6 \times 6 + 6 \times 6 = 192$.

Question 7

A triangle is shown.



What is $m\angle L$?

A. 42°

B. 45°

C. 48°

D. 138°

Benchmark: 6.3.2.2
Determine missing angle measures in a triangle using the fact that the sum of the interior angles of a triangle is $180°$. Use models of triangles to illustrate this fact.
For example: Cut a triangle out of paper, tear off the corners and rearrange these corners to form a straight line.
Another example: Recognize that the measures of the two acute angles in a right triangle sum to $90°$.

Item Specifications

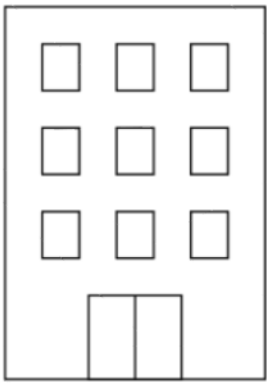
- Allowable notation: $\angle A$, $m\angle A$, ΔABC
- Vocabulary allowed in items: adjacent, complementary, supplementary, interior, exterior, hypotenuse, leg, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer: A

A	Correct. $180 - 93 - 45 = 42$
B	Used 90 degrees for angle *K*; $180 - 90 - 45 = 45$.
C	Incorrectly modified 45-45-90 triangle, by adding 3 to 45 instead of subtracting 3 from 45.
D	Added 93 and 45.

Question 8

A building has 9 windows. Each window is 5 feet tall.



About how tall is the building?

- A. 15 feet
- B. 25 feet
- C. 40 feet
- D. 45 feet

Benchmark: 6.3.3.2
Estimate weights, capacities and geometric measurements using benchmarks in measurement systems with appropriate units.
For example: Estimate the height of a house by comparing to a 6-foot man standing nearby.

Item Specifications
- Vocabulary allowed in items: customary, metric, capacity, and vocabulary given at previous grades

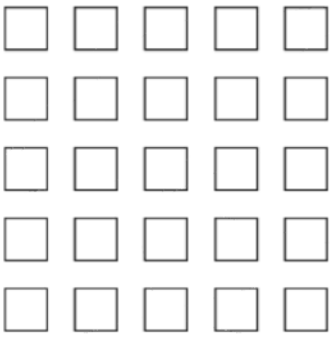
DOK: 2
Calculator: CL
Answer: C

A	Multiplied 3 rows of windows by 5 feet; $3 \times 5 = 15$.
B	Estimated the doors as 2 windows high, then multiplied 5 rows of windows by 5 feet; $5 \times 5 = 25$.
C	Correct. Estimated building as 8 windows high; $8 \times 5 = 40$.
D	Multiplied the two given numbers; $9 \times 5 = 45$.

Question 9

Ryan has 25 tiles. The probability that he randomly chooses a green tile is 12%. Show how many of Ryan's tiles are green.

Select the tiles you want to choose.



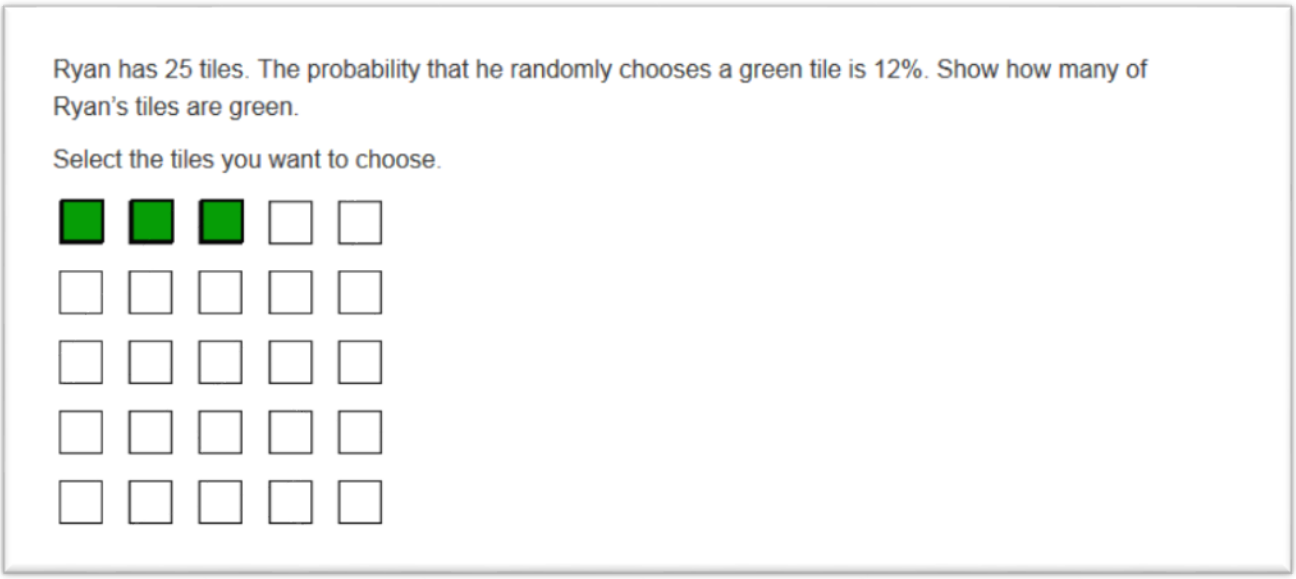
Benchmark: 6.4.1.2
Determine the probability of an event using the ratio between the size of the event and the size of the sample space; represent probabilities as percents, fractions and decimals between 0 and 1 inclusive. Understand that probabilities measure likelihood.

For example: Each outcome for a balanced number cube has probability $1/6$ and the probability of rolling an even number is $1/2$.

Item Specifications
- Size of the sample space is no more than 100
- Vocabulary allowed in items: probability, outcome, event, likely, unlikely, certain, impossible, ratio, random, sample space, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer:

This is a technology-enhanced item. A correct answer is shown. A student may select any 3 tiles in order to receive 1 point.



Notes on grade expectations: To find 12% of 25, multiply 0.12×25 to get 3.

Question 10

Tyler has a stack of cards. He picks a card, records the color, and returns the card to the stack. He repeats this 60 times and chooses a red card 24 times. What is the experimental probability of choosing a red card from the stack?

- A. 0.14
- B. 0.23
- C. 0.40
- D. 2.50

Benchmark: 6.4.1.4
Calculate experimental probabilities from experiments; represent them as percents, fractions and decimals between 0 and 1 inclusive. Use experimental probabilities to make predictions when actual probabilities are unknown.
For example: Repeatedly draw colored chips with replacement from a bag with an unknown mixture of chips, record relative frequencies, and use the results to make predictions about the contents of the bag.

Item Specifications
- Size of the sample space is no more than 100
- Vocabulary allowed in items: probability, outcome, event, experimental, frequency, predict, random, and vocabulary given at previous grades

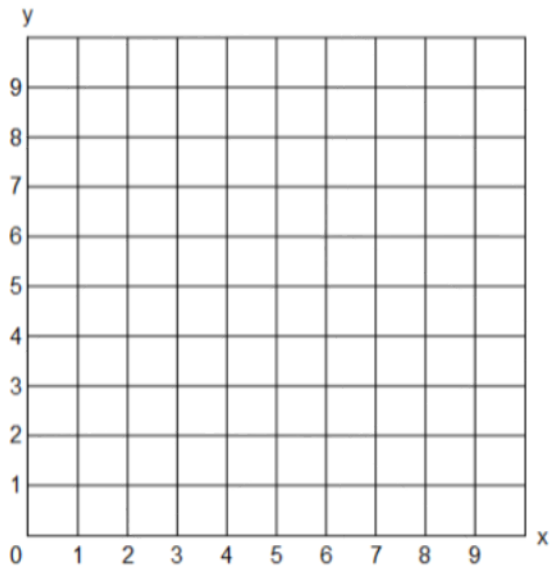
DOK: 2
Calculator: CL
Answer: C

A	Found $(60+24)/60 = 1.4$; misplaced the decimal point.
B	Miscalculated.
C	Correct. $24/60 = 0.40$
D	Divided the total number of draws by the number of red cards drawn instead reds/total; $60/24 = 2.50$.

Question 11

The equation $y = 3x + 1$ represents a line. Graph this line on the coordinate grid.

Select 2 points on the coordinate grid. A line will connect the 2 points.



Benchmark: 6.2.1.2
Represent the relationship between two varying quantities with function rules, graphs and tables; translate between any two of these representations.
For example: Describe the terms in the sequence of perfect squares
t = 1, 4, 9, 16, ... by using the rule t = n 2 for n = 1, 2, 3, 4, ...

Item Specifications

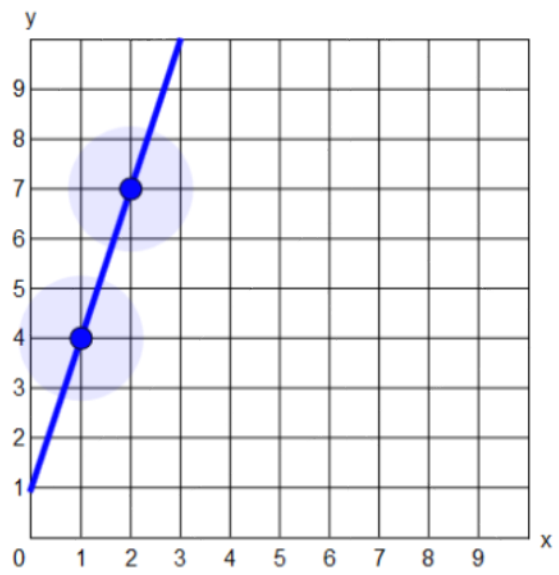
- Allowable multiplication notation: 3*x*, *xy*, $3 \cdot 4$, 3(4)
- Equations will not contain exponents
- Vocabulary allowed in items: translate, function, coordinate grid, and vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer:

This is a technology-enhanced item. The correct answer is shown. A student must select any two points on the line in order to receive 1 point.

The equation $y = 3x + 1$ represents a line. Graph this line on the coordinate grid.

Select 2 points on the coordinate grid. A line will connect the 2 points.



Notes on grade expectations: A grade 6 student has experience in graphing points on a coordinate grid (6.1.1.1) and solving equations when values for a variable are given (5.2.3.3). This item requires the student to use the two skills to determine the points for the line.

Any two of the following points can be used to create the line for $y = 3x + 1$.

x	***y***
0	1
1	4
2	7
3	10

Question 12

Which numbers are equivalent to $\frac{18}{72}$?

Select the numbers you want to choose.

- [ ] 25%
- [ ] $\frac{1}{9}$
- [ ] 0.14
- [ ] 4%
- [ ] $\frac{9}{36}$
- [ ] 1.4%
- [ ] 2.5

Benchmark: 6.1.1.4

Determine equivalences among fractions, decimals and percents; select among these representations to solve problems.
For example: If a woman making $25 an hour gets a 10% raise, she will make an additional $2.50 an hour, because $2.50 is $1/10$ or 10% of $25.

Item Specifications

- Allowable notation: 50%, ¼ , 0.95,
- Percents must be between 1 and 100, inclusive
- 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 check both boxes in order to receive 1 point.

Which numbers are equivalent to $\frac{18}{72}$?

Select the numbers you want to choose.

- [x] 25%
- [ ] $\frac{1}{9}$
- [ ] 0.14
- [ ] 4%
- [x] $\frac{9}{36}$
- [ ] 1.4%
- [ ] 2.5

Question 13

An equation is shown.

$$6(14) + 12 = c$$

Complete the sentence to make a true statement about the equation.

Select a phrase.

The equation shows that *c* is equal to [Choose...].

Benchmark: 6.2.3.1
Represent real-world or mathematical situations using equations and inequalities involving variables and positive rational numbers.
For example: The number of miles *m* in a *k* kilometer race is represented by the equation *m* = 0.62*k*.

Item Specifications

- Allowable multiplication notation: 3*x*, *xy*, $3 \cdot 4$, 3(4), *x*2
- $<, >$ and $=$ symbols are allowed
- Vocabulary allowed in items: vocabulary given at previous grades

DOK: 2
Calculator: CL
Answer:

This is a technology-enhanced item. The correct answer is highlighted. A student must select the correct statement from the drop-down menu in order to receive 1 point.

An equation is shown.

$$6(14) + 12 = c$$

Complete the sentence to make a true statement about the equation.

Select a phrase.

The equation shows that *c* is equal to [12 more than the].

The options for the drop-down menu are shown below.

12 more than the p .

Choose...
the sum of 14 and 12
6 times the sum of 14 and 12
12 more than the product of 6 and 14
the product of 6, 14, and 12
the sum of 6 and the product of 12 and 14

Grade 6 Mathematics MCA Item Sampler
Paper Answer Key

Segment 1
8 Questions

Item #	Correct Answer	Item Type	Online Sampler Location	Benchmark	Calculator
1	C	MC	Sec. 2, #3	6.1.1.7	NC
2	A	MC	Sec. 2, #4	6.1.3.1	NC
3	C	MC	Sec. 2, #5	6.1.1.3	NC
4	B	MC	Sec. 2, #6	6.1.1.5	NC
5	D	MC	Sec. 2, #7	6.2.1.1	NC
6	D	MC	Sec. 2, #8	6.2.1.2	NC
7	C	MC	Sec. 2, #9	6.2.2.1	NC
8	C	MC	Sec. 2, #10	6.3.2.1	NC

Segment 2
17 Questions

Item #	Correct Answer	Item Type	Online Sampler Location	Benchmark	Calculator
9	D	MC	Sec. 1, #1	6.1.1.2	CL
10	C	MC	Sec. 1, #2	6.1.2.1	CL
11	A	MC	Sec. 1, #3	6.1.2.3	CL
12	C	MC	Sec. 1, #4	6.1.3.3	CL
13	D	MC	Sec. 1, #5	6.3.1.1	CL
14	A	MC	Sec. 1, #6	6.3.1.3	CL
15	A	MC	Sec. 1, #8	6.3.3.1	CL
16	Grid	GR	Sec. 1, #9	6.4.1.1	CL
17	D	MC	Sec. 1, #10	6.4.1.3	CL
18	B	MC	Sec. 3, #1	6.1.1.4	CL
19	C	MC	Sec. 3, #2	6.1.1.6	CL
20	B	MC	Sec. 3, #3	6.1.2.2	CL
21	C	MC	Sec. 3, #5	6.2.3.2	CL
22	C	MC	Sec. 3, #6	6.3.1.2	CL
23	A	MC	Sec. 3, #7	6.3.2.2	CL
24	C	MC	Sec. 3, #8	6.3.3.2	CL
25	C	MC	Sec. 3, #10	6.4.1.4	CL