COMMON CORE ASSESSMENT COMPARISON FOR MATHEMATICS

GRADE 6

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INTRODUCTION

The purpose of this document is to illustrate the differences between the Delaware Comprehensive Assessment System (DCAS) and the expectations of the next-generation Common Core State Standard (CCSS) assessment in Mathematics. A side-by-side comparison of the current design of an operational assessment item and the expectations for the content and rigor of a next-generation Common Core mathematical item are provided for each CCSS. The samples provided are designed to help Delaware's educators better understand the instructional shifts needed to meet the rigorous demands of the CCSS. This document does not represent the test specifications or blueprints for each grade level, for DCAS, or the next-generation assessment.

For mathematics, next-generation assessment items were selected for CCSS that represent the shift in content at the new grade level. Sites used to select the next-generation assessment items include:

- Smarter Balanced Assessment Consortium
- Partnership of Assessment of Readiness for College and Career
- Illustrative Mathematics
- Mathematics Assessment Project

Using released items from other states, a DCAS-like item, aligned to the same CCSS, was chosen. These examples emphasize the contrast in rigor between the previous Delaware standards, known as Grade-Level Expectations, and the Common Core State Standards.

Section 1, DCAS-Like and Next-Generation Assessment Comparison, includes content that is in the CCSS at a different "rigor" level. The examples are organized by the CCSS. For some standards, more than one example may be given to illustrate the different components of the standard. Additionally, each example identifies the standard and is separated into two parts. Part A is an example of a DCAS-like item, and Part B is an example of a next-generation item based on CCSS.

Section 2 includes at least one Performance Task that addresses multiple aspects of the CCSS (content and mathematical practices).

How to Use Various Aspects of This Document
- Analyze the way mathematics standards are conceptualized in each item or task.
- Identify the instructional shifts that need to occur to prepare students to address these more rigorous demands. Develop a plan to implement the necessary instructional changes.
- Notice how numbers (e.g., fractions instead of whole numbers) are used in the sample items.
- Recognize that the sample items and tasks are only one way of assessing the standard.
- Understand that the sample items and tasks do not represent a mini-version of the next-generation assessment.
- Instruction should address "focus," coherence," and "rigor" of mathematics concepts.
- Instruction should embed mathematical practices when teaching mathematical content.

- For grades K–5, calculators should not be used as the concepts of number sense and operations are fundamental to learning new mathematics content in grades 6–12.
- The next-generation assessment will be online and the scoring will be done electronically. It is important to note that students may not be asked to show their work and therefore will not be given partial credit. It is suggested when using items within this document in the classroom for formative assessments, it is good practice to have students demonstrate their methodology by showing or explaining their work.

Your feedback is welcome. Please do not hesitate to contact Katia Foret at katia.foret@doe.k12.de.us or Rita Fry at rita.fry@doe.k12.de.us with suggestions, questions, and/or concerns.

* The Smarter Balanced Assessment Consortium has a 30-item practice test available for each grade level (3-8 and 11) for mathematics and ELA (including reading, writing, listening, and research). These practice tests allow students to experience items that look and function like those being developed for the Smarter Balanced assessments. The practice test also includes performance tasks and is constructed to follow a test blueprint similar to the blueprint intended for the operational test. The Smarter Balanced site is located at: http://www.smarterbalanced.org/.

Priorities in Mathematics

Grade	Priorities in Support of Rich Instruction and Expectations of Fluency and Conceptual Understanding
K–2	Addition and subtraction, measurement using whole number quantities
3–5	Multiplication and division of whole numbers and fractions
6	Ratios and proportional reasoning; early expressions and equations
7	Ratios and proportional reasoning; arithmetic of rational numbers
8	Linear algebra

Common Core State Standards for Mathematical Practices

Mathematical Practices		Student Dispositions:	Teacher Actions to Engage Students in Practices:
Essential Processes for a Productive Math Thinker	**1. Make sense of problems and persevere in solving them**	▪ Have an understanding of the situation ▪ Use patience and persistence to solve problem ▪ Be able to use different strategies ▪ Use self-evaluation and redirections ▪ Communicate both verbally and written ▪ Be able to deduce what is a reasonable solution	▪ Provide open-ended and rich problems ▪ Ask probing questions ▪ Model multiple problem-solving strategies through Think-Aloud ▪ Promote and value discourse ▪ Integrate cross-curricular materials ▪ Promote collaboration ▪ Probe student responses (correct or incorrect) for understanding and multiple approaches ▪ Provide scaffolding when appropriate ▪ Provide a safe environment for learning from mistakes
	6. Attend to precision	▪ Communicate with precision—orally and written ▪ Use mathematics concepts and vocabulary appropriately ▪ State meaning of symbols and use them appropriately ▪ Attend to units/labeling/tools accurately ▪ Carefully formulate explanations and defend answers ▪ Calculate accurately and efficiently ▪ Formulate and make use of definitions with others ▪ Ensure reasonableness of answers ▪ Persevere through multiple-step problems	▪ Encourage students to think aloud ▪ Develop explicit instruction/teacher models of thinking aloud ▪ Include guided inquiry as teacher gives problem, students work together to solve problems, and debrief time for sharing and comparing strategies ▪ Use probing questions that target content of study ▪ Promote mathematical language ▪ Encourage students to identify errors when answers are wrong
Reasoning and Explaining	**2. Reason abstractly and quantitatively**	▪ Create multiple representations ▪ Interpret problems in contexts ▪ Estimate first/answer reasonable ▪ Make connections ▪ Represent symbolically ▪ Talk about problems, real-life situations ▪ Attend to units ▪ Use context to think about a problem	▪ Develop opportunities for problem-solving strategies ▪ Give time for processing and discussing ▪ Tie content areas together to help make connections ▪ Give real-world situations ▪ Demonstrate thinking aloud for students' benefit ▪ Value invented strategies and representations ▪ More emphasis on the process instead of on the answer
	3. Construct viable arguments and critique the reasoning of others	▪ Ask questions ▪ Use examples and counter examples ▪ Reason inductively and make plausible arguments ▪ Use objects, drawings, diagrams, and actions ▪ Develop ideas about mathematics and support their reasoning ▪ Analyze others arguments ▪ Encourage the use of mathematics vocabulary	▪ Create a safe environment for risk-taking and critiquing with respect ▪ Provide complex, rigorous tasks that foster deep thinking ▪ Provide time for student discourse ▪ Plan effective questions and student grouping ▪ Probe students

Mathematical Practices		Students:	Teacher(s) promote(s) by:
Modeling and Using Tools	**4. Model with mathematics**	- Realize that mathematics (numbers and symbols) is used to solve/work out real-life situations - Analyze relationships to draw conclusions - Interpret mathematical results in context - Show evidence that they can use their mathematical results to think about a problem and determine if the results are reasonable—if not, go back and look for more information - Make sense of the mathematics	- Allowing time for the process to take place (model, make graphs, etc.) - Modeling desired behaviors (think alouds) and thought processes (questioning, revision, reflection/written) - Making appropriate tools available - Creating an emotionally safe environment where risk-taking is valued - Providing meaningful, real-world, authentic, performance-based tasks (non-traditional work problems) - Promoting discourse and investigations
	5. Use appropriate tools strategically	- Choose the appropriate tool to solve a given problem and deepen their conceptual understanding (paper/pencil, ruler, base ten blocks, compass, protractor) - Choose the appropriate technological tool to solve a given problem and deepen their conceptual understanding (e.g., spreadsheet, geometry software, calculator, web 2.0 tools) - Compare the efficiency of different tools - Recognize the usefulness and limitations of different tools	- Maintaining knowledge of appropriate tools - Modeling effectively the tools available, their benefits, and limitations - Modeling a situation where the decision needs to be made as to which tool should be used - Comparing/contrasting effectiveness of tools - Making available and encouraging use of a variety of tools
Seeing Structure and Generalizing	**7. Look for and make use of structure**	- Look for, interpret, and identify patterns and structures - Make connections to skills and strategies previously learned to solve new problems/tasks independently and with peers - Reflect and recognize various structures in mathematics - Breakdown complex problems into simpler, more manageable chunks "Step back" or shift perspective - Value multiple perspectives	- Being quiet and structuring opportunities for students to think aloud - Facilitating learning by using open-ended questions to assist students in exploration - Selecting tasks that allow students to discern structures or patterns to make connections - Allowing time for student discussion and processing in place of fixed rules or definitions - Fostering persistence/stamina in problem solving - Allowing time for students to practice
	8. Look for and express regularity in repeated reasoning	- Identify patterns and make generalizations - Continually evaluate reasonableness of intermediate results - Maintain oversight of the process - Search for and identify and use shortcuts	- Providing rich and varied tasks that allow students to generalize relationships and methods and build on prior mathematical knowledge - Providing adequate time for exploration - Providing time for dialogue, reflection, and peer collaboration - Asking deliberate questions that enable students to reflect on their own thinking - Creating strategic and intentional check-in points during student work time

For classroom posters depicting the Mathematical Practices, please see: http://seancarberry.cmswiki.wikispaces.net/file/detail/12-20math.docx

RATIOS AND PROPORTIONAL RELATIONSHIPS (RP)

Cluster: Understand ratio concepts and use ratio reasoning to solve problems.

6.RP.1 – Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.." "For every vote candidate A received, candidate C received nearly three votes."*

DCAS-Like

1A

The table below shows the 2009 population of Tennessee was represented by different age groups.

Tennessee Population in 2009

Age Group	Percent of Total Population
0 to 4	7
5 to 18	17
19 to 64	63
65 and over	13

Based on this information, which ratio represents the percent of the total population who were in the 65 and over age group to the percent of the total population who were in the 0 to 18 age group in Tennessee in 2009?

A. 1:8

B. 1:5

C. 13:24

D. 13:17

1B

The jar below contains grape and lemon jelly beans.

Key: ⬤ = lemon
⬤ = grape
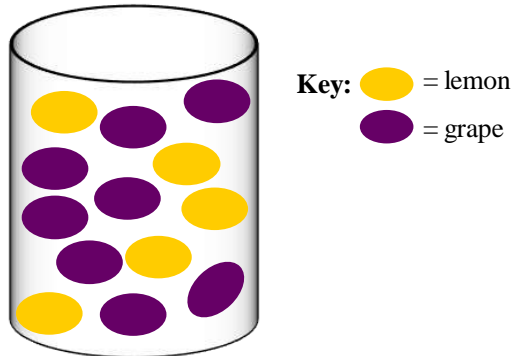
a. What is the ratio of lemon jelly beans to grape jelly beans?

_____

b. How many grape jelly beans would have to be added so that the ratio is 1 lemon jelly bean for 2 grape jelly beans?

_____

c. Show this solution by adding the grape jelly beans in the jar. How many beans are in the jar now?

_____

d. With the added jelly beans, write the ratio of lemon jelly beans to the whole jar of jelly beans in fraction form.

_____

e. With the added jelly beans, write the ratio of grape jelly beans to the whole jar of jelly beans in fraction form.

_____

6.RP.2 – Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0 (b not equal to zero), and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." (Expectations for unit rates in this grade are limited to non-complex fractions.)*

<div align="center">**DCAS-Like**</div>

2A

Ms. Anderson traveled from Nashville, Tennessee, to Kansas City, Missouri. Her trip was 480 miles and took 7 hours 30 minutes. Which trip represents the same rate of travel?

A. 120 miles in 2 hours

B. 192 miles in 3 hours

C. 100 miles in 1 hour 30 minutes

D. 240 miles in 3 hours 15 minutes

<div align="center">**Next-Generation**</div>

2B

Tony took the escalator to the second floor. The escalator is 12 meters long, and he rode the escalator for 30 seconds. Which statements are true? Select all that apply.

a. He traveled 2 meters every 5 seconds.   ○ True   ○ False

b. Every 10 seconds he traveled 4 meters.   ○ True   ○ False

c. He traveled 2.5 meters per second.   ○ True   ○ False

d. He traveled 0.4 meters per second.   ○ True   ○ False

e. Every 25 seconds, he traveled 7 meters.   ○ True   ○ False

6.RP.2 – Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0 (b not equal to zero), and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." (Expectations for unit rates in this grade are limited to non-complex fractions.)*

DCAS-Like

3A

A laundry detergent is sold at four stores.

Store	Size (ounces)	Price
Hawkin's Store	60	$6.50
Don's Store	54	$5.50
Allen's Market	48	$5.61
Value Market	40	$4.50

Which store has the lowest price per ounce?

A. Hawkin's Store

B. Don's Store

C.   Allen's Market

D. Value Market

Next-Generation

3B

The grocery store sells beans in bulk. The grocer's sign above the beans says:

5 pounds for $4

At this store, you can buy any number of pounds of beans at this same rate, and all prices include tax.

Alberto said, "The ratio of the number of dollars to the number of pounds is 4:5. That's $0.80 per pound."

Beth said, "The sign says the ratio of the number of pounds to the number of dollars is 5:4. That's 1.25 pounds per dollar."

a. Are Alberto and Beth both correct? Explain.

b. Claude needs $2\frac{1}{4}$ pounds of beans to make soup. How much money will he need?

c. Dora has $10 and wants to stock up on beans. How many pounds of beans can she buy?

d. Do you prefer to answer parts b. and c. using Albert's rate of $0.80 per pounds, using Beth's rate of 1.25 pounds per dollar, or using another strategy? Explain.

6.RP.3 – Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

    a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

    b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*

    c. Find a percentage of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percentage.

    d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

DCAS-Like

4A

A brand of pasta costs $2.10 for 14 ounces. At this rate, what is the price for 22 ounces of this brand of pasta?

A. $0.10

B. $0.15

C. $2.90

D. $3.30

Next-Generation

4B

Alia wants to buy pizza for a party.

- 40 to 50 people will be coming to the party.
- A large pizza from Paolo's Pizza Place serves 3 to 4 people.
- Each large pizza from Paolo's Pizza Place costs $11.50.

a. Alia wants to buy enough pizza so that people will not be hungry, and wants to have the least amount of pizza left over. How many large pizzas should Alia buy?

                                                   _____ pizzas

b. If Alia buys the number of large pizzas that you determined in Item a., how much money will she spend on pizza?

                                                  $_____

6.RP.3 – Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

    a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

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    c. Find a percentage of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percentage.

    d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

DCAS-Like

5A

Mr. Smith asked his students whether they prefer to go to a museum or the zoo for a field trip. He found that 35% of the students prefer to go to a museum, 45% prefer to go to the zoo, and the rest have no preference. What is the ratio of students who have no preference to the students who prefer to go to the museum?

A. 1:4

B. 1:5

C. 4:7

D. 4:9

Next-Generation

5B

In art class, Marvin painted tiles to use for a project. For every 5 tiles he painted blue, he painted 8 tiles green.

Identify the equivalent ratio(s) of blue tiles to green tiles. Select all that apply.

a. 20:23

b. 40:25

c. 50:800

d. 60:96

6.RP.3 – Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

    a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

    b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*

    c. Find a percentage of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percentage.

    d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

DCAS-Like

6A

A rectangular painting has an area of 720 square inches. Jasmine reduced both the length and width of this painting by a scale factor of $\frac{1}{6}$ to create a miniature copy. What is the area of the miniature copy?

A. 12 square inches

B. 20 square inches

C. 60 square inches

D. 120 square inches

Next-Generation

6B

Alexis needs to paint the four exterior walls of a large rectangular barn. The length of the barn is 80 feet, the width is 50 feet, and the height is 30 feet. The paint costs $28 per gallon, and each gallon covers 420 square feet. How much will it cost Alexis to paint the barn? Explain your work.

6.RP.3 – Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

   a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

   b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*

   c. Find a percentage of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percentage.

   d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

DCAS-Like

7A

Juanita earns $36 for 3 hours of work. At that rate, how long would she have to work to earn $720?

A. 12 hours

B. 20 hours

C. 60 hours

D. 140 hours

Next-Generation

7B

Joe was planning a business trip to Canada, so he went to the bank to exchange $200 U.S. dollars for Canadian (CDN) dollars (at a rate of $1.02 CDN per $1 U.S.). On the way home from the bank, Joe's boss called to say that the destination of the trip had changed to Mexico City. Joe went back to the bank to exchange his Canadian dollars for Mexican pesos (at a rate of 10.8 pesos per $1 CDN).

How many Mexican pesos did Joe get? Show how you got your answer.

THE NUMBER SYSTEM (NS)

Cluster: Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

6.NS.1 – Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.). How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*

DCAS-Like

8A

How long is a rectangular strip of land with a width of $\frac{5}{4}$ km and an area of $\frac{3}{4}$ square km?

A. $\frac{3}{5}$ km

B. $\frac{4}{5}$ km

C. $\frac{5}{3}$ km

D. $\frac{1}{2}$ km

Next-Generation

8B

Deb is stuck in a big traffic jam on the freeway and she is wondering how long it will take to get to the next exit, which is $1\frac{1}{2}$ miles away.

She is timing her progress and finds that she can travel $\frac{2}{3}$ of a mile in one hour. If she continues to make progress at this rate, how long will it be until she reaches the exit? Solve the problem with a diagram and explain your answer.

6.NS.1 – Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.). How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*

<div align="center">

DCAS-Like

</div>

9A

$6\frac{2}{7} \div 2\frac{3}{4} = $ _____

A. $2\frac{2}{7}$

B. $17\frac{2}{7}$

C. $2\frac{6}{11}$

D. $\frac{7}{16}$

<div align="center">

Next-Generation

</div>

9B

Alice, Raul, and Maria are baking cookies together. They need $\frac{3}{4}$ cup of flour and $\frac{1}{3}$ cup of butter to make a dozen cookies. They each brought the ingredients they had at home.

Alice brought 2 cups of flour and $\frac{1}{4}$ cup of butter, Raul brought 1 cup of flour and $\frac{1}{2}$ cup of butter, and Maria brought $1\frac{1}{4}$ cups of flour and $\frac{3}{4}$ cup of butter. If the students have plenty of the other ingredients they need (sugar, salt, baking soda, etc.), how many whole batches of a dozen cookies each can they make?

6.NS.1 − Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.). How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*

<div align="center">**DCAS-Like**</div>

10A

You have $2\frac{2}{3}$ cups of dried fruit to divide evenly among 3 children. How many cups of fruit will each child receive?

A. $\dfrac{7}{9}$

B. $\dfrac{9}{7}$

C. $\dfrac{8}{9}$

D. $\dfrac{9}{8}$

<div align="center">**Next-Generation**</div>

10B

Hisaki is making sugar cookies for a school bake sale. He has $3\frac{1}{2}$ cups of sugar. The recipe calls for $\dfrac{3}{4}$ cup of sugar for one batch of cookies. Which equation can be used to find b, the total number of batches of sugar cookies Hisaki can make?

a. $3\frac{1}{2} \times \frac{3}{4} = b$

b. $3\frac{1}{2} \div \frac{3}{4} = b$

c. $3\frac{1}{2} + b = \frac{3}{4}$

d. $3\frac{1}{2} - b = \frac{3}{4}$

6.NS.1 – Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.). How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*

<div align="center">**DCAS-Like**</div>

11A

The serving size for a toddler's daily vitamin C is $\frac{3}{4}$ cup of orange juice. If there are $2\frac{1}{4}$ cups of orange juice, how many servings of vitamin C are there for a toddler?

A. $\dfrac{16}{27}$

B. $\dfrac{12}{36}$

C. $1\dfrac{11}{16}$

D. 3

<div align="center">**Next-Generation**</div>

11B

If Monique wanted to run $\frac{7}{8}$ of a mile and she went to the school track which was one quarter of a mile long, how many laps would she have to run?

Which of the following equations could I use to find the answer? Check all that apply.

a. $L \times \dfrac{1}{4} = \dfrac{7}{8}$ ◯ Yes   ◯ No

b. $\dfrac{7}{8} \times \dfrac{1}{4} = L$ ◯ Yes   ◯ No

c. $\dfrac{7}{8} \times 4 = L$ ◯ Yes   ◯ No

d. $L \div \dfrac{7}{8} = \dfrac{1}{4}$ ◯ Yes   ◯ No

Cluster: Compute fluently with multi-digit numbers and find common factors and multiples.

6.NS.2 – Fluently divide multi-digit numbers using the standard algorithm.

DCAS-Like

12A

Marcus spent $3.25 to wash his car. If one quarter operates the car wash for 60 seconds, how long did it take him to wash his car?

A. 10 minutes

B. 13 minutes

C. 16 minutes

D. 32.5 minutes

Next-Generation

12B

a. Mr. Hall's first period class won the school recycling challenge. The PTSA baked 804 cookies for the winning class. If each of the 25 students in Mr. Hall's first period class will receive an equal share of cookies, how many cookies should each student receive? Give a written explanation to justify your solution.

b. The next month, the PTSA sponsored a food drive challenge and wanted each student in the winning class to receive 42 pieces of candy. The PTSA has collected 924 pieces of candy so far. If the winning class were selected today, how many students would need to be in the class so that each student could receive 42 pieces of candy? Give a written explanation to justify your solution.

6.NS.3 – Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

13A

Manny has $79.69 in his savings account. He takes out $34.37. How much money does he have left in the account?

A. $45.33

B. $45.32

C. $112.04

D. $114.06

13B

Hallie is in 6th grade and she can buy movie tickets for $8.25. Hallie's father was in 6th grade in 1987 when movie tickets cost $3.75.

a. When he turned 12, Hallie's father was given $20.00 so he could take some friends to the movies. How many movie tickets could he buy with this money?

b. How many movie tickets can Hallie buy for $20.00?

c. On Hallie's 12 birthday, her father said,

"When I turned 12, my dad gave me $20.00 so I could go with three of my friends to the movies and buy a large popcorn. I'm going to give you some money so you can take three of your friends to the movies and buy a large popcorn."

How much money do you think her father should give her?

6.NS.4 – Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4 (9 + 2).*

DCAS-Like

14A

A local reader's club has a set of 12 hardback books, a set of 18 paperbacks, and a set of 36 magazines. Each set can be divided equally among the club members. What is the greatest possible number of club members?

A. 3 members

B. 6 members

C. 4 members

D. 8 members

Next-Generation

14B

The florist can order roses in bunches of one dozen and lilies in bunches of 8. Last month she ordered the same number of roses as lilies. If she ordered no more than 100 roses, how many bunches of each could she have ordered? What is the smallest number of bunches of each that she could have ordered? Explain your reasoning.

6.NS.4 – Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4 (9 + 2).*

<hr>

DCAS-Like

15A

There are 190 guests at a wedding. What is the least number of circular tables needed to seat all the guests if each table seats exactly 8 people?

A. 22

B. 23

C. 24

D. 25

<hr>

Next-Generation

15B

a. Lindy is having a bake sale. She has 48 chocolate chip cookies to put in bags. How many bags can she fill if she puts the same number in each bag and uses them all? Find all the possibilities. Explain your reasoning.

b. Lindy has 64 vanilla wafer cookies to put in bags. How many bags can she fill if she puts the same number in each bag and uses them all? Find all the possibilities. Explain your reasoning.

c. How many bags can Lindy fill if she puts the chocolate chip cookies and the vanilla wafers in the same bags? She plans to use all the cookies and wants to include an equal number of chocolate chip cookies and an equal number of vanilla wafers in each bag. Explain your reasoning.

d. What is the largest number of bags she can make with an equal number of chocolate chip cookies and an equal number of vanilla wafers in each bag (assuming she uses them all)? Explain your reasoning.

Cluster: Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.5 – Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, debits/credits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

DCAS-Like

16A

One morning, the temperature was 5° below zero. By noon, the temperature rose 20° Fahrenheit (F) and then dropped 8°F by evening. What was the evening temperature?

A. 17° below zero

B. 15° below zero

C. 12° above zero

D. 7° above zero

Next-Generation

16B

Denver, Colorado is called "The Mile High City" because its elevation is 5280 feet above sea level. Someone tells you that the elevation of Death Valley, California is –282 feet.

a. Is Death Valley located above or below sea level? Explain.

b. How many feet higher is Denver than Death Valley? Explain

c. What would your elevation be if you were standing near the ocean? Explain

6.NS.6 – Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

   a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., -(-3) = 3, and that 0 is its own opposite.

   b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.

   c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

DCAS-Like

17A

The coordinates of the point A in the coordinate plane below are:
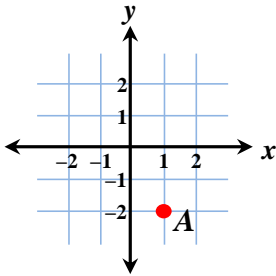
A. $(-1, -2)$

B. $(1, -2)$

C. $(-1, 2)$

D. $(-1, -2)$

Next-Generation

17B

The coordinates of point P are $(-6, 5)$. Point R is a reflection of point P across the x-axis.

The coordinates of point Q are $(-1, 0)$. Point T is a reflection of point Q across the y-axis.

Part A: Plot and label points P, Q, R, and T on the coordinate plane.
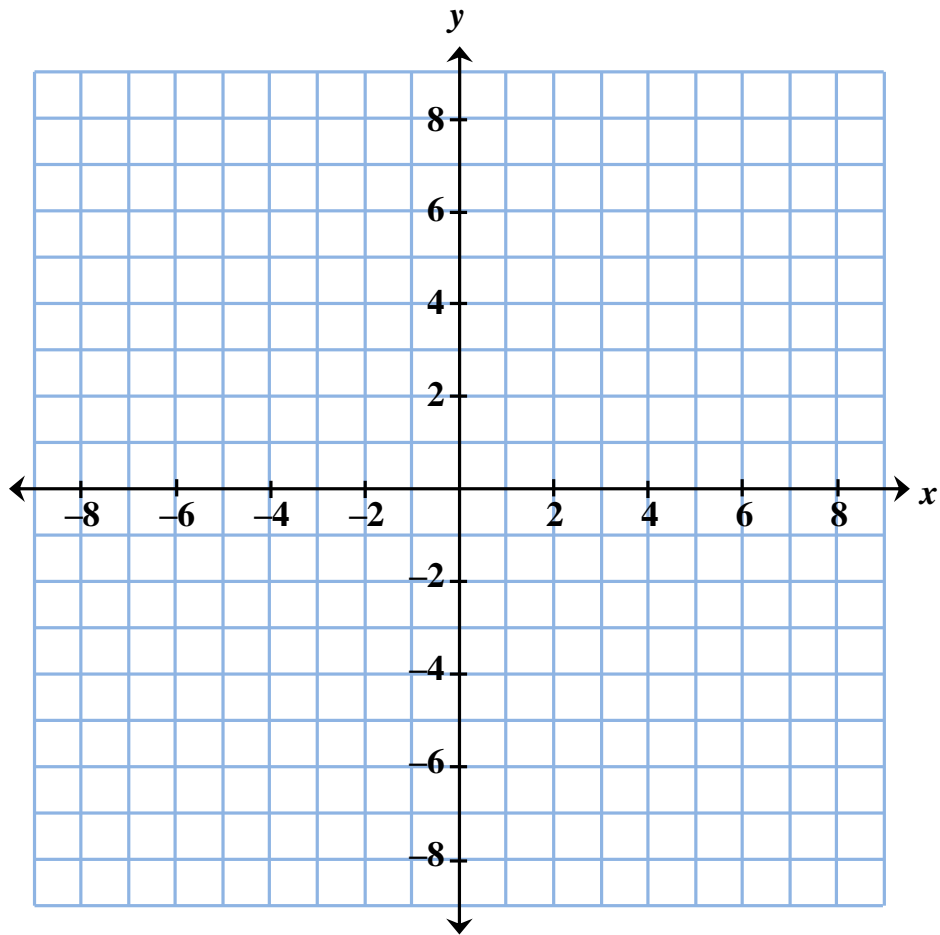
Part B: The coordinates of point V are $(7, 4)$. Point W is a reflection of point V across the x-axis.

In which quadrant will point W be located?

a. I

b. II

c. III

d. IV

6.NS.7 – Understand the ordering and the absolute value of rational numbers.

   a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right.*

   b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write -3 degrees C > -7 degrees C to express the fact that -3 degrees C is warmer than -7 degrees C.*

   c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of -30 dollars, write |-30| = 30 to describe the size of the debt in dollars.*

   d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.*

DCAS-Like

18A

Which number line shows Point *P* located closest to –15?

A.

B.

C.

D.
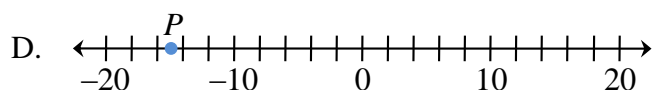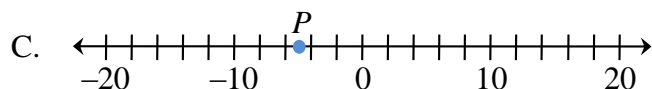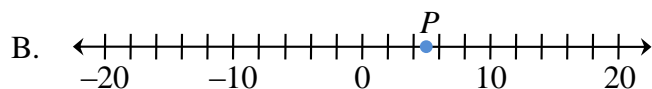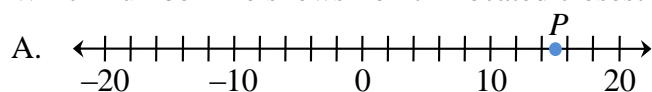
Next-Generation

18B

The level of the top of the water in the ocean is considered to be at an altitude of zero (0) feet.

- The ocean floor at a particular dive site is –20 feet.
- A diver is located at –5 feet at that same site.
- The captain of a boat is located at an altitude of 15 feet, directly above the diver.

a. The distance from the captain to the diver is greater than the distance from the top of the water to the ocean floor.

○ True   ○ False

b. The distance from the captain to the top of the water is the same as the distance from the diver to the ocean floor.

○ True   ○ False

c. When the diver swims to −10 feet, the diver will be the same distance below the top of the water as the captain is above the top of the water.

⭘ True   ⭘ False

d. When the diver swims to −10 feet, the diver's distance to the ocean floor will be equal to the diver's distance to the top of the water.

⭘ True   ⭘ False

6.NS.7 – Understand the ordering and the absolute value of rational numbers.

   a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right.*

   b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write -3 degrees C > -7 degrees C to express the fact that -3 degrees C is warmer than -7 degrees C.*

   c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of -30 dollars, write |-30| = 30 to describe the size of the debt in dollars.*

   d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.*

DCAS-Like

19A

Between noon and 10:00 p.m., Tyrone recorded –18°F as the change in temperature. Which <u>best</u> describes the change in temperature?

A. The temperature decreased by 18°F by 10:00 p.m.

B. The temperature increased 18°F by 10:00 p.m.

C. The temperature was –18°F at 10:00 p.m.

D. The temperature was 18°F at 10:00 p.m.

19B

The Tasty Treats Cake Factory bakes cakes to sell for a grocery chain. Each cake is weighed to see how close it is to the factory's target weight of 30 ounces. The scale shows how close the cake's weight is to the target. The scale will display:

- A positive number if the cake's weight is over 30 ounces.
- A negative number if the weight is less than 30 ounces.
- Zero if the weight is exactly 30 ounces.

Part A

On Monday, 3 cakes are weighed. The readings for the cakes are –2.1 ounces, –2.9 ounces, and 1.2 ounces.

Draw a dot on the number line below indicating the location of each reading.

a. –2.1

b. –2.9

c. 1.2
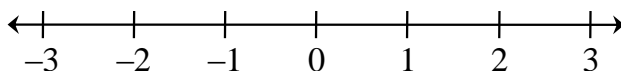
Part B

The table shows two readings from the scale on Tuesday.

Cake	Reading
F	–5 oz.
G	–3 oz.

Which of the following statements is true?

a. Cake F weighs less than Cake G because $-5 < -3$.   ○ True   ○ False

b. Cake F weighs more than Cake G because $-5 < -3$.   ○ True   ○ False

c. Cake F weighs less than Cake G because $-3 < -5$.   ○ True   ○ False

d. Cake F weighs more than Cake G because $-3 < -5$.   ○ True   ○ False

Part C

On Wednesday, the factory records the weights of 5 cakes. The reading with the largest absolute value belongs to:

a. The cake that weighs the least.

b. The cake that is closest to the target weight.

c. The cake that weighs the most.

d. The cake that is furthest from the target weight.

Part D

The scale is set to reject any cake that is more than 3 ounces from the target weight of 30 ounces. Which of the cakes would be rejected? Select all that apply.

a. A cake with a reading of –1.2 oz.　　　　○ Yes　　○ No

b. A cake with a reading of 2.7 oz.　　　　○ Yes　　○ No

c. A cake with a reading of –5.3 oz.　　　　○ Yes　　○ No

d. A cake with a reading of 3.1 oz.　　　　○ Yes　　○ No

6.NS.8 – Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

<center>**DCAS-Like**</center>

20A

For the figure above, which of the following points would be on the line that passes through points *N* and *P*?

A. $(-2, 0)$

B. $(1, 1)$

C. $(4, 5)$

D. $(5, 4)$
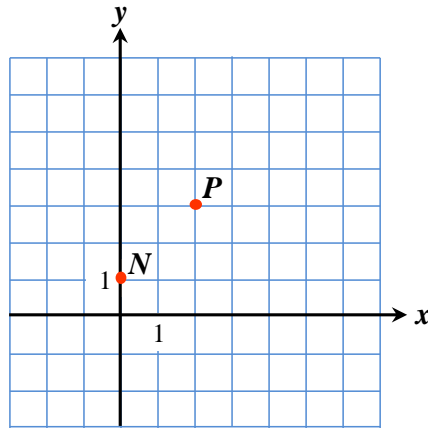
20B

The map of a town is placed on a coordinate grid with each whole number distance north (N), south (S), east (E), or west (W) representing 1 block.

A grocery store has the coordinates $(-2, -4)$. The owners of the grocery store plan to build an additional grocery store at a location that is 5 blocks to the east and 3 blocks to the north of the original store. Plot the location of the additional grocery store on the coordinate grid.
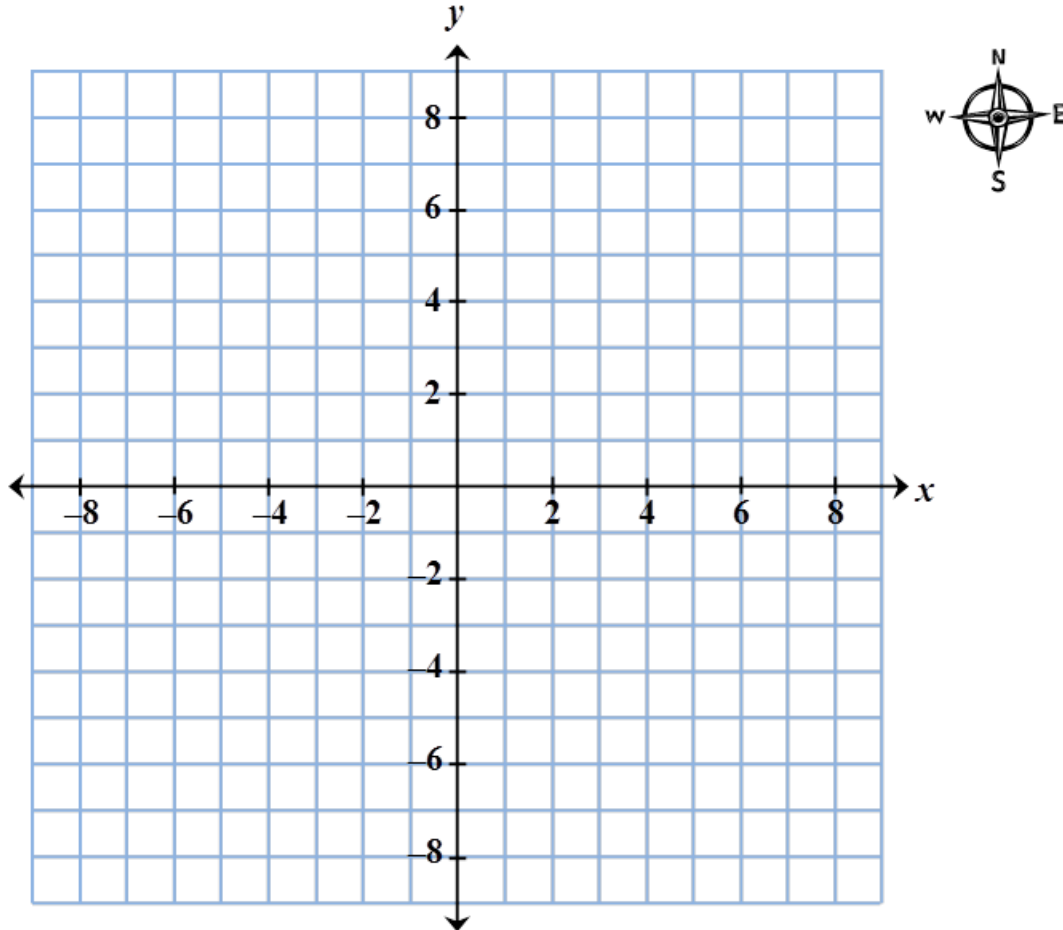
6.NS.8 – Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

<div align="center">DCAS-Like</div>

21A

In a coordinate plane, the points $(2, 4)$ and $(3, -1)$ are on a line. Which of the following <u>must</u> be true?

A. The line crosses the x-axis.

B. The line passes through $(0, 0)$.

C. The line stays above the x-axis at all times.

D. The line is parallel to the y-axis.

21B
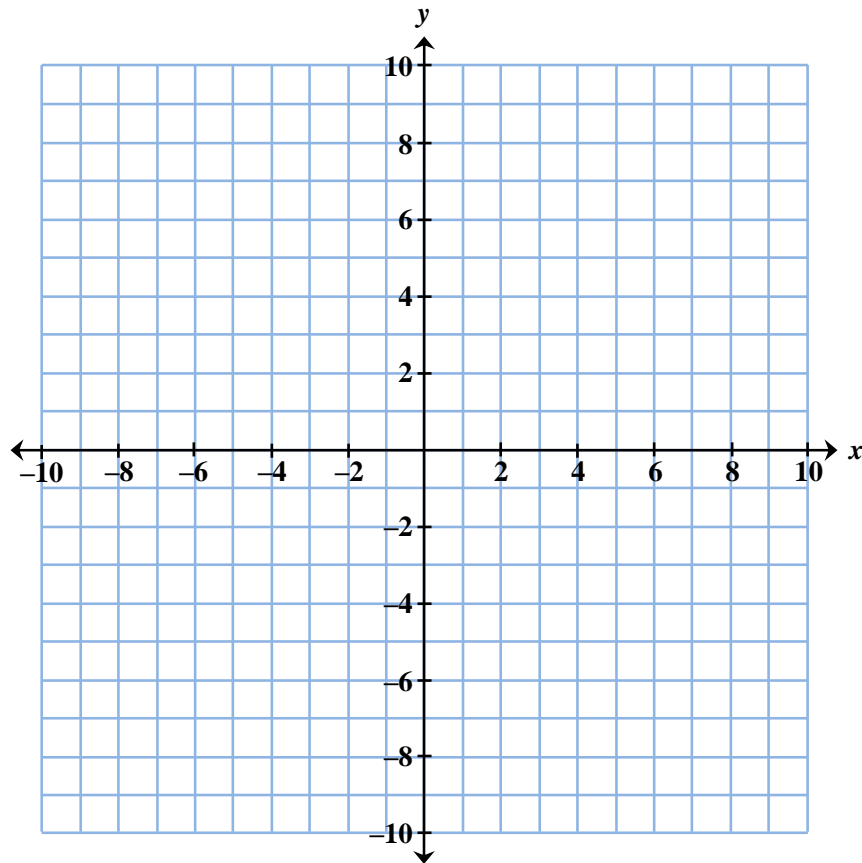
Listed below are the locations of six buildings will be added to the above coordinate plane are listed below.

- Bank $(-8, 5)$
- School $(-8, -6)$
- Park $(4, 5)$
- Post Office $(-9, 5)$
- Store $(-9, -6)$

For items a–d, select **True** or **False** for each statement based on the given information.

a. The bank is closer to the school than the post office is from the store.

       ○ True   ○ False

b. The distance from the bank to the school is equal to $|5| + |-6|$.

       ○ True   ○ False

c. A library has the same y-coordinate as the store. If the library is the same distance from the store as the park is from the bank, then the x-coordinate of the library is 4.

       ○ True   ○ False

d. The distance from the bank to the post office is equal to $|-8| + |-9|$.

       ○ True   ○ False

6.NS.8 – Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

DCAS-Like

22A

Look at the coordinate grid below.
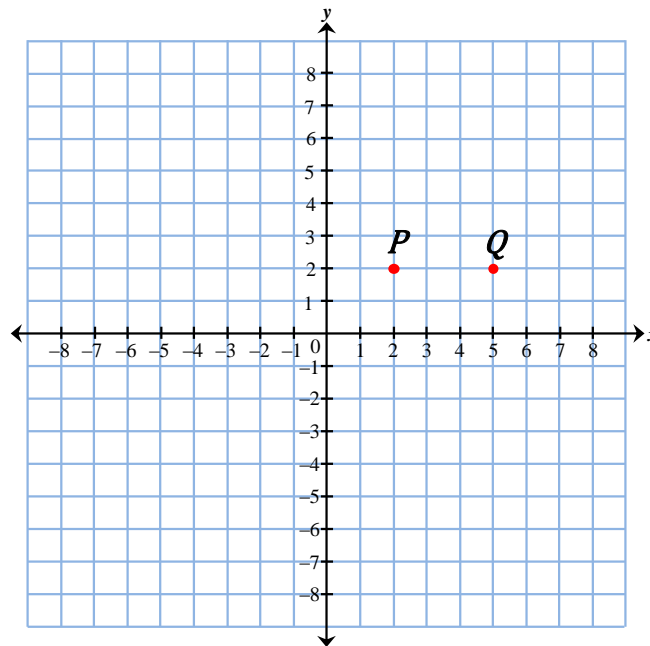
Points R and S will be added to the grid to form rectangle $PQRS$ with an area of 20 square units. Which ordered pairs could be the coordinates of R and S?

A. $(5, 1)$ and $(1, -1)$

B. $(5, -2)$ and $(1, -2)$

C. $(5, -3)$ and $(1, -3)$

D. $(5, -4)$ and $(1, -4)$

22B

Plot four unique points on the coordinate grid that are each 5 units from the point (1, 2). Each point must contain coordinates with integer values.
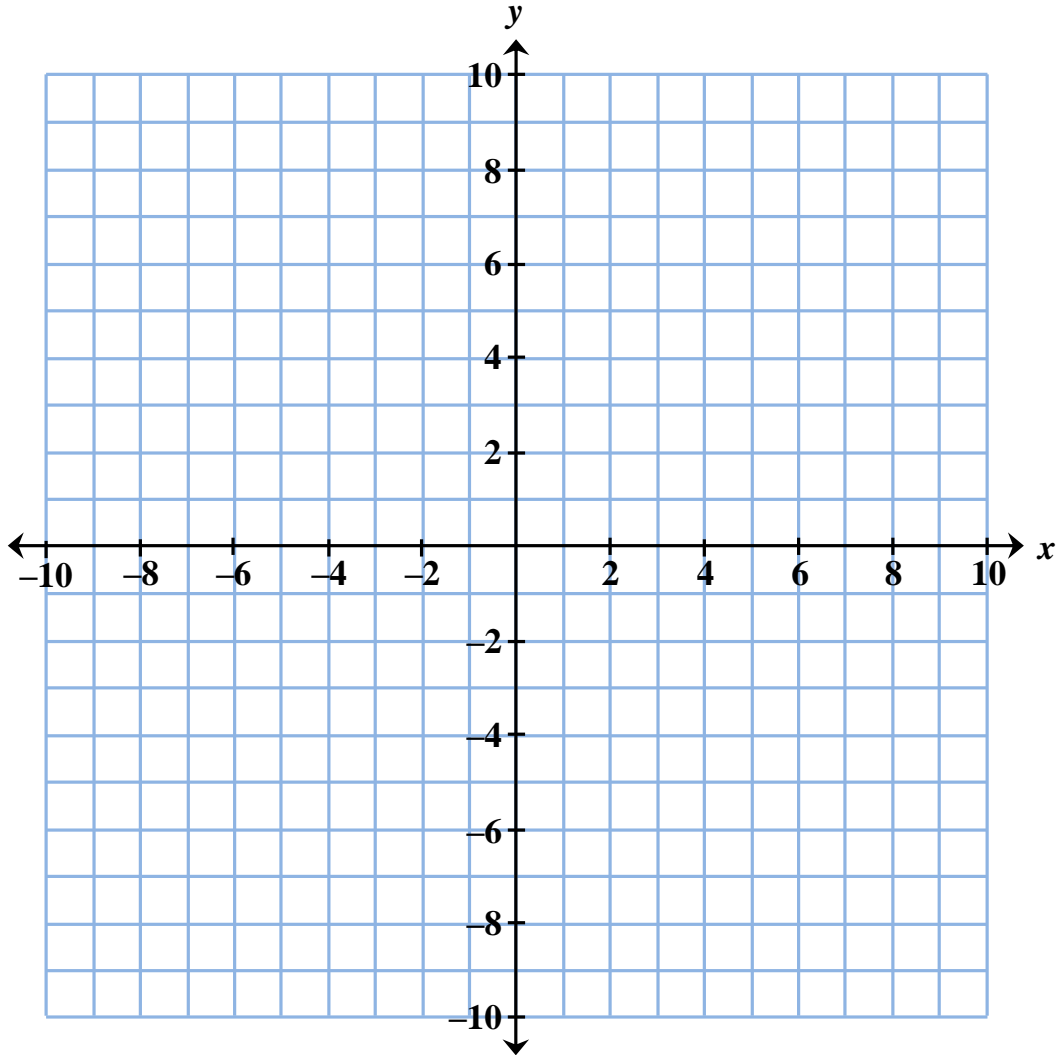
EXPRESSIONS AND EQUATIONS (EE)

Cluster: Apply and extend previous understandings of arithmetic to algebraic expressions.

6.EE.1 – Write and evaluate numerical expressions involving whole-number exponents.

DCAS-Like

23A

Simplify the expression below.

$3^3 - 2^2$

A. 1

B. 5

C. 23

D. 25

Next-Generation

23B

Write an expression that is equivalent to 64 using **each** of the following numbers and symbols **only once** in the expression.

7

7

7

^{2} (exponent of 2)

+

÷

( )

6.EE.2 – Write, read, and evaluate expressions in which letters stand for numbers.

a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 - y.*

b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2(8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.*

c. Evaluate expressions by substituting values for their variables. Include expressions that arise from formulas in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas V = s3 and A = 6 s2 to find the volume and surface area of a cube with sides of length s = 1/2.*

DCAS-Like

24A

Mike has x baseball cards. Tyrone has 3 times as many baseball cards as Mike. Frank has 20 baseball cards.

Which expression represents how many cards they have in all?

A. $x + 3x + 20$

B. $20 + 3x - x$

C. $x + 3 + 20$

D. $20 - 3x + x$

Next-Generation

24B

For the school dance only three members from the student government sold tickets. James sold ten more tickets than Bonnie, and Bonnie sold twice as many tickets as Mike.

a. Write an algebraic expression to represent how many tickets all three members sold.

b. A total of 295 tickets were sold for the dance. Using the information above, write an algebraic equation to calculate how many tickets James, Bonnie, and Mike sold individually.

c. Since party decorations and refreshments for the dance were donated, one hundred percent of all ticket sales from the dance are considered profit. If 295 students attended the dance at a ticket cost of $6, how much money did the student government make form the dance? Show all of your work.

6.EE.2 – Write, read, and evaluate expressions in which letters stand for numbers.

   a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 - y.*

   b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2(8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.*

   c. Evaluate expressions by substituting values for their variables. Include expressions that arise from formulas in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas V = s3 and A = 6 s2 to find the volume and surface area of a cube with sides of length s = 1/2.*

DCAS-Like

25A

Rita is moving a pile of 120 rocks by hand to build a rock wall. If h represents the number of rocks that she can carry in one load, which expression represents the total number of loads needed to move the entire pile of rocks?

A. $120 + h$

B. $120h$

C. $120 - h$

D. $\dfrac{120}{h}$

Next-Generation

25B

Some of the students at Kahlo Middle School like to ride their bikes to and from school. They always ride unless it rains.

Let d be the distance in miles from a student's home to the school. Write two different expressions that represent how far a student travels by bike in a four-week period if there is one rainy day each week.

6.EE.3 – Apply the properties of operations as strategies to generate equivalent expressions. *For example, apply the distributive property to the expression 3(2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6(4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*

<div align="center">

DCAS-Like
</div>

26A

Which expression is equivalent to $3x - 3y$?

A. $3xy$

B. $3(x - y)$

C. $3x - y$

D. $x - 3y$

<div align="center">

Next-Generation
</div>

26B

For items a–c, select **Yes** or **No** to indicate whether the pairs are equivalent expressions.

a. Are $4(3x - y)$ and $12x - 4y$ equivalent expressions?   ○ Yes   ○ No

b. Are $32 + 16y$ and $8(4 + 2y)$ equivalent expressions?   ○ Yes   ○ No

c. Are $3(x + 2y)$ and $3x + 2y$ equivalent expressions?   ○ Yes   ○ No

6.EE.3 – Apply the properties of operations as strategies to generate equivalent expressions. *For example, apply the distributive property to the expression 3(2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6(4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*

DCAS-Like

27A

Which is equal to $5(2a + 9)$?

A. $10a + 45$

B. $7a + 14$

C. $7a + 45$

D. $10a + 9$

Next-Generation

27B

Two expressions are shown below.

P: $2(3x - 9)$

Q: $6x - 9$

a. Apply the distributive property to write an expression that is equivalent to expression P.

b. Explain whether or not expressions P and Q are equivalent for any value of x.

6.EE.4 – Apply and extend previous understandings of arithmetic to algebraic expressions. Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number y stands for.*

DCAS-Like

28A

Which is equal to $3x + 5 + x + 10 + 2y$?

A. $6x + 15$

B. $3x + 2y + 15$

C. $4x + 2y + 15$

D. $9x + 12y$

Next-Generation

28B

Identify each expression as either equal to $12x + 36y$ or **not** equal to $12x + 36y$. Write **each** item letter in the appropriate box below.

a. $(10x + 36y) + (2x + y)$

b. $3(4x + 5y) + 7(3y)$

c. $6(2x + 6y)$

d. $5x + 5y + x + y + 6x + 6y$

Expressions Equivalent to $12x + 36y$	Expressions Not Equivalent to $12x + 36y$

Cluster: Reason about and solve one-variable equations and inequalities.

6.EE.5 – Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

DCAS-Like

29A

If $k = 6$, what is the value of $7k = 2$?

A. 30

B. 40

C. 54

D. 65

Next-Generation

29B

Select the **Yes** or **No** for each equation where $x = 5$ is a solution.

a. $2x + 4 = 14$ ○ Yes   ○ No

b. $5x = 55$ ○ Yes   ○ No

c. $6x + 3 = 14$ ○ Yes   ○ No

d. $8 + 3x = 23$ ○ Yes   ○ No

e. $6x = 30$ ○ Yes   ○ No

f. $5x = 1$ ○ Yes   ○ No

6.EE.5 – Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

DCAS-Like

30A

What value of y makes the equation $3y + 9 = 36$?

A. 9

B. 15

C. 30

D. 81

Next-Generation

30B

Part A

Ana is saving to buy a bicycle that costs $135. She has saved $98 and wants to know how much more money she needs to buy the bicycle.

The equation $135 = x + 98$ models this situation, where x represents the additional amount of money Ana needs to buy the bicycle.

a. When substituting for x, which value(s), if any, from the set $\{0, 37, 98, 135, 233\}$ will make the equation true?

b. Explain what this means in terms of the amount of money needed and the cost of the bicycle.

Part B

Ana considered buying the $135 bicycle, but then she decided to shop for a different bicycle.
She knows the other bicycle she likes will cost more than $150.

The situation can be modeled by the following inequality.

$$x + 98 > 150$$

c. Which values, if any, from −250 to 250 will make the inequality true? If more than one value
makes the inequality true, identify the least and greatest values that make the inequality true.

d. Explain what this means in terms of the amount of money needed and the cost of the bicycle.

6.EE.6 – Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

DCAS-Like

31A

What is "two more than the quotient of six and a number, n, written as an algebraic expression?

A. $6n + 2$

B. $6n - 2$

C. $\dfrac{6}{n} + 2$

D. $\dfrac{6}{n} - 2$

Next-Generation

31B

Let b represent a number.

Using the items below, create an expression that represents the following:

"5 more than the product of 3 and the number b"

Not all objects will be used.

$$\boxed{3} \quad \boxed{5} \quad \boxed{b} \quad \boxed{+} \quad \boxed{-} \quad \boxed{\times} \quad \boxed{\div}$$

_____
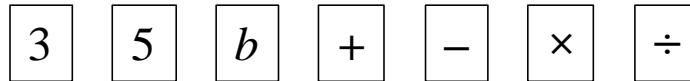
6.EE.7 – Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers.

DCAS-Like

32A

Ellen had some change in her pocket. After her friend gave her $0.45, Ellen had $1.35 altogether. Which equation can she use to find the original amount of money, m, she had in her pocket?

A. $m + 0.45 = 1.35$

B. $1.35 = m - 0.45$

C. $m = 1.35 \times 0.45$

D. $m + 1.35 = 0.45$

Next-Generation

32B

Read each of the following problem situations. Label each situation according to the equation that would answer the question. If neither equation works, select "Neither." The labels may be used more than one time.

	The school auditorium can seat 325 students. In the auditorium there are 25 rows with the same number of seats in each row. Which equation can be used to find x, the number of seats in each row in the school auditorium?
$25 + x = 325$	There are 25 soccer balls in a store. The total number of soccer balls and basketballs in the store is 325. Which equation can be used to find , the number of basketballs in the store?
$25x = 325$	Marissa had 25 marbles in a bag. She gave some to her brother. Her brother now has 325 marbles. Which equation can be used to find , the number of marbles that Marissa gave her brother?
Neither	There are 25 cans of soup in a case. The manager of a grocery store needs to order 325 cans of soup. Which equation can be used to find , the total number of cases the manager needs to order?
	Cleo has a certain number of seashells. Pete has 25 seashells. Together Cleo and Pete have 325 seashells. Which equation can be used to find , the total number of seashells that Cleo has?

6.EE.8 – Write an inequality of the form x > c or x < c to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form x > c or x < c have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

33A

Jan has 18 cards. Ray gives her v cards. Jan now has less than 30 cards.

Which best describes Jan's cards?
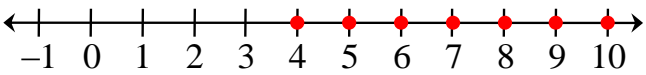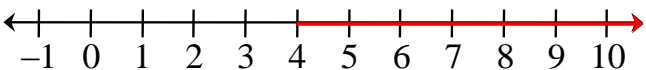
A. $v - 18 > 30$

B. $v + 18 < 30$

C. $v - 18 < 30$

D. $v + 18 > 30$

33B

An inequality is shown: $x > 4$

Select **Yes** or **No** for the statement(s) and number line(s) that can be represented by the inequality. Check all that apply.

a. The temperature increased by 4° Fahrenheit. ○ Yes ○ No

b. The value of a number substituted for x is greater than 4. ○ Yes ○ No

c. Marcus drinks more than 4 glasses of water every day. ○ Yes ○ No

d. ○ Yes ○ No

e. ○ Yes ○ No

Cluster: Represent and analyze quantitative relationships between dependent and independent variables.

6.EE.9 – Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.*

DCAS-Like

34A

The table below shows values of x and y.

x	y
−8	−16
−2	−10
4	−4
10	2

Which equation describes the relationship between the values of x and y?

A. $y = 2x$

B. $y = 5x$

C. $y = x + 8$

D. $y = x - 8$

34B

A car magazine is writing a story about four cars. For each car, they will report the number of miles driven for different amounts of gas.

Part A

This table shows the number of miles driven by Car A for different amounts of gas. If Car A uses gas at a constant rate, fill in the blanks to complete the table.

Miles Driven	_____	360	480	_____
Gallons of Gas	10	15	_____	24

Part B

A car magazine is writing a story about four cars. For each car, they will report the number of miles driven for different amounts of gas.

The magazine received gas mileage information for cars from several companies.

Miles Driven	__	360	480	__
Gallons of Gas	10	15	__	24

$D = 18g$ where D represents the distance traveled in miles, and g represents gallons of gas consumed.

Car *C* can travel 324 miles on a 12-gallon tank.

Car D Gas Mileage

(3,99)
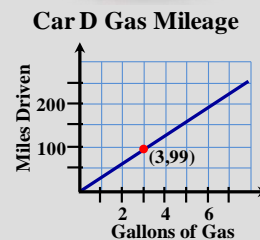
The magazine will list the cars in order. Indicate the order of the four cars from the **greatest** number of miles per gallon to the **least** number of miles per gallon.

a.   1st place: _____ (greatest number of miles per gallon)

b.   2nd place: _____

c.   3rd place: _____

d.   4th place: _____ (least number of miles per gallon)

Part C

Krystal bought one of these cars. She drove 924 miles and used 28 gallons of gas. Based on her gas consumption, which car did she most likely buy?

a.   Car A

b.   Car B

c.   Car C

d.   Car D

6.EE.9 – Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.*

DCAS-Like

35A

Which equation correctly describes the rule between x and y?

x	y
4	9
5	11
6	13
7	15

A. $y = x + 6 - 1$

B. $y = x \cdot x - 1$

C. $y = x + x - 1$

D. $y = x \cdot 2 + 1$

Next-Generation

35B

The diagram shows that 1 inch is approximately equal to 2.54 centimeters.
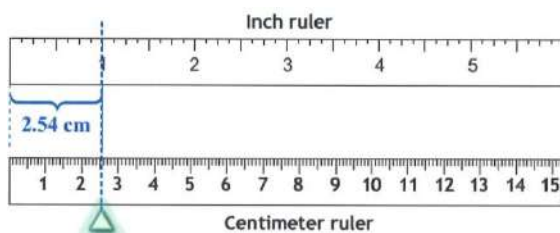
If we say that the relationship between the number of inches and the number of centimeters is exact, which of the following correctly represents the relationship? Select **True** or **False** for all that apply.

a. $i = 2.54c$, where i stands for the number of inches and c stands for the number of centimeters.

      ○ True   ○ False

b. $c = 2.54i$, where c stands for the number of centimeters and i stands for the number of inches.

      ○ True   ○ False

c. The ratio of centimeters to inches is 1 to 2.54.

      ○ True   ○ False

d. The ratio of centimeters to inches is 2.54 to 1.

      ○ True   ○ False

e.
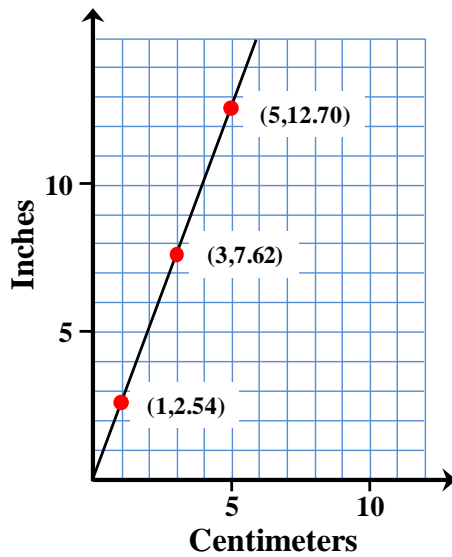
      ○ True   ○ False

GEOMETRY (G)

Cluster: Solve real-world and mathematical problems involving area, surface area, and volume.

6.G.1 – Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

DCAS-Like

36A

What is the area of the figure shown below?
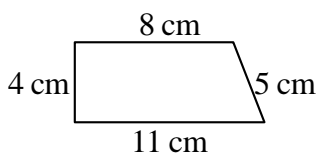
A. 28 square centimeters

B. 32 square centimeters

C. 38 square centimeters

D. 44 square centimeters

E. 64 square centimeters

Next-Generation

36B

Identify which of the formulas correctly finds the area, *A*, of the figure. Choose **True** or **False** for each equation.
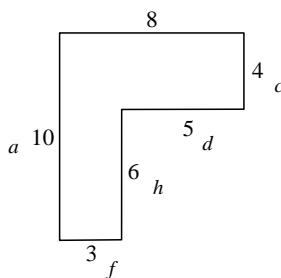
a. $A = 10 \times 8 + 6 \times 5$ ○ True   ○ False

b. $A = 4 \times 3 + 5 \times 4 + 6 \times 3$ ○ True   ○ False

c. $A = 5(10 - 6) + 10 \times 3$ ○ True   ○ False

d. $A = 10 \times 3 + 8 \times 4$ ○ True   ○ False

e. $A = 10 \times 8 - 6 \times 5$ ○ True   ○ False

f. $A = 3(10 - 6) + 5(10 - 6) + 6(10 - 4)$ ○ True   ○ False

6.G.1 – Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

37A

The diagram below shows the dimensions of the patio in Mr. Hampshire's backyard.
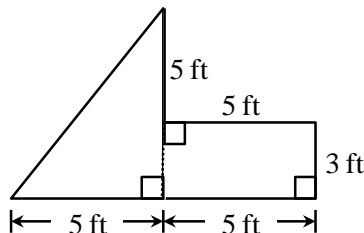
What is the area, in square feet, of the patio?

A. 20 square feet

B. 35 square feet

C. 40 square feet

D. 55 square feet

Next-Generation

37B
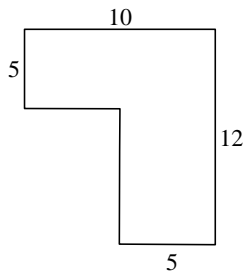
Ted wants to purchase floor covering for the hallway shown above. He knows there are many ways to find the area of the hallway.

Use the figures below to show 3 ways that Ted can divide the hallway to find its area. Below each figure use numbers and operations to calculate the area for Ted.
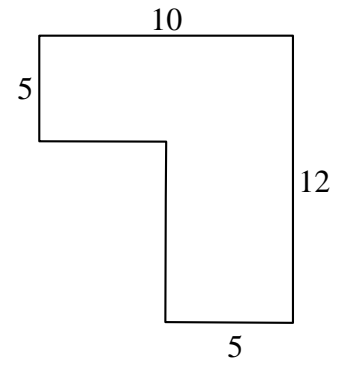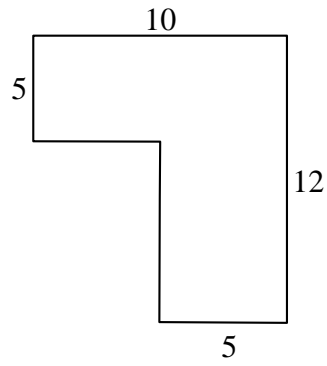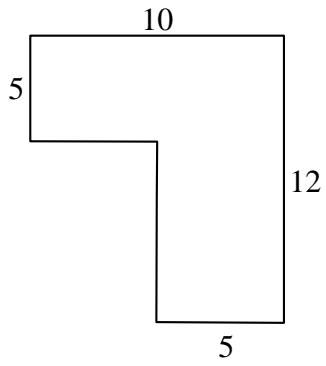
6.G.1 – Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

DCAS-Like

38A

Mrs. Salinas made a rose garden with the dimensions pictured below
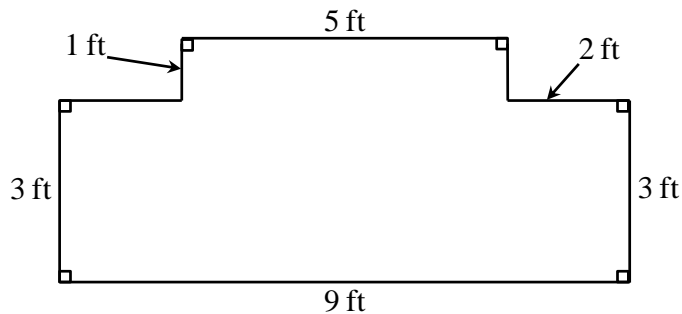
What is the area, in square feet (sq ft), of Mrs. Salinas's rose garden?

A. 23 sq ft

B. 26 sq ft

C. 27 sq ft

D. 32 sq ft

Next-Generation

38B

Triangle *ADE* is inside rectangle *ABCD*. Point *E* is halfway between points *B* and *C* on the rectangle. Side *AB* is 8 cm and side *AD* is 7 cm.

What is the area of triangle *ADE*? Show your work.
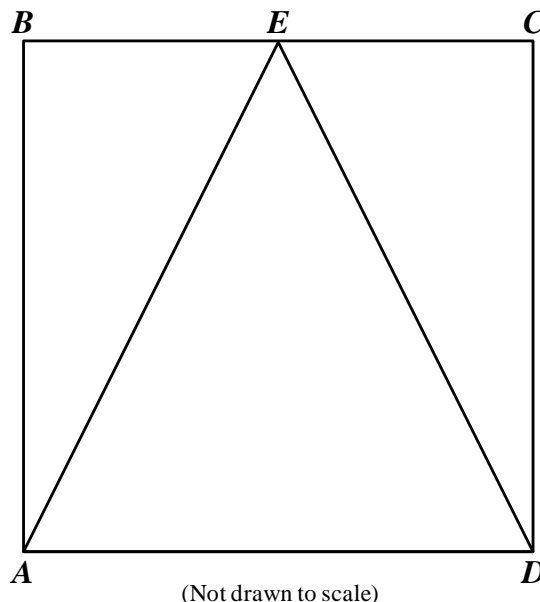
(Not drawn to scale)

6.G.2 – Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\,w\,h$ and $V = b\,h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

DCAS-Like

39A

Find the volume, in cubic feet, of the right rectangular prism pictured below.
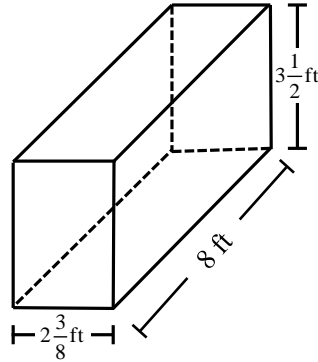
A. $8\dfrac{5}{16}$

B. 19

C. $48\dfrac{3}{16}$

D. $66\dfrac{1}{2}$

39B

Cube-shaped boxes will be loaded into the cargo hold of a truck. The cargo hold of the truck is in the shape of a rectangular prism. The edges of each box measure 2.50 feet, and the dimensions of the cargo hold are 7.50 feet by 15.00 feet by 7.50 feet, as shown below.
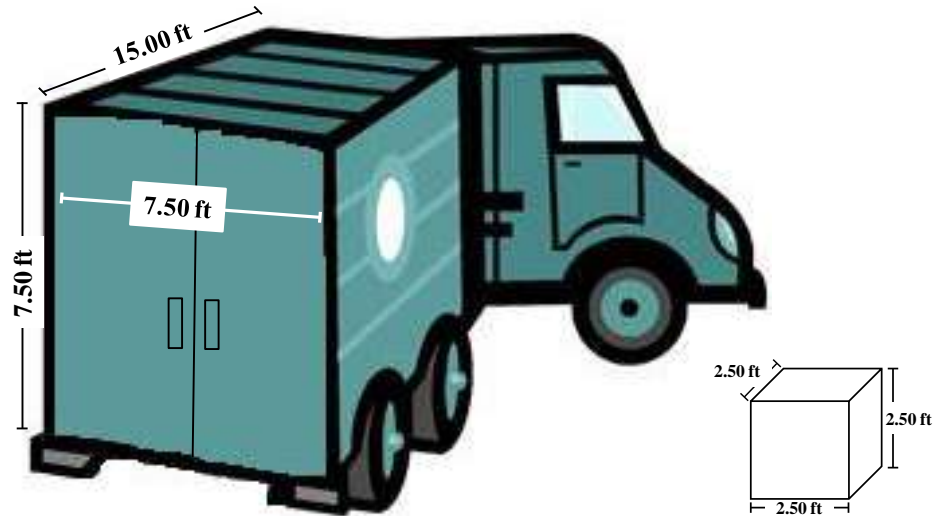
a. What is the volume, in cubic feet, of each box?

b. Determine the number of boxes that will completely fill the cargo hold of the truck. Use words and/or numbers to show how you determined your answer.

6.G.3 – Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

DCAS-Like

40A

Triangle PQR and triangle QRS have vertices $P(-09,7)$, $Q(4,7)$, $R(4,-3)$, and $S(10,-3)$.
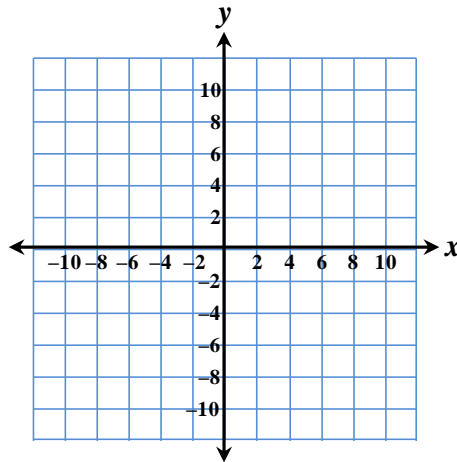
What is the area, in square units, of quadrilateral $PQSR$ which is formed by the two triangles?

A. 30

B. 65

C. 95

D. 190

Next-Generation

40B

a. On the coordinate grid, plot the following points in order and connect each plotted point to the previous one in the order shown to form a figure.

    1. Point A (2,5)

    2. Point B (2,9)

    3. Point C (5,7)

    4. Point D (8,9)

    5. Point E (8,5)

    6. Point A (2,5)
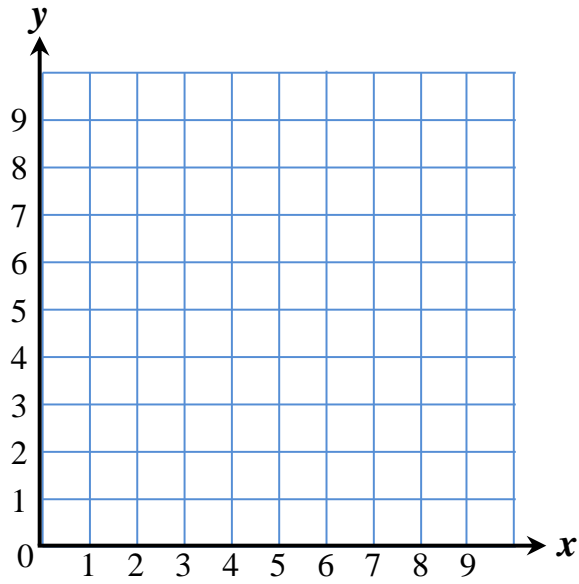
b. What is the area, in square units, of the enclosed figure?

   _____

6.G.4 – Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

DCAS-Like

41A

What is the surface area of the box formed by the pattern below?
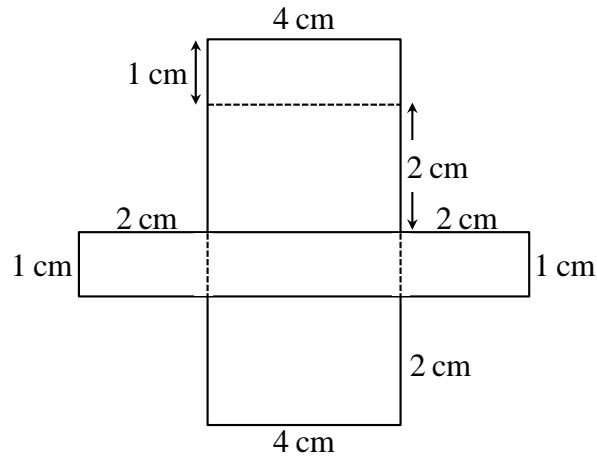
A. 28 cm^2

B. 24 cm^2

C. 14 cm^2

D. 8 cm^2

41B

Classify each net as representing a rectangular prism, a triangular prism, or a pyramid. Enter the letter for each object in the correct column below.

a.

b.

c.

d.

e.

f.
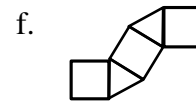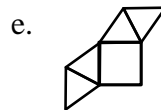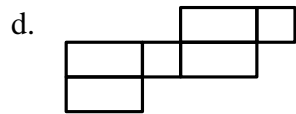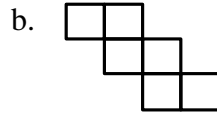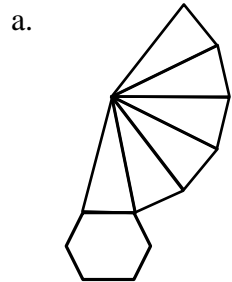
Nets Forming a Rectangular Prism	Nets Forming a Triangular Prism	Nets Forming a Pyramid

STATISTICS AND PROBABILITY (SP)

Cluster: Develop understanding of statistical variability.

6.SP.1 – Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*

<div align="center">

DCAS-Like

</div>

42A

Mary Peterson has just written a book about American work habits, and she is at the local bookstore answering questions. Which of the following are statistical questions that you could ask Mary Peterson?

A. How many Americans work more than 40 hours per week?

B. Which industry is the hardest working?

C. How many hours does the hardest-working industry work?

D. How far does the average American commute to work?

<div align="center">

Next-Generation

</div>

42B

Zeke likes to collect buttons and he keeps them in a jar. Zeke can empty the buttons out of the jar, so he can see all of his buttons at once.

Which of the following are statistical questions that someone could ask Zeke about his buttons? Check all that apply.

a. What is a typical number of holes for the buttons in the jar?	○ Yes	○ No
b. How many buttons are in the jar?	○ Yes	○ No
c. How large is the largest button in the jar?	○ Yes	○ No
d. If Zeke grabbed a handful of buttons, what are the chances that all of the buttons in his hard are round?	○ Yes	○ No
e. What is a typical size for the buttons in the jar?	○ Yes	○ No
f. How many buttons have four holes?	○ Yes	○ No
g. What is a typical number of holes for buttons in the jar?	○ Yes	○ No
h. How are these buttons distributed according to color?	○ Yes	○ No

6.SP.2 – Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

DCAS-Like

43A

The table below shows the scores of 10 students on a final examination. What is the range of these scores?

Student	Score
A	88
B	65
C	91
D	36
E	72
F	57
G	50
H	85
I	62
J	48

A. 33

B. 40

C. 55

D. 88

43B

The histogram below displays the birth weights, in ounces, of all the Labrador Retriever puppies born at Kingston Kennels in the last six months.
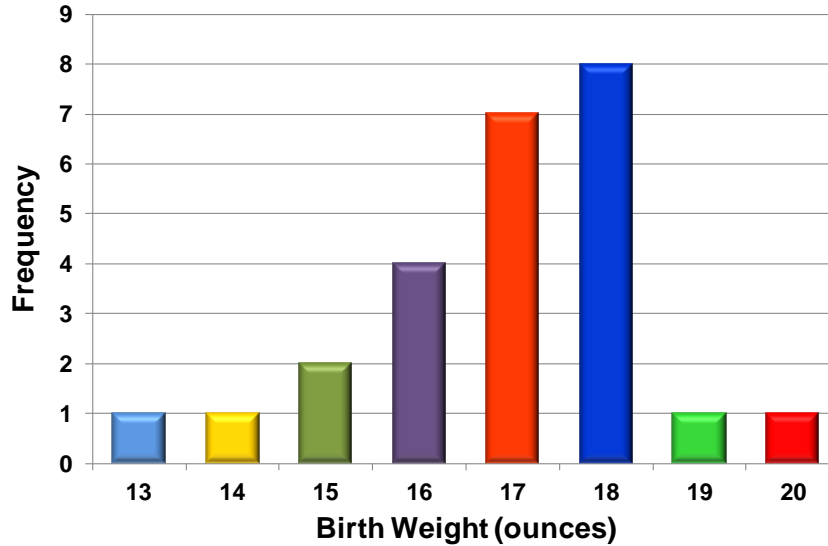
a. How many puppies were born in the last six months? _____

b. Describe the distribution of birth weights for puppies born at Kingston Kennels in the last six months. Be sure to describe shape, center, and variability.

6.SP.3 – Recognize that a measure of center for a numerical data set summarizes all of its values using a single number, while a measure of variation describes how its values vary using a single number.

44A

The table shows the number of turkey and ham sandwiches sold by Derby's Deli for several days in one week.

Sandwiches Sold at Derby's Deli

Day	Turkey	Ham
Monday	7	9
Tuesday	13	11
Wednesday	8	8
Thursday	15	6
Friday	12	16

What is the difference between the median number of turkey sandwiches sold and the median number of ham sandwiches sold?

A. 0

B. 1

C. 2

D. 3

44B

Michael Phelps is an employee at Google researching demand for the new Google glasses. Michael Phelps surveys a dozen people and asks each of them how much they would pay. The results are shown below.

```
                        X
                 X      X
                 X      X
        X    X   X  X   X                   X
        +----+----+----+----+----+----+----+----+----+----+
       $0       $100     $200     $300     $400     $500
                        Willing to Pay
```
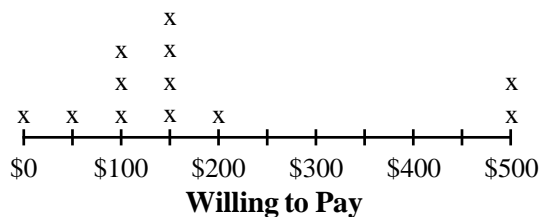
a. Summarize the data using the mean.

b. Summarize the data using the median.

c. Which measure provides a better summary of the data?

Cluster: Summarize and describe distributions.

6.SP.4 – Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

DCAS-Like

45A

The following data represent the number of years different students in a certain group have gone to school together: 12, 5, 8, 16, 15, 9, 19. These data are shown on the box-and-whisker plot below.
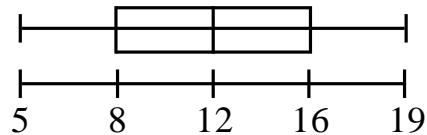
What is the median of the data?

A. 5

B. 8

C. 12

D. 16

45B

Mike takes pictures of birds.

a. Count the number of birds in each of Mike's pictures and enter the numbers into the table below.

Picture 1   Picture 2   Picture 3

Picture 4   Picture 5   Picture 6

Picture 7   Picture 8   Picture 9
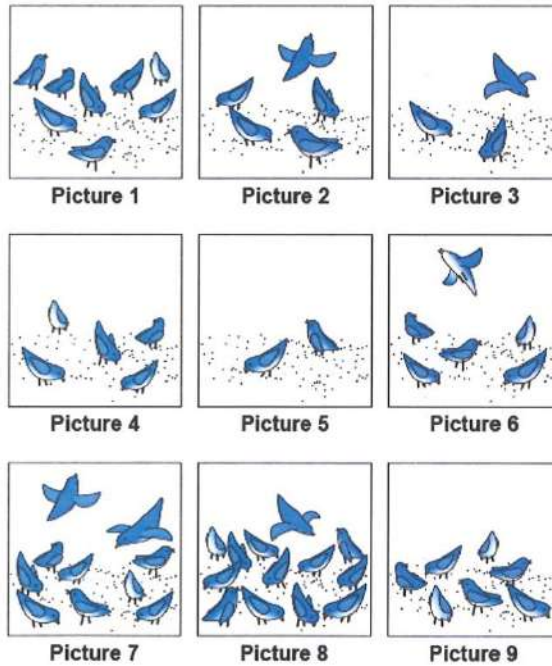
Mike's Pictures

Picture	Number of Birds
1	
2	
3	
4	
5	
6	
7	
8	
9	

b. Create a box plot that represents the data in part a.

$$\begin{array}{c}\longleftarrow\!\!\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!-\!\!+\!\!\!\!\longrightarrow\\ \mathbf{0\quad 1\quad 2\quad 3\quad 4\quad 5\quad 6\quad 7\quad 8\quad 9\quad 10\ 11\ 12\ 13\ 14}\end{array}$$

6.SP.4 – Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

46A

Which set of bars below represents the data in the circle graph?

A.

B.

C.

D.
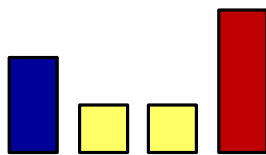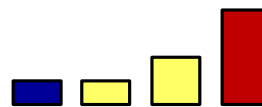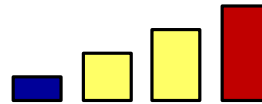
46B

The ages, in years, of the 28 members of a gym class are listed:

    19, 21, 22, 27, 29, 31, 31, 31, 33, 34, 37, 38, 39, 39,
    39, 41, 43, 45, 46, 47, 49, 49, 51, 51, 52, 54, 56, 63

Construct a box plot of the data in the list.

Ages of Gym Class Members

Age (years)

6.SP.5 – Summarize numerical data sets in relation to their context, such as by:
    a. Reporting the number of observations.
    b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
    c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data was gathered.
    d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data was gathered.

DCAS-Like

47A

The table below shows the number of customers at Malcolm's Bike Shop for 5 days as well as the mean (average), median, mode, and range for the number of customers for these 5 days.

**Number of Customers at
Malcolm's Bike Shop**

Day 1	100
Day 2	87
Day 3	90
Day 4	10
Day 5	91
Mean (average)	75.6
Median	90
Mode	None
Range	90

Which statistic, mean, median, mode, or range, best represents the typical number of customers at Malcolm's Bike Shop for these 5 days?

A. Mean

B. Median

C. Mode

D. Range

47B

Henry read from a book on Monday, Tuesday, and Wednesday. He read an average of 10 pages per day. Select whether each of the following is **Possible** or **Not Possible**.

	Pages Read			**Possible/Not Possible**
	Monday	**Tuesday**	**Wednesday**	
a.	4 pages	4 pages	2 pages	○ Possible ○ Not Possible
b.	9 pages	10 pages	11 pages	○ Possible ○ Not Possible
c.	5 pages	10 pages	15 pages	○ Possible ○ Not Possible
d.	10 pages	15 pages	20 pages	○ Possible ○ Not Possible

6.SP.5 – Summarize numerical data sets in relation to their context, such as by:

    a. Reporting the number of observations.

    b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

    c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data was gathered.

    d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data was gathered.

<div align="center">

DCAS-Like

</div>

48A

Which of the following pieces of information would NOT be useful in deciding what type of car is the most economical to drive?

A. Median income of drivers

B. Range of insurance costs

C. Average miles per gallon

D. Cost of routine maintenance

<div align="center">

Next-Generation

</div>

48B

The areas, in square kilometers, of 10 countries in South America are shown in the table.

Country	Area, in Square Kilometers
Uruguay	176,215
Ecuador	256,369
Paraguay	406,752
Chile	756,102
Venezuela	912,050
Bolivia	1,098,581
Colombia	1,141,748
Peru	1,285,216
Argentina	2,780,400
Brazil	8,514,877

The data is also summarized in the box plot.

Area of 10 Countries in South America in sq km
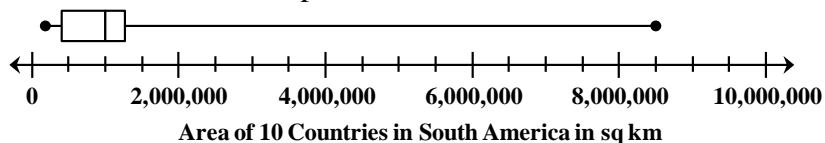
Which measure of center, the mean or the median, is best to use when describing this data? Thoroughly explain your reasoning for choosing one measure over the other measure.

ANSWER KEY AND ITEM RUBRICS

Ratios and Proportional Relationships (RP)

DCAS-Like Answer	Next-Generation Solution
1A: C (6.RP.1)	**1B:** a. 5:8 b. 2 c. 15 d. $\frac{5}{15}$ or $\frac{1}{3}$ if student decides to simplify e. $\frac{10}{15}$ or $\frac{2}{3}$ if student decides to simplify
2A: B (6.RP.2)	**2B:** This is a one-point item. a. True b. True c. False d. True e. False

DCAS-Like Answer	Next-Generation Solution
3A: B (6.RP.2)	**3B:** a. Alberto and Beth are both correct. Their rates could be illustrated with a double number line or a ratio table like the following: <table><tr><th>Pounds</th><th>Dollars</th></tr><tr><td>1</td><td>0.80</td></tr><tr><td>1.25</td><td>1</td></tr><tr><td>2.5</td><td>2</td></tr><tr><td>5</td><td>4</td></tr></table> b. Double the quantities in Alberto's rate to find the price of two pounds: <table><tr><th>Pounds</th><th>Dollars</th></tr><tr><td>1</td><td>0.80</td></tr><tr><td>2</td><td>1.60</td></tr></table> c. Starting from Beth's rate and multiplying both quantities by ten shows the number of pounds that can be purchased for 10 dollars: <table><tr><th>Pounds</th><th>Dollars</th></tr><tr><td>1.25</td><td>1</td></tr><tr><td>12.50</td><td>10</td></tr></table> d. Answers may vary. We can efficiently answer part b. using Alberto's rate and part c. using Beth's rate.

DCAS-Like Answer	Next-Generation Solution
4A: D (6.RP.3)	**4B:** a. 13 pizzas b. $149.50 *Scoring Rubric:* Responses to this item will receive 0-2 points, based on the following: **2 points:** The student demonstrates a thorough understanding of how to apply mathematics to solve problems involving ratio and rate reasoning and computation with multi-digit decimals. The student provides an estimate of 12 to 15 pizzas and correctly computes the cost for that number of pizzas. **1 point:** The student demonstrates a partial understanding of how to apply mathematics to solve problems involving ratio and rate reasoning and computation with multi-digit decimals. The student provides a low or high estimate of 9-11 or 16-18 pizzas, but correctly computes the cost for that number of pizzas OR the student provides an estimate of 12-15 pizzas but does not correctly compute the cost for that number of pizzas. **0 points:** The student shows inconsistent or no understanding of how to apply mathematics to solve problems involving ratio and rate reasoning and computation with multi-digit decimals.
5A: C (6.RP.3)	**5B:** a. Thought that any difference of 3 is equivalent b. Reversed the ratio (green to blue) c. Saw the 5 and 8 and did not pay attention to the place value d. Answer

DCAS-Like Answer	Next-Generation Solution
6A: B (6.RP.3)	**6B:** First, Alexis needs to find the area she needs to paint. Alexis will need to paint two, 30 foot-by-50 foot walls and two, 30 foot-by-80 foot walls. $$2 \times 30 \, feet \times 50 \, feet = 3000 \, square \, feet$$ $$2 \times 30 \, feet \times 80 feet = 4800 \, square \, feet$$ Alexis will need to paint $3000 + 4800 = 7800 \, square \, feet$. *Two strategies to find the cost:* 1. The table below shows how many square feet she can cover with different quantities of paint.

<table>
<tr><th>Number of Gallons of Paint</th><th>Area Covered</th></tr>
<tr><td>1</td><td>420</td></tr>
<tr><td>5</td><td>2100</td></tr>
<tr><td>10</td><td>4200</td></tr>
<tr><td>15</td><td>6300</td></tr>
<tr><td>20</td><td>8400</td></tr>
</table>

20 gallons is a little more than she needs, so she can check 19 gallons and 18 gallons:

<table>
<tr><th>Number of Gallons of Paint</th><th>Area Covered</th></tr>
<tr><td>1</td><td>420</td></tr>
<tr><td>5</td><td>2100</td></tr>
<tr><td>10</td><td>4200</td></tr>
<tr><td>15</td><td>6300</td></tr>
<tr><td>20</td><td>8400</td></tr>
<tr><td>19</td><td>7980</td></tr>
<tr><td>18</td><td>7560</td></tr>
</table>

DCAS-Like Answer	Next-Generation Solution
	18 gallons is not quite enough and 19 gallons is a bit more than she needs. Since paint is usually sold in whole gallons, it makes sense for Alexis to buy 19 gallons of paint. Finally, since paint costs $28 per gallon, the total cost will be: $$19 \text{ } gallons \times \$28 \text{ } per \text{ } gallon = \$532$$ It will cost Alexis $532 to paint the barn. 2. Estimate the number of gallons of paint for 7800 square feet. Since 1 gallon covers 420 square feet: $$(420 \text{ } square \text{ } feet)(? \text{ } gallons) = 7800 \text{ } square \text{ } feet$$ $$\frac{7800}{420} = 18.57 \text{ } gallons$$ So, round up to 19 gallons. Cost is $19 \text{ } gallons \times \$28 = \$532$

DCAS-Like Answer	Next-Generation Solution
7A: C (6.RP.3)	**7B:** ***Solution Using the Unit Rate*** Since there are 1.02 Canadian dollars for every 1 U.S. dollar, we can multiply the number of U.S. dollars by 1.02 to find out how many Canadian dollars he can buy. $$200 \times 1.02 = 204$$ So, Joe will get \$204 CDN for his \$200 U.S. Since there are 10.8 pesos for every 1 CDN dollar, we can multiply the number of CDN dollars by 10.8 to find out how many pesos he can buy. $$204 \times 10.8 = 2203.2$$ So, Joe will get 2203.2 pesos for his \$204 CDN. ***Solution Using Dimensional Analysis*** We can do the same thing as in the first solution, but keep the units in the equation: $$200 \; US \times \frac{1.02 \; CDN}{1 \; US} = 200 \times 1.02 \; CDN = 204 \; CDN$$ and $$204 \; CDN \times \frac{10.8 \; pesos}{1 \; CDN} = 204 \times 10.8 \; pesos = 2203.2 \; pesos$$ Joe will get 2203.2 pesos for his \$200 U.S.

The Number System (NS)

DCAS-Like Answer	Next-Generation Solution
8A: A (6.NS.1)	**8B:** Since $1\frac{1}{2} = \frac{9}{6}$ and it takes an hour to travel $\frac{2}{3} = \frac{4}{6}$ miles, we can look at the number lines above and see that it will take $2\frac{1}{4}$ hours to travel the distance to the exit. Since we are asking "How many $\frac{2}{3}$ are there in $1\frac{1}{2}$?", this is a "How many groups?" division problem: $$1\frac{1}{2} \div \frac{2}{3} = ?$$ We have found that the answer to this division problem is $2\frac{1}{4}$. Other strategies are valid.
9A: A (6.NS.1)	**9B:** The children brought $2 + 1 + 1\frac{1}{4} = 4\frac{1}{4}$ cups of flour and $\frac{1}{4} + \frac{1}{2} + \frac{3}{4} = 1\frac{1}{2}$ cups of butter. They have enough flour for 4 whole batches of a dozen cookies each.
10A: C (6.NS.1)	**10B:** a. Incorrect operation; does not correctly interpret the quotient of fractions b. Correct c. Incorrect operation and equation; does not correctly interpret the quotient of fractions or the placement of the variable d. Incorrect operation and question; does not correctly interpret the quotient of fractions or the placement of the variable

DCAS-Like Answer	Next-Generation Solution
11A: D (6.NS.1)	**11B:** a. Yes b. No c. Yes d. Yes
12A: B (6.NS.2)	**12B:** The set-up of the problem is more important than the actual answers. Students can use multiple strategies including counting up. a. $$\begin{array}{r} 32.16 \\ 25\overline{)804.00} \\ -750.00 \\ \hline 54.00 \\ -\ 50.00 \\ \hline 4.00 \\ -\ 2.50 \\ \hline 1.50 \\ -\ 1.50 \\ \hline 0 \end{array}$$ b. $$\begin{array}{r} 22 \\ 42\overline{)924} \\ -840 \\ \hline 84 \\ -\ 84 \\ \hline 0 \end{array}$$

DCAS-Like Answer	Next-Generation Solution
	Alternate answer: a. $25\ students \times \#\ of\ cookies \leq 804\ cookies$ $25 \times 30 = 750$ $25 \times 2 = 50$ $25 \times 32 = 800\ cookies$ (with 4 left over) Answer is 32 cookies each. b. $42\ candies \times \#\ of\ students = 924\ candies$ $42 \times 20 = 840$ $42 \times 2 = 84$ $42 \times 22 = 924$ $\#\ of\ students = 22$
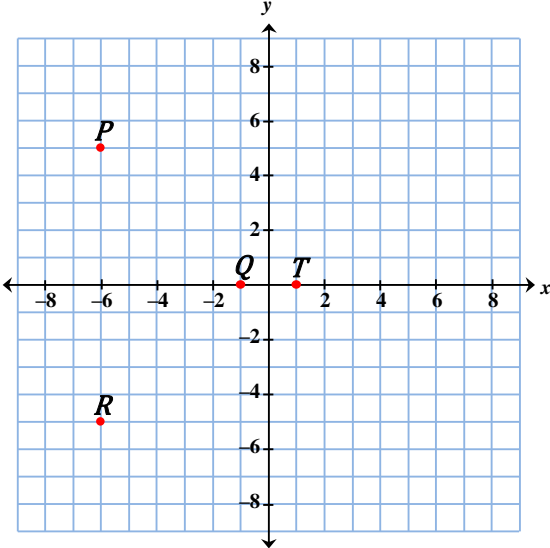
DCAS-Like Answer	Next-Generation Solution
13A. B (6.NS.3)	**13B:** Students should be able to fluently multiply and divide decimals. The details of the algorithms for multiplying and dividing are not shown here. a. To find out how many tickets he could buy with $20, we divide 20 by the price of a single ticket: $$20 \div 3.75 = 5.3$$ Since it is not possible to purchase a part of a ticket, this means that he could buy 5 tickets and will have some money left over. Since: $$5 \times 3.75 = 18.75$$ and $$20 - 18.75 = 1.25$$ her father could buy 5 movie tickets in 1987 with $20, and he would have $1.25 left over. b. As before, to find out how many tickets she could buy with $20, we divide 20 by the price of a single ticket: $$20 \div 8.25 = 2.42$$ As before, she cannot buy part of a ticket. Furthermore: $$2 \times 8.25 = 16.50$$ and $$20 - 16.50 = 3.50$$ So, Hallie can buy 2 movie tickets if she has $20, and she will have $3.50 left over. c. Since $4 \times \$3.75 = \$15.00$, a large popcorn had to cost $5.00 or less if her father bought it with the change from buying the tickets. Hallie's movie tickets cost $8.25 \div 3.75 = 2.2$ times as much as movie tickets cost in 1987. Assuming the price of popcorn increased at the same rate, and since $2.2 \times 5 = 11$, she should be able to buy a large popcorn for $11.00. Four tickets cost $4 \times \$8.25 = \$33.00$. With these assumptions, Hallie's father should give her at least $44.00.

DCAS-Like Answer	Next-Generation Solution

14A: B
(6.NS.4)
	14B
	
	The florist could have ordered any multiple of 12 roses that is less than 100:
	
	    12, 24, 36, 48, 60, 72, 84, or 96.
	
	The florist could have ordered any multiple of 8 lilies that is less than 100:
	
	    8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, or 96
	
	If she ordered the same number of each kind of flower, she must have ordered a common multiple of 8 and 12, shown in the table below:
	
	<table><tr><td>Number of each kind of flower</td><td>24</td><td>48</td><td>72</td><td>96</td></tr><tr><td>Number of bunches of roses</td><td>2</td><td>4</td><td>6</td><td>8</td></tr><tr><td>Number of bunches of lilies</td><td>3</td><td>6</td><td>9</td><td>12</td></tr></table>
	The number of bunches of each are shown in the second and third rows. We can find the number of bunches of roses by dividing the number of flowers by 12, and we can find the number of bunches of lilies by dividing the number of flowers by 8.
	
	The smallest number of each she could have ordered was 2 bunches of roses and 3 bunches of lilies.
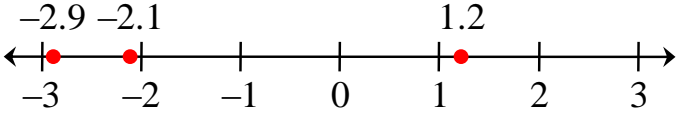
DCAS-Like Answer	Next-Generation Solution
15A: C (6.NS.4)	**15B** a. 1, 2, 3, 4, 6, 8, 12, 16, 24, 48 – the number of bags she can make is shown in the table:

15B

a. 1, 2, 3, 4, 6, 8, 12, 16, 24, 48 – the number of bags she can make is shown in the table:

Number of chocolate chip cookies in each bag	1	2	3	4	6	8	12	16	24	48
Number of bags	48	24	16	12	8	6	4	3	2	1

Since the number of cookies that goes in a bag is a factor of the total number of cookies, all the factors of 48 are listed in the first row of the table. Each column corresponds to a situation where the 48 cookies are divided equally among some bags, and the product of the numbers in each column is 48. The number of bags is also a factor of the total number of cookies.

b. 1, 2, 4, 8, 16, 32, 64

Number of vanilla wafers in each bag	1	2	4	8	16	32	64
Number of bags	64	32	16	8	4	2	1

Since the number of cookies that goes in a bag is a factor of the total number of cookies, all the factors of 64 are listed in the first row of the table. Each column corresponds to a situation where the 64 cookies are divided equally among some bags, and the product of the numbers in each column is 64. The number of bags is also a factor of the total number of cookies.
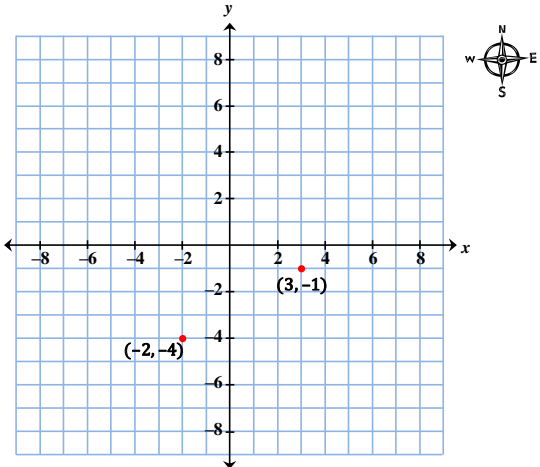
DCAS-Like Answer	Next-Generation Solution
	c. 1, 2, 4, 8, 16 Since the number of bags must be a factor of both 48 and 64, the common factors of 48 and 64 represent all the possibilities for the number of bags she can make. The table below shows these possibilities along with the number of each kind of cookie that would go in each bag. <table><tr><td>Number of bags</td><td>1</td><td>2</td><td>4</td><td>8</td><td>16</td></tr><tr><td>Number of chocolate chip cookies in each bag</td><td>48</td><td>24</td><td>12</td><td>6</td><td>3</td></tr><tr><td>Number of vanilla wafers in each bag</td><td>64</td><td>32</td><td>16</td><td>8</td><td>4</td></tr></table> d. Looking at the table from Item c., we see that the largest number of bags she can make corresponds to the largest common factor, which is 16 in this case. If there are 16 bags, there will be 3 chocolate chip cookies and 4 vanilla wafers in each bag.
16A: D (6.NS.5)	**16B** a. Death Valley is located below sea level. We know this because its elevation is negative. Sea level is the base for measuring elevation. Sea level elevation is defined as 0 feet. All other elevations are measured from sea level. Those places on Earth that are above sea level have positive elevations, and those places on Earth that are below sea level have negative elevations. Thus, Death Valley, with an elevation of –282 feet, is located below sea level. b. To find out how much higher Denver is than Death Valley, we can reason as follows: Death Valley is 282 feet below sea level. Denver is 5280 feet above sea level. So to go from Death Valley to Denver, you would go up 282 feet to get to sea level and then go up another 5280 feet to get to Denver for a total of $282 + 5280 = 5562$ feet. Thus, Denver, Colorado is 5562 feet higher than Death Valley, California. c. If you were standing near the ocean, your elevation would be close to zero. Depending on how high or low the tide is and where exactly you are standing, your elevation could be as low as –50 feet (or as high as 50 feet) if you are at the edge of a very low tide (or a very high tide, respectively) at the Bay of Fundy.

DCAS-Like Answer	Next-Generation Solution
17A: B (6.NS.6)	**17B:** *Part A* ![Coordinate plane graph showing points P at (-6, 5), Q at (-1, 0), T at (1, 0), and R at (-6, -5)] *Part B:* d

DCAS-Like Answer	Next-Generation Solution
18A: D (6.NS.7)	**18B:** a. False b. True c. False d. True *Scoring Rubric* Responses to this item will receive 0-2 points based on the following: **2 points:** FTFT – The student shows a thorough understanding of using the absolute value of coordinates to represent distances. **1 point:** FTFF, TTFT, FTTT, FFFT – The student shows a partial understanding of using the absolute value of coordinates to represent distances and makes a single error. **0 points:** TFTF, TTTT, TFFT, FFTT, TTTF, TFTT, TFFF, FFTF, TTFF, FTTF, FFFF – The student shows a limited or inconsistent understanding of using the absolute value of coordinates to represent distances.

DCAS-Like Answer	Next-Generation Solution
19A: A (6.NS.7)	**19B:** *Part A:* 1 point *Part B:* 1 point a. True b. False c. False d. False *Part C:* 1 point Item d. is correct – The cake that is furthest from the target weight. *Part D:* 1 point a. No b. No c. Yes d. Yes

DCAS-Like Answer	Next-Generation Solution
20A: D (6.NS.8)	**20B:**
21A: A (6.NS.8)	**21B:** a. False b. True c. False d. False *Scoring Rubric for Multi-Part Items:* Each part is independently scored and worth 1 point for a total of 4 points.
22A: C (6.NS.8)	**22B:** Four points at: $(-4, 2), (6, 2), (1, 7), (1, -3)$

Expressions and Equations (EE)

DCAS-Like Answer	Next-Generation Solution
23A: C (6.EE.1)	**23B:** $(7 \div 7 + 7)^2$
24A: A (6.EE.2)	**24B:** a. James $= 2x + 10$ Bonnie $= 2x$ Mike $= x$ Total Tickets $=$ James Tickets $+$ Bonnie Tickets $+$ Mike Tickets Total Tickets $= 2x + 10 + 2x + x$ Total Tickets $= 5x + 10$ b. Total Tickets $= 5x + 10$ $295 = 5x + 10$ $285 = 5x$ $57 = x$ c. Profit $=$ Cost $\times$ # of Tickets Profit $= \$6 \times 295$ Profit $= \$1{,}770$

DCAS-Like Answer	Next-Generation Solution
25A: D (6.EE.2)	**25B: Addition versus Multiplication** The distance to school, and therefore home, is d. Thus, the student rides $(d + d)$ miles in one day. Equivalently, she rides $(2d)\,miles$ in one day. Repeatedly adding the distance traveled in one day for each school day of the week, we find that in one week the student travels $2d + 2d + 2d + 2d + 2d)\,miles$. Equivalently, she travels $5(2d)\,miles$ or $(10d)\,miles$ in a normal, rain-free week. *Expression 1* We know that she travels $(10d)\,miles$ in a normal, rain-free week. In a 4-week period, she would normally ride $(10d + 10d + 10d + 10d)\,miles$, but we need to subtract the miles for the rainy days. For each rain day we have to subtract $2d$ miles. Therefore, she traveled $(10d + 10d + 10d + 10d - 2d - 2d - 2d - 2d)$ or $(10d + 10d + 10 + 10d - (2d + 2d + 2d + 2d))$. Equivalently, we can write $4(10d) - 4(2d) = (40d - 8d)$. *Expression 2* If we decide to combine the rainy day miles with the weekly miles traveled ahead of time, then the expression for one school week with one rainy day looks like $(10d - 2d)$ or $(8d)$ and the four week total is $(8d + 8d + 8d + 8d)$. Equivalently we can write $4(8d)$. The equivalent expressions will vary greatly. Comparing the cases above, we see that $(40d - 8d)$ and $4(8d)$ represent the same distance traveled and therefore are equivalent expressions.
26A: B (6.EE.3)	**26B:** a. Yes b. Yes c. No

DCAS-Like Answer	Next-Generation Solution
27A: A (6.EE.3)	**27B:** a. $6x - 18$ b. *P* and *Q* are not equivalent since the distributive property was not applied correctly. The first terms of *P* and *Q*, $6x$, are equivalent, but the second terms of *P* and *Q*, -18 and -9 respectively, are different. *Scoring Rubric:* Responses to this item will receive 0-2 points based on the following: **2 points:** The student shows thorough understanding of why the expressions *P* and *Q* are not equivalent and generates an equivalent expression for *P* by applying the distributive property. **1 point:** The student generates an equivalent expression for *P* by applying the distributive property, but is not able to adequately explain that *P* and *Q* are not equivalent. OR The student can adequately explain why *P* and *Q* are not equivalent but makes an error in applying the distributive property to *P* when generating an equivalent expression. **0 points:** The student shows little or no understanding of why the equations are not equivalent and does not generate an equivalent expression when applying the distributive property. Stating that the expressions are not equivalent, without proper support, is not sufficient to earn any points.
28A: C (6.EE.4)	**28B:** a. Expressions equivalent to $12x + 36y$: b and c b. Expressions not equivalent to $12x + 36y$: a and d

DCAS-Like Answer	Next-Generation Solution
29A: B (6.EE.5)	**29B:** *Key and Scoring Rubric:* **2 points:** The student shows a thorough understanding of evaluating equations at specific values. Chooses A, D, and E only. **1 point:** The student shows partial understanding of evaluating equations at specific values. Misses only 1 of the correct answers. **0 points:** The student shows inconsistent or no understanding of evaluating equations at specific values or solving equations.
30A: A (6.EE.5)	**30B:** a. 37 is the only value in the set that makes the equation true. b. This means that Ana will need exactly $37 more to buy the bicycle. c. The values from 53 to 250 will make the inequality true. d. This means that Ana will need from $53 to $250 to buy the bicycle. *Scoring Rubric:* Responses to this item will receive 0-3 points based on the following: **3 points:** The student shows a thorough understanding of equations and inequalities in a contextual scenario, as well as a thorough understanding of substituting values into equations and inequalities to verify whether or not they satisfy the equation or inequality. The student offers a correct interpretation of the equality and the inequality in the context of the problem. The student correctly states that 37 will satisfy the equation and that the values from 53 to 250 will satisfy the inequality. **2 points:** The student shows a thorough understanding of substituting values into equations and inequalities to verify whether or not they satisfy the equation or inequality but limited understanding of equations or inequalities in a contextual scenario. The student correctly states that 37 will satisfy the equation and that the values from 53 to 250 will satisfy the inequality, but the student offers an incorrect interpretation of the equality or the inequality in the context of the problem. **1 point:** The student shows a limited understanding of substituting values into equations and inequalities to
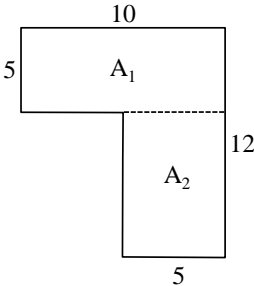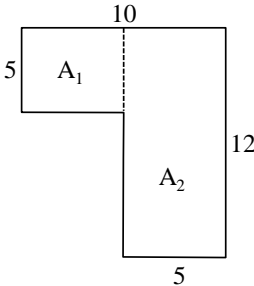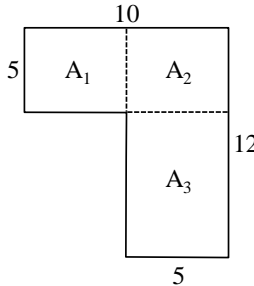
DCAS-Like Answer	Next-Generation Solution
	verify whether or not they satisfy the equation or inequality and a limited understanding of equations and inequalities in a contextual scenario. The student correctly states that 37 will satisfy the equation, does not state that the values from 53 to 250 will satisfy the inequality, and offers incorrect interpretations of the equality and the inequality in the context of the problem. OR The student correctly states that the values from 53 to 250 will satisfy the inequality, does not state that 37 satisfies the equation, and offers incorrect interpretations of the equality and the inequality in the context of the problem.
	0 points: The student shows little or no understanding of the equations and inequalities in a contextual scenario and little or no understanding of substituting values into equations and inequalities to verify whether or not they satisfy the equation or inequality. The student offers incorrect interpretations of the equality and the inequality in the context of the problem, does not state that 37 satisfies the equation, and does not state that the values from 53 to 250 will satisfy the inequality.
31A: C (6.EE.6)	**31B:** Key: $3b + 5$ or $3xb + 5$ or $bx3 + 5$ or $5 + 3b$ or $5 + 3xb$ or $5 + bx3$
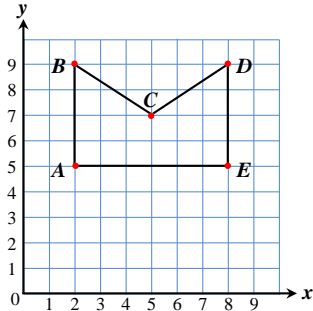
DCAS-Like Answer	Next-Generation Solution
32A: A (6.EE.7)	**32B:** *Sample Top-Score Response:* The school auditorium can seat 325 students. In the auditorium there are 25 rows with the same number of seats in each row. Which equation can be used to find x, the number of seats in each row in the school auditorium? $25 + x = 325$ There are 25 soccer balls in a store. The total number of soccer balls and basketballs in the store is 325. Which equation can be used to find , the number of basketballs in the store? $25x = 325$ Marissa had 25 marbles in a bag. She gave some to her brother. Her brother now has 325 marbles. Which equation can be used to find , the number of marbles that Marissa gave her brother? Neither There are 25 cans of soup in a case. The manager of a grocery store needs to order 325 cans of soup. Which equation can be used to find , the total number of cases the manager needs to order? Cleo has a certain number of seashells. Pete has 25 seashells. Together Cleo and Pete have 325 seashells. Which equation can be used to find , the total number of seashells that Cleo has?

Scoring Rubric:

2 points: The student shows a thorough understanding of identifying equations that match a given real-world scenario and chooses $25x = 35$, $25 + x = 325$, Neither, $25x = 325$, $25 + x = 325$.

1 point: The student shows a limited understanding of identifying equations that match a given real-world scenario and misidentifies one of the equations by using addition instead of multiplication for the variable, or multiplication instead of addition for the variable, or uses "Neither" in place of where an equation could have been utilized.

0 points: The student shows little or no understanding of identifying equations that match a given real-world scenario and misidentifies two or more of the equations by using addition instead of multiplication for the variable, and/or multiplication instead of addition for the variable, and/or uses "Neither" in place of where an equation could have been utilized.

DCAS-Like Answer	Next-Generation Solution
33A: B (6.EE.8)	**33B:** a. No b. Yes c. Yes d. No e. Yes
34A: D (6.EE.9)	**34B:** *Part A* Student gives a correct answer: <table><tr><td>**Miles Driven**</td><td>**240**</td><td>360</td><td>480</td><td>**576**</td></tr><tr><td>**Gallons of Gas**</td><td>10</td><td>15</td><td>**20**</td><td>24</td></tr></table> *Part B* a. 1st place: Car D b. 2nd place: Car C c. 3rd place: Car A d. 4th place: Car B *Part C* Car D

DCAS-Like Answer	Next-Generation Solution
35A: D (6.EE.9)	**35B:** Student selects two correct answers out of two submitted: a. False b. True c. False d. True e. False

Geometry (G)

DCAS-Like Answer	Next-Generation Solution
36A: C (6.G.1)	**36B:** a. False b. True c. True d. True e. False
37A: B (6.G.1)	**37B:** $A = A_1 + A_2$ $A = 5 \times 10 + 5(12 - 5)$ $A = 85$ $A = A_1 + A_2$ $A = 5(10 - 5) + 5 \times 12$ $A = 25 + 60$ $A = 85$ $A = A_1 + A_2 + A_3$ $A = 5(10 - 5) + 5 \times 5 + 5(12 - 5)$ $A = 25 + 25 + 35$ $A = 85$
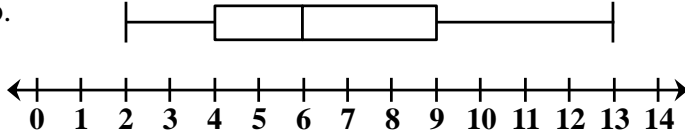
DCAS-Like Answer	Next-Generation Solution
38A: D (6.G.1)	**38B:** Area of triangle: 28 sq cm *Rationale:* Using the formula to find the area of the triangle, the base of triangle *ADE* is 8 cm and its height is 7 cm. The area of $\frac{1}{2}(7 \times 8) = 28$ sq cm.
39A: D (6.G.2)	**39B:** a. The volume of each box is 15.625 cubic feet. b. 54 boxes completely fill the cargo hold of the truck. The length of the cargo hold is 15 feet, so 15 divided by 2.50 equals 6. The width and height of the cargo hold are each 7.5 feet, so 7.5 divided by 2.5 equals 3. So the 6 boxes times 3 boxes times 3 boxes equals 54 total boxes that fit in the cargo hold.
40A: C (6.G.3)	**40B:** a. b. 18 square units *Suggested Scoring Rubric* • Each part is scored independently—worth 1 point each.
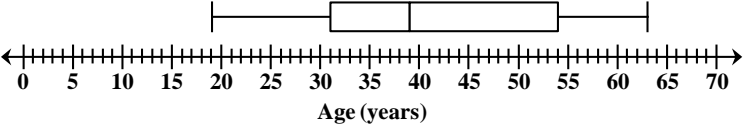
DCAS-Like Answer	Next-Generation Solution
41: A (6.G.4)	**41B:** <table><tr><th>Nets Forming a Rectangular Prism</th><th>Nets Forming a Triangular Prism</th><th>Nets Forming a Pyramid</th></tr><tr><td>b. d.</td><td>f.</td><td>a. c. e.</td></tr></table>

Statistics and Probability (SP)

DCAS-Like Answer	Next-Generation Solution
42A: B (6.SP.1)	**42B:** a. Yes b. No c. No d. Yes e. Yes f. No g. Yes h. Yes
43A: C (6.SP.2)	**43B:** a. 25 b. The distribution of birth weights is centered at approximately 17 (median = 17 ounces, mean = 16.92 ounces), and the interquartile range is 2 ounces and the mean absolute deviation (MAD) is 1.149 ounces. The distribution has a longer tail for lower values (that is, skewed left).
44A: D (6.SP.3)	**44B:** a. Mean about $179. b. Median is $150. c. Median is a better summary of the data because the two outliers of $500 skew the data.

DCAS-Like Answer	Next-Generation Solution
45A: C (6.SP.4)	**45B:** a. Mike's pictures: _(see table below)_

a. Mike's pictures:

Picture	Number of Birds
1	8
2	5
3	3
4	5
5	2
6	6
7	10
8	13
9	7

b.


```
←+—+—+—+—+—+—+—+—+—+—+—+—+—+—→
  0  1  2  3  4  5  6  7  8  9  10 11 12 13 14
```

Points Assigned
- 1 point for entering the correct number of birds from each photo
- 1 point for 3 to 4 correct values represented on the box plot
- 1 point for 5 correct values represented on the box plot

Note: The extreme values and quartiles are calculated based on the data given in part a. The student receives full credit for part b. if the box plot matches the data they provided in part A.

DCAS-Like Answer	Next-Generation Solution
46A: A (6.SP.4)	**46B:** **Ages of Gym Class Members** *Scoring Rubric* Responses to this item will receive 0-2 points based on the following: **2 points:** The student shows a thorough understanding of how to construct a box plot. The student correctly plots the minimum, both quartiles, median, and maximum. **1 point:** The student shows a partial understanding of how to construct a box plot. The student correctly plots 3 or 4 of the 5 values mentioned above, and the values that are not plotted correctly are only 1 away from the correct value. **0 points:** The student shows little or no understanding of how to construct a box plot. The student correctly plots less than 3 of the 5 values, or the student plots 1 or more values that are more than 1 away from the correct value.
47A: B (6.SP.5)	**47B:** a. Not possible b. Possible c. Possible d. Not possible

DCAS-Like Answer	Next-Generation Solution
48A: A (6.SP.5)	**48B:** The mean is not the best measure of center to use because the area of Brazil is much larger than the other areas. Only two areas are larger than the mean area. The best measure of center to use is the median because most of the areas are clustered together, as can be seen in the box plot, so the median reflects what the typical area is. *Scoring Rubric* Responses to this item will receive 0-2 points based on the following: **2 points:** The student demonstrates thorough understanding of the best measure of center to use to describe a given set of data. The student provides a good explanation of why the mean is not the best AND why the median is the best. **1 point:** The student demonstrates partial understanding of the best measure of center to use to describe a given set of data. The student provides either a good explanation of why the mean is not the best OR a good explanation of why the median is the best. **0 points:** The student shows inconsistent or no understanding of the best measure of center to use to describe a given set of data. The student provides neither a good explanation of why the mean is not the best nor a good explanation of why the median is the best.

SECTION 3: PERFORMANCE TASKS

BEAD BRACELET

Common Core Standards:

6.EE.9 – Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.*

6.G.1 – Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

6.G.2 – Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = l w h and V = b h to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

5.MD.3 – Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

   a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.

   b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.

5.MD.5 – Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

   a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent three-fold whole-number products as volumes, e.g., to represent the associative property of multiplication.

   b. Apply the formulas V =(l)(w)(h) and V = (b)(h) for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.

   c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

5.OA.2 – Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.*

4.MD.3 – Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.

Primary Claim: Claim 4 – Modeling and Data Analysis

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

Secondary Claim: Claim 1 – Concepts and Procedures

Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.

Primary Content Domain: Ratios and Proportional Relationships

Secondary Content Domain: Equations and Expressions, The Number System, Numbers and Operations in Base Tent

Assessment Targets:

4 A: Apply mathematics to solve problems arising in everyday life, society, and the workplace.

4 B: Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem.

4 D: Interpret results in the context of a situation.

1 A: Understand ratio concepts and use ratio reasoning to solve problems.

1 F: Reason about and solve one-variable equations and inequalities.

1 G: Represent and analyze quantitative relationships between dependent and independent variables.

1 C: Compute fluently with multi-digit numbers and find common factors and multiples.

1 C: (Grade 5) Understand the place-value system.

Mathematics Practices: 1, 3, 4, 5

Depth of Knowledge: 3

Item Type: PT

Score Points: 16

Difficulty: H

How This Task Addresses the "Sufficient Evidence" for This Claim: The student carries out mathematical procedures with precision when determining the design of a bracelet. Once the design is determined, the student uses ratio and proportion to determine the number and type of beads needed for a necklace as well as uses properties of inequalities in some instances. Finally, the student creates a cost analysis by determining the cost of the bracelet and necklace, along with the profit for the items when given a percentage.

Target-Specific Attributes: Accommodations may be necessary for students with fine motor-skill challenges and language-processing challenges.

Stimulus/Source: http://www.orientaltrading.com/

Task Overview: Students must calculate various ratios and proportions when constructing a beaded bracelet and necklace. Additionally, students must perform calculations to determine the cost of the items and the possible amount of profit, given certain criteria.

Teacher Preparation/Resource Requirements: None

Teacher Responsibilities During Administration: Monitor individual student work; provide resources as necessary.

Time Requirements: Two sessions totaling no more than 120 minutes. Part A and Part B should be completed in Session 1. Part C and Part D should be completed in Session 2.

Prework: None

Student Task – Bead Bracelets

Your school is hosting an Arts and Crafts Fair to raise funds. Your class has been asked to help by designing and making jewelry for the fund raiser. In this task, you will be asked to design a bracelet, calculate ratios, make predictions, and calculate costs.

Part A – Designing a Bracelet

Your principal has purchased the materials to make the jewelry. The materials include:

- Three types of glass beads
- Three types of spacer beads (the beads used to separate sections of glass beads)
- Beading wire (the wire that holds the beads when making a bracelet or a necklace)
- Clasps (the fasteners that hold the ends of a bracelet or necklace together)

The cost of each type of bead is shown below.

Glass Beads	
Type A	$4.25 for a bag of 48 beads
Type B	$6.00 for a bag of 25 beads
Type C	$8.00 for a bag of 25 beads

Spacer Beads	
Type D	$4.00 for a bag of 25 beads
Type E	$8.00 for a bag of 24 beads
Type F	$7.00 for a bag of 300 beads

Design a bracelet using at least **two** types of glass beads and **one** type of spacer bead.

- Use between 8 and 12 glass beads.
- Use at least 6 spacer beads.
- Use no more than 25 total beads in your bracelet.

Write the type letter (A, B, C, D, E, or F) to represent each bead in your design. Use the 25 blanks below to lay out the design for your bracelet. Only write one letter in each blank you use.

__/__

Write 5 ratios that can be used to mathematically describe the bracelet you designed. Make sure your ratios show each of the following:

- The relationship between one type of glass bead used and another type of glass bead used
- The relationship between one type of glass bead used and all the beads used
- The relationship between one type of glass bead used and a type of spacer bead used
- The relationship between all the glass beads used and all the spacer beads used
- The relationship between one type of spacer bead used and all the beads used

You have been given one bag of each type of bead that you have selected. Based on your design, how many complete bracelets can you make before you run out of one type of bead? Explain your answer using diagrams, mathematical expressions, and/or words.

Part B – Calculating the Costs

The cost of one clasp and enough beading wire to make a bracelet is $0.25. Using the information from *Part A*, determine the cost to create <u>one</u> of the bracelets you designed. Explain your answer using diagrams, mathematical expressions, and/or words.

In *Part A*, you determined the number of complete bracelets you could make before running out of one type of bead. Determine the cost to create this number of bracelets. Explain your answer using diagrams, mathematical expressions, and/or words.

Part C – Matching Necklaces

Your principal would like you to make some necklaces to match the bracelets you designed.

- The cost of one clasp and enough beading wire to make a 24-inch necklace is $0.30.
- Your bracelet is 8-inches long.

Determine the cost to create a 24-inch necklace that contains the same ratios of beads as your bracelet contains. Explain your answer using diagrams, mathematical expressions, and/or words.

Approximately how many of each type of bead will be needed to create a 24-inch necklace? Explain your answer using diagrams, mathematical expressions, and/or words.

Part D – Predicting Profits

Note: The teacher should discuss the definition of profit in this context. "A profit is the amount of money that is earned when a product is sold. Profit is determined by subtracting the cost of making the products from the price charged to customers."

For the Arts and Crafts Fair, your principal sets the price of each bracelet and necklace such that the school makes a profit that is 60% of the cost to make each piece of jewelry.

Determined the price at which your bracelet and necklace will be sold at the Arts and Crafts Fair. Explain your answer using diagrams, mathematical expressions, and/or words.

Your principal would also like to offer discounted prices for customers who buy sets of 3 bracelets. When customers buy sets of 3 bracelets, the school will make a profit that is 40% of the cost to make each bracelet. Determine the price at which a set of 3 bracelets will be sold at the Arts and Crafts Fair. Explain your answer using diagrams, mathematical expressions, and/or words.

The list below shows the pieces of jewelry that were sold at the Arts and Crafts Fair.

- 5 sets of 3 bracelets
- 3 necklaces
- 20 individual bracelets

Determine the **total** profit the school made from selling these pieces of jewelry. Explain your answer using diagrams, mathematical expressions, and/or words.

Sample Top-Score Response

Part A

F / D / A / D / A / D / F / B / F / D / A / D / A / D / F / B / F / D / A / D / A / D / F

Ratios will vary based upon the layout of beads chosen by the student.

- 1 Type B glass bead to 3 Type A glass beads (1: 3)
  3 Type A glass beads to 1 Type B glass bead (3: 1)

- 6 Type A glass beads out of 23 beads in total (6: 23)
  2 Type B glass beads out of 23 beads in total (2: 23)

- 2 Type A glass beads to 3 Type D spacer beads (2: 3)
  1 Type A glass bead to 1 Type F spacer bead (1: 1)
  2 Type B glass beads to 9 Type D spacer beads (2: 9)
  2 Type B glass beads to 6 Type F spacer beads (1: 3)

- 8 glass beads to 15 spacer beads (8: 15)

- 9 Type D spacer beads out of 23 beads in total (9: 23)
  6 Type F spacer beads out of 23 beads in total (6: 23)

I can make 2 bracelets. There are only 25 Type D spacer beads in a package, and my bracelet used 9 per bracelet. $25 \div 9 = 2\ R7$, so I can only make 2 complete bracelets before I run out of Type D spacer beads.

Part B

- $4.25 \div 48 = 0.089$ so $0.09 per Type A glass bead
- $6.00 \div 25 = 0.24$ so $0.24 per Type B glass bead
- $4.00 \div 25 = 0.16$ so $0.16 per Type D spacer bead
- $7.00 \div 300 = 0.023$ so $0.02 per Type F spacer bead
- $6(\$0.09) + 2(\$0.24) + 9(\$0.16) + 6(\$0.02) + \$0.25 = \$2.83$

$2(\$2.83) = \$5.66$

Part C

$\$2.83 - \$0.25 = \$2.58$; $\$2.58 \times 3 + \$0.30 = \$8.04$

The 8-inch bracelet was designed with 6 Type A glass beads. Based on this design, a 24-inch necklace would have 18 of these beads.

There are 2 Type B glass beads in the 8-inch bracelet. The 24-inch necklace would have 6 of these beads.

There are 9 Type D spacer beads in the 8-inch bracelet. The 24-inch necklace would have 27 of these beads.

There are 6 Type F spacer beads in the 8-inch bracelet. The 24-inch necklace would have 18 of these beads.

OR

$23 \div 8 = 2.875$ beads per inch
$2.875 \times 24 = 69$ beads on a 24-inch necklace

$23 \div 6 = 3.83$
$69 \div 3.83 = 18.02$
There will be approximately 18 Type A glass beads and 18 Type F spacer beads on the necklace.

$23 \div 2 = 11.5$
$69 \div 11.5 = 6$
There will be approximately 6 Type B glass beads on the necklace.

$23 \div 9 = 2.56$
$69 \div 2.56 = 26.95$
There will be approximately 27 Type D spacer beads on the necklace.

OR

$\frac{6}{23} = \frac{n}{69}$
$6(69) = 23n$
$414 = 23n$
$414 \div 23 = n$
$18 = n$
The will be approximately 18 Type A glass beads and 18 Type F spacer beads on the necklace.

$\frac{2}{23} = \frac{n}{69}$
$2(69) = 23n$
$138 = 23n$
$138 \div 23 = n$
$6 = n$
There will be approximately 6 Type B glass beads on the necklace.

$\frac{9}{23} = \frac{n}{69}$
$9(69) = 23n$
$621 = 23n$
$621 \div 23 = n$
$27 = n$
There will be approximately 27 Type D spacer beads on the necklace.

Part D

$\$2.83 \times 1.6 = \$4.53$
$\$8.04 \times 1.6 = \$12.86$

$(\$2.83 \times 3) \times 1.4 = \$11.89$

Profit from sets of bracelets:
$11.89 × 5 = $59.45; $2.83 × 15 = $42.45; $59.45 − $42.45 = $17.00

Profit from necklaces:
$12.86 × 4 = $51.44; $8.04 × 4 = $32.16; $51.44 − $32.16 = $19.28

Profit from individual bracelets:
$4.53 × 20 = $90.60; $2.83 × 20 = $56.60; $90.60 − $56.60 = $34.00

Total profit:
$17.00 + $19.28 + $34.00 = $70.28

Scoring Note: Each section is evaluated independently. The total number of points is determined by adding the point assigned for each task.

Scoring Rubric

Part A

6 points: Thorough understanding of ratio and proportional relationships. Thorough understanding of the given directions. The student correctly used one type of spacer bead and at least two types of glass beads. The student correctly used no more than 25 total beads and correctly used 8 to 12 glass beads and at least 6 spacer beads. The student correctly wrote a set of 5 ratios according to bulleted directions. The student correctly used mathematics to find the number of bracelets that can be made using *all* the different types of beads the student chose for the bracelet.

5 points: Thorough understanding of ratio and proportional relationships. Partial understanding of the given directions. The student correctly used one type of spacer bead and at least two types of glass beads. The student used a number of glass beads or spacer beads that were outside of directions. The student correctly wrote a set of 5 ratios according to bulleted directions. The student correctly used mathematics to find the number or bracelets that can be made using *all* the different types of beads the student chose for the bracelet. **OR** The student did everything else required, but only correctly wrote 4 of the 5 required ratios. **OR** The student did everything else required, but did not correctly determine the number of bracelets that could be made.

4 points: Partial understanding of ratio and proportional relationships. Partial understanding of the given directions. The student did everything else required, but only correctly wrote 3 of the 5 required ratios. **OR** The student did everything else required, but only correctly wrote 4 of the 5 required ratios and did not correctly determine the number of bracelets that could be made. **OR** The student did everything else required, but used a number of glass beads or spacer beads that were outside of directions and only correctly wrote 4 of the 5 required ratios. **OR** The student did everything else required, but used a number of glass beads or spacer beads that were outside of directions and did not correctly determine the number of bracelets that could be made.

3 points: Partial understanding of ratio and proportional relationships. Partial understanding of the given directions. The student did everything else required, but only correctly wrote 2 of the 5 required ratios. **OR** The student did everything else required, but only correctly wrote 3 of the 5 required ratios and did not correctly determine the number of bracelets that could be made. **OR** The student did everything else required,

but used a number of glass beads or spacer beads that were outside of directions and only correctly wrote 3 of the 5 required ratios. **OR** The student used a number of glass beads or spacer beads that were outside of directions, made an error with 1 ratio, and did not correctly determine the number of bracelets that could be made.

2 points: Partial understanding of ratio and proportional relationships. Partial understanding of the given directions. The student did everything else required, but only correctly wrote 1 of the 5 required ratios. **OR** The student did everything else required, but only correctly wrote 2 of the 5 required ratios and did not correctly determine the number of bracelets that could be made. **OR** The student did everything else required, but used a number of glass beads or spacer beads that were outside of directions and only correctly wrote 2 of the 5 required ratios. **OR** The student used a number of glass beads or spacer beads that were outside of directions, made an error with 2 ratios, and did not correctly determine the number of bracelets that could be made.

1 point: Limited understanding of ratio and proportional relationships. Limited understanding of the given directions. The student used a number of glass beads or spacer beads that were outside of directions, made an error with 3 or more ratios, and did not correctly determine the number of bracelets that could be made. **OR** The student used a number of glass beads or spacer beads that were outside of directions, made an error with 4 or 5 ratios, but correctly determined the number of bracelets that could be made.

0 points: No understanding of ratio and proportional relationships. No understanding of the given directions. The student made errors in every section of Part A.

Part B

3 points: Thorough understanding of numbers and operations. Thorough understanding of solving real-world problems involving the cost of making bracelets. The student correctly determines the minimum cost of the bracelet by first dividing the total cost of each package of beads by the number of beads in the package. Then the student correctly multiplies each individual cost by the number of each type of bead in the bracelet. The student correctly determines the cost of the total number of bracelets created from one bag of each style of bead by multiplying the number of bracelets that can be made and the cost of each individual bracelet.

2 points: Partial understanding of numbers and operations. Partial understanding of solving real-world problems involving the cost of making bracelets. The student correctly determines the minimum cost of the bracelet by first dividing the total cost of each package of beads by the number of beads in the package. Then the student correctly multiplies each individual cost by the number of each type of bead in the bracelet. The student incorrectly determines the cost of the total number of bracelets created from one bag of each style of bead when multiplying the number of bracelets that can be made and the cost of each individual bracelet.

1 point: Limited understanding of numbers and operations. Limited understanding of solving real-world problems involving the cost of making bracelets. The student correctly determines the minimum cost of the bracelet by first dividing the total cost of each package of beads by the number of beads in the package. Then the student incorrectly multiplies each individual cost by the number of each type of bead in the bracelet. The student incorrectly determines the cost of the total number of bracelets created

from one bag of each style of bead when multiplying the number of bracelets that can be made and the cost of each individual bracelet.

0 points: No understand of numbers and operations. No understanding of solving real-world problems involving the cost of making bracelets. The student incorrectly determines the minimum cost of the bracelet when dividing the total cost of each package of beads by the number of beads in the package. Then the student incorrectly multiplies each individual cost by the number of each type of bead in the bracelet. The student incorrectly determines the cost of the total number of bracelets created from one bag of each style of bead when multiplying the number of bracelets that can be made and the cost of each individual bracelet.

Part C

4 points: Through understanding of ratio and proportions. Thorough understanding of mathematical expressions. The student correctly determines the cost for each inch of the necklace by subtracting $0.25, multiplying the cost of the bracelet by 3, and adding $0.30. The student correctly determines the number of each type of bead that would be needed for the necklace.

3 points: Partial understanding of ratio and proportions. Partial understanding of mathematical expressions. The student correctly determines the cost for each inch of the necklace by subtracting $0.25, multiplying the cost of the bracelet by 3, and adding $0.30. The student makes an error when determining the number of 1 type of bead that would be needed for the necklace. **OR** The student makes an error when determining the cost of the necklace, but correctly determines the number of each type of bead that would be needed for the necklace.

2 points: Partial understanding of ratio and proportions. Partial understanding of mathematical expressions. The student correctly determines the cost for each inch of the necklace by subtracting $0.25, multiplying the cost of the bracelet by 3, and adding $0.30. The student makes an error when determining the number 2 types of bead that would be needed for the necklace. **OR** The student makes an error when determining the cost of the necklace and makes an error when determining the number of 1 type of bead that would be needed for the necklace.

1 point: Limited understanding of ratio and proportions. Limited understanding of mathematical expressions. The student correctly determines the cost for each inch of the necklace by subtracting $0.25, multiplying the cost of the bracelet by 3, and adding $0.30. The student does make errors in determining the number of 3 or more of the bead types needed to make the necklace. **OR** The student makes an error when determining the cost of the necklace and makes an error when determining the number of 2 types of bead that would be needed for the necklace.

0 points: No understanding of ratio and proportions. No understanding of mathematical expressions and inequalities. The student does not correctly complete any section of Part C.

Part D

3 points: Thorough understanding of numbers and operations and the number system. The student correctly determines the profit of 60% by multiplying the cost of the bracelet by 1.6 and the cost of the necklace by 1.6. The student correctly determines the 40%

profit from selling a set of 3 bracelets by multiplying the cost of the bracelet by 3 and then multiplying that total by 1.4. The student correctly determines a total profit of $70.28.

2 points: Partial understanding of numbers and operations and the number system. The student makes an error in 1 of the 3 sections of Part D.

1 point: Limited understanding of numbers and operations and the number system. The student makes an error in 2 of the 3 sections of Part D.

0 points: Little or no understanding of numbers and operations and the number system. The student makes errors in all 3 sections of Part D.

DESIGN A GARDEN

Common Core Standards:

6.EE.9 – Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.

6.G.1 – Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

6.G.2 – Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = l w h and V = b h to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

5.MD.3 – Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
    a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.
    b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.

5.MD.5 – Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
    a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent three-fold whole-number products as volumes, e.g., to represent the associative property of multiplication.
    b. Apply the formulas V =(l)(w)(h) and V = (b)(h) for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.
    c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

5.OA.2 – Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.*

4.MD.3 – Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.

Primary Claim: Claim 4 – Modeling and Data Analysis

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

Secondary Claim: Claim 1 – Concepts and Procedures

Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.

Primary Content Domain: Equations and Expressions

Secondary Content Domain: Geometry, Operations and Algebraic Thinking, Measurement and Data

Assessment Targets:

4 A: Apply mathematics to solve problems arising in everyday life, society, and the workplace.

4 B: Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem.

4 D: Interpret results in the context of a situation.

1 G: (Grade 6) Represent and analyze quantitative relationships between dependent and independent variables.

1 H: (Grade 6) Solve real-world and mathematical problems involving area, surface area, and volume.

1 I: (Grade 5) Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

1 A: (Grade 5) Write and interpret numerical expressions.

1 I: (Grade 4) Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

Mathematics Practices: 1, 3, 4, 5

Depth of Knowledge: 3

Item Type: PT

Score Points: 12

Difficulty: M

How This Task Addresses the "Sufficient Evidence" for This Claim: The student uses measurement skills such as finding the area of polygons, finding the volume to determine the amount of soil or mulch that must be purchased to fill the gardens for planting, and finding the perimeter to and surface area of each garden area. The student determines the cost of each garden by using variables to represent two quantities that change in relationship to one another; writes equations to express one quantity, thought of as the independent variable; and analyzes the relationship between the dependent and independent variable using tables.

Target-Specific Attributes: Accommodations may be necessary for students with fine motor-skill challenges and language-processing challenges.

Stimulus/Source: www.homedepot.com, www.lowes.com, custom-created flyer or newspaper advertisements

Task Overview: Students must work through various calculations in order to find the best deal, area, perimeter, and volume of each garden.

Teacher Preparation/Resource Requirements: Calculators are aavailable to students, either online or physically.

Teacher Responsibilities During Administration: Monitor individual student work; provide resources as necessary.

Time Requirements: Two sessions totaling no more than 120 minutes. Part A and Part B should be completed in Session 1. Part C, Part D, and the conclusion should be completed in Session 2.

Prework: None

Design a Garden

You are volunteering at a community center. The director of the center has asked you to design a garden and to determine the amount and cost of materials to build the garden, including wood, soil, and the plants.

Part A

The director has asked you to design different sections of the garden that meet the following conditions:

- Section 1 must be shaped like a square.
- Section 1 must have an area between 26 square feet and 50 square feet.
- Section 2 must be shaped like a rectangle but must **not** be a square.
- Section 2 must be exactly twice the area of Section 1.

On the grid at the top of the next page, draw your design for Section 1 and Section 2. Be sure to label each section (1 or 2) and include the dimensions. Each box in the grid represents 1 square foot.
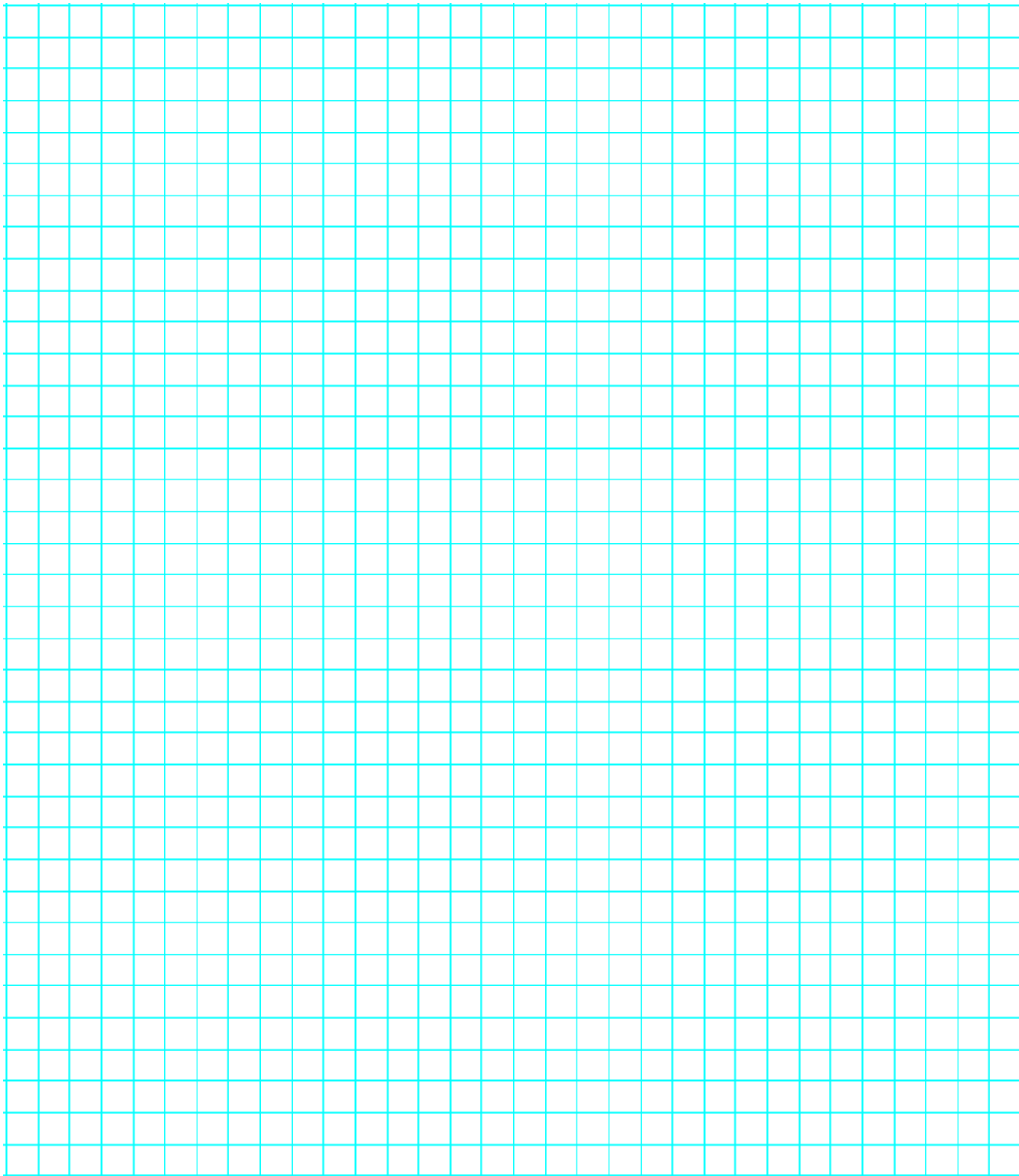
Based on your design, complete the following table:

| Section	Area (square feet)	Perimeter (feet)
1		
2		

Part B – Building the Planter Boxes

The director would like the sections to be contained in planter boxes that are 20 inches deep. You must buy the wood to construct the boxes for Section 1 and Section 2.

As seen in the picture below, a planter box is a rectangular prism that is filled with soil. It has no top or base.

Morris Hardware Store offers pressure-treated wood in two different lengths.
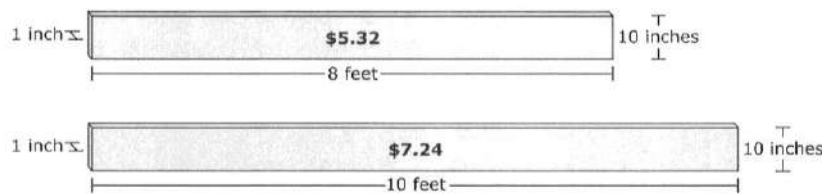
What is the minimum amount of wood that needs to be purchased to construct a planter box for both Sections 1 and 2? Explain your answer using diagrams, pictures, mathematical expressions, and/or words.

You plan to buy the wood to make the planter boxes from Morris Hardware Store. Using the information above, what is the minimum cost to buy the amount of wood needed for both boxes? Use mathematics to justify your answer.

Part C – Buying Plants

The director would like you to buy and plant carrots and tomatoes in the garden.

You will plant carrots in Section 1 and tomatoes in Section 2. Each plant must be 1 foot away from the sides of the planter box and 1 foot away from each other. How many carrot plants and tomato plants do you need to buy? Provide mathematical justification for your answer.

Number of carrot plants: _____

Number of tomato plants: _____

You have a choice of two stores to buy the carrot plants and tomato plants, as shown below.

	Greenthumb Garden Mart	**Lawn & Garden Depot**
Carrots	$1.29 each	$7.92 for 6
Tomatoes	$1.89 each	$8.70 for 6

Based on the unit rate, write an equation to represent the total cost to purchase any number of tomato plants at the Lawn & Garden Depot. In the equation, let C represent the total cost of the tomato plants in dollars and n represent the number of tomato plants bought.

What is the minimum amount you will need to pay to buy the carrot and tomato plants? Provide justification for your answer.

Part D – Buying Soil

It is recommended that planter boxes be filled with 6 or 9 inches of soil, depending on the type of plant. The carrot plants will be planted in 9 inches of soil and the tomato plants will be planted in 6 inches of soil.

Complete the table below to convert inches into feet.

Depth (in inches)	Depth (in feet)
3 inches	0.25 foot
6 inches	
9 inches	
12 inches	1 foot

Determine the depth, in feet, of the soil in each planter box.

Section	Depth (in feet)
1	
2	

Determine the minimum volume, in cubic feet, of soil that will be needed for the carrot plants and the tomato plants. Use mathematics to justify your answer.

Carrot plants need _____ cubic feet of soil.

Tomato plants need _____ cubic feet of soil.

The Greenthumb Garden Mart offers two different prices for soil, as shown below.

Organic Garden Soil Mix 1.5 cubic feet — $6.97

Premium Enriched Potting Soil 40 lb. — $2.22

At this store, a cubic foot of soil weighs 80 points. Which type of soil will be the least expensive for you to buy? Use mathematics to justify your answer.

What is the total cost for purchasing soil from Greenthumb Garden Mart to fill both planter boxes? Explain your answer using diagrams, pictures, mathematical expressions, and/or words.

Conclusion

You have been given a budget of $450 to build the garden you designed. Based on your work in Part C and Part D, do you have enough money to build the garden you designed? If so, justify your answer using mathematics or words. If not, what could you change so that you do not go over budget?

Sample Top-Score Response:

Part A

On the grid, draw and label Section 1 as a 6-by-6 square and Section 2 as an 8-by-9 rectangle.

- Section 1 Area = 36 square feet   Perimeter = 24 feet
- Section 2 Area = 72 square feet   Perimeter = 34 feet

Part B

For Section 1, I must buy 48 feet of wood. I multiplied the perimeter by 2 because the height of the planter box is 20 inches, and the height of the boards is 10 inches. For Section 2, I must buy 68 feet.

The unit price for the 8-foot board is $0.67 and for the 10-foot board is $0.72. The minimum cost is $78.32. I found this cost by adding the cost for Section 1 and Section 2.

- Section 1: $48 \div 8 = 6\ boards \times \$5.32 = \$31.92$
- Section 2: I need 68 feet, so I will buy 6, 8-foot boards and 2, 10-foot boards. So the cost is $6\ boards \times \$5.32 + 2\ boards \times \$7.24 = \$46.40$.

Part C

I will need to purchase 25 carrot plants and 56 tomato plants. I used the grid from the begging of the test. Since the scare of each grid box is 1 foot by 1 foot, there are 5×5 and 7×8 intersections of grid lines. Each of these intersections is 1 foot away from the edge and 1 foot away from each other.

$$C = 1.45n$$

The unit price for carrots is less at Greenthumb Garden Mart ($1.29/plant) than at lawn & Garden Depot ($1.32/plant). The unit price for tomatoes is less at Lawn & Garden Depot ($1.45/plant) than at Greenthumb Garden Mart ($1.89/plant). So the minimum cost is $\$113.45 = \$1.29 \times 25 + \$1.45 \times 56$.

Part D

6 inches = 0.50 feet   and   9 inches = 0.75 feet

Carrot plants need 27 cubic feet of soil—($0.75\ feet \times 36$) square feet.

Tomato plants need 36 cubic feet of soil—($0.5\ feet\ \times 72$) square feet.

The unit price of Organic Garden Soil Mix is $\$4.65 = \$6.97 \div 1.5$. Since 80 pounds of soil = 1 cubic foot, the unit rate of Premium Enriched Potting Soil is $\$4.44 = 2 \times \$2.22$.

I will buy Premium Enriched Potting Soil. The total cost of soil is $\$279.72 = \$4.44(27 + 36)$.

Conclusion

No, my plan is not within budget. The total cost to build the garden is:

$$\$479.49 = \$31.92 + \$46.40 + \$113.45 + \$279.72$$

Scoring Rubric

Scoring Notes: Each part is evaluated independently. The total number of points is determined by adding the points assigned for each task

Part A

2 points: Thorough understanding of how to find area and perimeter of squares and rectangles. The student correctly draws on the grid a square and rectangle that satisfies the given conditions and correctly determines the area and perimeter of these quadrilaterals.

1 point: Limited or inconsistent understanding of how to find area and perimeter of squares and rectangles. The student correctly finds the area and perimeter of a square and a rectangle that fails to satisfy one of the given conditions. **OR** The student correctly draws on the grid a square and rectangle that satisfy the given conditions but incorrectly determines the area or perimeter of one of these quadrilaterals.

0 points: Limited or no understanding of how to find area and perimeter of squares and rectangles. The student does not completely answer any of the parts correctly.

Part B

3 points: Thorough understanding of determining unit rates. Thorough understanding of solving real-world problems involving the perimeter of squares and rectangles. The student correctly determines the minimum cost of $73.32.

2 points: Thorough understanding of determining unit rates but partial understanding of solving real-world problems involving the perimeter of squares and rectangles. The student correctly determines the unit rate but finds the minimum cost by using 8, 8-foot boards for Sections 2. **OR** Thorough understanding of solving real-world problems involving the perimeter of squares and rectangles but partial understanding of determining unit rates. The student incorrectly determines the unit rate but consistently uses this rate in determining the minimum cost.

1 point: Partial or inconsistent understanding of determining unit rates or of solving real-world problems involving the perimeter of squares and rectangles. The student finds only the unit rates.

0 points: Limited or no understanding of determining unit rates and solving real-world problems involving the perimeter of squares and rectangles. The student does not correctly answer any part.

Part C

3 points: Thorough understanding of analyzing patterns. Thorough understanding of writing an equation. Thorough understanding of solving real-world problems involving operations with decimals. The student correctly determines the number of plants to be 25 carrots and 56 tomatoes. The student writes a correct equation and defines all variables. The student determines the minimum cost to be $113.45 with explanation.

2 points: Thorough understanding of analyzing patterns and writing equations but partial understanding of solving real-world problems involving decimals. The student correctly determines the number of plants and writes a correct equation but incorrectly solves the real-world problem involving decimals. **OR** Thorough understanding of analyzing patterns and of solving real-world problems involving decimals but partial

understanding of writing equations. The student correctly determines the number of plants and solves the real-world problem involving decimals but writes an incorrect equation or a correct equation with variables undefined. **OR** Thorough understanding of writing equations and solving real-world problems but limited understanding of analyzing patterns. The student correctly writes an equation and consistently solves the real-world problem involving decimals using an incorrect solution to the number of plants.

1 point: Thorough understanding of either analyzing pattern or writing an equation. The student correctly determines the number of plants or writes a correct equation but is not able to solve real-world problems. **OR** Partial or inconsistent understanding of analyzing patterns or writing an equation or solving real-world problems involving operations with decimals. The student does not answer any part completely correctly.

0 points: Limited or no understanding of analyzing patterns or writing an equation or solving real-world problems involving operations with decimals. The student does not correctly answer any part.

Part D

3 points: Thorough understanding of solving real-world problems involving the volume of rectangular prisms. Thorough understanding of determining unit rates. The student correctly determines the cost of the soil is $279.72.

2 points: Thorough understanding of solving real-world problems involving the volume of rectangular prisms but limited understanding of determining unit rates. The student incorrectly determines the unit rate but consistently uses it to determine the cost of the soil. **OR** The student correctly determines the unit rates and the volume but incorrectly determines the cost.

1 point: Partial or inconsistent understanding of solving real-world problems involving the volume of rectangular prisms and of determining unit rates. The student incorrectly finds one of the unit rates and incorrectly calculates volume as well. **OR** The student only finds the unit rate. **OR** The student finds the volume of one of the prisms.

0 points: Limited or no understanding of solving real-world problems involving the volume of rectangular prisms and of determining unit rates. The student determines only the conversion of the units. **OR** The student does not correctly answer any part.

Conclusion

1 point: Thorough understanding of interpreting results in the context of a situation. The student provides a mathematical justification of why the plan is not within budget or provides a change to the plan that will bring the plan within budget.

0 points: No understanding of interpreting results in the context of a situation. The student does not provide a mathematical justification for the answer.