

Sample Items for CMT-3 Strand 25: Mathematical Applications

Strand 25 of the 3rd Generation of the Connecticut Mastery Test is called Mathematical Applications. The items that assess this strand are 4-point open-ended items that require students to solve a complex problem, show their work and explain their reasoning.

4th graders are given one numerical and one statistical problem. 6th and 8th graders are given one numerical, one statistical, and one spatial problem.

These items are designed to assess integrated understanding of key mathematical ideas as well as student's ability to communicate their understanding and demonstrate their reasoning.

The generic rubric used to create task specific rubrics for these items is:

Score of 3: Student shows a correct and/or appropriate answer and shows work and/or an explanation that demonstrates full and complete understanding.

Score of 2: Student has minor flaws in the answer, but the work and/or explanation is acceptable and the reasoning is appropriate.

Score of 1: Student does not have a reasonable answer or does not provide a reasonable explanation or show sufficient work, resulting in a demonstration of only limited understanding.

Score of 0: Student shows no understanding of the problem or how to arrive at a solution.

Grade 4 Sample Mathematical Applications Items

Sample Item 4-1 (Numerical): The Nut Store

The owner of a nut store packages nuts into 2 different sizes of packages. The prices for the two sizes are:

Weight	Cost
2 pound bag	\$2.00
5 pound bag	\$5.00

This morning, she needs to package 50 pounds of nuts and needs at least 5 bags of each size. Complete the table below to show

- how many 2 pound bags and how many 5 pound bags she could package
- the total weight of these bags, and
- how much money these bags will sell for.

In the space below the chart, show how you arrived at your answers.

Bag size	Number of bags packaged	Total weight of packaged nuts	Total value of the bags
2 pounds	_____	_____	\$ _____
5 pounds	_____	_____	\$ _____
	Total number of bags packaged: _____	Total weight of the packaged bags: _____	Total value of the bags of nuts: _____

Show your work here:

Sample Item 4-2 (Numerical): The School Store

The school store sells pencils, pens and erasers. The chart below shows the cost of each of these items:

ITEM	COST
Pencils	15¢
Pens	25¢
Erasers	40¢

Allyson purchased several items in the store and spent 95¢. Show three DIFFERENT ways that she could have purchased some pencils, pens and erasers and spent exactly 95¢.

Pens _____	Pens _____	Pens _____
Pencils _____	Pencils _____	Pencils _____
Erasers _____	Erasers _____	Erasers _____
Total Cost _____	Total Cost _____	Total Cost _____

Show your work here:

Sample Item 4-3 (Statistical): Pick a Card, Any Card

A set of cards for a new game contains 25 cards.

Sixteen cards are labeled A

Eight cards are labeled B

One card is labeled C.

In the game, points are awarded in this way:

A cards are worth 2 points

B cards are worth 5 points

C cards are worth 10 points

Bill could have ended up with all 16 A cards for a total of 32 points.

Show **THREE** other ways that Bill could have gotten a total of 32 points and show how these combinations add up to 32 points.

Sample Item 4-5 (Numerical): Breakfast Choices

Samantha has the following types of food:

- 6 donuts that cost 20¢ each**
- 3 bagels that cost 30¢ each**
- 7 pastries that cost 40¢ each**
- 4 granola bars that cost 50¢ each**

To make breakfast bags for 5 groups of students, Samantha needs to sort ALL 20 of the food items into 5 bags.

- Each bag must contain the same total number of items.
- Each bag must contain at least three different types of items.
- No two bags can be filled exactly like another bag.

Show how Samantha can put the items into each bag and then find the total cost of each bag.

BAG 1

BAG 2

BAG 3

BAG 4

BAG 5

Cost:

Cost:

Cost:

Cost:

Cost:

Sample Item 4-6 (Statistical): Puppet Show Songs Schedule

You and your classmates must provide music for a puppet show that will last 30 minutes.

The table below shows the songs that you can use and the number of minutes long each song is:

Song Title	Length in Minutes
Do Re Me	2
Sara's Waltz	5
Puppet Polka	8
Whispering Leaves	6
General March	4
Bells of Billings	4
Trumpet Tune	6
Spring and Fall	3

Use the information in the table to complete the schedule below that shows which songs you will use and the time each song will begin so that you will have exactly 30 minutes of music beginning at 2:00.

Time that Song Begins	Song Title
2:00	
2:30	

Grade 6 Sample Mathematical Applications Items

Sample Item 6-1 (Statistical): The Relay Race

Tom, Bob and Vic are racing against each other in a 100 meter dash. In how many different orders could they finish the race, assuming that ties are possible. That is, one finishing order could be Bob, then Tom and then Vic; another could be Tom and Vic in a tie and then Bob.

Show all the different orders in which the race could end – including possible ties.

Sample Item 6-2 (Statistical): Making Change

You pay for an item costing 40¢ item with a \$1.00 bill. Show all the different ways you could get your 60¢ change with combinations of only nickels, dimes and quarters.

Sample Item 6-3 (Statistical): The Jewelry Store

A jewelry designer makes bracelets, necklaces, pins and earrings. The chart below shows the number of items made, the cost of materials and the selling price for each type of jewelry.

Type of jewelry	Number made	Cost of materials	Selling price
Bracelets	25	\$4	\$8
Necklaces	15	\$2.50	\$6
Pins	10	\$5	\$9
Earrings (pairs)	30	\$1.50	\$4

One day last week the designer made a profit (the difference between the selling price and the cost of the materials) of ABOUT \$200.

Show how many of each type of jewelry could have been sold that day. Show or explain how you arrived at your solution and how you calculated the profit.

Sample Item 6-4 (Spatial): The Jewelry Display

A jewelry store displays some of the items it sells in a 3 by 6 rectangular display box. The store owner wants to display several of each of the following items that the store sells:

- Gold bracelets (G) that cost \$8 each**
- Silver necklaces (S) that cost \$6 each**
- Copper pins (C) that cost \$9 each**
- Pairs of wire earrings (E) that cost \$4 each pair**

The display must meet the following conditions:

- There are at least two of each item;
- The total cost of the items in the display is more than \$120; and
- No two display boxes that share a side can have the same item.

Show how the jewelry can be displayed in the 18 display boxes and show the total cost of the items in the display.

TOTAL COST OF THE ITEMS DISPLAYED _____

Sample Item 6-5 (Numerical): Feeding the Horses

Ben's barn is the home for two horses and one pony. The chart below shows how much hay these animals eat each day:

Large horse	1 ½ bales of hay per day
Small horse	1 bale of hay per day
Pony	½ a bale of hay per day

How many bales of hay should Ben purchase for a 30-day supply for his three animals?

If hay costs \$1.25 per bale, how much will the 30-day supply cost?

Show or explain how you arrived at your answer.

Sample Item 6-6 (Numerical): Picnic Order

You are planning a picnic for your neighbors.

You estimate that:

- 30 of the people who come will have two hot dogs with buns;**
- 20 of the people who come will have one hot dog with a bun;**
- 10 of the people who come will have a hot dog without a bun.**

**You find that hot dogs come in packages of 6 for \$1.59 and packages of 10 for \$1.99
You also find that buns come in packages of 8 for \$0.99 and packages of 12 for \$1.29.**

Use this information to order enough hot dogs and hot dog buns for the people coming to the picnic. Show how many packages of each size you will purchase and compute the total cost of these items. Show how you arrived at your answers.

YOUR ORDER:

TOTAL COST:

Sample Item 6-8 (Statistical): A Day at the Science Center

The brochure for the City Science Center describes the following activities at the museum:

Demonstrations:

Gravity on the Moon – 15 minutes at 10:00, 11:30 and 1:00

Physics of Light – 20 minutes at 10:30, 12:30 and 1:30

Lectures:

Famous Scientists – 30 minutes at 11:00 and 2:00

The DNA mystery – 15 minutes at 9:30 and 11:00

Movies:

Volcanoes – 45 minutes at 9:15 and 2:15

Whales and Dolphins – 25 minutes at noon and 1:30

Exhibits:

Space Travel

Dinosaurs

Energy

Use the information above, including taking a 45 minute lunch break, to plan a day at the science center that includes at least 2 hours in the exhibits and at least one demonstration, one lecture and one movie. Complete a schedule that shows your plan.

TIME	ACTIVITY
9:00	Arrive at the science center
	Lunch
3:00	Depart from Science Center

Sample Item 6-9 (Numerical): Fruit Punch for a Party

A recipe for fruit punch calls for the following ingredients:

Orange juice	4 cups
Lemon juice	½ cup
Club Soda	3 cups
Serves 6	

The chart below shows the ingredients you have in your kitchen. It also shows how you can purchase these ingredients, and their cost.

What you have		How it's sold and what it costs	
Orange juice	½ gallon	Orange juice	\$3.95/gallon
Lemon juice	1 ½ quarts	Lemon juice	\$1.25/pint
Club Soda	1 gallon	Club Soda	\$1.00/2 quarts

You know that there are:

- 2 cups in 1 pint
- 2 pints in 1 quart
- 4 quarts in one gallon

In order to make enough fruit punch for 60 people, how much of each ingredient will you need to buy and how much will these ingredients cost? Complete the table below to show your answers and show how you arrived at your answers in the space below the table.

Ingredient	How much do you need to buy?	What will this cost?
Orange juice		
Lemon juice		
Club Soda		

Total Cost: _____

Show your work here:

Grade 8 Sample Mathematical Applications Items

Sample Item 8-1 (Statistical): School Growth

The table below shows the student enrollment at Eastside High School for five different years from 1960 to 2000.

<u>Year</u>	<u>Enrollment</u>
1960	185
1970	315
1980	577
1990	930
2000	1362

- a. Construct a scatter plot of the data in the table.
-
-
-
-
-
-
-
-
-
-
- b. Based on the pattern in your graph, what do you predict the school's enrollment will be in 2001?

- c. Explain how you arrived at your prediction.

Sample Item 8-2 (Numerical): Shirt Order

Last month, a store had the following inventory of shirts.

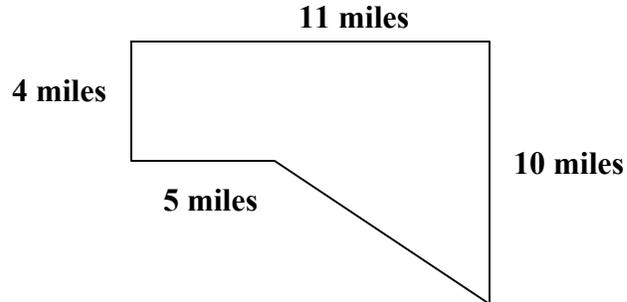
<u>Type of Shirt</u>	<u>Number at the beginning of the month</u>	<u>Number at the end of the month</u>
Dress shirts	375	191
Polo shirts	610	288
T-shirts	158	60

The factory where these shirts are manufactured, has set a minimum number of shirts that can be ordered at 1000 shirts.

In the space below, explain how you could use the data in the table to decide how many of each type of shirt you should order to reach the 1000 shirt minimum. Be sure that your order reflects the sales of each type of shirt during the last month. Show or explain how you arrived at your answer.

Sample Item 8-4 (Spatial): How Big?

A town planner sketches the map of his community shown below.



Use the distances on the map to make an estimate of the number of square miles in the community.

Your estimate: _____

Show or explain how you arrived at your estimate.

Sample Item 8-5 (Numerical): Buying Tickets

The carnival offers you two different options for buying tickets.

OPTION A: \$2.00 per person plus \$0.75 per ride

OR

OPTION B: \$5.00 per person plus \$0.25 per ride

If your uncle gave you \$10 for the carnival, which option – A or B - would you choose. Show the mathematics you used to determine your answer.

OPTION CHOSEN: _____

Explanation:

Sample Item 8-6 (Statistical): Constructing a Bookcase

A bookcase you are building uses 4 boards that are each 42” long for the shelves and 2 boards that are each 65” long for the sides.

The wood you need can be purchased in 3 difference lengths and can be cut to the length you need:

4 foot boards for \$2.75

6 foot boards for \$3.50

8 foot boards for \$4.75

Complete the chart below to show how many of each length of board you would buy in order to construct the bookcase for the LEAST amount of money. Show how you cut the boards to get the 6 boards you need for the bookcase. Show your work and explain how you know you have spent the least amount of money.

Board Length	Number of boards to be purchased	Cost	Bookcase board lengths to be cut
4 feet			
6 feet			
8 feet			

Total Cost: _____

Show your work here:

Sample Item 8-7 (Spatial): Ordering Topsoil

The park foreman decides that there is a need for a 4-inch layer of topsoil on the soccer field to get it ready for the upcoming soccer season. He knows that:

- **The soccer field measures 100 feet by 250 feet**
- **Topsoil is ordered by the truckload**
- **One truckload contains 5 cubic yards of topsoil**

How many truckloads of topsoil should the park foreman order to have enough topsoil for this job. Show your work and explain how you arrived at your answer.

Sample Item 8-8 (Numerical): Ordering Pizza

Pizza House sells two types of pizza that each come in three sizes. The chart below shows the price of each type of pizza and how many people each serves.

Pizza Sizes and Servings

Size/Type	Small (1 serving)	Medium (3 servings)	Large (8 servings)
Thin crusted	\$2.50	\$4.95	\$8.50
Thick crusted	\$2.95	\$5.45	\$9.75

Place an order that meets the following conditions:

- The order serves exactly 30 people;
- Half the servings must be thin crusted and half thick crusted;
- Costs the LEAST.

a. Show how many of what size and what type you would order to meet these conditions.

b. What is the total cost of your order?

Show your work here:

Sample Item 8-9 (Statistical): Making Change

You pay for a \$3.75 item with a \$5.00 bill.

How many different ways could get your change using nickels, dimes and quarters and dollar bills? _____

In the space below, show each of these combinations of bills and coins.

Sample Item 8-10 (Numerical): Buying Sneakers

You need a new pair of sneakers and find the following two ads in the newspaper for the same type of sneaker.

Sneaker City	Active Feet
New sneakers \$45.95	New sneakers \$54.50
On sale this week take 10% off (plus 6% sales tax)	On sale this week take 20% off (plus 6% sales tax)

At which store would you pay LESS for the sneakers? Show your work and explain how you arrived at your answer.

Sample Item 8-11: Coin Toss

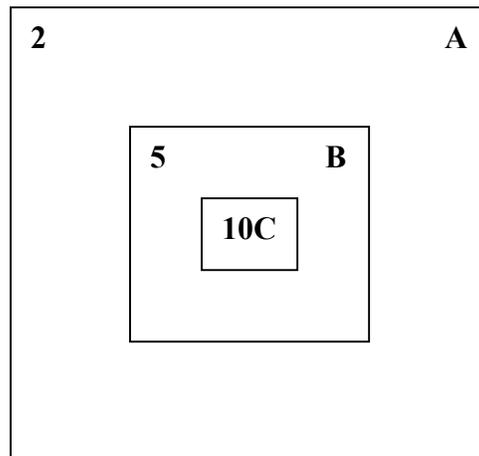
On the game board for the coin toss shown below:

- the area of region A is 70 square inches,
- the area of region B is 20 square inches, and
- the area of region C is 5 square inches.

As shown on the game board, you get:

- 2 points for landing in region A,
- 5 points for landing in region B, and
- 10 points for landing in region C.

If your coin lands on a border line, you get to toss the coin again.



If there is an equal chance of landing anywhere on the board, and if you make 25 tosses onto the board, where none of the tosses lands on a border line, how many points would you expect to get?

Show your work and explain how you arrived at your answer.