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There are all kinds of measurements on tests. You have to know about length, which includes inches, feet, yards, centimeters, and meters. You have to know about capacity, such as cups, pints, quarts, gallons, milliliters, and liters. You have to know about units like ounces, pounds, grams, and kilograms that are used to measure weight and mass. Money, time, and temperature are also kinds of measurement.
Let’s look at a problem in measurement that you might have to solve on a test. Let’s see how to solve it. Remember, we want to get a perfect score of 4 on our scoring rubric.

1. Read and Think

What question were we asked?

- What is the area of the playground in square yards?

What are the keywords?

- rectangular
- length
- width
- many
- square yards

2. Select a Strategy

This problem has two parts. We can use the Divide and Conquer strategy.

The first part is converting feet to yards. The second part is finding the area.

3. Solve

1 yard = 3 feet, so divide the length and the width of the playground by 3 to find the number of yards.

\[
\frac{120}{3} = 40, \text{ so the playground has a length of 40 yards.}
\]

\[
\frac{60}{3} = 20, \text{ so the playground has a width of 20 yards.}
\]

To find the area of a rectangle, multiply the length times the width.

\[ A = lw \]

\[ A = 40 \text{ yd} \times 20 \text{ yd} \]

\[ A = 800 \text{ yd}^2 \]

The area of the playground will be 800 yd\(^2\), so 800 yd\(^2\) of tar is needed.
4. Write/Explain
We used the Divide and Conquer strategy to find the area of the playground in square yards. First, we converted the measures from feet to yards. Then we used the formula for area to find the area of the playground. Since the playground is being blacktopped, it is necessary to find the area to know how much tar is needed.

5. Reflect
Let’s look at our work and answer.

- Did we show that we knew what the problem asked for? Yes.
- Did we know what the keywords were? Yes.
- Did we show that we knew what facts were given? Yes.
- Did we name and use the correct strategy? Yes.
- Was our mathematics correct? Yes. We checked it. It was correct.
- Did we label our work? Yes.

- Was our answer correct? Yes. The area is 800 yd².
- Were all of our steps included? Yes.
- Did we explain why we chose the strategy and how it was used? Yes.
- Did we write a good, clear explanation of our work? Yes.

Score
This solution would earn a 4 on our rubric. Divide and Conquer is a good strategy to use when a problem has more than one part.
Now we'll look at other open-ended math problems. For each guided problem, there are four parts. The first lets you solve the problem. The second lets you use a rubric to score someone else’s work, and then correct it to make it a perfect score of 4. The third is an example of work by someone who got a perfect score of 4, using a strategy that may differ from your own. The fourth are answers to your work on the first and second parts.

8. Measurement

Guided Problem #1

Phil is painting the walls and the ceiling of his bedroom. The room is 15 feet by 12 feet. The ceiling is 8 feet high. He has two windows that each measure 4 feet by 5 feet. He will use 2 coats of paint. If each gallon of paint covers 300 ft², how many gallons of paint does he need to buy?

Keywords: ? ?

Use the rubric on page 13 to score this work.

NOTICE: Photocopying any part of this book is prohibited by law.
1. Try It Yourself.

Answer the questions below to get a score of 4.

What question are you being asked?

What are the keywords?

What are the facts you need to solve the problem?

What strategy can you use to solve the problem?

Solve the problem.

Write/Explain what you did to solve the problem.

Reflect. Use the rubric to help you.

Possible answers include: Divide and Conquer and Draw a Picture.
2. Look How Trish Solved the Problem.

Trish’s Paper

Questions: What is the surface area that Phil will paint? How many gallons of paint does Phil need?
Keywords: each, many, gallon
Facts: The room is 15 feet by 12 feet. The ceiling is 8 feet high. There are two windows that each measure 4 feet by 5 feet. He will use 2 coats of paint. A gallon of paint covers 300 ft².
Strategy: Divide and Conquer
Solve: Wall 1: 15 ft × 8 ft = 120 ft²
Wall 2: 12 ft × 8 ft = 96 ft²
Ceiling: 15 ft × 12 ft = 180 ft²
Window 1: 4 ft × 5 ft = 20 ft²
Window 2: 4 ft × 5 ft = 20 ft²
120 ft² + 96 ft² + 180 ft² + 20 ft² + 20 ft² = 436 ft²
436 ft² × 2 = 872 ft²
872 ft² = 2 R272
300 ft² = 2 R30
Phil needs 3 gallons of paint.
Write/Explain: I used the Divide and Conquer strategy. I found the area of the walls, the ceiling, and the windows. Then I added the areas and multiplied by 2 since Phil is using 2 coats. I divided the sum of the areas by 300 to find how many gallons of paint are needed. Since there was a remainder, I added 1 to the quotient.

Score the Answer.
According to the rubric, from 1 to 3 what score would you give Trish? Explain why you gave that score.

Make It a 4! Rewrite.

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3. There’s More Than One Way.

Remember there is often more than one way to solve a problem. Here is how Francesca solved this problem.

**Francesca’s Paper**

**Questions:** What is the surface area that Phil will paint? How many gallons of paint does Phil need?

**Keywords:** each, many, gallon

**Facts:** The room is 15 feet by 12 feet. The ceiling is 8 feet high. There are 2 windows that each measure 4 feet by 5 feet. He will use 2 coats of paint. A gallon of paint covers 300 ft².

**Strategies:** I Wrote Number Sentences and Used Divide and Conquer.

**Solve:**
- Wall: \(2 \times 2 \times 15 \times 8 = 480\) ft²
- Wall: \(2 \times 2 \times 12 \times 8 = 384\) ft²
- Ceiling: \(2 \times 15 \times 12 = 360\) ft²
- Total: \(480 + 384 + 360 = 1,224\) ft²
- Windows: \(2 \times 2 \times 4 \times 5 = 80\) ft²
- Total: \(1,224 - 80 = 1,144\) ft²
- \(1,144\) ft²/300 = 3 R244

Phil needs 4 gallons of paint.

**Write/Explain:** I Wrote Number Sentences and used the Divide and Conquer strategy. I found the area of each of the longer walls, the shorter walls, the ceiling, and the windows. I multiplied each by 2 since there were 2 of each wall and by 2 again since Phil is using 2 coats of paint. I subtracted the surface area of the windows from the total surface area of the walls. I then divided the area by 300 since each coat can cover 300 ft². Since there was a remainder, I added 1 to the quotient.

**Score:** Francesca would earn a 4 on the rubric. She knew the questions that she needed to answer and gave the keywords and listed the facts. She correctly chose and used her strategies. Her strategies helped her to keep her facts straight. She clearly explained and labeled her work. Her math was correct, as was her answer.
8. Measurement

Try It Yourself (pages 89–90)

Questions: What is the surface area that Phil will paint?
How many gallons of paint does Phil need?

Keywords: each, many, gallon

Facts: The room is 15 feet by 12 feet.
The ceiling is 8 feet high.
There are 2 windows that each measure 4 feet by 5 feet.
He will use 2 coats of paint.
A gallon of paint covers 300 ft².

Strategies: Make a Table and Divide and Conquer

Solve:

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Width</th>
<th>Area in ft²</th>
<th>Total Area in ft²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall 1</td>
<td>15 ft</td>
<td>8 ft</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>Wall 2</td>
<td>15 ft</td>
<td>8 ft</td>
<td>120</td>
<td>240</td>
</tr>
<tr>
<td>Wall 3</td>
<td>12 ft</td>
<td>8 ft</td>
<td>96</td>
<td>336</td>
</tr>
<tr>
<td>Wall 4</td>
<td>12 ft</td>
<td>8 ft</td>
<td>96</td>
<td>432</td>
</tr>
<tr>
<td>Ceiling</td>
<td>15 ft</td>
<td>12 ft</td>
<td>180</td>
<td>612</td>
</tr>
<tr>
<td>Window 1</td>
<td>4 ft</td>
<td>5 ft</td>
<td>20</td>
<td>592</td>
</tr>
<tr>
<td>Window 2</td>
<td>4 ft</td>
<td>5 ft</td>
<td>20</td>
<td>572</td>
</tr>
</tbody>
</table>

572 ft² × 2 = 1,144 ft²
1,144 ft² ÷ 300 = 3 R244

Phil needs 4 gallons of paint.

Write/Explain: I Made a Table and used the Divide and Conquer strategy. I found the area of each of the walls, the windows, and the ceiling. I kept a running total of the area and subtracted the area of the windows from the total. I multiplied the total area by 2 since Phil is using 2 coats of paint. I then divided the area by 300 since each coat can cover 300 ft². Since there was a remainder, I added 1 to the quotient.
Trish’s Paper (page 91)

Score the Answer: I would give Trish a 2. She knew what the question was asking, gave the keywords, and listed the facts. She correctly chose and used a strategy. She labeled her work and included all her steps. And Trish wrote a clear explanation of her work. However, she did not find the area of all of the walls, which caused her to write an incorrect answer. There were two 8 by 15 walls, and two 8 by 12 walls.

Make It a 4!

\[ A = 240 + 192 + 180 - 40 = 572^2 \]

<table>
<thead>
<tr>
<th>Number</th>
<th>Length</th>
<th>Width</th>
<th>Area in ft.²</th>
<th>Total Area in ft.²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longer walls</td>
<td>2</td>
<td>15 ft.</td>
<td>8 ft.</td>
<td>120</td>
</tr>
<tr>
<td>Shorter Walls</td>
<td>2</td>
<td>12 ft.</td>
<td>8 ft.</td>
<td>96</td>
</tr>
<tr>
<td>Ceiling</td>
<td>15 ft.</td>
<td>12 ft.</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>Windows</td>
<td>2</td>
<td>4 ft.</td>
<td>5 ft.</td>
<td>20</td>
</tr>
</tbody>
</table>

\[ 572 \text{ ft}^2 \times 2 = 1,144 \text{ ft}^2 \]

\[ 1,144 \text{ ft}^2 \div 300 = 3 \text{ R}244 \]

Phil needs 4 gallons of paint.

I Made a Table and used the Divide and Conquer strategy. I found the area of each of the walls, the windows, and the ceiling. I kept a running total of the area and subtracted the area of the windows from the total. I multiplied the total area by 2 since Phil is using 2 coats of paint. I then divided the area by 300 since each coat can cover 300 ft². Since there was a remainder, I added 1 to the quotient.

Guided Problem #2

The houses on Von Bargen Avenue are each 25 meters long. They are 40 meters from each other. The corner houses are at least 50 meters away from the intersecting streets. Von Bargen Avenue is 500 meters long. How many houses are on each side of Von Bargen Avenue?

Keywords: ? ?

1. Try It Yourself.

Answer the questions below to get a score of 4.

What question are you being asked?

What are the keywords?
What are the **facts** you need to solve the problem?

What **strategy** can you use to solve the problem?

**Solve** the problem.

**Write/Explain** what you did to solve the problem.

**Reflect**. Use the rubric to help you.

---

**2. Look How Gina Solved the Problem.**

**Gina’s Paper**

**Question:** How many houses are on each side of the avenue?

**Keywords:** each, long, at least, away, many

**Facts:** The houses are 25 meters long.
The houses are 40 meters from each other.
The corner houses are 50 meters away from the intersecting streets.
The street is 500 meters long.

**Strategy:** I Made an Organized List.

**Solve:**

- 0-25 meters: House 1
- 65-90 meters: House 2
- 130-155 meters: House 3
- 195-220 meters: House 4
- 260-285 meters: House 5
- 325-350 meters: House 6
- 390-415 meters: House 7
- 465-480 meters: House 8

There are 8 houses on each side of Von Bargen Ave.

**Write/Explain:** I Made a List. I made each house 25 meters long and there are 40 meters between the houses. I then listed each house until I reached 500 meters.
Score the Answer.
According to the rubric, from 1 to 3 what score would you give Gina? Explain why you gave that score.

Make It a 4! Rewrite.

Use the rubric on page 13 to score this work.
3. There's More Than One Way.

Remember there is often more than one way to solve a problem. Here is how Jorge solved this problem.

**Jorge's Paper**

**Question:** How many houses are on each side of the avenue?

**Keywords:** each, long, at least, away, many

**Facts:** The houses are 25 meters long.
The houses are 40 meters apart from each other.
The corner houses are 50 meters away from the intersecting streets.
The street is 500 meters long.

**Strategy:** I Looked For a Pattern.

**Solve:** Since each house is 25 meters long and each house must be 40 meters away from the next house, I added 65 meters for each house starting from 50.

- 50: House 1
- 115: House 2
- 180: House 3
- 245: House 4
- 310: House 5
- 375: House 6
- 440: Not enough meters to have another house.

**Write/Explain:** I Looked For a Pattern. I started from 50 meters since the first house is at least 50 meters from the intersecting street. All of the houses are 25 meters long and 40 meters away from the next house, so I found a pattern of 65 meters from the start of one house to the start of the next. I added 65 to the location of each house until I reached 375. Since 375 + 25 + 40 = 440, the last house would have started at 440 meters, but there is not enough space for the house to be built before the next intersecting street. There are 6 houses on each side of the avenue.

**Score:** Jorge’s solution would earn a 4 on a test. He identified the question that was asked, the Keywords, and the facts. He picked and correctly used a good strategy. He clearly explained the steps taken to solve the problem and labeled his work.
4. Answers

Guided Problem #2

The houses on Von Bargen Avenue are each 25 meters long. They are 40 meters from each other. The corner houses are at least 50 meters away from the intersecting streets. Von Bargen Avenue is 500 meters long. How many houses are on each side of Von Bargen Avenue?

Keywords: each, long, at least, many, away

Try It Yourself (pages 94–95)

Question: How many houses are on each side of the avenue?

Keywords: each, long, at least, many, away

Facts: The houses are 25 meters long. The houses are 40 meters from each other. The corner houses are 50 meters away from the intersecting streets. The street is 500 meters long.

Strategy: Make a Table

Write/Explain: I Made a Table. I made sure that each of the corner properties is at least 50 meters away from the intersecting streets. The houses are 40 meters apart and each house is 25 meters long. There are 6 houses on each side of the avenue.

Gina’s Paper (pages 95–96)

Score the Answer: I would give Gina a 2. She knew what question was asked, and gave the keywords and the facts. She picked and correctly used a strategy. She also labeled her work and included all her steps. However, she did not follow the instructions of the question. She started her list from 0 and found as many houses as she could until reaching 500, but she forgot that the houses were at least 50 meters from the intersecting street, so her answer was incorrect.

Make It a 4!

50–75 meters: House 1
115–140 meters: House 2
180–205 meters: House 3
245–270 meters: House 4

8. Measurement
310–335 meters: House 5
375–400 meters: House 6

**Strategy:** Make an Organized List

**Write/Explain:** I made sure that each of the corner properties are at least 50 meters away from the intersecting streets. The houses are 40 meters apart and each house is 25 meters long. There are 6 houses on each side of the avenue.

---

**Guided Problem #3**

Ken brought 4 gallons of bottled water to his soccer game. Mrs. Jennings brought 20 one-quart containers of bottled water for the team. Coach Wilson brought a cooler that holds 500 fluid ounces of water. Brenda brought 3 pounds of trail mix. Who brought the most water? Order the amounts of water from least to greatest.

**Keywords:** ? ?

---

1. **Try It Yourself.**

Answer the questions below to get a score of 4.

What **questions** are you being asked?

What are the **keywords**?

What are the **facts** you need to solve the problem?

What **strategy** can you use to solve the problem?

---

**Hint**

Possible answers include: **Divide and Conquer** and **Write a Number Sentence**.
8. Measurement

Solve the problem.

Write/Explain what you did to solve the problem.

Reflect. Use the rubric to help you.

2. Look How Dana Solved the Problem.

**Dana’s Paper**

**Question:** Who brought the most water?
What is the order from least to greatest?

**Keywords:** gallons, quart, fluid ounces, most, least, greatest

**Facts:** Ken brought 4 gallons.
Mrs. Jennings brought 20 quarts.
Coach Wilson brought 500 fluid ounces.
Brenda brought 3 pounds of trail mix.

**Strategy:** Write Number Sentences

**Solve:**

\[
\begin{align*}
4 \times 128 &= 512 \\
20 \times 32 &= 640 \\
500 &= 500
\end{align*}
\]

Mrs. Jennings brought the most water.

**Write/Explain:** I Wrote Number Sentences. I converted gallons to fluid ounces and quarts to fluid ounces. Since 640 is greater than 512 and 500, Mrs. Jennings brought the most water.
Score the Answer.

According to the rubric, from 1 to 3 what score would you give Dana? Explain why you gave that score.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Make it a 4! Rewrite.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Use the rubric on page 13 to score this work.
3. There’s More Than One Way.

Remember there is often more than one way to solve a problem. Here is how Sophie solved this problem.

Sophie’s Paper

**Question:** Who brought the most water? What is the order from least to greatest?

**Keywords:** gallons, quart, fluid ounces, most, least, greatest

**Facts:**
- Ken brought 4 gallons.
- Mrs. Jennings brought 20 quarts.
- Coach Wilson brought 500 fluid ounces.

**Strategy:** I used Logical Thinking.

**Solve:**
- 1 gallon = 4 quarts, so 4 gallons < 20 quarts
- 1 quart = 32 fluid ounces, so 20 quarts = 640 fluid ounces
- Mrs. Jennings brought 20 quarts > 500 fluid ounces
- 1 gallon = 128 fluid ounces
- 128 x 4 = 512, so 4 gallons > 500 fluid ounces

Mrs. Jennings brought the most water.

From least to greatest the amounts are 500 fl oz, 4 gal, 20 qt.

**Write/Explain:** I used Logical Thinking. I converted gallons to quarts and found that 4 gallons is less than 20 quarts. I converted quarts to fluid ounces and found that 20 quarts is greater than 500 fluid ounces, so Mrs. Jennings brought the most water. I converted gallons to fluid ounces and found that 4 gallons is greater than 500 fluid ounces. I then ordered the amounts of water from least to greatest.

**Score:** Sophie would earn a 4 on our rubric. She identified the question that was asked, the keywords, and the facts, and picked a good strategy and used it correctly. She clearly explained and labeled her work and gave the correct answer.
Guided Problem #3

Ken brought 4 gallons of bottled water to his soccer game. Mrs. Jennings brought 20 one-quart containers of bottled water for the team. Coach Wilson brought a cooler that holds 500 fluid ounces of water. Brenda brought 3 pounds of trail mix. Who brought the most water? Order the amounts of water from least to greatest.

Keywords: ? ?

Try It Yourself (pages 99–100)

Question: Who brought the most water? What is the order from least to greatest?

Keywords: gallons, quart, fluid ounces, most, least, greatest


Strategies: Make a Table and Logical Thinking

Solve:

<table>
<thead>
<tr>
<th>Person</th>
<th>Unit</th>
<th>Conversion to Fl Oz</th>
<th>Fluid Ounces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ken</td>
<td>4 gal</td>
<td>$128 \times 4$</td>
<td>512</td>
</tr>
<tr>
<td>Mrs. Jennings</td>
<td>20 qt</td>
<td>$32 \times 20$</td>
<td>640</td>
</tr>
<tr>
<td>Coach Wilson</td>
<td>500 fl oz</td>
<td></td>
<td>500</td>
</tr>
</tbody>
</table>

Mrs. Jennings brought the most water. Order from least to greatest is 500 fl oz, 4 gal, 20 qt.

Write/Explain: I Made a Table. I converted gallons to fluid ounces by multiplying by 128 and quarts to fluid ounces by multiplying by 32 and then compared the numbers. Mrs. Jennings brought the most water. I then used logical thinking to write the amounts of water from least to greatest.

Dana’s Paper (pages 100–101)

Score the Answer: I would give Dana a 2. She knew the question, and gave the keywords, but forgot to answer the second part of the question. She also wrote the extraneous information as part of the facts and did not label the water amounts. Her math was correct. And she picked and used a strategy correctly.

Make It a 4!

$4 \text{ gal} \times 128 \text{ fl oz} = 512 \text{ fl oz}$

$20 \text{ qt} \times 32 \text{ fl oz} = 640 \text{ fl oz}$

500 fl oz

Least to greatest: 500 fl oz, 4 gal, 20 qt.

I Wrote Number Sentences and converted 4 gallons and 20 quarts into fluid ounces. I then compared and ordered the numbers to answer the questions.
A swimming pool is 60 feet long, 40 feet wide, and 5 feet deep. How much water can the swimming pool hold if it is completely full?

The rim on a basketball court stands 120 inches above the ground. When Lester extends his arms, his hand reaches 6 feet 4 inches. How high must Lester jump for him to reach the rim? Write your answer in feet and inches.

What is the greatest area that a rectangle with a perimeter of 20 inches can have?
4. Barry bought a rug that is circular. The diameter of the rug is 3 feet. What is the approximate area of the rug? Use 3.14 for $\pi$.

5. Sydney wants to run 3,000 meters today. She has run 1.2 kilometers so far. How much farther does she have to run to meet her goal? Write your answer in meters.

6. Mrs. Hindes’s rose garden is shaped like a right triangle. The sides of her garden are 12 feet, 16 feet, and 20 feet. What is the area of the garden?

7. Mr. Martin’s basement does not have windows. The room is 24 feet by 15 feet. The ceiling is 7 feet high. What is the surface area of the basement including the ceiling and floor?