Problem Solving

Populations and Samples

Write the correct answer.

1. There are 750 students at Waller Middle School. A random sample of 50 students shows that 21 of them ride their bike to school. Write and solve a proportion to predict the total number of students who ride their bike to school.

2. An office manager orders 500 pens printed with the company logo. She checks a random sample of 25 pens and finds that the logo is missing on 4 of them. Write and solve a proportion to predict the total number of pens that are missing the logo.

3. A large aquarium contains 400 tropical fish. A random sample of 30 fish shows that 9 of them have White Spot disease. Based on the sample, predict the number of fish in the aquarium that have the disease.

4. There are 1,245 people at a chili festival. A random sample of 24 people at the festival shows that 8 of them also attended the barbecue cook-off. Based on the sample, predict the number of people at the chili festival who went to the barbecue cook-off.

Lisa surveyed random samples of adults in four different towns to find out how many of them were registered to vote. The table shows the results. Use the table for Exercises 5–6.

<table>
<thead>
<tr>
<th>Voter Registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Town A</td>
</tr>
<tr>
<td>Town B</td>
</tr>
<tr>
<td>Town C</td>
</tr>
<tr>
<td>Town D</td>
</tr>
</tbody>
</table>

5. Town A has 12,000 adults. Based on the sample, which is the best prediction of the number of registered voters in the town?
   - A 3,000
   - B 5,760
   - C 9,600
   - D 11,520
   
6. According the U.S. Census Bureau, 72% of adults are registered to vote. Based on the samples, which town comes closest to the national percentage?
   - F Town A
   - G Town B
   - H Town C
   - J Town D
**Step 1**
Capture a random sample of fish from the lake. Mark all of these fish with a tag. Let \( T \) be the total number of fish that are tagged.

**Step 2**
Release the fish back into the lake and let them mix with the other fish.

**Step 3**
Recapture a random sample of fish. Let \( n \) be the number of fish in this sample. Count the number of fish \( t \) in the sample that are tagged.

**Step 4**
Let \( N \) be the total number of fish in the lake. Find \( N \) by solving the proportion \( \frac{t}{N} = \frac{N}{T} \).

Example
A biologist captures and tags 200 fish. She releases the fish and waits several days. Then she recaptures a random sample of 169 fish. She finds that 8 of these fish are tagged. Estimate the number of fish in the lake.

In this case, \( T = 200 \), \( n = 169 \), and \( t = 8 \).

Set up the proportion \( \frac{t}{N} = \frac{N}{T} \).

The cross-products are equal, so \( 8N = 160 \cdot 200 \) and \( N = 4000 \). There are approximately 4000 fish in the lake.

### Solve each problem.

1. An ecologist captures and tags 50 frogs from a pond. He releases the frogs and waits several days. Then he recaptures a random sample of 169 fish. He finds that 8 of these fish are tagged. Write and solve a proportion to estimate the number of frogs in the pond.

   \[
   \frac{8}{160} = \frac{x}{50} \]

   \[
   x = \frac{50 \cdot 8}{160} = 25 \]

2. A group of students capture and mark 20 grasshoppers in their schoolyard. They release the grasshoppers and wait several days. Then they recapture a random sample of 40 grasshoppers and find that 5 of them have been marked. Write and solve a proportion to estimate the number of grasshoppers in the schoolyard.

   \[
   \frac{5}{40} = \frac{x}{20} \]

   \[
   x = \frac{20 \cdot 5}{40} = 10 \]

### Problem Solving

#### Populations and Samples

Write the correct answer.

1. There are 750 students at Waller Middle School. A random sample of 50 students shows that 21 of them ride their bike to school. Write and solve a proportion to predict the total number of students who ride their bike to school.

   \[
   \frac{21}{50} = \frac{x}{750} \]

   \[
   x = \frac{750 \cdot 21}{50} = 285 \]

2. An office manager orders 500 pens printed with the company logo. She checks a random sample of 25 pens and finds that the logo is missing on 4 of them. Write and solve a proportion to predict the total number of pens that are missing the logo.

   \[
   \frac{4}{25} = \frac{x}{500} \]

   \[
   x = \frac{500 \cdot 4}{25} = 80 \]

3. A large aquarium contains 400 tropical fish. A random sample of 30 fish shows that 9 of them have White Spot disease. Based on the sample, predict the number of fish in the aquarium that have the disease.

   \[
   \frac{9}{30} = \frac{x}{400} \]

   \[
   x = \frac{400 \cdot 9}{30} = 120 \]

4. There are 1,245 people at a chili festival. A random sample of 24 people at the festival shows that 8 of them also attended the barbecue cook-off. Based on the sample, predict the number of people at the chili festival who went to the barbecue cook-off.

   \[
   \frac{8}{24} = \frac{x}{1245} \]

   \[
   x = \frac{1245 \cdot 8}{24} = 315 \]

Lisa surveyed random samples of adults in four different towns to find out how many of them were registered to vote. The table shows the results. Use the table for Exercises 5–6.

<table>
<thead>
<tr>
<th>Town</th>
<th>Sample Registered to Vote</th>
<th>Not Registered to Vote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town A</td>
<td>48</td>
<td>12</td>
</tr>
<tr>
<td>Town B</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>Town C</td>
<td>36</td>
<td>14</td>
</tr>
<tr>
<td>Town D</td>
<td>68</td>
<td>12</td>
</tr>
</tbody>
</table>

5. Town A has 12,000 adults. Based on the sample, which is the best prediction of the number of registered voters in the town?

   \[
   \begin{align*}
   A & : 3,000 \\
   B & : 5,760 \\
   C & : 11,520 \\
   D & : 19,360
   \end{align*}
   \]

   The best prediction is \( C \) with 11,520 registered voters.

6. According the U.S. Census Bureau, 72% of adults are registered to vote. Based on the samples, which town comes closest to the national percentage?

   \[
   \begin{align*}
   A & : 3,120 \\
   B & : 3,780 \\
   C & : 2,736 \\
   D & : 4,116
   \end{align*}
   \]

   Town D is closest with 4,116 voters.

For each situation, determine whether the estimate is likely to be accurate. Circle the letter in the correct column. Then write the circled letters on the numbered answer blanks to solve the riddle.

<table>
<thead>
<tr>
<th>Term</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>A population</td>
<td>All students at Webster Middle School.</td>
</tr>
<tr>
<td>A sample</td>
<td>The students who are in the Webster Middle School library at 2 pm.</td>
</tr>
<tr>
<td>A random sample</td>
<td>The names of all the students at the school are written on cards and placed in a barrel. A volunteer reaches into the barrel and chooses 10 of the names without looking.</td>
</tr>
</tbody>
</table>

### Puzzles, Twisters & Teasers

#### Pearls of Wisdom

For each situation, determine whether the estimate is likely to be accurate. Circle the letter in the correct column. Then write the circled letters on the numbered answer blanks to solve the riddle.