Focus Area Topic C: Scale Drawings

Scale Factor as a Percent for a Scale Drawing (continued)

Example:
Create a scale drawing of the picture below using a scale factor of 80%. Write equations that show how you determined the lengths of the parts of the resulting picture.

Scale Factor: \(40\% = \frac{40}{100} = \frac{2}{5}\)

Horizontal Distances:
- \(10\left(\frac{2}{5}\right) = 4\)
- \(5\left(\frac{2}{5}\right) = 2\)

Vertical Distances:
- \(7\left(\frac{2}{5}\right) = \frac{14}{2} = 3\)

Changing Scales
Given Drawing 1 and Drawing 2 (a scale model of Drawing 1 with scale factor), students understand that Drawing 1 is also a scale model of Drawing 2 and compute the scale factor, and given three drawings that are scale drawings of each other and two scale factors, students will compute the other related scale factor.

Example:
A regular octagon is an eight-sided polygon with side lengths that are all equal. Both octagons are scale drawings of each other. Use the chart and the side lengths to compute each scale factor as a percent.

<table>
<thead>
<tr>
<th>Actual Drawing to Scale Drawing</th>
<th>Scale Factor</th>
<th>Equation to Illustrate Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing 1 to Drawing 2</td>
<td>(\frac{12}{10} = 1.20 = 120%)</td>
<td>(10(1.2) = 12)</td>
</tr>
<tr>
<td>Drawing 2 to Drawing 1</td>
<td>(\frac{10}{12} = \frac{5}{6} \approx 0.83 \approx 83\frac{1}{3}%)</td>
<td>(12(0.83) = 10)</td>
</tr>
</tbody>
</table>
Focus Area Topic C:

Scale Drawings

Computing Actual Lengths from a Scale Drawing
Given a scale drawing, students compute the lengths in the actual picture using the scale factor.

Example:
The length of a rectangular picture is 8 inches, and the picture is to be reduced to be $45\frac{1}{2}$% of the original picture. Write an equation that relates the lengths of each picture. Explain how the equation illustrates the relationship.

$$8(0.455) = 3.64$$

The length of the reduced picture is 3.64 inches. The equation shows that the length of the reduced picture, 3.64, is equal to the original length, 8, multiplied by the scale factor, 0.455.

Solving Area Problems Using Scale Drawings
Students solve area problems related to scale drawings and percent by using the fact that an area, $A'$, of a scale drawing is $k^2$ times the corresponding area, $A$, in the original drawing, where $k$ is the scale factor.

Example:
What percent of the area of the large square is the area of the small square?

![Small Square and Large Square]

Scale Factor Small to Large Square: $\frac{1}{5}$

Area of Small to Large: \( \left( \frac{1}{5} \right)^2 = \left( \frac{1}{25} \right) = 0.04 = 4\% \)

Focus Area Topic D:

Population, Mixture, and Counting Problems Involving Percents

Students are provided additional experience solving word problems related to percents. Students see the relevance and purpose of their algebraic work as they use it to efficiently solve multi-step word problems involving percents. They also see percent applied to other areas of math and science. Students represent and solve population and mixture problems using algebraic expressions and equations. Topic D concludes with students solving counting problems involving percents, preparing them for future work with probability.

Population Problems
Students write and use algebraic expressions and equations to solve percent word problems related to populations and compilations.

Example:
A school has 60% girls and 40% boys. If 20% of the girls wear glasses and 40% of the boys wear glasses, what percent of all students wears glasses?

Let $n$ represent the number of students in the school. The number of girls is 0.6$n$. The number of boys is 0.4$n$.

Let $x$ be the amount of soil with 30% clay.

1st soil amount (% of clay) + 2nd soil amount (% of clay) = Resulting amount (resulting % of clay)

\[
(0.3)x + (0.7)(10 - x) = (0.5)(10)
\]

\[
0.3x + 7 - 0.7x = 5
\]

\[
-0.4x + 7 - 7 = 5 - 7
\]

\[
-0.4x = -2
\]

\[
x = 5
\]

Counting Problems
Students solve counting problems related to computing percents.

Example:
How many 4-letter passwords can be formed using the letters “A” and “B”?

AAAA, AABA, ABBB, ABBB, ABBB, ABAA, ABAB, ABBA, BABB, BBBA, BBAA, BABA, BABAB, BABB, BABB, BAAB 16 passwords.

What percent of the 4-letter passwords contain no “A”s?

\[
\frac{1}{16} = 0.0625 = 6.25\%
\]