1. Find the value of \( a \).
   \[ \frac{a}{2} = \frac{15}{6} \]
   A. 1
   B. 2
   C. 3.5
   D. 5

2. Find the value of \( n \).
   \[ \frac{29}{18} = \frac{87}{n} \]
   A. 45
   B. 54
   C. 67
   D. 76

3. Find the value of \( x \).
   \[ \frac{8}{4} = \frac{x}{5} \]
   \[ 4x = 40 \]
   \[ x = 10 \]
   A. 8.5
   B. 9
   C. 10
   D. 11

4. Find the value of \( x \).
   \[ \frac{14}{7} = \frac{18}{x} \]
   A. 9
   B. 10
   C. 11
   D. 12
**New Vocabulary**

- dilation
- similarity transformation
- center of dilation
- scale factor of a dilation
- enlargement \( SF > 1 \)
- reduction \( < 1 \)

**Types of Dilations**

A dilation with a scale factor greater than 1 produces an **enlargement**, or an image that is larger than the original figure.

Symbols

- If \( k > 1 \), the dilation is an enlargement.

Example

\( \triangle FGH \) is dilated by a scale factor of 3 to produce \( \triangle RST \). Since \( 3 > 1 \), \( \triangle RST \) is an enlargement of \( \triangle FGH \).
A dilation with a scale factor between 0 and 1 produces a **reduction**, an image that is smaller than the original figure.

**Symbols** If $0 < k < 1$, the dilation is a reduction.

**Example** $ABCD$ is dilated by a scale factor of $\frac{1}{4}$ to produce $WXYZ$. Since $0 < \frac{1}{4} < 1$, $WXYZ$ is a reduction of $ABCD$.

**EXAMPLE 1** Identify a Dilation and Find Its Scale Factor

**A.** Determine whether the dilation from Figure A to Figure B is an **enlargement** or a **reduction**. Then find the scale factor of the dilation.

\[
\frac{\text{New}}{\text{old}} = \frac{3}{6} = \frac{2}{4}
\]

- $\frac{1}{2}$
- $\frac{1}{2}$

**EXAMPLE 1** Check Your Progress

**B.** Determine whether the dilation from Figure A to Figure B is an enlargement or a reduction. Then find the scale factor of the dilation.

- **A.** reduction; $\frac{1}{2}$
- **B.** reduction; $\frac{1}{3}$
- **C.** enlargement; 2
- **D.** enlargement; 3
**PHOTOCOPYING** A photocopy of a receipt is 1.5 inches wide and 4 inches long. By what percent should the receipt be enlarged so that its image is 2 times the original? What will be the dimensions of the enlarged image?

- \[ 1.5 \times 2 = 3 \]
- \[ 4 \times 2 = 8 \]
- \[ 3 \times 8 = 24 \]  

**PHOTOGRAPHS** Mariano wants to enlarge a picture he took that is 4 inches by 7.5 inches. He wants it to fit perfectly into a frame that is 400% of the original size. What will be the dimensions of the enlarged photo?

- **A.** 15 inches by 25 inches
- **B.** 8 inches by 15 inches
- **C.** 12 inches by 22.5 inches
- **D.** 16 inches by 30 inches

**EXAMPLE 3** Verify Similarity after a Dilation

A. Graph the original figure and its dilated image. Then verify that the dilation is a similarity transformation.

- Original: \( M(-6, -3), N(6, -3), O(-6, 6) \)
- Image: \( D(-2, -1), F(2, -1), G(-2, 2) \)

- \[ \frac{3}{9} = \frac{1}{3} \]
- \[ \frac{4}{4} = 1 \]  

**EXAMPLE 3** Verify Similarity after a Dilation

B. Graph the original figure and its dilated image. Then verify that the dilation is a similarity transformation.

- Original: \( G(2, 1), H(4, 1), I(2, 0), J(4, 0) \)
- Image: \( Q(4, 2), R(8, 2), S(4, 0), T(8, 0) \)
\[ GH = \sqrt{(2 - 4)^2 + (1 - 1)^2} = \sqrt{4} = 2 \]
\[ QR = \sqrt{(4 - 8)^2 + (2 - 2)^2} = \sqrt{16} = 4 \]
\[ HJ = \sqrt{(4 - 4)^2 + (1 - 0)^2} = \sqrt{1} = 1 \]
\[ RT = \sqrt{(8 - 8)^2 + (2 - 0)^2} = \sqrt{4} = 2 \]
\[ JL = \sqrt{(2 - 4)^2 + (0 - 0)^2} = \sqrt{4} = 2 \]
\[ TS = \sqrt{(4 - 8)^2 + (0 - 0)^2} = \sqrt{16} = 4 \]
\[ IG = \sqrt{(2 - 2)^2 + (1 - 0)^2} = \sqrt{1} = 1 \]
\[ SQ = \sqrt{(4 - 4)^2 + (2 - 0)^2} = \sqrt{4} = 2 \]

Find and compare the ratios of corresponding sides.

\[
\frac{QR}{GH} = \frac{4}{2} \text{ or } 2 \quad \frac{RT}{HJ} = \frac{2}{1} \quad \frac{TS}{JL} = \frac{4}{2} \text{ or } 2 \quad \frac{SQ}{IG} = \frac{2}{1}
\]