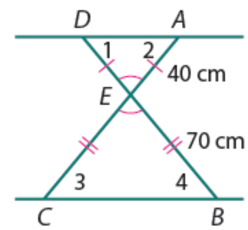
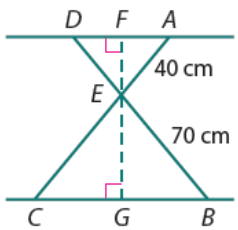
3.1.3 solutions

6 **a.** To justify $\overleftrightarrow{AD} \parallel \overleftrightarrow{BC}$, we could determine that $\angle 1 \cong \angle 4$ or $\angle 2 \cong \angle 3$. These pairs are alternate interior angles for $\overleftrightarrow{AD}$ and $\overleftrightarrow{BC}$. Students might use the congruent vertical angles to explain why $\angle 1 \cong \angle 2 \cong \angle 3 \cong \angle 4$. (Note that $m\angle 1 = m\angle 2 = \frac{1}{2}(180° - m\angle DEA) = \frac{1}{2}(180° - m\angle CEB) = m\angle 3 = m\angle 4$.)

Alternatively, students could use the scale factor of $\frac{4}{7}$ relating $\triangle CEB$ to $\triangle AED$ for $\overline{AE}$ and $\overline{CE}$, and $\overline{DE}$ and $\overline{BE}$, along with the vertical angles to deduce that $\triangle AED \sim \triangle CEB$ (SAS Similarity Theorem). Then the alternate interior angles are congruent because they are corresponding angles of similar triangles. Thus, $\overleftrightarrow{AD} \parallel \overleftrightarrow{BC}$.



b.



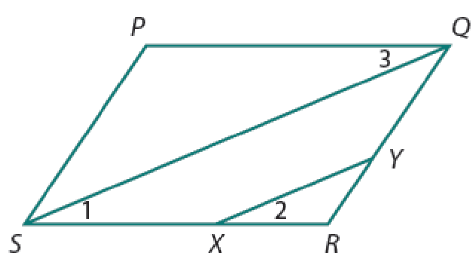
The altitudes of the similar triangles are in the same proportion as the sides. Use $4x$ for EF and $7x$ for EG.

$$4x + 7x = 90$$
$$11x = 90$$
$$x = \frac{90}{11} \approx 8.18$$
$$EF = 4x = 32.72 \text{ cm}$$

Find AD:

$$AF = \sqrt{40^2 - 32.72^2} \approx 23 \text{ cm}$$
$$AD = 2AF \approx 46 \text{ cm}$$
$$m\angle DAE = \sin^{-1}\left(\frac{32.72}{40}\right) \approx 55°$$

9 **a.** Since $\overleftrightarrow{SQ} \parallel \overleftrightarrow{XY}$ and $\overline{SR}$ is a transversal of these lines, the pair of corresponding angles ($\angle 1$ and $\angle 2$) are congruent. Also, $\angle R$ is common to both triangles. So, by the AA Similarity Theorem, $\triangle XYR \sim \triangle SQR$.



b. $\angle 1 \cong \angle 3$ because they are alternate interior angles for parallel lines $\overleftrightarrow{PQ}$ and $\overleftrightarrow{SR}$. In Part a, we showed that $\angle 1 \cong \angle 2$, thus $\angle 3 \cong \angle 2$. $\angle P$ and $\angle R$ are opposite angles of $\square PQRS$ and are thus congruent. So, $\triangle XYR \sim \triangle QSP$ (AA Similarity Theorem).

c. The center of the size transformation is R and the magnitude is $\frac{SR}{XR} = \frac{QR}{YR} = \frac{SQ}{XY}$.

15 **a.** We proved in the *Reasoning and Proof* unit that there is one line through a point not on a given line that is perpendicular to the given line.

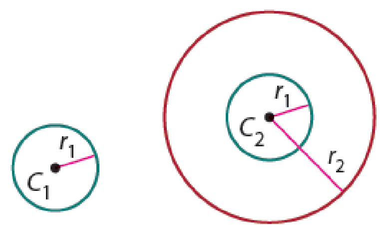
b. The slope of ℓ_1 is $-\frac{BC}{OB}$.

The slope of ℓ_2 is $\frac{AB}{OB}$.

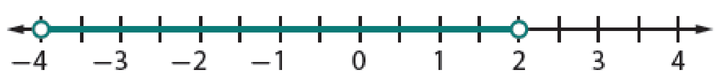
c. Students might directly apply Applications Task 5 (page 181) to justify $\triangle AOB \sim \triangle OCB$ or show two pairs of corresponding angles are the same measure.

d. We want to show that $-\frac{BC}{OB} \cdot \frac{AB}{OB} = -1$. By Part c, $\triangle AOB \sim \triangle OCB$, so $\frac{BC}{OB} = \frac{OB}{AB}$. So by substitution, $-\frac{BC}{OB} \cdot \frac{AB}{OB} = -\frac{OB}{AB} \cdot \frac{AB}{OB} = -1$.

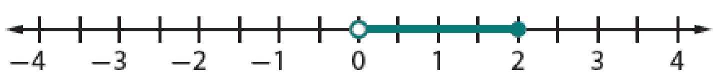
22 Make the circles concentric by translating the center C_1 of the small circle to the center C_2 of the large circle. Then the circle of radius 12 is the result of a size transformation centered at C_2 with factor $\frac{12}{5}$ of the circle with radius 5. In general, any two circles with radii r_1 and r_2 (with $r_1 \neq r_2$) are similar because they too are related by the composition of a translation and a size transformation of factor either $\frac{r_1}{r_2}$ or $\frac{r_2}{r_1}$. When $r_1 = r_2$, the circles are congruent and related by a translation.



37 **a.** $-4 < x < 2$



b. $0 < x \leq 2$



c. No solution

Just in Time

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a. LM

b. BC

c. PL

d. $m\angle M$

e. $m\angle L$

f. $m\angle C$