

7.5 – PROPORTION APPLICATIONS

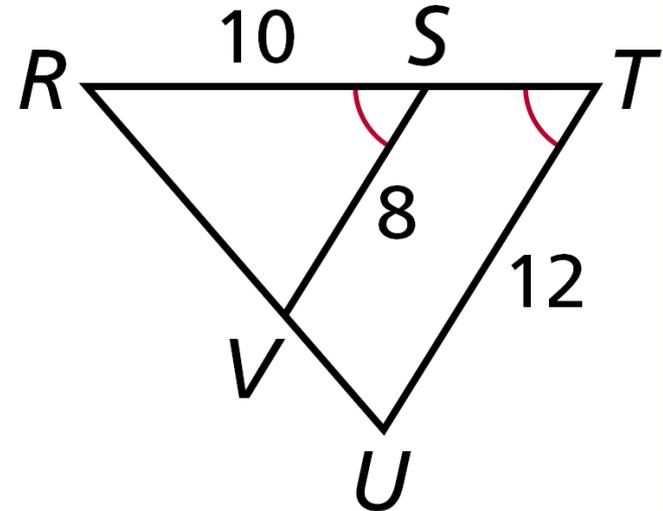
Check It Out! Example 3

Explain why $\triangle RSV \sim \triangle RTU$ and then find RT .

Step 1 Prove triangles are similar.

It is given that $\angle S \cong \angle T$.
 $\angle R \cong \angle R$ by Reflexive Property of \cong .

Therefore $\triangle RSV \sim \triangle RTU$ by AA \sim .



Check It Out! Example 3 Continued

Step 2 Find RT .

$$\frac{RT}{RS} = \frac{TU}{SV}$$

Corr. sides are proportional.

$$\frac{RT}{10} = \frac{12}{8}$$

Substitute RS for 10, 12 for TU , 8 for SV .

$$RT(8) = 10(12)$$

Cross Products Prop.

$$8RT = 120$$

Simplify.

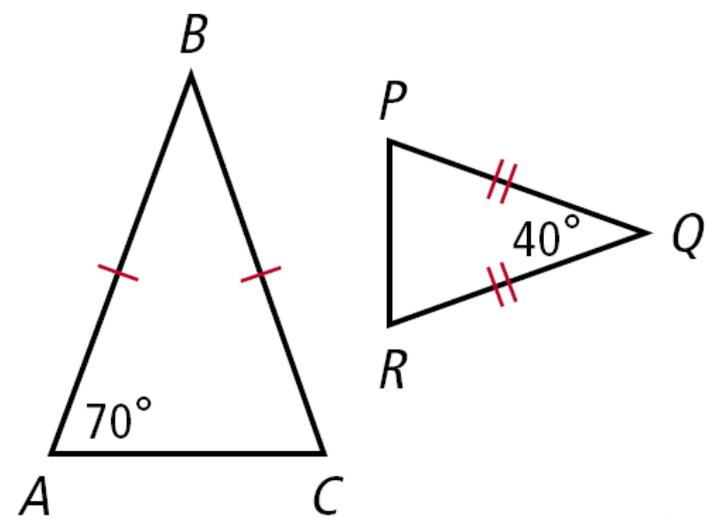
$$RT = 15$$

Divide both sides by 8.

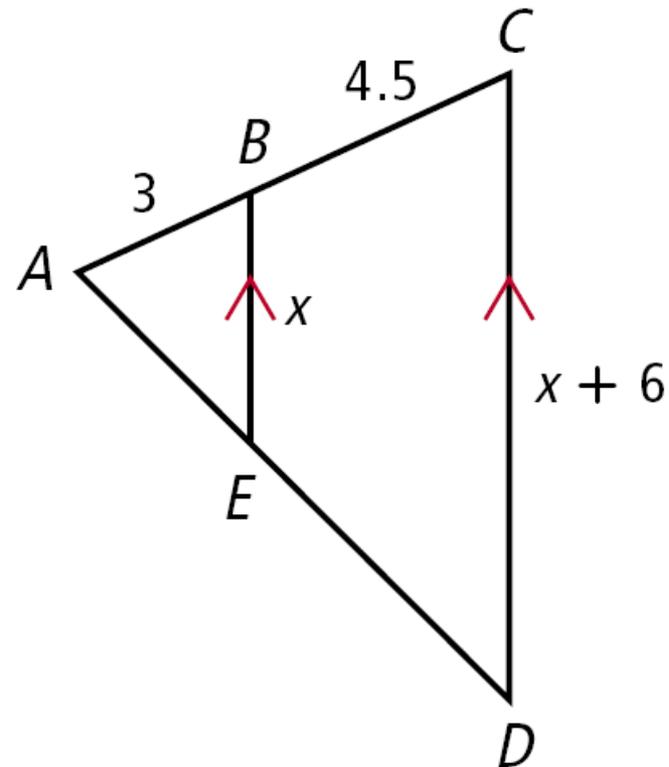


Lesson Quiz

1. Explain why the triangles are similar and write a similarity statement.



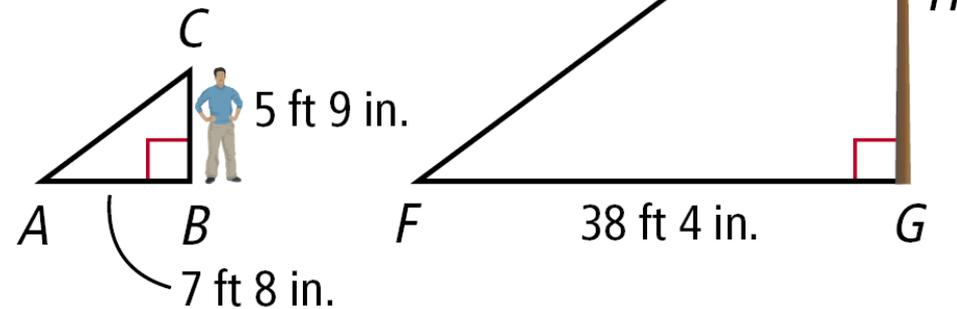
2. Explain why the triangles are similar, then find BE and CD .



- **Indirect measurement** is any method that uses formulas, similar figures, and/or proportions to measure an object. The following example shows one indirect measurement technique.



Tyler wants to find the height of a telephone pole. He measured the pole's shadow and his own shadow and then made a diagram. What is the height h of the pole?



Example 1 Continued

Step 1 Convert the measurements to inches.

$$AB = 7 \text{ ft } 8 \text{ in.} = (7 \cdot 12) \text{ in.} + 8 \text{ in.} = 92 \text{ in.}$$

$$BC = 5 \text{ ft } 9 \text{ in.} = (5 \cdot 12) \text{ in.} + 9 \text{ in.} = 69 \text{ in.}$$

$$FG = 38 \text{ ft } 4 \text{ in.} = (38 \cdot 12) \text{ in.} + 4 \text{ in.} = 460 \text{ in.}$$

Step 2 Find similar triangles.

Because the sun's rays are parallel, $\angle A \cong \angle F$. Therefore $\triangle ABC \sim \triangle FGH$ by AA \sim .



Example 1 Continued

Step 3 Find h .

$$\frac{BC}{GH} = \frac{AB}{FG}$$

Corr. sides are proportional.

$$\frac{69}{h} = \frac{92}{460}$$

Substitute 69 for BC, h for GH, 92 for AB, and 460 for FG.

$$92h = 69 \cdot 460$$

Cross Products Prop.

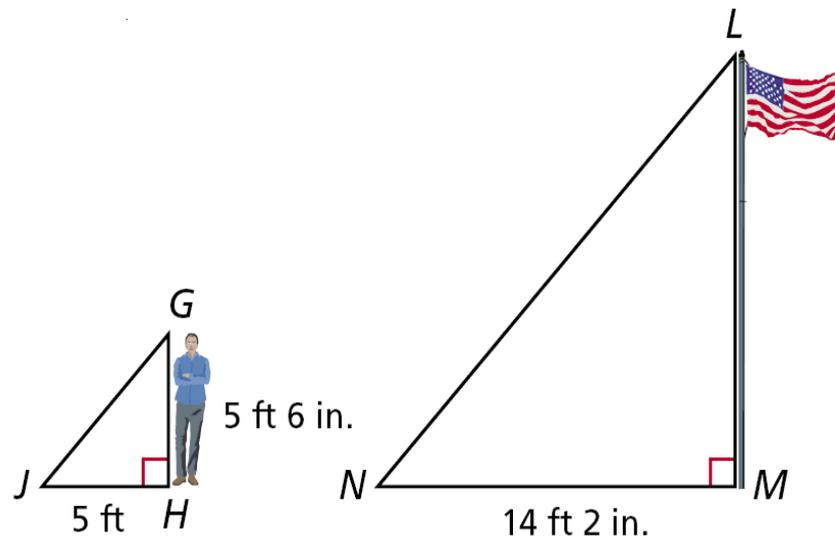
$$h = 345$$

Divide both sides by 92.

The height h of the pole is 345 inches, or 28 feet 9 inches.



A student who is 5 ft 6 in. tall measured shadows to find the height LM of a flagpole. What is LM ?



Check It Out! Example 1 Continued

Step 2 Find similar triangles.

Because the sun's rays are parallel, $\angle L \cong \angle G$. Therefore $\triangle JGH \sim \triangle NLM$ by AA \sim .

Step 3 Find h .

$$\frac{GH}{JH} = \frac{LM}{MN}$$

Corr. sides are proportional.

$$\frac{66}{60} = \frac{h}{170}$$

Substitute 66 for BC, h for LM, 60 for JH, and 170 for MN.

$$60(h) = 66 \cdot 170$$

Cross Products Prop.

$$h = 187$$

Divide both sides by 60.

The height of the flagpole is 187 in., or 15 ft. 7 in.



Lady Liberty holds a tablet in her left hand. The tablet is 7.19 m long and 4.14 m wide. If you made a scale drawing using the scale 1 cm:0.75 m, what would be the dimensions to the nearest tenth?



Example 3 Continued

Set up proportions to find the length ℓ and width w of the scale drawing.

$$\frac{\ell}{7.19} = \frac{1}{0.75}$$

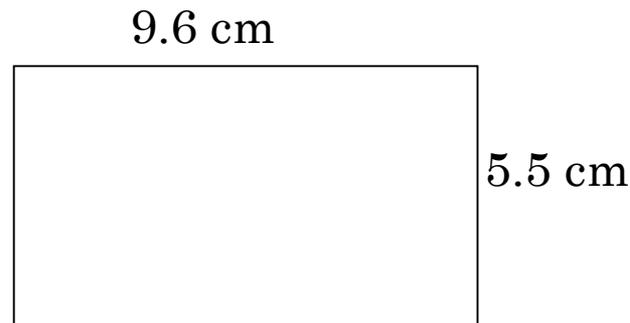
$$0.75\ell = 7.19$$

$$\ell \approx 9.6 \text{ cm}$$

$$\frac{w}{4.14} = \frac{1}{0.75}$$

$$0.75w = 4.14$$

$$w \approx 5.5 \text{ cm}$$



The rectangular central chamber of the Lincoln Memorial is 74 ft long and 60 ft wide. Make a scale drawing of the floor of the chamber using a scale of 1 in.:20 ft.



Check It Out! Example 3 Continued

Set up proportions to find the length ℓ and width w of the scale drawing.

$$\frac{\ell}{74} = \frac{1}{20}$$

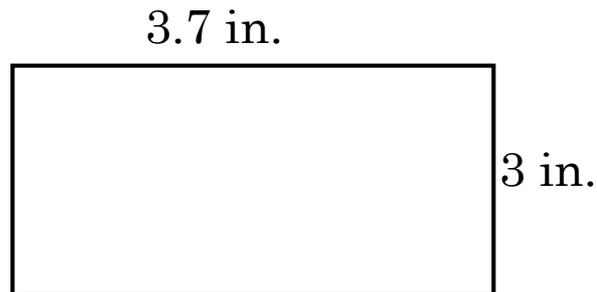
$$20\ell = 74$$

$$\ell = 3.7 \text{ in.}$$

$$\frac{w}{60} = \frac{1}{20}$$

$$20w = 60$$

$$w = 3 \text{ in}$$

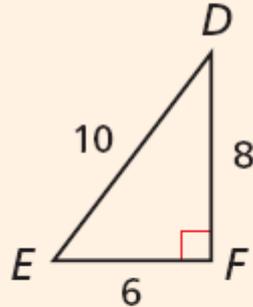
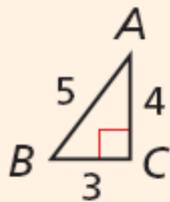


Similar Triangles

Similarity, Perimeter, and Area Ratios

STATEMENT

$$\triangle ABC \sim \triangle DEF$$



RATIO

$$\text{Similarity ratio: } \frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF} = \frac{1}{2}$$

$$\text{Perimeter ratio: } \frac{\text{perimeter } \triangle ABC}{\text{perimeter } \triangle DEF} = \frac{12}{24} = \frac{1}{2}$$

$$\text{Area ratio: } \frac{\text{area } \triangle ABC}{\text{area } \triangle DEF} = \frac{6}{24} = \frac{1}{4} = \left(\frac{1}{2}\right)^2$$

Theorem 7-5-1 Proportional Perimeters and Areas Theorem

If the similarity ratio of two similar figures is $\frac{a}{b}$, then the ratio of their perimeters is $\frac{a}{b}$, and the ratio of their areas is $\frac{a^2}{b^2}$, or $(\frac{a}{b})^2$.

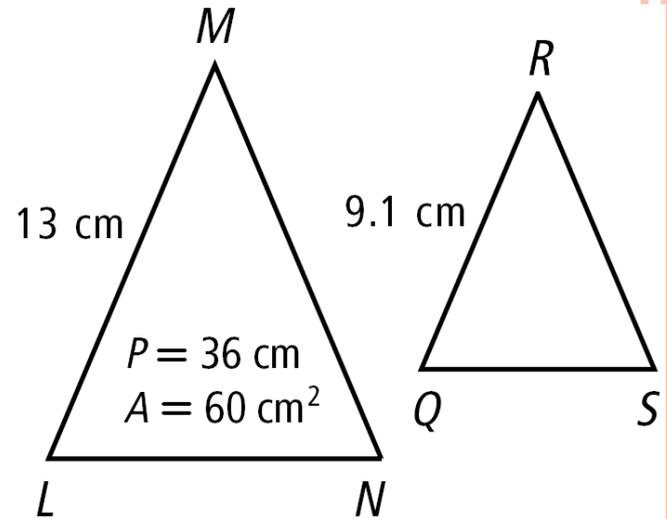


Example 4: Using Ratios to Find Perimeters and Areas

Given that $\triangle LMN \sim \triangle QRS$, find the perimeter P and area A of $\triangle QRS$.

The similarity ratio of $\triangle LMN$ to $\triangle QRS$ is

$$\frac{13}{9.1}$$



By the Proportional Perimeters and Areas Theorem, the ratio of the triangles' perimeters is also $\frac{13}{9.1}$, and the ratio of the triangles' areas is

$$\left(\frac{13}{9.1}\right)^2$$



Example 4 Continued

Perimeter

$$\frac{36}{P} = \frac{13}{9.1}$$

$$13P = 36(9.1)$$

$$P = 25.2$$

Area

$$\frac{60}{A} = \left(\frac{13}{9.1}\right)^2$$

$$13^2A = (9.1)^2(60)$$

$$A = 29.4 \text{ cm}^2$$

The perimeter of $\triangle QRS$ is 25.2 cm, and the area is 29.4 cm².



Check It Out! Example 4

$\triangle ABC \sim \triangle DEF$, $BC = 4$ mm, and $EF = 12$ mm. If $P = 42$ mm and $A = 96$ mm² for $\triangle DEF$, find the perimeter and area of $\triangle ABC$.

Perimeter

$$\frac{42}{P} = \frac{12}{4}$$

$$12P = 42(4)$$

$$P = 14 \text{ mm}$$

Area

$$\frac{96}{A} = \left(\frac{12}{4}\right)^2$$

$$12^2 A = (4)^2(96)$$

$$A = 10\frac{2}{3} \text{ mm}^2$$

The perimeter of $\triangle ABC$ is 14 mm, and the area is 10.7 mm^2 .



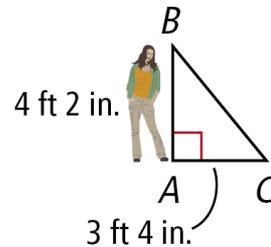
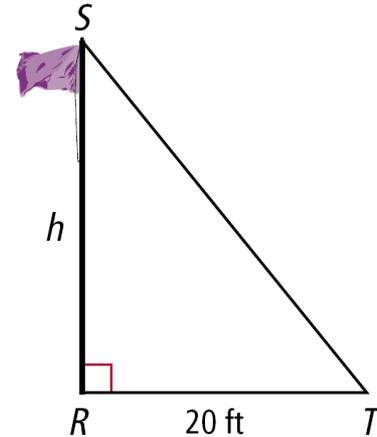
Lesson Quiz: Part I

1. Maria is 4 ft 2 in. tall. To find the height of a flagpole, she measured her shadow and the pole's shadow. What is the height h of the flagpole?

25 ft

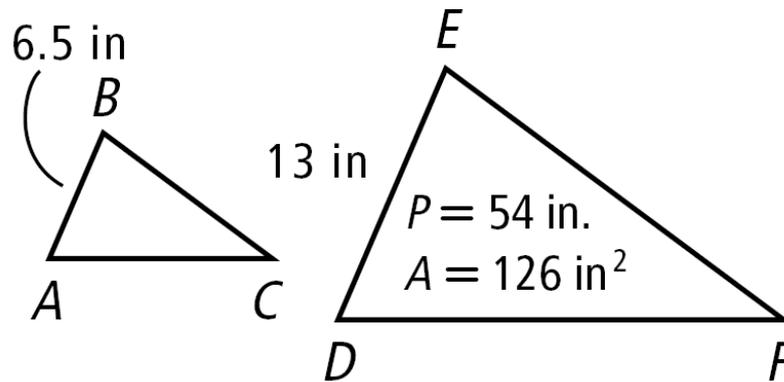
2. A blueprint for Latisha's bedroom uses a scale of 1 in.:4 ft. Her bedroom on the blueprint is 3 in. long. How long is the actual room?

12 ft



Lesson Quiz: Part II

3. $\triangle ABC \sim \triangle DEF$. Find the perimeter and area of $\triangle ABC$.



$P = 27$ in., $A = 31.5$ in²

