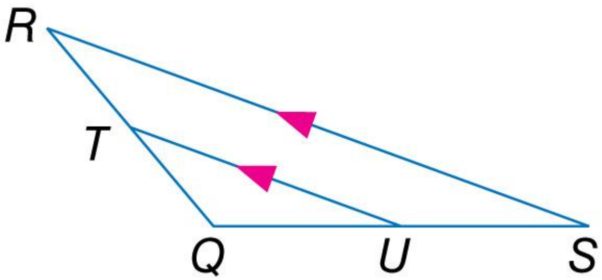
Lesson Menu

5-Minute Check

Over Lesson 7–5

1 If $QT = 5$, $TR = 4$, and $US = 6$, find QU.



A. 5.5

B. 6

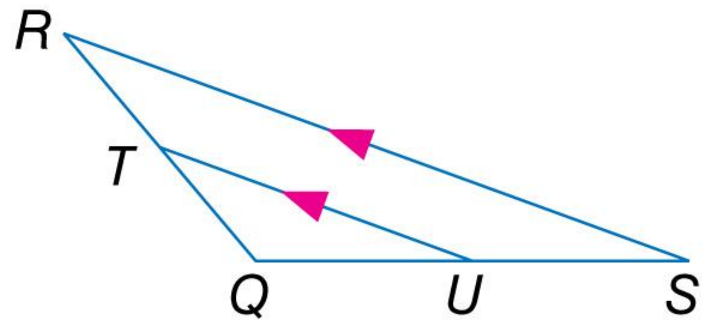
C. 7

D. 7.5

5-Minute Check

Over Lesson 7–5

2 If $TQ = x + 1$, $TR = x - 1$, $QU = 10$, and $QS = 15$, solve for x.



A. 2

B. 3

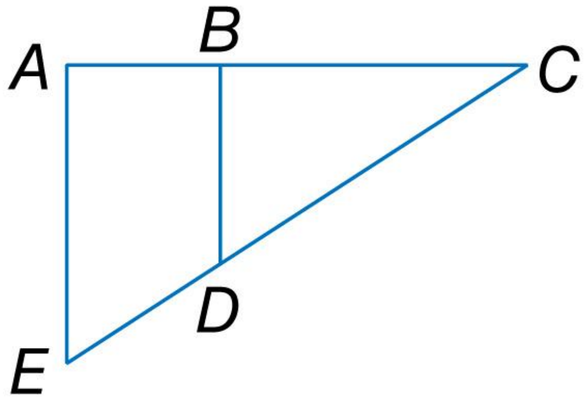
C. 4.4

D. 5.6

5-Minute Check

Over Lesson 7–5

3 If $AB = 5$, $ED = 8$, $BC = 11$, and $DC = x - 2$, find x so that $\overline{BD} \parallel \overline{AE}$.



A. 10

B. 15.4

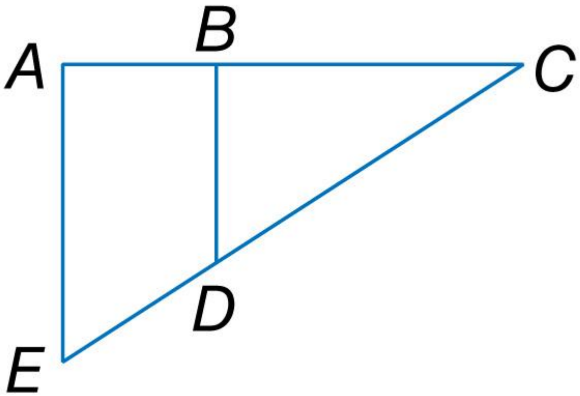
C. 19.6

D. 21.3

5-Minute Check

Over Lesson 7–5

4 If $AB = 4$, $BC = 7$, $ED = 5$, and $EC = 13.75$, determine whether $\overline{BD} \parallel \overline{AE}$.



A. yes

B. no

5-Minute Check

Over Lesson 7–5

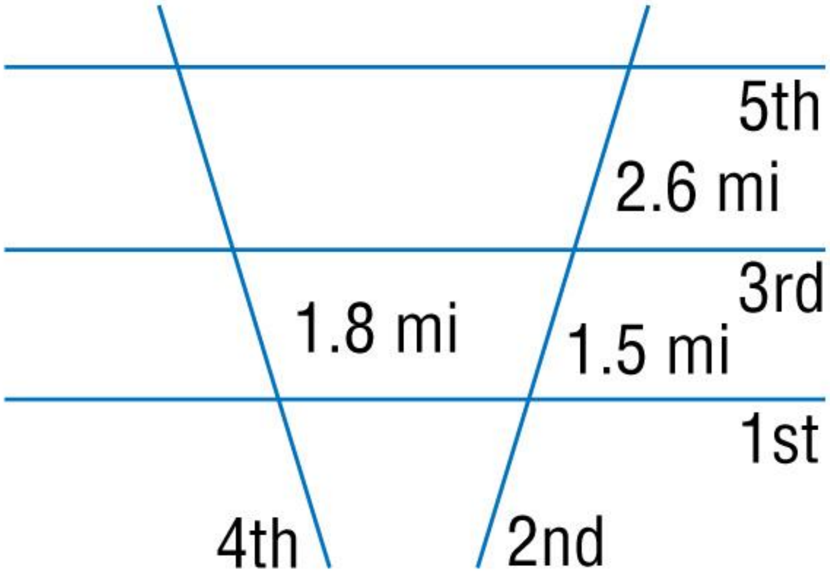
5 In the diagram, 1st Street is parallel to 3rd Street and 5th Street. Find the distance from 3rd Street to 5th Street if you are traveling on 4th Street.

A. 1.0 mi

B. 2.2 mi

C. 2.9 mi

D. 3.1 mi



MP

Mathematical Practices

1 Make sense of problems and persevere in solving them.

3 Construct viable arguments and critique the reasoning of others.

Content Standards

G.SRT.4 Prove theorems about triangles.

G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Then

You learned that corresponding sides of similar polygons are proportional.

Now

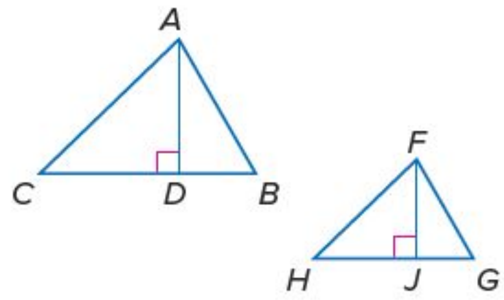
- Recognize and use proportional relationships of corresponding angle bisectors, altitudes, and medians of similar triangles.
- Use the Triangle Bisector Theorem.

Theorems Special Segments of Similar Triangles

7.8 If two triangles are similar, the lengths of corresponding altitudes are proportional to the lengths of corresponding sides.

Abbreviation ~$\triangle$s *have corr. altitudes proportional to corr. sides.*

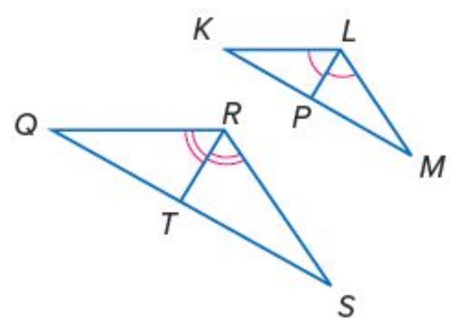
Example If $\triangle ABC \sim \triangle FGH$, then $\frac{AD}{FJ} = \frac{AB}{FG}$.



7.9 If two triangles are similar, the lengths of corresponding angle bisectors are proportional to the lengths of corresponding sides.

Abbreviation ~$\triangle$s *have corr. $\angle$ bisectors proportional to corr. sides.*

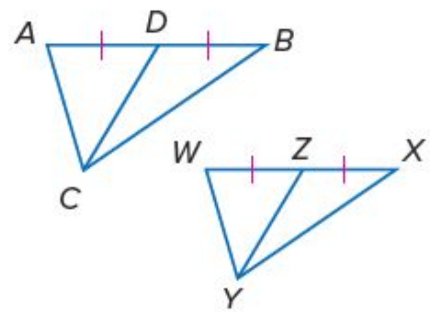
Example If $\triangle KLM \sim \triangle QRS$, then $\frac{LP}{RT} = \frac{LM}{RS}$.



7.10 If two triangles are similar, the lengths of corresponding medians are proportional to the lengths of corresponding sides.

Abbreviation ~$\triangle$s *have corr. medians proportional to corr. sides.*

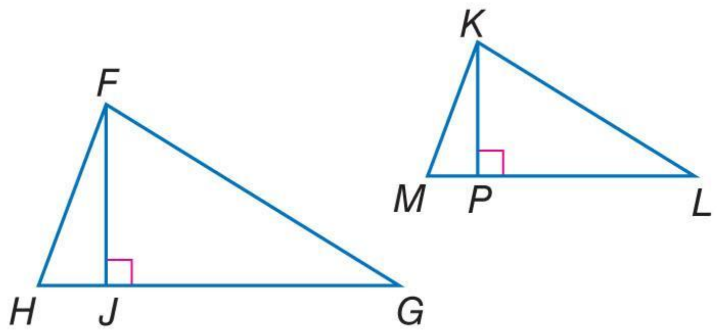
Example If $\triangle ABC \sim \triangle WXY$, then $\frac{CD}{YZ} = \frac{AB}{WX}$.



Proof Theorem 7.8

Given: $\triangle FGH \sim \triangle KLM$
$\overline{FJ}$ and $\overline{KP}$ are altitudes.

Prove: $\dfrac{FJ}{KP} = \dfrac{HF}{MK}$



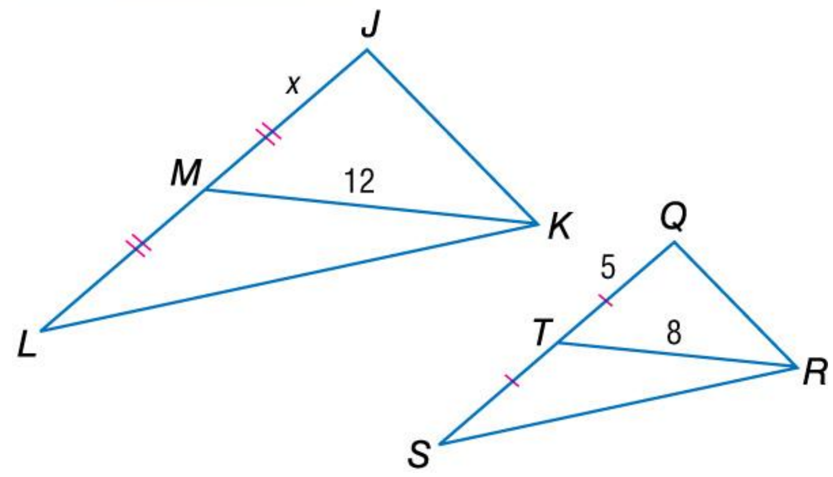
Paragraph Proof:
Since $\triangle FGH \sim \triangle KLM$, $\angle H \cong \angle M$. $\angle FJH \cong \angle KPM$ because they are both right angles created by the altitudes drawn to the opposite side and all right angles are congruent.

Thus $\triangle HFJ \sim \triangle MKP$ by AA Similarity. So $\dfrac{FJ}{KP} = \dfrac{HF}{MK}$ by the definition of similar polygons.

Since the corresponding altitudes are chosen at random, we need not prove Theorem 7.8 for every pair of altitudes.

Example 1 Use Special Segments in Similar Triangles

In the figure, $\Delta LJK \sim \Delta SQR$. Find the value of *x*.



$\overline{MK}$ and $\overline{TR}$ are corresponding medians and $\overline{LJ}$ and $\overline{SQ}$ are corresponding sides. $JL = 2x$ and $QS = 2(5)$ or 10.

Example 1 Use Special Segments in Similar Triangles

$$\frac{MK}{TR} = \frac{JL}{QS}$$ ~Δ have corr. medians proportional to the corr. sides.

$$\frac{12}{8} = \frac{2x}{10}$$ Substitution

$12 \bullet 10 = 8 \bullet 2x$ Cross Products Property

$120 = 16x$ Simplify.

$7.5 = x$ Divide each side by 16.

Answer: $x = 7.5$

Example 1

Guided Practice

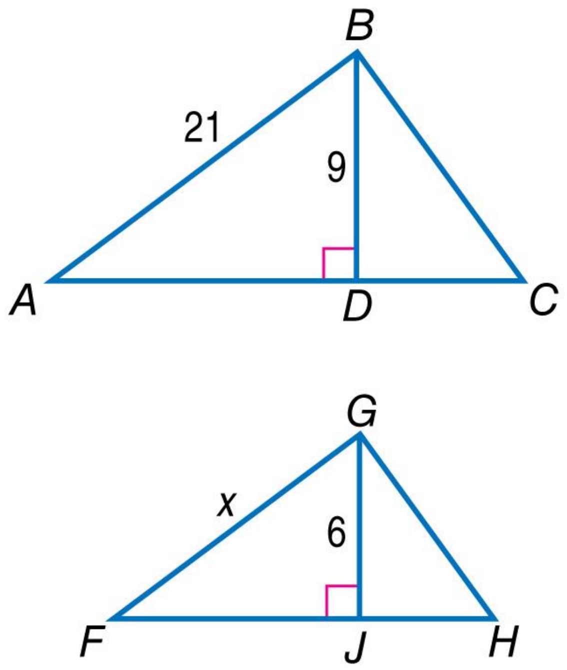
In the figure, $\Delta ABC \sim \Delta FGH$. Find the value of x.

A. 7

B. 14

C. 18

D. 31.5



Real-World Example 2 Use Similar Triangles to Solve Problems

ESTIMATING DISTANCE Sanjay's arm is about 9 times longer than the distance between his eyes. He sights a statue across the park that is 10 feet wide. If the statue appears to move 4 widths when he switches eyes, estimate the distance from Sanjay's thumb to the statue.

Real-World Example 2 Use Similar Triangles to Solve Problems

$9 \bullet 40 = x \bullet 1$ Cross Products Property

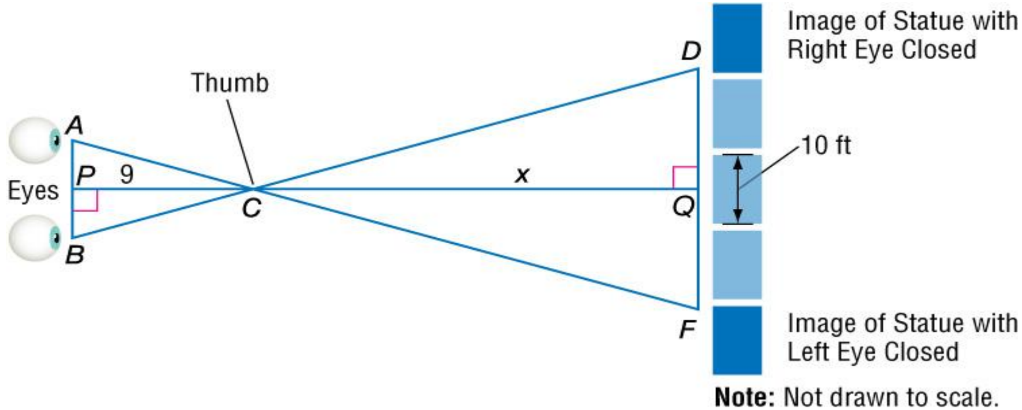
$360 = x$ Simplify.

Answer: So, the estimated distance to the statue is 360 feet.

Check The ratio of Sanjay's arm length to the width between his eyes is 9 to 1. The ratio of the distance to the statue to the distance the image of the statue jumped is 40 to 360 or 9 to 1.

Real-World Example 2 Use Similar Triangles to Solve Problems

Understand Make a diagram of the situation labeling the given distance you need to find as *x*. Also, label the vertices of the triangles formed.



We assume if Sanjay's thumb is straight out in front of him, then $\overline{PC}$ is an altitude of ΔABC. Likewise, $\overline{QC}$ is the corresponding altitude. We assume that $\overline{AB} \parallel \overline{DF}$.

Real-World Example 2 Use Similar Triangles to Solve Problems

Plan Since $\overline{AB} \parallel \overline{DF}$, $\angle BAC \cong \angle DFC$ and $\angle CBA \cong \angle CDF$ by the Alternate Interior Angles Theorem. Therefore, $\Delta ABC \sim \Delta FDC$ by AA Similarity. Write a proportion and solve for x.

Solve

$$\frac{PC}{QC} = \frac{AB}{DF}$$ Theorem 7.8

$$\frac{9}{x} = \frac{1}{10 \bullet 4}$$ Substitution

$$\frac{9}{x} = \frac{1}{40}$$ Simplify.

Real-World Example 2

Use the information from Example 2. Suppose Sanjay turns around and sees a sailboat in the lake that is 12 feet wide. If the sailboat appears to move 4 widths when he switches eyes, estimate the distance from Sanjay's thumb to the sailboat.

A. 324 feet

B. 432 feet

C. 448 feet

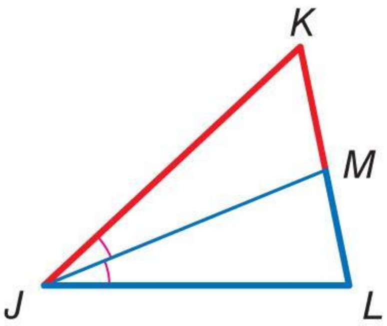
D. 512 feet

Theorem 7.11 Triangle Angle Bisector

An angle bisector in a triangle separates the opposite side into two segments that are proportional to the lengths of the other two sides.

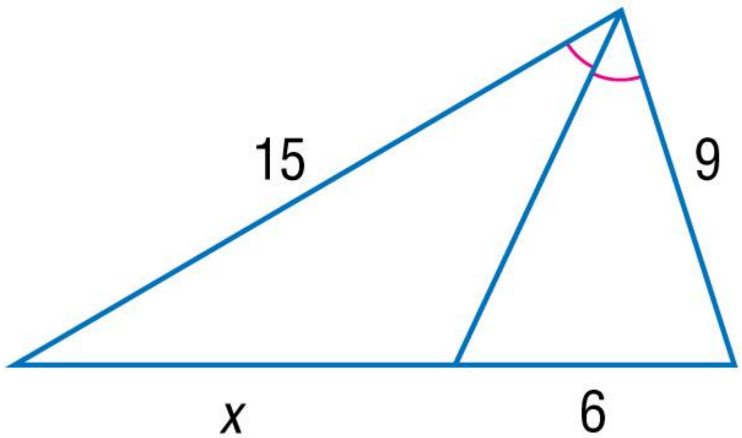
Example If $\overline{JM}$ is an angle bisector of $\triangle JKL$,

then $\frac{KM}{LM} = \frac{KJ}{LJ}$. ← segments with vertex *K* ← segments with vertex *L*



Example 3 Use the Triangle Angle Bisector Theorem

Find *x*.



Since the segment is an angle bisector of the triangle, the Angle Bisector Theorem can be used to write a proportion.

Example 3 Use the Triangle Angle Bisector Theorem

$$\frac{x}{6} = \frac{15}{9}$$ Triangle Angle Bisector Theorem

$9x = (15)(6)$ Cross Products Property

$9x = 90$ Simplify.

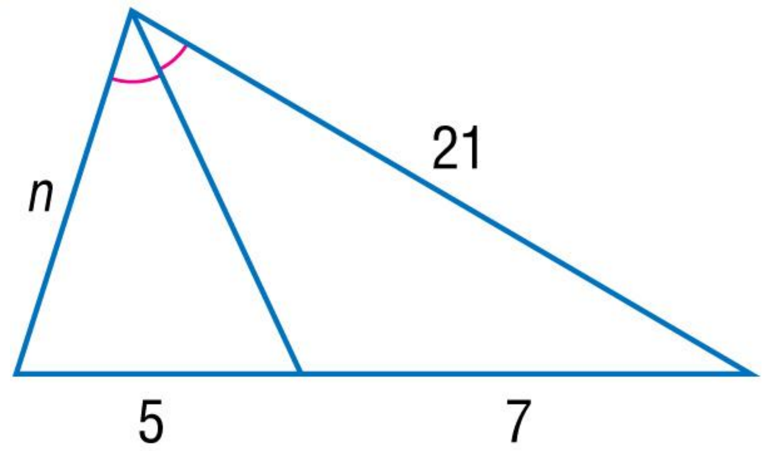
$x = 10$ Divide each side by 9.

Answer: $x = 10$

Example 3

Guided Practice

Find *n*.



A. 10

B. 15

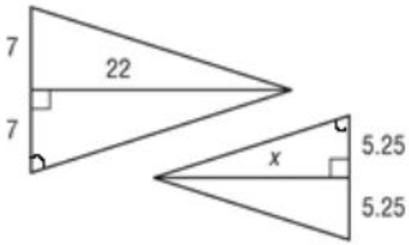
C. 20

D. 25

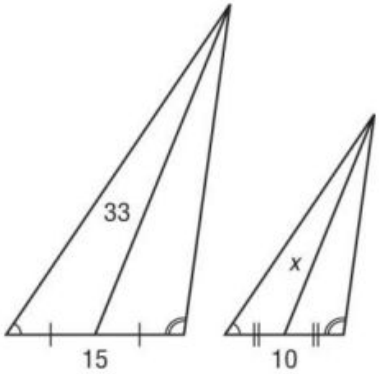
Additional Practice:

Find *x*.

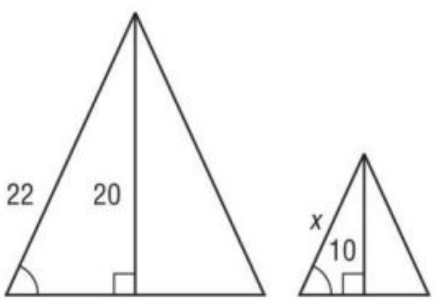
1.



2.



3.



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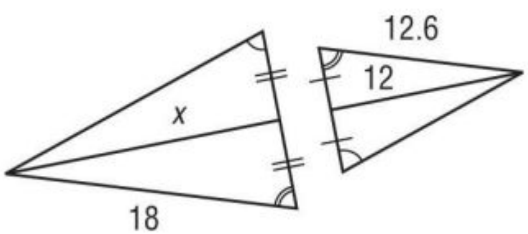
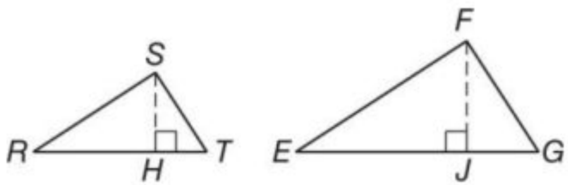
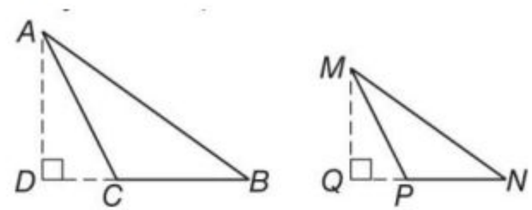


Additional Practice:

5. If $\triangle RST \sim \triangle EFG$, $\overline{SH}$ is an altitude of $\triangle RST$, $\overline{FJ}$ is an altitude of $\triangle EFG$, $ST = 6$, $SH = 5$, and $FJ = 7$, find FG.



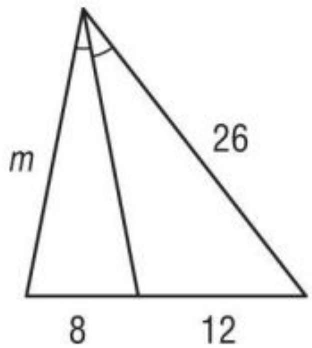
6. If $\triangle ABC \sim \triangle MNP$, $\overline{AD}$ is an altitude of $\triangle ABC$, $\overline{MQ}$ is an altitude of $\triangle MNP$, $AB = 24$, $AD = 14$, and $MQ = 10.5$, find MN.



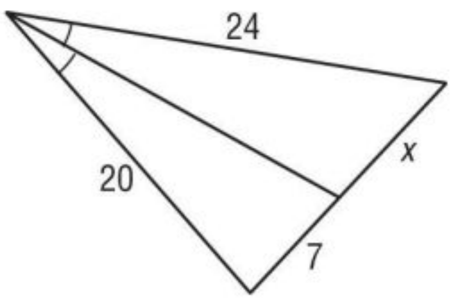
Additional Practice:

Find the value of each variable.

7.



8.



Additional Practice: Word Problems

1. **FLAGS** An ocean liner is flying two similar triangular flags on a flag pole. The altitude of the larger flag is three times the altitude of the smaller flag. If the measure of a leg on the larger flag is 45 inches, find the measure of the corresponding leg on the smaller flag.

2. **TENTS** Jana went camping and stayed in a tent shaped like a triangle. In a photo of the tent, the base of the tent is 6 inches and the altitude is 5 inches. The actual base was 12 feet long. What was the height of the actual tent?