Name _Key_

# Indirect Measurement and Similarity Extra Practice ACC

1. Mary Ellen, who is 1.68 meters tall, wants to find the height of a tree in her backyard. From the tree's base, she walks 10.5 meters along the tree's shadow to a position where the end of her shadow exactly overlaps the end of the tree's shadow. She is now 3.10 meters from the end of the shadows. How tall is the tree?

1.68   10.5   3.1

$$\frac{x}{1.68} = \frac{13.6}{3.1}$$ AA similarity

$$x \approx 7.37 \text{ m tall}$$

2. A family of spiders has found a mirror on the ground and they have been positioning themselves to see each other in the mirrors. Mama and Sister spider are shown below. Sister spider, who is 45 inches off the ground, can see Mama spider in the mirror that is on the ground between them. The mirror is 24 inches from the point directly below Sister spider and 16 inches from the point directly below Mama spider. How far is Mama spider form the ground? Please write in all the measurements in the correct places in the diagram.

Sister Spider   Mama Spider   45   x   24 Mirror 16
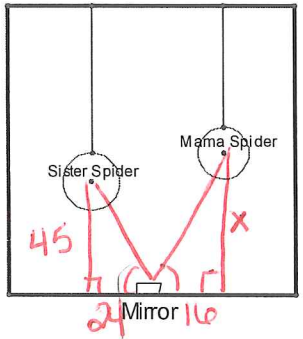
AA similarity

$$\frac{x}{45} = \frac{16}{24}$$

$$x = 30 \text{ inches off the ground}$$

3. Thach is standing 4 feet behind a fence 5ft 11 in. tall. When he looks over the fence, he can just see the top edge of building. He knows that the building is 6 ft 8 in. behind the fence. His eyes are 5 ft 7 in. from the ground. How tall is the building? Give your answer to the nearest foot.

4   x   48   128   5ft 7in   Fence   Building   4in   5ft 11in   4ft   48in   6ft 8in   80in   whole = 128in
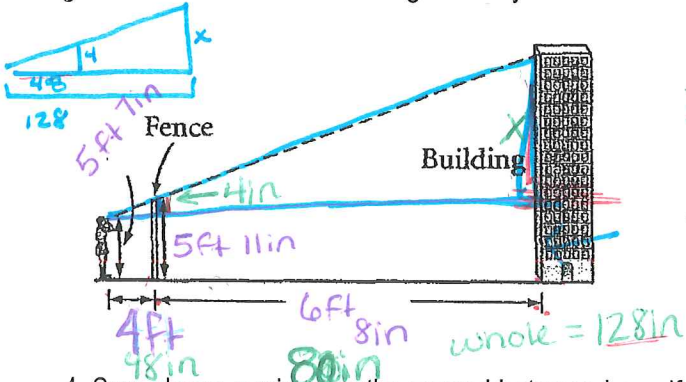
AA similarity

$$\frac{x}{4} = \frac{128}{48}$$

$$x = 10.6 \text{ in}$$ +5(12) +7in   Building is 77.6 in tall
$$x = .8 \text{ ft}$$
Building is ≈ 6 ft   ÷12
Small building!

4. Sam places a mirror on the ground between herself and an apartment building and stands so that she can see the top of a window on the 10th floor. The mirror is 1.34 meters from her feet and 7.68 meters from the base of the building. Samantha's eye is 1.43 meters above the ground. How high is the window?

AA Similarity

1.43m   1.34m   7.68m   x
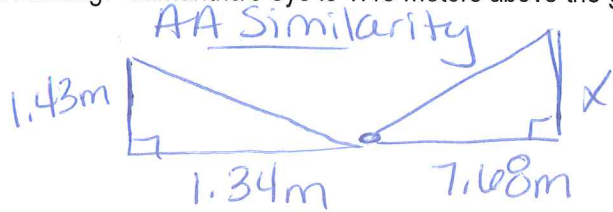
$$\frac{x}{1.43} = \frac{7.68}{1.34}$$

$$x \approx 8.2 \text{ m high}$$

5. Show all work. Romeo is trying to see his Juliet but the only way to do so is to climb through her window. Her window is 14 feet off the ground. He knows his 10 foot ladder is too short because it only reaches up 8 feet. He has an idea to use his 18 foot ladder, but he is unsure if the ladder will reach. Use the following information to help Romeo see his love: *The two ladders are leaning against a wall such that they make the same angle with the ground. The 10 foot ladder reaches 8 feet up the wall.*
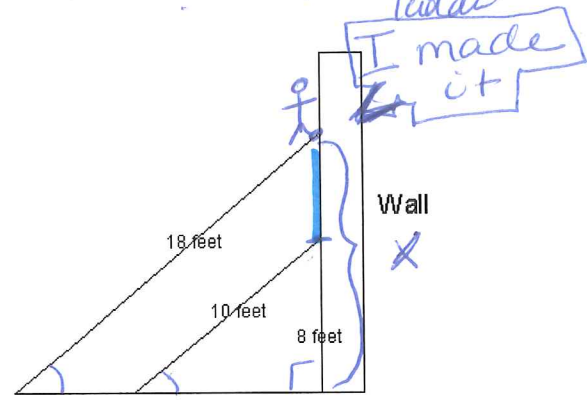
Safely

How high does the 18 foot ladder reach? _____ 14.4ft _____

How much further does the 18 foot ladder reach? _____ 6.4ft than the 10 ft ladder _____
If Romeo can climb through Juliet's window, illustrate this in the picture.

AA Similarity

$$\frac{X}{8} = \frac{18}{10}$$

$$X = 14.4 ft$$

I made it

Wall

18 feet

10 feet

8 feet

X

6. The principal asked Hank to demonstrate what he was learning in math class. Hank decided to use the mirror method to estimate the principal's height. Here are the measurements Hank recorded. Use them to find the principal's height.

Height from the ground to Hank's eyes = 1.5 m
Distance from the center of the mirror to Hank = 3 m
Distance from the center of the mirror to the principal = 3.7 m

AA Similarity

$$\frac{X}{1.5} = \frac{3.7}{3.7}$$

$$X = 1.85 m$$

X

1.5m

3.7m   3m
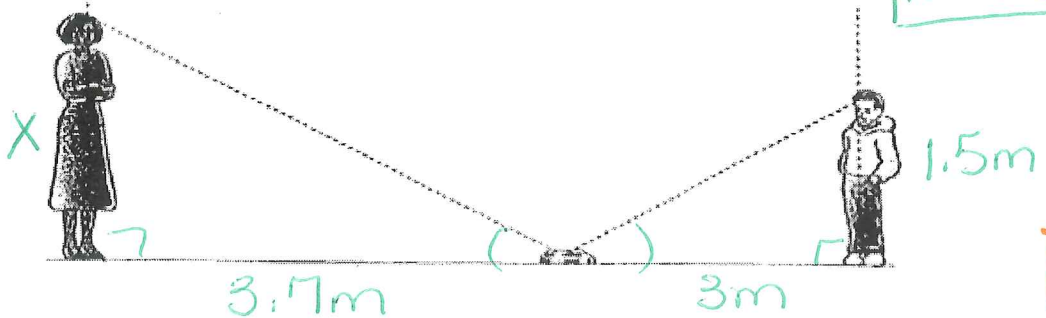
7. Igor, who is 4 ft 8 in. tall, wishes to find the height of an oak tree in front of his castle. He walks along the shadow of the tree until the end of his shadow exactly overlaps the end of the treetop's shadow. At that point, he is 22 ft from the foot of the tree and 11 ft from the end of the shadows. How tall is the oak tree?
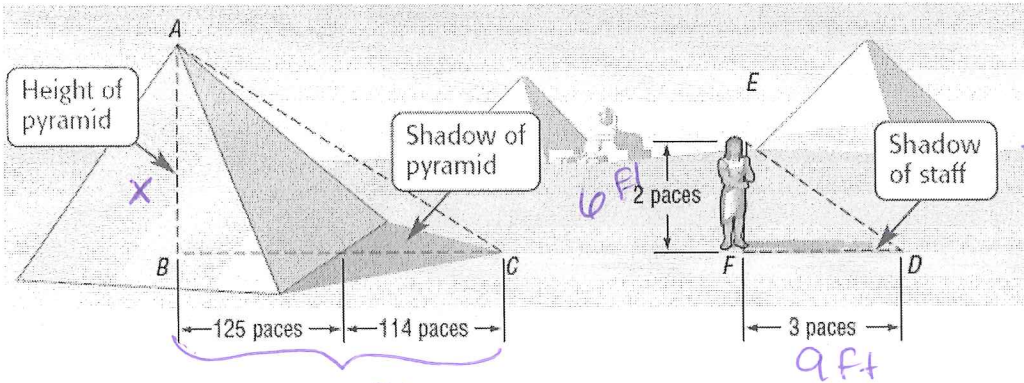
AA Similarity

5'6in

4ft 8in   X

11ft   22ft
132in   264in

396in
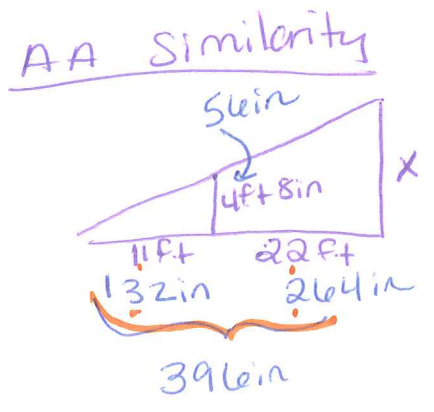
$$\frac{X}{56} = \frac{396}{132}$$

$$X \approx 168.0 in$$

$$X \approx 13.86 ft$$

14 Fall

8. **HISTORY** The Greek mathematician Thales was the first to measure the height of a pyramid by using geometry. He showed that the ratio of a pyramid to a staff was equal to the ratio of one shadow to the other. If a pace is about 3 feet, approximately how tall was the pyramid at that time?
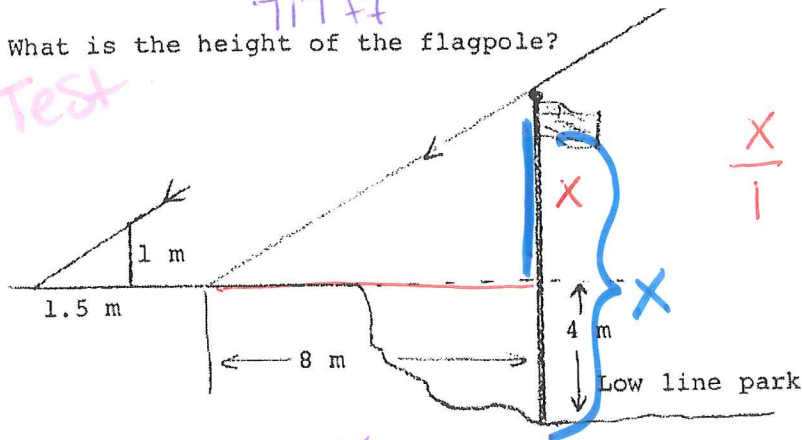
AA Similarity

Height of pyramid — x

Shadow of pyramid

Shadow of staff

A E B C F D

6 Ft 2 paces

←125 paces→ ←114 paces→   ←3 paces→

717 ft   9 ft

$$\frac{x}{6} = \frac{717}{9}$$

$x = 478$ ft tall

9. What is the height of the flagpole?

1 m
1.5 m
8 m
x
4 m
Low line park

$$\frac{x}{1} = \frac{8}{1.5} = 5.\overline{3} +4 \quad \text{AA Similarity}$$

$x \cong 9.\overline{3} m$

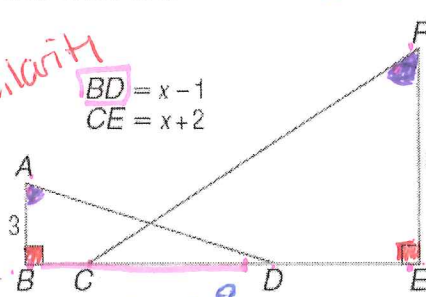**ALGEBRA** Identify the similar triangles, and find x and the measures of the indicated sides.

10. $\overline{BD}$ and $\overline{EC}$ △DAB ∼ △CFE

AA Similarity

$BD = x - 1$
$CE = x + 2$

A 3 B C D 8 F E

$$\frac{BD}{CE} = \frac{AB}{FE}$$

$$\frac{x-1}{x+2} = \frac{3}{8}$$
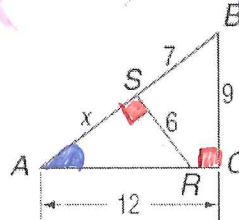
$8(x-1) = 3(x+2)$
$8x - 8 = 3x + 6$
$5x = 14$
$x = 2.8$

$BD = 1.8$
$CE = 4.8$

11. $\overline{AB}$ and $\overline{AS}$ AA Similarity
△ACB ∼ △ASR

B 7 S 9 x 6 A R C 12

$$\frac{AS}{AC} = \frac{SR}{CB}$$

$$\frac{x}{12} = \frac{6}{9}$$

$x = 8$

$AB = 15$
$AS = 8$

13. $\overline{AB}$ and $\overline{AC}$ △ABE ∼ △ACD

AA Similarity

A 3 $x+2$ E B 8 5 6 D C
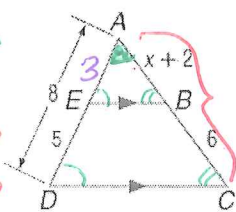
$$\frac{AB}{AC} = \frac{AE}{AD}$$

$$\frac{x+2}{x+8} = \frac{3}{8}$$

$8(x+2) = 3(x+8)$
$8x + 16 = 3x + 24$
$5x = 8$
$x = 1.6$

$AB = 3.6$
$AC = 9.6$

14. Why is △TMR ∼ △THM ∼ △MHR?   By AA Similarity
Find x, y, and h.
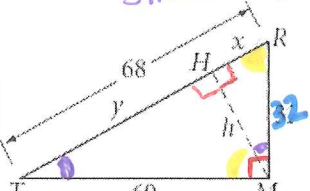
68 H x R y h 32 T 60 M

$$\frac{RH}{RM} = \frac{RM}{RT} \qquad \frac{HT}{TM} = \frac{TM}{TR}$$

$$\frac{x}{32} = \frac{32}{68} \qquad \frac{y}{60} = \frac{60}{68}$$

$x = 15.1$ $y \approx 52.9$

$$\frac{HM}{TM} = \frac{RM}{TR} \quad \frac{h}{60} = \frac{32}{68}$$
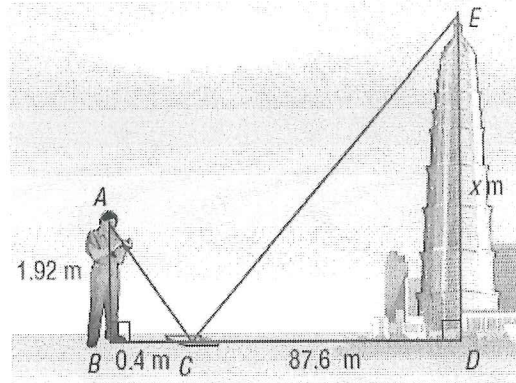
$h \approx 28.2$

cel

15. To estimate the height of the Jin Mao Tower in Shanghai, a tourist sights the top of the tower in a mirror that is on the ground and faces upward.

How tall is the tower?

$A\,A$
Similarity

$$\frac{X}{1.92} = \frac{87.6}{0.4}$$

$$\boxed{X = 420.48 \text{ m tall}}$$

A
1.92 m
B 0.4 m C   87.6 m   D
x m
E

16. Is $\triangle PHY \sim \triangle YHT$?

Is $\triangle PTY$ a right triangle?
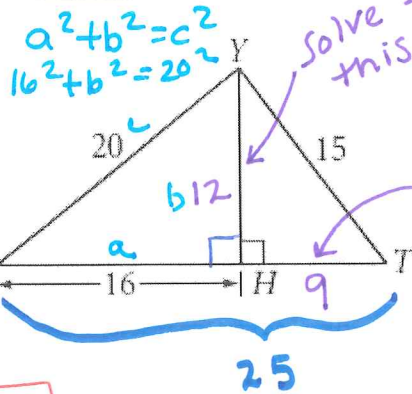
Explain why or why not.

yes, SSS

$$\frac{PH}{YH} = \frac{16}{12} = \frac{4}{3}$$

$$\frac{PY}{YT} = \frac{20}{15} = \frac{4}{3}$$

$$\frac{HY}{HT} = \frac{12}{9} = \frac{4}{3}$$

$\boxed{\text{SLR's are} =}$

$a^2 + b^2 = c^2$
$16^2 + b^2 = 20^2$ ← solve for this 1st

Then solve for this

Right $\triangle$
$20^2 + 15^2 \overset{?}{=} 25^2$
$625 = 625$

Y, 20, 15, b 12, a, 16, H, 9, T, P, 25

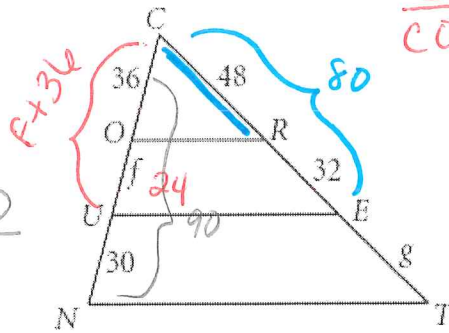**17.** $\overline{OR} \parallel \overline{UE} \parallel \overline{NT}$

Find f and g.

$$\frac{CT}{CR} = \frac{CN}{CO} \quad \frac{80+g}{48} = \frac{90}{36}$$

$$36(g+80) = 48 \cdot 90$$
$$36g + 2880 = 4320$$
$$\boxed{g = 40}$$

find f

$$\frac{CU}{CO} = \frac{CE}{CR} \quad \frac{f+36}{36} = \frac{80}{48}$$

$$48(f+36) = 36 \cdot 80$$
$$48f + 1728 = 2880$$
$$\boxed{f = 24}$$

C, f+36, 36, 48, 80, O, R, f, 24, 90, 32, U, E, 30, 90, g, N, T

For Exercises 28–35, use the following information to find each measure.
Polygon $ABCD \sim$ polygon $AEFG$, $m\angle AGF = 108$, $GF = 14$, $AD = 12$, $DG = 4.5$, $EF = 8$, and $AB = 26$.

Test

28. scale factor of trapezoid $ABCD$ to trapezoid $AEFG$

29. AG

30. DC

31. $m\angle ADC$

32. BC

33. perimeter of trapezoid $ABCD$

34. perimeter of trapezoid $AEFG$

35. ratio of the perimeter of polygon $ABCD$ to the perimeter of polygon $AEFG$

26, E, B, A, 7.5, 108°, 8, 12 G, 4.5, 14, F, D, C
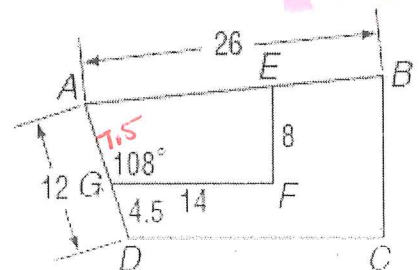
28.) SF: $\dfrac{AD}{AG} = \dfrac{12}{7.5} = 1.6 = \dfrac{8}{5}$

29.) $AG = 7.5$

30.) $\dfrac{DC}{GF} = \dfrac{AD}{AG}$

$\dfrac{DC}{14} = \dfrac{12}{7.5}$

$\boxed{DC = 22.4}$

31.) $\angle ADC = 108°$

32.) $\dfrac{BC}{EF} = \dfrac{AD}{AG}$

$\dfrac{BC}{8} = \dfrac{12}{7.5}$

$\boxed{BC = 12.8}$

33.) Perimeter of ABCD

$P = AB + BC + CD + DA$
$P = 26 + 12.8 + 22.4 + 12$
$\boxed{P = 73.2}$

34.) Perimeter of AEFG
Method 1:

$SLR = PR$ $\dfrac{8}{5} = \dfrac{73.2}{X}$

$\boxed{X = 45.75}$

OR

Method 2: Find EA 1st

$\dfrac{EA}{26} = \dfrac{7.5}{12}$ $EA = 16.25$

$P = AE + EF + GF + AG$
$P = 16.25 + 8 + 14 + 7.5$
$\boxed{P = 45.75}$

35.) $\dfrac{ABCD}{AEFG} = \dfrac{73.2}{45.75} = 1.6 = \dfrac{8}{5}$

which is Exactly the SLR

$\therefore$ SLR = SF = PR !