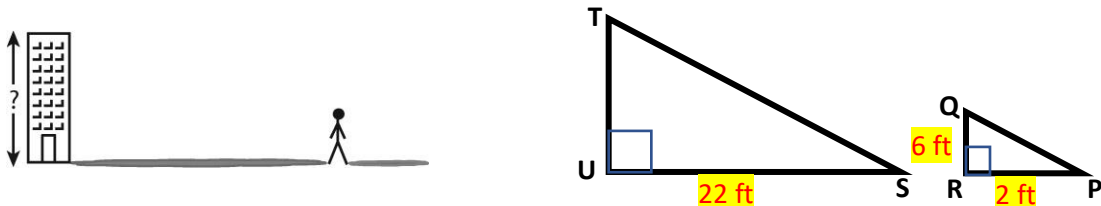**Module 12.3 & 12.4 Show all work.**

A 6-foot tall man casts a 2-foot long shadow. At the same time, a building casts a 22-foot long shadow. Use the figure below to help calculate the height of the building.


1. On the triangles above, label the segments that represent the height of the man and the shadows.

2. The sun casts shadows for the man and the building. Because the rays of the sun are parallel, which side in $\triangle STU$ is parallel to $\overline{QP}$? **TS**

3. Because of the parallel pair of line segments in Problem 2, what angle is congruent to $\angle P$? **$\angle S$**

4. Why are $\angle U$ and $\angle R$ congruent? **They are both right (90°) angles.**

5. The two triangles are similar by $AA\sim$. Write a similarity statement for the two triangles. **$\triangle STU \sim \triangle PQR$**

6. Write a proportion that shows the relation between the corresponding segments in the triangles. Use it to find the height of the building. **$\frac{x}{22} = \frac{6}{2}$, $x = 66$ ft**

7. Alicia is 5 feet, 4 inches tall. She casts a shadow that is 6 feet long. The tree casts a shadow that is 18 feet long. **Label the triangles.** How tall is the tree? **16 feet or 192 inches**
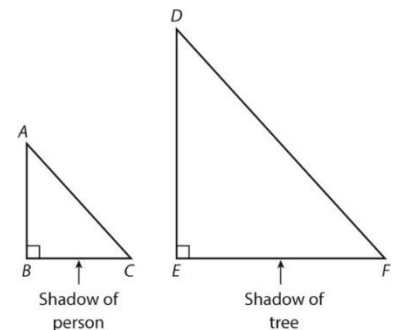

In the figure, $\overline{PQ}$ represents the width of a lake. $\overline{PQ}$ and $\overline{ST}$ are parallel. The figure is not drawn to scale.

8. Suppose $QR = 52$ yards, $RS = 15$ yards, and $ST = 20$ yards. **Label the picture.** How wide is the lake? **$69\frac{1}{3}$ yards or 69 yards and 1 foot**
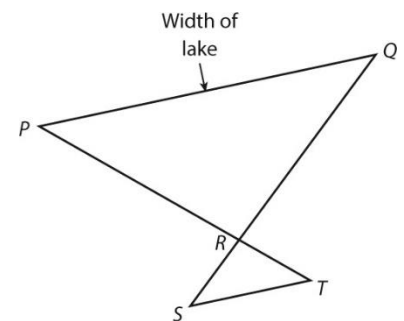
A mirror is placed on the ground, shown by point N, so that a person looking at it can see the top of a nearby statue, shown by point P. The figure is not drawn to scale.

9. The mirror is placed 30 feet away from the statue, and Jean stands 5 feet from the mirror. If her eyes are 5 feet, 6 inches above the ground, shown by $\overline{LM}$, how tall is the statue? **Label the figure.** **33 feet**
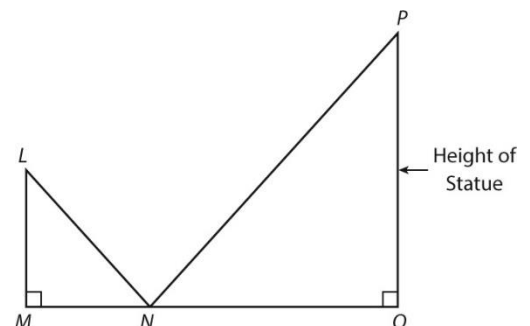
Find the geometric mean of each pair. Give answers in simplest radical for if necessary.

10. 3 and 12 $\frac{3}{x} = \frac{x}{12}$ **6**

11. 9 and 16 $\frac{9}{x} = \frac{x}{16}$ **12**

12. 4 and 25 $\frac{4}{x} = \frac{x}{25}$ **10**

13. $\frac{1}{4}$ and 4 $\frac{\frac{1}{4}}{x} = \frac{x}{4}$ **1**

14. 3 and 75 $\frac{3}{x} = \frac{x}{75}$ **15**

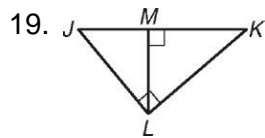15. 4 and 18 $\frac{4}{x} = \frac{x}{18}$ **$6\sqrt{2}$**

16. $\frac{1}{2}$ and 9 $\frac{\frac{1}{2}}{x} = \frac{x}{9}$

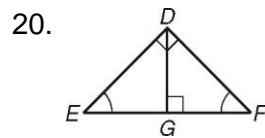17. 10 and 14 $\frac{10}{x} = \frac{x}{14}$ **$2\sqrt{35}$**

18. 4 and 12.25 $\frac{4}{x} = \frac{x}{12.25}$ **7**

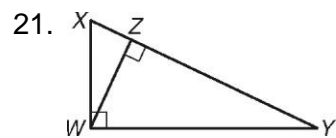$\sqrt{\frac{9}{2}} = \frac{\sqrt{9}}{\sqrt{2}} = \frac{3}{\sqrt{2}} = \frac{3\sqrt{2}}{2}$

Write a similarity statement comparing the three triangles in each diagram.

19.

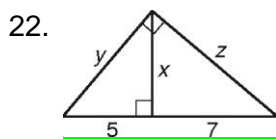$\Delta JKL \sim \Delta JLM \sim \Delta LKM$

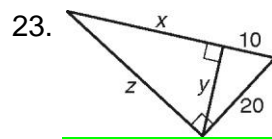20.

$\Delta DEF \sim \Delta GED \sim \Delta GFD$

21.

$\Delta WXY \sim \Delta ZXW \sim \Delta ZWY$

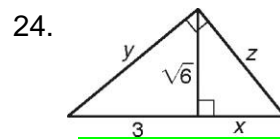**Find x, y, and z. Write answers in simplest radical form.**

22.

$x = \sqrt{35}, y = \sqrt{60} = 2\sqrt{15},$
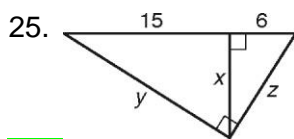$z = \sqrt{84} = 2\sqrt{21}$

23.

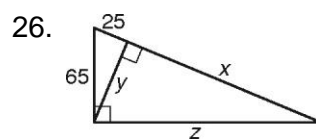$x = 30, y = \sqrt{300} = 10\sqrt{3}$
$z = \sqrt{1200} = 20\sqrt{3}$

24.

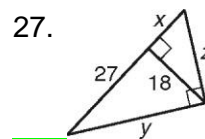$x = 2, y = \sqrt{15}, z = \sqrt{10}$

25.

$x = \sqrt{900} = 3\sqrt{10}, y = \sqrt{315} = 3\sqrt{35}$
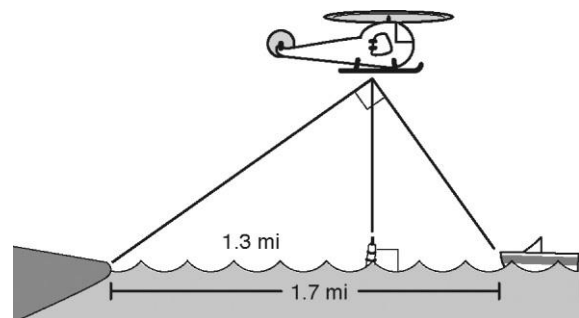$z = \sqrt{126} = 3\sqrt{14}$

26.

$x = 144, y = 60, z = 156$

27.

$x = 12, y = \sqrt{1053} = 9\sqrt{13}$
$z = \sqrt{468} = 6\sqrt{13}$

28. The Coast Guard has sent a rescue helicopter to retrieve passengers off a disabled ship. The ship has called in its position as 1.7 miles from shore. When the helicopter passes over a buoy that is known to be 1.3 miles from shore, the angle formed by the shore, the helicopter, and the disabled ship is 90°. Determine what the altimeter would read to the nearest foot when the helicopter is directly above the buoy. Note that 1 mile is 5280 feet.

1.3 mi

1.7 mi

3807 feet.