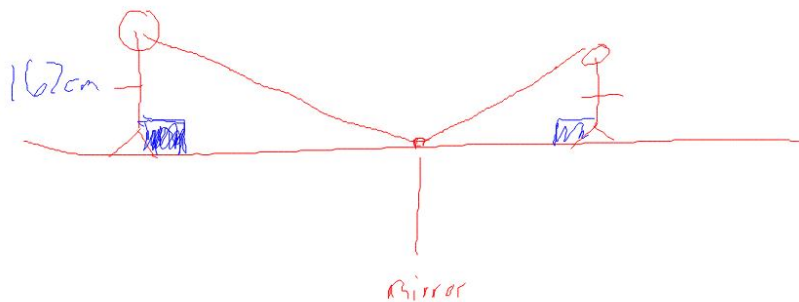


$$\frac{64}{64} = \frac{x}{167}$$

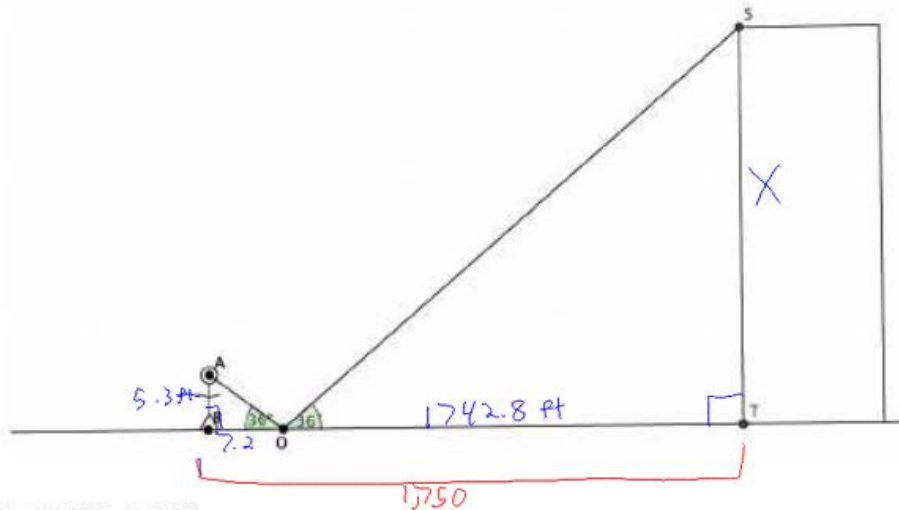
$$\frac{64x}{64} = \frac{1018.7}{64}$$

$$x = 159.17$$



Mathematical Modeling Exercises

- You want to determine the approximate height of one of the tallest buildings in the city. You are told that if you place a mirror some distance from yourself so that you can see the top of the building in the mirror, then you can indirectly measure the height using similar triangles. Let  $O$  be the location of the mirror so that the person shown can see the top of the building.

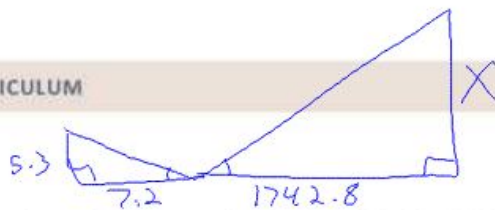


- Explain why  $\triangle ABO \sim \triangle STO$ .

Both  $\triangle$ 's have  $90^\circ$  angles in them, and they both have  $\sphericalangle$  measures of  $36^\circ$ . Therefore  $\triangle ABO \sim \triangle STO$  through the AA criterion.

- Label the diagram with the following information: The distance from eye-level straight down to the ground is 5.3 feet. The distance from the person to the mirror is 7.2 feet. The distance from the person to the base of the building is 1,750 feet. The height of the building will be represented by  $x$ .
- What is the distance from the mirror to the building?

$$\begin{array}{r} 1750.0 \\ \underline{\phantom{1750.0} 7.2} \\ 1742.8 \end{array}$$



d. Do you have enough information to determine the approximate height of the building? If yes, determine the approximate height of the building. If not, what additional information is needed?

Yes

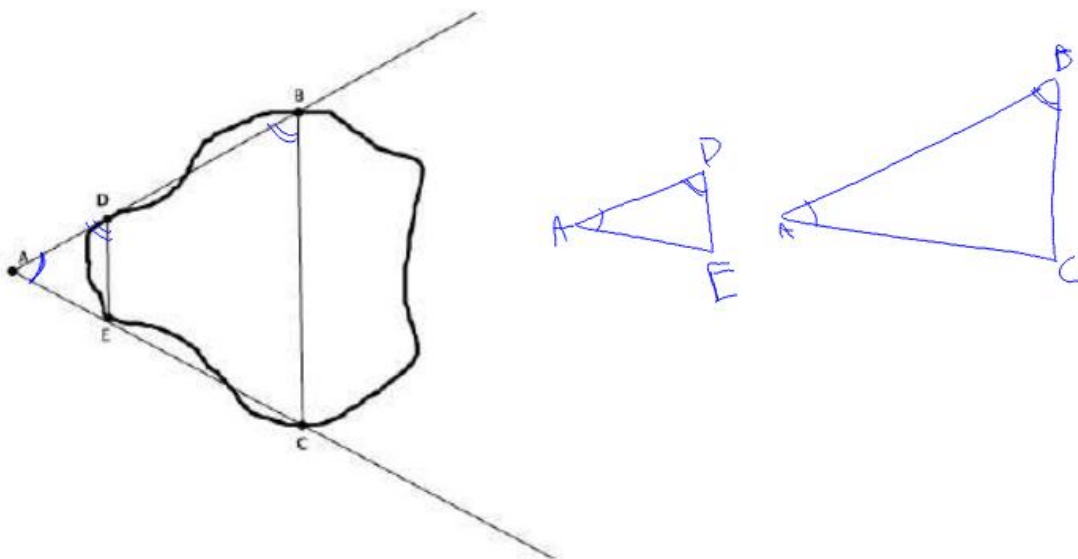
$$\frac{1742.8}{7.2} = 5.3$$

$$7.2x = \frac{9236.84}{7.2}$$

$$x = 1282.89 \text{ ft.}$$

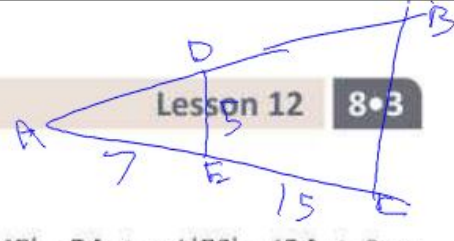
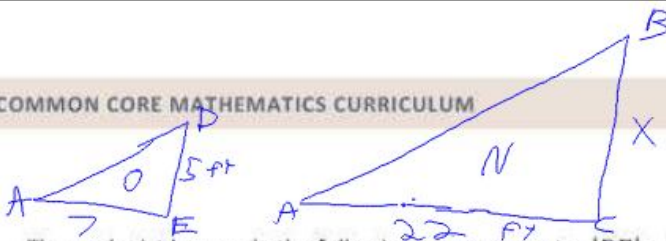
The building is 1282.89 ft. tall

2. A geologist wants to determine the distance across the widest part of a nearby lake. The geologist marked off specific points around the lake so that line  $DE$  would be parallel to line  $BC$ . The segment  $BC$  is selected specifically because it is the widest part of the lake. The segment  $DE$  is selected specifically because it was a short enough distance to easily measure. The geologist sketched the situation as shown below.



a. Has the geologist done enough work so far to use similar triangles to help measure the widest part of the lake? Explain.

He has properly set up similar  $\Delta$ 's. The geologist still has to measure the lengths of  $\overline{DE}$ ,  $\overline{AE}$ , and  $\overline{AC}$



- b. The geologist has made the following measurements:  $|DE| = 5$  feet,  $|AE| = 7$  feet, and  $|EC| = 15$  feet. Does she have enough information to complete the task? If so, determine the length across the widest part of the lake. If not, state what additional information is needed.

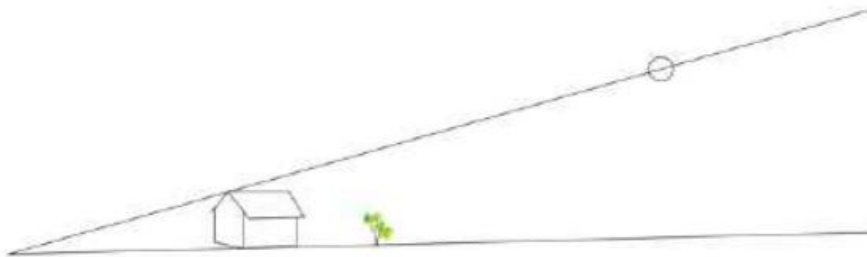
$$\frac{22}{7} = \frac{X}{5}$$

$$\frac{110}{7} = \frac{X}{1}$$

$$X \approx 15.7 \text{ ft}$$

- c. Assume the geologist could only measure a maximum distance of 12 feet. Could she still find the distance across the widest part of the lake? What would need to be done differently?

3. A tree is planted in the backyard of a house with the hope that one day it will be tall enough to provide shade to cool the house. A sketch of the house, tree, and sun is shown below.



- a. What information is needed to determine how tall the tree must be to provide the desired shade?