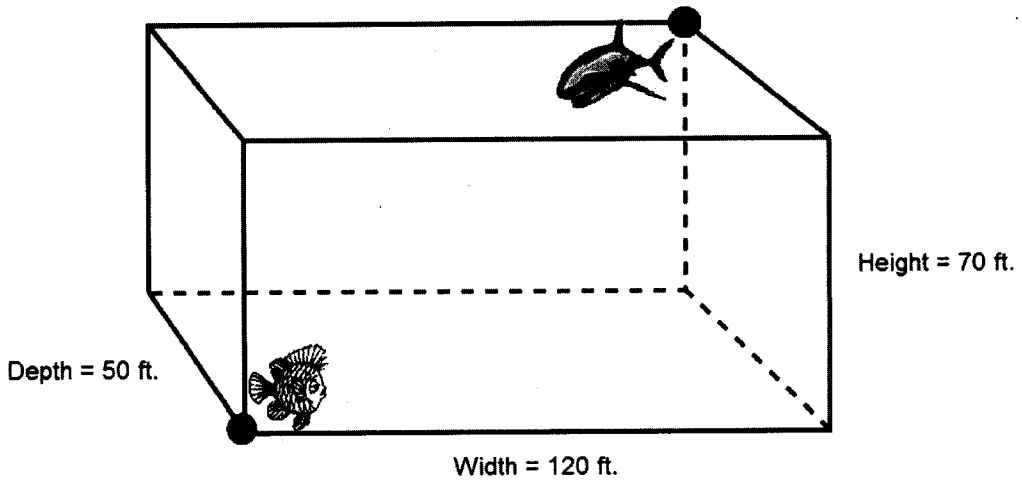
Important: Remind Students to Change Units on ModelMaker to Centimeters

Shark Tank Problem

(File → Preferences → Units → Centimeters)

It's feeding time at the Monterey Bay Aquarium in Monterey, California! The sharks are eagerly anticipating one of their three weekly meals, and today's menu includes their favorite dish – fresh fish. *By constructing a 3-D model of the shark tank and applying the Pythagorean Theorem, you will calculate the shortest distance that the shark will travel to reach a fish that has been dropped into the tank.*

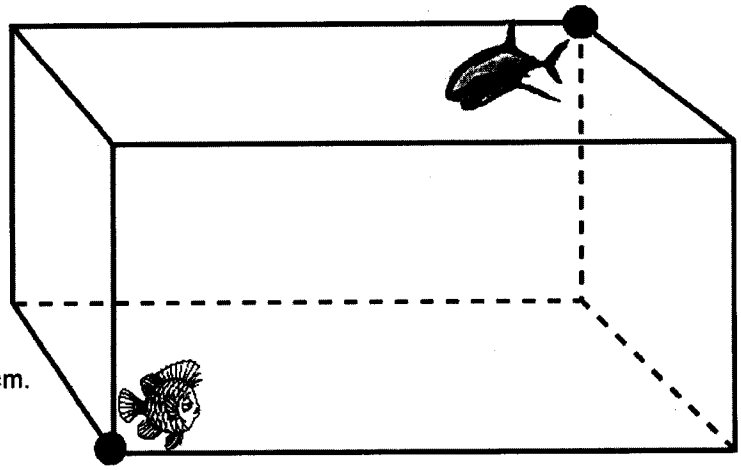


1. Find the dimensions of a model shark tank given the following scale:

1 cm. = 20 ft.

$\frac{1\text{ cm.}}{20\text{ ft.}} = \frac{H\text{ cm.}}{70\text{ ft.}}$

$\frac{1\text{ cm.}}{20\text{ ft.}} = \frac{D\text{ cm.}}{50\text{ ft.}}$



Height = 3.5 cm.

Depth = 2.5 cm.

Width = 6 cm.

$\frac{1\text{cm.}}{20\text{ ft.}} = \frac{W\text{ cm}}{120\text{ ft.}}$

(HINT: Think about proportions!)

2. **Design, print,** and **fabricate** a scale model of the shark tank.

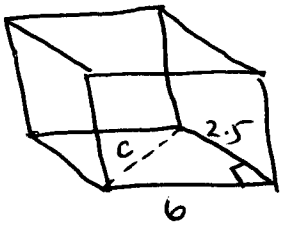
3. Use the yarn and tape to plot the path of shortest distance that the shark will follow to reach the fish as quickly as possible. Why did you choose this route?

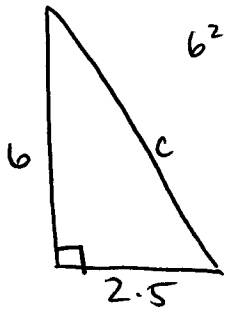
The shortest distance between 2 points is a line.

4. Calculate the distance (cm.) that the shark will travel to reach the fish *in the scale model.* In order to do this, you will need to use the Pythagorean Theorem. It may help to draw and label triangles that represent parts of your 3-D model.

Step 1

$$a^2 + b^2 = c^2$$

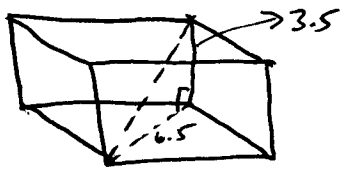


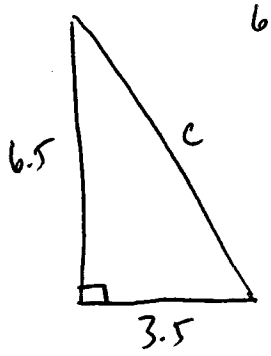


$6^2 + 2.5^2 = c^2$

$c = 6.5$

Step 2





$6.5^2 + 3.5^2 = c^2$

$c \approx 7.38$

DISTANCE TRAVELED: 7.38 cm.

(HINT: You may need to calculate the distance of another hypotenuse before calculating the distance of your chosen route.)

5. Check your work: Measure the length of the yarn that you used to plot the shark's path. Does it match your answer to the previous question? ≈ 7.38 cm.

6. **Extension Questions**:

   a. Use the scale from Question 1 to determine the *actual* distance (ft.) that the shark will travel to reach the fish.

$$\frac{1 \text{ cm.}}{20 \text{ ft.}} = \frac{7.38 \text{ cm.}}{D \text{ ft.}}$$

$$D = 7.38 \cdot 20 = 147.6 \text{ ft.}$$

   b. If the shark is traveling at a rate of 5 feet per second, how long will it take the shark to reach the fish? Round to the nearest second. Use the following formula:

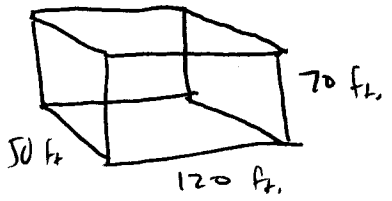
Distance = Rate x Time

$$147.6 = 5 \cdot t$$

$$\frac{\text{ft}}{\text{ft}} = \frac{147.6}{5}$$

$$t = 30 \text{ seconds}$$

   c. Surface Area: The aquarium would like to purchase new glass walls for the shark tank. The top and bottom of the tank are *not* made of glass. How much glass, in square feet, should the aquarium order?



$$2(120 \times 70) + 2(50 \times 70) =$$
$$16{,}800 + 7{,}000 = 23{,}800 \text{ ft.}^2$$

d. Volume:

a. Using the following formula, calculate the volume ($ft.^3$) of the shark tank.

Volume = Length x Width x Height

$V = 120 \times 50 \times 70$

$V = 420{,}000\ ft.^3$

b. Given the following conversion, calculate how many gallons of water are needed to fill the shark tank.

1 cubic foot = 7.5 US gallons

$$\frac{1\ ft.^3}{7.5\ \text{GALLONS}} = \frac{420{,}000\ ft.^3}{y\ \text{GALLONS}}$$

$y = 7.5 \times 420{,}000$

$y = 3{,}150{,}000$ gallons (3.15 million)