

## Ahoy, Matey!

Mayor Barnum and the town council have voted unanimously to put a circular pond in the park so folks can come and race their remote control boats. Decide where to place the pond, dig it out to a depth of 1 meter, cover the bottom with sand, and fill the remaining space with water. Careful not to overflow!

### Ahoy, Matey! Subtask 1: Place and size the pond.

Think about:

- The pond is circular with a diameter of 30 meters.
- About 50% of the pond should be in the shade at 2:00 PM.
- The largest tree has a height of about 40 meters.
- The 3 meter lamppost casts a 4 meter shadow at 2:00 PM.

Accepted Answers: Student sizes the circle to have a diameter covering 3 units and places it so that about half the pond is within 4 units of the center of the largest tree. There are several accepted placements; the pond will snap to a specific placement used for the 3-D view.

Size of pond:

$$\frac{1 \text{ unit}}{10 \text{ meters}} = \frac{n \text{ units}}{30 \text{ meters}}$$
$$30 = 10n$$
$$3 = n$$

Location of pond:

$$\frac{3 \text{ meters}}{4 \text{ meters}} = \frac{3 \text{ units}}{n \text{ units}}$$
$$3n = 12$$
$$n = 4$$

The pond has a diameter of 3 units and should be within 4 units of the largest tree.

### Ahoy, Matey! Subtask 2: Dig out the pond.

Think about:

- The pond is a cylinder with a diameter of 30 meters and a depth of 1 meter.
- One scoop holds about 5 cubic meters.

Accepted answers: any number from 141 scoops to 142 scoops

Volume of pond:

$$V = \pi r^2 h$$
$$V = \pi(15 \text{ m})^2(1 \text{ m})$$
$$V \approx 706.858 \text{ m}^3$$

Number of scoops:

$$\frac{\text{Volume}}{5 \text{ m}^3 / \text{scoop}} = n \text{ scoops}$$
$$\frac{706.858 \text{ m}^3}{5 \text{ m}^3 / \text{scoop}} \approx 141.372 \text{ scoops}$$

The volume of the pond is about  $706.9 \text{ m}^3$ , so about 141 or 142 scoops of dirt should be removed. Note: Using 3.14 as the value for pi, the volume is  $706.5 \text{ m}^3$ .

### Ahoy Matey! Subtask 3: Cover the bottom of the pond with sand.

Think about:

- The sand should cover the bottom of the pond to a depth of 10 cm.

Accepted answers: any number from 14 scoops to 15 scoops

**Math by Design**  
**Flossville Town Park Tasks and Subtasks Answer Key**

Volume of sand:

$$V = \pi r^2 h$$

$$V = \pi(15\text{m})^2(0.1\text{m})$$

$$V \approx 70.686\text{m}^3$$

Number of scoops:

$$\frac{\text{Volume}}{5\text{m}^3 / \text{scoop}} = n \text{ scoops}$$

$$\frac{70.686\text{m}^3}{5\text{m}^3 / \text{scoop}} \approx 14.137 \text{ scoops}$$

About 70.7 m<sup>3</sup> of sand are needed to cover the bottom of the pond, so about 14 or 15 scoops of sand should be used. Note: Using 3.14 as the value for pi, the volume is 70.65 m<sup>3</sup>.

**Ahoy Matey! Subtask 4: Fill the pond with water.**

Think About:

The pond already contains sand to a depth of 10 cm. Fill the rest of the pond with water.

One cubic meter of space holds 1,000 liters of water.

Accepted answers: any number from 636,172 liters to 636,173 liters or 635,850 liters

Volume of water:

$$V = \pi r^2 h$$

$$V = \pi(15\text{m})^2(0.9\text{m})$$

$$V \approx 636.173\text{m}^3$$

Amount of water:

$$\text{Number of liters} = (1000 \text{ L/m}^3)(\text{Volume})$$

$$\text{Number of liters} \approx (1000 \text{ L/m}^3)(636.173 \text{ m}^3)$$

$$\text{Number of liters} \approx 636,173 \text{ L}$$

The remaining volume of the pond is about 636.173 m<sup>3</sup>, which holds about 636,173 liters of water. Note: If 3.14 is used as the value for pi, then the volume is 635.85 m<sup>3</sup> and 635,850 liters is the correct answer.