# Problem of the Week
Problem C and Solution
Reach for the Top

Problem

Priya has a container in the shape of a rectangular prism with base 40 cm by 40 cm and height 50 cm. She fills the container with water so that the water reaches half of the height of the container. A solid cube with side length 20 cm is then placed in the container.

How far from the top of the container does the water now reach?
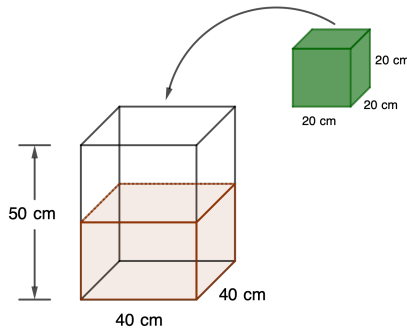
Solution

Solution 1

The height of the water is $\frac{50}{2} = 25$ cm. Since volume = length × width × height, the volume of water in the container is $40 \times 40 \times 25 = 40\,000$ cm³.

The volume of the solid cube is $20 \times 20 \times 20 = 8000$ cm³.

Thus, the total volume is $40\,000 + 8000 = 48\,000$ cm³.

Let x represent the height of the water, in centimetres, after the cube is added. Then, using the formula for volume of a rectangular solid with 40 cm by 40 cm base, we have

$$48\,000 = 40 \times 40 \times x$$
$$48\,000 = 1600 \times x$$
$$x = 30$$

Therefore, the new water height is 30 cm and the water is $50 - 30 = 20$ cm from the top of the container.

Solution 2

Let h be the height of a rectangular prism with base 40 cm by 40 cm and with the same volume as the solid cube. Since volume = length × width × height, we have

$$40 \times 40 \times h = 20 \times 20 \times 20$$
$$1600 \times h = 8000$$
$$h = 5$$

Therefore, increasing the height of water in the container by 5 cm will increase the volume by 8000 cm³, which is equal to the volume of the solid cube.

Therefore, the new water height is $25 + 5 = 30$ cm and the water is $50 - 30 = 20$ cm from the top of the container.