



# Problem of the Week

## Problem B and Solution

### These Lakes Are Better Than Good

#### Problem

The table below shows data related to the five Great Lakes, which span the border between Canada and United States.

Lake	Area (miles <sup>2</sup> )	Area (km <sup>2</sup> )	Volume (miles <sup>3</sup> )	Volume (km <sup>3</sup> )
Superior	31 700	82 100	2900	12 070
Michigan	22 410	58 030	1180	4930
Huron	23 010	59 590	840	3520
Erie	9910	25 667	117	488
Ontario	7320	18 970	391	1631



- (a) Find values for each of the following. Round your answers to two decimal places.
- How many times bigger is Lake Superior's area than Lake Ontario's?
  - How many times bigger is Lake Superior's volume than Lake Erie's?
  - What percentage of the total volume of all five lakes does Lake Superior contain?
- (b) For the comparisons in part (a), does it matter whether you use the data based in miles, or in kilometres?
- (c) What are the mean and the median areas of the Great Lakes in square kilometres?
- (d) DISCOVERY: Lake Superior is the second largest lake in the world, by area, and Lake Huron is the fourth largest. Do some research to find the first and third largest lakes (by area). Try to discover some past data to see how their sizes have changed over time.



## Solution

(a) The approximate values of the comparisons using metric measures are as follows.

(i) Lake Superior's area is  $\frac{82100}{18970} \approx 4.33$  times bigger than Lake Ontario's.

(ii) Lake Superior's volume is  $\frac{12070}{488} \approx 24.73$  times bigger than Lake Erie's.

(iii) The total volume of all five lakes is

$12\,070 + 4\,930 + 3\,520 + 488 + 1\,631 = 22\,639 \text{ km}^3$ . Thus, the percentage of the total volume of all five lakes contained by Lake Superior is  $\frac{12\,070}{22\,639} \times 100\% \approx 53.32\%$ .

(b) For these comparisons, it doesn't matter whether the data in miles, or in kilometres, is used, as long as the same unit is used for all lakes in the calculation. However, there may be slight variations in the values found in part (a), due to rounding and the precision of the values in the table.

(c) The mean area is

$\frac{1}{5}(82\,100 + 58\,030 + 59\,590 + 25\,667 + 18\,970) = \frac{244\,357}{5} = 48\,871.4 \text{ km}^2$ . To find the median area we look for the third largest area, which is  $58\,030 \text{ km}^2$ .

(d) The lake with the greatest area in the world is the Caspian Sea, which is surrounded by Kazakhstan, Russia, Turkmenistan, Azerbaijan, and Iran, and has an area of  $389\,000 \text{ km}^2$ . The third largest lake is Victoria Lake in Africa, surrounded by Uganda, Kenya, and Tanzania, with an area of  $59\,940 \text{ km}^2$ . Looking at variation in water level gives some idea of how the area and volume of a lake changes over time. For example, Lake Superior's mean water level varies by only one metre or so over the year, although climate change seems to be causing greater fluctuations. It is estimated that the Caspian Sea water level will drop as much as eight metres or more in this century.