Problem of the Week
Problem B and Solution
Sticky Keys

Problem

For some time, Joanne has relied on a calculator to multiply. She just realized that the 8 button on her calculator is broken.

(a) Determine a method for Joanne to use her broken calculator to determine the value of 82×816.

(b) Suppose both the 8 button and the 4 button were broken. Could Joanne still use her calculator to determine the product in part (a)?

Solution

(a) Answers will vary. To solve the problem, Joanne could write each number as a product of whole numbers that do not involve an 8. She can write 82 as 2×41 and 816 as 4×204. Then $82 \times 816 = 2 \times 41 \times 4 \times 204$, which Joanne can determine using her calculator.

NOTE: If her calculator has brackets, part (a) could also be done using sums. For example, $82 \times 816 = (32 + 50) \times (500 + 316)$.

(b) If the 4 key were broken as well, Joanne would not be able to solve this problem using the technique in part (a). This is because the only way to obtain a product of 82 using whole numbers is as 1×82 or as 2×41. This means that she cannot write 82 as a product of whole numbers without one of the numbers involving a 4 or an 8.

However, Joanne could write 82 as a sum of numbers without using 4 or 8. For example, $82 = 30 + 52$. Since $816 = 2 \times 2 \times 2 \times 102$, the product could be found by calculating the sum $30 + 52$, and then multiplying the result by $2 \times 2 \times 2 \times 102$.