

## ACTIVITY IA8.6: Shortcut 100

**Intended learning:** To use semi-formal written strategies for 3-digit multiplication.

**Instructional mode:** Longer, inquiry mode for individuals or groups.

**Materials:** Writing materials.

**Description:** Solicit two numbers just beyond 100 (e.g. 104 and 107). *I need a number a bit greater than 100. And another one.* Challenge students to multiply the two numbers together. Discuss solutions and strategies.

Next, introduce a written shortcut technique for multiplications of this form (see Figure 8.9a). Write the two numbers in vertical format. Beside each one, write the excess from 100: 104 has an excess of 4, 107 an excess of 7. Add on a diagonal:  $107 + 4 = 111$ . The sum of the diagonal gives the first three digits of the answer. Multiply the excesses:  $4 \times 7 = 28$ . The product of the excesses gives the last two digits of the answer: the final answer is 11,128. Students practise using the shortcut for a few tasks. They also calculate the same tasks using their own method, to confirm that the shortcut works.

$$\begin{array}{r}
 104 \quad +4 \\
 \times 107 \quad +7 \\
 \hline
 111 \quad 28
 \end{array}$$

**Ans: 11,128**  
(a)

$$\begin{array}{r}
 96 \quad +4 \\
 \times 93 \quad +7 \\
 \hline
 89 \quad 28
 \end{array}$$

**Ans: 8,928**  
(b)

**Figure 8.9** (a) Shortcut for  $104 \times 107$ , and (b) shortcut for  $96 \times 93$

Finally, challenge students to explain why the shortcut works. Students can compare calculations using the shortcut with calculations using a column strategy such as the partial products method, to help analyse how these calculations work.

**Responses, variations and extensions:**

- The initial multiplications are a manageable challenge in multi-digit multiplication, suitable for students developing informal or semi-formal written strategies.
- Learning the shortcut is an experience of following a formal written procedure, like a formal algorithm. Some students may have difficulty with following the procedure, others may find it easy and enjoyable.
- When students try cases where the product of the excesses is a 1-digit number, they should realize that a 0 needs to be inserted in the tens place of the answer.

- Trying to explain why the shortcut works can develop insight into place value.
- An alternative productive challenge is to determine the range of cases for which the shortcut works. The shortcut works when the product of the excesses is a 1- or 2-digit number, including cases up to  $101 \times 199$ ,  $102 \times 149$ ,  $103 \times 133$ , ...  $109 \times 111$ .
- For students who enjoy the shortcut, there is a parallel shortcut technique for multiplying two numbers just *less* than 100. Figure 8.9b illustrates an example: the *deficits* from 100 of each number are recorded, the *difference* on the diagonal gives the first digits of the answer, and the product of the deficits gives the last two digits of the answer. Why does this work?