

# Mental Maths - Answers

## ACMNA151

7 8 9 10 11 12



TI-Nspire



Investigation



Student



50 min

## Objective

Use a visual representation of the distributive law to improve mental computation strategies.

## Equipment

For this activity you will need:

- TI-Nspire
- TI-Nspire file: "Mental Maths" (tns)

## Instructions

Open the TI-Nspire file:

"Mental Maths"

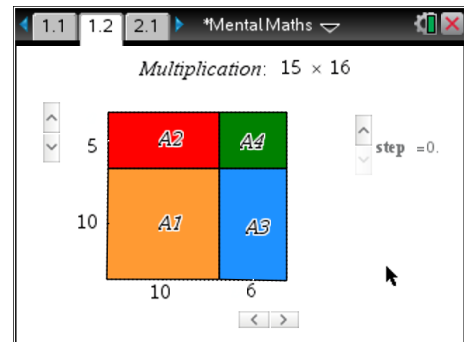
Navigate to page 1.2.

Make sure the sliders are set as follows:

$$a = 5$$

$$b = 6$$

$$\text{step} = 0$$



The overall shape is a rectangle; its area is equal to  $15 \times 16$ .

The rectangle is broken up into a square (A1:  $10 \times 10$ ) and three smaller rectangles A2, A3 and A4.

### Question: 1.

Change the **step** value to 1. Which shape is visible and what is its area? **Area A1 = 100**

### Question: 2.

Change the step value to 2. Which shape is visible and what is its area? **Area A2 = 50**

### Question: 3.

Change the step value to 3. Which shape is visible and what is its area? **Area A3 = 60**

### Question: 4.

Change the step value to 4. Which shape is visible and what is its area? **Area A4 = 30**

### Question: 5.

What is the total area:  $A1 + A2 + A3 + A4$ ? Compare your result with  $15 \times 16$ .  **$15 \times 16 = 240$  (Same)**

**Question: 6.**

Use the diagram on the calculator to help complete the following table:

Expression	A1	A2	A3	A4	Answer (total)
14 x 17	10 x 10 = 100	4 x 10 = 40	7 x 10 = 70	7 x 4 = 28	238
13 x 15	10 x 10 = 100	3 x 10 = 30	5 x 10 = 50	3 x 5 = 15	195
14 x 19	10 x 10 = 100	4 x 10 = 40	9 x 10 = 90	4 x 9 = 36	266
16 x 18	10 x 10 = 100	6 x 10 = 60	8 x 10 = 80	6 x 8 = 48	288
16 x 17	10 x 10 = 100	6 x 10 = 60	7 x 10 = 70	6 x 7 = 42	272

**Question: 7.**

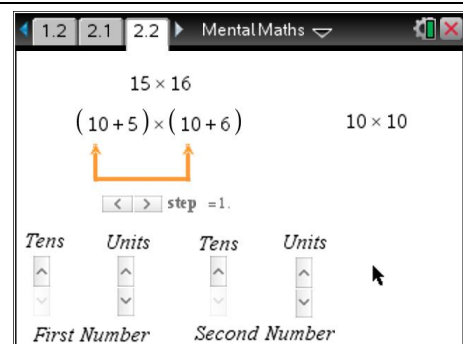
Use the diagram on the calculator to help complete the following table. Comment on any short-cuts for working with perfect squares.

Expression	A1	A2	A3	A4	Answer (total)
12 x 12	10 x 10 = 100	2 x 10 = 20	2 x 10 = 20	2 x 2 = 4	144
13 x 13	10 x 10 = 100	3 x 10 = 30	3 x 10 = 30	3 x 3 = 9	169
14 x 14	10 x 10 = 100	4 x 10 = 40	4 x 10 = 40	4 x 4 = 16	196
15 x 15	10 x 10 = 100	5 x 10 = 50	5 x 10 = 50	5 x 5 = 25	225
16 x 16	10 x 10 = 100	6 x 10 = 60	6 x 10 = 60	6 x 6 = 36	256

A symbolic representation of the distributive law is included on Page 2.2. Two digit numbers are once again disassembled and considered as a combination of 'tens' and 'units'.

Navigate to page 2.2 and adjust the corresponding sliders to produce: 15 x 16

Adjust the 'step' to 0 and then proceed through each step to see how the distributive law works.



**Question: 8.**

Use the interactive diagram for the distributive law to help complete the following table:

Expression	Step 1	Step 2	Step 3	Step 4	Answer (total)
$13 \times 15$	$10 \times 10 = 100$	$10 \times 5 = 50$	$3 \times 10 = 30$	$3 \times 5 = 15$	195
$23 \times 35$	$20 \times 30 = 600$	$20 \times 5 = 100$	$3 \times 30 = 90$	$3 \times 5 = 15$	805
$34 \times 52$	$30 \times 50 = 1500$	$30 \times 2 = 60$	$4 \times 50 = 200$	$4 \times 2 = 8$	1768
$96 \times 23$	$90 \times 20 = 1800$	$90 \times 3 = 270$	$6 \times 20 = 120$	$6 \times 3 = 18$	2208
$82 \times 31$	$80 \times 30 = 2400$	$80 \times 1 = 80$	$2 \times 30 = 60$	$2 \times 1 = 2$	2542

**Question: 9.**

Use the interactive diagram for the distributive law to help complete the following table. Comment on any short-cuts for working with perfect squares.

Expression	A1	A2	A3	A4	Answer (total)
$42 \times 42$	$40 \times 40 = 1600$	$40 \times 2 = 80$	$40 \times 2 = 80$	$2 \times 2 = 4$	1724
$53 \times 53$	$50 \times 50 = 2500$	$50 \times 3 = 150$	$50 \times 3 = 150$	$3 \times 3 = 9$	2809
$61 \times 61$	$60 \times 60 = 3600$	$60 \times 1 = 60$	$60 \times 1 = 60$	$1 \times 1 = 1$	3721
$82 \times 82$	$80 \times 80 = 6400$	$80 \times 2 = 160$	$80 \times 2 = 160$	$2 \times 2 = 4$	6724
$76 \times 76$	$70 \times 70 = 4900$	$70 \times 6 = 420$	$70 \times 6 = 420$	$6 \times 6 = 36$	5776

**Question: 10.**

Use traditional multiplication techniques to calculate  $76 \times 76$  and compare the calculation **process** with the approach in question 9.

$76$	The first computation is to multiply the 'units' digit of each number: $6 \times 6$ , this is the same as step 4 (above). The second computation is a 'tens' digit by a 'units' digit and then the other 'units' digit by the corresponding 'tens' digit, this is the same as steps 2 and 3. The final step is multiplication of the 'tens' digit in both numbers, the same as step 1.
$\times 76$	The difference in these methods is that the standard multiplication method includes addition processes during multiplication. Both methods used on the calculator do all the multiplications first, then additions in the last step.
$456$	
$5320$	
$5776$	

**Comments:** Students should identify that the processes are similar with regards to the multiplication of each digit. Student should use appropriate terminology in their answer. Students may also use diagrams to help explain differences and similarities. From a learning perspective, the examples provided on the calculator encourage students to use actual values such as 'seventy times six' rather than 'seven times six' where the seven has lost its place value. Long multiplication also requires students to alternate between multiplication and addition... again however during their addition students often refer to 'carry one' which could mean 'carry ten' or 'carry one hundred'.