

## Multiplying Polynomials

by – Dennis Ivany

### Activity overview

A slightly different way to look at multiplying polynomials by looking at multiplication of numbers.

### Concepts

*Multiplying Numbers*  
*Multiplying Binomials*  
*Multiplying a Binomial by a Polynomial*  
*Multiplying Polynomials*

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### Teacher preparation

Load the activity **NumberSense\_ChineseDecimals\_Ivany.tns** on each TI Nspire..

### Classroom management tips

*It may help to work through the first example or two with students to ensure they know how to insert text on a Graphs and Geometry page.*

### TI-Nspire Applications

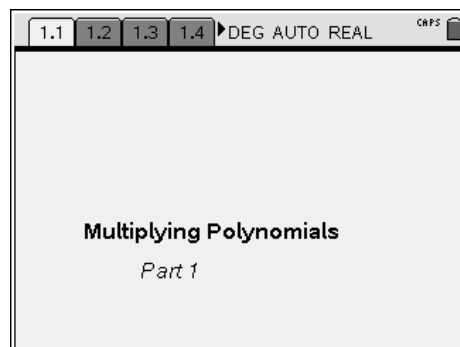
*Graphs and Geometry*

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### Step-by-step directions



Open the document

**algebra\_MultiplyingPolynomials\_Ivany.tns**

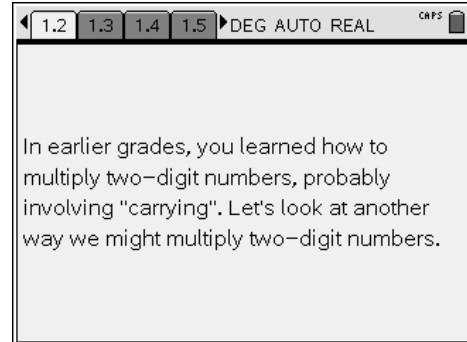


Follow the instructions in the slides.

Use   to move to the next slide in the document.

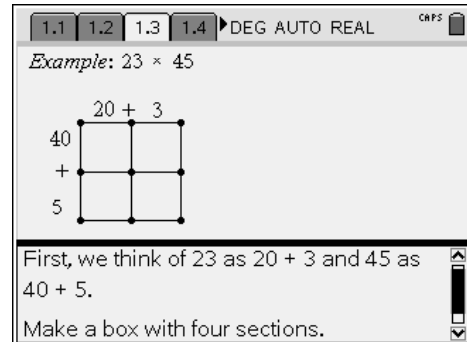
Use   to move between applications on the same slide.

Setting up the problem.



1.2 1.3 1.4 1.5 ▶ DEG AUTO REAL CRPS

In earlier grades, you learned how to multiply two-digit numbers, probably involving "carrying". Let's look at another way we might multiply two-digit numbers.



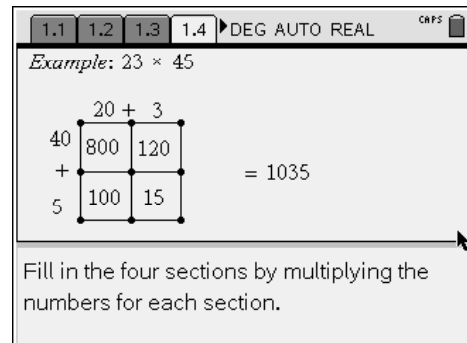
1.1 1.2 1.3 1.4 ▶ DEG AUTO REAL CRPS

*Example:*  $23 \times 45$

		20 + 3	
40	+		
5			

First, we think of 23 as  $20 + 3$  and 45 as  $40 + 5$ .

Make a box with four sections.



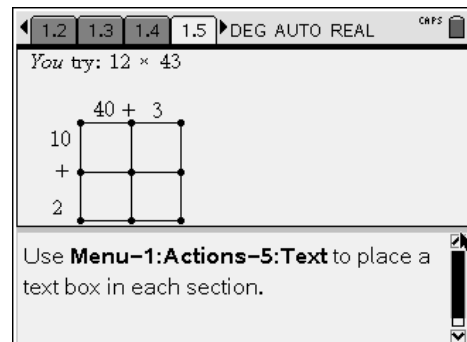
1.1 1.2 1.3 1.4 ▶ DEG AUTO REAL CRPS

*Example:*  $23 \times 45$

		20 + 3	
40	+	800	120
5		100	15

$= 1035$

Fill in the four sections by multiplying the numbers for each section.



1.2 1.3 1.4 1.5 ▶ DEG AUTO REAL CRPS

*You try:*  $12 \times 43$

		40 + 3	
10	+		
2			

Use **Menu-1:Actions-5:Text** to place a text box in each section.

## Multiplying Polynomials

by: Dennis Ivany

Grade level: 9-12

Subject: Algebra I

Time required: 60 to 120 minutes

Materials: Notebook

The solution is on the next slide.

1.3 1.4 1.5 1.6 DEG AUTO REAL CRPS

Let's apply the same idea to multiplying two binomials.

1.4 1.5 1.6 1.7 DEG AUTO REAL CRPS

Example:  $(x + 2)(x + 1)$

	$x$	$+$	$2$
$x$			
$+$			
$1$			

1.5 1.6 1.7 1.8 DEG AUTO REAL CRPS ctr1

	$x$	$+$	$2$	
$x$	$x^2$		$2x$	
$+$				
$1$	$1x$		$2$	

Therefore

$$(x + 2)(x + 1) = x^2 + 3x + 2$$

Time to give it a whirl yourself.

1.6 1.7 1.8 1.9 DEG AUTO REAL CRPS

Some Practice

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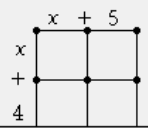
Materials: Notebook

Type your answer in the blank space after you have completed the problem using the box.

Press   to see the answer provided.

1.7 1.8 1.9 1.10 DEG AUTO REAL CRPS

Multiply:  $(x + 5)(x + 4)$



Question

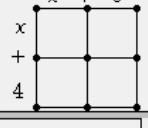
$(x + 5)(x + 4) = \underline{\hspace{2cm}}$

Answer

1.8 1.9 1.10 1.11 DEG AUTO REAL CRPS

Multiply:  $(x - 5)(x + 4)$

Hint: It is helpful to write  $(x - 5)$  as  $(x + -5)$  first.



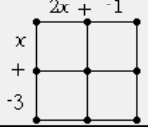
Question

$(x - 5)(x + 4) = \underline{\hspace{2cm}}$

Answer

1.9 1.10 1.11 1.12 DEG AUTO REAL CRPS

Multiply:  $(2x - 1)(x - 3)$



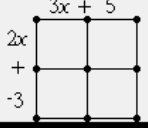
Question

$(2x - 1)(x - 3) = \underline{\hspace{2cm}}$

Answer

1.10 1.11 1.12 1.13 DEG AUTO REAL CRPS

Multiply:  $(3x + 5)(2x - 3)$



Question

$(3x + 5)(2x - 3) = \underline{\hspace{2cm}}$

Answer

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Reversing the procedure.

On the next few slides, see if you can figure out the binomials that were multiplied to give the trinomial.

1.11 1.12 1.13 1.14 DEG AUTO REAL CRPS


Can you reverse it?

1.12 1.13 1.14 1.15 DEG AUTO REAL CRPS

x	$x^2$	$5x$
+		
3	$3x$	15

Question

$x^2 + 8x + 15 = (? + ?)(x + ?)$


Answer 

1.13 1.14 1.15 1.16 DEG AUTO REAL CRPS

	$x^2$	$2x$
	$5x$	10

Question

$x^2 + 7x + 10 = (? + ?)(? + ?)$


Answer 

1.14 1.15 1.16 1.17 DEG AUTO REAL CRPS

	$x^2$	$2x$
	$-5x$	-10

Question

$x^2 - 3x - 10 = (? + ?)(? + ?)$

Answer 

# Multiplying Polynomials

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Materials: Notebook

◀ 1.15 1.16 1.17 1.18 ▶ DEG AUTO REAL CRPS

$2x^2$	$6x$
$x$	$3$

Question

$$2x^2 + 7x + 3 = (\ ? + \ ?)(\ ? + \ ?)$$

Answer ⬆

◀ 1.16 1.17 1.18 1.19 ▶ DEG AUTO REAL CRPS

*Challenging!*

$6x^2$	$18x$
$x$	$3$

Question

$$6x^2 + 19x + 3 = (\ ? + \ ?)(\ ? + \ ?)$$

Answer ⬆

Move to Problem 2 on the Nspire.

◀ 1.17 1.18 1.19 2.1 ▶ DEG AUTO REAL CRPS

**Multiplying Polynomials**  
*Part 2*

Follow the activity on the slides.

◀ 1.18 1.19 2.1 2.2 ▶ DEG AUTO REAL CRPS

We can extend our thinking a little so that we can multiply other polynomials.

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Subject: Algebra I

Time required: 60 to 120 minutes

Materials: Notebook

1.19 2.1 2.2 2.3 DEG AUTO REAL CRPS

Example:  $123 \times 45$

	100 + 20 + 3		
40	4000	800	120
+			
5	500	100	15

= 5535

First, we think of 123 as  $100 + 20 + 3$  and 45 as  $40 + 5$ .

Add a column to the box.

2.1 2.2 2.3 2.4 DEG AUTO REAL CRPS

Example:  $(x^2 + 3x + 2)(x + 5)$

	$x^2 + 3x + 2$		
x	$x^3$	$3x^2$	$2x$
+			
5	$5x^2$	$15x$	10

=  $x^3 + 8x^2 + 17x + 10$

Add a column to the box in order to accommodate the three terms of the trinomial.

Time to practice.

2.2 2.3 2.4 2.5 DEG AUTO REAL CRPS

Some Practice

2.3 2.4 2.5 2.6 DEG AUTO REAL CRPS

$213 \times 54$

	200 + 10 + 3	
50		
+		
4		

$213 \times 54 = \underline{\quad ? \quad}$

**Answer**

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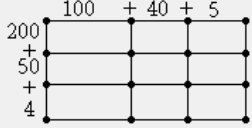
Subject: Algebra I

Time required: 60 to 120 minutes

Materials: Notebook

2.4 2.5 2.6 2.7 DEG AUTO REAL CRPS

$145 \times 254$

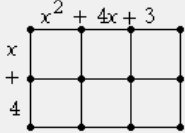


$145 \times 254 = \underline{\quad ? \quad}$

**Answer**

2.5 2.6 2.7 2.8 DEG AUTO REAL CRPS

$(x+4)(x^2+4x+3)$

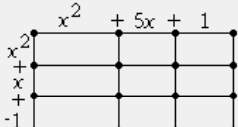


$(x+4)(x^2+4x+3) = \underline{\quad ? \quad}$

**Answer**

2.6 2.7 2.8 2.9 DEG AUTO REAL CRPS

$(x^2+5x+1)(x^2+x-1)$



$(x^2+5x+1)(x^2+x-1) = \underline{\quad ? \quad}$

**Answer**

2.7 2.8 2.9 2.10 DEG AUTO REAL CRPS

**Further Practice**

Try the problems on the next two slides on paper. Instructions on how to check your work are on the last slide.



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Subject: Algebra I

Time required: 60 to 120 minutes

Materials: Notebook

◀ 2.8 2.9 2.10 2.11 ▶ DEG AUTO REAL CRPS

Practice:

A)  $(x + 1)(x^2 + 5x + 3)$

B)  $(x - 3)(x^2 - 2x - 4)$

C)  $(5x - 3)(2x^2 + 3x + 1)$

◀ 2.9 2.10 2.11 2.12 ▶ DEG AUTO REAL CRPS

D)  $(x^2 + 3x + 1)(x^2 + 5x + 4)$

E)  $(x^2 - 2x + 1)(x^2 + 2x - 1)$

F)  $(x - 2)(5x^3 + 3x^2 + 2x + 1)$

G)  $(x - \frac{1}{2})(2x^2 + 4x + 8)$

◀ 2.10 2.11 2.12 2.13 ▶ DEG AUTO REAL CRPS

Checking your answers:

A calculator page has been inserted on the next slide.

**Menu -4:Algebra-3:Expand** will allow your TI-Nspire CAS to multiply the polynomials for you. Question A) has been done to show you the format.

◀ 2.11 2.12 2.13 2.14 ▶ DEG AUTO REAL CRPS

$\text{expand}((x+1) \cdot (x^2+5 \cdot x+3))$

$x^3+6 \cdot x^2+8 \cdot x+3$

|

1/99



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### Assessment and evaluation

- |                           |   |
|---------------------------|---|
| Journal -                 | Have students write about how they can tell the number of terms in the product of two polynomials.                                    |
| Assignment -              | Provide practice sheets with 8 to 10 more exercises for students to try.  |
| Student self-assessment - | For those who struggle initially, have them record the number of problems they correctly complete each day using a broken line graph. |