

# Chapter 3

## Creating and editing expressions

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### Introduction

This chapter explains how to use Equation Writer to create and edit expressions. Expressions that you create are displayed as they are when you write them on paper. From the command line, you can open an expression in Equation Writer.

# Creating a new expression

This section describes how to use Equation Writer to create an expression, and to store it in a variable.

As you create an expression, you press  $\blacktriangleright$  to select the previous components that the new operator or function will relate to. Each time you press  $\blacktriangleright$ , more of the previous components are selected.

Consider the expression:

$$\frac{(3x + 4)(5x^2 - 2)}{\sqrt[3]{x - 1}}$$

This is how you use Equation Writer to create the expression and save it in memory.

1. Ensure that the command line is clear, and press  $\boxed{\text{EQW}}$  to open Equation Writer.

2. Enter the first component.

$$3\boxed{x}\boxed{+}4$$

3. Select the component you entered, and then press  $\boxed{\times}$ . Equation Writer encloses the selected expression in brackets and inserts  $\bullet$  to represent the multiplication.

$$\blacktriangleright\boxed{\times}$$

4. Enter the first term of the second component.

$$5\boxed{x}\boxed{y^x}2$$

5. Select the term, and press  $\boxed{-}2$ . Equation Writer creates the component, and encloses it in brackets.

$$\blacktriangleright\blacktriangleright\boxed{-}2$$

6. Select the expression you have entered so far, and press  $\div$  to insert the division bar under it.



$$\frac{(3x+4)(5x^2-2)}{3x-1}$$

7. Enter the denominator expression.

$$3 \rightarrow (\sqrt{x}) (x) - 1$$

8. Press  $\text{ENTER}$  to place the expression on the command line.

$$\frac{(3x+4)(5x^2-2)}{3x-1}$$

9. To store the expression in memory:

- a. press  $\text{STO} \rightarrow$
- b. press  $\text{ALPHA}$   $\text{ALPHA}$  and then enter a name for the equation
- c. press  $\text{ENTER}$  to store the expression.

## Editing an expression

You can edit an expression on the command line, or in Equation Writer. See “Editing the command line” on page 2-13 for details on using the command line editor.

To edit an expression in Equation Writer:

1. With the expression on the command line, press  $\nabla$ .  
Equation Writer opens with the expression ready for editing.
2. Edit the expression.
3. Press  $\text{ENTER}$  to place the expression on the command line.
4. Press  $\text{ENTER}$  again to save your changes.



If you want to insert a component into an expression, you can:

1. With the expression on the command line, place the cursor where you want the component to be inserted.
2. Press  $\text{EQW}$  to open Equation Writer with a blank screen.
3. Create the component.
4. Press  $\text{ENTER}$ . The component is inserted into the expression on the command line.
5. Press  $\text{ENTER}$  again to save the modified expression.

# Using Equation Writer

As you create or edit an expression, keep the following points in mind:

- You use the operators and the functions from the keyboard to specify the operations that your expression contains. For example, to include an arithmetic addition, press  $\oplus$ . To include a sine function, press  $\sin$ .
- By default, any operation you select is applied to the function or term immediately to the left of the cursor. You press  $\blacktriangleright$  to extend the selection on the left to which the next operation will apply.

## Implied multiplication

You normally press  $\otimes$  to specify multiplication. However, for certain expressions, Equation Writer assumes that multiplication is intended and you do not need to specify it. This is the case in the following situations:

- a number followed by a letter, for example  $2x$
- a number or letter followed by an opening parenthesis
- a number or letter followed by a prefix function, that is a function where the arguments appear after the name, for example  $\sin(x)$ .
- a right parenthesis followed by a left parenthesis.

## Entering $e$ and $i$

To enter the value  $e$ , the base for natural logarithms, or  $i$ , the square root of  $-1$ , you can simply use the alpha keys to enter lower-case  $e$  or  $i$ . That is:

- to enter  $e$ , press  $\alpha \text{ } e$
- to enter  $i$ , press  $\alpha \text{ } i$ .

In algebraic expressions, the HP 49G recognizes these letters as the equivalent values.

You can also enter  $i$  by pressing  $\text{ } i$ .

# Operating modes

There are four modes of operation within Equation Writer. These are:

- Entry mode

This is the default mode. If you are using another mode, Equation Writer returns to Entry mode whenever you enter a value.

The image shows the Equation Writer interface in Entry mode. The expression  $4x^2+3x+4$  is displayed. Below the expression is a menu bar with the following options: EDIT, CURS, BIG, EVAL, FACTO, TENP. A cursor is positioned at the end of the expression.

- Term selection mode

Use this mode when you want to modify existing terms. You can select only one term at a time.

The image shows the Equation Writer interface in Term selection mode. The expression  $4x^2+3x+2$  is displayed. The term  $3x$  is selected, indicated by a dark background. Below the expression is a menu bar with the following options: EDIT, CURS, BIG, EVAL, FACTO, TENP.

- Selection mode

You use this mode when applying algebraic operations to components of an expression.

The image shows the Equation Writer interface in Selection mode. The expression  $4x^2+3x+2$  is displayed. The entire expression is selected, indicated by a dark background. Below the expression is a menu bar with the following options: EDIT, CURS, BIG, EVAL, FACTO, TENP.

- Cursor mode

You use this mode to select components of an expression.

The image shows the Equation Writer interface in Cursor mode. The expression  $4x^2+3x+2$  is displayed. A cursor is positioned over the  $x$  in the term  $3x$ , indicated by a small square. Below the expression is a menu bar with the following options: EDIT, CURS, BIG, EVAL, FACTO, TENP.

## Working with modes

Equation Writer's functionality varies depending on the mode that you are using.

### Using Entry mode

1. Enter a term or operator to apply to the term immediately to the left of the cursor.
2. Press  $\blacktriangleright$  to select terms to the left of the cursor to which you want to apply the next operator or function. Each time you press  $\blacktriangleright$ , more terms to the left are selected.

## Using Term selection mode:

- To start Term selection mode:
  - From Entry mode, press  $\nabla$ .
  - From Selection mode, press  $\boxed{\rightarrow}\nabla$ .

The cursor changes to a box.
- Press  $\rightarrow$  and  $\leftarrow$  to navigate through the expression and select the term you want to change.
- When the term that you want is selected, perform either of the following:
  - Enter a new term or terms to replace the selection.
  - Select a function or operator to apply to the selection.

When you enter a term, function, or operator, Equation Writer returns to Entry mode.

## Using Selection mode

- Press  $\blacktriangle$  to start Selection mode.
- Use the arrow keys to select the components that you want. See “How Equation Writer sees expressions” on page 3-7 to help understand how to select components.
- When the part of the expression that you want is selected, perform one of the following:
  - Enter a new term or terms to replace the selection.
  - Select a function or operator to apply to the selection.
  - Use the computer algebra functions to manipulate the selection.
- To return to Entry mode, enter a term, function, or operator. To return to Term Selection mode, press  $\boxed{\rightarrow}\nabla$ .

## Using Cursor mode

Use Cursor mode to select parts of an expression. You cannot edit a selection in cursor mode.

- Press CURS to start Cursor mode.
- Use the arrow keys to enclose the selection you want in a box.
- Press  $\boxed{\text{ENTER}}$  to select the boxed area, and return to Selection mode, or press  $\boxed{\text{CANCEL}}$  to return to Edit mode without selecting the boxed area.

## How Equation Writer sees expressions

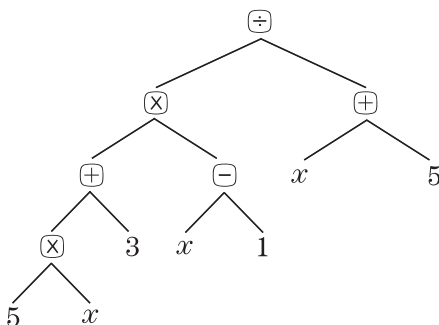
Understanding how Equation Writer sees expressions will help you work with expressions.

The expression that you are editing is represented within Equation Writer as a tree structure, with the operators as branching points, and operands as branches. You use the arrow keys to navigate around the tree and select groups of branches.

For example, consider the expression:

$$\frac{(5x + 3)(x - 1)}{(x + 5)}$$

The tree structure for this expression appears as follows to Equation Writer:



In Selection mode, when the cursor is positioned on 5 in the  $(5x + 3)$  component:

- If you press  $\blacktriangle$  once, the selection point moves to the  $\otimes$  operator and Equation Writer selects the  $5x$  expression.
- If you press  $\blacktriangle$  again, the selection point moves to the  $\oplus$  operator, and Equation Writer selects the  $(5x + 3)$  expression.
- If you press  $\blacktriangle$  again, the selection point moves to the  $\otimes$  operator, and Equation Writer selects the entire numerator.
- If you press  $\blacktriangle$  again, the selection point moves to the top of the tree structure, and Equation Writer selects the entire expression.

You can press  $\blacktriangleright$  or  $\blacktriangleleft$  to move laterally within the equation tree to select terms and expressions at the same level.

# Examples

This section includes examples of how to create specific expressions.

## Example 1

$$\frac{(5x+3)(x-1)}{x+1}$$

1. Enter the numerator expression.  
 $5(x+3)(x-1)$
2. Select the expression and press  $\div$  to insert the division bar under it.  
 $\rightarrow \rightarrow \rightarrow \div$
3. Enter the denominator expression.  
 $(x+1)$

$(5 \cdot x + 3) \cdot (x - 1)$

EDIT CURS BIG ▢ EVAL FACTO TENP

$$\frac{(5 \cdot x + 3) \cdot (x - 1)}{x + 1}$$

EDIT CURS BIG ▢ EVAL FACTO TENP

$$\frac{(5 \cdot x + 3) \cdot (x - 1)}{x + 1}$$

EDIT CURS BIG ▢ EVAL FACTO TENP

## Example 2

$$(2x^3 + 5) \cdot \sqrt{4x^2 + 2x + 7}$$

1. Enter the first component of the expression.  
 $2(x^3+5)$
2. Select the expression, and press  $\times$ .  
 $\rightarrow \times$
3. Enter the second expression.  
 $4(x^2+2x+7)$

$2 \cdot x^3 + 5$

EDIT CURS BIG ▢ EVAL FACTO TENP

$(2 \cdot x^3 + 5) \cdot$

EDIT CURS BIG ▢ EVAL FACTO TENP

$(2 \cdot x^3 + 5) \cdot (4 \cdot x^2 + 2 \cdot x + 7)$

EDIT CURS BIG ▢ EVAL FACTO TENP



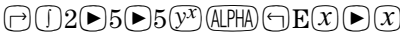
4. Select the expression and apply the square root to it.



### Example 3

$$\int_2^5 5^{ex} dx$$

1. Press the following keys:



## Equation Writer keys

This table lists the keys you can use from within Equation Writer.

	Starts Selection mode, selects terms at the next level up the equation tree.
	Selects the first term of the selected expression. If at the lowest level, invokes Term selection mode.
	Invokes Term selection mode.
	In Term selection mode, moves the cursor left. In Selection mode, selects the term at the same level to the left.
	In Term selection mode, moves the cursor right. In Selection mode, selects the term at the same level to the right.
	In Term selection mode, selects the first term in the expression.
	In Term selection mode, selects the last term in the expression.
	Puts Equation Writer into Cursor mode.
	In Selection mode, selects the next component of a term. In Edit mode, enters a comma (,) character, for example, when entering a complex number.
	In Cursor mode, selects the boxed component. In any other mode, exits Equation Writer and puts the current expression onto the command line.

