# **Lesson Objectives**

1. Perform Arithmetic Operations (+, –, ×, ÷) on Two Functions
   1. Symbolically (with formula)
   2. Numerically (with table)
   3. Graphically
2. Perform a Composition of Two Functions
   1. Symbolically (with formula)
   2. Numerically (with table)
   3. Graphically

# Perform **Arithmetic Operations** (+, – , ×, ÷) on Two Functions

## **Symbolically** (by hand)

**Properties**

If *f*(*x*) and *g*(*x*) both exist, the sum, difference, product, and quotient are defined as:

Sum of Functions:

Difference of Functions:

Product of Functions:

Quotient of Functions

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* **EXAMPLE:** Let .   
  Evaluate each expression symbolically. [5.1.9]







– = **\_\_\_**



· = **\_\_\_**

1. but, is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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## **Numerically** (with table)

* **EXAMPLE:** Use the given table to complete the table below. [5.1.47]

Given table:

|  |  |  |
| --- | --- | --- |
| ***x*** |  |  |
| **– 2** | 0 | 8 |
| **0** | 6 | 0 |
| **2** | 7 | – 4 |
| **4** | 14 | 7 |

Complete the table. (Simplify your answers. Type N if the answer is undefined.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***x*** |  |  |  |  |
| **– 2** |  |  |  |  |
| **0** |  |  |  |  |
| **2** |  |  |  |  |
| **4** |  |  |  |  |

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## **Graphically**

* **EXAMPLE:** Use the graph to the right to evaluate the following functions. [5.1.39]

|  |  |
| --- | --- |
| (get the *y*-coordinates at *x* = 0) | This is a graph of two functions together y = f(x) which is a blue line and y = g(x) which is a red parabola. No function formulas are given; however, the blue line  is actually y=-6x and the red parabola is actually y=-(x^2)+3  This is a duplicate image of the one above it. It is for instructional clarity only. This is a graph of two functions together y = f(x) which is a blue line and y = g(x) which is a red parabola. No function formulas are given; however, the blue line  is actually y=-6x and the red parabola is actually y=-(x^2)+3 |
| )  (get the *y*-coordinates at *x* = – 1) |
| (get the *y*-coordinates at *x* = 1) |
| (get the *y*-coordinates at *x* = 2) |

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# Perform a **Composition** of Two Functions

**Definition** **Function Composition** is defined as follows:

“*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*.”

The output of the second function is the input into the first function

## **Symbolically** (by hand)

* **EXAMPLE:** Find when

and . [5.1-26]

Always start with the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** function, and use the given input value.

\_\_\_\_\_\_\_

Take that **OUTPUT** (answer) from 2ND function and **INPUT** into **FIRST** function:

## **Numerically** (with table)

* **EXAMPLE:** Use the tables to evaluate the expressions. [5.1.89]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 5 | 7 |
|  | 5 | 7 | 1 | 2 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 5 | 7 |
|  | 2 | 5 | 7 | 8 |

Find You do these similar to the symbolic (formula) way.

|  |  |
| --- | --- |
| Always start with the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** function, and use the given input value. | Take that **OUTPUT** (answer) from 2ND function and **INPUT** into **\_\_\_\_\_\_\_** function: |
|  | So, |

(continued from previous page – same problem)

* **EXAMPLE:** Use the tables to evaluate the expressions. [5.1.89]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 5 | 7 |
|  | 5 | 7 | 1 | 2 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 5 | 7 |
|  | 2 | 5 | 7 | 8 |

Find You do these similar to the symbolic (formula) way.

|  |  |
| --- | --- |
| Always start with the **SECOND** function, and use the given input value. | Take that **OUTPUT** (answer) from 2ND function and **INPUT** into **FIRST** function: |
|  | So, |

(continuation of same problem)

* **EXAMPLE:** Use the tables to evaluate the expressions. [5.1.89]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 5 | 7 |
|  | 5 | 7 | 1 | 2 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 5 | 7 |
|  | 2 | 5 | 7 | 8 |

Find You do these similar to the symbolic (formula) way.

|  |  |
| --- | --- |
| Always start with the **SECOND** function, and use the given input value. | Take that **OUTPUT** (answer) from 2ND function and **INPUT** into **FIRST** function: |
|  | is \_\_\_\_\_\_\_\_ in the table.  There’s no in the table.    So, |

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## **Graphically**

* **EXAMPLE:** Use the graph to evaluate the following expressions.[5.1.87]

**SOLUTION**

This is a graph of a blue parabola f(x) and a red line g(x). No function formulas are given, only graphs.
The blue parabola f(x) is actually the graph y=-(x-2)^2 and the red line g(x) is actually the line y=x+1

means using the graph, find the *y*-coordinate when

means using the graph, find the *y*-coordinate when .

So,

This is a duplicate picture of the one beside it for part (a) and is used for instructional clarity.
This is a graph of a blue parabola f(x) and a red line g(x). No function formulas are given, only graphs.
The blue parabola f(x) is actually the graph y=-(x-2)^2 and the red line g(x) is actually the line y=x+1

means using the graph, find the *y*-coordinate when .

means using the graph, find the *y*-coordinate when .

So,

This is a duplicate picture of the ones beside it for parts (a) and (b) and is used for instructional clarity.
This is a graph of a blue parabola f(x) and a red line g(x). No function formulas are given, only graphs.
The blue parabola f(x) is actually the graph y=-(x-2)^2 and the red line g(x) is actually the line y=x+1

means using the graph, find the *y*-coordinate when .

means using the graph, find the *y*-coordinate when .

So,

Source Used: MyLab Math for *College Algebra with Modeling and Visualization*, 6th Edition, Rockswold, Pearson Education Inc.