

1.5 Function Arithmetic

1.5.1 Exercises

page 84: 1, 11, 17, 21,23,25, 46, 57

Exam 1, Wednesday, 02/12/25; if college closed, Thursday, 02/13/25

1.1-1.5

1.5:46

In Exercises 46 - 50, $C(x)$ denotes the cost to produce x items and $p(x)$ denotes the price-demand function in the given economic scenario. In each Exercise, do the following:

- Find and interpret $C(0)$.
- Find and interpret $\bar{C}(10)$.
- Find and interpret $p(5)$.
- Find and simplify $R(x)$.
- Find and simplify $P(x)$.
- Solve $P(x) = 0$ and interpret.

46. The cost, in dollars, to produce x "I'd rather be a Sasquatch" T-Shirts is $C(x) = 2x + 26$, $x \geq 0$ and the price-demand function, in dollars per shirt, is $p(x) = 30 - 2x$, $0 \leq x \leq 15$.

1.5: 21

In Exercises 21 - 45, find and simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$ for the given function.

$$21. f(x) = 2x - 5$$

$$\frac{\Delta f}{\Delta x} = \frac{f(x+h) - f(x)}{h}, \quad h \neq 0$$

$$= \frac{[2(x+h) - 5] - [2x - 5]}{h}$$

$$= \frac{\cancel{2x} + 2h - \cancel{5} - \cancel{2x} + \cancel{5}}{h}$$

$$= \frac{2h}{h}$$

$$\boxed{\frac{\Delta f}{\Delta x} = 2}$$

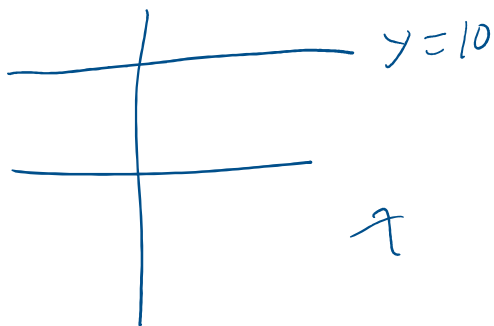
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$$f(x) = 10$$

$$f(1) = 10$$

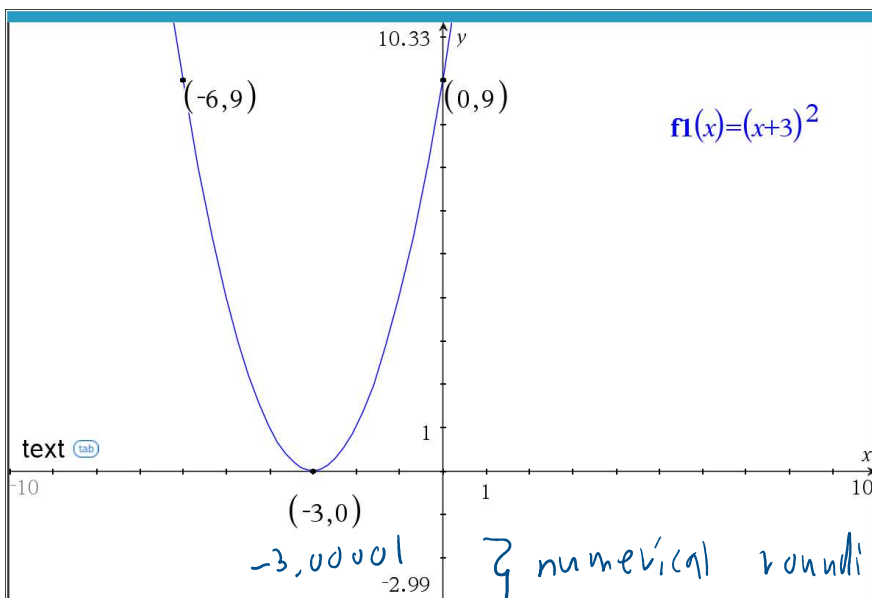
$$f(2x) = 10$$

$$f(x+h) = 10$$



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

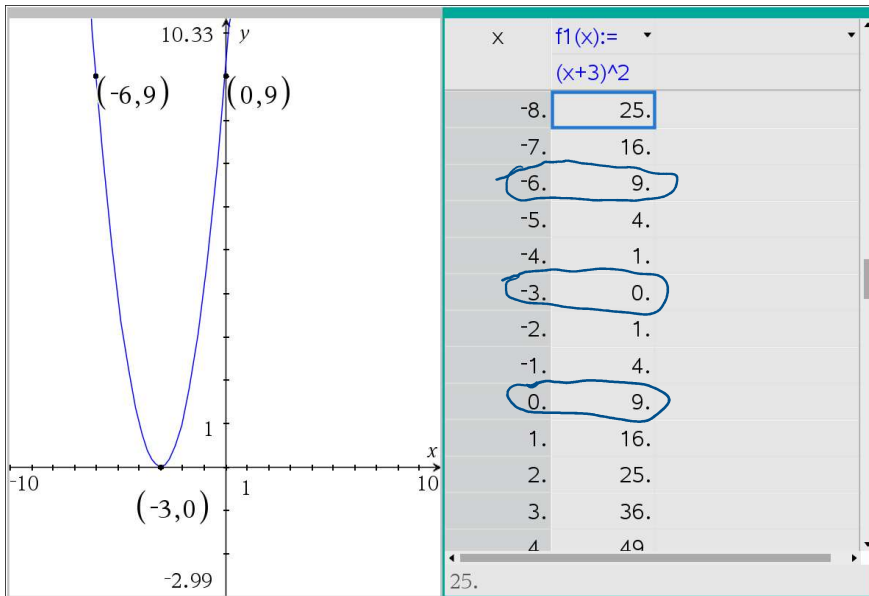
$$g(0) = (0+3)^2 = (3)^2 = 9$$



-3.00001

-2.99999

} numerical rounding error



Here's an example problem involving function notation:

Problem:

A bakery sells cupcakes. The cost of making x cupcakes can be represented by the function $C(x) = 2x + 5$, where $C(x)$ is the total cost in dollars.

- a) What is the cost of making 10 cupcakes?
- b) If the bakery spends \$35, how many cupcakes did they make?
- c) What does $C(0)$ represent in this context?

Solution:

a) What is the cost of making 10 cupcakes?

To find the cost of making 10 cupcakes, we substitute $x = 10$ into the function $C(x)$:

$$C(10) = 2(10) + 5$$

$$C(10) = 20 + 5$$

$$C(10) = 25$$

So, the cost of making 10 cupcakes is \$25.

b) If the bakery spends \$35, how many cupcakes did they make?

Here, we know the cost, $C(x) = \$35$, and we need to find the number of cupcakes, x . We set up the equation:

$$35 = 2x + 5$$

Now, we solve for x :

$$35 - 5 = 2x$$

$$30 = 2x$$

$$x = 30 / 2$$

$$x = 15$$

So, if the bakery spends \$35, they made 15 cupcakes.

c) What does $C(0)$ represent in this context?

$C(0)$ means we substitute $x = 0$ into the function:

$$C(0) = 2(0) + 5$$

$$C(0) = 0 + 5$$

$$C(0) = 5$$

In this context, $C(0) = \$5$ represents the fixed cost the bakery has even before making any cupcakes. This could represent things like the cost of ingredients they already have on hand, rent, or other overhead. It's the cost they incur regardless of how many cupcakes they produce.

My day is fine, Co-Pilot. How was your day?

Well, Donald, every day is a good day for me! I'm ready to dive into whatever you've got. Anything interesting on your agenda?

Okay, I would like an example of a problem involving function arithmetic.

Sure thing! Let's say you're at a store, and you want to buy 3 t-shirts. Each t-shirt costs \$20. Function arithmetic would be used to calculate the total cost. So, you'd have a function $f(x) = 20x$, where x is the number of t-shirts. If you plug in 3 for x , the function $f(3) = 20 * 3$, giving you a total of \$60.

$f(3)$

1.1.4 EXERCISES

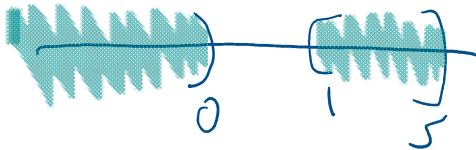
1. Fill in the chart below:

Set of Real Numbers	Interval Notation	Region on the Real Number Line
$\{x \mid -1 \leq x < 5\}$	$[-1, 5)$	
$\{x \mid 0 \leq x < 3\}$	$[0, 3)$	
$\{x \mid -5 < x \leq 0\}$		
	$(-3, 3)$	

In Exercises 2 - 7, find the indicated intersection or union and simplify if possible. Express your answers in interval notation.

6. $(-\infty, 0) \cup [1, 5]$

Already simplified



After class notes

$$2(3 + 4) = 2(7) = \boxed{14}$$

$$= (2)(3) + (2)(4)$$

Distributive property of multiplication over addition

$$= 6 + 8 = \boxed{14}$$

$$a(b + c) = ab + ac$$

$$(b + c)a = ba + ca$$

$$(b+c)a = ba + ca$$

$$ab = ba$$

Commutative property of multiplication of real numbers.

$$(a+b)(c+d) = ac + bc + bd + ad$$

$$\begin{array}{r} a+b \\ \times \quad c+d \\ \hline da + db \end{array}$$

$$\begin{array}{r} ac + cb \\ \hline (ac + da + cb + db) \end{array}$$

Equivalent

$$\begin{array}{r} 12 \\ \times 23 \\ \hline 36 \\ + 24 \\ \hline 276 \end{array}$$

$$\begin{array}{r} 12 \quad 12 \\ 3 \quad 20 \\ \hline 36 \quad 240 \\ \hline 36 \\ + 240 \\ \hline 276 \end{array}$$

$$(x+3)(2x-1)$$

$$= 2x^2 + 6x - x - 3$$

$$= 2x^2 + 5x - 3$$

Let $f(x) = 4x^2 - 3x + 2$ | $f(\text{input}) = 4(\text{input})^2 - 3(\text{input}) + 2$

Find and simplify $\frac{\Delta f}{\Delta x}$

input = $x+h$

$$\frac{\Delta f}{\Delta x} = \frac{f(x+h) - f(x)}{h}, \quad h \neq 0$$

$$= \frac{[4(x+h)^2 - 3(x+h) + 2] - [4x^2 - 3x + 2]}{h}$$

$$= 4(x^2 + 2hx + h^2) - 3x - 3h + 2$$

$$(x+h)^2 = (x+h)(x+h)$$

$$= \frac{4(x^2 + 2hx + h^2) - 3x - 3h + 2 - 4x^2 + 3x - 2}{h}$$

$$\begin{aligned} & (x+h) \\ & = (x+h)(x+h) \\ & = x^2 + 2hx + h^2 \end{aligned}$$

$$= \frac{\cancel{4x^2} + 8hx + 4h^2 - \cancel{3x} - \cancel{3h} + \cancel{2} - \cancel{4x^2} + \cancel{3x} - \cancel{2}}{h}$$

$$= \frac{8hx + 4h^2 - 3h}{h}$$

$$= \frac{\cancel{h}(8x + 4h - 3)}{\cancel{h}}$$

$$\frac{\Delta f}{\Delta x} = 8x + 4h - 3$$