Section 2.1
Introduction to Functions

Say *WHAT*???

You may have noticed that mathematical notation occasionally can have more than one meaning depending on the context.

For example, $(-3, 6)$ could refer to the ordered pair where $x = -3$ and $y = 6$, or it could refer to the open interval $-3 < x < 6$.

Similarly, in this section of the textbook, we will use the notation, $f(x)$. It may surprise you to find out that it does *not* mean to multiply "f times x."

It will be important for you to gain an understanding of what this notation *does* mean as you work through this essential concept of "functions."

$$f(x) \quad f(x) \quad f(x)$$

First Steps:

- ☐ **Take comprehensive notes** from your instructor's lecture and insert your notes into this section of the *Learning Guide*. Be sure to write down all examples, definitions, and other key concepts. Additional learning resources include the *Lecture Series on DVD*, the *PowerPoints*, and Section 2.1 of your textbook which begins on page 104.
- ☐ Complete the ***Concept and Vocabulary Check*** on page 110 of the textbook.

Guided Practice:

- ☐ Review each of the following ***Solved Problems*** and complete each ***Pencil Problem***.

Objective #1: Find the domain and range of a relation.

✔ *Solved Problem #1*

1. Find the domain and range of the relation:
{(0, 9.1), (10, 6.7), (20, 10.7), (30, 13.2), (38, 19.6)}

The domain is the set of all first components.

Domain:
{0, 10, 20, 30, 38}.

The range is the set of all second components.

Range:
{9.1, 6.7, 10.7, 13.2, 19.6}.

✎ *Pencil Problem #1* ✎

1. Find the domain and range of the relation:
{(3, 4), (3, 5), (4, 4), (4, 5)}

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Objective #2: Determine whether a relation is a function.

✔ *Solved Problem #2*

2a. Determine whether the relation is a function:

$$\{(1,2),(3,4),(5,6),(5,7)\}$$

5 corresponds to both 6 and 7. If any element in the domain corresponds to more than one element in the range, the relation is not a function.

Thus, the relation is not a function.

✎ *Pencil Problem #2*

2a. Determine whether the relation is a function:

$$\{(3, 4), (3, 5), (4, 4), (4, 5)\}$$

2b. Determine whether the relation is a function:

$$\{(1,2),(3,4),(6,5),(7,5)\}$$

Every element in the domain corresponds to exactly one element in the range. No two ordered pairs in the given relation have the same first component and different second components.

Thus, the relation is a function.

2b. Determine whether the relation is a function:

$$\{(-3,-3),(-2,-2),(-1,-1),(0,0)\}$$

Objective #3: Evaluate a function.

✔ *Solved Problem #3*

3a. Find $f(6)$ for $f(x) = 4x + 5$.

$$f(x) = 4x + 5$$
$$f(6) = 4(6) + 5$$
$$= 29$$

✎ *Pencil Problem #3*

3a. Find $g(0)$ for $g(x) = 3x - 2$.

3b. Find $g(-5)$ for $g(x) = 3x^2 - 10$.

$$g(x) = 3x^2 - 10$$
$$g(-5) = 3(-5)^2 - 10$$
$$= 65$$

3b. Find $h(4)$ for $h(x) = 3x^2 + 5$.

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3c. Find $h(-4)$ for $h(r) = r^2 - 7r + 2$.

$$h(r) = r^2 - 7r + 2$$
$$h(-4) = (-4)^2 - 7(-4) + 2$$
$$= 46$$

3c. Find $f(3)$ for $f(x) = 2x^2 + 3x - 1$.

3d. Find $F(a+h)$ for $F(x) = 6x + 9$.

$$F(x) = 6x + 9$$
$$F(a+h) = 6(a+h) + 9$$
$$= 6a + 6h + 9$$

3d. Find $f(5a)$ for $f(x) = 2x^2 + 3x - 1$.

3e. Function g is defined by the following table:

x	$g(x)$
0	3
1	0
2	1
3	2
4	3

Find $g(1)$.

To find $g(1)$, locate 1 in the x-column.

x	$g(x)$
0	3
1	0
2	1
3	2
4	3

When the input is 1, the output is 0.

Thus, $g(1) = 0$.

3e. Function f is defined by the following table:

x	$f(x)$
−4	3
−2	6
0	9
2	12
4	15

Find $f(2)$.

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3f. Function g is defined by the following table:

x	$g(x)$
0	3
1	0
2	1
3	2
4	3

Find x such that $g(x) = 3$.

Locate 3 in the $g(x)$ column. Note that it occurs twice.

x	$g(x)$
[0]	[3]
1	0
2	1
3	2
[4]	[3]

When the output is 3, the input is 0 or 4.

Thus, $g(x) = 3$ for $x = 0$ and $x = 4$.

3f. Function f is defined by the following table:

x	$f(x)$
−4	3
−2	6
0	9
2	12
4	15

Find x such that $f(x) = 9$.

Answers for Pencil Problems *(Textbook Exercise references in parentheses)*:

1. Domain: {3, 4}. Range: {4, 5}. *(2.1 #3)*

2a. not a function *(2.1 #3)* **2b.** function *(2.1 #5)*

3a. −2 *(2.1 #11a)* **3b.** 53 *(2.1 #13c)*

3c. 26 *(2.1 #15b)* **3d.** $50a^2 + 15a - 1$ *(2.1 #15e)*

3e. 12 *(2.1 #21b)* **3f.** 0 *(2.1 #21c)*

Homework:

- ☐ **Review the Section 2.1 summary** on page 167 of the textbook.
- ☐ **Insert your homework** into this section of the *Learning Guide*. Show all work neatly and check your answers. Strive to work through difficulties when possible, making note of any exercises where you need additional help. Remember, even if your instructor assigns homework through *MyMathLab*, you should still write out your work.

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