What Is This Module About?

This module is a continuation of the module entitled *Relations and Functions.* It will tell you more about functions. You will learn how to evaluate functions and perform the four fundamental operations (addition, subtraction, multiplication and division) on them.

This module contains three lessons. These are:

Lesson 1 – *Evaluation of Functions*

Lesson 2 – *Addition and Subtraction of Functions*

Lesson 3 – *Multiplication and Division of Functions*

What Will You Learn From This Module?

After reading this module, you should be able to:

- evaluate functions; and
- perform the four fundamental operations on functions.

Wait!

Before you study this module, make sure that you have already read the module *Relations and Functions.*

Let's See What You Already Know

Before reading this module, answer the following questions first to determine how much you already know about the topics to be discussed.

1. If $f(x) = x^2 - 2x + 5$, what is the value of $f(-1)$?

   a. –8 b. –4 c. 4 d. 8

2. If $f(x) = 3x + 5$, what is the value of $3f(x)$?

   a. $3x + 5$ b. $9x + 5$ c. $9x + 25$ d. $9x + 15$

3. If $f(x) = 3x + 5$ and $g(x) = 8x - 4$, what is $f(x) + g(x)$?

a. $11x + 1$ c. $11x^2 + 1$

b. $11x + 9$ d. $11x^2 + 9$

4. If $f(x) = 7x^2 + 5x - 2$ and $g(x) = 5x^2 - 3x + 10$, what is $f(x) - g(x)$?

a. $x^2 + 4x - 6$ c. $2x^4 + 8x - 12$

b. $2x^2 + 8x - 12$ d. $2x^4 + 2x - 6$

5. If $f(x) = x^2 + 4x + 5$ and $g(x) = 2x + 1$, what is the value of $f(x) - 2g(x)$?

a. $x^2 + 2x + 4$ c. $x^2 - 3$

b. $x^2 - 2x + 3$ d. $x^2 + 3$

6. If $f(x) = x + 2$ and $g(x) = x$, what is the product of $f(x)$ and $g(x)$?

a. $x^2 + 2$ c. $2x + 2$

b. $x^2 + 2x$ d. 1

7. If $f(x) = x^3 - 2x$ and $g(x) = x$, what is $f(x)g(x)$?

a. $x^3 + x$ c. $x^4 - 2x^2$

b. $x^3 - 3x$ d. $x^2 - 2$

8. If $f(x) = 2x + 5$ and $g(x) = 7x$, what is the value of $f(2) - g(1)$?

a. -2 c. 2

b. 0 d. 16

9. If $f(x) = 2x - 3$ and $g(x) = 4x$, what is the value of $f(2)g(1)$?

a. -8 b. -4 c. 4 d. 8

10. What is the value of $f(2) + g(x)$ if $f(x) = x^2 - 2$ and $g(x) = x^2 - 8$?

a. $x^2 - 14$ c. $x^2 - 6$

b. $x^2 - 10$ d. $x^2 - 2$

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on pages 18 to 20 to find out.

If all your answers are correct, very good! This shows that you already know much about the topic. You may still study the module to review what you already know. Who knows, you might learn a few more new things as well.

If you got a low score, don't feel bad. This means that this module is for you. It will help you understand some important concepts that you can apply in your daily life. If you study this module carefully, you will learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page to begin Lesson 1.

Evaluation of Functions

Can you still remember what the words **domain** and **range** mean in a relation? Can you still recall the rule that says all functions are relations, but not all relations are functions?

This lesson will teach you how to evaluate functions. It will teach you how to find the value of a function given a certain value of x.

Let's Study and Analyze

Remember that a set of ordered pairs is called a **relation.** The **domain** of a relation is the set of first elements in the ordered pairs (set of all xs) while the **range** is the set of all possible second elements in the ordered pairs (set of all ys).

Given the following set of ordered pairs: A = {(1, 2), (3, 4), (5, 6), (7, 8), (9, 10)}, we say that the domain of Set A is {1, 3, 5, 7, 9} and its range is {2, 4, 6, 8, 10}.

Similarly, suppose you are given: B = {(1, 3), (2, 4), (3, 5), (4, 6), (5, 7)}, what is the domain of Set B? What is its range?

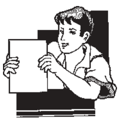
Domain = ______________________________

Range = ______________________________

Compare your answers with mine.

Domain = {1, 2, 3, 4, 5}

Range = {3, 4, 5, 6, 7}



Let's Learn

In any function in which y is written in terms of x, the variable y can be replaced by $f(x)$.

To evaluate a function, you simply need to find the value of y or $f(x)$. Let us look at the following examples.

EXAMPLE 1 If $f(x) = x + 1$, what is the value of $f(-1)$? $f(0)$?

To find the value of $f(x)$, follow these steps:

STEP 1 Replace x in the equation $f(x) = x + 1$.

If $x = -1$, we substitute -1 for x in the equation $f(x) = x + 1$.

STEP 2 Perform the indicated operation and simplify the result.

$f(-1) = -1 + 1$

$= 0$

Thus, $f(-1) = 0$

Similarly, to find $f(0)$:

STEP 1 Replace x in the equation $f(x) = x + 1$ with $x = 0$.

. $f(0) = 0 + 1$

STEP 2 Perform the indicated operation and simplify the result.

$f(0) = 0 + 1$

$= 1$

thus, $f(0) = 1$

EXAMPLE 2 If $f(x) = 2x + 1$, what is the value of $f(-1)$? $f(0)$?

Follow the same steps used in the previous example.

Solution: If $x = -1$, then

$f(-1) = 2x + 1$

$= 2(-1) + 1$

$= -2 + 1$

$= -1$

Thus, $f(-1) = -1$

If $x = 0$, then $f(0) = 2x + 1$

$= 2(0) + 1$

$= 0 + 1$

$= 1$

thus, $f(0) = 1$

EXAMPLE 3 If $f(x) = 2x^2 - 5$, what is the value of $f(-1)$? $f\left(\frac{1}{2}\right)$?

Try solving this problem on your own following the steps you have just learned.

Compare your answers with mine.

Given: $f(x) = 2x^2 - 5$

Unknown: $f(-1)$; $f\left(\frac{1}{2}\right)$

Solution: If $x = -1$

$$
\begin{aligned}
f(-1) &= 2(-1)^2 - 5 \\
&= 2[(-1)(-1)] - 5 \\
&= 2(1) - 5 \\
&= 2 - 5 \\
&= -3
\end{aligned}
$$

Hence, $f(-1) = -3$

If $x = \left(\frac{1}{2}\right)$

$$
\begin{aligned}
f\left(\frac{1}{2}\right) &= 2\left(\frac{1}{2}\right)^2 - 5 \\
&= 2\left[\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\right] - 5 \\
&= 2\left(\frac{1}{4}\right) - 5 \\
&= \frac{1}{2} - 5 = \frac{1}{2} - \frac{5}{1} = \frac{1-10}{2} = \frac{-9}{2} = -4\frac{1}{2}
\end{aligned}
$$

Hence, $f\left(\frac{1}{2}\right) = -4\frac{1}{2}$

EXAMPLE 4 If $f(x) = x^2 - 2x + 1$, what is the value of $2f(3)$?

Solve, then compare your answer with mine.

Is your answer the same as this?

Given: $f(x) = x^2 - 2x + 1$

Unknown: $2f(3)$

Solution: $f(3) = 3^2 - 2(3) + 1$

$= 9 - 6 + 1$

$= 3 + 1$

$= 4$

thus, $f(3) = 4$

$2f(3) = 2(4)$

$= 8$

Thus, $2f(3) = 8$

Let's Review

If $f(x) = x^2 - x - 10$, find $3f(5)$.

Compare your answer with the one in the *Answer Key* on page 20.

Let's See What You Have Learned

Given the following equations:

$f(x) = 3x + 5$

$g(x) = x^2 - 2$

$h(x) = x^2 - 9$

Find the values of the following. You may write your solutions on a separate sheet of paper.

1. $f(2)$
2. $g(0)$
3. $h(3)$
4. $3f(1)$

Compare your answers with those in the *Answer Key* on page 21. Did you get all the correct answers? If you did, that's very good. If you did not, that's okay too. Just review the parts you did not understand very well before going to the next lesson.

Let's Remember

- To find the value of $f(x)$, do the following steps:
    1. Replace the variable x with the given values.
    2. Perform the indicated operations and simplify the result.
- To find the value of $kf(x)$, do the following steps:
    1. Replace the variable x with the given values to find $f(x)$.
    2. Perform the indicated operations and simplify the result.
    3. Multiply k with the value of $f(x)$. Simplify the result.

Addition and Subtraction of Functions

In Lesson 1, you learned how to evaluate functions. This lesson will now teach you how to add and subtract functions.

Before you proceed to adding and subtracting functions, let us recall how to add and subtract algebraic expressions first. **Algebraic expressions** consist of numbers and one or more variables joined by a symbol of operation and sometimes use grouping symbols.

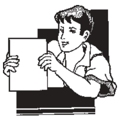
Examples: $10 + 12$
$4y$
$8(x + y)$

Let's Try This

Match the items in Column A with those in Column B. Write the letters only.

		A		B
_____	1.	$5x + 12 + (10x - 5)$	a.	$-6x + 10$
_____	2.	$2x^2 - 4x - 7 - (x^2 - 6x - 3)$	b.	$3x - 10$
_____	3.	$x^2 - 3x + 5 + (-x^2 - 3x + 5)$	c.	$15x + 7$
_____	4.	$2(x - 3y - 5) + x + 6y$	d.	$x^2 + 2x - 4$
_____	5.	$x^2 - 5x + 3 - (-x^2 - 4x - 7)$	e.	$2x^2 - x + 10$

Compare your answers with those in the *Answer Key* on pages 21 and 22.



Let's Learn

In adding and subtracting functions, follow the steps enumerated on the next page. Remember that $f(x) + g(x)$ means you will add the given functions while $f(x) - g(x)$ means you will subtract the given functions.

EXAMPLE 1 Given $f(x) = 3x + 4$ and $g(x) = 2x + 5$, what is $f(x) + g(x)$?

To find $f(x) + g(x)$, follow these steps.

STEP 1 Substitute the values of $f(x)$ and $g(x)$ in the equation $f(x) + g(x)$.

$f(x) + g(x) = (3x + 4) + (2x + 5)$

STEP 2 Combine similar terms.

$$\begin{aligned} f(x) + g(x) &= (3x + 4) + (2x + 5) \\ &= (3x + 2x) + (4 + 5) \end{aligned}$$

STEP 3 Simplify the terms.

$$\begin{aligned} f(x) + g(x) &= (3 + 2)x + (4 + 5) \\ &= 5x + 9 \end{aligned}$$

EXAMPLE 2 What is $f(x) – g(x)$?

To find $f(x) – g(x)$, follow these steps:

STEP 1 Substitute the values of $f(x)$ and $g(x)$ in the equation $f(x) – g(x)$.

$f(x) – g(x) = (3x + 4) – (2x + 5)$

STEP 2 Perform the indicated operations and combine similar terms.

$$\begin{aligned} f(x) - g(x) &= (3x + 4) - (2x + 5) \\ &= (3x - 2x) + (4 - 5) \end{aligned}$$

STEP 3 Simplify the terms.

$$\begin{aligned} f(x) - g(x) &= (3 - 2)x + (4 - 5) \\ &= x - 1 \end{aligned}$$

EXAMPLE 3 Given $f(x) = 2x^2 + 3x + 1$ and $g(x) = 4x^2 – 7x + 5$, what is $f(x) + g(x)$?

$f(x) – g(x)$?

Try solving this on your own following the steps you have just learned.

Compare your answers with mine.

Given: $f(x) = 2x^2 + 3x + 1$

$g(x) = 4x^2 – 7x + 5$

Unknown: $f(x) + g(x)$; $f(x) - g(x)$

Solution:

$$
\begin{aligned}
f(x) + g(x) &= (2x^2 + 3x + 1) + (4x^2 - 7x + 5) \\
&= (2x^2 + 4x^2) + (3x - 7x) + (1 + 5) \\
&= 6x^2 - 4x + 6
\end{aligned}
$$

$$
\begin{aligned}
f(x) - g(x) &= (2x^2 + 3x + 1) - (4x^2 - 7x + 5) \\
&= (2x^2 + 3x + 1) + (-4x^2 + 7x - 5) \\
&= (2x^2 - 4x^2) + (3x + 7x) + (1 - 5) \\
&= -2x^2 + 10x - 4
\end{aligned}
$$

Did you get the correct answers? If you did, that's very good!

Let's See What You Have Learned

Given the following equations:

$f(x) = 3x + 5$

$g(x) = x^2 - 2$

$h(x) = x^2 - 9$

$r(x) = 7x - 10$

Find the following.

1. $f(x) + g(x)$
2. $g(x) + h(x)$
3. $h(x) + r(x)$
4. $f(x) - r(x)$
5. $g(x) - h(x)$

Compare your answers with those in the *Answer Key* on pages 22 and 23. Did you get all the answers right? If you did, that's very good. If you did not, that's okay. Just read again the parts of the lesson you did not understand very well before going to the next lesson.

Let's Remember

- To find $f(x) + g(x)$, follow these steps:

    1. Substitute the values of $f(x)$ and $g(x)$.
    2. Combine similar terms and perform the indicated operations.
    3. Simplify the answer.

- To find $f(x) - g(x)$, follow these steps:

    1. Substitute the values of $f(x)$ and $g(x)$.
    2. Combine similar terms and perform the indicated operations.
    3. Simplify.

Multiplication and Division of Functions

In the previous lesson, you learned how to add and subtract functions. This time you will learn how to multiply and divide functions.

But first, let us recall how to multiply and divide algebraic expressions.

Let's Try This

Match the items in Column A with those in Column B. Write only the letters of the correct answers.

A	B
____ 1. $(x + 4)(x - 2)$	a. $2x^2 - 5x - 3$
____ 2. $(x - 8)(x - 5)$	b. $x^2 + 2x - 8$
____ 3. $(2x + 1)(x - 3)$	c. $x^4 - x^2$
____ 4. $(x^3 - x)x$	d. $x^2 - 13x + 40$
____ 5. $(4x^2 - 2x)2x$	e. $8x^3 - 4x^2$

Compare your answers with those in the *Answer Key* on page 23.

Let's Study and Analyze

Multiplying and dividing functions is the same as multiplying and dividing algebraic expressions. Look at the following examples. Keep in mind that $f(x)g(x)$ means that you are going to multiply the two functions while $f(x) \div g(x)$ means you are going to divide the given functions.

EXAMPLE 1 Given $f(x) = x + 4$ and $g(x) = x + 5$, what is $f(x)g(x)$?

To find $f(x)g(x)$, follow these steps:

STEP 1 Substitute the values of $f(x)$ and $g(x)$.

$f(x)g(x) = (x + 4)(x + 5)$

STEP 2 Multiply each term in the first polynomial by every term in the second polynomial.

$$\begin{aligned} f(x)g(x) &= (x + 4)(x + 5) \\ &= x(x + 5) + 4(x + 5) \end{aligned}$$

STEP 3 Perform the indicated operations.

$$f(x)g(x) = x^2 + 5x + 4x + 20$$

STEP 4 Combine similar terms.

$$f(x)g(x) = x^2 + (4 + 5)x + 20$$

STEP 5 Simplify the terms.

$$f(x)g(x) = x^2 + 9x + 20$$

EXAMPLE 2 Given $f(x) = x - 4$ and $g(x) = x + 7$, what is $f(x)g(x)$?

Try solving this on your own. Follow the steps used in the example.

Compare your answer with mine.

$$\begin{aligned} f(x)g(x) &= (x - 4)(x + 7) \\ &= x(x + 7) - 4(x + 7) \\ &= (x^2 + 7x) + (-4x - 28) \\ &= x^2 + (7x - 4x) - 28 \\ &= x^2 + 3x - 28 \end{aligned}$$

EXAMPLE 3 Given $f(x) = x^2 - 4x$ and $g(x) = x$, what is $f(x) \div g(x)$?

To find $f(x) \div g(x)$, follow these steps.

STEP 1 Substitute the values of $f(x)$ and $g(x)$.

$$f(x) \div g(x) = (x^2 - 4x) \div x$$

STEP 2 Divide the terms.

$$\begin{aligned} f(x) \div g(x) &= \frac{x^2 - 4x}{x} \\ &= \frac{x^2}{x} - \frac{4x}{x} \end{aligned}$$

STEP 3 Simplify the terms.

$$f(x) \div g(x) = x - 4$$

EXAMPLE 4 Given $f(x) = x^2 - 10x$ and $g(x) = x$, what is $f(x) \div g(x)$?

Try solving this on your own following the procedure used in the example.

Compare your answers with mine.

$$\begin{aligned} f(x) \div g(x) &= (x^2 - 10x) \div x \\ &= \frac{x^2 - 10x}{x} \\ &= \frac{x^2}{x} - \frac{10x}{x} \\ &= x - 10 \end{aligned}$$

Let's See What You Have Learned

1. If $f(x) = x^2 + 4$ and $g(x) = x$, find:

   a. $f(x)g(x)$ b. $f(x) \div g(x)$

2. If $r(x) = x^2 + 4x$ and $s(x) = 2x$, find:

   a. $r(x)s(x)$ b. $r(1) \div s(1)$

Compare your answers with those found in the *Answer Key* on page 24. Did you get all the answers right? If you did, that's very good! If you did not, that's okay. Just read again the parts of the lesson you did not understand very well.

Let's Remember

♦ To find $f(x)g(x)$, follow these steps:

1. Substitute the values of $f(x)$ and $g(x)$.
2. Multiply the terms.

3. Combine similar terms.
4. Simplify.

- To find $f(x) \div g(x)$, follow these seps:
  1. Substitute the values of $f(x)$ and $g(x)$.
  2. Divide the terms.
  3. Simplify.

Well, this is the end of the module! Congratulations for finishing it. Did you like it? Did you learn something useful from it? A summary of its main points is given below to help you remember them better.

Let's Sum Up

This module tells us that:

- To find the value of $f(x)$, use the following steps:
  1. Substitute the value of x.
  2. Perform the indicated operation and simplify the result.
- To find the value of $kf(x)$, use the following steps:
  1. Substitute the value of x to find $f(x)$.
  2. Perform the indicated operations and simplify the result.
  3. Multiply k by the value of $f(x)$. Simplify the result.
- To find $f(x) + g(x)$, follow these steps:
  1. Substitute the values of $f(x)$ and $g(x)$.
  2. Combine similar terms and perform the indicated operations.
  3. Simplify the answer.
- To find $f(x) – g(x)$, follow these steps:
  1. Substitute the values of $f(x)$ and $g(x)$.
  2. Combine similar terms and perform the indicated operations.
  3. Simplify the answer.
- To find $f(x)g(x)$, follow these steps:
  1. Substitute the values of $f(x)$ and $g(x)$.
  2. Multiply the terms.
  3. Combine similar terms.
  4. Simplify.

- To find $f(x) \div g(x)$, follow these steps:
  1. Substitute the values of $f(x)$ and $g(x)$.
  2. Divide the terms.
  3. Simplify.

What Have You Learned?

Answer the following questions.

1. If $f(x) = x^2 - 2x + 5$, what is the value of $f(1)$?

2. If $g(x) = -2x^2 - 5$, what is the value of $-2g(x)$?

3. If $f(x) = 3x - 5$ and $g(x) = 10x - 5$, what is $f(x) + g(x)$?

4. If $f(x) = 3x^2 - 2x + 7$ and $g(x) = x^2 - 5x - 2$, what is $g(x) - f(x)$?

5. If $f(x) = x^2 - 3x + 1$ and $g(x) = x^2 + 2x$, what is the value of $2f(x) - g(x)$?

6. If $f(x) = x - 2$ and $g(x) = x + 1$, what is $f(x)g(x)$?

7. If $f(x) = 4x^3 - 2x^2$ and $g(x) = 2x$, what is the quotient of $f(x) \div g(x)$?

8. If $f(x) = 2x + 5$ and $g(x) = 7x$, what is the value of $g(1) - f(2)$?

9. If $f(x) = 2x - 3$ and $g(x) = 4x$, what is $f(1)g(2)$?

10. What is the value of $f(x) + g(2)$ if $f(x) = x^2 - 2$ and $g(x) = x^2 - 8$?

Compare your answers with those in the *Answer Key* on pages 25 and 26. Did you get a perfect score? If you did, that's very good. If you did not, that's okay. Just review the parts of the module you did not understand very well before moving on to the next one.

Answer Key

A. Let's See What You Already Know *(pages 1–2)*

1. **(d)**

$$\begin{aligned} f(x) &= x^2 - 2x + 5 \\ f(-1) &= (-1)^2 - 2(-1) + 5 \\ &= (-1)(-1) + 2 + 5 \\ &= 1 + 7 \\ &= 8 \end{aligned}$$

2. **(d)**

$$\begin{aligned} f(x) &= 3x + 5 \\ 3f(x) &= 3(3x + 5) \\ &= 9x + 15 \end{aligned}$$

3. **(a)**

$$\begin{aligned} f(x) &= 3x + 5 \\ g(x) &= 8x - 4 \\ f(x) + g(x) &= (3x + 5) + (8x - 4) \\ &= 3x + 5 + 8x - 4 \\ &= 3x + 8x + 5 - 4 \\ &= 11x + 1 \end{aligned}$$

4. **(b)**

$$\begin{aligned} f(x) &= 7x^2 + 5x - 2 \\ g(x) &= 5x^2 - 3x + 10 \\ f(x) - g(x) &= (7x^2 + 5x - 2) - (5x^2 - 3x + 10) \\ &= (7x^2 + 5x - 2) + (-5x^2 + 3x - 10) \\ &= 7x^2 + 5x - 2 - 5x^2 + 3x - 10 \\ &= 7x^2 - 5x^2 + 5x + 3x - 2 - 10 \\ &= 2x^2 + 8x - 12 \end{aligned}$$

5. **(d)**

$f(x) = x^2 + 4x + 5$

$g(x) = 2x + 1$

$2g(x) = 2(2x + 1)$

$= 4x + 2$

$f(x) - 2g(x) = (x^2 + 4x + 5) - (4x + 2)$

$= (x^2 + 4x + 5) + (-4x - 2)$

$= x^2 + 4x + 5 - 4x - 2$

$= x^2 + 4x - 4x + 5 - 2$

$= x^2 + 3$

6. **(b)**

$f(x) = x + 2$

$g(x) = x$

$f(x)g(x) = (x + 2)x$

$= x^2 + 2x$

7. **(d)**

$f(x) = x^3 - 2$

$g(x) = x$

$f(x) \div g(x) = (x^3 - 2x) \div x$

$$= \frac{x^3 - 2x}{x}$$

$$= \frac{x^3}{x} - \frac{2x}{x}$$

$= x^2 - 2$

8. **(c)**

$f(x) = 2x + 5$

$g(x) = 7x$

$f(2) = 2(2) + 5$

$= 4 + 5$

$= 9$

$g(1) = 7(1)$

$= 7$

$f(2) - g(1) = 9 - 7$

$= 2$

9. **(c)**

$f(x) = 2x - 3$

$g(x) = 4x$

$f(2) = 2(2) - 3$

$= 4 - 3$

$= 1$

$g(1) = 4(1)$

$= 4$

$f(2)g(1) = 4$

$= 4$

10. **(c)**

$f(x) = x^2 - 2$

$g(x) = x^2 - 8$

$f(2) = 2^2 - 2$

$= 2(2) - 2$

$= 4 - 2$

$= 2$

$f(2) + g(x) = 2 + (x^2 - 8)$

$= 2 + x^2 - 8$

$= -6 + x^2$

$= x^2 - 6$

B. Lesson 1

Let's Review (page 6)

$f(x) = x^2 - x - 10$

$f(5) = 5^2 - 5 - 10$

$= 25 - 5 - 10$

$= 25 - 15$

$f(5) = 10$

$3f(5) = 3(10)$

$= 30$

Let's See What You Have Learned (pages 6–7)

1. $f(x) = 3x + 5$

   $f(2) = 3(2) + 5$

   $= 6 + 5$

   $= 11$

2. $g(x) = x^2 - 2$

   $g(0) = 0^2 - 2$

   $= 0 - 2$

   $= -2$

3. $h(x) = x^2 - 9$

   $h(3) = 3^2 - 9$

   $= 9 - 9$

   $= 0$

4. $3f(1) = 24$

   $f(x) = 3x + 5$

   $f(1) = 3(1) + 5$

   $= 3 + 5$

   $= 8$

   $3f(1) = 3(8)$

   $= 24$

C. Lesson 2

Let's Try This (page 8)

1. **(c)**

   $$\begin{aligned} 5x + 12 + (10x - 5) &= 5x + 12 + 10x - 5 \\ &= 5x + 10x + 12 - 5 \\ &= 15x + 7 \end{aligned}$$

2. **(d)**

   $$\begin{aligned} 2x^2 - 4x - 7 - (x^2 - 6x - 3) &= 2x^2 - 4x - 7 + (-x^2 + 6x + 3) \\ &= 2x^2 - 4x - 7 - x^2 + 6x + 3 \\ &= 2x^2 - x^2 - 4x + 6x - 7 + 3 \\ &= x^2 + 2x - 4 \end{aligned}$$

3. **(a)**

$$\begin{aligned} x^2 - 3x + 5 + (-x^2 - 3x + 5) &= x^2 - 3x + 5 - x^2 - 3x + 5 \\ &= x^2 - x^2 - 3x - 3x + 5 + 5 \\ &= -6x + 10 \end{aligned}$$

4. **(b)**

$$\begin{aligned} 2(x - 3y - 5) + x + 6y &= 2x - 6y - 10 + x + 6y \\ &= 2x + x - 6y + 6y - 10 \\ &= 3x - 10 \end{aligned}$$

5. **(e)**

$$\begin{aligned} x^2 - 5x + 3 - (x^2 - 4x - 7) &= x^2 - 5x + 3 + (x^2 + 4x + 7) \\ &= x^2 - 5x + 3 + x^2 + 4x + 7 \\ &= x^2 + x^2 - 5x + 4x + 3 + 7 \\ &= 2x^2 - x + 10 \end{aligned}$$

Let's See What You Have Learned (page 10)

1. $f(x) = 3x + 5$

$g(x) = x^2 - 2$

$$\begin{aligned} f(x) + g(x) &= (3x + 5) + (x^2 - 2) \\ &= 3x + 5 + x^2 - 2 \\ &= x^2 + 3x + 5 - 2 \\ &= x^2 + 3x + 3 \end{aligned}$$

2. $g(x) = x^2 - 2$

$h(x) = x^2 - 9$

$$\begin{aligned} g(x) + h(x) &= (x^2 - 2) + (x^2 - 9) \\ &= x^2 - 2 + x^2 - 9 \\ &= x^2 + x^2 - 2 - 9 \\ &= 2x^2 - 11 \end{aligned}$$

3. $h(x) = x^2 - 9$

$r(x) = 7x - 10$

$$\begin{aligned} h(x) + r(x) &= (x^2 - 9) + (7x - 10) \\ &= x^2 - 9 + 7x - 10 \\ &= x^2 + 7x - 9 - 10 \\ &= x^2 + 7x - 19 \end{aligned}$$

4. $f(x) = 3x + 5$

$r(x) = 7x - 10$

$$
\begin{aligned}
f(x) - r(x) &= (3x + 5) - (7x - 10) \\
&= 3x + 5 + (-7x + 10) \\
&= 3x + 5 - 7x + 10 \\
&= 3x - 7x + 5 + 10 \\
&= -4x + 15
\end{aligned}
$$

5. $g(x) = x^2 - 2$

$h(x) = x^2 - 9$

$$
\begin{aligned}
g(x) - h(x) &= (x^2 - 2) - (x^2 - 9) \\
&= x^2 - 2 + (-x^2 + 9) \\
&= x^2 - 2 - x^2 + 9 \\
&= x^2 - x^2 - 2 + 9 \\
&= 7
\end{aligned}
$$

D. Lesson 3

Let's Try This (page 12)

1. **(b)**

$$
\begin{aligned}
(x + 4)(x - 2) &= x(x - 2) + 4(x - 2) \\
&= x^2 - 2x + 4x - 8 \\
&= x^2 + 2x - 8
\end{aligned}
$$

2. **(d)**

$$
\begin{aligned}
(x - 8)(x - 5) &= x(x - 5) - 8(x - 5) \\
&= x^2 - 5x + (-8x + 40) \\
&= x^2 - 5x - 8x + 40 \\
&= x^2 - 13x + 40
\end{aligned}
$$

3. **(a)**

$$
\begin{aligned}
(2x + 1)(x - 3) &= 2x(x - 3) + 1(x - 3) \\
&= 2x^2 - 6x + x - 3 \\
&= 2x^2 - 5x - 3
\end{aligned}
$$

4. **(c)**

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

5. **(e)**

$(4x^2 - 2x)2x = 8x^3 - 4x^2$

Let's See What You Have Learned (page 14)

1. a. $f(x) = x^2 + 4$

$g(x) = x$

$f(x)g(x) = (x^2 + 4)x$

$= x^3 + 4x$

b. $f(x) = x^2 + 4$

$g(x) = x$

$f(x) \div g(x) = (x^2 + 4) \div x$

$$= \frac{x^2 + 4}{x}$$

$$= \frac{x^2}{x} + \frac{4}{x}$$

$$= x + \frac{4}{x}$$

2. a. $r(x) = x^2 + 4x$

$s(x) = 2x$

$r(x)s(x) = (x^2 + 4x)\,2x$

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

b. $r(x) = x^2 + 4x$

$r(1) = 1^2 + 4(1)$

$= 1 + 4$

$= 5$

$s(x) = 2x$

$s(1) = 2(1)$

$= 2$

$r(1) \div s(1) = 5 \div 2$

$$= \frac{5}{2}$$

$$= 2\frac{1}{2}$$

E. **What Have You Learned?** *(pages 16–17)*

1. $f(x) = x^2 - 2x + 5$

   $f(1) = 1^2 - 2(1) + 5$

   $= 1 - 2 + 5$

   $= -1 + 5$

   $= 4$

2. $g(x) = -2x^2 - 5$

   $-2g(x) = -2(-2x^2 - 5)$

   $= 3x - 5 + 10x - 5$

   $= 4x^2 + 10$

3. $f(x) = 3x - 5$

   $g(x) = 10x - 5$

   $f(x) + g(x) = 3x - 5 + (10x - 5)$

   $= 3x - 5 + 10x - 5$

   $= 13x - 10$

4. $g(x) = x^2 - 5x - 2$

   $f(x) = 3x^2 - 2x + 7$

   $g(x) - f(x) = x^2 - 5x - 2 - (3x^2 - 2x + 7)$

   $= x - 5x - 2 + (-3x^2 + 2x - 7)$

   $= x - 5x - 2 - 3x^2 + 2x - 7$

   $= x^2 - 3x^2 - 5x + 2x - 2 - 7$

   $= -2x^2 - 3x - 9$

5. $f(x) = x^2 - 3x + 1$

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

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

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

   $2f(x) - g(x) = 2x^2 - 6x + 2 - (x^2 + 2x)$

   $= 2x^2 - 6x + 2 + (-x^2 - 2x)$

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

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

   $= x^2 - 8x + 2$

6. $f(x) = x - 2$

   $g(x) = x + 1$

   $f(x)g(x) = (x - 2)(x + 1)$

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

   $= x^2 + x - 2x - 2$

   $= x^2 - x - 2$

7. $f(x) = 4x^3 - 2x^2$

$g(x) = 2x$

$f(x) \div g(x) = (4x^3 - 2x^2) \div 2x$

$= \dfrac{4x^3 - 2x^2}{2x}$

$= \dfrac{4x^3}{2x} - \dfrac{2x^2}{2x}$

$= 2x^2 - x$

8. $g(x) = 7x$

$g(1) = 7(1)$

$= 7$

$f(x) = 2x + 5$

$f(2) = 2(2) + 5$

$= 4 + 5$

$= 9$

$g(1) - f(2) = 7 - 9$

$= -2$

9. $f(x) = 2x - 3$

$f(1) = 2(1) - 3$

$= 2 - 3$

$= -1$

$g(x) = 4x$

$g(2) = 4(2)$

$= 8$

$f(1)g(2) = -1(8)$

$= -8$

10. $f(x) = x^2 - 2$

$g(x) = x^2 - 8$

$g(2) = 2^2 - 8$

$= 2(2) - 8$

$= 4 - 8$

$= -4$

$f(x) + g(2) = x^2 - 2 + (-4)$

$= x^2 - 2 - 4$

$= x^2 - 6$

References

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Sia, Lucy O., et al. *21st Century Mathematics, Second Year.* Quezon City: Phoenix Publishing House, Inc., 2000.