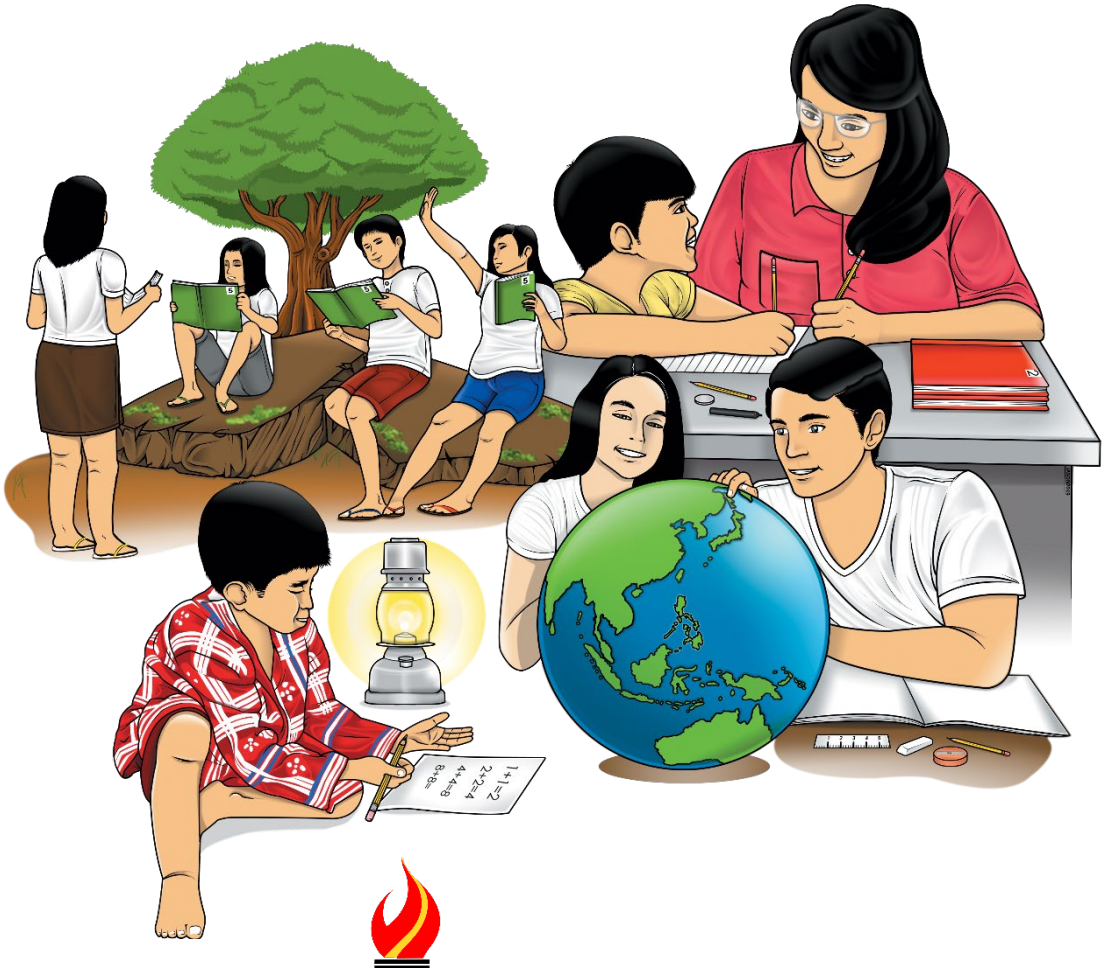
Senior High School

DepED
DEPARTMENT OF EDUCATION

General Mathematics

Quarter 1 – Module 8:
The Domain and Range of a Rational Functions



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Quarter 1 – Module 8:
The Domain and Range of a Rational Functions

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

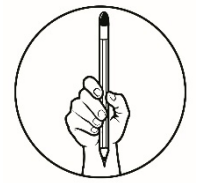
Thank you.

What I Need to Know

This module was designed and written with you in mind. It is here to help you master the domain and range of a rational function. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

After going through this module, you are expected to:

1. define domain and range; and
2. find the domain and range of a rational function.



What I Know

Read and analyze each item carefully. Write the letter that corresponds to your answer for each statement.

1. In the coordinate system, the x-axis is called _____.
   a. abscissa
   b. ordinate
   c. quadrant
   d. slope

2. In the coordinate system, the y-axis is called _____.
   a. abscissa
   b. ordinate
   c. quadrant
   d. slope

3. In the linear form y = 2x + 3, which is the independent variable?
   a. b
   b. m
   c. x
   d. y

4. In the linear form y = 3x - 4, which is the dependent variable?
   a. b
   b. m
   c. x
   d. y

5. In writing sets, the format {x ϵ R| x ≠ 2} is called a _____
   a. enumeration
   b. roster form
   c. set-builder notation
   d. interval notation

6. In a set of ordered pairs (1,2), (2,3), (3,4), (4,5), (5,6), the domain D = _____
   a. {1,2,3,4,5}
   b. {2,3,4,5,6}
   c. {6,5,4,3,2}
   d. {1,2,3,4,5,6}

7. In a set of ordered pairs (1,3), (2,5), (3,7), (4,9), (5,11), the range R = _____
   a. {1,2,3,4,5}
   b. {3,5,7,9,11}
   c. {5,4,3,2,1}
   d. {1,2,3,4,5,7,9,11}

8. Some values for the Domain of the rational function f(x) = $3x^2 - 5$ are 1, 2, 3, 4, and 5. Find the Range corresponding to each value. _____
   a. {-2,7,22,43,70}
   b. {-5,-2,7,22,43,70}
   c. {5,4,3,2,1}
   d. {1,2,3,4,5}

9. Some values for the Range of the rational function f(x) = $3x^2 - 5$ are 22, 70, and 295. Find the Domain corresponding to each value. _____
   a. {-5,-3,3,5,10}
   b. {-3,-5,-10}
   c. {3,5,10}
   d. {±3, ±5, ±10}

10. Find the domain and range of the linear function f(x) = $2x + 4$.D _____ R _____
   a. D {x ϵ R| x ≠ -4};R {y ϵ R| y ≠ 4}
   b. D {x|x ϵ R};R {y|y ϵ R}
   c. D {x ϵ R| x ≠ 0};R {y ϵ R| y ≠ 0}
   d. D {x|x ϵ N};R {y|y ϵ N}

11. Find the domain and range of the quadratic function f (x) = $x^2 + 3x + 4$. D _____ R _____
   a. D {x ϵ R| x ≠ 4};R {y ϵ R| y ≠ -4}
   b. D {x|x ϵ N};R {y|y ϵ N}
   c. D {x ϵ R| x ≠ -3};R {y ϵ R| y ≠ 3}
   d. D {x|x ϵ R};R {y|y ϵ R}

12. Find the domain and range of the rational function f(x) = $\frac{22+x}{25+x}$ D _____R _____

a. D(-∞, -22) U (-22, ∞);R(-∞, 1) U (1, ∞).
b. D(-∞, -25) U (-25, ∞);R(-∞, -25) U (-25, ∞).
c. D(-∞, -25) U (-25, ∞);R(-∞, 1) U (1, ∞).
d. D(-∞, -22) U (-25, ∞);R(-∞, -25) U (-22, ∞).

13. Find the domain and range of the rational function f(x) = $\frac{x^2-x-6}{x+2}$ D_____R _____

a. D(-∞, -2) U (-2, ∞);R (-∞, -2) U (-2, ∞).
b. D(-∞, -2) U (-2, ∞);R (-∞, -3) U (-3, ∞).
c. D(-∞, -2) U (-2, ∞);R (-∞, 3) U (3, ∞).
d. D(-∞, -2) U (-2, ∞);R (-∞, -5) U (-5, ∞).

14. Find the domain of the rational function f(x) = $\frac{3x^2-8x-3}{2x^2+7x-4}$ D _____

a. D(-∞, -4) U (-4, 2) U (2, ∞).
b. D(-∞, -4) U (-4, 1/2) U (1/2, ∞).
c. D(-∞, -1/2) U (-1/2, 4) U (4, ∞).
d. D(-∞, -4) U (-4, ∞)

15. A cellphone provider offers a new phone for ₱7,000.00 plus ₱1,299.00 monthly plan. What would be the average cost after 12 months?

a. ₱1,799.00
b. ₱1,882.00
c. ₱7,799.00
d. ₱8,299.00

Lesson 1 The Domain and Range of a Rational Functions

Introduction

To be able to understand the domain and range of a rational function, let us see the real-life application of a rational function in this situation:

Average Grade Problem

Let's say you are taking an exam in your General Mathematics subject. You knew that you already have 22 correct answers out of 25 questions. Twenty-two out of 25 questions had already an 88% rating. Now you told yourself, "I must have a final grade of 90%." The question is how many more correct answers to additional questions do you need, to get your desired final grade of 90? How about if you desire a grade of 89 or 95?

In this module, you will know the answer to that real-life problem. But first, you will have to learn the definition of the domain and range of a rational function. Subsequently, along your study, you will learn how to find the domain and range and apply your knowledge of it in solving real-life problems involving a rational function.

What's In

In your previous lesson, you learned how to represent rational functions in the form of table of values, graphs, and equations.

As a review, ready yourself in doing this first drill.

Let us have an equation y = 3x + 2. When x = 6, you know that y = 20. Now, find the value of y on the following equations when x = -4.

a) $2y = 4x - 6$

b) $y = \frac{7x+4}{3x}$

c) $y = \frac{x^2+x-4}{x+4}$

Notes to the Teacher

This contains helpful tips or strategies that will help you in guiding the learners.

What's New

Now imagine that you are ninety-six kilometers (96 km.) away from Manila. You are planning to visit your grandmother who will be celebrating her birthday. Your father has allowed you to drive his car so that you will arrive at the party on time. Assuming there will be no traffic during that day, you have resolved to arrive at the party from 1 to 2 hours. So, at what speed are you going to travel to arrive in a certain period of time?

For your Activity 1, construct a table of values that would represent the given problem. Subsequently, plot the values obtained on a Cartesian plane. You may use paper and pencil or any applicable graphing apps such as MS Excel, GeoGebra, or Desmos. You may use the table below as your reference.

Table 1

t in hours	1	1.25	1.5	1.75	2
r (rate in km/hr)					

Questions to ponder:

1. How are you going to represent the problem through a function?

_____

2. What is/are the given in the problem? What are you going to solve?

_____

3. How can you describe the relationship between the rate r and the time t in the problem? Which do you think is the variable that depends on the value of another variable?

_____

4. What can you say about the graph? Can the values in t increase infinitely?

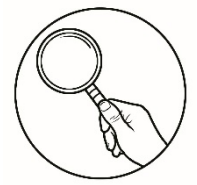
_____

5. What do you think would be the value of r when t is equal to zero?

_____

From the foregoing activity, you have constructed a function of your speed against your time, and represent a function with a table of values, a graph, and equation.

Congratulation!



What is It

Now, observe that there is a set of values that can be found in x (t, as used in the preceding problem) that corresponds to a unique value in f(x) or in the latter case r(t). In the graph, it can be seen that these x-values represent the points plotted along the x-axis called *abscissa*. On the other hand, those values in the y-axis are called *ordinates*. In a set of ordered pairs (1,6), (2,7), (3,8), (4,9), and (5,10), the points (1,2,3,4,5) are the abscissa since they are on the x-axis while points (6,7,8,9,10) are the ordinates since they are on the y-axis.

Corollary, the x-values are considered the *independent variable (input)* while the y-values are considered the *dependent variables (output)* in forms such as the linear form $y=mx + b$. This can be extended to quadratic, polynomial, and rational functions. In functions, the symbol $f(x)$ is used instead of y. So, $y = f(x)$ and can be read as "y equals f of x".

In our study of rational function these x-values represent the domain and the y-values represent the range of a rational function. In definition, the **domain** of a function is the set of all values that the variable x can take while the **range** of a function is the set of all values that y or $f(x)$ can take. But how do we determine and write the domain and range of a rational function?

If you can recall, we can write the domain and range using different forms:

1. by *roster* format - this method enumerates the lists of all values in the set. Ex. The domain of r(t) are (1, 1.25, 1.5, 1.75, 2).

2. by *set-builder* form or notation - for example, in numbers 10 to 20. you can say {x | x are even numbers from 10 to 20). The | is read as "such that." Assuming that you also include odd numbers in the domain from 10 to 20, then, you can write the domain of the function D(x) as {x | x ϵ R, 10≤x≤20}, read as "x such that x is an element of a real number wherein x is greater than or equal to 10 but less than or equal to 20."

3. by *interval notation* – for example, in a function f*(x)* = $\frac{5}{x-3}$, the domain of this function can be written in the form, (-∞, 3) U (3, ∞). This means that the values of the domain can take all real values of x except 3, otherwise the function is undefined.

In the succeeding activities, you will learn how to find the domain and the range using different methods. But first let us have another activity that will facilitate the understanding of these methods.

Activity 2 – Mobile Plan

Glolibee Telecom would like to offer you the newest smartphone which has 50x zoom in its camera. It is the latest top-of-the-line product. In order to avail this, you only have to pay ₱12,000.00 down-payment while the rest may be paid ₱1,799.00 monthly for 24 months. So that would cost you ₱12,000.00 + ₱1,799.00(x) in 24 months. Think about it and answer the following questions.

Questions

1. If you are just a student would you ask your parents to buy you this top-of-the-line smartphone? Why or why not?

2. How much would be the total cost of buying this type of smartphone in 24-monthly installment?

4. How much do you think would be the average cost after you have already paid for 12 months? When will be the average monthly cost be less than ₱2,500.00?

Considering the foregoing questions, the answers to questions 2 and 3 above may be mathematically explained using the domain and range of a rational function. While your answer for question number 1, other than having your own personal conviction, may depend on your answers on questions 2 and 3. Why is that so?

First, let us find out the total cost f*(x)* of the new smartphone. This can be expressed in the linear function:

$$f(x) = 12000 + 1799(x),$$

where x is the independent variable (month) while the 12000 is the constant (down-payment). The f(x)=y is the dependent variable which in this case, it is the total cost. Assuming that we have to pay the smartphone in 24 months then, the total cost would be,

$$f(x) = 12000 + 1799(24)$$
$$=55176$$

So, you have to pay ₱55,176.00 in 2 years (24 months). This should be your answer in question number 2. Wow, that is a lot of money!
Now to find the average cost, we have to divide the total cost by the number of months you have used the phone service. Thus, we now have a rational function in the form:

$$f(x) = \frac{12000 + 1799(x)}{x}$$

Using a table of values, we can see the average cost in 12 months:

Table 2

Fixed amount	**Monthly Payment**	**Month (x)**	**Average Cost (y)**
₱12,000.00	₱1,799.00	1	₱13,799.00
₱12,000.00	₱1,799.00	2	₱7,799.00
₱12,000.00	₱1,799.00	3	₱5,799.00
₱12,000.00	₱1,799.00	4	₱4,799.00
₱12,000.00	₱1,799.00	5	₱4,199.00
₱12,000.00	₱1,799.00	6	₱3,799.00
₱12,000.00	₱1,799.00	7	₱3,513.00
₱12,000.00	₱1,799.00	8	₱3,299.00
₱12,000.00	₱1,799.00	9	₱3,132.00
₱12,000.00	₱1,799.00	10	₱2,999.00
₱12,000.00	₱1,799.00	11	₱2,890.00
₱12,000.00	₱1,799.00	12	₱2,799.00

In table 2, the x-values (month) is the domain of the function while the y-values (average cost) is the range of the function. The table shows that after 12 months your average cost is ₱2,799.00. But take note you still have 12 more months to pay. And when will be the average monthly cost be less than ₱2,500.00? To answer this question, we will predict situations from this rational function using the inequality:
$2500 > \frac{12000 + 1799(x)}{x}$

$$(2500)\ (x) > 12000 + 1799x$$

$$2500x - 1799x > 120000$$

$$701x > 12000$$

$$x > 17.12 \approx 17 \text{ month}$$

Therefore, starting on the 17th month you will be paying an average cost of less than ₱2,500.00. This real-life situation has shown you the applicability of the domain-range of a rational function which you may apply in your daily life.

This discussion has illustrated how to determine the domain and range of rational function by table of values and by listing elements in the domain and range using what we call the roster method. We also substitute the values in the domain to find the corresponding values in the range. Another method, the set-builder and interval notation may be shown in the following examples:

Example 1:

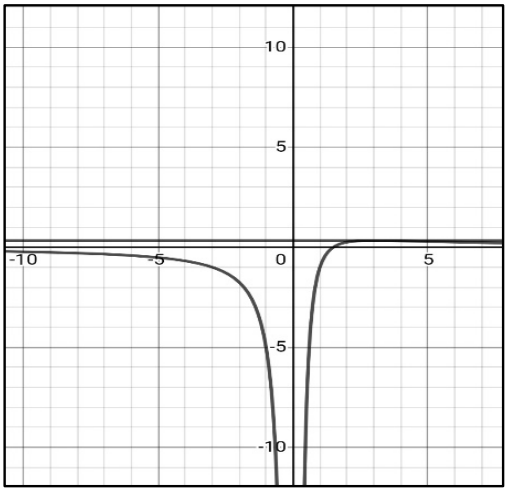
Find the domain and range of the rational function

$$f(x) = \frac{2x-3}{x^2}$$

first, we equate the denominator $x^2 = 0$, therefore $x = 0$

Domain: $\{x \mid x \in R, x \neq 0\}$ or simply $\{x \in R \mid x \neq 0\}$, that is all values can take the variable x except 0 because when the denominator becomes 0, f(x) will be undefined (undef).

To find the range, we use f(x) = y so that,



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

$$yx^2 = 2x - 3$$

$$yx^2 - 2x + 3 = 0 \quad (ax^2 + bx + c)$$

use $b^2 - 4ac \geq 0$ to get real solutions

let a = y, b = -2, c = 3

Therefore, $(-2)^2 - 4(y)(3) \geq 0$

$$4 - 12y \geq 0$$

$$4 \geq 12y$$

$$1/3 \geq y$$

In summary, D(x) = {x ϵ R | x ≠ 0} and the Range is {y ϵ R | y ≤ 1/3}.

Example 2:

Find the domain and range of the rational function

$$f(x) = \frac{x-2}{x+2}$$

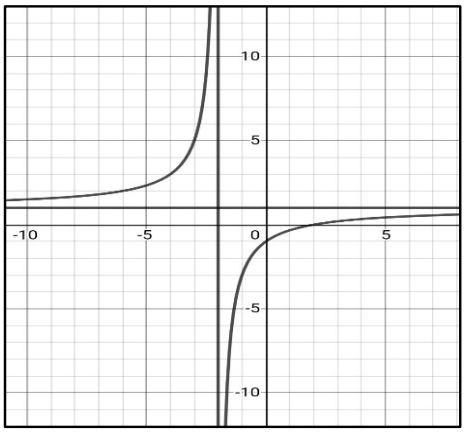
first, we equate the denominator x + 2 = 0, therefore x = -2

Domain: {x | x ϵ R, x ≠ -2}, that is all values can take the variable x except -2 because the denominator becomes 0 and f(x) will be undefined. The interval notation can also be written as D (-∞, -2) U (-2, ∞).

To find the range, we use f(x) = y so that,

$$y = \frac{x-2}{x+2}$$

in solving this, you just multiply y and the denominator x + 2 so that it becomes,



$$xy + 2y = x - 2$$

$$xy - x = -2y - 2$$

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

$$x = \frac{-2(y+1)}{y-1}$$

Equate y – 1 = 0

y = 1

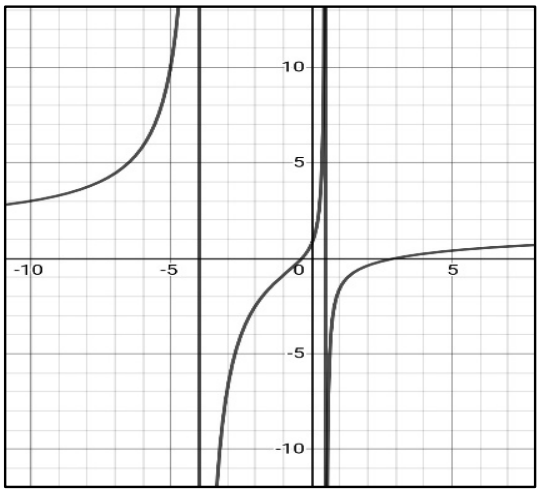
therefore, y ≠ 1, otherwise the denominator is zero.

Range: {y | y ϵ R, y ≠ 1}, that is all values can take the variable y except 1 because the denominator becomes 0 and x will be undefined.

Example 3:

Find the domain of the rational function

$$f(x) = \frac{3x^2-8x-3}{2x^2+7x-4}$$



first, we equate the denominator $2x^2 + 7x - 4 = 0$,

by factoring we have, $(2x - 1)(x + 4) = 0$

therefore $x = ½, x = -4$

Domain: {x ϵ R | x ≠ -4, 1/2}, that is all values can take the variable x except -4 and 1/2 because the denominator becomes 0 and f(x) will be undefined. The interval notation can also be written as D(-∞, -4) U (-4, ½) U (1/2, ∞).

Example 4:

Find the domain and range of the rational function

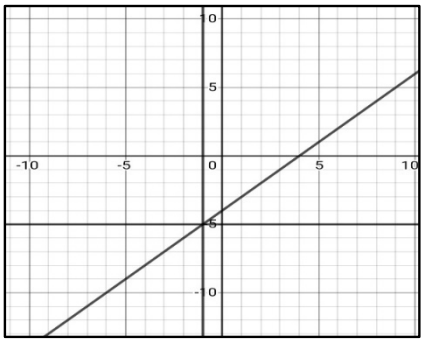
$$f(x) = \frac{x^2-3x-4}{x+1}$$

first, we equate the denominator $x + 1 = 0$,

therefore $x = -1$

Domain: {x ϵ R | x ≠ -1}, that is all values can take the variable x except -1 because the denominator becomes 0 and f(x) will be undefined. The interval notation can also be written as D (-∞, -1) U (-1, ∞).

To find the range, we can factor first the numerator.



$$f(x) = \frac{(x+1)(x-4)}{x+1}$$

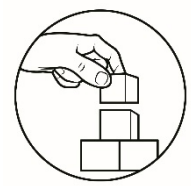
You can cancel both (x + 1) of the numerator and denominator so that what remain is f(x) = (x – 4). Then we substitute x = -1 to find y.

y = x – 4

y = -1 – 4

y = -5

Therefore, the Range: {y ϵ R | y ≠ -5}. In interval notation, (-∞, -5) U (-5, ∞).



What's More

Enrichment Activity 1

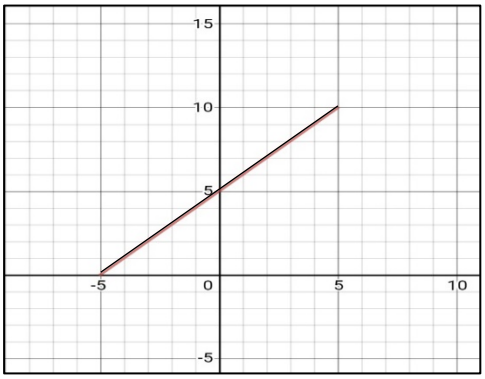
Find the x-values or the domain of the following:

1. H = {(1,2), (2,3), (3,4), (4,5), (5,6)} D(H) _____
2. B = {(Rizal, 1861), (Bonifacio, 1863), (Mabini, 1864), (Luna. A., 1866), (Del Pilar, G., 1875)} D(B) _____
3. If the ordinates of A are {Quezon, Cavite, Rizal, Batangas, Laguna} and its abscissa are each provinces' corresponding Capitals, what would be the domain of (A)?

   _____
4. The table shows: f(x) = 2x + 4. Solve for x.

x					
y	6	8	10	12	14

5. The graph shows:



y = {0, 3, 4, 7, 9}

x = {__, __, __, __, __}

That's it. Good job!

Enrichment Activity 2

Given the domain {-2, -1, 0, 1, 2}, determine the range for each expression. Use a table of values.

1. y = 3x + 2
2. x + y = 8
3. y = 5x – 1
4. y = $3x^2$
5. y = $\frac{2x-1}{2}$
6. x – 2y = 6
7. y = $\frac{(x^2 - 1)}{x}$
8. x = y – 3
9. y = x^2 – 4x - 3
10. y = (x – 1(x +1)

Great job!

Independent Practice

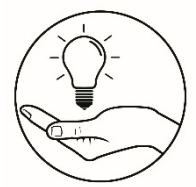
Find the domain and range of the following rational function. Use any notation.

1. f*(x)* = $\frac{2}{x+1}$
2. f*(x)* = $\frac{3x}{x+3}$
3. f*(x)* = $\frac{3-x}{x-7}$
4. f(x) = $\frac{2+x}{x}$
5. f*(x)* = $\frac{(x+1)}{x^2-1}$

Independent Assessment

Find the domain and range of the following rational function. Use any notation.

1. f*(x)* = $\frac{3}{x-1}$
2. f*(x)* = $\frac{2x}{x-4}$
3. f*(x)* = $\frac{x+3}{5x-5}$
4. f*(x)* = $\frac{2+x}{2x}$
5. f*(x)* = $\frac{(x2+4x+3)}{x^2-9}$

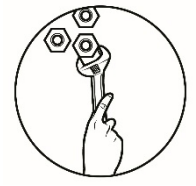


What I Have Learned

This module is about the domain and range of a rational function. It laid down the basic concepts of domain and range and showed how to determine them in a rational function. From this module, you learned that a function is a simple rule of correspondence between two variables x and y. The x variable is considered the input which is also called the independent variable while the y variable is the output which is also called the dependent variable. It is a basic notion that for every value of x there corresponds a value in y. This set of values in x is the domain while the set of values in y is the range of a rational function.

Now you try to summarize on your own by filling in the blanks:

To determine the domain and range in rational functions, _____ the denominator to _____ and solve for the variable x. The objective is that it must have _____ denominator. The value that would make it zero is the value that would not be in included in the domain. To find the range, solve the equation for x in terms of ____. Again, it must have non-zero denominator. The value that would make the _____ equal to zero is the value that would not be included in the range.



What I Can Do

Application

There are many ways of applying rational functions in our lives. Examples of these are: average cost, medical dosage, average grade problem, cost of living, and economic production of goods. An example of its application can be seen below.

Field of Application: Medical Dosage

Situation analysis: After a drug is injected into a patient's bloodstream, the concentration C of the drug in the bloodstream t hours after the injection is given by

$$C(t) = \frac{12t}{t^2+5}$$

Use the given formula to find the concentration of the drug after 1-4 hours.

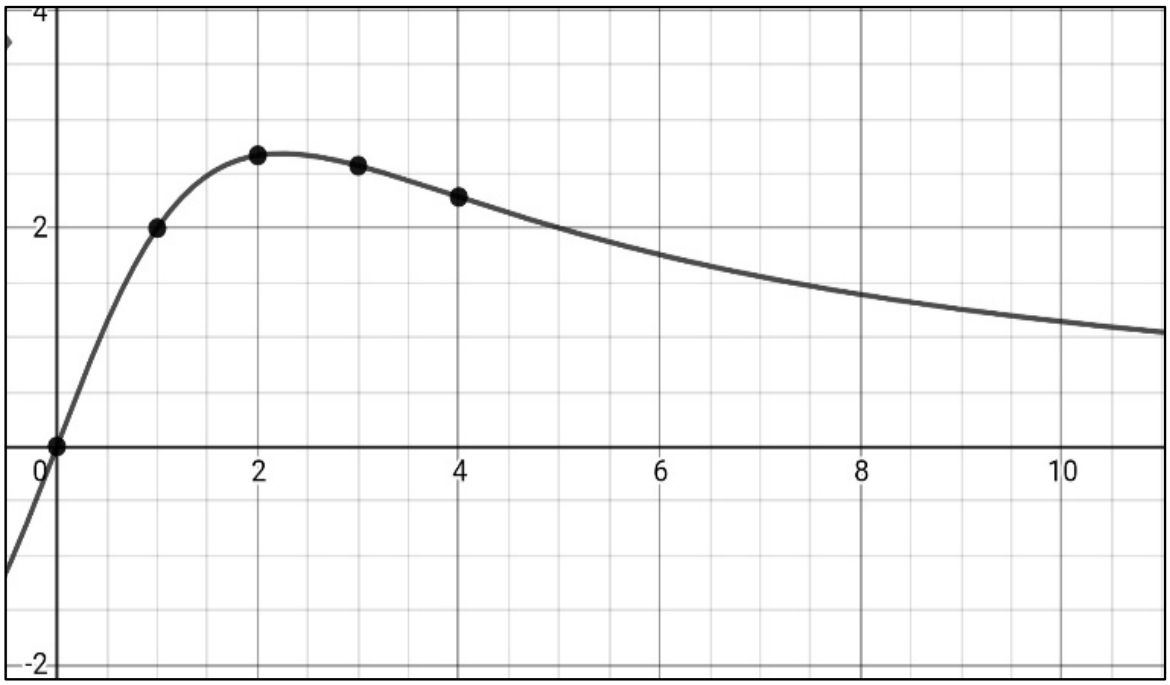
Data manipulation: when t=0, $C(0) = \frac{12(0)}{0^2+5} = 0$

Presentation: Using a table of values, we have:

Table 3

t	1	2	3	4
C(t)	2.00	2.67	2.57	2.29

This is the graph of the function:



Interpretation: The table and the graph show that the drug is most effective after 2 hours where it peaked at 2.67 mg/L. The Domain and Range of the given function are D{x ϵR| x ≥ 0} R{y ϵR| y ≥ 0}

Now, It's Your Turn

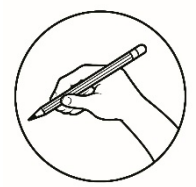
1. Create your own or similar real-life situation where rational function is applied.

2. In a bond paper, present the problem from *Field of application* up to *Presentation* as illustrated above.

3. You can use graphing paper, MS Excel, Desmos, or any graphing app to graph the function. You can also use calculators to solve the table of values.

4. Your grade will be according to the criteria below:

Clarity of Presentation	60%
Organization	30%
Applicability to current situation	10%
TOTAL	**100%**



Assessment

Read and analyze each item carefully. Write the letter that corresponds to your answer for each statement.

1. The abscissa of the point (-3, 5) is _____.
    a. 0
    b. -3
    c. 5
    d. 1

2. Point A is in Quadrant III. The ordinate in this point is _____.
    a. both – and +
    b. negative (-)
    c. positive (+)
    d. zero

3. The set of all possible input values (x) which produce a valid output (y) from function is called _____
    a. algebra
    b. binomial
    c. domain
    d. range

4. The Range in a rational function is also the _____ variable?
    a. constant
    b. dependent
    c. fixed
    d. independent

5. In writing the domain/range of a rational function, the format $(-\infty, 1) \cup (1, \infty)$ is called a/an _____
    a. enumeration
    b. roster form
    c. set-builder notation
    d. interval notation

6. In a set of ordered pairs (-5,-4), (-5,1), (-2,3), (2,1), (2,-4), the domain D =_____
    a. {-5,-2,2}
    b. {-4,1,3,1,-4}
    c. {-5,-5,-2,2,2}
    d. {1,2,3,4,5}

7. In a set of ordered pairs (-5,-4), (-5,1), (-2,3), (2,1), (2,-4), the range R = _____
   a. {-4,1,3}
   b. {-5,-5,-2,2,2}
   c. {-4,1,3,1,-4}
   d. {1,2,3,4,5}

8. Some values for the Domain of the rational function f(x) = $6x^2$ - 5 are -2, -1, 0, 1, and 2. Find the Range corresponding for each value. _____
   a. {91,19,-5,19,91}
   b. {-2,-1,0,1,2}
   c. {19,1,-5,1,19}
   d. {0,1,2,3,4}

9. Some values for the Range of the rational function f(x) = $\frac{3x^2-5}{x}$ are undefined, -2, and 10.75. Find the Domain corresponding to each value. _____
   a. {0,-1,-4}
   b. {1,2,3}
   c. {-2,-1,0}
   d. {0, 1, 4}

10. Find the domain and range of the function f(x) = $6x - 4$. D _____ R _____
   a. D {x ∈ R| x ≠ -4} R {y ∈ R| y ≠ 6}
   b. D {x|x ∈ R} R {y|y ∈ R}
   c. D {x ∈ R| x ≠ 0} R {y ∈ R| y ≠ 0}
   d. D {x|x ∈ N} R {y|y ∈ N}

11. Find the domain and range of the function f (x) = $x^2 - 8x + 15$. D _____ R _____
   a. D {x ∈ R| x ≠ 4} R {y ∈ R| y ≠ -4}
   b. D {x|x ∈ N} R {y|y ∈ N}
   c. D {x ∈ R| x ≠ -5} R {y ∈ R| y ≠ -3}
   d. D {x|x ∈ R} R {y|y ∈ R}

12. Find the domain and range of the rational function f(x) = $\frac{7+x}{x-5}$ D _____ R _____
   a. D(-∞, 5) U (5, ∞) R(-∞, 1) U (1, ∞)
   b. D(-∞, 7) U (7, ∞) R(-∞, -5) U (-5, ∞)
   c. D(-∞, 5) U (5, ∞) R(-∞, -1) U (-1, ∞)
   d. D(-∞, -7) U (-7, ∞) R(-∞, 5) U (5, ∞)

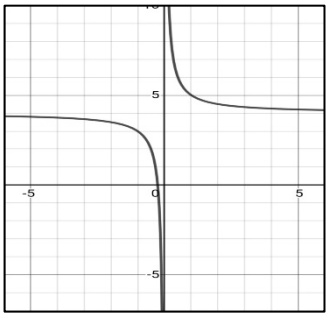
13. Find the domain and range of the rational function f(x) = $\frac{x^2-4x+4}{x-2}$ D _____ R _____

a. D(-∞, -1) U (-1, ∞) R(-∞, 4) U (4, ∞)

b. D(-∞, 5) U (5, ∞) R(-∞, -2) U (-2, ∞)

c. D(-∞, 2) U (2, ∞) R(-∞, 0) U (0, ∞)

d. D(-∞, 2) U (2, ∞) R(-∞, 2) U (2, ∞)



14. Find the domain and range of this graph.

a. D(-∞, 0) U (0, ∞) R(-∞, 4) U (4, ∞)

b. D(-∞, 0) U (0, ∞) R(-∞, 1) U (1, ∞)

c. D(-∞, 0) U (0, ∞) R(-∞, -1/4) U (-1/4, ∞)

d. D(-∞, 1/4) U (1/4, ∞) R(-∞, 4) U (4, ∞)

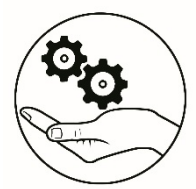
15. The concentration of a drug in the bloodstream can be modeled by the function C(t) = $\frac{30t}{t^2+9,}$ 0≤t≤5. Determine when the maximum amount of drug is in the body and the amount at that time.

a. in 2 hrs. with 5 mg/L

b. in 3 hrs. with 5 mg/L

c. in 3 hrs. with 6 mg/L

d. in 4 hrs. with 4.8 mg/L



Additional Activities

In doing this activity you may need MS Excel or a mobile app such as Desmos to sketch the graph.

In this module's introduction, you were asked about average grade problem. The rational function for that situation is:

$$f(x) = \frac{22+x}{25+x}$$

Construct a table of values and sketch the graph for this rational function. Find the domain and range.

Answer:

The table of values for this function:

Table 4

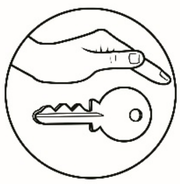
x	0	1	2	3	4	5
f(x)						

In answering the questions in this module's introduction, how many correct answers do you need to have a 90% rating, what would be your answer? _____

How about to have an 89% rating? _____ 95%? _____

From this table of values, what do you think would be its domain and range? _____

Sketch the graph of this rational function in the space below.



Answer Key

Pre-Assessment: 1. A, 2. B, 3. C, 4. D, 5. C, 6. A, 7. B, 8. A, 9. D, 10. B, 11. D, 12. C, 13. D, 14. B, 15. B
Assessment: 1. A, 2. B, 3. C, 4. B, 5. D, 6. A, 7. A, 8. C, 9. D, 10. B, 11. D, 12. A, 13. C, 14. A, 15. B

Independent Assessment

1. D = {x ϵ R | x ≠ 1} or (-∞, 1) U (1, ∞)

   R = {y ϵ R | y ≠ 0} or (-∞, 0) U (0, ∞)

2. D = {x ϵ R | x ≠ 4} or (-∞, 4) U (4, ∞)

   R = {y ϵ R | y ≠ 2} or (-∞, 2) U (2, ∞)

3. D = {x ϵ R | x ≠ 1} or (-∞, 1) U (1, ∞)

   R = {y ϵ R | y ≠ 1/5} or (-∞, 1/5) U (1/5, ∞)

4. D = {x ϵ R | x ≠ 0} or (-∞, 0) U (0, ∞)

   R = {y ϵ R | y ≠ 0} or (-∞, 0) U (0, ∞)

5. D = {x ϵ R | x ≠ -3, 3} or (-∞, -3) U (-3, 3) U (3, ∞)

R = {y ϵ R | y ≠ 1} or (-∞, 1) U (1, ∞)

Independent Practice

1. D = {x ϵ R | x ≠ -1} or (-∞, -1) U (-1, ∞)

   R = {y ϵ R | y ≠ 0} or (-∞, 0) U (0, ∞)

2. D = {x ϵ R | x ≠ -3} or (-∞, -3) U (-3, ∞)

   R = {y ϵ R | y ≠ 3} or (-∞, 3) U (3, ∞)

3. D = {x ϵ R | x ≠ 7} or (-∞, 7) U (7, ∞)

   R = {y ϵ R | y ≠ 1} or (-∞, 1) U (1, ∞)

4. D = {x ϵ R | x ≠ 0} or (-∞, 0) U (0, ∞)

   R = {y ϵ R | y ≠ 1} or (-∞, 1) U (1, ∞)

5. D = {x ϵ R | x ≠ 1} or (-∞, 1) U (1, ∞)

   R = {y ϵ R | y ≠ 0} or (-∞, 0) U (0, ∞)

Enrichment Activity 2

No.	**Domain** *Range*	**-2**	**-1**	**0**	**1**	**2**
#1	*y*	-4	-1	2	5	8
#2	*y*	10	9	8	7	6
#3	*y*	-11	-6	-1	4	9
#4	*y*	12	3	0	3	12
#5	*y*	-2.5	-1.5	-0.5	0.5	1.5
#6	*y*	-4	-3.5	-3	-2.5	-2
#7	*y*	-1.5	0	undef	0	1.5
#8	*y*	-5	-4	-3	-2	-1
#9	*y*	9	2	-3	-6	-7
#10	*y*	3	0	-1	0	3

Enrichment Activity 1

1. D(H) = {1, 2, 3, 4, 5}

2. D(B) = {Rizal, Bonifacio, Mabini, Luna, A. Del Pilar, G.}

3. D(A) = {Lucena City, Imus City, Antipolo City, Batangas City, Santa Cruz}

4. f(x) = 2x + 4

x	1	2	3	4	5
y	6	8	10	12	14

5.

x	-5	-2	-1	2	4
y	0	3	4	7	9

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