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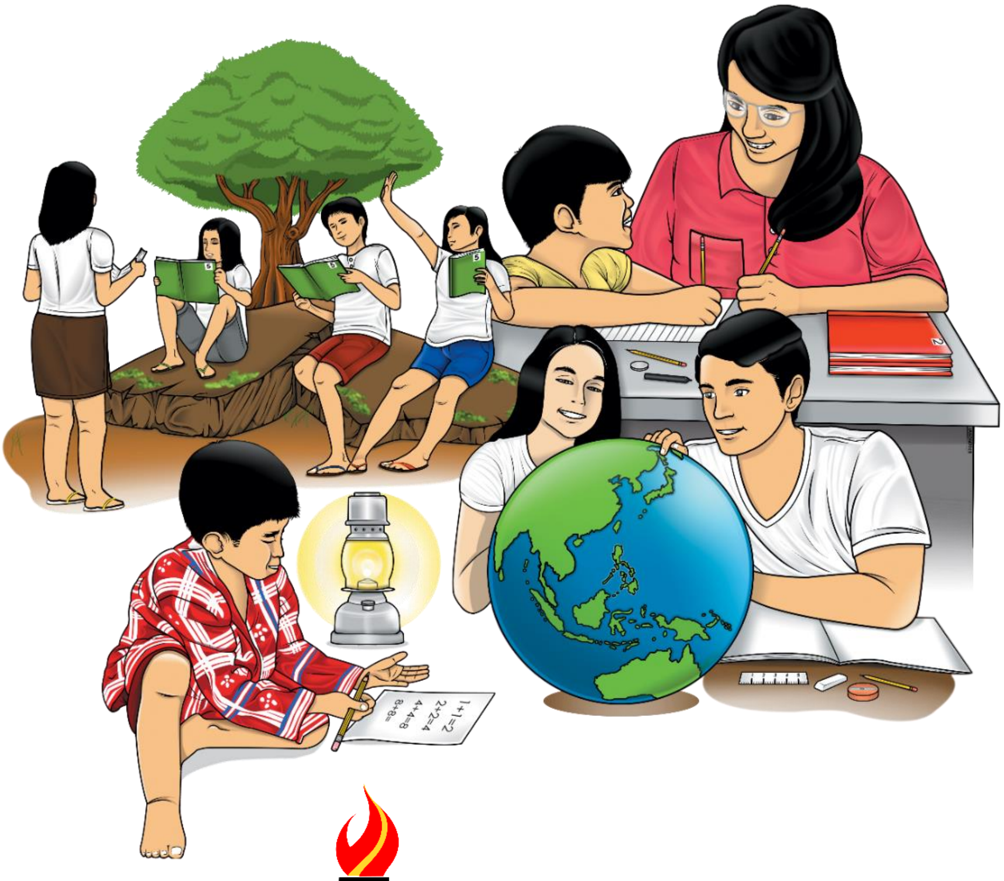
DEPARTMENT OF EDUCATION

# Mathematics

## Quarter 1 – Module 5C
## Solving Problems Involving Rational Algebraic Expressions




ALTERNATIVE DELIVERY MODE
ADM

**Mathematics – Grade 8**
**Alternative Delivery Mode**
**Quarter 1 – Module 5 Solving Problems Involving Rational Algebraic Expressions**
**First Edition, 2020**



Published by the Department of Education
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Undersecretary: Diosdado M. San Antonio

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**Printed in the Philippines by** ________________________

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# 8

# Mathematics

## Quarter 1 – Module 5C
## Solving Problems Involving Rational Algebraic Expressions

DEPARTMENT OF EDUCATION

# Introductory Message

For the facilitator:

Welcome to the Mathematics 8 Alternative Delivery Mode (ADM) Module on Solving Problems Involving Rational Algebraic Expressions!

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

As a facilitator, you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the Mathematics 8 Alternative Delivery Mode (ADM) Module on Solving Problems Involving Rational Algebraic Expressions!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:

| | |
|---|---|
| ***What I Need to Know*** | This will give you an idea of the skills or competencies you are expected to learn in the module. |
| ***What I Know*** | This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correct (100%), you may decide to skip this module. |
| ***What's In*** | This is a brief drill or review to help you link the current lesson with the previous one. |
| ***What's New*** | In this portion, the new lesson will be introduced to you in various ways; a story, a song, a poem, a problem opener, an activity or a situation. |
| ***What is It*** | This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills. |
| ***What's More*** | This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module. |
| ***What I Have Learned*** | This includes questions or blank sentence/paragraph to be filled in to process what you learned from the lesson. |
| ***What I Can Do*** | This section provides an activity which will help you transfer your new knowledge or skill into real life situations or concerns. |
| ***Assessment*** | This is a task which aims to evaluate your level of mastery in achieving the learning competency. |
| ***Additional Activities*** | In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned. |
| ***Answer Key*** | This contains answers to all activities in the module. |

At the end of this module you will also find:

| | |
|---|---|
| ***References*** | This is a list of all sources used in developing this module. |

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!

# *What I Need to Know*

This module was designed and written with you in mind. It is here to help you master the skills of solving problems involving rational algebraic expressions. You are provided with varied activities to process the knowledge and skills learned and to deepen and transfer your understanding of the lesson. The scope of this module enables you to use it in many different learning situations. 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.

This module contains:

Lesson 1- Solving Problems Involving Rational Algebraic Expressions

After going through this module, you are expected to solve problems involving rational algebraic expressions.

## What I Know

Choose the letter of the correct answer. Write the chosen letter on a separate sheet of paper. Exclude values of the variable/s that will make the denominator/s zero.

1. What is the correct rational expression of the phrase "the quotient of $2x$ and $3y$?

   A. $\frac{3y}{2x}$ C. $(2x)(3y)$

   B. $\frac{2x}{3y}$ D. $(2x-3y)$

2. Which of the following is the correct rational expression of "the fraction whose denominator is $6$ more than the numerator $z$"?

   A. $\frac{z}{z+6}$ C. $\frac{z+6}{z}$

   B. $\frac{z}{6}$ D. $\frac{1}{z}+6$

3. Write the verbal phrase into rational algebraic expression: "the average speed in $x^2+7$ kilometers traveled in $x-2$ hours.

   A. $(x^2+7)(x-2)$ C. $\frac{x^2+7}{x-2}$

   B. $\frac{x-2}{x^2+7}$ D. $\left(\frac{1}{x^2+7}\right)(x-2)$

4. There are two numbers whose sum is 48. One number is one-third of the other. What are the two numbers?

   A. 10 and 38 C. 14 and 34

   B. 12 and 36 D. 20 and 28

For items 5 & 6: Think of a number. Double a number. Subtract 6 from the result and divide the answer by 2. the quotient will be 20.

5. What is the correct rational equation to represent the problem?

   A. $2x-\frac{6}{2}=20$ C. $\frac{2x-6}{2}=20$

   B. $\frac{2x}{2}=\frac{x-6}{20}$ D. $\frac{1}{2}x=\frac{2x-6}{20}$

6. What is the number?

   A. 15 C. 20

   B. 18 D. 23

For items 7 & 8: Dianne and Agnes are siblings. Dianne can complete her household chores in $x$ hours while Agnes can do the same chores in 4 hours.

7. What part of the job can be completed by Dianne after 5 hours?

   A. $x+5$

   B. $x-5$

   C. $\frac{x}{5}$

   D. $\frac{5}{x}$

8. Which expression below represents the rate of Dianne and Agnes working together?

   A. $4+x$

   B. $x-4$

   C. $\frac{1}{4}-\frac{1}{x}$

   D. $\frac{1}{4}+\frac{1}{x}$

For items 9-12: Joe and John are planning to paint a house together. John thinks that if he worked alone, it would take him 3 times as long as it would take Joe to paint the entire house. Working together, they can complete the job in 24 hours.

9. What is the time it takes for John to complete the job?

   A. $x$

   B. $3x$

   C. $\frac{1}{x}$

   D. $\frac{1}{3x}$

10. What is the work rate of Joe?

    A. $3x$

    B. $\frac{1}{3x}$

    C. $\frac{1}{x}$

    D. $\frac{1}{x}+\frac{1}{3x}$

11. What is the correct rational algebraic equation that can represent both Joe and John working together?

    A. $\frac{1}{x}+\frac{1}{24}=\frac{1}{3x}$

    B. $\frac{1}{3x}-\frac{1}{x}=\frac{1}{24}$

    C. $\frac{1}{x}+\frac{1}{3x}=\frac{x}{24}$

    D. $\frac{1}{x}+\frac{1}{3x}=\frac{1}{24}$

12. How long would it take Joe to complete the job alone?

    A. $32$ hours

    B. $96$ hours

    C. $72$ hours

    D. $24$ hours

13. Three years ago, Aiko's age is one-half of the age she will be in 6 years. How old is she now?

    A. $12$ years old

    B. $15$ years old

    C. $18$ years old

    D. $21$ years old

14. If the same number is added to both numerator and denominator of the fraction $\frac{7}{9}$, the result is $\frac{8}{9}$. What is the number?

   A. 1
   B. 2
   C. 8
   D. 9

15. It took six hours for Danny to clean the attic while Piolo took twelve hours to do the same job. If Danny and Piolo worked together, how long had it took them to complete the job?

   A. 6
   B. 11
   C. 3
   D. 4

# Lesson 1 Solving Problems Involving Rational Algebraic Expressions

## What's In

### Verbal Phrases and Algebraic Expressions

In translating a verbal phrase to an algebraic expression, assign a variable to an unknown quantity. Then, write an expression for any other unknown quantities involved in terms of that variable.

Examples:

A. Translate each verbal phrase into an algebraic expression

1. 10 added to twice a number n - $10+2n$
2. A number x decreased by 3 - $x-3$
3. Twice a number z divided by 4 - $\frac{2z}{4}$

B. Formulas are equations that state relationships between quantities. These formulas can be translated into verbal sentences.

1. $P = 2l + 2w$ → The perimeter of a rectangle is the sum of twice its length *l* and twice its width *w.*
2. $d = rt$ → The distance travelled by a moving body is the product of its rate *r* and the time *t* elapsed.

**Try this out**

A. Match the verbal phrase in column A with the corresponding algebraic expression in column B. Write only the letter only.

| A | B |
|---|---|
| 1. A number *x* subtracted from 5 | a. $\frac{n}{6}$ |
| 2. Twice the product of 4 and *y* | b. $5x$ |
| 3. A number n divided by 6 | c. $5-x$ |
| 4. Five times the number *x* | d. $x-5$ |
| 5. A number *x* increased by 7 | e. $2(4y)$ |
| | f. $x+7$ |

B. Translate each formula into a verbal statement.

1. $P = 4s$
2. $A = s^2$
3. $A = \frac{1}{2}bh$

Questions:

1. Were you able to correctly identify the correct algebraic expressions in A?
2. Were you able to correctly translate each formula in B into its equivalent verbal statement?
3. Did you have any difficulty in performing the activity? If so, what did you do to overcome this difficulty?
4. Find s in formula $P = 4s$.
5. Find s in formula $A = s^2$.
6. Find $h$ in the formula $A = \frac{1}{2}bh$.

# *What's New*

**Will the Pool Be Full?**

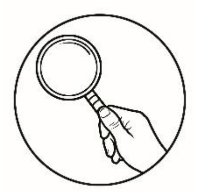
Read the situation below and answer the questions that follow.

Suppose you are tasked to organize a pool party for your bestfriend's birthday. Your other friends suggested that it has to be held in the lone inland resort in the city. You decided not to book the event in advance and planned to just come to the resort early to arrange for the pool party on that same day. However, when you came to the resort, you had been informed that the pool was drained and is scheduled to be refilled within the day. One pipe can fill the empty pool in 12 hours and another can fill the empty pool in 18 hours. Suppose both pipes are opened at 8:00A.M. and you have scheduled the pool party for your bestfriend's birthday at 2:00 P.M. on the same day.

Questions:

1. Will the pool be filled by 2:00 P.M.? Elaborate your answer.
2. At what exact time will the pool be completely filled?
3. Would the situation be different if you have booked for the event ahead of time?
4. What do you think should be the best decision to make?
   A. Cancel the event.
   B. Move the schedule at a later time within the day.
   C. Move the schedule at an earlier time within the day.

D. Wait for the pool to be completely filled before inviting your friends to come over.



# *What is It*

The situation presented in the previous section is one of the applications of the concepts on rational algebraic expressions.

To determine the number of hours it will take for both pipes to fill the pool given that one of the pipes can fill the pool in 12 hours while the other in 18 hours, we need to do the following steps:

Step 1. Read and understand the problem. Identify what is the given and what is being unknown. Choose a variable to represent the unknown number.

Let $x$ = the number of hours it will take to fill the pool if both pipes are used

Step 2. Express the other unknowns, if there are any, in terms of the variable chosen in step 1.

Let $\frac{1}{x}$ what both pipes can do together to fill the pool

Step 3. Write an equation to represent the relationship among the given and the unknown/s.

| *What the first pipe can do to fill the pool* | plus | *What the second pipe can do to fill the pool* | equals | *what both pipes can do together to fill the pool* |
|---|---|---|---|---|
| ↓ | | ↓ | | ↓ |
| $\frac{1}{12}$ | $+$ | $\frac{1}{18}$ | $=$ | $\frac{1}{x}$ |

Step 4. Solve the equation for the unknown and use the solution to find the quantities being asked.

$$\frac{1}{12}+\frac{1}{18} = \frac{1}{x}$$ *Equation to represent the situation*

$$36x\left(\frac{1}{12}+\frac{1}{18}\right) = 36x\left(\frac{1}{x}\right)$$ *Multiply both sides by the LCD 36x, to clear the fractions*

$$36x\left(\frac{1}{12}\right)+36x\left(\frac{1}{18}\right) = 36x\left(\frac{1}{x}\right)$$ *Distribute*

$$
\begin{aligned}
3x + 2x &= 36 && \textit{Simplify} \\
5x &= 36 && \textit{Combine similar terms} \\
\frac{5x}{5} &= \frac{36}{5} && \textit{Divide both sides by 5} \\
x &= 7\frac{1}{5} \text{ or } 7.2
\end{aligned}
$$

Hence, it will take 7.2 hours or 7 hours and 12 minutes to fill the pool.

Step 5. Check.

In 7.2 hours or 7 hours and 12 minutes, the first pipe fills $\frac{1}{12}$ $of$ $\frac{36}{5}$ and the second pipe can fill $\frac{1}{18}$ $of$ $\frac{36}{5}$. If we get the sum of these, we have:

$\frac{1}{12}\left(\frac{36}{5}\right) + \frac{1}{18}\left(\frac{36}{5}\right) = \frac{3}{5} + \frac{2}{5} = \frac{5}{5} = 1$, which is equal to one completely filled swimming pool.

Knowing that it will take 7 hours and 12 minutes to completely fill the pool, will the pool be filled by 2:00 P.M. if both pipes are opened at 8:00 A.M.? The answer is no since there are only six hours in between 8:00 A.M. to 2:00 P.M and that the pool be completely filled by 3:12 P.M. This means, that the best decision that you could make is to move the schedule after 3:12 P.M.

Let us now explore some of the other examples of problems involving rational algebraic expressions.

**A. Number Problem**

Example: If the same number is added to both numerator and denominator of the fraction $\frac{1}{2}$, the result is $\frac{3}{4}$. Find the number.

Solution:

Step 1: Let $x$ = the number

Step 2: $1 + x$ = numerator

$2 + x$ = denominator

Step 3: $\frac{1+x}{2+x} = \frac{3}{4}$

Step 4:

$$
\begin{aligned}
\frac{1+x}{2+x} &= \frac{3}{4} && \textit{Equation} \\
4(1+x) &= 3(2+x) && \textit{Cross multiply} \\
4 + 4x &= 6 + 3x && \textit{Distributive Property} \\
4 + (-4) + 4x + (-3x) &= 6 + (-4) + 3x + (-3x) && \textit{Addition Property of Equality} \\
x &= 2 && \textit{Combine like terms}
\end{aligned}
$$

Hence, the number is 2.

Step 5. Check

$$\frac{1+x}{2+x} = \frac{3}{4} \rightarrow \frac{1+2}{2+2} = \frac{3}{4} \rightarrow \frac{3}{4} = \frac{3}{4}$$

**B. Age Problem**

Age problems are algebraic problems that deal with the ages of people currently, in the past or in the future.

Example: Five years ago, John's age was half of the age he will be in 8 years. How old is he now?

Solution:

Step 1: Let x John's age

Step 2: $x-5$ is John's age five years ago

$\frac{1}{2}(x+8)$ is half of the age he will be in 8 years

Step 3: $x-5=\frac{1}{2}(x+8)$

Step 4: Solve.

| | | | |
|---|---|---|---|
| $x-5$ | $=$ | $\frac{1}{2}(x+8))$ | *Equation* |
| $2\,(x-5)$ | $=$ | $x+8$ | *Cross multiply* |
| $2x-10$ | $=$ | $x+8$ | *Distributive Property* |
| $2x+(-x)-10+10$ | $=$ | $x+(-x)+8+10$ | *Addition Property of Equality* |
| $x$ | $=$ | $18$ | *Combine like terms* |

Hence, John's age now is 18 years old.

Step 5. Check

$$\frac{1+x}{2+x} = \frac{3}{4} \rightarrow \frac{1+2}{2+2} = \frac{3}{4} \rightarrow \frac{3}{4} = \frac{3}{4}$$

**C. Work Problem**

The formula for work problem that involves two persons is

$$\frac{1}{t_1}+\frac{1}{t_2}=\frac{1}{t_3}$$

where $t_1$ is time taken by the first person

$t_2$ is the time taken by the second person

$t_3$ is the time taken by both

Example: Joey can mow the lawn in 40 minutes and Pet can mow the lawn in 60 minutes. How long will it take for them to mow the lawn together?

Solution:

Step 1: Assign variables

Let x = time to mow lawn together

Step 2: Joey = $\frac{1}{40}$, Pet = $\frac{1}{60}$, Joey and Pet will mow together = $\frac{1}{x}$

Step 3: Write the equation

$$\frac{1}{40}+\frac{1}{60}=\frac{1}{x}$$

Step 4: Solve.

| | | | |
|---|---|---|---|
| $\frac{1}{40}+\frac{1}{60}$ | $=$ | $\frac{1}{x}$ | *Equation* |
| $120x\left(\frac{1}{40}+\frac{1}{60}\right)$ | $=$ | $120x\left(\frac{1}{x}\right)$ | *Multiply both sides by 120x, the LCM of 40, 60, and x* |
| $\frac{120x}{40}+\frac{120x}{60}$ | $=$ | $\frac{120x}{x}$ | *Distributive Property* |
| $3x+2x$ | $=$ | $120$ | *Simplify* |
| $5x$ | $=$ | $120$ | *Combine like terms* |
| $\frac{5x}{5}$ | $=$ | $\frac{120}{5}$ | *Divide both sides by 5* |
| $x$ | $=$ | $24$ | *Simplify* |

Hence, it will take 24 minutes for both of them to mow the lawn together

Step 5. Check

$$\frac{1}{40}(24)+\frac{1}{60}(24)=\frac{24}{40}+\frac{24}{60}\rightarrow\frac{3}{5}+\frac{2}{5}\rightarrow\frac{3+2}{5}\rightarrow\frac{5}{5}=1$$

**D. Speed/Travel Problem**

An object is said to be in **uniform motion** when it moves without changing its speed, or rate.

$$\boldsymbol{distance = rate\ x\ time}$$

$$\boldsymbol{d = rt}$$

Example: Macky won a two-day bicycle race. He travelled 60 km each day and his average speed on the second day was doubled that of the first day. If Macky rode for a total of 6 hours, what was his average speed each day?

Solution:

Step 1: Assign variables

Let x = speed on the first day

Step 2:

| | distance | Speed (rate) | time |
|---|---|---|---|
| Day 1 | 60 | $x$ | $\frac{60}{x}$ |
| Day 2 | 60 | $2x$ | $\frac{60}{2x}$ |
| Total | | | 6 hours |

Step 3: Write the equation

$$\frac{60}{x}+\frac{60}{2x}=6$$

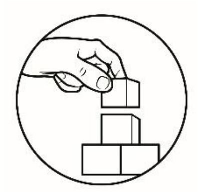
Step 4: Solve.

| | | | |
|---|---|---|---|
| $\frac{60}{x}+\frac{60}{2x}$ | $=$ | $6$ | *Equation* |
| $2x\left(\frac{60}{x}+\frac{60}{2x}\right)$ | $=$ | $2x(6)$ | *Multiply both sides by 2x, the LCM of x and 2x* |
| $\frac{120x}{x}+\frac{120x}{2x}$ | $=$ | $12x$ | *Distributive Property* |
| $120+60$ | $=$ | $12x$ | *Simplify* |
| $180$ | $=$ | $12x$ | *Combine like terms* |
| $\frac{180}{12}$ | $=$ | $\frac{12x}{12}$ | *Divide both sides by 12* |
| $15$ | $=$ | $x$ | *Simplify* |

Hence, the speed on Day 1 is $15\ km/h$
and on Day 2 is $2x = 2(15) = 30\ km/h$.

Step 5.

$$\frac{60}{15}+\frac{60}{2(15)} = 4+2=6$$



# *What's More*

**Activity 1: Find a Number (Number Problem)**

Analyze the problem and fill in with the correct answers in every step. Write your answer in a clean sheet of paper.

Problem: The denominator of a fraction is one more than the numerator. If 3 is subtracted to the numerator and to the denominator, the resulting fraction is equivalent to $\frac{1}{2}$. What is the original fraction?

Solution:

Step 1: ______________________________
______________________________

Step 2: ______________________________
______________________________

Step 3: ______________________________
______________________________

Step 4: ______________________________
______________________________
______________________________
______________________________
______________________________
______________________________
______________________________

Step 5: ______________________________

**Activity 2: What is my Age? (Age Problem)**

To add more skills on solving problems involving rational algebraic expressions, let us answer this activity. Fill in with the correct answer by choosing the answer form the box below.

Problem: One-half of Alvin's age two years from now plus one-third of his age three years ago is twenty years. How old is he now?

Solution:

Step 1: Let x = Alvin's age now

Step 2:

Create an expression using the problem: One-half of Alvin's age two years from now plus one-third of his age three years ago is twenty years.

(1.)__________ → Alvin's age two years from now

(2.)__________ → Alvin's age three years ago

(3.)__________ → One-half of age 2 years from now

(4.)__________ → One-third of age 3 years ago

Step 3: Write out the equation:

| | |
|---|---|
| (5.)________________ | Equation based on the problem. |

Step 4: Solution:

| | |
|---|---|
| $\frac{1}{2}x+1+\frac{1}{3}x-1=20$ | Distributive Property |
| (6.)_________________ | Combine like terms and simplify |
| $6(\frac{1}{2}x+\frac{1}{3}x=20)6$ | Multiply both sides by the LCM |
| (7.)_________________ | Distributive Property |
| $3x+2x=120$ | Simplify |
| (8.)________________ | Combine similar terms |
| $\frac{5x}{5}=\frac{120}{5}$ | Divide both sides by 5 |
| (9.)________________ | Final Answer |

Choices:

| | | |
|---|---|---|
| $\frac{1}{2}(x+2)+\frac{1}{3}(x-3)=20$ | $5x=120$ | $\frac{1}{3}(x-3)$ |
| $x+2$ | $\frac{1}{2}(x+2)$ | $\frac{6}{2}x+\frac{6}{3}x=120$ |
| $x=24$ | $\frac{1}{2}x+\frac{1}{3}x=20$ | $x-3$ |

### Activity 3: Working in Pair (Work Problem)

Read the problem carefully. Arrange the solutions based on the steps given. Write only the letter.

Problem: Bob and Pat are asked to paint a house. Bob can paint the house by himself in 12 hours and Pat can paint by herself in 16 hours. How long would it take to paint the house if they worked together?

Solution:

Step 1: Assign variables

Let x = time of Bob and Pat are working together

Step 2: Bob = $\frac{1}{12}$, Pat = $\frac{1}{16}$,

Bob and Pat work together = $\frac{1}{x}$

Step 3:

1. Write the equation

______________________

Step 4:

2. The LCM of 12 and 16

______________________

3. Multiply both sides with the LCM.

______________________

4. Distribute the LCM to the formula

______________________

5. Simplify

______________________

6. Add

______________________

7.Multiply both sides by x

______________________

8. Divide both sides by the numerical coefficient

______________________

9. Final Answer

______________________

Choices:

A. $48\left(\frac{1}{12}+\frac{1}{16}=\frac{1}{x}\right)48$

B. $\frac{1}{12}+\frac{1}{16}=\frac{1}{x}$

C. $\frac{7x}{7}=\frac{48}{7}$

D. $\frac{48}{12}+\frac{48}{16}=\frac{48}{x}$

E. $x\left(7=\frac{48}{x}\right)x$

F. $4+3=\frac{48}{x}$

G. $x=6.9$

H. $7x=48$

I. 48

J. $7=\frac{48}{x}$

### Activity 4: How Fast Am I? (Speed/Travel Problem)

A passenger train can travel, on average, 20 miles per hour faster than a freight train. If the passenger train covers 390 miles in the same time it takes the freight train to cover 270 miles, then how fast is each train?

Solution:

Step 1: ______________________

Step 2: ______________________

Step 3: ______________________

Step 4: ______________________

Step 5. ____________________

## *What I Have Learned*

Fill in the blanks with the correct word to make the statement true.

To solve word problems on rational algebraic expressions, we will know how to write equations. There are steps to follow in writing the equation and finding the solution.

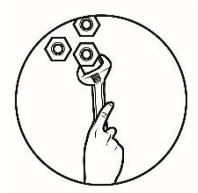
A. Read and understand the (1) ______. Identify what is the given and what is being unknown. Choose a (2) ______ to represent the unknown number.

B. Express the other unknowns, if there are any, in terms of the variable chosen in step 1.

C. Write an (3) _______ to represent the relationship among the given and the unknown/s.

D. (4) _______ the equation for the unknown and use the solution to find the quantities being asked.

E. Check.



## *What I Can Do*

**Let's Cook!**

In your TLE class, you are asked by your teacher to cook a recipe with the following ingredients:

**Ingredients:**
1/2 tsp baking powder
2/3 cup brown sugar
**1/4 cup Cocoa powder**
2 1/3 cups Flour
1/4 tsp nutmeg
1/2 tsp salt
2 cups semi-sweet chocolate chips
**3/4 cup butter**
10 1/2 oz condensed milk, sweetened

If the same number is added to both numerator and denominator of the amount of cocoa powder used in the recipe, the result is the amount of butter to be used. Find the number.

# Assessment

Choose the letter of the correct answer. Write the chosen letter on a separate sheet of paper.

1. Write the expression “the ratio of five less than thrice a number x and four” in symbols.

   A. $\frac{5-3x}{4}$

   B. $\frac{5<3x}{4}$

   C. $\frac{3x-5}{4}$

   D. $\frac{3x<5}{4}$

2. Which of the following is the correct translation for the phrase, “ten less than twice the sum of two number x and y divided by five”?

   A. $\frac{10-2(x+y)}{5}$

   B. $\frac{-2(x+y)10}{5}$

   C. $\frac{2(x+y)-10}{5}$

   D. $\frac{10<2(x+y)}{5}$

3. Translate this phrase into algebraic expression: “The ratio of two and x less by the quotient of 2 and square of x”.

   A. $\frac{2}{x}-\frac{2}{x^2}$

   B. $\frac{2}{x}<\frac{2}{x^2}$

   C. $\frac{x^2}{2}-\frac{x}{2}$

   D. $\frac{x^2}{2}<\frac{2}{x}$

4. The numerator of a fraction is three less than the denominator. If 4 is added to the numerator and to the denominator, the resulting fraction is equivalent to $\frac{3}{4}$. What is the final equation of this problem?

   A. $\frac{d-3+4}{d+4}=\frac{3}{4}$

   B. $\frac{d-4+3}{d+4}=\frac{3}{4}$

   C. $\frac{d+4}{d-3+4}=\frac{3}{4}$

   D. $\frac{d+4-3}{d-4}=\frac{3}{4}$

5. Find the denominator of the given problem in number 4.

   A. 5

   B. 6

   C. 7

   D. 8

6. What is the original fraction in the problem #4?

A. $\frac{5}{6}$

B. $\frac{5}{8}$

C. $\frac{4}{7}$

D. $\frac{7}{8}$

7. Dividing 20 by a number gives the same result as dividing 12 by 2 less than the same number. What is a number?

A. $5$

B. $6$

C. $7$

D. $8$

8. Jay's father is twice as old as Jay. In 20 years, Jay will be two-thirds as old as his father. How is Jay now?

A. $10$ years old

B. $15$ years old

C. $20$ years old

D. $25$ years old

9. What is the age of Jay's father now in problem number 8?

A. $20$

B. $40$

C. $50$

D. $60$

10. Bob can do his project in x hours, what part of the job can be completed by Bob after 2 hours?

A. $x-2$

B. $x+2$

C. $\frac{2}{x}$

D. $\frac{x}{2}$

11. Shane can clean the house in 3 hours and Ana can clean the house in 5 hours, what is the correct equation below represents if they are working together?

A. $\frac{1}{3}+\frac{x}{5}=1$

B. $\frac{1}{3}-\frac{x}{5}=1$

C. $\frac{1}{3}+\frac{1}{5}=\frac{1}{x}$

D. $\frac{1}{3}-\frac{1}{5}=\frac{1}{x}$

12. Leah can clean the store in five hours. If Angelo helps, it takes them four hours. Without help, how many hours would it take Angelo to complete this job?

A. $10$

B. $25$

C. $20$

D. $15$

13. It takes Jordan 36 minutes to mow the lawn while it takes James 45 minutes to mow the same lawn. What is the completed part of James?

A. $\frac{1}{36}$

B. $\frac{1}{45}$

C. $\frac{x}{36}$

D. $\frac{x}{45}$

14. What is the correct equation will be used in problem number 13?

A. $\frac{1}{36}+\frac{1}{45}=x$

B. $\frac{x}{36}+\frac{x}{45}=1$

C. $\frac{x}{36}+\frac{x}{45}=x$

D. $\frac{1}{36}+\frac{x}{45}=1$

15. Using problem number 13, If Jordan and James work together, using two lawn mowers, how long would it take them to mow the lawn?

A. 10 minutes

B. 15 minutes

C. 20 minutes

D. 25 minutes

# Additional Activities

In the problem presented in the What's New section of this module, one pipe could fill the pool in 12 hours while the other pipe could fill the same pool in 18 hours. You were asked to find how long would it take to completely fill the pool if both pipes were used. Explain why each of the following approaches is INCORRECT.

1. The time it would take to fill the pool is the sum of the lengths of time it takes each pipe to fill the pool:

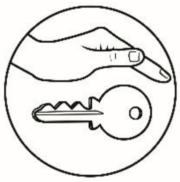
$$\cancel{12\ hours + 18\ hours = 30\ hours}$$

2. The time it would take to fill the pool is the difference in the lengths of time it takes each pipe to fill the pool:

$$\cancel{18\ hours - 12\ hours = 6\ hours}$$

3. The time it would take to fill the pool is the average of the lengths of time it takes each pipe to fill the pool:

$$\cancel{\frac{12\ hours + 18\ hours}{2} = \frac{30\ hours}{2} = 15\ hours}$$



# Answer Key

**What I Know**

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

**What's In**

A.

1. c
2. e
3. a
4. b
5. f

B

1.The perimeter of a

square is 4 times its side

2. The area of a square

is the square of its side

3.The area of a triangle

Is one-half its base and height

**What's New**

1. No. It will take 7 hours and 12 minutes to completely fill the pool, hence, it will not yet be completed at 2 P.M.

2. 3:12 P.M.

3. Yes. Reasons may vary.

4. B

**What's More**

**Activity 1**

**Step 1**

n = numerator

d = denominator

**Step 2**

$d = n+1$

**Step 3**

$\frac{n-3}{d-3} = \frac{1}{2}$

$\frac{n-3}{n+1-3} = \frac{1}{2}$

**Step 4**

$\frac{n-3}{n+1-3} = \frac{1}{2}$

$\frac{n-3}{n+4} = \frac{1}{2}$

$2(n+3) = n+2$

$2n+6 = n-2$

$2n-n = -2+6$

$n = 4$ the numerator

$d = n+1$

$d = 5$ the denominator

$\frac{4}{5}$ the original fraction

**What's More**

Activity 2

1. $x+2$
2. $x-3$
3. $\frac{1}{2}(x+2)$
4. $\frac{1}{3}(x-3)$
5. $\frac{1}{2}(x+2)+\frac{1}{3}(x-3)=20$
6. $\frac{1}{2}x + \frac{1}{3}x = 20$
7. $\frac{6}{2}x + \frac{6}{3}x = 120$
8. $5x = 120$
9. $x = 2$

**What's More**

Activity 3

1. B
2. I
3. A
4. D
5. F
6. H
7. E
8. C
9. G

**What I Have Learned**

1. Problem
2. Variable
3. Equation
4. Solve

**What's More**

Activity 4

Step 1

Let x = speed of the passenger train

Step 2

| | distance | | rate | time |
|---|---|---|---|---|
| Passenger train | 390 | | $x+20$ | $\frac{390}{x+20}$ |
| Freight train | 270 | | $x$ | $\frac{270}{x}$ |
| Total | | | | |

Step 3

$\frac{390}{x+20} = \frac{270}{x}$

Step 4

$x(x+20)\left(\frac{390}{x+20} = \frac{270}{x}\right)x(x+20)$

$390x = 270(x+20)$

$390x = 270x + 5400$

$120x = 5400$

$x = 45$ miles/hour speed of freight train

65miles/hour, speed of passenger train

**What I Can Do**

The number is 8

$\frac{1+x}{4+x} = \frac{3}{4}$

$4(1+x) = 3(4+x)$

$4+4x = 12+3x$

$4x-3x = 12-4$

$x = 8$

**Assessment**

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

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