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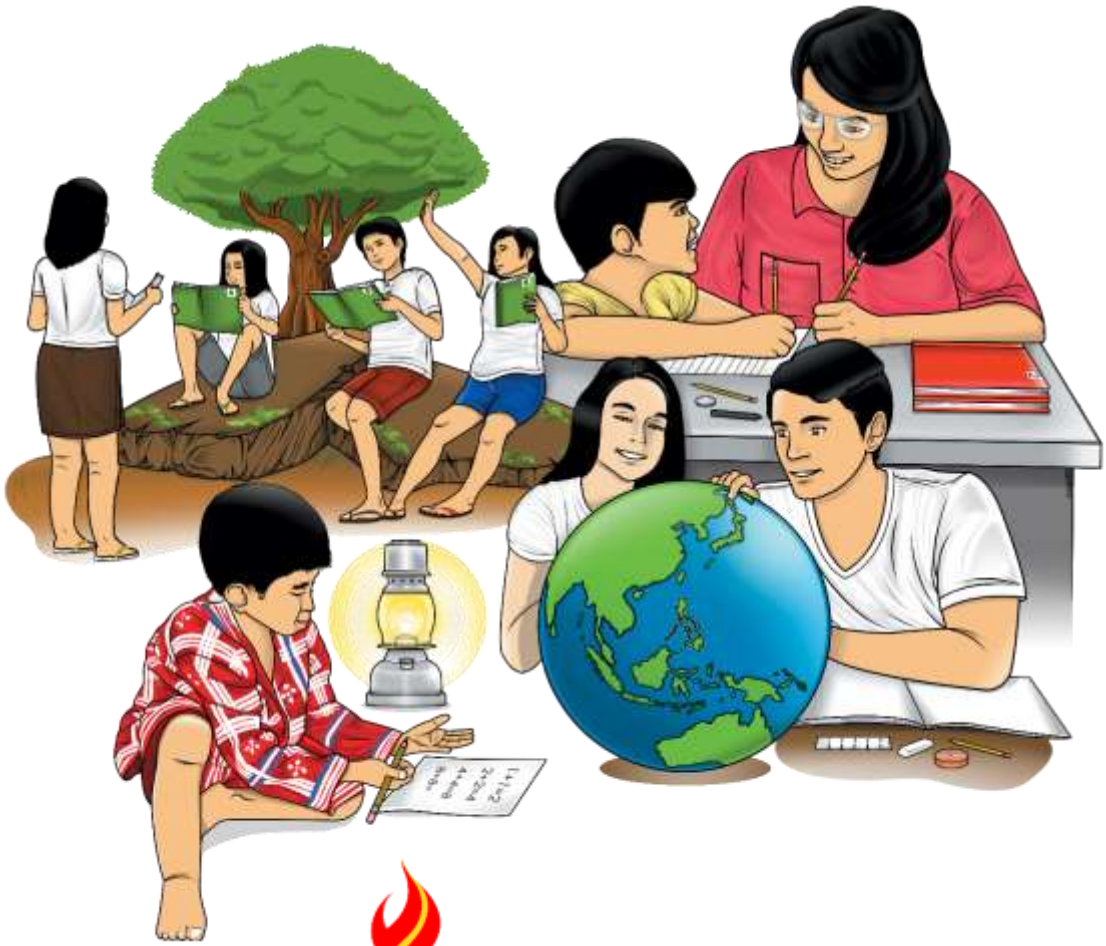
Mathematics

Quarter 2 – Module 11: "Determining the Inverse, Converse and Contrapositive of an If-then Statement"



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Mathematics

Quarter 2 – Module 11: "Determining the Inverse, Converse, and Contrapositive of an If-then Statement"

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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 for you to master the skills in determining the inverse, converse, and contrapositive of an if-then statement. You are provided with different activities which will help you to process knowledge and skills learned. The scope of this module enables you to communicate mathematical thinking with coherence and clarity in logic and reasoning. The lesson is 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 - Determining the Inverse, Converse, and Contrapositive of an If-then Statement

After going through this module, you are expected to:

1. define an inverse, converse, and contrapositive of a conditional (if-then) statement;
2. classify the statement as inverse, converse, or contrapositive of conditional (if-then) statement; and
3. relate the inverse, converse, and contrapositive of conditional (if-then) statement to real-life situations.

What I Know

Pre – Assessment

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

1. Which of the following best describes the inverse of a conditional statement?
   A. If it is in the form of "If p, then q".
   B. Both the hypothesis and conclusion are negated.
   C. The hypothesis and the conclusion are interchanged.
   D. The hypothesis and the conclusion of its converse are negated.

2. Which of the following forms is a contrapositive of "If *p*, then *q*"?
   A. If ***p***, then ***q***
   B. If ***p***, then ***p***
   C. If not ***p***, then not ***q***
   D. If not ***q***, then not ***p***

3. Which of the following forms is an inverse of "If *p*, then *q*"?
   A. If ***p***, *then* ***q***
   B. If ***q,*** then ***p***
   C. If not ***p***, then not ***q***
   D. If not ***q,*** then not ***p***

4. Given the conditional statement ***"If*** $2x + 5 = 7$***, then*** $x = 1$***".*** The statement "If $x = 1$, then $2x + 5 = 7$" is its_____.
   A. contrapositive
   B. converse
   C. hypothesis
   D. inverse

For items 5-7, refer to the statement below

"If the figure is a quadrilateral, then it is a four-sided polygon".

5. If a polygon is four-sided, then it is a quadrilateral.
   A. contrapositive
   B. converse
   C. hypothesis
   D. inverse

6. If a polygon is not a quadrilateral, then it is not four-sided.
   A. conclusion
   B. contrapositive
   C. converse
   D. inverse

7. If a polygon is not four-sided, then it is not a quadrilateral.
   A. contrapositive
   B. converse
   C. hypothesis
   D. inverse

For items 8-10, refer to the statement below

"If a number is divisible by 2 and 3, then it is divisible by 6"

8. How is it written in an inverse form?
   A. If a number is divisible by 6, then it is divisible by 2 and 3.
   B. If a number is not divisible by 2 and 3, then it is divisible by 6.
   C. If a number is not divisible by 2 and 3 then it is not divisible by 6.
   D. If a number is not divisible by 6, then it is not divisible by 2 and 3.

9. Which of the following is the converse of the statement?
   A. If a number is divisible by 6, then it is divisible by 2 and 3.
   B. If a number is divisible by 6, then it is not divisible by 2 and 3.
   C. If a number is not divisible by 2 and 3, then it is divisible by 6
   D. If a number is not divisible by 2 and 3 then it is not divisible by 6.

10. What is its contrapositive?
   A. If a number is divisible by 6, then it is not divisible by 2 and 3.
   B. If a number is not divisible by 2 and 3, then it is divisible by 6.
   C. If a number is not divisible by 2 and 3 then it is not divisible by 6.
   D. If a number is not divisible by 6, then it is not divisible by 2 and 3.

For items 11-13, refer to the statement below

"If you are in love, then you are inspired."

11. If you are not inspired, then you are not in love.
   A. conclusion
   B. contrapositive
   C. converse
   D. inverse

12. If you are not in love, then you are not inspired.
   A. contrapositive
   B. converse
   C. hypothesis
   D. inverse

13. If you are inspired, then you are in love.
   A. conclusion
   B. contrapositive
   C. converse
   D. inverse

14. Jenny asked her friend Jacky to help her write the contrapositive of the statement ***"If you are a second-year student, then you are a sophomore".*** To write it correctly, which of the following should be the answer of Jacky?

   A. If you are not second year student, then you are a sophomore.
   B. If you are not a sophomore, then you are a second-year student.
   C. If you are not a second-year student, then you are not a sophomore.
   D. If you are not a sophomore, then you are not a second-year student.

15. Karl was asked by his Mathematics teacher to write the inverse form of the statement "***If you are a second-year student, then you are a sophomore"***. His answer is written this way "If you are a sophomore, then you are a second year student". What can you conclude about the answer of Karl?

A. His answer is correct since it is in the inverse form.
B. His answer is wrong since it is in converse form.
C. His answer is wrong since it is in contrapositive form.
D. His answer is correct since it is in conditional (if-then) form.

Lesson 1 Determining the Inverse, Converse, and Contrapositive of an If-then Statement

What's In

Let us begin the lesson by activating your prior knowledge on identifying the hypothesis and conclusion of an if-then statement.

ACTIVATING PRIOR KNOWLEDGE

Directions: Identify the hypothesis and conclusion of each conditional (if-then) statement.

1. If a number is even, then it is divisible by two.
   Hypothesis: _____
   Conclusion: _____

2. If I study hard, then I will graduate.
   Hypothesis: _____
   Conclusion: _____

3. If I say bad words, then I will be punished.
   Hypothesis: _____
   Conclusion: _____

Guide Questions:

a. How did you identify the hypothesis and conclusion of each conditional statement?
b. Did you find any pattern on how conditional statements are written? If yes, what are those?

What's New

Given the statement "If ***you drink water, then you obey your thirst"***. If this statement is written in different ways such as:

1. If you obey your thirst, then you drink water.
2. If you do not drink water, then you do not obey your thirst.
3. If you do not obey your thirst, then you do not drink water.

Examine these statements and their relationship to the original conditional statement.

Guide Questions:

a. How does statement 1 relate to the given conditional statement?
b. What do you observe on the structure of statement 2 when compared to the original conditional statement?
c. What about in statement number 3, what are your observations on its structure?
d. Do you have any idea of what these statements are? If yes, what are those?
e. Does the thought of the original conditional statement changed when it was rewritten?

What is It

The Inverse, Converse, and Contrapositive of a Conditional Statement Conditional statement is a statement that can be expressed in **if-then** statement. This statement is in the form, "if ***p,*** *then* ***q"***. In the if-then form, the two parts of conditional statement can be easily identified. One part, the statement following ***if,*** is called the ***hypothesis***. The other part, the statement following ***then****,* is the ***conclusion.***

The if-then statements, in terms of p and q, can be converted into inverse, converse and contrapositive forms. The table below summarizes the converted statements in terms of ***p*** and ***q***.

Conditional Statement	If ***p*, then *q***
Inverse	If *not p*, then *not q*
Converse	If *q*, then *p*
Contrapositive	If *not q*, then *not p*

Inverse

To write the ***inverse*** of a conditional statement, simply negate both the hypothesis and conclusion.

Illustrative Example 1:

Conditional Statement *(If **p**, then **q**)*	**Inverse** *(If not **p**, then not **q**)*
If you drink water, then you obey your thirst.	*If you do not drink water, then you do not obey your thirst.*

Converse

To write the ***converse*** of a conditional statement, simply interchange the hypothesis and the conclusion. That is, the ***then*** part becomes the ***if*** part and the ***if*** part becomes the ***then*** part.

Illustrative Example 2:

Conditional Statement *(If **p**, then **q**)*	**Converse** *(If **q**, then **p**)*
If you drink water, then you obey your thirst.	*If you obey your thirst, then you drink water.*

Contrapositive

To form the ***contrapositive*** of a conditional statement, first, get its inverse. Then, interchange its hypothesis and conclusion.

Illustrative Example 3:

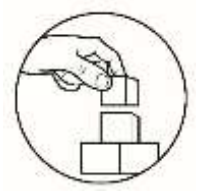
Conditional Statement *(If **p**, then **q**)*	**Contrapositive** *(If not **q**, then not **p**)*

If you drink water, then you obey your thirst. ↓ **Inverse** *If you do not drink water, then you do not obey your thirst.*	*If you do not obey your thirst, then you do not drink water.*

Illustrative Example 4: Transform the conditional statement into its inverse, converse, and contrapositive.

If it is raining, then the field is wet.

Conditional Statement *(If **p**, then **q**)*	**Inverse** *(If not **p**, then not **q**)*	**Converse** *(If **q**, then **p**)*	**Contrapositive** *(If not **q**, then not **p**)*
If it is raining, then the field is wet.	If it is not raining, then the field is not wet.	If the field is wet, then it is raining.	If the field is not wet, then it is not raining.



What's More

Judge Us!

Directions: Determine the following statement if it is converse, inverse or contrapositive of the given conditional (if-then) statement.

Conditional statement: If it's a right angle, then its measure is 90 degrees.

_____1. If the measure of the angle is 90 degrees, then it is a right angle.
_____2. If the measure of the angle is not 90 degrees, then it is not a right angle.
_____3. If the angle is not a right angle, then its measure is not 90 degrees

Conditional statement: If you do your homework, then you will pass in Mathematics.

_____4. If you do not pass in Mathematics, then you do not do your homework.

_____5. If you passed in Mathematics, then you did your homework.

_____6. If you do not do your homework, then you will not pass in Mathematics.

ACTIVITY 2: What Am I?

Directions: Identify if the following statements are the converse, inverse, or contrapositive of the conditional statement. Check the column of your answer.

Conditional Statement	**Given form**	**Converse**	**Inverse**	**Contrapositive**
1. If you are a disciplined person, then you are God-fearing.	a. If you are not God-fearing, then you are not a disciplined person.			
	b. If you are God-fearing, then you are a disciplined person.			
	c. If you are not a disciplined person, then then you are not God-fearing.			
2. If they are healthy, then they are health conscious.	a. If they are health conscious, then they are healthy.			
	b. If they are not healthy, then they are not health conscious.			
	c. If they are not health conscious, then they are not healthy.			

Conditional Statement	Given form	Converse	Inverse	Contrapositive
3.If lines are parallel, then they do not intersect.	a. If the lines do not intersect, then they are parallel.			
	b. If the lines are not parallel, then they intersect.			
	c. If the lines intersect, then they are not a parallel.			

What I Have Learned

Activity: Answer Me!

Directions: Write the given if-then statement using p and q. Then identify whether each of the following statements represents converse, inverse, or contrapositive of the given if - then statement below.

Given Statement: ***"If a figure is a rhombus, then its diagonals are perpendicular to each other."***

_____	_____	_____
_____	_____	_____
"If the diagonals of a figure are perpendicular to each other, then it is a rhombus.	If a figure is not a rhombus, then its diagonals are not perpendicular to each other.	If the diagonals of a figure are not perpendicular to each other, then it is a not rhombus.

Questions:

1. Compare the inverse and the original statement. What did you do with ***p***? What did you do with ***q***?
2. What can you conclude about the contrapositive given the converse of an if- then statement?

What I Can Do

Activity: Inbox!

Directions: Write a conditional statement about the situation below and state its converse, inverse, and contrapositive. Write your answer on a separate sheet of paper.

"Some students are faced with problems in life such as failing grades and difficulties in meeting deadline."

Conditional (If-then) Statement	**Inverse**	**Converse**	**Contrapositive**

Rubric:

10	**8**	**6**	**4**
Is able to write correctly the conditional statement and its inverse, converse and contraposive.	Is able to write correctly the conditional statement and any 2 of its inverse, converse and contraposive.	Is ableto write correctly the conditional statement and any 1 of its inverse, converse and contraposive.	Is able to write correctly the conditional statement only.

Assessment

Post-Assessment

Directions: Read each item carefully then choose the letter of the correct answer. Write it on your paper.

1. Given "If p, then q", which of the following describes a converse statement?
   A. If ***p***, then ***q***
   B. If ***q***, then ***p***
   C. If not ***p,*** then not ***q***
   D. If not ***q***, then not ***p***

*2.*Which of the following best describes the contrapositive of a conditional statement?
   A. If it is in the form of "If p, then q".
   B. Both the hypothesis and conclusion are negated.
   C. The hypothesis and the conclusion are interchanged.
   D. The hypothesis and the conclusion of its inverse are interchanged.

3. Which of the following refers to an inverse statement?
   A. If ***p,*** then ***q***
   B. If ***q,*** then ***p***
   C. If not ***p,*** then not ***q***
   D. If not ***q***, then not ***p***

For items 4-7, refer to the statement below.

"If a figure is a square, then it has 4 equal sides."

4. What is the hypothesis of the statement?
   A. equal sides
   B. is a square
   C. a figure is a square
   D. it has 4 equal sides

5. If a figure is not square, then it doesn't have 4 equal sides.
   A. contrapositive
   B. converse
   C. if-then
   D. inverse

6. If a figure has 4 equal sides, then it is a square.
   A. conclusion
   B. contrapositive
   C. converse
   D. inverse

7. If a figure doesn't have 4 equal sides, then it is not a square.
   A. contrapositive
   B. converse
   C. hypothesis
   D. inverse

For items 8-10, refer to the statement below.

"If it is June 12 in the Philippines, then it is Independence Day."

8. What is its contrapositive?
   A. If it is not Independence Day in the Philippines, then it is June 12.
   B. If it is not Independence Day in the Philippines, then is not June 12.
   C. If it is not June 12 in the Philippines, then it is Independence Day.
   D. If it is not June 12 in the Philippines, then it is not Independence Day.

9. Which of the following is the inverse of the given conditional (if-then) statement?
   A. If it is Independence Day in the Philippines, then is not June 12.
   B. If it is June 12 in the Philippines, then it is not Independence Day.
   C. If it is not Independence Day in the Philippines, then it is June 12.
   D. If it is not June 12 in the Philippines, then it is not Independence Day.

10. What is the converse of the given conditional (if-then) statement?
   A. If it is Independence Day in the Philippines, then it is June 12.
   B. If it is June 12 in the Philippines, then it is not Independence Day.
   C. if it is not Independence Day in the Philippines, then it is not June 12.
   D. If it is not June 12 in the Philippines, then it is not Independence Day.

For items 11-13, refer to the statement below.

"If you were born in the Philippines, then you are a Filipino."

11. If you are not a Filipino, then you were not born in the Philippines.
   A. contrapositive
   B. converse
   C. hypothesis
   D. inverse

12. If you were not born in the Philippines, then you are not a Filipino.
   A. conclusion
   B. contrapositive
   C. converse
   D. inverse

13. If you are a Filipino, then you were born in the Philippines.
   A. contrapositive
   B. converse
   C. hypothesis
   D. inverse

14. Jessa says that the converse of the statement ***"If a number has 1 and itself as factors, then it is prime"*** is "If *a number does not have 1 and itself as factors, then it is not prime".* Which of the following reasons would support her statement?

    A. To write the converse, negate both hypothesis and conclusion.
    B. To write the converse, interchange the hypothesis and conclusion.
    C. To write the converse, interchange the hypothesis and conclusion of its converse.
    D. To write the converse, interchange and negate both hypothesis and conclusion.

15. In a Grade 8 class, Ms. Azarcon asked students to rewrite the statement "If *today is Monday, then tomorrow is Tuesday"* into its inverse form. Vanessa volunteered to write her answer on the board. Her answer is written this way, *"If tomorrow is Tuesday, then today is Monday".* Was her answer correct?

    A. Yes, no errors were committed.
    B. No, because the answer should be *"If tomorrow is not Tuesday, then today is not Monday."*
    C. No, because the answer should be *"If today is not Monday, then tomorrow is not Tuesday".*
    D. No, because the answer should be *"If today is not Monday, then tomorrow is Tuesday".*

Additional Activities

Journal Writing:

Write an entry in your activity notebook describing how much you have learned about the inverse, converse, and contrapositive of a conditional (if-then) statement, and how these can be applied in real life. Cite concrete examples of application. Also add the parts of the lesson that you still find confusing, if any.

Answer Key

What's More

Activity 1: Judge Us!

1. converse
2. contrapositive
3. inverse
4. contrapositive
5. converse
6. inverse

Activity2 : What Am I?

1. A. contrapositive
B. converse
C. inverse
2. A. converse
B. inverse
C. contrapositive

3. A. converse
B. inverse
C. contrapositive

What's New

a. By interchanging the hypothesis and the conclusion of the given conditional statement, statement 1 is being formed. So, statement 1 is related to the given conditional statement.

b. Both the hypothesis and the conclusion of the given conditional statement are negated to form statement 2.

c. By getting first the inverse of the conditional statement and interchanging the hypothesis and the conclusion, statement 3 is being formed.

d. Yes, these statements are the inverse, converse and contrapositive of conditional statements.

e. No.

What's In

1. If a number is even, then it is divisible by two.
   Hypothesis: A number is even.
   Conclusion: It is divisible by two.

2. If I study hard, then I will graduate.
   Hypothesis: I study hard.
   Conclusion: I will graduate.

3. If I say bad words, then I will be punished.
   Hypothesis: I say bad words
   Conclusion: I will be punished.

a. By determining the statement following "if" as the hypothesis and by determining the statement following "then" as the conclusion.

b. Yes, I found patterns on how conditional statements are written in different ways. These include both the hypothesis and the conclusion are negated, the hypothesis and conclusion are interchanged, and the hypothesis and conclusion are negated and are interchanged.

What I Know

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

Additional Activities

(Answers will vary with students)

Post-Assessment

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

What I Can Do

(Answers will vary with students)

What I Have Learned

p: The diagonals of a figure are perpendicular to each other. q: It is a rhombus.	p: A figure is not a rhombus. q: Its diagonals are not perpendicular to each other.	p: The diagonals of a figure are not perpendicular to each other. q: It is a not rhombus.
CONVERSE	INVERSE	CONTRAPOSITIVE
"If the diagonals of a figure are perpendicular to each other, then it is a rhombus.	If a figure is not a rhombus, then its diagonals are not perpendicular to each other.	If the diagonals of a figure are not perpendicular to each other, then it is a not rhombus.

1. Both p and q of the original statement are negated to form an inverse statement. Hence, the inverse is the opposite/reverse statement of the original statement.
2. By negating both the hypothesis and the conclusion of the converse of an if-then statement, a contrapositive statement is formed.

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