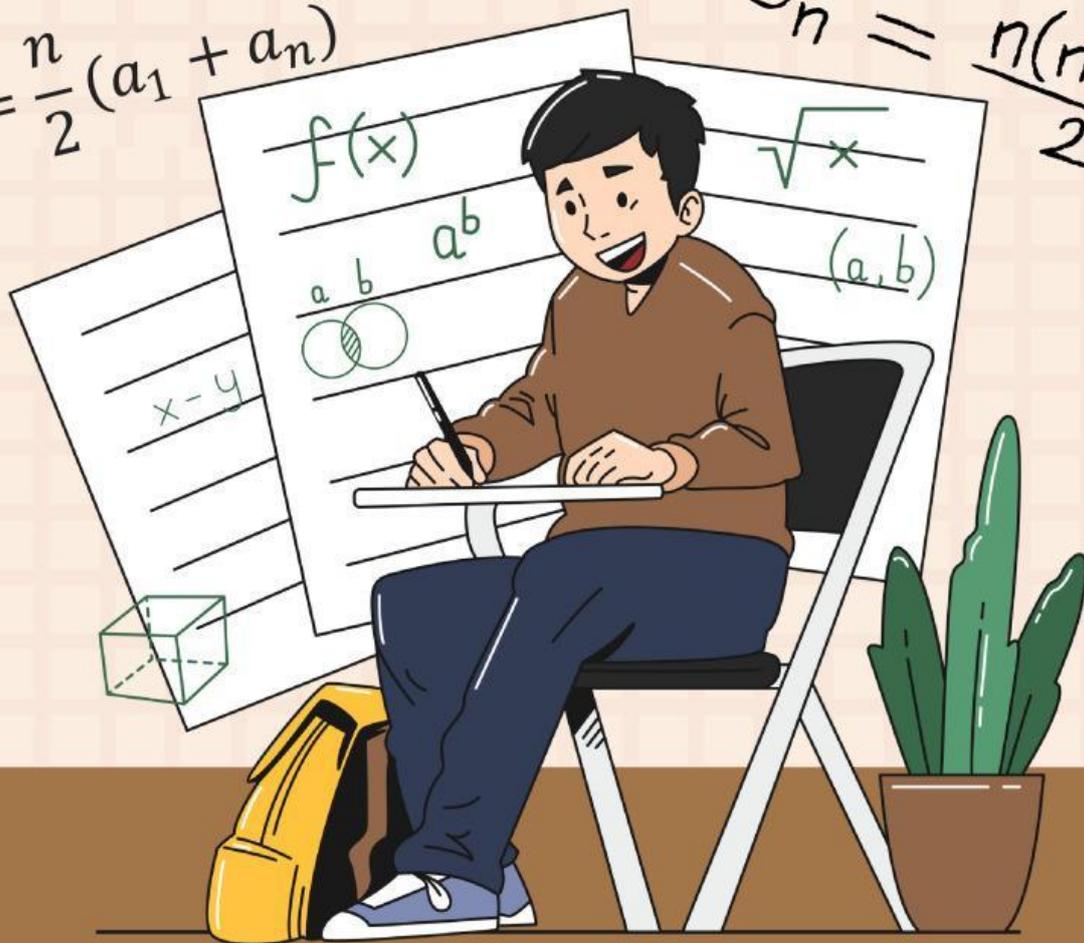**Based On Kurikulum Merdeka**

Teaching Module

MATHEMATIC

ARITHMATIC SERIES

For Grade X High School

$$S_n = \frac{n}{2}(a_1 + a_n)$$

$$S_n = \frac{n(n+1)}{2}$$

$f(x)$

$a \ b \quad a^b$

$\sqrt{x}$

(a,b)

$x - y$

Adelia Br Tarigan

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STUDENTS WORKSHEET

MATHEMATIC

ARITHMATIC SERIES

For Grade X High School

$$S_n = \frac{n}{2}(a_1 + a_n)$$

$$f(x)$$

$$a \quad b \qquad a^b$$

$$x - y$$

$$\sqrt{x}$$

$$(a, b)$$

$$S_n = \frac{n(n+1)}{2}$$

Name: ....

Class: ....

INTRODUCTION

IDENTITY:

Level of School   : High School
Grade   : X
subject matter   : Arithmetic Series
Time Allocation   : 25 Minutes x 2

LEARNING OBJECTIVE:

1. Students can understand the concept of arithmetic series after group discussion nicely.
2. After group discussion, Learners can determine the number of n-th term of an arithmetic series correctly.
3. Students can solve daily life problems related to the. concept of arithmetic series well after group discussion.

WORKING INSTRUCTIONS:

1. Pray before working on the Student Worksheet
2. Follow every step in the Student Worksheet
3. Discuss with your classmates to answer the questions given.
4. Write down the results of the discussion in the space provided
5. If there are problems, ask the teacher!

LEARNING ACTIVITIES

THE CONCEPT OF SERIES

LET'S EXPLORE BY DOING A HANDSHAKE WITH SOME FRIENDS IN YOUR GROUP. THEN, ANSWER THE FOLLOWING QUESTIONS IN COLLABORATION WITH YOUR GROUP MEMBERS.
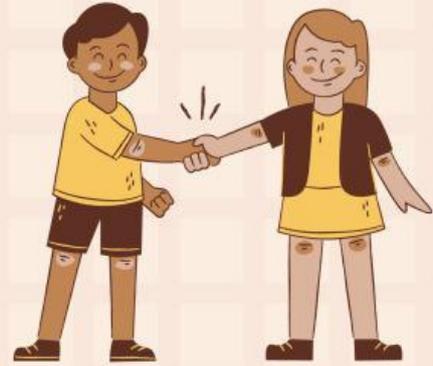
1. If there are 2 people, how many handshakes are there? _____

2. If there are 3 people, how many handshakes are there? _____

3. If there are 4 people, how many handshakes are there? _____

4. How many students are in your group, and how many handshakes are there?

_____

DO MANY OF THE HANDSHAKES ABOVE FORM A SEQUENCE? EXPLAIN YOUR ANSWER!

THE MANY HANDSHAKES THAT HAPPEN IN THE CLASSROOM

Number of people shaking hands	Many handshakes	The details of many handshakes
Two people	1	1
Three people	3	1 + 2
Four people	_____	1 + ___ + ___
Five people	_____	1 + ___ + ___ + ___

Is the description of the number of handshakes the sum of a number sequence?

CONCLUSION

The sum of a number sequence will form a number series.
So, a number series is:

ARITHMETIC SERIES

THE CONCEPT OF ARITHMETIC SERIES

AN ARITHMETIC SERIES IS A SERIES OBTAINED BY ADDING THE TERMS OF AN ARITHMETIC SEQUENCE.

FROM AN ARITHMETIC SEQUENCE:

$$U_1, U_2, U_3, U_4, \ldots \ldots \ldots, U_n.$$

AN ARITHMETIC SERIES CAN BE FORMED:

$$U_1 + U_2 + U_3 + U_4 + \ldots \ldots \ldots + U_{10}$$

WHERE:

$$U_1 = a \qquad\qquad U_6 = a + 5b$$
$$U_2 = a + b \qquad\quad U_7 = a + 6b$$
$$U_3 = a + 2b \qquad\quad U_8 = a + 7b$$
$$U_4 = a + 3b \qquad\quad U_9 = a + 8b$$
$$U_5 = a + 4b \qquad\quad U_{10} = a + 9b$$

AND $\quad U_n = a + (n - 1)b$

SO, $\ \mathrm{Sn} = \mathrm{U1} + \mathrm{U2} + \mathrm{U3} + \ldots + \mathrm{Un}$

$\mathrm{Sn} = a + (\underline{\qquad}) + (\underline{\qquad}) + \ldots + (\underline{\qquad\qquad})$

Since $Sn = a + (a + b) + ... + (a + (n-2)b) + (a + (n-1)b)$

then, The sum of the arithmetic series is reversed from U1 to Un becomes Un to U1 is:

$$Sn = a \qquad + (a+b) \qquad +... + (a+(n-2)b) + (a+(n-1)b)$$
$$Sn = (a+(n-1)b) + (a+(n-2)b) +... + (a+b) \qquad + a$$
$$\overline{}+$$
$$2Sn = \underline{\qquad} + \underline{\qquad} +... + \underline{\qquad} + \underline{\qquad}$$

as many as _____

Since _____ is as many as ......, we can make the formula as follows:

$2\,Sn = ...\, (\underline{\qquad\qquad\qquad\qquad})$

$Sn = \dfrac{........}{2}\, (\underline{\qquad\qquad\qquad\qquad})$

Did you know?
There are other formulas of arithmetic series that are developed from the formulas we have found before.
Create it!

FROM THE PREVIOUS PROBLEM, HOW MANY HANDSHAKES WILL STUDENTS DO IF THERE ARE 101 PEOPLE SHAKING HANDS?

SOLUTION

- **DETERMINE THE LAST NUMBER OF A NUMBER SERIES USING THE ARITHMETIC SEQUENCE FORMULA**

  if there are 101 students shaking hands, then the number sequence will be in the 100th row.

  And it is known:

  First Row (a) = _____

  Difference between rows (b) = _____

  Then the 100th row is:

  $$U100 = \underline{\quad} + (\underline{\quad} - \underline{\quad}) \underline{\quad}$$

  $$= \underline{\quad} + (\underline{\quad}) \underline{\quad}$$

  $$= \underline{\quad} + \underline{\quad}$$

  $$U100 = \underline{\quad}$$

- **MAKE IT INTO AN ARITHMETIC SERIES**

  If there are 101 students who shake hands then the details of many handshakes are:

  $$1 + 2 + 3 + 4 + 5 + \underline{\ } + \underline{\ } + \underline{\ } + \underline{\ } + \underline{\ } + ... + 100$$

- **SOLVE THE PROBLEM**

EXAMPLE OF PROBLEM IN REAL LIFE

A FARMER DECIDED TO PLANT MANGO TREES IN HIS GARDEN. HE WANTS TO PLANT THE TREES IN AN EQUAL SPACING PATTERN. IN THE FIRST ROW, HE PLANTS 5 TREES, AND IN EACH SUBSEQUENT ROW HE ADDS 3 MORE TREES THAN THE PREVIOUS ROW. IF THE FARMER WANTS TO PLANT 10 ROWS OF TREES, HOW MANY TREES WILL HE PLANT IN THE 10TH ROW, AND WHAT WILL BE THE TOTAL NUMBER OF TREES HE PLANTS?

SOLUTION STEPS

DETERMINE THE 10TH ROW

Formula for the n-th term in an arithmetic sequence:

$$Un = \underline{\hspace{1cm}} + (\underline{\hspace{1cm}} - \underline{\hspace{1cm}}) \underline{\hspace{1cm}}$$

- First Row (a) = _____ Trees.
- Difference between rows (b) = _____ Trees.
- Then the 10th row is:

$$U10 = \underline{\hspace{1cm}} + (\underline{\hspace{1cm}} - \underline{\hspace{1cm}}) \underline{\hspace{1cm}}$$

$$= \underline{\hspace{1cm}} + (\underline{\hspace{1cm}}) \underline{\hspace{1cm}}$$

$$= \underline{\hspace{1cm}} + \underline{\hspace{1cm}}$$

$$= \underline{\hspace{1cm}}$$

So, in the 10th row the farmer will plant _____ trees.

CALCULATE THE TOTAL TREES PLANTED USING THE ARITHMETIC SERIES FORMULA:

SELF-EVALUATION ACTIVITIES

1. Given some formulas below:

   a) $U_n = \frac{n}{2}(2a + (n-1)b)$

   b) $S_n = \frac{n}{2}(a + U_n)$

   c) $U_n = a + (n-1)b$

   Determine which are formulas and which are not formulas of an arithmetic series and give your reasons!

2. Given some number arrangements below:

   a) $1, 2, 3, 4, 5, \ldots, 10$

   b) $a + b + c + d + e + \ldots + m$

   c) $1 + 2 + 3 + 4 + 5 + \ldots + 10$

   Determine which is an example and which is not an example of an arithmetic series and give a reason!

3. Consider the following number sequence: $2, 5, 8, 11, \ldots$. Find the sum of the first 28 terms of the sequence!

4. Andi started swimming with a distance of 100 meters in the first week. Each week, he increased his distance by 50 meters. What is his total distance after 15 weeks?

5. A movie theater has 25 rows of seats. The first row has 18 seats, the second row has 22 seats, and so on with the same addition of seats in each subsequent row. How many seats are there in the movie theater?

REFLECTION ACTIVITIES

From the learning activities you have done, what did you get? fill in the following table to measure yourself against the material you have learned. answer honestly and in accordance with actual conditions.

Reflection Table

No	Questions	Never	Rare	Often	Always
1.	I know the difference between sequence and series.				
2.	I can understand the concept of Arithmetic Series				
3.	I can determine the sum of the first n terms of an arithmetic sequence				
4.	I can model mathematical sentences in the form of Arithmetic Series				

DESCRIPTION:

1. Choose **Never** if from the beginning to the end of the learning activity you still don't understand the problem presented.
2. Choose **Rare** if from the beginning to the end of the learning activity you can still sometimes understand the problem presented.
3. Choose **Often** if from the beginning to the end of the learning activity you can still often understand the problems presented.
4. Choose **Always** if from the beginning to the end of the learning activity you are always able to understand the problem presented.