

FIND THE 100TH TERM IN THE FOLLOWING ARITHMETIC SEQUENCE: -10, -15, -20, -25, ... HINT: WRITE A FORMULA

FIND THE 100TH TERM IN THE FOLLOWING ARITHMETIC SEQUENCE: -10, -15, -20, -25, ... HINT: WRITE A FORMULA

UNDERSTANDING ARITHMETIC SEQUENCES IS FUNDAMENTAL IN MATHEMATICS, ESPECIALLY WHEN DEALING WITH PROBLEMS INVOLVING PATTERNS, SERIES, AND SEQUENCES. IN THIS ARTICLE, WE WILL EXPLORE HOW TO FIND THE 100TH TERM IN THE ARITHMETIC SEQUENCE: -10, -15, -20, -25, ... BY DERIVING AND APPLYING A GENERAL FORMULA. THIS COMPREHENSIVE GUIDE WILL HELP YOU GRASP THE CONCEPT THOROUGHLY AND ENHANCE YOUR PROBLEM-SOLVING SKILLS.

WHAT IS AN ARITHMETIC SEQUENCE?

AN ARITHMETIC SEQUENCE IS A SEQUENCE OF NUMBERS WHERE EACH TERM AFTER THE FIRST IS OBTAINED BY ADDING A FIXED NUMBER, CALLED THE COMMON DIFFERENCE, TO THE PREVIOUS TERM.

DEFINITION:

AN ARITHMETIC SEQUENCE IS A SEQUENCE OF THE FORM:

$$\{a_1, a_2, a_3, \dots, a_n\}$$

WHERE EACH TERM SATISFIES:

$$a_n = a_{n-1} + d$$

FOR ALL $(n > 1)$, WITH:

- a_1 AS THE FIRST TERM
- d AS THE COMMON DIFFERENCE

EXAMPLE:

IN THE SEQUENCE -10, -15, -20, -25, ..., THE FIRST TERM a_1 IS -10, AND THE COMMON DIFFERENCE d IS -5.

IDENTIFYING THE COMPONENTS OF THE SEQUENCE

BEFORE DERIVING THE FORMULA TO FIND A SPECIFIC TERM, LET'S ANALYZE THE GIVEN SEQUENCE:

- FIRST TERM a_1 : -10
 - COMMON DIFFERENCE d :
- TO FIND d , SUBTRACT THE FIRST TERM FROM THE SECOND:

$$d = -15 - (-10) = -15 + 10 = -5$$

CONFIRMING WITH THE NEXT TERMS:

$$-20 - (-15) = -20 + 15 = -5$$

$$-25 - (-20) = -25 + 20 = -5$$

THE COMMON DIFFERENCE IS CONSISTENTLY -5.

SUMMARY:

TERM INDEX	TERM VALUE	CALCULATION
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(a_1)	-10	GIVEN
(d)	-5	CALCULATED

DERIVING THE GENERAL FORMULA FOR THE NTH TERM

THE KEY TO SOLVING PROBLEMS INVOLVING SPECIFIC TERMS IN AN ARITHMETIC SEQUENCE IS TO USE THE NTH TERM FORMULA, WHICH PROVIDES A DIRECT WAY TO FIND ANY TERM WITHOUT LISTING ALL PREVIOUS TERMS.

THE FORMULA:

$$a_n = a_1 + (n - 1)d$$

WHERE:

- (a_n) : THE NTH TERM
- (a_1) : THE FIRST TERM
- (d) : THE COMMON DIFFERENCE
- (n) : THE POSITION OF THE TERM IN THE SEQUENCE

APPLYING THE FORMULA TO OUR SEQUENCE:

GIVEN:

- $(a_1 = -10)$
- $(d = -5)$
- $(n = 100)$

PLUGGING INTO THE FORMULA:

$$a_{100} = -10 + (100 - 1)(-5)$$

SIMPLIFY:

$$a_{100} = -10 + 99 \text{ TIMES } (-5)$$

$$a_{100} = -10 - 495$$

$$a_{100} = -505$$

THEREFORE, THE 100TH TERM OF THE SEQUENCE IS -505.

STEP-BY-STEP CALCULATION PROCESS

LET'S BREAK DOWN THE PROCESS OF FINDING THE 100TH TERM:

1. IDENTIFY THE FIRST TERM (a_1): GIVEN AS -10.
2. DETERMINE THE COMMON DIFFERENCE (d): CALCULATED AS -5.
3. DECIDE WHICH TERM TO FIND (n): HERE, $n = 100$.
4. APPLY THE NTH TERM FORMULA:

$$a_n = a_1 + (n - 1)d$$

5. SUBSTITUTE KNOWN VALUES:

$$a_{100} = -10 + (100 - 1)(-5)$$

6. PERFORM THE CALCULATIONS:

$$a_{100} = -10 + 99 \times (-5) = -10 - 495 = -505$$

7. INTERPRETATION: THE 100TH TERM IN THIS SEQUENCE IS -505.

UNDERSTANDING THE PATTERN AND BEHAVIOR OF THE SEQUENCE

THE SEQUENCE:

$$-10, -15, -20, -25, \dots$$

CONTINUES DECREASING BY 5 EACH TIME BECAUSE THE COMMON DIFFERENCE IS NEGATIVE. THIS MEANS THE SEQUENCE IS DECREASING AND MOVING TOWARDS NEGATIVE INFINITY AS THE NUMBER OF TERMS INCREASES.

VISUALIZING THE SEQUENCE:

TERM NUMBER	TERM VALUE
1	-10
2	-15
3	-20
4	-25
...	...
100	-505

THE SEQUENCE EXHIBITS A LINEAR PATTERN WHERE EACH SUBSEQUENT TERM IS 5 LESS THAN THE PREVIOUS ONE.

APPLICATIONS OF THE NTH TERM FORMULA

THE FORMULA FOR THE NTH TERM OF AN ARITHMETIC SEQUENCE IS WIDELY USED IN VARIOUS FIELDS, INCLUDING:

- FINANCE: CALCULATING INSTALLMENTS OR PAYMENTS OVER TIME
- PHYSICS: DESCRIBING UNIFORM MOTION
- COMPUTER SCIENCE: GENERATING SEQUENCES OR ANALYZING ALGORITHMS
- STATISTICS: MODELING DATA WITH LINEAR TRENDS

PRACTICAL EXAMPLE:

SUPPOSE A SAVINGS ACCOUNT STARTS WITH \$100 AND DECREASES BY \$10 EACH MONTH DUE TO FEES. TO FIND OUT HOW MUCH MONEY WILL BE LEFT AFTER 50 MONTHS, YOU CAN MODEL THIS AS AN ARITHMETIC SEQUENCE AND APPLY THE NTH TERM FORMULA.

COMMON MISTAKES TO AVOID

WHEN WORKING WITH THE NTH TERM FORMULA, BE CAUTIOUS OF THE FOLLOWING:

- INCORRECTLY IDENTIFYING THE FIRST TERM OR COMMON DIFFERENCE: ALWAYS VERIFY THESE VALUES BY CHECKING MULTIPLE TERMS.
- MISAPPLYING THE FORMULA: REMEMBER TO SUBTRACT 1 FROM (n) IN THE FORMULA.
- SIGN ERRORS: PAY CLOSE ATTENTION TO THE SIGNS OF (a_1) AND (d) .

SUMMARY AND CONCLUSION

IN SUMMARY, TO FIND THE 100TH TERM IN THE ARITHMETIC SEQUENCE: -10, -15, -20, -25, ...:

- RECOGNIZE THE SEQUENCE IS ARITHMETIC WITH $(a_1 = -10)$ AND $(d = -5)$.
- USE THE FORMULA:

$$a_n = a_1 + (n - 1)d$$

- PLUG IN $(n = 100)$:

$$a_{100} = -10 + (100 - 1)(-5) = -10 - 495 = -505$$

THUS, THE 100TH TERM IS -505.

THIS APPROACH CAN BE GENERALIZED TO FIND ANY TERM IN AN ARITHMETIC SEQUENCE, MAKING IT A POWERFUL TOOL IN MATHEMATICAL PROBLEM-SOLVING AND REAL-WORLD APPLICATIONS.

ADDITIONAL RESOURCES FOR LEARNING ARITHMETIC SEQUENCES

- ONLINE TUTORIALS AND VIDEOS ON ARITHMETIC SEQUENCES AND SERIES
- MATHEMATICS TEXTBOOKS COVERING SEQUENCES AND SERIES
- PRACTICE PROBLEMS TO REINFORCE UNDERSTANDING
- INTERACTIVE CALCULATORS FOR SEQUENCE CALCULATIONS

BY MASTERING THE DERIVATION AND APPLICATION OF THE NTH TERM FORMULA, STUDENTS AND ENTHUSIASTS CAN CONFIDENTLY ANALYZE AND SOLVE PROBLEMS INVOLVING ARITHMETIC PROGRESSIONS.

REMEMBER: THE KEY TO SOLVING SEQUENCE PROBLEMS IS TO UNDERSTAND THE PATTERN, IDENTIFY THE SEQUENCE'S COMPONENTS, AND CAREFULLY APPLY THE FORMULA. WITH PRACTICE, FINDING SPECIFIC TERMS BECOMES STRAIGHTFORWARD AND EFFICIENT.

FREQUENTLY ASKED QUESTIONS

WHAT IS THE GENERAL FORMULA TO FIND THE NTH TERM IN AN ARITHMETIC SEQUENCE?

THE GENERAL FORMULA IS $a_n = a_1 + (n - 1)d$, WHERE a_1 IS THE FIRST TERM, d IS THE COMMON DIFFERENCE, AND n IS THE TERM NUMBER.

GIVEN THE SEQUENCE -10, -15, -20, -25, WHAT IS THE COMMON DIFFERENCE?

THE COMMON DIFFERENCE d IS -5, SINCE EACH TERM DECREASES BY 5.

HOW DO YOU FIND THE 100TH TERM IN THE SEQUENCE -10, -15, -20, -25, ...?

USE THE FORMULA: $a_{100} = a_1 + (100 - 1)d$. SUBSTITUTE $a_1 = -10$ AND $d = -5$ TO GET $a_{100} = -10 + 99(-5) = -10 - 495 = -505$.

WHAT IS THE VALUE OF THE 100TH TERM IN THE GIVEN SEQUENCE?

THE 100TH TERM IS -505.

CAN THE ARITHMETIC SEQUENCE FORMULA BE APPLIED TO ANY SEQUENCE TO FIND THE NTH TERM?

NO, THE FORMULA APPLIES SPECIFICALLY TO ARITHMETIC SEQUENCES WHERE THE DIFFERENCE BETWEEN CONSECUTIVE TERMS IS CONSTANT.

WHY IS WRITING A FORMULA IMPORTANT FOR FINDING SPECIFIC TERMS IN AN ARITHMETIC SEQUENCE?

WRITING A FORMULA ALLOWS YOU TO DIRECTLY CALCULATE ANY TERM IN THE SEQUENCE WITHOUT LISTING ALL PREVIOUS TERMS, SAVING TIME AND EFFORT.

ADDITIONAL RESOURCES

FIND THE 100TH TERM IN THE FOLLOWING ARITHMETIC SEQUENCE: -10, -15, -20, -25, ...

WHEN APPROACHING AN ARITHMETIC SEQUENCE, ONE OF THE MOST COMMON AND FUNDAMENTAL PROBLEMS INVOLVES FINDING A SPECIFIC TERM WITHIN THE SEQUENCE. IN THIS CASE, OUR GOAL IS TO DETERMINE THE 100TH TERM OF THE SEQUENCE: -10, -15, -20, -25, ... THIS TASK NOT ONLY REINFORCES THE UNDERSTANDING OF ARITHMETIC SEQUENCES BUT ALSO EMPHASIZES THE IMPORTANCE OF DERIVING AND APPLYING A GENERAL FORMULA. THIS ARTICLE WILL GUIDE YOU THROUGH THE PROCESS STEP-BY-STEP, BREAKING DOWN THE CONCEPTS, FORMULAS, AND METHODS NEEDED TO SOLVE SUCH PROBLEMS EFFICIENTLY.

UNDERSTANDING ARITHMETIC SEQUENCES

BEFORE DIVING INTO THE SOLUTION, IT'S ESSENTIAL TO GRASP WHAT AN ARITHMETIC SEQUENCE IS AND ITS DEFINING CHARACTERISTICS.

DEFINITION OF AN ARITHMETIC SEQUENCE

AN ARITHMETIC SEQUENCE IS A SEQUENCE OF NUMBERS IN WHICH THE DIFFERENCE BETWEEN ANY TWO CONSECUTIVE TERMS IS CONSTANT. THIS CONSTANT DIFFERENCE IS CALLED THE COMMON DIFFERENCE, DENOTED AS (d) .

EXAMPLE:

FOR THE SEQUENCE: 3, 7, 11, 15, ...

- THE COMMON DIFFERENCE $(d = 4)$
- EACH TERM INCREASES BY 4 FROM THE PREVIOUS TERM.

IN OUR SEQUENCE:

- SEQUENCE: -10, -15, -20, -25, ...
- COMMON DIFFERENCE $(d = -5)$ (SINCE EACH TERM DECREASES BY 5)

KEY PROPERTIES OF ARITHMETIC SEQUENCES

- THE SEQUENCE PROGRESSES LINEARLY.
- THE (n^{th}) TERM CAN BE EXPRESSED USING A GENERAL FORMULA.
- THE SEQUENCE IS FULLY CHARACTERIZED BY ITS FIRST TERM AND COMMON DIFFERENCE.

DERIVING THE GENERAL FORMULA FOR THE N-TH TERM

THE CORE TOOL FOR SOLVING PROBLEMS INVOLVING SPECIFIC TERMS IN AN ARITHMETIC SEQUENCE IS THE FORMULA FOR THE (n^{th}) TERM.

GENERAL FORMULA FOR THE (n^{th}) TERM

IF (a_1) IS THE FIRST TERM, AND (d) IS THE COMMON DIFFERENCE, THEN THE (n^{th}) TERM, DENOTED AS (a_n) , IS GIVEN BY:

$$a_n = a_1 + (n - 1)d$$

EXPLANATION:

- STARTING FROM THE FIRST TERM (a_1) , EACH SUBSEQUENT TERM INCREASES (OR DECREASES) BY (d) .
- TO REACH THE (n^{th}) TERM, WE ADD $(n - 1)$ TIMES THE COMMON DIFFERENCE.

APPLYING THE FORMULA TO OUR SEQUENCE

GIVEN SEQUENCE: -10, -15, -20, -25, ...

- FIRST TERM: $(a_1 = -10)$
- COMMON DIFFERENCE: $(d = -5)$

PLUGGING INTO THE FORMULA:

$$a_n = -10 + (n - 1)(-5)$$

THIS SIMPLIFIES TO:

$$a_n = -10 - 5(n - 1)$$

FURTHER SIMPLIFYING:

$$\begin{aligned} a_n &= -10 - 5n + 5 \\ a_n &= (-10 + 5) - 5n \\ a_n &= -5 - 5n \end{aligned}$$

SO, THE EXPLICIT FORMULA FOR THE n^{th} TERM OF OUR SEQUENCE IS:

$$a_n = -5(n + 1)$$

NOTE: THIS FORMULA ALLOWS US TO DIRECTLY COMPUTE ANY TERM IN THE SEQUENCE WITHOUT LISTING ALL PREVIOUS TERMS.

FINDING THE 100TH TERM

USING THE DERIVED FORMULA:

$$a_n = -5(n + 1)$$

WE CAN SUBSTITUTE $(n = 100)$:

$$a_{100} = -5(100 + 1) = -5 \times 101 = -505$$

RESULT:

THE 100TH TERM IN THE SEQUENCE IS -505.

STEP-BY-STEP SUMMARY OF THE SOLUTION PROCESS

1. IDENTIFY THE FIRST TERM AND COMMON DIFFERENCE:

- FIRST TERM $(a_1 = -10)$
- COMMON DIFFERENCE $(d = -5)$

2. DERIVE THE GENERAL FORMULA:

$$a_n = a_1 + (n - 1)d$$

SUBSTITUTING KNOWN VALUES:

$$a_n = -10 + (n - 1)(-5) = -5(n + 1)$$

3. CALCULATE THE DESIRED TERM (THE 100TH):

$$a_{100} = -5(100 + 1) = -505$$

FEATURES AND BENEFITS OF USING THE FORMULA APPROACH

USING A FORMULA TO FIND SPECIFIC TERMS IN AN ARITHMETIC SEQUENCE OFFERS SEVERAL ADVANTAGES:

PROS:

- EFFICIENCY: QUICKLY COMPUTE ANY TERM WITHOUT LISTING ALL PREVIOUS TERMS.
- ACCURACY: REDUCES THE CHANCE OF MANUAL CALCULATION ERRORS.
- VERSATILITY: EASILY ADAPTABLE FOR ANY POSITION (n) IN THE SEQUENCE.
- CLARITY: PROVIDES A CLEAR MATHEMATICAL EXPRESSION THAT DESCRIBES THE SEQUENCE.

CONS:

- REQUIRES UNDERSTANDING OF THE DERIVATION: IF UNFAMILIAR WITH THE FORMULA, INITIAL COMPREHENSION MAY BE CHALLENGING.
- ASSUMES CORRECT IDENTIFICATION OF (a_1) AND (d) : MISTAKES IN THESE VALUES LEAD TO INCORRECT RESULTS.
- LIMITED TO LINEAR SEQUENCES: NOT APPLICABLE TO GEOMETRIC OR OTHER COMPLEX SEQUENCES WITHOUT MODIFICATION.

ADDITIONAL TIPS FOR SOLVING SIMILAR PROBLEMS

- ALWAYS VERIFY THE FIRST TERM AND COMMON DIFFERENCE BEFORE APPLYING THE FORMULA.
- IN SEQUENCES WHERE THE PATTERN IS NOT IMMEDIATELY OBVIOUS, LIST THE FIRST FEW TERMS TO IDENTIFY (a_1) AND (d) .
- FOR LARGE (n) , RELY ON THE FORMULA RATHER THAN LISTING TERMS.
- PRACTICE DERIVING THE FORMULA FROM THE SEQUENCE TO STRENGTHEN UNDERSTANDING.

CONCLUSION

FINDING THE 100^{th} TERM IN AN ARITHMETIC SEQUENCE IS STRAIGHTFORWARD ONCE YOU UNDERSTAND THE UNDERLYING FORMULA. THE KEY STEPS INVOLVE IDENTIFYING THE FIRST TERM AND THE COMMON DIFFERENCE, DERIVING THE GENERAL FORMULA, AND SUBSTITUTING THE SPECIFIC TERM NUMBER. IN OUR EXAMPLE, THE SEQUENCE: $-10, -15, -20, -25, \dots$ YIELDS A 100TH TERM OF -505 . MASTERY OF THIS APPROACH ENHANCES PROBLEM-SOLVING SKILLS IN ALGEBRA AND PREPARES YOU FOR MORE ADVANCED TOPICS INVOLVING SEQUENCES AND SERIES.

BY DEVELOPING A STRONG GRASP OF THE FORMULA AND ITS APPLICATION, STUDENTS AND LEARNERS CAN CONFIDENTLY TACKLE SIMILAR PROBLEMS, ANALYZE PATTERNS, AND EXPLORE THE FASCINATING WORLD OF SEQUENCES WITH CLARITY AND PRECISION.

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