

GIVEN $F(x) = x - 2$, IF THE DOMAIN IS 5, FIND THE RANGE

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UNDERSTANDING FUNCTIONS IS FUNDAMENTAL IN MATHEMATICS, ESPECIALLY WHEN DEALING WITH CONCEPTS SUCH AS DOMAIN AND RANGE. IN THIS ARTICLE, WE WILL EXPLORE HOW TO DETERMINE THE RANGE OF A SIMPLE LINEAR FUNCTION GIVEN A SPECIFIC DOMAIN. SPECIFICALLY, WE WILL ANALYZE THE FUNCTION $F(x) = x - 2$ WHEN THE DOMAIN IS LIMITED TO FIVE ELEMENTS. THIS GUIDE AIMS TO CLARIFY THE PROCESS, PROVIDE STEP-BY-STEP INSTRUCTIONS, AND OFFER INSIGHTS INTO RELATED MATHEMATICAL PRINCIPLES, MAKING IT ACCESSIBLE FOR STUDENTS, EDUCATORS, AND MATH ENTHUSIASTS ALIKE.

UNDERSTANDING THE FUNCTION $F(x) = x - 2$

BEFORE DIVING INTO THE PROBLEM, IT IS ESSENTIAL TO UNDERSTAND THE BASIC STRUCTURE AND BEHAVIOR OF THE FUNCTION $F(x) = x - 2$.

WHAT IS A LINEAR FUNCTION?

A LINEAR FUNCTION IS A FUNCTION WHOSE GRAPH IS A STRAIGHT LINE. IT CAN GENERALLY BE WRITTEN IN THE FORM $F(x) = mx + b$, WHERE:

- m IS THE SLOPE OF THE LINE
- b IS THE Y-INTERCEPT

IN OUR CASE, $F(x) = x - 2$, WHICH IS LINEAR WITH:

- SLOPE (m) = 1
- Y-INTERCEPT (b) = -2

GRAPHICAL REPRESENTATION

THE GRAPH OF $F(x) = x - 2$ IS A STRAIGHT LINE CROSSING THE Y-AXIS AT -2 AND INCREASING WITH A SLOPE OF 1. THIS MEANS FOR EVERY INCREASE OF 1 IN x , $F(x)$ INCREASES BY 1.

DEFINING THE DOMAIN AND RANGE

WHAT IS DOMAIN?

THE DOMAIN OF A FUNCTION REFERS TO THE SET OF ALL POSSIBLE INPUT VALUES (x -VALUES) FOR WHICH THE FUNCTION IS DEFINED.

WHAT IS RANGE?

THE RANGE OF A FUNCTION IS THE SET OF ALL OUTPUT VALUES ($F(x)$ OR y -VALUES) PRODUCED BY THE FUNCTION FOR THE GIVEN DOMAIN.

SPECIFYING THE DOMAIN: THE NUMBER 5

IN THE PROBLEM, THE DOMAIN IS SPECIFIED AS 5, WHICH TYPICALLY INDICATES THAT THE DOMAIN CONSISTS OF EXACTLY FIVE ELEMENTS OR VALUES.

COMMON INTERPRETATIONS INCLUDE:

- THE DOMAIN IS A SET OF FIVE SPECIFIC VALUES, SUCH AS $\{x_1, x_2, x_3, x_4, x_5\}$
- THE DOMAIN IS AN INTERVAL WITH LENGTH 5 (E.G., FROM SOME VALUE A TO $A+5$)
- THE DOMAIN IS A SET OF FIVE CONSECUTIVE INTEGERS

FOR CLARITY, IN MOST CASES, THE DOMAIN BEING "5" SUGGESTS A SET OF FIVE SPECIFIC X-VALUES.

FINDING THE RANGE WHEN THE DOMAIN IS 5

STEP 1: CLARIFY THE DOMAIN

SINCE THE PROBLEM STATES "THE DOMAIN IS 5," THE FIRST STEP IS TO DETERMINE EXACTLY WHICH FIVE X-VALUES ARE INVOLVED.

POSSIBLE INTERPRETATIONS:

1. THE DOMAIN CONSISTS OF FIVE SPECIFIC X-VALUES: $\{x_1, x_2, x_3, x_4, x_5\}$
2. THE DOMAIN IS A SET OF FIVE CONSECUTIVE INTEGERS: $\{x, x+1, x+2, x+3, x+4\}$
3. THE DOMAIN IS AN INTERVAL OF LENGTH 5: $[A, A+5]$

ASSUMPTION FOR THIS ARTICLE: LET'S ASSUME THE DOMAIN IS A SET OF FIVE CONSECUTIVE INTEGERS FOR DEMONSTRATION:

- DOMAIN = $\{x, x+1, x+2, x+3, x+4\}$

YOU CAN REPLACE THESE WITH ANY SPECIFIC VALUES BASED ON THE ACTUAL PROBLEM.

STEP 2: COMPUTE THE FUNCTION VALUES

ONCE THE DOMAIN IS DEFINED, CALCULATE THE CORRESPONDING FUNCTION OUTPUTS FOR EACH X-VALUE.

EXAMPLE:

SUPPOSE THE DOMAIN IS $\{1, 2, 3, 4, 5\}$

CALCULATIONS:

- $F(1) = 1 - 2 = -1$
- $F(2) = 2 - 2 = 0$
- $F(3) = 3 - 2 = 1$
- $F(4) = 4 - 2 = 2$
- $F(5) = 5 - 2 = 3$

RESULTING RANGE: $\{-1, 0, 1, 2, 3\}$

STEP 3: DETERMINE THE RANGE

THE RANGE IS THE SET OF ALL OUTPUT VALUES CORRESPONDING TO THE DOMAIN.

IN THE ABOVE EXAMPLE, THE RANGE IS: $\{-1, 0, 1, 2, 3\}$

KEY POINTS:

- SINCE THE FUNCTION IS LINEAR WITH A SLOPE OF 1, THE OUTPUTS FORM AN ARITHMETIC SEQUENCE.
- THE MINIMUM OUTPUT CORRESPONDS TO THE SMALLEST X-VALUE, AND THE MAXIMUM OUTPUT CORRESPONDS TO THE LARGEST X-VALUE.

GENERAL APPROACH FOR FINDING THE RANGE

1. IDENTIFY THE DOMAIN

- IS IT A SET OF SPECIFIC NUMBERS?
- IS IT AN INTERVAL?
- IS IT A SET OF CONSECUTIVE INTEGERS?

2. CALCULATE THE FUNCTION OUTPUTS FOR EACH DOMAIN ELEMENT

- SUBSTITUTE EACH X-VALUE INTO $F(x) = x - 2$
- RECORD THE OUTPUTS

3. FIND THE MINIMUM AND MAXIMUM OUTPUT VALUES

- THE RANGE WILL SPAN FROM THE MINIMUM TO THE MAXIMUM OUTPUT
- FOR DISCRETE SETS, THE RANGE IS THE SET OF ALL OUTPUT VALUES
- FOR CONTINUOUS INTERVALS, THE RANGE IS AN INTERVAL BETWEEN THE MINIMUM AND MAXIMUM

4. EXPRESS THE RANGE

- AS A SET FOR DISCRETE DOMAINS
- AS AN INTERVAL FOR CONTINUOUS DOMAINS

EXAMPLE: DOMAIN AS FIVE CONSECUTIVE INTEGERS

SUPPOSE THE DOMAIN IS $\{10, 11, 12, 13, 14\}$

CALCULATIONS:

- $F(10) = 10 - 2 = 8$
- $F(11) = 11 - 2 = 9$
- $F(12) = 12 - 2 = 10$
- $F(13) = 13 - 2 = 11$
- $F(14) = 14 - 2 = 12$

RANGE: {8, 9, 10, 11, 12}

SPECIAL CASES AND CONSIDERATIONS

MULTIPLE TYPES OF DOMAINS

- FINITE SETS: DIRECT CALCULATION OF OUTPUTS YIELDS THE RANGE.
- INTERVALS: THE RANGE IS CONTINUOUS; THE MINIMUM AND MAXIMUM OUTPUTS DEFINE THE INTERVAL.
- INFINITE DOMAINS: NOT APPLICABLE IN THIS SPECIFIC PROBLEM, BUT IMPORTANT TO RECOGNIZE FOR BROADER UNDERSTANDING.

NON-LINEAR FUNCTIONS

WHILE OUR FOCUS IS ON A LINEAR FUNCTION, THE APPROACH VARIES FOR NON-LINEAR FUNCTIONS, REQUIRING MORE ADVANCED TECHNIQUES SUCH AS CALCULUS FOR CONTINUOUS DOMAINS.

IMPACT OF DOMAIN RESTRICTIONS

RESTRICTING THE DOMAIN AFFECTS THE RANGE SIGNIFICANTLY. FOR EXAMPLE, LIMITING x TO POSITIVE VALUES OR TO A SPECIFIC INTERVAL CHANGES THE OUTPUT SET.

CONCLUSION AND SUMMARY

IN THIS ARTICLE, WE'VE DISSECTED THE PROCESS OF FINDING THE RANGE OF THE FUNCTION $F(x) = x - 2$ WHEN THE DOMAIN IS SPECIFIED AS FIVE ELEMENTS. THE KEY STEPS INVOLVE:

1. CLARIFYING THE DOMAIN: KNOWING WHICH FIVE x -VALUES ARE INVOLVED.
2. COMPUTING THE CORRESPONDING $F(x)$ VALUES FOR EACH DOMAIN ELEMENT.
3. IDENTIFYING THE MINIMUM AND MAXIMUM OUTPUTS.
4. EXPRESSING THE RANGE EITHER AS A SET OR AN INTERVAL.

KEY TAKEAWAYS:

- FOR A LINEAR FUNCTION LIKE $F(x) = x - 2$, THE RANGE DEPENDS DIRECTLY ON THE DOMAIN.
- WHEN THE DOMAIN IS A SET OF FINITE POINTS, THE RANGE IS THE SET OF CORRESPONDING OUTPUTS.
- WHEN THE DOMAIN IS AN INTERVAL, THE RANGE IS THE INTERVAL BETWEEN THE MINIMUM AND MAXIMUM OUTPUT VALUES.

PRACTICAL TIP: ALWAYS CLARIFY THE EXACT DOMAIN BEFORE ATTEMPTING TO FIND THE RANGE, AS ASSUMPTIONS CAN LEAD TO INCORRECT CONCLUSIONS.

ADDITIONAL RESOURCES FOR LEARNING ABOUT DOMAIN AND RANGE

- KHAN ACADEMY'S ALGEBRA COURSE: COMPREHENSIVE LESSONS ON FUNCTIONS, DOMAIN, AND RANGE.
- MATH IS FUN: INTERACTIVE EXPLANATIONS AND EXAMPLES.
- PURPLEMATH: DETAILED TUTORIALS ON FUNCTIONS AND THEIR PROPERTIES.

By mastering these concepts, students can confidently analyze various types of functions and understand how domain restrictions influence their range. Whether for academic purposes or practical applications, understanding the relationship between domain and range is fundamental in mathematics.

META DESCRIPTION: LEARN HOW TO FIND THE RANGE OF THE FUNCTION $F(x) = x - 2$ WHEN THE DOMAIN IS FIVE ELEMENTS. STEP-BY-STEP GUIDE WITH EXAMPLES, EXPLANATIONS, AND TIPS FOR MASTERING FUNCTIONS AND THEIR PROPERTIES.

FREQUENTLY ASKED QUESTIONS

WHAT IS THE FUNCTION GIVEN IN THE PROBLEM?

THE FUNCTION GIVEN IS $F(x) = x - 2$.

WHAT IS THE DOMAIN PROVIDED FOR THE FUNCTION?

THE DOMAIN PROVIDED IS 5.

HOW DO YOU INTERPRET THE DOMAIN '5' IN THIS CONTEXT?

IT MEANS THE INPUT x CAN ONLY BE THE VALUE 5.

HOW DO YOU FIND THE RANGE OF THE FUNCTION WHEN THE DOMAIN IS A SINGLE VALUE?

SINCE THE DOMAIN IS 5, THE RANGE IS SIMPLY $F(5) = 5 - 2 = 3$.

WHAT IS THE RANGE OF $F(x)$ WHEN THE DOMAIN IS 5?

THE RANGE IS 3.

CAN THE RANGE BE DIFFERENT IF THE DOMAIN IS DIFFERENT?

YES, CHANGING THE DOMAIN WILL AFFECT THE RANGE; HERE, WITH DOMAIN 5, THE RANGE IS 3.

ADDITIONAL RESOURCES

GIVEN $F(x) = x - 2$, IF THE DOMAIN IS 5, FIND THE RANGE

INTRODUCTION

IN THE REALM OF ALGEBRA AND FUNCTION ANALYSIS, UNDERSTANDING THE INTERPLAY BETWEEN A FUNCTION'S DOMAIN AND ITS RANGE IS FUNDAMENTAL. THIS RELATIONSHIP NOT ONLY SHEDS LIGHT ON THE BEHAVIOR OF THE FUNCTION BUT ALSO SERVES AS A CORNERSTONE IN VARIOUS MATHEMATICAL APPLICATIONS, FROM CALCULUS TO REAL-WORLD PROBLEM-SOLVING. THE PROBLEM STATEMENT—GIVEN $F(x) = x - 2$, IF THE DOMAIN IS 5, FIND THE RANGE—MAY INITIALLY APPEAR STRAIGHTFORWARD, BUT IT ENCAPSULATES ESSENTIAL CONCEPTS THAT MERIT A COMPREHENSIVE EXPLORATION. THIS ARTICLE AIMS TO DISSECT THIS QUESTION THOROUGHLY, PROVIDING CLARITY, CONTEXT, AND DETAILED INSIGHT INTO HOW THE DOMAIN INFLUENCES THE RANGE, ESPECIALLY WITHIN THE FRAMEWORK OF A LINEAR FUNCTION.

UNDERSTANDING THE FUNCTION $F(x) = x - 2$

AT ITS CORE, THE FUNCTION $F(x) = x - 2$ IS A LINEAR FUNCTION CHARACTERIZED BY ITS SLOPE AND Y-INTERCEPT. EXPRESSED IN SLOPE-INTERCEPT FORM:

- SLOPE (M): 1
- Y-INTERCEPT (B): -2

THIS MEANS THAT FOR ANY INPUT x , THE OUTPUT $F(x)$ IS EXACTLY ONE UNIT GREATER THAN x MINUS 2. LINEAR FUNCTIONS ARE WELL-UNDERSTOOD FOR THEIR CONSTANT RATE OF CHANGE, WHICH IMPLIES THAT THEIR GRAPHS ARE STRAIGHT LINES EXTENDING INFINITELY IN BOTH DIRECTIONS.

CLARIFYING THE DOMAIN AND RANGE

BEFORE DELVING INTO CALCULATIONS, IT'S CRUCIAL TO INTERPRET THE PROBLEM STATEMENT ACCURATELY:

- DOMAIN: THE SET OF ALL POSSIBLE INPUT VALUES FOR THE FUNCTION.
- RANGE: THE SET OF ALL POSSIBLE OUTPUT VALUES.

THE QUESTION SPECIFIES: "IF THE DOMAIN IS 5". THIS PHRASE IS SOMEWHAT AMBIGUOUS BUT, IN TYPICAL MATHEMATICAL CONTEXT, IT SUGGESTS THAT THE DOMAIN IS LIMITED TO A SINGLE VALUE, I.E., THE SET $\{5\}$. ALTERNATIVELY, IT COULD IMPLY THE DOMAIN IS A SET OF FIVE ELEMENTS, BUT GIVEN THE PHRASING, THE MOST LOGICAL INTERPRETATION IS THAT THE DOMAIN CONTAINS JUST ONE ELEMENT, 5.

ANALYZING THE DOMAIN AS A SINGLE VALUE

WHEN THE DOMAIN IS $\{5\}$

IF THE DOMAIN OF $F(x)$ IS RESTRICTED EXCLUSIVELY TO THE VALUE $\{5\}$, THEN THE FUNCTION'S BEHAVIOR IS ESSENTIALLY EVALUATED AT THAT POINT:

- INPUT: $x = 5$
- OUTPUT: $F(5) = 5 - 2 = 3$

RESULT: THE RANGE, UNDER THIS DOMAIN RESTRICTION, IS SIMPLY THE SINGLETON SET $\{3\}$.

IN OTHER WORDS, RESTRICTING THE DOMAIN TO A SINGLE POINT COLLAPSES THE RANGE TO A SINGLE VALUE. THIS SCENARIO IS OFTEN ENCOUNTERED IN FUNCTIONS DEFINED OVER RESTRICTED DOMAINS, SUCH AS IN PIECEWISE FUNCTIONS OR IN PROBLEM-SPECIFIC CONTEXTS.

EXTENDING THE INTERPRETATION: WHAT IF THE DOMAIN IS A SET OF 5 ELEMENTS?

WHILE LESS DIRECTLY IMPLIED, SOME INTERPRETATIONS CONSIDER THE DOMAIN AS A SET OF FIVE ELEMENTS. FOR EXAMPLE, IF THE DOMAIN IS $\{x_1, x_2, x_3, x_4, x_5\}$, THEN:

- THE RANGE WOULD BE THE SET OF CORRESPONDING OUTPUTS:

$$F(x_1), F(x_2), F(x_3), F(x_4), F(x_5)$$

- SINCE $F(x) = x - 2$, THE RANGE WOULD BE THE SET:

$$\{x_1 - 2, x_2 - 2, x_3 - 2, x_4 - 2, x_5 - 2\}$$

IN SUCH A CASE, THE ACTUAL RANGE DEPENDS ON THE SPECIFIC X-VALUES WITHIN THE DOMAIN. WITHOUT EXPLICIT X-VALUES, THE RANGE CANNOT BE PRECISELY DETERMINED.

KEY INSIGHTS AND IMPLICATIONS

1. SINGLE-VALUE DOMAIN

- WHEN THE DOMAIN CONSISTS OF A SINGLE POINT, THE RANGE IS THAT POINT'S IMAGE UNDER THE FUNCTION.
- FOR THE GIVEN FUNCTION AND DOMAIN $\{5\}$, THE RANGE IS $\{3\}$.

2. MULTIPLE-VALUE (FINITE) DOMAINS

- IF THE DOMAIN SPECIFIES MULTIPLE POINTS, THE RANGE IS A SET OF CORRESPONDING OUTPUTS.
- FOR EXAMPLE, IF THE DOMAIN IS $\{1, 2, 3, 4, 5\}$, THEN:

$$\text{Range} = \{1 - 2, 2 - 2, 3 - 2, 4 - 2, 5 - 2\} = \{-1, 0, 1, 2, 3\}$$

- THE RANGE IN THIS CASE IS A FINITE SET: $\{-1, 0, 1, 2, 3\}$.

3. INFINITE DOMAINS

- FOR AN UNRESTRICTED DOMAIN (ALL REAL NUMBERS), THE RANGE OF $F(x) = x - 2$ IS ALSO ALL REAL NUMBERS, EXTENDING FROM $-\infty$ TO $+\infty$.
- RESTRICTING THE DOMAIN TO A FINITE SET LIMITS THE RANGE ACCORDINGLY.

FORMAL MATHEMATICAL EXPLANATION

CASE 1: DOMAIN IS $\{5\}$

- DOMAIN $D = \{5\}$
- RANGE $R = \{F(5)\} = \{5 - 2\} = \{3\}$

CASE 2: DOMAIN IS AN INTERVAL OR SET OF MULTIPLE ELEMENTS

- $D = \{x_1, x_2, \dots, x_n\}$
- $R = \{x_1 - 2, x_2 - 2, \dots, x_n - 2\}$

THUS, THE RANGE IS DIRECTLY DETERMINED BY THE DOMAIN ELEMENTS.

PRACTICAL EXAMPLES AND APPLICATIONS

UNDERSTANDING THIS RELATIONSHIP IS ESSENTIAL ACROSS NUMEROUS FIELDS:

- COMPUTER PROGRAMMING: LIMITING INPUT VALUES TO SPECIFIC DOMAINS AFFECTS OUTPUT EXPECTATIONS.
- PHYSICS: WHEN MODELING LINEAR RELATIONSHIPS (E.G., CONSTANT VELOCITY), THE DOMAIN RESTRICTIONS REFLECT PHYSICAL CONSTRAINTS.
- ECONOMICS: DEMAND FUNCTIONS OR SUPPLY MODELS OFTEN CONSIDER RESTRICTED DOMAINS REPRESENTING SPECIFIC MARKET CONDITIONS.

COMMON MISCONCEPTIONS AND CLARIFICATIONS

- MISCONCEPTION: THE RANGE OF A LINEAR FUNCTION IS ALWAYS ALL REAL NUMBERS.

CLARIFICATION: THE FULL RANGE OF $F(x) = x - 2$ IS $\mathbb{R}$, BUT RESTRICTING THE DOMAIN TO A FINITE SET OR A SPECIFIC POINT LIMITS THE RANGE ACCORDINGLY.

- MISCONCEPTION: THE DOMAIN AND RANGE ARE ALWAYS BOTH INFINITE.

CLARIFICATION: DOMAINS CAN BE FINITE OR RESTRICTED, WHICH CONSEQUENTLY LIMITS THE RANGE.

- AMBIGUITY IN PROBLEM STATEMENT: THE PHRASE "THE DOMAIN IS 5" SHOULD IDEALLY SPECIFY WHETHER IT MEANS A DOMAIN OF A SINGLE ELEMENT $\{5\}$ OR A SET OF FIVE ELEMENTS. CONTEXTUALLY, THE SIMPLEST INTERPRETATION IS A SINGLETON DOMAIN.

FINAL CONCLUSIONS

THE CORE TAKEAWAY FROM THE PROBLEM "GIVEN $F(x) = x - 2$, IF THE DOMAIN IS 5, FIND THE RANGE" IS:

- IF THE DOMAIN IS EXACTLY THE SET $\{5\}$, THEN:

$$\text{Range} = \{3\}$$

- IF THE DOMAIN IS A SET OF MULTIPLE ELEMENTS, THE RANGE IS THE SET OF THEIR IMAGES UNDER $F(x)$:

$$\text{Range} = \{x - 2 \mid x \in \text{Domain}\}$$

- FOR AN UNRESTRICTED DOMAIN (ALL REAL NUMBERS), THE RANGE IS ALL REAL NUMBERS.

THIS EXPLORATION UNDERSCORES THE IMPORTANCE OF EXPLICITLY UNDERSTANDING THE DOMAIN IN FUNCTION ANALYSIS, ESPECIALLY WHEN DEALING WITH LINEAR FUNCTIONS. RECOGNIZING THE INFLUENCE OF DOMAIN RESTRICTIONS ON THE RANGE IS VITAL FOR ACCURATE INTERPRETATION AND APPLICATION ACROSS MATHEMATICAL AND REAL-WORLD CONTEXTS.

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