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UNDERSTANDING THE DIMENSIONS OF A RECTANGLE IS FUNDAMENTAL IN GEOMETRY, ESPECIALLY WHEN DEALING WITH REAL-WORLD APPLICATIONS SUCH AS CONSTRUCTION, DESIGN, AND MANUFACTURING. IN THIS GUIDE, WE WILL EXPLORE A SPECIFIC PROBLEM INVOLVING A RECTANGLE WHERE THE LENGTH DEPENDS ON ITS WIDTH, AND THE PERIMETER IS GIVEN. WE WILL ANALYZE HOW TO DETERMINE THE RECTANGLE'S DIMENSIONS USING ALGEBRAIC METHODS, INTERPRET THE RESULTS, AND UNDERSTAND THE IMPLICATIONS OF THESE MEASUREMENTS. THIS COMPREHENSIVE DISCUSSION AIMS TO HELP STUDENTS, EDUCATORS, AND ENTHUSIASTS GRASP THE PROCESS OF SOLVING SUCH GEOMETRIC PROBLEMS EFFECTIVELY.

INTRODUCTION TO RECTANGLES AND THEIR PROPERTIES

BEFORE DELVING INTO THE SPECIFIC PROBLEM, IT'S CRUCIAL TO REVIEW THE BASIC PROPERTIES OF RECTANGLES, AS THEY FORM THE FOUNDATION FOR UNDERSTANDING THE PROBLEM'S CONTEXT.

WHAT IS A RECTANGLE?

A RECTANGLE IS A FOUR-SIDED POLYGON (QUADRILATERAL) CHARACTERIZED BY:

- OPPOSITE SIDES THAT ARE EQUAL IN LENGTH.
- INTERIOR ANGLES THAT ARE ALL RIGHT ANGLES (90 DEGREES).

KEY PROPERTIES OF RECTANGLES

UNDERSTANDING THESE PROPERTIES HELPS IN SOLVING PROBLEMS RELATED TO RECTANGLES:

1. PERIMETER: THE TOTAL DISTANCE AROUND THE RECTANGLE, CALCULATED AS 2 TIMES THE SUM OF ITS LENGTH AND WIDTH.
2. AREA: THE SPACE ENCLOSED WITHIN THE RECTANGLE, CALCULATED AS LENGTH MULTIPLIED BY WIDTH.
3. DIAGONAL: THE LINE SEGMENT CONNECTING OPPOSITE CORNERS, WHICH CAN BE CALCULATED USING THE PYTHAGOREAN THEOREM.

PROBLEM STATEMENT AND KEY INFORMATION

THE PROBLEM STATEMENT PROVIDES SPECIFIC DETAILS:

- THE LENGTH (L) OF A RECTANGLE IS 3 MORE THAN 3 TIMES ITS WIDTH (W).
- THE PERIMETER (P) OF THE RECTANGLE IS 174 INCHES.

EXPRESSED MATHEMATICALLY:

$$- L = 3 + 3W$$

$$- P = 174 \text{ INCHES}$$

OUR GOAL IS TO DETERMINE THE DIMENSIONS — SPECIFICALLY, THE WIDTH (W) AND THE LENGTH (L) — OF THE RECTANGLE BASED ON THIS INFORMATION.

FORMULATING THE MATHEMATICAL MODEL

TO SOLVE THE PROBLEM, WE TRANSLATE THE GIVEN INFORMATION INTO ALGEBRAIC EQUATIONS.

EXPRESSING LENGTH IN TERMS OF WIDTH

GIVEN:

$$L = 3 + 3W$$

THIS EQUATION INDICATES THAT THE LENGTH DEPENDS LINEARLY ON THE WIDTH.

USING THE PERIMETER FORMULA

THE PERIMETER (P) OF A RECTANGLE IS GIVEN BY:

$$P = 2(L + W)$$

SUBSTITUTING THE KNOWN PERIMETER:

$$174 = 2(L + W)$$

NOW, SUBSTITUTE L FROM THE FIRST EQUATION INTO THE PERIMETER FORMULA:

$$174 = 2((3 + 3W) + W)$$

SIMPLIFY THE EXPRESSION INSIDE THE PARENTHESES:

$$174 = 2(3 + 3W + W)$$

$$174 = 2(3 + 4W)$$

DISTRIBUTE THE 2:

$$174 = 2 \cdot 3 + 2 \cdot 4W$$

$$174 = 6 + 8W$$

NEXT, SOLVE FOR W:

$$174 - 6 = 8W$$

$$168 = 8W$$

$$W = 21$$

HAVING W , WE FIND L :

$$L = 3 + 3W = 3 + 3(21) = 3 + 63 = 66$$

RESULT:

- WIDTH (W) = 21 INCHES
- LENGTH (L) = 66 INCHES

INTERPRETING THE RESULTS

THE CALCULATIONS REVEAL THAT THE RECTANGLE'S WIDTH IS 21 INCHES, AND ITS LENGTH IS 66 INCHES. THESE DIMENSIONS SATISFY THE ORIGINAL CONDITIONS:

- THE LENGTH IS INDEED 3 MORE THAN 3 TIMES THE WIDTH: $3 + 3(21) = 66$ INCHES.
- THE PERIMETER MATCHES THE GIVEN TOTAL: $2(66 + 21) = 2(87) = 174$ INCHES.

UNDERSTANDING THESE RESULTS PROVIDES INSIGHT INTO HOW ALGEBRAIC EXPRESSIONS MODEL REAL-WORLD GEOMETRY PROBLEMS.

ADDITIONAL GEOMETRIC CONSIDERATIONS

WHILE THE PROBLEM PRIMARILY FOCUSES ON PERIMETER AND THE RELATIONSHIP BETWEEN LENGTH AND WIDTH, THERE ARE OTHER ASPECTS TO CONSIDER:

AREA OF THE RECTANGLE

CALCULATING THE AREA PROVIDES ADDITIONAL UNDERSTANDING OF THE SIZE OF THE RECTANGLE:

$$\text{AREA} = L \times W = 66 \times 21 = 1386 \text{ SQUARE INCHES}$$

THIS LARGE AREA MIGHT BE RELEVANT IN APPLICATIONS LIKE LAND MEASUREMENT OR MATERIAL ESTIMATION.

DIAGONAL LENGTH

USING THE PYTHAGOREAN THEOREM:

$$D = \sqrt{L^2 + W^2} = \sqrt{66^2 + 21^2} = \sqrt{4356 + 441} = \sqrt{4797} \approx 69.28 \text{ INCHES}$$

KNOWING THE DIAGONAL LENGTH CAN BE USEFUL IN CONSTRUCTION AND DESIGN FOR FITTING PURPOSES OR STRUCTURAL ANALYSIS.

PRACTICAL APPLICATIONS OF THE PROBLEM

UNDERSTANDING HOW TO DETERMINE THE DIMENSIONS OF A RECTANGLE BASED ON PERIMETER AND PROPORTIONAL RELATIONSHIPS IS VALUABLE ACROSS VARIOUS FIELDS:

ARCHITECTURE AND CONSTRUCTION

- DESIGNING ROOMS, FLOORS, OR OUTDOOR AREAS WITH SPECIFIC PERIMETER CONSTRAINTS.
- ESTIMATING MATERIALS NEEDED BASED ON DIMENSIONS.

MANUFACTURING AND FABRICATION

- CUTTING MATERIALS TO PRECISE SIZES FOR FURNITURE, FABRICS, OR PACKAGING.
- ENSURING COMPONENTS FIT WITHIN SPECIFIED LIMITS.

LANDSCAPING AND LAND MEASUREMENT

- CALCULATING AREAS OF PLOTS WITH KNOWN BOUNDARY LENGTHS.
- PLANNING FENCES OR BOUNDARY WALLS.

STEP-BY-STEP SUMMARY OF THE SOLUTION PROCESS

TO ENSURE CLARITY, HERE IS A SUMMARIZED STEP-BY-STEP GUIDE TO SOLVING SIMILAR PROBLEMS:

1. IDENTIFY THE VARIABLES INVOLVED (E.G., WIDTH W , LENGTH L).
2. TRANSLATE THE PROBLEM STATEMENT INTO ALGEBRAIC EQUATIONS (E.G., $L = 3 + 3W$).
3. USE KNOWN FORMULAS (PERIMETER $= 2(L + W)$).
4. SUBSTITUTE ONE VARIABLE'S EXPRESSION INTO THE PERIMETER FORMULA TO CREATE AN EQUATION WITH ONE VARIABLE.
5. SOLVE FOR THE VARIABLE (W).
6. CALCULATE THE OTHER VARIABLE (L) USING ITS EXPRESSION.
7. VERIFY THE SOLUTION BY CHECKING IF IT SATISFIES ALL ORIGINAL CONDITIONS.
8. INTERPRET THE RESULTS IN CONTEXT, INCLUDING ADDITIONAL PROPERTIES LIKE AREA OR DIAGONAL IF NEEDED.

CONCLUSION AND FINAL THOUGHTS

THIS EXPLORATION DEMONSTRATES HOW ALGEBRA CAN BE EFFECTIVELY USED TO SOLVE GEOMETRIC PROBLEMS INVOLVING RECTANGLES. THE KEY TAKEAWAY IS THE IMPORTANCE OF TRANSLATING WORD PROBLEMS INTO MATHEMATICAL MODELS, SOLVING FOR UNKNOWNNS SYSTEMATICALLY, AND VERIFYING SOLUTIONS AGAINST THE ORIGINAL CONDITIONS. THE SPECIFIC CASE WHERE THE LENGTH IS 3 MORE THAN 3 TIMES THE WIDTH, COUPLED WITH A KNOWN PERIMETER, PROVIDES AN EXCELLENT EXAMPLE OF APPLYING ALGEBRAIC TECHNIQUES TO REAL-WORLD SCENARIOS. WHETHER FOR ACADEMIC PURPOSES OR PRACTICAL

APPLICATIONS, MASTERING THESE PROBLEM-SOLVING STRATEGIES ENHANCES MATHEMATICAL LITERACY AND PROBLEM-SOLVING SKILLS.

BY UNDERSTANDING THE RELATIONSHIPS BETWEEN DIFFERENT DIMENSIONS OF A RECTANGLE AND HOW TO MANIPULATE EQUATIONS, STUDENTS AND PROFESSIONALS ALIKE CAN CONFIDENTLY APPROACH SIMILAR CHALLENGES INVOLVING GEOMETRIC MEASUREMENTS AND CONSTRAINTS.

FREQUENTLY ASKED QUESTIONS

WHAT IS THE RELATIONSHIP BETWEEN THE LENGTH AND WIDTH OF THE RECTANGLE?

THE LENGTH IS 3 MORE THAN 3 TIMES ITS WIDTH, EXPRESSED AS $L = 3W + 3$.

HOW DO YOU SET UP AN EQUATION FOR THE PERIMETER OF THE RECTANGLE?

USING THE PERIMETER FORMULA $P = 2(L + W)$, AND SUBSTITUTING $L = 3W + 3$, THE EQUATION BECOMES $174 = 2(3W + 3 + W)$.

WHAT IS THE FIRST STEP TO FIND THE WIDTH OF THE RECTANGLE?

SIMPLIFY THE PERIMETER EQUATION TO SOLVE FOR W : $174 = 2(4W + 3)$.

HOW DO YOU SIMPLIFY THE PERIMETER EQUATION TO SOLVE FOR W ?

DISTRIBUTE THE 2: $174 = 8W + 6$, THEN SUBTRACT 6 FROM BOTH SIDES: $168 = 8W$.

WHAT IS THE VALUE OF THE WIDTH W ?

$W = 168 / 8 = 21$ INCHES.

HOW DO YOU FIND THE LENGTH OF THE RECTANGLE?

PLUG $W = 21$ INTO $L = 3W + 3$: $L = 3(21) + 3 = 63 + 3 = 66$ INCHES.

WHAT IS THE PERIMETER OF THE RECTANGLE WITH THE FOUND DIMENSIONS?

PERIMETER $P = 2(L + W) = 2(66 + 21) = 2(87) = 174$ INCHES, CONFIRMING THE GIVEN PERIMETER.

WHY IS IT IMPORTANT TO VERIFY THE SOLUTION IN THIS PROBLEM?

TO ENSURE THE CALCULATED DIMENSIONS SATISFY BOTH THE LENGTH-WIDTH RELATIONSHIP AND THE PERIMETER CONDITION.

CAN THIS PROBLEM BE SOLVED USING A DIFFERENT APPROACH?

YES, BY SETTING UP A SYSTEM OF EQUATIONS OR USING SUBSTITUTION, BUT DIRECT SUBSTITUTION INTO THE PERIMETER FORMULA IS MOST STRAIGHTFORWARD.

WHAT REAL-WORLD APPLICATIONS CAN THIS PROBLEM RELATE TO?

DESIGNING RECTANGULAR SPACES LIKE GARDENS, ROOMS, OR FRAMES WHERE SPECIFIC PERIMETER AND DIMENSION RELATIONSHIPS ARE REQUIRED.

ADDITIONAL RESOURCES

RECTANGLE DIMENSIONS CALCULATION: AN IN-DEPTH ANALYSIS

UNDERSTANDING THE PRECISE DIMENSIONS OF A RECTANGLE IS FUNDAMENTAL IN VARIOUS FIELDS — FROM CONSTRUCTION AND MANUFACTURING TO DESIGN AND MATHEMATICS. IN THIS ARTICLE, WE WILL EXPLORE A SPECIFIC PROBLEM INVOLVING A RECTANGLE WHERE THE LENGTH IS RELATED TO THE WIDTH BY A PARTICULAR ALGEBRAIC EXPRESSION, AND THE PERIMETER IS GIVEN. WE WILL DELVE INTO THE STEP-BY-STEP PROCESS OF TRANSLATING WORDED CONDITIONS INTO ALGEBRAIC EQUATIONS, SOLVING FOR UNKNOWNNS, AND INTERPRETING THE RESULTS WITH CLARITY AND PRECISION.

INTRODUCTION TO THE PROBLEM

IMAGINE YOU ARE DESIGNING A RECTANGULAR FRAME, A PIECE OF FABRIC, OR A GARDEN PLOT WITH SPECIFIC PROPORTIONAL CONSTRAINTS. THE PROBLEM STATES:

- THE LENGTH (L) OF THE RECTANGLE IS 3 MORE THAN 3 TIMES ITS WIDTH (W).
- THE PERIMETER (P) OF THE RECTANGLE IS 174 INCHES.

THESE CONDITIONS FORM THE BASIS FOR A MATHEMATICAL PROBLEM THAT REQUIRES CONSTRUCTING AN EQUATION, SOLVING FOR THE UNKNOWNNS, AND UNDERSTANDING THE RELATIONSHIP BETWEEN THE RECTANGLE'S DIMENSIONS.

UNDERSTANDING THE RELATIONSHIP BETWEEN LENGTH AND WIDTH

EXPRESSING LENGTH IN TERMS OF WIDTH

THE PROBLEM STATES:

- > THE LENGTH IS 3 MORE THAN 3 TIMES THE WIDTH.

MATHEMATICALLY, THIS CAN BE EXPRESSED AS:

$$[L = 3W + 3]$$

THIS ALGEBRAIC EXPRESSION IS CRUCIAL BECAUSE IT ALLOWS US TO RELATE THE LENGTH DIRECTLY TO THE WIDTH, REDUCING THE PROBLEM TO SOLVING FOR A SINGLE VARIABLE.

WHY IS THIS RELATIONSHIP IMPORTANT?

- IT SIMPLIFIES THE PROBLEM BY REDUCING THE NUMBER OF UNKNOWNNS.
- IT ALLOWS US TO SUBSTITUTE THE EXPRESSION FOR L INTO THE PERIMETER FORMULA.
- IT PROVIDES INSIGHT INTO THE PROPORTION BETWEEN THE LENGTH AND WIDTH, WHICH CAN HELP IN PRACTICAL APPLICATIONS LIKE MATERIAL ESTIMATION OR SPATIAL PLANNING.

UNDERSTANDING AND APPLYING THE PERIMETER FORMULA

THE PERIMETER OF A RECTANGLE

THE PERIMETER (P) OF A RECTANGLE IS THE TOTAL DISTANCE AROUND IT, CALCULATED BY:

$$P = 2L + 2W$$

GIVEN THAT:

$$P = 174 \text{ INCHES}$$

WE CAN SUBSTITUTE THE EXPRESSION FOR L INTO THIS FORMULA TO CREATE AN EQUATION WITH ONE VARIABLE.

SUBSTITUTING LENGTH INTO THE PERIMETER EQUATION

USING $L = 3W + 3$:

$$174 = 2(3W + 3) + 2W$$

EXPANDING THE EQUATION:

$$174 = 6W + 6 + 2W$$

COMBINING LIKE TERMS:

$$174 = 8W + 6$$

SOLVING FOR THE WIDTH (W)

STEP-BY-STEP SOLUTION

1. SUBTRACT 6 FROM BOTH SIDES:

$$174 - 6 = 8W$$

$$168 = 8W$$

2. DIVIDE BOTH SIDES BY 8:

$$W = \frac{168}{8}$$

$$W = 21 \text{ INCHES}$$

THIS IS THE WIDTH OF THE RECTANGLE.

INTERPRETING THE RESULT

- THE WIDTH OF THE RECTANGLE IS 21 INCHES.
- THIS MEASUREMENT IS PRACTICAL, ALLOWING FOR PRECISE CONSTRUCTION OR DESIGN SPECIFICATIONS.

CALCULATING THE LENGTH (L)

NOW THAT WE HAVE THE WIDTH, WE CAN FIND THE LENGTH:

$$[L = 3W + 3]$$

SUBSTITUTING $(W = 21)$:

$$[L = 3(21) + 3]$$

$$[L = 63 + 3]$$

$$[L = 66 \text{ INCHES}]$$

THEREFORE, THE LENGTH OF THE RECTANGLE IS 66 INCHES.

VERIFICATION OF THE SOLUTION

TO ENSURE THE CALCULATIONS ARE CORRECT, VERIFY THAT THE PERIMETER MATCHES THE GIVEN VALUE:

$$[P = 2L + 2W]$$

$$[P = 2(66) + 2(21)]$$

$$[P = 132 + 42]$$

$$[P = 174 \text{ INCHES}]$$

THIS CONFIRMS THAT OUR SOLUTION ALIGNS WITH THE PROBLEM STATEMENT.

SUMMARY OF FINDINGS

DIMENSION	CALCULATION	RESULT
WIDTH (W)	CALCULATED FROM PERIMETER EQUATION	21 INCHES
LENGTH (L)	$(3W + 3)$	66 INCHES

THESE DIMENSIONS SATISFY THE CONDITIONS, WITH THE LENGTH BEING INDEED 3 MORE THAN THREE TIMES THE WIDTH, AND THE PERIMETER TOTALING 174 INCHES.

PRACTICAL APPLICATIONS AND CONSIDERATIONS

UNDERSTANDING SUCH A PROBLEM HAS TANGIBLE BENEFITS:

- DESIGN AND CONSTRUCTION: ENSURING THAT MATERIALS ARE CUT TO PRECISE DIMENSIONS.
- INTERIOR DESIGN: PLANNING FURNITURE OR FIXTURES WITHIN SPECIFIED SPACE CONSTRAINTS.
- AGRICULTURAL PLANNING: DESIGNING PLOTS WITH PROPORTIONAL RELATIONSHIPS.
- EDUCATIONAL CONTEXT: TEACHING ALGEBRAIC MODELING AND PROBLEM-SOLVING STRATEGIES.

WHEN APPLYING THESE CALCULATIONS IN REAL-WORLD SCENARIOS, CONSIDER FACTORS LIKE MATERIAL THICKNESS, MANUFACTURING TOLERANCES, OR AESTHETIC PROPORTIONS, WHICH MAY SLIGHTLY INFLUENCE THE IDEAL DIMENSIONS.

EXTENDED INSIGHTS AND VARIATIONS

- CHANGING THE PERIMETER: IF THE PERIMETER WERE DIFFERENT, THE SAME APPROACH COULD BE USED BY SUBSTITUTING THE NEW VALUE.
- DIFFERENT RELATIONSHIPS BETWEEN DIMENSIONS: FOR EXAMPLE, IF LENGTH WERE DIRECTLY PROPORTIONAL TO WIDTH, OR INVOLVED DIFFERENT CONSTANTS, THE ALGEBRAIC EXPRESSIONS WOULD ADAPT ACCORDINGLY.
- THREE-DIMENSIONAL ANALOGS: EXTENDING THE CONCEPT TO RECTANGULAR PRISMS OR OTHER SHAPES INTRODUCES ADDITIONAL VARIABLES AND COMPLEXITY.

CONCLUSION

THROUGH A SYSTEMATIC APPROACH, WE'VE DETERMINED THAT A RECTANGLE WITH A PERIMETER OF 174 INCHES, WHERE ITS LENGTH IS 3 MORE THAN 3 TIMES ITS WIDTH, HAS DIMENSIONS:

- WIDTH: 21 INCHES
- LENGTH: 66 INCHES

THIS CASE EXEMPLIFIES HOW ALGEBRAIC EXPRESSIONS AND FORMULAS CAN BE COMBINED TO SOLVE REAL-WORLD PROBLEMS EFFICIENTLY AND ACCURATELY. MASTERY OF SUCH TECHNIQUES IS INVALUABLE ACROSS SCIENTIFIC, ENGINEERING, AND EVERYDAY CONTEXTS, ENABLING PRECISE PLANNING AND EXECUTION IN VARIOUS PROJECTS.

IN ESSENCE, UNDERSTANDING HOW TO TRANSLATE WORDED CONSTRAINTS INTO ALGEBRAIC FORMULAS AND THEN SOLVING THEM IS A CORNERSTONE OF APPLIED MATHEMATICS THAT EMPOWERS PROFESSIONALS AND STUDENTS ALIKE TO NAVIGATE COMPLEX PROBLEMS WITH CONFIDENCE AND CLARITY.

[The Length Of A Rectangle Is 3 More Than 3 Times Its Width](#)

The Perimeter Of The Rectangle Is 174 Inches

The Length Of A Rectangle Is 3 More Than 3 Times Its Width The Perimeter Of The Rectangle Is 174 Inches

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