

THE RATIO OF THE LENGTH OF TWO SIMILAR RECTANGLES IS 3 RATIO 4. WHAT IS THE SCALE RATIO OF THEIR AREAS

THE RATIO OF THE LENGTH OF TWO SIMILAR RECTANGLES IS 3 RATIO 4. WHAT IS THE SCALE RATIO OF THEIR AREAS

UNDERSTANDING THE RELATIONSHIP BETWEEN THE DIMENSIONS OF SIMILAR RECTANGLES AND THEIR AREAS IS FUNDAMENTAL IN GEOMETRY. WHEN TWO RECTANGLES ARE SIMILAR, THEIR CORRESPONDING SIDES ARE PROPORTIONAL, AND THEIR AREAS ARE RELATED BY THE SQUARE OF THE RATIO OF THEIR CORRESPONDING SIDE LENGTHS. THIS PRINCIPLE IS CRUCIAL FOR SOLVING PROBLEMS INVOLVING SIMILAR FIGURES, ESPECIALLY WHEN THE RATIOS OF SIDES ARE KNOWN. IN THIS ARTICLE, WE EXPLORE THE SPECIFIC CASE WHERE THE RATIO OF THE LENGTHS OF TWO SIMILAR RECTANGLES IS 3:4, AND WE AIM TO DETERMINE THE SCALE RATIO OF THEIR AREAS. BY THE END OF THIS GUIDE, YOU'LL HAVE A CLEAR UNDERSTANDING OF HOW TO RELATE SIDE RATIOS TO AREA RATIOS AND APPLY THESE CONCEPTS TO VARIOUS GEOMETRIC PROBLEMS.

UNDERSTANDING SIMILAR RECTANGLES AND THEIR PROPERTIES

WHAT ARE SIMILAR RECTANGLES?

SIMILAR RECTANGLES ARE RECTANGLES THAT HAVE THE SAME SHAPE BUT NOT NECESSARILY THE SAME SIZE. THIS MEANS:

- THEIR CORRESPONDING ANGLES ARE EQUAL (ALL ANGLES ARE 90 DEGREES).
- THE LENGTHS OF THEIR CORRESPONDING SIDES ARE PROPORTIONAL.

FOR EXAMPLE, IF RECTANGLE A AND RECTANGLE B ARE SIMILAR, THEN THE RATIO OF THEIR CORRESPONDING SIDES WILL BE CONSTANT.

THE IMPORTANCE OF SIDE RATIOS

THE RATIO OF THE LENGTHS OF CORRESPONDING SIDES IN SIMILAR RECTANGLES IS CALLED THE SCALE FACTOR. IF:

- RECTANGLE A HAS SIDES OF LENGTHS a AND b .
- RECTANGLE B HAS SIDES OF LENGTHS a' AND b' .

AND THESE ARE PROPORTIONAL SUCH THAT

$$\left[\frac{a'}{a} = \frac{b'}{b} = k, \right]$$

THEN k IS THE SCALE FACTOR OF THE SIDES.

CALCULATING THE SCALE RATIO OF AREAS FROM SIDE RATIOS

THE RELATIONSHIP BETWEEN SIDE RATIOS AND AREA RATIOS

THE KEY CONCEPT IN SIMILAR FIGURES IS THAT THE RATIO OF THEIR AREAS IS THE SQUARE OF THE RATIO OF THEIR CORRESPONDING SIDES. MATHEMATICALLY:

$\left[\right]$

$$\frac{\text{Area of Rectangle B}}{\text{Area of Rectangle A}} = k^2,$$
 where (k) is the scale factor of the sides.

APPLYING THE CONCEPT TO OUR PROBLEM

GIVEN:

- SIDE RATIO OF THE TWO SIMILAR RECTANGLES: 3:4.

WE IDENTIFY:

$$k = \frac{4}{3},$$

SINCE THE LARGER RECTANGLE'S SIDE IS 4 UNITS AND THE SMALLER'S IS 3 UNITS.

NOW, THE RATIO OF THEIR AREAS IS:

$$\text{Area Ratio} = k^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}.$$

THEREFORE, THE SCALE RATIO OF THEIR AREAS IS 16:9.

THIS INDICATES THAT THE LARGER RECTANGLE'S AREA IS $\left(\frac{16}{9}\right)$ TIMES THE SMALLER RECTANGLE'S AREA.

STEP-BY-STEP SOLUTION TO THE PROBLEM

STEP 1: IDENTIFY THE SIDE RATIO

- THE PROBLEM STATES THAT THE RATIO OF THE LENGTHS IS 3:4.
- THIS MEANS THE SMALLER RECTANGLE HAS SIDES PROPORTIONAL TO 3 UNITS, AND THE LARGER TO 4 UNITS.

STEP 2: DETERMINE THE SCALE FACTOR (k)

- SINCE THE RATIO OF SIDES IS 3:4, THE SCALE FACTOR FROM THE SMALLER TO THE LARGER RECTANGLE IS:

$$k = \frac{\text{LARGER SIDE}}{\text{SMALLER SIDE}} = \frac{4}{3}.$$

STEP 3: CALCULATE THE AREA RATIO

- THE AREA RATIO IS THE SQUARE OF THE SIDE RATIO:

$$\left(\frac{4}{3}\right)^2 = \frac{16}{9}.$$

- THIS MEANS:

$$\text{Area of Larger Rectangle} : \text{Area of Smaller Rectangle} = 16 : 9.$$

STEP 4: INTERPRET THE RESULTS

- IF THE SMALLER RECTANGLE HAS AN AREA OF, SAY, 9 SQUARE UNITS, THEN THE LARGER RECTANGLE WOULD HAVE AN AREA OF 16 SQUARE UNITS.
- THE RATIO 16:9 IS A DIRECT REFLECTION OF THE SQUARE OF THE SIDE RATIO.

PRACTICAL APPLICATIONS OF AREA RATIOS IN SIMILAR RECTANGLES

REAL-WORLD EXAMPLES

UNDERSTANDING THESE RATIOS IS NOT ONLY ACADEMICALLY INTERESTING BUT ALSO PRACTICALLY USEFUL IN VARIOUS FIELDS:

- **ARCHITECTURE:** SCALING BLUEPRINTS FOR BUILDINGS OR COMPONENTS, ENSURING PROPORTIONAL ACCURACY IN AREAS.
- **ENGINEERING:** DESIGNING PARTS THAT NEED TO FIT TOGETHER PROPORTIONALLY, CONSIDERING SURFACE AREAS.
- **ART AND DESIGN:** CREATING SCALED DRAWINGS OR MODELS WITH ACCURATE AREA REPRESENTATIONS.

PROBLEM-SOLVING TIPS

TO EFFECTIVELY SOLVE SIMILAR PROBLEMS:

- ALWAYS IDENTIFY THE GIVEN SIDE RATIO.
- FIND THE SCALE FACTOR (k) FROM THE RATIO.
- SQUARE THE SCALE FACTOR TO DETERMINE THE AREA RATIO.
- APPLY THE RATIO TO REAL MEASUREMENTS IF AVAILABLE.

ADDITIONAL EXAMPLE PROBLEMS TO REINFORCE THE CONCEPT

EXAMPLE 1: IF THE SIDE RATIO OF TWO SIMILAR RECTANGLES IS 5:2, WHAT IS THE RATIO OF THEIR AREAS?

- SOLUTION:

$$k = \frac{5}{2}, \quad \text{AREA RATIO} = k^2 = \left(\frac{5}{2}\right)^2 = \frac{25}{4}.$$

- ANSWER: THE AREA RATIO IS 25:4.

EXAMPLE 2: THE AREAS OF TWO SIMILAR RECTANGLES ARE IN A 25:16 RATIO. FIND THE RATIO OF THEIR SIDE LENGTHS.

- SOLUTION:

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$$\frac{\text{Area}_1}{\text{Area}_2} = \left(\frac{\text{Side}_1}{\text{Side}_2} \right)^2,$$

SO

$$\frac{25}{16} = \left(\frac{\text{Side}_1}{\text{Side}_2} \right)^2,$$

THEN

$$\frac{\text{Side}_1}{\text{Side}_2} = \sqrt{\frac{25}{16}} = \frac{5}{4}.$$

- ANSWER: THE SIDE LENGTH RATIO IS 5:4.

CONCLUSION

IN SUMMARY, WHEN DEALING WITH SIMILAR RECTANGLES, THE RATIO OF THEIR AREAS IS THE SQUARE OF THE RATIO OF THEIR CORRESPONDING SIDE LENGTHS. GIVEN A SIDE RATIO OF 3:4, THE SCALE RATIO OF THEIR AREAS IS 16:9. UNDERSTANDING THIS RELATIONSHIP SIMPLIFIES MANY GEOMETRIC PROBLEMS AND PROVIDES INSIGHT INTO HOW DIMENSIONS SCALE IN SIMILAR FIGURES. WHETHER IN ACADEMIC EXERCISES, ENGINEERING PROJECTS, OR DESIGN WORK, MASTERING THE CONNECTION BETWEEN SIDE RATIOS AND AREA RATIOS IS ESSENTIAL FOR ACCURATE CALCULATIONS AND EFFECTIVE PROBLEM-SOLVING.

IF YOU'RE WORKING ON SIMILAR PROBLEMS, REMEMBER THE KEY FORMULA:

$$\text{Area Ratio} = (\text{Side Ratio})^2,$$

AND APPLY IT CAREFULLY TO FIND THE RELATIONSHIPS BETWEEN SCALED FIGURES.

FREQUENTLY ASKED QUESTIONS

IF THE RATIO OF THE LENGTHS OF TWO SIMILAR RECTANGLES IS 3:4, WHAT IS THE RATIO OF THEIR AREAS?

THE RATIO OF THEIR AREAS IS THE SQUARE OF THE RATIO OF THEIR LENGTHS, SO IT IS $3^2:4^2$, WHICH EQUALS 9:16.

HOW DO YOU DETERMINE THE RATIO OF AREAS FROM THE RATIO OF LENGTHS IN SIMILAR RECTANGLES?

YOU SQUARE THE RATIO OF THEIR CORRESPONDING SIDES TO FIND THE RATIO OF THEIR AREAS.

GIVEN TWO SIMILAR RECTANGLES WITH A LENGTH RATIO OF 3:4, WHAT IS THE SCALE FACTOR OF THEIR AREAS?

THE SCALE FACTOR OF THE AREAS IS 9:16.

WHY DO THE AREAS OF SIMILAR RECTANGLES RELATE TO THE SQUARE OF THEIR SIDE RATIOS?

BECAUSE AREA IS A TWO-DIMENSIONAL MEASUREMENT, IT SCALES WITH THE SQUARE OF THE LINEAR SCALE FACTOR BETWEEN SIMILAR FIGURES.

IF THE LENGTH RATIO OF TWO SIMILAR RECTANGLES IS 3:4, WHAT IS THE PERCENTAGE DIFFERENCE IN THEIR AREAS?

THE AREAS ARE IN THE RATIO 9:16, SO THE PERCENTAGE DIFFERENCE IS $((16 - 9)/9) \times 100\% \approx 77.78\%$.

CAN THE RATIO OF AREAS OF SIMILAR RECTANGLES BE DIRECTLY PROPORTIONAL TO THEIR LENGTH RATIO?

NO, THE RATIO OF AREAS IS PROPORTIONAL TO THE SQUARE OF THE LENGTH RATIO, NOT DIRECTLY PROPORTIONAL.

WHAT IS THE MATHEMATICAL FORMULA TO FIND THE RATIO OF AREAS GIVEN THE RATIO OF LENGTHS IN SIMILAR RECTANGLES?

IF THE LENGTH RATIO IS A:B, THEN THE AREA RATIO IS $A^2:B^2$.

IN SIMILAR RECTANGLES, IF ONE RECTANGLE'S AREA IS 27 SQUARE UNITS AND THE LENGTH RATIO IS 3:4, WHAT IS THE AREA OF THE OTHER RECTANGLE?

FIRST, FIND THE AREA RATIO: 9:16. SINCE THE FIRST AREA IS 27, SET UP THE PROPORTION: $27/\text{AREA}_2 = 9/16$. SOLVING FOR AREA₂ GIVES $(27 \times 16)/9 = 48$ SQUARE UNITS.

ADDITIONAL RESOURCES

UNDERSTANDING THE SCALE RATIO OF AREAS IN SIMILAR RECTANGLES: A COMPREHENSIVE GUIDE

WHEN EXPLORING THE FASCINATING WORLD OF GEOMETRIC FIGURES, ONE OF THE MOST INTRIGUING CONCEPTS IS THE RELATIONSHIP BETWEEN SIMILAR SHAPES. THIS RELATIONSHIP NOT ONLY PROVIDES INSIGHTS INTO THEIR PROPORTIONS BUT ALSO REVEALS HOW THEIR AREAS AND OTHER PROPERTIES SCALE RELATIVE TO EACH OTHER. TODAY, WE DIVE DEEP INTO A SPECIFIC SCENARIO INVOLVING SIMILAR RECTANGLES, FOCUSING PARTICULARLY ON UNDERSTANDING HOW THEIR SIDE LENGTHS AND AREAS RELATE WHEN THEIR SIDE LENGTH RATIOS ARE GIVEN.

INTRODUCTION TO SIMILAR RECTANGLES AND SCALE RATIOS

SIMILAR RECTANGLES ARE FIGURES THAT HAVE THE SAME SHAPE BUT DIFFER IN SIZE. THIS SIMILARITY IMPLIES THAT CORRESPONDING ANGLES ARE EQUAL, AND THE LENGTHS OF CORRESPONDING SIDES ARE PROPORTIONAL. THESE PROPORTIONAL RELATIONSHIPS ARE CENTRAL TO MANY APPLICATIONS, FROM ARCHITECTURE TO DESIGN, AND UNDERSTANDING THEM IS KEY TO SOLVING NUMEROUS GEOMETRIC PROBLEMS.

WHY FOCUS ON RATIOS?

RATIOS SERVE AS A FUNDAMENTAL TOOL IN GEOMETRY BECAUSE THEY SUCCINCTLY EXPRESS THE PROPORTIONAL RELATIONSHIPS BETWEEN FIGURES. SPECIFICALLY, WHEN DISCUSSING SIMILAR RECTANGLES, THE RATIO OF THEIR CORRESPONDING SIDE LENGTHS DIRECTLY INFLUENCES THE RATIO OF THEIR AREAS. THIS CONNECTION IS CRUCIAL FOR PRACTICAL CALCULATIONS, WHETHER IN ENGINEERING, CONSTRUCTION, OR ACADEMIC PROBLEM-SOLVING.

UNDERSTANDING THE GIVEN RATIO: LENGTHS OF TWO SIMILAR RECTANGLES

THE PROBLEM STATES:

> THE RATIO OF THE LENGTHS OF TWO SIMILAR RECTANGLES IS 3:4.

THIS STATEMENT INDICATES THAT IF ONE RECTANGLE HAS SIDES OF LENGTH 3 UNITS (OR ANY PROPORTIONAL MEASURE), THE OTHER HAS SIDES OF LENGTH 4 UNITS. TO UNDERSTAND THE IMPLICATIONS FOR THEIR AREAS, WE NEED TO ANALYZE HOW THIS RATIO INFLUENCES THE OVERALL SIZE AND HOW IT SCALES.

KEY POINT:

SINCE THE RECTANGLES ARE SIMILAR, THE RATIO OF THEIR CORRESPONDING SIDES IS CONSTANT ACROSS ALL PAIRS OF SIDES.

THE RELATIONSHIP BETWEEN SIDE LENGTH RATIOS AND AREA RATIOS

UNDERSTANDING HOW THE RATIO OF SIDES IMPACTS THE RATIO OF AREAS IS FUNDAMENTAL.

FUNDAMENTAL PRINCIPLE:

IF TWO SIMILAR FIGURES HAVE A LINEAR SCALE FACTOR OF k , THEN THE RATIO OF THEIR AREAS IS k^2 .

APPLYING TO OUR PROBLEM:

GIVEN THE SIDE LENGTH RATIO OF 3:4, THE SCALE FACTOR k IS $3/4$ (OR 0.75).

- SIDE LENGTH RATIO (k): 3:4
- AREA RATIO (k^2): $(3/4)^2 = 9/16$

THIS MEANS THAT THE AREA OF THE SMALLER RECTANGLE (WITH SIDES OF LENGTH 3 UNITS) IS $9/16$ THE AREA OF THE LARGER RECTANGLE (WITH SIDES OF LENGTH 4 UNITS), ASSUMING THE MEASURE IS CONSISTENT.

IMPORTANT CLARIFICATION:

THE RATIO OF SIDE LENGTHS (3:4) DIRECTLY INFLUENCES THE RATIO OF AREAS (9:16). THIS QUADRATIC RELATIONSHIP IS FUNDAMENTAL IN GEOMETRY AND HELPS IN SOLVING REAL-WORLD PROBLEMS INVOLVING SIMILAR FIGURES.

CALCULATING THE SCALE RATIO OF THEIR AREAS

LET'S FORMALIZE THE CALCULATION PROCESS TO UNDERSTAND HOW THE SCALE RATIO OF AREAS IS DERIVED, ENSURING CLARITY AND PRECISION.

STEP 1: IDENTIFY THE SCALE FACTOR

GIVEN THE RATIO OF SIDE LENGTHS:

- SIDE OF RECTANGLE A: 3 UNITS
- SIDE OF RECTANGLE B: 4 UNITS

THE SCALE FACTOR k FROM RECTANGLE A TO RECTANGLE B:

$$k = \frac{\text{SIDE OF RECTANGLE B}}{\text{SIDE OF RECTANGLE A}} = \frac{4}{3}$$

NOTE:

DEPENDING ON WHICH RECTANGLE IS CONSIDERED LARGER, THE SCALE FACTOR CAN BE EXPRESSED AS $\frac{4}{3}$ (IF RECTANGLE B IS LARGER) OR $\frac{3}{4}$ (IF CONSIDERING THE SMALLER TO LARGER).

STEP 2: DETERMINE THE AREA SCALE RATIO

SINCE THE AREAS SCALE WITH THE SQUARE OF THE LINEAR SCALE FACTOR:

$$\left[\text{Area Ratio} = k^2 \right]$$

USING THE LARGER-TO-SMALLER RATIO ($\frac{4}{3}$):

$$\left[\left(\frac{4}{3} \right)^2 = \frac{16}{9} \right]$$

THIS INDICATES:

- THE LARGER RECTANGLE'S AREA IS $\left(\frac{16}{9} \right)$ TIMES THE SMALLER RECTANGLE'S AREA.

ALTERNATIVELY, IF THE RATIO IS CONSIDERED FROM SMALLER TO LARGER:

$$\left[\left(\frac{3}{4} \right)^2 = \frac{9}{16} \right]$$

WHICH INDICATES:

- THE SMALLER RECTANGLE'S AREA IS $\left(\frac{9}{16} \right)$ OF THE LARGER RECTANGLE'S AREA.

STEP 3: EXPRESSING THE SCALE RATIO OF AREAS

SUMMARY:

- FROM SMALLER TO LARGER: 9:16
- FROM LARGER TO SMALLER: 16:9

PRACTICAL INTERPRETATION:

IF THE SMALLER RECTANGLE HAS AN AREA OF, SAY, 9 SQUARE UNITS, THEN THE LARGER RECTANGLE HAS AN AREA OF 16 SQUARE UNITS.

REAL-WORLD APPLICATIONS AND EXAMPLES

UNDERSTANDING THE SCALE RATIO OF AREAS HAS PRACTICAL SIGNIFICANCE ACROSS VARIOUS FIELDS:

1. ARCHITECTURE AND DESIGN:

DESIGNERS OFTEN CREATE SCALED MODELS OF BUILDINGS. KNOWING HOW THE AREA SCALES HELPS ESTIMATE THE MATERIAL REQUIREMENTS AND VISUAL PROPORTIONS.

2. ENGINEERING AND MANUFACTURING:

WHEN PRODUCING PARTS BASED ON SCALED PROTOTYPES, CALCULATING THE AREA RATIOS ENSURES PROPER SCALING OF SURFACE TREATMENTS, COATINGS, OR MATERIALS.

3. ART AND GRAPHICS:

ARTISTS AND GRAPHIC DESIGNERS UTILIZE PROPORTIONAL SCALING TO MAINTAIN VISUAL HARMONY WHEN RESIZING IMAGES OR FIGURES.

EXAMPLE SCENARIO:

SUPPOSE A BLUEPRINT OF A RECTANGULAR ROOM MEASURES 3 METERS BY 4 METERS. IF A SCALED MODEL IS CREATED WITH

SIDES 2.25 METERS BY 3 METERS (MAINTAINING THE 3:4 RATIO), THE AREA SCALE RATIO IS:

$$\left[\left(\frac{2.25}{3}\right)^2 = \left(\frac{3}{4}\right)^2 = \frac{9}{16}\right]$$

THIS CONFIRMS THAT THE MODEL'S AREA IS $\left(\frac{9}{16}\right)$ OF THE ACTUAL ROOM, ALLOWING PRECISE CALCULATIONS FOR MATERIALS AND FURNISHINGS.

CONCLUSION: KEY TAKEAWAYS AND SUMMARY

UNDERSTANDING THE RELATIONSHIP BETWEEN THE LENGTHS OF SIMILAR RECTANGLES AND THEIR AREAS IS FUNDAMENTAL IN GEOMETRY. THE CORE PRINCIPLE HINGES ON THE FACT THAT:

- THE RATIO OF AREAS OF SIMILAR FIGURES IS THE SQUARE OF THE RATIO OF THEIR CORRESPONDING SIDES.
- GIVEN A SIDE LENGTH RATIO OF 3:4, THE AREA RATIO IS 9:16.
- THE SCALE RATIO OF THEIR AREAS IS HENCE 9:16, MEANING THE SMALLER RECTANGLE'S AREA IS 9 UNITS WHEN THE LARGER'S IS 16 UNITS, ASSUMING A CONSISTENT UNIT MEASURE.

IN ESSENCE, THE PRECISE COMPUTATION OF THE SCALE RATIO OF AREAS REQUIRES IDENTIFYING THE LINEAR SCALE FACTOR AND THEN SQUARING IT. THIS FUNDAMENTAL CONCEPT FINDS APPLICATIONS ACROSS DISCIPLINES, SHOWCASING THE BEAUTY AND UTILITY OF GEOMETRIC PROPORTIONS.

FINAL NOTE:

WHETHER YOU'RE A STUDENT TACKLING A HOMEWORK PROBLEM, AN ENGINEER DESIGNING SCALED MODELS, OR AN ARTIST ADJUSTING PROPORTIONS, GRASPING HOW SIDE RATIOS INFLUENCE AREA RATIOS ENHANCES YOUR GEOMETRIC INTUITION AND PROBLEM-SOLVING SKILLS. REMEMBER, IN SIMILAR FIGURES, THE AREA SCALES WITH THE SQUARE OF THE LINEAR SCALE FACTOR — A PRINCIPLE AS ELEGANT AS IT IS POWERFUL.

The Ratio Of The Length Of Two Similar Rectangles Is 3 Ratio 4 What Is The Scale Ratio Of Their Areas

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