

FIND AN EQUATION FOR THE LINE WHICH IS PARALLEL TO $2Y+16X=4$ AND PASSES THROUGH THE POINT $(8,4)$. WRITE

FIND AN EQUATION FOR THE LINE WHICH IS PARALLEL TO $2Y+16X=4$ AND PASSES THROUGH THE POINT $(8,4)$. WRITE

UNDERSTANDING HOW TO FIND THE EQUATION OF A LINE THAT IS PARALLEL TO A GIVEN LINE AND PASSES THROUGH A SPECIFIC POINT IS A FUNDAMENTAL SKILL IN ANALYTIC GEOMETRY. THIS PROCESS INVOLVES IDENTIFYING THE SLOPE OF THE ORIGINAL LINE, RECOGNIZING THAT PARALLEL LINES SHARE THE SAME SLOPE, AND THEN APPLYING THE POINT-SLOPE FORM OF A LINE'S EQUATION TO FIND THE DESIRED LINE. IN THIS ARTICLE, WE WILL WALK THROUGH EACH STEP IN DETAIL, ILLUSTRATING THE METHOD WITH THE EXAMPLE OF THE LINE PARALLEL TO $2Y + 16X = 4$ PASSING THROUGH THE POINT $(8, 4)$.

ANALYZING THE GIVEN EQUATION

REWRITING THE EQUATION IN SLOPE-INTERCEPT FORM

THE FIRST STEP IS TO ANALYZE THE GIVEN LINE:

$$\{ 2Y + 16X = 4 \}$$

OUR GOAL IS TO FIND THE SLOPE OF THIS LINE, WHICH WE CAN DO BY REWRITING THE EQUATION IN SLOPE-INTERCEPT FORM, $\{ Y = MX + B \}$, WHERE $\{ M \}$ IS THE SLOPE AND $\{ B \}$ IS THE Y-INTERCEPT.

TO ACHIEVE THIS:

1. SUBTRACT $\{ 16X \}$ FROM BOTH SIDES:

$$\{ 2Y = -16X + 4 \}$$

2. DIVIDE BOTH SIDES BY 2:

$$\{ Y = -8X + 2 \}$$

NOW, THE EQUATION IS IN SLOPE-INTERCEPT FORM:

$$\{ Y = -8X + 2 \}$$

FROM THIS FORM, WE IDENTIFY THE SLOPE:

$$\{ M = -8 \}$$

KEY POINT: THE SLOPE OF THE GIVEN LINE IS $\{ -8 \}$.

UNDERSTANDING PARALLEL LINES

THE SLOPE CRITERION FOR PARALLELISM

IN COORDINATE GEOMETRY, TWO LINES ARE PARALLEL IF AND ONLY IF THEY HAVE THE SAME SLOPE. SINCE WE'VE ESTABLISHED THAT THE ORIGINAL LINE HAS A SLOPE OF (-8) , ANY LINE PARALLEL TO IT MUST ALSO HAVE A SLOPE OF (-8) .

THEREFORE:

$$\text{SLOPE OF THE PARALLEL LINE} = -8$$

FORMULATING THE EQUATION OF THE PARALLEL LINE

USING THE POINT-SLOPE FORM

THE POINT-SLOPE FORM OF A LINE'S EQUATION IS:

$$Y - Y_1 = M(X - X_1)$$

WHERE:

- (X_1, Y_1) IS A POINT THROUGH WHICH THE LINE PASSES,
- (M) IS THE SLOPE.

IN OUR CASE:

- $(X_1, Y_1) = (8, 4)$,
- $(M = -8)$.

SUBSTITUTING THESE VALUES:

$$Y - 4 = -8(X - 8)$$

EXPANDING AND SIMPLIFYING TO SLOPE-INTERCEPT FORM

LET'S EXPAND THE EQUATION:

$$y - 4 = -8x + 64$$

ADDING 4 TO BOTH SIDES:

$$y = -8x + 64 + 4$$

$$y = -8x + 68$$

THIS IS THE EQUATION OF THE LINE PARALLEL TO THE ORIGINAL LINE AND PASSING THROUGH THE POINT (8, 4).

FINAL EQUATION:

$$\boxed{y = -8x + 68}$$

VERIFICATION OF THE SOLUTION

CHECK THAT THE POINT (8, 4) LIES ON THE DERIVED LINE

SUBSTITUTE $(x = 8)$:

$$y = -8(8) + 68 = -64 + 68 = 4$$

INDEED, THE POINT (8, 4) SATISFIES THE EQUATION, CONFIRMING CORRECTNESS.

CHECK THE SLOPE

THE SLOPE FROM THE EQUATION $(y = -8x + 68)$ IS (-8) , MATCHING THE SLOPE OF THE ORIGINAL LINE, ENSURING PARALLELISM.

SUMMARY OF KEY STEPS

- REWRITE THE GIVEN LINE IN SLOPE-INTERCEPT FORM TO FIND ITS SLOPE.
- IDENTIFY THAT PARALLEL LINES SHARE THE SAME SLOPE.

- USE THE POINT-SLOPE FORM WITH THE POINT $(8, 4)$ AND THE SLOPE -8 .
- EXPAND AND SIMPLIFY TO GET THE SLOPE-INTERCEPT FORM OF THE NEW LINE.
- VERIFY BY SUBSTITUTING THE POINT INTO THE EQUATION.

ADDITIONAL NOTES AND PRACTICE

ALTERNATIVE FORMS OF THE EQUATION

THE LINE EQUATION CAN ALSO BE EXPRESSED IN OTHER FORMS:

- STANDARD FORM: $Ax + By = C$

TO CONVERT $y = -8x + 68$ INTO STANDARD FORM:

$$8x + y = 68$$

PRACTICE PROBLEM

FIND THE EQUATION OF A LINE PARALLEL TO $3y - 9x = 6$ PASSING THROUGH THE POINT $(2, -1)$.

SOLUTION OUTLINE:

1. REWRITE THE ORIGINAL LINE IN SLOPE-INTERCEPT FORM TO FIND ITS SLOPE.
2. USE THE POINT-SLOPE FORM WITH THE POINT $(2, -1)$ AND THE SLOPE.
3. SIMPLIFY TO FIND THE FINAL EQUATION.

CONCLUSION

FINDING THE EQUATION OF A LINE PARALLEL TO A GIVEN LINE AND PASSING THROUGH A SPECIFIC POINT IS A SYSTEMATIC PROCESS INVOLVING UNDERSTANDING SLOPES, REARRANGING EQUATIONS, AND APPLYING THE POINT-SLOPE FORM. BY CAREFULLY ANALYZING THE ORIGINAL EQUATION, RECOGNIZING THE IMPORTANCE OF THE SLOPE, AND APPLYING ALGEBRAIC TECHNIQUES, WE DERIVED THE PARALLEL LINE PASSING THROUGH $(8, 4)$ AS:

$$\boxed{y = -8x + 68}$$

THIS METHOD CAN BE EXTENDED TO VARIOUS PROBLEMS INVOLVING PARALLEL LINES, HIGHLIGHTING THE IMPORTANCE OF THE

FREQUENTLY ASKED QUESTIONS

HOW DO YOU FIND THE EQUATION OF A LINE PARALLEL TO THE GIVEN LINE $2Y + 16X = 4$ THAT PASSES THROUGH $(8, 4)$?

FIRST, REWRITE THE GIVEN LINE IN SLOPE-INTERCEPT FORM TO FIND ITS SLOPE. THEN, USE THAT SLOPE AND THE POINT $(8, 4)$ IN POINT-SLOPE FORM TO FIND THE NEW LINE'S EQUATION.

WHAT IS THE SLOPE OF THE LINE $2Y + 16X = 4$?

REARRANGED IN SLOPE-INTERCEPT FORM: $2Y = -16X + 4$, so $Y = -8X + 2$. THEREFORE, THE SLOPE IS -8 .

HOW DO YOU WRITE THE EQUATION OF A LINE PARALLEL TO THE ORIGINAL LINE PASSING THROUGH $(8, 4)$?

SINCE PARALLEL LINES HAVE THE SAME SLOPE, USE SLOPE -8 AND POINT $(8, 4)$ IN POINT-SLOPE FORM: $Y - 4 = -8(X - 8)$. SIMPLIFY TO GET THE SLOPE-INTERCEPT FORM.

WHAT IS THE EQUATION OF THE LINE PARALLEL TO $2Y + 16X = 4$ PASSING THROUGH $(8, 4)$?

USING POINT-SLOPE FORM: $Y - 4 = -8(X - 8)$. SIMPLIFYING, $Y - 4 = -8X + 64$, so $Y = -8X + 68$.

HOW CAN I VERIFY THAT THE LINE $Y = -8X + 68$ PASSES THROUGH $(8, 4)$?

SUBSTITUTE $X = 8$ INTO THE EQUATION: $Y = -8(8) + 68 = -64 + 68 = 4$, CONFIRMING THAT THE POINT LIES ON THE LINE.

ADDITIONAL RESOURCES

FIND AN EQUATION FOR THE LINE WHICH IS PARALLEL TO $2Y + 16X = 4$ AND PASSES THROUGH THE POINT $(8, 4)$

INTRODUCTION

MATHEMATICS, PARTICULARLY COORDINATE GEOMETRY, OFTEN PRESENTS US WITH THE CHALLENGE OF IDENTIFYING LINES WITH SPECIFIC CONDITIONS. AMONG THE FUNDAMENTAL CONCEPTS IN THIS DOMAIN ARE PARALLEL LINES—LINES THAT NEVER INTERSECT AND MAINTAIN A CONSTANT DISTANCE APART. THE TASK OF FINDING AN EQUATION OF A LINE PARALLEL TO AN EXISTING LINE AND PASSING THROUGH A PARTICULAR POINT IS A CLASSIC PROBLEM THAT COMBINES UNDERSTANDING OF SLOPE-INTERCEPT FORM, POINT-SLOPE FORM, AND THE PROPERTIES OF PARALLELISM.

THIS ARTICLE DELVES INTO THE PROCESS OF SOLVING SUCH A PROBLEM, OFFERING A COMPREHENSIVE EXAMINATION OF THE STEPS INVOLVED, THE UNDERLYING PRINCIPLES, AND THE MATHEMATICAL REASONING REQUIRED TO DERIVE THE EQUATION OF THE DESIRED LINE. BY DISSECTING THE PROBLEM, ANALYZING THE ORIGINAL LINE EQUATION, AND SYSTEMATICALLY APPLYING ALGEBRAIC TRANSFORMATIONS, WE AIM TO PROVIDE CLARITY AND INSIGHT INTO THIS ESSENTIAL ASPECT OF ANALYTIC GEOMETRY.

UNDERSTANDING THE GIVEN EQUATION

THE ORIGINAL LINE: $2y + 16x = 4$

THE INITIAL STEP INVOLVES INTERPRETING THE GIVEN LINE, WHICH IS PRESENTED IN ITS STANDARD FORM:

$$[2y + 16x = 4]$$

TO ANALYZE ITS PROPERTIES, PARTICULARLY ITS SLOPE, IT IS OFTEN ADVANTAGEOUS TO CONVERT THE EQUATION INTO SLOPE-INTERCEPT FORM:

$$[y = mx + b]$$

WHERE (m) IS THE SLOPE AND (b) IS THE Y-INTERCEPT.

CONVERTING TO SLOPE-INTERCEPT FORM

STARTING WITH:

$$[2y + 16x = 4]$$

WE ISOLATE (y) :

$$\begin{aligned} [\\ 2y &= -16x + 4 \\] \end{aligned}$$

DIVIDING EVERY TERM BY 2:

$$\begin{aligned} [\\ y &= -8x + 2 \\] \end{aligned}$$

THIS FORM REVEALS THAT THE ORIGINAL LINE HAS A SLOPE:

$$\begin{aligned} [\\ m_{\text{ORIGINAL}} &= -8 \\] \end{aligned}$$

AND A Y-INTERCEPT AT $(0, 2)$.

FUNDAMENTAL CONCEPT: PARALLEL LINES AND THEIR SLOPES

THE PRINCIPLE OF PARALLELISM

TWO LINES ARE PARALLEL IF AND ONLY IF THEIR SLOPES ARE EQUAL. THIS IS A CORE CONCEPT IN COORDINATE GEOMETRY, WHICH ALLOWS US TO DETERMINE THE EQUATION OF A LINE PARALLEL TO A GIVEN LINE ONCE WE KNOW ITS SLOPE.

GIVEN THAT THE ORIGINAL LINE HAS A SLOPE $(m_{\text{ORIGINAL}} = -8)$, ANY LINE PARALLEL TO IT WILL ALSO HAVE A SLOPE:

$$\begin{aligned} [\\ m_{\text{PARALLEL}} &= -8 \\] \end{aligned}$$

SIGNIFICANCE OF THE SLOPE IN LINE EQUATIONS

THE SLOPE DICTATES THE ANGLE AND STEEPNESS OF THE LINE. FOR THE PROBLEM AT HAND, PRESERVING THE SLOPE ENSURES THE LINE REMAINS PARALLEL.

FORMULATING THE NEW LINE EQUATION

THE POINT THE LINE PASSES THROUGH: $(8, 4)$

GIVEN A POINT $((x_1, y_1) = (8, 4))$ AND A SLOPE $(m = -8)$, THE GOAL IS TO FIND THE LINE'S EQUATION PASSING THROUGH THIS POINT AND PARALLEL TO THE ORIGINAL LINE.

USING POINT-SLOPE FORM

THE POINT-SLOPE FORM OF A LINE IS:

$$y - y_1 = m(x - x_1)$$

SUBSTITUTING THE KNOWN VALUES:

$$y - 4 = -8(x - 8)$$

EXPANDING THE RIGHT SIDE:

$$y - 4 = -8x + 64$$

ADDING 4 TO BOTH SIDES:

$$y = -8x + 64 + 4$$

$$y = -8x + 68$$

THIS IS THE SLOPE-INTERCEPT FORM OF THE REQUIRED LINE.

FINAL EQUATION OF THE LINE

$$\boxed{\text{y} = -8\text{x} + 68}$$

THIS LINE IS PARALLEL TO THE ORIGINAL $(2y + 16x = 4)$ AND PASSES THROUGH THE POINT $(8, 4)$.

VERIFYING THE SOLUTION

CHECK IF THE POINT $(8, 4)$ LIES ON THE LINE

SUBSTITUTE $(x = 8)$:

$$y = -8(8) + 68 = -64 + 68 = 4$$

WHICH MATCHES THE Y-COORDINATE EXACTLY, CONFIRMING THE POINT LIES ON THE LINE.

CONFIRMING PARALLELISM

SINCE BOTH LINES HAVE THE SAME SLOPE (-8) , THEY ARE INDEED PARALLEL. THE ORIGINAL LINE'S SLOPE WAS FOUND TO BE (-8) , AND OUR DERIVED LINE SHARES THIS SLOPE.

ADDITIONAL CONSIDERATIONS: ALTERNATIVE FORMS AND APPLICATIONS

STANDARD FORM

TRANSFORMING $(y = -8x + 68)$ INTO STANDARD FORM:

$$8x + y = 68$$

WHICH IS OFTEN USEFUL IN CERTAIN APPLICATIONS, SUCH AS SYSTEMS OF EQUATIONS OR GRAPHICAL ANALYSIS.

PRACTICAL APPLICATIONS

- ENGINEERING: DESIGNING PARALLEL COMPONENTS OR PATHWAYS.
- NAVIGATION: ENSURING ROUTES MAINTAIN CONSISTENT BEARINGS.
- ARCHITECTURE: PLANNING PARALLEL STRUCTURAL ELEMENTS.

COMMON PITFALLS AND CLARIFICATIONS

- INCORRECTLY IDENTIFYING THE SLOPE: ALWAYS CONVERT TO SLOPE-INTERCEPT FORM TO VERIFY THE SLOPE.
- CONFUSING THE POINT WITH THE LINE: REMEMBER THE LINE MUST PASS THROUGH THE SPECIFIED POINT; VERIFY AFTER DERIVING THE EQUATION.
- ASSUMING DIFFERENT FORMS: THE CHOICE BETWEEN SLOPE-INTERCEPT, POINT-SLOPE, OR STANDARD FORM DEPENDS ON CONTEXT; UNDERSTAND HOW TO CONVERT BETWEEN FORMS.

SUMMARY AND CONCLUSIONS

THE PROBLEM OF FINDING AN EQUATION FOR A LINE PARALLEL TO A GIVEN LINE AND PASSING THROUGH A SPECIFIC POINT ENCAPSULATES FUNDAMENTAL PRINCIPLES OF COORDINATE GEOMETRY. THE KEY STEPS INVOLVE:

1. CONVERTING THE ORIGINAL LINE TO SLOPE-INTERCEPT FORM TO IDENTIFY ITS SLOPE.
2. RECOGNIZING THAT PARALLEL LINES SHARE THE SAME SLOPE.
3. APPLYING THE POINT-SLOPE FORM TO INCORPORATE THE GIVEN POINT.
4. SIMPLIFYING TO THE PREFERRED FORM FOR CLARITY AND USE.

THE RESULTING LINE:

$$\boxed{8x + y = 68}$$

$$y = -8x + 68$$

SATISFIES ALL THE CONDITIONS, DEMONSTRATING A STRAIGHTFORWARD YET VITAL APPLICATION OF ALGEBRAIC TECHNIQUES IN GEOMETRIC CONTEXTS.

FINAL REMARKS

UNDERSTANDING HOW TO MANIPULATE LINEAR EQUATIONS AND RECOGNIZE PROPERTIES LIKE PARALLELISM IS ESSENTIAL FOR STUDENTS AND PROFESSIONALS ENGAGED IN FIELDS REQUIRING SPATIAL REASONING AND ANALYTICAL SKILLS. THIS PROBLEM EXEMPLIFIES THE ELEGANCE OF ALGEBRA IN SOLVING REAL-WORLD GEOMETRIC PROBLEMS, AFFIRMING THE IMPORTANCE OF FOUNDATIONAL CONCEPTS IN ADVANCED MATHEMATICAL REASONING AND PRACTICAL APPLICATIONS.

END OF ARTICLE

Find An Equation For The Line Which Is Parallel To $2y = 16x + 4$ And Passes Through The Point $(8, 4)$ Write

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