

THE DIFFERENCE BETWEEN TWICE A NUMBER, X, AND A SMALLER NUMBER, Y, IS 3. THE SUM OF TWICE THE NUMBER

THE DIFFERENCE BETWEEN TWICE A NUMBER, X, AND A SMALLER NUMBER, Y, IS 3. THE SUM OF TWICE THE NUMBER IS A COMMON PHRASE ENCOUNTERED IN ALGEBRAIC WORD PROBLEMS. IT OFTEN APPEARS IN MATH EXERCISES DESIGNED TO HELP STUDENTS UNDERSTAND HOW TO TRANSLATE VERBAL STATEMENTS INTO ALGEBRAIC EXPRESSIONS AND EQUATIONS. GRASPING THE NUANCES OF SUCH PROBLEMS IS ESSENTIAL FOR MASTERING BASIC ALGEBRA AND DEVELOPING CRITICAL THINKING SKILLS NECESSARY FOR SOLVING REAL-WORLD PROBLEMS INVOLVING RELATIONSHIPS BETWEEN NUMBERS.

IN THIS ARTICLE, WE WILL EXPLORE THE DETAILED STEPS INVOLVED IN INTERPRETING THESE KINDS OF STATEMENTS, FORMULATING ALGEBRAIC EQUATIONS, AND SOLVING FOR THE UNKNOWN. WHETHER YOU'RE A STUDENT PREPARING FOR EXAMS OR SOMEONE INTERESTED IN SHARPENING YOUR MATH SKILLS, UNDERSTANDING HOW TO APPROACH THESE PROBLEMS WILL SIGNIFICANTLY ENHANCE YOUR PROBLEM-SOLVING TOOLKIT.

UNDERSTANDING THE PROBLEM STATEMENT

THE PHRASE "THE DIFFERENCE BETWEEN TWICE A NUMBER, X, AND A SMALLER NUMBER, Y, IS 3" CAN SEEM COMPLEX AT FIRST GLANCE. HOWEVER, BREAKING IT DOWN INTO SMALLER PARTS MAKES IT MORE MANAGEABLE:

- "TWICE A NUMBER, X" REFERS TO $2x$.
- "A SMALLER NUMBER, Y" IS SIMPLY y .
- "THE DIFFERENCE BETWEEN TWICE A NUMBER, X, AND Y" INDICATES SUBTRACTING y FROM $2x$.
- "IS 3" MEANS THIS DIFFERENCE EQUALS 3.

THE SECOND PART OF THE PHRASE, "THE SUM OF TWICE THE NUMBER," SUGGESTS THERE'S AN ADDITIONAL COMPONENT INVOLVING THE SUM OF TWICE SOME NUMBER, WHICH LIKELY RELATES TO THE TOTAL OR ANOTHER PART OF THE PROBLEM.

TRANSLATING WORD PROBLEMS INTO MATHEMATICAL EQUATIONS

THE KEY TO SOLVING WORD PROBLEMS IS TRANSLATING THE VERBAL STATEMENTS INTO ALGEBRAIC EQUATIONS. LET'S ANALYZE THE STATEMENT STEP-BY-STEP:

STEP 1: IDENTIFY KNOWN AND UNKNOWN VARIABLES

- LET x REPRESENT THE LARGER NUMBER.
- LET y REPRESENT THE SMALLER NUMBER.

STEP 2: WRITE THE FIRST EQUATION BASED ON THE DIFFERENCE

THE PHRASE "THE DIFFERENCE BETWEEN TWICE A NUMBER, X, AND A SMALLER NUMBER, Y, IS 3" TRANSLATES TO:

$$[2x - y = 3]$$

STEP 3: INTERPRETING "THE SUM OF TWICE THE NUMBER"

THIS PART INDICATES THERE IS A SUM INVOLVING TWICE SOME NUMBER. IT COULD BE:

- THE SUM OF TWICE THE LARGER NUMBER, OR

- THE SUM INVOLVING THE TWO NUMBERS.

DEPENDING ON THE FULL CONTEXT, THERE MIGHT BE AN ADDITIONAL STATEMENT SUCH AS:

> "THE SUM OF TWICE THE NUMBER X AND Y IS ..."

OR

> "THE SUM OF TWICE X AND TWICE Y IS ..."

SINCE THE ORIGINAL PHRASE IS INCOMPLETE, WE'LL EXPLORE COMMON INTERPRETATIONS.

COMMON SCENARIOS AND HOW TO FORMULATE EQUATIONS

LET'S CONSIDER TYPICAL SCENARIOS BASED ON SIMILAR PROBLEMS.

SCENARIO 1: SUM OF TWICE THE LARGER NUMBER AND THE SMALLER NUMBER

SUPPOSE THE PROBLEM STATES:

> "THE SUM OF TWICE THE LARGER NUMBER, X, AND THE SMALLER NUMBER, Y, IS SOME VALUE."

THEN, THE EQUATION BECOMES:

$$\backslash[2x + y = \text{SOME VALUE} \backslash]$$

IF THE VALUE IS PROVIDED, FOR EXAMPLE, 10, THE EQUATION IS:

$$\backslash[2x + y = 10 \backslash]$$

SCENARIO 2: SUM OF TWICE BOTH NUMBERS

ALTERNATIVELY, IF THE STATEMENT IS:

> "THE SUM OF TWICE X AND TWICE Y IS 20,"

THEN:

$$\backslash[2x + 2y = 20 \backslash]$$

WHICH SIMPLIFIES TO:

$$\backslash[x + y = 10 \backslash]$$

SCENARIO 3: THE COMPLETE PROBLEM STATEMENT

PUTTING IT ALL TOGETHER, A TYPICAL PROBLEM MIGHT BE:

> "THE DIFFERENCE BETWEEN TWICE A NUMBER, X, AND A SMALLER NUMBER, Y, IS 3. THE SUM OF TWICE THE LARGER NUMBER AND THE SMALLER NUMBER IS 10. FIND THE NUMBERS."

THIS WOULD LEAD TO THE SYSTEM OF EQUATIONS:

$$\backslash[\begin{cases} \end{cases}$$

$$\begin{aligned} 2x - y &= 3 \\ 2x + y &= 10 \end{aligned}$$

SOLVING THE SYSTEM OF EQUATIONS

ONCE THE EQUATIONS ARE ESTABLISHED, SOLVING THE PROBLEM INVOLVES ALGEBRAIC METHODS SUCH AS SUBSTITUTION OR ELIMINATION.

USING THE ELIMINATION METHOD

GIVEN THE SYSTEM:

$$\begin{aligned} & \begin{aligned} & 2x - y = 3 \quad (1) \\ & 2x + y = 10 \quad (2) \end{aligned} \end{aligned}$$

ADD EQUATIONS (1) AND (2):

$$(2x - y) + (2x + y) = 3 + 10$$

SIMPLIFY:

$$4x = 13$$

SOLVE FOR X:

$$x = \frac{13}{4} = 3.25$$

SUBSTITUTE X INTO EQUATION (1):

$$2(3.25) - y = 3$$

CALCULATE:

$$6.5 - y = 3$$

SOLVE FOR Y:

$$y = 6.5 - 3 = 3.5$$

\]

FINAL ANSWER:

- THE LARGER NUMBER x IS 3.25.
- THE SMALLER NUMBER y IS 3.5.

KEY TAKEAWAYS FROM THESE TYPES OF PROBLEMS

- ALWAYS CAREFULLY READ THE PROBLEM TO IDENTIFY WHAT EACH PART REFERS TO.
- BREAK DOWN THE VERBAL STATEMENTS INTO ALGEBRAIC EXPRESSIONS.
- FORMULATE THE APPROPRIATE EQUATIONS BASED ON THE RELATIONSHIPS DESCRIBED.
- USE ALGEBRAIC METHODS LIKE SUBSTITUTION OR ELIMINATION TO SOLVE THE SYSTEM.
- VERIFY SOLUTIONS BY SUBSTITUTING BACK INTO ORIGINAL EQUATIONS.

ADDITIONAL TIPS FOR SOLVING SIMILAR WORD PROBLEMS

- IDENTIFY ALL VARIABLES CLEARLY: ASSIGN SYMBOLS TO UNKNOWN QUANTITIES.
- TRANSLATE STEP-BY-STEP: CONVERT EACH PHRASE INTO AN ALGEBRAIC EXPRESSION.
- WRITE ALL EQUATIONS EXPLICITLY: AVOID ASSUMPTIONS; BASE EQUATIONS ON THE STATEMENTS.
- CHECK FOR MULTIPLE INTERPRETATIONS: SOME PROBLEMS CAN HAVE MORE THAN ONE VALID EQUATION BASED ON CONTEXT.
- SOLVE SYSTEMATICALLY: USE SUBSTITUTION OR ELIMINATION TECHNIQUES.
- VERIFY YOUR SOLUTIONS: PLUG VALUES BACK INTO ORIGINAL STATEMENTS TO ENSURE ACCURACY.

PRACTICE PROBLEMS TO ENHANCE YOUR SKILLS

1. PROBLEM 1: THE DIFFERENCE BETWEEN TWICE A NUMBER AND A SMALLER NUMBER IS 5. THE SUM OF TWICE THE LARGER NUMBER AND THE SMALLER NUMBER IS 15. FIND BOTH NUMBERS.
2. PROBLEM 2: IF THE DIFFERENCE BETWEEN TWICE A NUMBER, x , AND y IS 7, AND THE SUM OF THE TWO NUMBERS IS 20, WHAT ARE THE VALUES OF x AND y ?
3. PROBLEM 3: THE DIFFERENCE BETWEEN TWICE A NUMBER AND ANOTHER SMALLER NUMBER IS 4. THE SUM OF TWICE THE LARGER NUMBER AND TWICE THE SMALLER NUMBER IS 18. FIND THE NUMBERS.

CONCLUSION

UNDERSTANDING THE DIFFERENCE BETWEEN PHRASES LIKE "THE DIFFERENCE BETWEEN TWICE A NUMBER, x , AND A SMALLER NUMBER, y , IS 3" AND TRANSLATING THEM INTO ALGEBRAIC EQUATIONS IS FOUNDATIONAL IN ALGEBRA. MASTERING THIS PROCESS ENABLES SOLVING A WIDE RANGE OF WORD PROBLEMS INVOLVING RELATIONSHIPS BETWEEN NUMBERS. REMEMBER TO CAREFULLY INTERPRET THE PROBLEM, FORM ACCURATE EQUATIONS, AND APPLY APPROPRIATE SOLVING METHODS. WITH

PRACTICE, YOU'LL BECOME PROFICIENT IN TRANSLATING COMPLEX VERBAL DESCRIPTIONS INTO MATHEMATICAL SOLUTIONS, ENHANCING BOTH YOUR PROBLEM-SOLVING SKILLS AND YOUR CONFIDENCE IN ALGEBRA.

BY PRACTICING THESE TYPES OF PROBLEMS AND UNDERSTANDING THE UNDERLYING PRINCIPLES, YOU'LL BE WELL-EQUIPPED TO HANDLE SIMILAR ALGEBRAIC CHALLENGES CONFIDENTLY AND EFFICIENTLY.

FREQUENTLY ASKED QUESTIONS

WHAT DOES THE PHRASE 'THE DIFFERENCE BETWEEN TWICE A NUMBER, X , AND A SMALLER NUMBER, Y , IS 3' MEAN MATHEMATICALLY?

IT MEANS THAT $2X$ MINUS Y EQUALS 3, OR $2X - Y = 3$.

HOW CAN WE EXPRESS 'THE SUM OF TWICE THE NUMBER' IN AN EQUATION?

THE SUM OF TWICE THE NUMBER IS $2X$, WHICH CAN BE WRITTEN AS $2X$.

IF $2X - Y = 3$, HOW CAN WE FIND POSSIBLE VALUES FOR X AND Y ?

WE NEED ADDITIONAL INFORMATION OR A SECOND EQUATION TO SOLVE FOR SPECIFIC VALUES OF X AND Y ; OTHERWISE, THE RELATIONSHIP IS INDEFINITE.

WHAT IS THE SIGNIFICANCE OF THE PHRASE 'TWICE A NUMBER' IN FORMING EQUATIONS?

IT INDICATES THAT THE VARIABLE X IS MULTIPLIED BY 2, WHICH IS ESSENTIAL IN SETTING UP EQUATIONS LIKE $2X$.

CAN YOU SOLVE FOR Y IN TERMS OF X USING THE GIVEN INFORMATION?

YES, FROM $2X - Y = 3$, $Y = 2X - 3$.

IF X IS 5, WHAT IS THE VALUE OF Y BASED ON THE GIVEN DIFFERENCE?

$Y = 2(5) - 3 = 10 - 3 = 7$.

WHAT IS THE KEY MATHEMATICAL RELATIONSHIP IN 'THE DIFFERENCE BETWEEN TWICE A NUMBER, X , AND A SMALLER NUMBER, Y , IS 3'?

THE KEY RELATIONSHIP IS $2X - Y = 3$, WHICH LINKS THE TWO NUMBERS.

HOW CAN THIS PROBLEM BE EXTENDED TO FIND THE SUM OF THE TWO NUMBERS?

ONCE Y IS EXPRESSED IN TERMS OF X , THE SUM IS $X + Y = X + (2X - 3) = 3X - 3$. ADDITIONAL INFORMATION ABOUT X WOULD BE NEEDED TO FIND A SPECIFIC SUM.

ADDITIONAL RESOURCES

THE DIFFERENCE BETWEEN TWICE A NUMBER, X , AND A SMALLER NUMBER, Y , IS 3. THE SUM OF TWICE THE NUMBER

INTRODUCTION

MATHEMATICS OFTEN PRESENTS US WITH INTRIGUING PROBLEMS THAT CHALLENGE OUR REASONING AND PROBLEM-SOLVING SKILLS. ONE SUCH PROBLEM INVOLVES UNDERSTANDING THE RELATIONSHIP BETWEEN TWO NUMBERS: A LARGER NUMBER, X , AND A SMALLER NUMBER, Y . THE PROBLEM STATES: THE DIFFERENCE BETWEEN TWICE A NUMBER, X , AND A SMALLER NUMBER, Y , IS 3. THE SUM OF TWICE THE NUMBER—WHICH WE INTERPRET AS TWICE X —IS ALSO RELEVANT TO THE PROBLEM. ALTHOUGH IT SOUNDS STRAIGHTFORWARD, UNPACKING THIS STATEMENT REQUIRES CAREFUL ANALYSIS, ALGEBRAIC REPRESENTATION, AND LOGICAL REASONING. THIS ARTICLE EXPLORES THE CORE CONCEPTS BEHIND SUCH PROBLEMS, DEMONSTRATES HOW TO FORMULATE EQUATIONS, AND PROVIDES A STEP-BY-STEP APPROACH TO SOLVING THEM.

UNDERSTANDING THE PROBLEM STATEMENT

AT FIRST GLANCE, THE PHRASE "THE DIFFERENCE BETWEEN TWICE A NUMBER, X , AND A SMALLER NUMBER, Y , IS 3" CAN BE TRANSLATED INTO A MATHEMATICAL EXPRESSION:

EQUATION 1:
 $2X - Y = 3$

THIS INDICATES THAT IF YOU DOUBLE THE LARGER NUMBER X AND THEN SUBTRACT THE SMALLER NUMBER Y , THE RESULT IS 3.

THE SECOND PART OF THE STATEMENT, "THE SUM OF TWICE THE NUMBER," SUGGESTS CONSIDERING THE SUM OF TWICE THE LARGER NUMBER, WHICH IS:

$2X$

WHILE THE SENTENCE MIGHT SEEM INCOMPLETE, CONTEXTUALLY, IT IMPLIES THAT THE PROBLEM INVOLVES THE SUM OF THESE TWO QUANTITIES OR THEIR RELATION TO OTHER PARTS. OFTEN, SUCH PROBLEMS ARE DESIGNED TO FIND THE SPECIFIC VALUES OF X AND Y THAT SATISFY THE GIVEN CONDITIONS.

FORMALIZING THE PROBLEM USING ALGEBRA

TO ANALYZE THE PROBLEM SYSTEMATICALLY, WE NEED TO ESTABLISH CLEAR EQUATIONS BASED ON THE STATEMENT:

- KNOWN:

1. THE DIFFERENCE BETWEEN TWICE X AND Y IS 3.
2. THE SUM INVOLVING TWICE X OR OTHER RELATED QUANTITIES.

- OBJECTIVE:

FIND THE VALUES OF X AND Y THAT SATISFY THESE CONDITIONS.

LET'S DEFINE THE VARIABLES:

- X : THE LARGER NUMBER.
- Y : THE SMALLER NUMBER.

FROM THE STATEMENT, THE PRIMARY EQUATION IS:

EQUATION 1:
 $2X - Y = 3$

DEPENDING ON THE COMPLETE PROBLEM DESCRIPTION, THERE MIGHT BE ADDITIONAL INFORMATION OR CONSTRAINTS. FOR EXAMPLE, IF THE PROBLEM STATES "THE SUM OF TWICE THE NUMBER AND Y IS SOME VALUE," OR " Y IS SMALLER THAN X ," THESE WILL INFLUENCE THE EQUATIONS.

DEVELOPING THE EQUATIONS

GIVEN THE INITIAL STATEMENT, WE CAN THINK OF MULTIPLE SCENARIOS:

SCENARIO 1: THE SUM OF TWICE THE NUMBER AND Y

SUPPOSE THE PROBLEM CONTINUES WITH: "THE SUM OF TWICE X AND Y IS SOME CONSTANT," SAY S. THEN:

EQUATION 2:

$$2X + Y = S$$

WITHOUT A SPECIFIC VALUE FOR S, WE CAN'T SOLVE EXPLICITLY, BUT WE CAN ANALYZE THE RELATIONSHIPS.

SCENARIO 2: Y IS SMALLER THAN X

THIS IS OFTEN AN ASSUMPTION, WHICH MATHEMATICALLY IS:

$$Y < X$$

THIS INEQUALITY HELPS IN UNDERSTANDING THE SOLUTION SET.

SOLVING THE EQUATIONS

LET'S ASSUME THE PROBLEM IS TO FIND X AND Y SUCH THAT:

1. $2X - Y = 3$ (FROM THE INITIAL STATEMENT)
2. $2X + Y = S$ (HYPOTHETICAL, DEPENDING ON THE PROBLEM)

METHOD:

BY ADDING EQUATIONS, WE CAN ELIMINATE Y:

$$(2X - Y) + (2X + Y) = 3 + S$$

SIMPLIFIES TO:

$$4X = 3 + S$$

THEN:

$$X = (3 + S) / 4$$

ONCE X IS KNOWN, SUBSTITUTE BACK INTO EITHER EQUATION TO FIND Y:

$$Y = 2X - 3$$

NOTE:

WITHOUT A SPECIFIC VALUE FOR S, THIS REMAINS A GENERAL SOLUTION.

PRACTICAL EXAMPLES AND NUMERICAL SOLUTIONS

TO ILLUSTRATE, SUPPOSE THE PROBLEM STATES:

"THE DIFFERENCE BETWEEN TWICE A NUMBER, X, AND Y, IS 3. THE SUM OF TWICE X AND Y IS 11."

THIS GIVES:

- EQUATION 1: $2X - Y = 3$
- EQUATION 2: $2X + Y = 11$

ADDING BOTH EQUATIONS:

$$\begin{aligned}(2X - Y) + (2X + Y) &= 3 + 11 \\ 4X &= 14 \\ X &= 14 / 4 = 3.5\end{aligned}$$

SUBSTITUTING BACK INTO EQUATION 1:

$$\begin{aligned}2(3.5) - Y &= 3 \\ 7 - Y &= 3 \\ Y &= 7 - 3 = 4\end{aligned}$$

SOLUTION:

- $X = 3.5$
- $Y = 4$

NOTICE THAT Y IS LARGER THAN X IN THIS CASE, WHICH MIGHT CONTRADICT THE "SMALLER NUMBER" ASSUMPTION UNLESS THE PROBLEM PERMITS EQUALITY OR $Y > X$ IN CERTAIN CONTEXTS.

INTERPRETING THE RESULTS AND CONSTRAINTS

DEPENDING ON THE PROBLEM CONTEXT, THE SOLUTIONS MIGHT NEED TO SATISFY ADDITIONAL CONSTRAINTS:

- POSITIVITY: USUALLY, NUMBERS ARE POSITIVE UNLESS STATED OTHERWISE.
- ORDER: $Y < X$, AS Y IS A SMALLER NUMBER.
- INTEGER SOLUTIONS: IF THE PROBLEM SPECIFIES INTEGERS, FRACTIONAL SOLUTIONS ARE INVALID.

IN THE PREVIOUS EXAMPLE, SINCE $Y = 4$ AND $X = 3.5$, Y IS LARGER THAN X , WHICH CONTRADICTS THE ASSUMPTION THAT Y IS SMALLER. TO MAINTAIN $Y < X$, THE PROBLEM'S PARAMETERS NEED ADJUSTMENT, PERHAPS WITH DIFFERENT SUMS OR DIFFERENCES.

BROADER APPLICATIONS AND REAL-WORLD RELEVANCE

UNDERSTANDING SUCH ALGEBRAIC RELATIONSHIPS IS ESSENTIAL IN VARIOUS FIELDS:

- FINANCE: CALCULATING DIFFERENCES BETWEEN INVESTMENTS OR ASSETS.
- ENGINEERING: ANALYZING SYSTEM PARAMETERS WITH CONSTRAINTS.
- STATISTICS: INTERPRETING DATA DIFFERENCES AND SUMS.

THE CORE SKILL INVOLVES TRANSLATING VERBAL STATEMENTS INTO ALGEBRAIC EQUATIONS, SOLVING SYSTEMATICALLY, AND INTERPRETING SOLUTIONS WITHIN THE PROBLEM'S CONTEXT.

TIPS FOR SOLVING SIMILAR PROBLEMS

- IDENTIFY KEY QUANTITIES: DETERMINE WHAT THE PROBLEM STATES EXPLICITLY.
- TRANSLATE WORDS INTO EQUATIONS: WRITE ALGEBRAIC EXPRESSIONS THAT REFLECT THE CONDITIONS.
- MAINTAIN CLARITY: KEEP TRACK OF KNOWN AND UNKNOWN.
- CHECK CONDITIONS: ENSURE SOLUTIONS SATISFY ALL CONSTRAINTS, INCLUDING INEQUALITIES AND DOMAIN RESTRICTIONS.

- USE SUBSTITUTION AND ELIMINATION: EMPLOY ALGEBRAIC TECHNIQUES TO SOLVE SYSTEMS OF EQUATIONS EFFICIENTLY.

CONCLUSION

PROBLEMS LIKE "THE DIFFERENCE BETWEEN TWICE A NUMBER, X , AND A SMALLER NUMBER, Y , IS 3," SERVE AS EXCELLENT EXERCISES TO SHARPEN ALGEBRAIC REASONING. BY CAREFULLY TRANSLATING VERBAL CONDITIONS INTO EQUATIONS, ANALYZING POSSIBLE SOLUTIONS, AND CONSIDERING CONSTRAINTS, LEARNERS DEVELOP A DEEPER UNDERSTANDING OF RELATIONSHIPS BETWEEN NUMBERS. WHETHER APPLIED IN ACADEMIC SETTINGS OR REAL-WORLD SCENARIOS, MASTERING THESE PROBLEM-SOLVING TECHNIQUES IS INVALUABLE. AS WITH MANY MATHEMATICAL CHALLENGES, PATIENCE, SYSTEMATIC APPROACH, AND CRITICAL THINKING PAVE THE WAY TO ACCURATE SOLUTIONS AND INSIGHTS.

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