

KATE BOUGHT 6 CDs AND 2 DVD FOR \$56.WS JAKE BOUGHT 3 CDs AND 3 DVDs FOR \$48.IF X IS THE COST OF A CD AND

KATE BOUGHT 6 CDs AND 2 DVD FOR \$56.WS JAKE BOUGHT 3 CDs AND 3 DVDs FOR \$48.IF X IS THE COST OF A CD AND THIS SCENARIO PRESENTS AN INTERESTING OPPORTUNITY TO EXPLORE HOW TO DETERMINE THE INDIVIDUAL PRICES OF CDs AND DVDs BASED ON GIVEN TOTAL COSTS. THIS TYPE OF PROBLEM IS COMMON IN ALGEBRA AND HELPS DEVELOP CRITICAL THINKING SKILLS RELATED TO SYSTEMS OF EQUATIONS. IN THIS ARTICLE, WE WILL ANALYZE THE PROBLEM, SET UP THE NECESSARY EQUATIONS, SOLVE FOR THE COSTS, AND DISCUSS REAL-WORLD APPLICATIONS OF SUCH MATHEMATICAL CONCEPTS.

UNDERSTANDING THE PROBLEM

EVERY WORD PROBLEM INVOLVING MULTIPLE ITEMS AND THEIR TOTAL COSTS TYPICALLY REQUIRES TRANSLATING THE INFORMATION INTO ALGEBRAIC EQUATIONS. HERE, WE ARE TOLD:

- KATE BOUGHT 6 CDs AND 2 DVDs FOR A TOTAL OF \$56.
- JAKE BOUGHT 3 CDs AND 3 DVDs FOR A TOTAL OF \$48.
- THE COST OF A CD IS REPRESENTED BY X.

OUR GOAL IS TO FIND THE COST OF A DVD, WHICH WE WILL DENOTE AS Y, BASED ON THE INFORMATION PROVIDED.

SETTING UP THE EQUATIONS

TO SOLVE FOR THE INDIVIDUAL PRICES, WE NEED TO TRANSLATE THE PROBLEM INTO TWO EQUATIONS WITH TWO VARIABLES:

- EQUATION 1 (KATE'S PURCHASE):
 $6X + 2Y = 56$

- EQUATION 2 (JAKE'S PURCHASE):
 $3X + 3Y = 48$

SINCE WE KNOW X (THE COST OF A CD), OR AT LEAST WE WANT TO FIND IT, THESE EQUATIONS CAN BE MANIPULATED TO FIND Y, THE DVD'S COST.

EXPRESSING THE EQUATIONS

LET'S WRITE DOWN THE EQUATIONS CLEARLY:

1. KATE'S PURCHASE:
 $6X + 2Y = 56$

2. JAKE'S PURCHASE:

$$3X + 3Y = 48$$

THE NEXT STEP INVOLVES SOLVING THESE EQUATIONS SIMULTANEOUSLY.

SOLVING FOR THE COST OF A DVD

TO FIND THE VALUE OF Y , WE NEED TO ELIMINATE ONE VARIABLE. THERE ARE DIFFERENT METHODS TO DO THIS, SUCH AS SUBSTITUTION OR ELIMINATION. HERE, WE'LL USE THE ELIMINATION METHOD.

STEP 1: SIMPLIFY THE EQUATIONS

IT'S HELPFUL TO SIMPLIFY THE EQUATIONS WHERE POSSIBLE TO MAKE CALCULATIONS EASIER:

- EQUATION 1:

$$6X + 2Y = 56$$

DIVIDE THROUGH BY 2:

$$3X + Y = 28$$

- EQUATION 2:

$$3X + 3Y = 48$$

NOW, THE SYSTEM IS:

$$1. 3X + Y = 28$$

$$2. 3X + 3Y = 48$$

STEP 2: SUBTRACT THE FIRST EQUATION FROM THE SECOND

SUBTRACT EQUATION 1 FROM EQUATION 2:

$$(3X + 3Y) - (3X + Y) = 48 - 28$$

THIS SIMPLIFIES TO:

$$3X + 3Y - 3X - Y = 20$$

WHICH SIMPLIFIES FURTHER:

$$2Y = 20$$

SOLVING FOR Y :

$$Y = 20 / 2 = 10$$

THEREFORE, THE COST OF A DVD IS \$10.

STEP 3: FIND THE COST OF A CD

NOW THAT WE KNOW $Y = \$10$, SUBSTITUTE INTO EQUATION 1 TO FIND X :

$$3X + Y = 28$$

$$3X + 10 = 28$$

$$3X = 28 - 10 = 18$$

$$X = 18 / 3 = 6$$

THUS, THE COST OF A CD IS \$6.

SUMMARY OF RESULTS

FROM THE CALCULATIONS:

- COST OF A CD (X): \$6
- COST OF A DVD (Y): \$10

THESE VALUES SATISFY BOTH ORIGINAL PURCHASE SCENARIOS, CONFIRMING THEIR ACCURACY.

REAL-WORLD APPLICATIONS OF SUCH PROBLEMS

PROBLEMS LIKE THESE ARE NOT JUST ACADEMIC EXERCISES; THEY HAVE PRACTICAL APPLICATIONS IN VARIOUS FIELDS:

- **BUDGET PLANNING:** DETERMINING THE COST OF ITEMS BASED ON TOTAL EXPENSES HELPS IN CREATING ACCURATE BUDGETS.
- **PRICING STRATEGIES:** BUSINESSES CAN ANALYZE HOW DIFFERENT COMBINATIONS OF PRODUCTS IMPACT REVENUE AND PROFITABILITY.
- **SHOPPING AND COST COMPARISON:** CONSUMERS CAN COMPARE PRICES EFFECTIVELY WHEN THEY UNDERSTAND UNIT PRICES AND TOTAL COSTS.
- **INVENTORY MANAGEMENT:** KNOWING INDIVIDUAL ITEM COSTS AIDS IN INVENTORY VALUATION AND PRICING DECISIONS.

ADDITIONAL CONSIDERATIONS

WHILE THE PROBLEM WAS STRAIGHTFORWARD, REAL-LIFE SCENARIOS OFTEN INVOLVE MORE COMPLEXITIES SUCH AS TAXES, DISCOUNTS, OR BULK PRICING. WHEN DEALING WITH SUCH FACTORS:

- ADJUST EQUATIONS TO ACCOUNT FOR ADDITIONAL COSTS OR REDUCTIONS.
- USE SYSTEMS OF EQUATIONS TO INCORPORATE MULTIPLE VARIABLES AND CONSTRAINTS.

- EMPLOY ALGEBRAIC TECHNIQUES LIKE SUBSTITUTION, ELIMINATION, OR MATRIX METHODS FOR LARGER SYSTEMS.

COMMON MISTAKES AND HOW TO AVOID THEM

WHEN SOLVING SIMILAR PROBLEMS, BE AWARE OF TYPICAL ERRORS:

- INCORRECTLY SETTING UP EQUATIONS: ALWAYS VERIFY THAT THE EQUATIONS MATCH THE PROBLEM'S CONDITIONS.
- ARITHMETIC ERRORS DURING CALCULATIONS: DOUBLE-CHECK BASIC OPERATIONS, ESPECIALLY WHEN DIVIDING OR MULTIPLYING.
- ASSUMING VALUES WITHOUT VERIFICATION: AFTER FINDING A SOLUTION, SUBSTITUTE BACK INTO ORIGINAL EQUATIONS TO CONFIRM ACCURACY.
- IGNORING UNITS: KEEP TRACK OF UNITS THROUGHOUT THE PROBLEM TO AVOID CONFUSION.

CONCLUSION

DETERMINING THE INDIVIDUAL COSTS OF ITEMS BASED ON TOTAL PURCHASE AMOUNTS IS A FUNDAMENTAL APPLICATION OF ALGEBRA. IN THE SCENARIO WHERE KATE BOUGHT 6 CDs AND 2 DVDs FOR \$56, AND JAKE BOUGHT 3 CDs AND 3 DVDs FOR \$48, WE SUCCESSFULLY CALCULATED THAT EACH CD COSTS \$6 AND EACH DVD COSTS \$10. THESE KINDS OF PROBLEMS ENHANCE PROBLEM-SOLVING SKILLS AND ARE DIRECTLY APPLICABLE IN EVERYDAY FINANCIAL DECISION-MAKING, BUSINESS PRICING, AND BUDGETING TASKS. MASTERY OF SETTING UP AND SOLVING SYSTEMS OF EQUATIONS IS ESSENTIAL FOR STUDENTS AND PROFESSIONALS ALIKE, PROVIDING A STRONG FOUNDATION FOR QUANTITATIVE REASONING.

REMEMBER: WHEN APPROACHING SIMILAR PROBLEMS, ALWAYS CAREFULLY READ THE PROBLEM, TRANSLATE THE WORDS INTO EQUATIONS, SIMPLIFY WHERE POSSIBLE, AND VERIFY YOUR SOLUTIONS. WITH PRACTICE, SOLVING SUCH PROBLEMS BECOMES QUICK AND INTUITIVE, EMPOWERING YOU TO HANDLE COMPLEX REAL-WORLD SCENARIOS WITH CONFIDENCE.

FREQUENTLY ASKED QUESTIONS

WHAT IS THE COST OF ONE CD IN THE GIVEN SCENARIO?

THE COST OF ONE CD IS \$8.

WHAT IS THE COST OF ONE DVD BASED ON THE GIVEN DATA?

THE COST OF ONE DVD IS \$16.

HOW CAN WE SET UP THE EQUATIONS TO FIND THE PRICE OF A CD AND A DVD?

LET X BE THE COST OF A CD AND Y BE THE COST OF A DVD. FROM THE DATA: $6X + 2Y = 56$ AND $3X + 3Y = 48$.

WHAT METHOD CAN BE USED TO SOLVE FOR X AND Y IN THIS PROBLEM?

YOU CAN USE SUBSTITUTION OR ELIMINATION METHODS TO SOLVE THE SYSTEM OF EQUATIONS AND FIND THE VALUES OF X AND Y .

IF THE COST OF A CD IS \$8, WHAT IS THE TOTAL COST OF 4 CDs AND 2 DVDs?

TOTAL COST = $4 \times \$8 + 2 \times \$16 = \$32 + \$32 = \$64$.

ADDITIONAL RESOURCES

UNDERSTANDING THE COST OF CDs AND DVDs: A DETAILED MATHEMATICAL BREAKDOWN

WHEN EXPLORING THE WORLD OF PURCHASING ENTERTAINMENT MEDIA SUCH AS CDs AND DVDs, IT'S OFTEN INSIGHTFUL TO ANALYZE THE COSTS INVOLVED AND DETERMINE THE INDIVIDUAL PRICES OF EACH ITEM. IN THIS COMPREHENSIVE REVIEW, WE'LL DELVE INTO A SPECIFIC PROBLEM INVOLVING TWO BUYERS—KATE AND JAKE—who purchase different quantities of CDs and DVDs AT A TOTAL COST, AND WE'LL WORK THROUGH HOW TO FIND THE COST OF A SINGLE CD, DENOTED AS X . THIS PROCESS NOT ONLY ILLUSTRATES FUNDAMENTAL ALGEBRAIC CONCEPTS BUT ALSO EMPHASIZES PRACTICAL APPLICATIONS OF SYSTEMS OF EQUATIONS IN REAL-WORLD SCENARIOS.

INTRODUCTION TO THE PROBLEM SCENARIO

IMAGINE KATE AND JAKE, TWO AVID CONSUMERS OF MUSIC AND MOVIES, MAKING PURCHASES FROM A STORE THAT SELLS CDs AND DVDs. THEIR PURCHASE DETAILS ARE AS FOLLOWS:

- KATE BOUGHT 6 CDs AND 2 DVDs FOR A TOTAL OF \$56.
- JAKE BOUGHT 3 CDs AND 3 DVDs FOR A TOTAL OF \$48.

OUR GOAL IS TO DETERMINE X , THE COST OF ONE CD, GIVEN THESE PURCHASE DATA POINTS.

THIS PROBLEM IS A CLASSIC EXAMPLE OF SETTING UP A SYSTEM OF EQUATIONS BASED ON THE PURCHASE INFORMATION AND SOLVING FOR THE UNKNOWN—SPECIFICALLY, THE UNIT PRICES OF CDs AND DVDs.

DEFINING VARIABLES AND SETTING UP EQUATIONS

BEFORE SOLVING, WE NEED TO DEFINE OUR VARIABLES:

- LET X = COST OF ONE CD (IN DOLLARS)
- LET Y = COST OF ONE DVD (IN DOLLARS)

USING THESE VARIABLES, WE CAN TRANSLATE THE PURCHASE INFORMATION INTO ALGEBRAIC EQUATIONS:

EQUATION FOR KATE'S PURCHASE:

$$\{ 6X + 2Y = 56 \}$$

EQUATION FOR JAKE'S PURCHASE:

$$\{ 3X + 3Y = 48 \}$$

THESE TWO EQUATIONS FORM A SYSTEM OF LINEAR EQUATIONS WHICH WE WILL NOW ANALYZE.

ANALYZING AND SIMPLIFYING THE EQUATIONS

STEP 1: WRITE DOWN THE EQUATIONS EXPLICITLY:

```
\[
\begin{cases}
6X + 2Y = 56 \quad (1) \\
3X + 3Y = 48 \quad (2)
\end{cases}
\]
```

STEP 2: SIMPLIFY EQUATIONS WHERE POSSIBLE

EQUATION (1):

DIVIDE THROUGH BY 2 TO SIMPLIFY:

```
\[
3X + Y = 28 \quad (3)
\]
```

EQUATION (2):

DIVIDE THROUGH BY 3:

```
\[
X + Y = 16 \quad (4)
\]
```

NOW, THE SIMPLIFIED SYSTEM BECOMES:

```
\[
\begin{cases}
3X + Y = 28 \quad (3) \\
X + Y = 16 \quad (4)
\end{cases}
\]
```

NOTE: SIMPLIFICATION MAKES THE COEFFICIENTS EASIER TO WORK WITH, FACILITATING STRAIGHTFORWARD ELIMINATION OR SUBSTITUTION METHODS.

SOLVING THE SYSTEM OF EQUATIONS

METHOD 1: SUBSTITUTION

FROM EQUATION (4):

```
\[
X + Y = 16 \rightarrow Y = 16 - X
\]
```

SUBSTITUTE Y INTO EQUATION (3):

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\[
```

$$3X + (16 - X) = 28$$

SIMPLIFY:

$$3X + 16 - X = 28$$

$$(3X - X) + 16 = 28$$

$$2X + 16 = 28$$

SUBTRACT 16 FROM BOTH SIDES:

$$2X = 12$$

DIVIDE BOTH SIDES BY 2:

$$X = 6$$

RESULT: THE COST OF ONE CD (X) IS \$6.

DETERMINING THE COST OF A DVD

WITH X KNOWN, WE CAN FIND Y USING EQUATION (4):

$$Y = 16 - X = 16 - 6 = 10$$

RESULT: THE COST OF ONE DVD (Y) IS \$10.

VERIFICATION OF THE SOLUTION

TO ENSURE ACCURACY, VERIFY THE SOLUTION AGAINST THE ORIGINAL EQUATIONS:

- FOR KATE:

$$6X + 2Y = 6 \times 6 + 2 \times 10 = 36 + 20 = 56$$

- FOR JAKE:

$$\begin{aligned} & \\ 3X + 3Y &= 3 \times 6 + 3 \times 10 = 18 + 30 = 48 \\ & \end{aligned}$$

BOTH EQUATIONS CHECK OUT CORRECTLY, CONFIRMING OUR SOLUTION IS ACCURATE.

IMPLICATIONS AND APPLICATIONS OF THE SOLUTION

UNDERSTANDING THE INDIVIDUAL COSTS OF CDs AND DVDs HAS SEVERAL PRACTICAL APPLICATIONS:

- BUDGET PLANNING: CONSUMERS CAN DETERMINE HOW MUCH THEY SHOULD EXPECT TO PAY PER ITEM, AIDING IN BUDGETING FOR ENTERTAINMENT EXPENSES.
- PRICE COMPARISON: KNOWING UNIT PRICES ALLOWS CONSUMERS TO COMPARE DIFFERENT STORES OR BRANDS TO FIND THE BEST DEALS.
- BUSINESS ANALYSIS: RETAILERS CAN ANALYZE PRICING STRATEGIES AND UNDERSTAND COMPETITIVE MARKET PRICES.
- EDUCATIONAL VALUE: THIS PROBLEM EXEMPLIFIES HOW ALGEBRA CAN BE APPLIED TO REAL-WORLD SCENARIOS, ENHANCING PROBLEM-SOLVING SKILLS.

FURTHER EXPLORATIONS AND VARIATIONS

1. CHANGING PURCHASE QUANTITIES:

SUPPOSE KATE OR JAKE BOUGHT DIFFERENT QUANTITIES, HOW WOULD THE EQUATIONS CHANGE? FOR EXAMPLE, IF KATE BOUGHT 8 CDs AND 1 DVD FOR \$62, HOW DOES THAT IMPACT THE CALCULATIONS?

2. INTRODUCING ADDITIONAL VARIABLES:

WHAT IF THE STORE HAS DISCOUNTS OR TAXES? INCORPORATING THESE FACTORS WOULD INTRODUCE ADDITIONAL VARIABLES AND COMPLEXITIES INTO THE EQUATIONS.

3. APPLICATION TO OTHER CONTEXTS:

SIMILAR SYSTEMS OF EQUATIONS CAN BE USED TO SOLVE PROBLEMS INVOLVING MIXTURES, RATES, AND OTHER COMBINATION SCENARIOS SUCH AS:

- PRICING OF MULTIPLE PRODUCTS
- RESOURCE ALLOCATION
- COST ANALYSIS IN MANUFACTURING

CONCLUSION: THE POWER OF ALGEBRA IN EVERYDAY TRANSACTIONS

THROUGH THIS DETAILED ANALYSIS, WE'VE DEMONSTRATED HOW TO SET UP AND SOLVE A REAL-WORLD PROBLEM INVOLVING THE COSTS OF CDs AND DVDs. THE KEY STEPS INVOLVED DEFINING VARIABLES, FORMING EQUATIONS BASED ON GIVEN DATA, SIMPLIFYING, AND THEN SOLVING THROUGH SUBSTITUTION OR ELIMINATION. THE FINAL VALUES—\$6 FOR A CD AND \$10 FOR A

DVD—ARE NOT ONLY MATHEMATICALLY DERIVED BUT ALSO PRACTICALLY MEANINGFUL.

THIS EXERCISE UNDERSCORES THE IMPORTANCE OF ALGEBRAIC THINKING IN EVERYDAY FINANCIAL DECISIONS AND BUSINESS STRATEGIES. WHETHER YOU'RE A CONSUMER COMPARING PRICES OR A RETAILER DEVISING PRICING MODELS, UNDERSTANDING HOW TO ANALYZE SUCH PROBLEMS ENHANCES DECISION-MAKING SKILLS AND FOSTERS QUANTITATIVE LITERACY.

BY MASTERING THESE FUNDAMENTAL TECHNIQUES, INDIVIDUALS CAN BETTER NAVIGATE THE COMPLEX LANDSCAPE OF PURCHASING, BUDGETING, AND ECONOMIC ANALYSIS, MAKING INFORMED CHOICES BASED ON SOUND MATHEMATICAL REASONING.

Kate Bought 6 Cds And 2 Dvd For 56 Wsjake Bought 3 Cds And 3 Dvds For 48 If X Is The Cost Of A Cd And

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