Section 8

Money

Money problems involve different denominations. How many five-dollar bills are in your wallet? Do you have more quarters than nickels? In this section, you will learn to solve these problems.

8.1 Definition Of A Denomination Of Money

When the word "Denomination" is used in connection with money, it is **defining different numerical values** of money. Money includes both bills and coins.

With coins, you have a different value according to each type of coin. Therefore, each different type is a different denomination. A penny is one denomination, a nickel is another, dimes and quarters are two more. If someone has three denominations of coins in their hand, you know they are holding three different kinds of coins.

The same holds true for paper money (bills). Each different value is a different denomination of money. A one-dollar bill is one kind of denomination. A five-dollar bill is another kind of denomination, and so on.

If you only had twenties in your wallet, you would say you have only one denomination. All of your bills would be the same denomination. If you only had dimes in your hand, you would say the same -- you only have one denomination of money in your hand, because all your coins would be the same value.

To summarize, each kind of bill or coin that has a different value is called a denomination of money.

8.2 Value Of Denominations

Each denomination, whether bills or coins, has a value that you use in Money Word Problems.

- With coins, you use the decimal value of a single coin.
- With bills you use the whole number value of a single bill.

For example, if the problem states "fives" or "five-dollar bills", you would normally translate this as $5.00. However, since the decimal places are always zeros, you do not need the decimal point at all.

To simplify matters, just use the whole number "5". If the problem involved "twenties" or "twenty-dollar bills", use the whole number "20". The same would hold true for any bill denomination.

DENOMINATION VALUE CHART

If Problem States	Value Of Denomination (A Single Bill Or Coin)
Pennies	.01
Nickels	.05
Dimes	.10
Quarters	.25
Bills	Use Its Whole Number

8.3 Defining The Total Number Of Each Denomination & The Total Worth

With Money Problems, you have to be careful not to confuse the **number** of each denomination (bills or coins) with the **worth** of the money. In Money Word Problems, the **Total Worth** is given to you.

- *Number* has to do with "**how many**".

- *Worth* has to do with "**how much**".

When you discuss the **number** of a denomination, this is referring to "**how many**" you have of a particular denomination, NOT how much it is worth.

For example, if you have six quarters and three dimes, you have **two** denominations:

- The **value** of the 1st denomination (quarters) is .25.

- The **number** of the 1st denomination is 6.

- The **worth** of the 1st denomination is $1.50.

- The **value** of the 2nd denomination (dimes) is .10.

- The **number** of the 2nd denomination is 3.

- The **worth** of the 2nd denomination is 30¢.

The **Total Number** of these two denominations added together is 9 (6 quarters and 3 dimes).

The **Total Worth** of these two denominations added together is $1.80 ($1.50 in quarters and 30¢ in dimes).

8.4 Name The Expression For The Number Of Each Denomination

There are two methods used to name the expression for the number (how many) of each denomination.

Method #1 is when you are given Direct Translation words in the problem. In this event, name the **Totally Unknown** with the variable *x,* and then build upon that variable with **Direct Translation** to name the other expression. (This method is the same one you have been using in previous sections.)

Method #2 is used when you are *not* given Direct Translation Words. In that event, the problem will always give you the **Total Number** of both denominations added together. Name the expression for the number of one denomination as the variable *x*, and name the expression for the number of the other denomination as the **Total Number minus *x***.

HELPFUL HINT

- Method #2 can be used in any type of word problem when you need to name two different expressions and the only information you have is their total.

	First Expression	**Second Expression**
Method To Use	*x*	Total Number − *x*
Sample If Total Number Is 50	*x*	50 − *x*

8.5 Solving The Problem

Step 1
Read Through The Problem

Look for and make note of the three items you need to set up your chart and your equation:

- The **two different denominations** being used so you can determine their **value**.

- **Direct Translation Words** OR a **Total Number** (how many) of the denominations in order to name the expressions for the number of each denomination.

- The **Total Worth** of all the money together.

Step 2
Set Up And Fill In A Chart

Set up a pre-equation chart like the one below to determine the **Denomination Worth.**

- Write the two denominations (such as twenties and fives) in the **Denomination** Column.
- In the **Value** Column, enter the value for each denomination as shown in the chart in 8.2.
- In the **Number** Column, enter the expression for the number of each denomination as explained in 8.4.
- To fill in each **Denomination Worth,** multiply the **Value times the Number**.

Denomination	*Value* •	*Number* =	*Denomination Worth*

Step 3
Set Up An Equation

The equation is the two Denomination Worths from your chart added together and set **equal to the Total Worth** of the money, which is given to you in the problem. The formula is:

$$1^{\text{st}} \text{ Denomination Worth } + 2^{\text{nd}} \text{ Denomination Worth } = \text{ Total Worth}$$

Step 4
Solve the Equation

Using the method taught by your instructor, solve the equation for the variable *x*.

Step 5
Make Sure to Answer the Question Being Asked

When you solve the equation, you will find the solution for *x*, but that might not be the answer to the question. You need to reread the problem and make sure exactly what question is being asked.

It is possible that the amount for the variable *x* may be your answer. But it may *not* be.
For example, the amount for *x* may give you the number of five-dollar bills, while the problem may be asking for the number of twenty-dollar bills.

You will have to substitute the solution for *x* into the original expression for twenty-dollar bills that you will set up in the chart in Step 2 in order to get the correct answer. Always be sure of exactly what the question is.

EXAMPLES

EXAMPLE 1 Sarah has 6 more fives than twenties in her purse. If she has a total of $105 in her purse, how many fives does Sarah have?

SOLUTION

Step 1 *Read The Problem*

- The two denominations are twenty-dollar bills and five-dollar bills.
- There are Direct Translation Words [more than] given in the problem.
- The Total Worth of the money is $105.

Step 2 *Set Up And Fill In A Chart*

- Write "Twenties" in 1st row and "Fives" in 2nd row of the Denomination Column.
- Fill in the 1st row of the Value Column with "20" as per chart in 8.2.
- Fill in the 2nd row of the Value Column with "5" as per chart in 8.2.
- Use Direct Translation to write expressions for the *number* of each denomination.
- Fill in the 1st row of the Number Column with "*x*" to represent the number of Twenties.
- Fill in the 2nd row of the Number Column with "*x* + 6" to represent the number of Fives.
- Multiply the Value times the Number to get each Denomination Worth.

Denomination	*Value* •	*Number* =	*Denomination Worth*
Twenties	20	*x*	20(*x*)
Fives	5	*x* + 6	5(*x* + 6)

Step 3 *Set Up The Equation*

- Use the two Denomination Worths from your chart. They are 20(*x*) and 5(*x* + 6).
- The Total Worth is always given in a Money problem. In this example, it is $105.
- Set up equation as 1st Denomination Worth + 2nd Denomination Worth = Total Worth.

$$20(x) \; + \; 5(x + 6) \; = \; 105$$

Step 4 *Solve The Equation*

• The solution to the equation is

$$x = 3$$

Step 5 *Answer The Question Asked*

- You have the solution to the equation, but it is NOT the answer to the question.
- The amount of x is the number of Twenties; the problem asks the number of *Fives*.
- You need to use the expression for the number of Fives you named in the chart in Step 2.
- Get the answer by substituting the solution for x (which is 3) into that expression.

Number of Fives = $x + 6$
Number of Fives = $3 + 6$
Number of Fives = 9

Answer: Sarah has 9 five-dollar bills in her purse.

EXAMPLE 2   Consuelo has $1.70 in change consisting of three more dimes than quarters. Find the number of dimes and quarters that she has.

SOLUTION

Step 1 *Read The Problem*

- The two denominations are Dimes and Quarters.
- There are Direct Translation Words [more than] given.
- The Total Worth of the money is $1.70.

Step 2 *Set Up And Fill In A Chart*

- Write "Quarters" in the 1st row and "Dimes" in the 2nd row of the Denomination Column.
- Fill in the 1st row of the Value Column with ".25" as per chart in 8.2.
- Fill in the 2nd row of the Value Column with ".10" as per chart in 8.2.
- Use Direct Translation to write expressions for the *number* of each denomination.
- Fill in the 1st row of the Number Column with "x" to represent the number of quarters.
- Fill in the 2nd row of the Number Column with "$x + 3$" to represent the dimes.

- Multiply the Value times the Number to get each Denomination Worth.

Denomination	Value •	Number	=	Denomination Worth
Quarters	.25	x		.25(x)
Twenties	.10	$x + 3$		.10($x + 3$)

Step 3 *Set Up The Equation*

- Use the two Denomination Worths from your chart. They are .25(x) and .10($x + 3$).
- The Total Worth is always given in a Money problem. In this example, it is $1.70.
- Set up equation as 1st Denomination Worth + 2nd Denomination Worth = Total Worth.

$$.25(x) \ + \ .10(x + 3) \ = \ 1.70$$

Step 4 *Solve The Equation*

- The solution to the equation is
$$x = 4$$

Step 5 *Answer The Question Asked*

- You have the solution to the equation, but it does not answer the COMPLETE question.
- The amount of x is the number of Quarter; you are also asked for he number of Dimes.
- Use the expression for the number of Dimes you named in the chart in Step 2.
- Get the answer by substituting the solution for x (which is 5) into that expression.

Number of Dimes = $x + 3$
Number of Dimes = $4 + 3$
Number of Dimes = 7

Answer: Consuelo has 4 quarters and 7 dimes.

EXAMPLE 3 Jacob has a total of 15 bills worth $120 in his wallet. If he only has five-dollar bills and ten-dollar bills in his wallet, how many fives does he have?

SOLUTION

Step 1 *Read The Problem*

- The two denominations are five-dollar bills and ten-dollar bills.
- There are NO Direct Translation Words given in the problem.
- You ARE given the Total Number of the denominations added together (15).
- The Total Worth of the money is $120.

Step 2 *Set Up And Fill In A Chart*

- Write "Fives" in the 1st row and "Tens" in the 2nd row of the Denomination Column.
- Fill in the 1st row of the Value Column with "5" as per chart in 8.2.
- Fill in the 2nd row of the Value Column with "10" as per chart in 8.2.
- The Total Number method from Section 8.4 is used to name the Number expressions.
- Fill in the 1st row of the Number Column with "x" to represent the number of fives.
- Fill in the 2nd row of the Number Column with "15 – x" to represent the number of tens.
- Multiply the Value times the Number to get each Denomination Worth.

Denomination	Value •	Number	= Denomination Worth
Fives	5	x	$5(x)$
Tens	10	$15 - x$	$10(15 - x)$

Step 3 *Set Up The Equation*

- Use the two Denomination Worths from your chart. They are $5(x)$ and $10(15 - x)$.
- The Total Worth is always given in a Money problem. In this example, it is $120.
- Set up equation as 1st Denomination Worth + 2nd Denomination Worth = Total Worth.

$$5(x) \;+\; 10(15 - x) \;=\; 120$$

Step 4 *Solve The Equation*

- The solution to the equation is

$$x = 6$$

Step 5 *Answer The Question Asked*

- You have the solution to the equation, and it *is* the answer to the question.
- The value of *x* is the number of fives. That is what the question is asking.

    Answer: Jacob has 6 five-dollar bills in his wallet.

Section 8: Money Exercise Set

1. When Rafael emptied his pockets, he found he had a total of $3.50 in quarters and nickels. If he had 8 more quarters than nickels, how many quarters did Rafael have?

2. A collection of coins consists of dimes and nickels. The number of dimes is two more than the twice the number of nickels. The value of the collection is $2.70. How many dimes are in the collection?

3. Giovanni has 18 more one-dollar bills than five-dollar bills that he collected selling raffle tickets. He sold $78 worth of tickets. How many five-dollar bills did he collect?

4. When the Broward Center of the Performing Arts counted the twenties and fifties in their cash register, they totaled $1720. If there were 16 more twenties than fifties, how many twenties were there?

5. A jar of coins consisting of nickels and dimes totals $11.10. If there are 22 more nickels than twice the amount of dimes, how many dimes and nickels are there?

6. A collection of 57 coins is made up of quarters and dimes. If the collection totals $9.00, how many quarters are there?

7. While selling tickets to the school play, Lee Lai collected $265 in five-dollar bills and ten-dollar bills. If the numbers of tens was 16 less than twice the number of fives, how many five-dollar bills and ten-dollar bills did Lee Lai collect?

8. Mario's Pizzeria made a total of $220 during lunch, consisting of one-dollar bills and five-dollar bills. If the number of fives was 4 less than three times the number of ones, how many one-dollar bills did Mario's Pizzeria have after lunch?

9. Jack had 46 coins in a cigar box consisting of dimes and quarters. If he had a total of $7.90 in the cigar box, how many of each denomination did Jack have?

10. Cheyenne kept quarters and dimes in the change holder of her car to use for tolls on the Sawgrass Expressway. She had 30 coins in the change holder totaling $6.30. How many of each type of coin did Cheyenne have?

11. Irene had a total of 40 bills hidden under her mattress. There were fifty-dollar bills and twenty-dollars bills totaling $1160. How many of each type of bill did Irene have?

12. At the end of each week, José would take the ones and fives out of his wallet to save up for spending money on his vacation. After a year, he had a total of 220 bills that were worth a total of $600. How many of each type of bill did José have?

13. Regina withdrew $270 in fifties and twenties from an ATM. She got 3 less fifties than twenties. How many fifties did Regina get?

14. Ariel deposited $300 consisting of tens and twenties into her bank account. She deposited 6 more tens than twenties. How many of each bill did Ariel deposit?

15. Suppose you have $15.20 in pennies and dimes. If you have 20 more pennies than 5 times the number of dimes, how many of each coin do you have?

16. Suppose you have $6.05 in nickels and quarters. If you have twice as many quarters as nickels, how many nickels do you have?

17. Jasmine has $1090 in twenties and fifties. If she has 7 less fifties than twice the number of twenties, how many twenties does she have?

18. Aaron purchased $270 worth of computer accessories using ten-dollar bills and five-dollar bills. If he used 6 less fives than tens, how many fives did he use?

19. Rusty saved $980 for a rainy day. He had a total of 60 bills consisting of tens and twenties. How many ten-dollar bills did Rusty save?

20. Susie found $1.95 in nickels and dimes. If she found a total of 25 coins, how many nickels and dimes did she find?