Section 4

Parts

You can usually recognize Parts Problems because they:
- Often use the words "**sum**" or "**total**" in the problem
- Ask you to find the answers to questions such as **how long**, **how much**, and **how many**?
- Give a **whole amount** that is **separated into different parts or items**

To solve a Parts Problem, follow these steps…

Step 1
Read Through The Entire Problem

This is important because you want to get a sense of the information given in the problem and what question is being asked.
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Step 2
Name The Expressions Using Direct Translation & Use A Variable For The Totally Unknown

In Parts Problems, you will be given two or three items (or parts) that added together would make up a whole. For example, a certain amount of boys and a certain amount of girls added together make up the total amount of students in a class.

Although it may sometimes seem you do not have enough information to solve the problem, you will learn how to name a **Totally Unknown** and how use Direct Translation to name the other expressions to set up an equation.

For example, if the problem says "the class contained 5 more boys than girls", you are getting *some* information about the boys (there are 5 more boys than girls). You are not getting *any* information about the girls.

Since you are not getting any information about the girls, the girls become the **Totally Unknown**. Therefore, you will represent "the girls" with a variable, such as *x*.

Once you name the **Totally Unknown** with a variable, you can build upon that variable using Direct Translation in order to name the other expressions.

HELPFUL HINTS

- If you are not sure which part is the **Totally Unknown,** look for the word at the end of the phrase or sentence *that gives you information about the parts*.

- In the above example, "the class contained 5 more boys than girls", the word "girls" is at the end of the information phrase or sentence. Therefore, you can confirm that "**girls**" is the **Totally Unknown**.

Step 3
Set Up An Equation

The total amount will always be given in a Parts Problem. So once you name the expressions for each part, you will have all the information you need. Set up the equation by adding all of the expressions together set equal to the total amount given.

Step 4
Solve the Equation

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

Step 5
Make Sure to Answer the Question Being Asked

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

It is possible that the value for the variable x may be your answer. But it may *not* be.

For example, the value for x may give you the amount of girls in the class, while the problem may be asking for the amount of boys. You will have to substitute the value for x into the original expression for boys that you set up in Step 2 in order to get the correct answer. Always be sure of exactly what the question is.

HELPFUL HINT

- Once you have the numerical value for each part, you can always check if your answer is correct by adding up all the numerical values. Your total should equal the total of the whole amount given in the problem.

EXAMPLES

EXAMPLE 1 Jessica and Natalie are sisters. Jessica is 3 years younger than Natalie. If the sum of their ages is 25, how old is Jessica?

SOLUTION

Step 1 *Read The Problem*

- The problem uses the word "sum".
- Jessica's age and Natalie's age are two parts of the whole (the sum of their ages).
- The answer wanted is Jessica's age.
- The problem contains Direct Translation Words [younger than, is].

Step 2 *Name The Expressions*

- You are given information about Jessica's age – she is 3 years younger than Natalie.
- You are not given information about Natalie's age. Her age is the Totally Unknown.
- Confirm Totally Unknown by checking position of word "Natalie" (Step 2 Helpful Hint).
- Use a variable to represent the Totally Unknown (in this example, Natalie's age).
- Use Direct Translation to name an expression for Jessica's age.

$$\text{Natalie's age} = x$$
$$\text{Jessica's age} = x - 3$$

Step 3 *Set Up The Equation*

- Natalie's age plus Jessica's age equals the total (the sum of their ages).
- Use the expressions you named in step 2 for their ages.
- The sum of their ages is 25. This amount is given in the problem.

$$x + x - 3 = 25$$

Step 4 *Solve The Equation*

•The solution to the equation is

$$x = 14$$

Step 5 *Answer The Question Asked*

•You have the solution to the equation, but it is NOT the answer to the question.
•The value of x is Natalie's age; the problem asks "How old is *Jessica?*"
•You need to use the expression for Jessica's age that you named in Step 2.
•Get the answer by substituting the solution for x (which is 14) into that expression.

Jessica's age = $x - 3$
Jessica's age = $14 - 3$
Jessica's age = 11

Answer: Jessica is 11 years old.

EXAMPLE 2   The Boyd Anderson High School Band has a total of 93 members. The band has 7 less Sophomores than Juniors and 10 more Seniors than Juniors. How many members of the Boyd Anderson High School Band are Seniors?

SOLUTION

Step 1 *Read The Problem*

- The problem tells a story and uses the word "total".
- The Sophomores, Juniors, and Seniors are 3 parts of the whole (the total band members).
- The answer wanted is the amount of members that are Seniors.
- The problem contains Direct Translation Words [less than, more than].

Step 2 *Name The Expressions*

- You have information about the Sophomores; there are 7 less Sophomores than Juniors.
- You have information about the Seniors; there are 10 more Seniors than Juniors.
- You have no information about the Juniors, so that amount is the Totally Unknown.
- Confirm Totally Unknown by checking position of word "Juniors" (Step 2 Helpful Hint).
- Use a variable to represent the Totally Unknown (in this example, the Juniors).
- Use Direct Translation to name the two expressions for the Sophomores and Seniors.

$$\text{Juniors} = x$$
$$\text{Sophomores} = x - 7$$
$$\text{Seniors} = x + 10$$

Step 3 *Set Up The Equation*

- The Juniors plus the Sophomores plus the Seniors equal the total (the sum of members).
- Use the expressions you named in Step 2 for the different members of the band.
- The sum of all the members in the band is 93. This amount is given in the problem.

$$x + x - 7 + x + 10 = 93$$

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Step 4 *Solve The Equation*

•The solution to the equation is

$$x = 30$$

Step 5 *Answer The Question Asked*

•You have the solution to the equation, but it is NOT the answer to the question.
•x is the amount of Juniors; the question asks how many band members "are Seniors?"
•You need to use the expression for Seniors that you named in Step 2.
•Get the answer by substituting the solution for x (which is 30) into that expression.

Seniors $= x + 10$
Seniors $= 30 + 10$
Seniors $= 40$

Answer: There are 40 Seniors in the band.

Parts: Exercise Set

1. Jacob is 7 years older than twice Sarah's age. If the sum of their ages is 61, how old is Jacob?

2. On an Algebra test, the highest grade was 38 points higher than the lowest grade. The sum of the two grades was 142. Find the lowest grade.

3. A History textbook costs $7 less than a Sociology textbook. If the total cost of both textbooks is $73, what is the cost of the history textbook?

4. A Pre-Algebra class contains a total of 45 students. If the number of women is 3 less than twice the number of men, how many women and how many men are in the class?

5. A box of candy contains 28 pieces. If the number of pieces of milk chocolate is 4 less than 3 times the number of pieces of dark chocolate, how many pieces of each kind are there?

6. Victor Gil runs a ski train. One day he noticed that the train contained 13 more women than men. If there were a total of 165 people on the train, how many of them were women?

7. On a Geometry test, the highest grade was 57 points higher than the lowest grade. The sum of the two grades was 95. Find the highest and lowest grades.

8. Alexandra and Valery sold a total of 348 boxes of Girl Scout cookies. Alexandra sold 52 more boxes than Valery. How many boxes did Valery sell?

9. On a small cruise ship, there were 110 more women than men. If there were 910 people on the cruise ship, how many women were there?

10. In the 1992 Presidential Election, George Bush received 202 less electoral votes than his opponent, Bill Clinton. The electoral college has a total of 538 votes to cast. How many electoral votes did the winner, Bill Clinton, receive in the 1992 election?

11. At Central Park School Field Day, Jarred Suede threw a baseball 12 feet further than his friend, Brendan. If the sum of the distances of both of their throws was 52 feet, how far did Jarred Suede throw the baseball?

12. Lee spent $32 more on a CD player than she did on a scientific calculator. If the total amount that Lee spent was $62, how much did each item cost?

13. In the 2000 Senate race for Connecticut, the winner was Senator Joe Lieberman. He received 379,034 more votes than his opponent Phil Giordano. If a total of 1,269,658 votes were cast, how many votes did Senator Lieberman receive?

14. Antonio and Cristian swim at a local pool. Cristian usually swims 4 less than twice the amount of laps Antonio swims. If they swam a total of 44 laps altogether, how many laps did Cristian swim?

15. A 61-foot board will be cut into three pieces. The second piece will be 6 feet shorter than twice the first piece, and the third piece will be 7 feet longer than the first piece. How long will the second piece of the board be?

16. Irene paid $40 more for her cell phone bill in July than in June. In August, she paid $10 less than her June bill. If she paid a total of $120 for her cell phone bills for all three months, how much did she pay for her August bill?

17. A piece of string 37 inches long was cut into three pieces. The first piece is 7 inches shorter than the second piece, and the third piece is twice as long as the second piece. How long is each piece of the string?

18. Elena checked out a total of 20 books from the library. She checked out 4 more mystery novels than romance novels, and she checked out 5 less biographies than romance novels. How many of each type of book did Elena check out of the library?

19. Lafayette County in Florida has 4269 registered voters. There are 3428 more Democrats than 5 times the amount of Independents, and there are 497 more Republicans than twice the amount of Independents. How many of the voters in Lafayette county are registered Democrats?

20. In an episode of the Powerpuff Girls, Buttercup defeated twice as many villains as Blossom. Bubbles defeated 6 less villains than Blossom. If the Powerpuff Girls defeated a total of 74 villains, how many villains did Buttercup defeat?