1.09 *Introduction to Word Problems*

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"What good is equation solving?" That's a common question at this point! An even better question is "What good is math?"! Math and likewise equation solving are seldom ends in themselves, but rather they are tools or stepping stones to something else. Math is a tool for the sciences, business, and technology, for example, and it is not really very useful at all until you need it to solve a problem in real life. Unfortunately, real life problems do not usually come with equations. Rather, you must take the situation in sentences (words) and translate it into mathematics (equations).

In this sense, word problems (applications) are like a foreign language. (Do you identify with that statement?) There is a vocabulary of words to be translated from English into math symbols (or equation!). Moreover, there is a definite sentence structure, even as there is when translating from one language to another. You must first know the vocabulary. The following is an English to math dictionary that may help you get started.

ENGLISH to MATH DICTIONARY

English	Mathematics (operation)
"Decreased by"	"-" (be careful of the order)
"Difference"	"-" (be careful of the order)
"Equals"	"="
"Increased by"	"+"
"Is" or "Was"	"="
"Less than"**	"-" (be careful of the order)
"More than"**	"+"
"Of"	"X", "·", "times"
"Perimeter"	"Sum of the sides"
"Product"	"X", "·", "times"
"Quotient"	"÷"
"Such that"	"Get ready--here comes the equation!"
"Sum"	"+"
"Times"	"X", "·", "times"
"Twice"	"Two times" or "2·_____"

****NOTE:** "Less than" and "more than" may also refer to inequalities, which will be explained in Section 1.11.

Question #1: If a jar contains **15** marbles, and **3** marbles are taken out of the jar, how many marbles are left in the jar? _____
What operation did you use? _____________.

Answer: **12 marbles**, and the operation was **subtraction**.

Question #2: What if the jar contains **15** marbles, and **5** are taken out. How many marbles are left? _______.

Answer: **10 marbles**.

Question #3: What if the jar contains **15** marbles, and **x** (an unknown number) marbles are removed. Now what operation is used, and how many marbles are left? ______________________.

Answer: The operation is subtraction.
There will be "**15 'take away' x"** marbles left. That is, there will be **"15 - x"** marbles.

Question #4: Suppose a board that is **15 feet** long is cut so that one piece is **3 feet** long. How long is the other piece? _____
What operation was used? __________.

Answer: **12 feet**, and the operation was **subtraction**.

Question #5: What if the board was **15 feet** long, and the piece cut off is **5 feet** long. How long is the other piece? _______.

Answer: **10 feet**.

Question #6: What if the board is **15 feet** long, and a piece of board that is **x feet** long is cut off. How long is the other piece? _____. What operation was used? __________.

Answer: **Subtraction,** and the other piece is **"15 - x" feet**.

Question #7: Suppose you have **$15,000** to invest in two separate investments (or accounts). If you place **$3,000** in one account, how much is in the other account? ________.

Answer: **$12,000**.

Question #8: If you have a total of **$15,000**, and you place **$5,000** in one account, how much is in the other account? ________.

Answer: **$10,000**.

Question #9: Now, if you have a total of **$15,000**, and you place an unknown **x** dollars in one account, how much is in the other account?

Answer: **15,000 - x.**

It may seem that these are three different problems: a marble problem, a board problem, and an investment problem. However, if you can see above the specifics involved, there is really just one type of problem. The word problems of this chapter will be like this. Try to see above the specifics, and recognize the broad categories of problems.

Before attempting the real applications, it will be helpful to practice with a few examples and exercises in vocabulary--that is, translating from English words to math symbols.

EXAMPLES: **Let x represent the unknown number, and translate into math symbols.**

		ANSWERS
1.	Three more than an unknown number	$x + 3$ or $3 + x$
2.	Three less than an unknown number	$x - 3$ (Not $3 - x$!!)
3.	The sum of an unknown number and eight	$x + 8$
4.	Twice an unknown number	$2x$
5.	The sum of 4 and twice an unknown number	$4 + 2x$ or $2x + 4$
6.	Four times an unknown number, plus 5	$4x + 5$
7.	Four times an unknown number, less 5	$4x - 5$
8.	Five less than four times an unknown number	$4x - 5$
9.	Five more than four times an unknown number	$4x + 5$
10.	The product of a number and four more than the number	$x(x + 4)$
11.	The product of a number and four less than the number	$x(x - 4)$
12.	If there are a total of 20 marbles in a dish, and someone takes x of them, how many are left?	$20 - x$
13.	If there are a total of 20 coins, in dimes and quarters in a box, and x are dimes, how many quarters are in the box?	$20 - x$
14.	If a person has \$20 and he/she spends \$x, how much is left?	$20 - x$

EXERCISES: **Translate each of the following statements into math symbols. Let *x* represent the unknown number.**

1. 6 more than x ______________
2. 15 more than x ______________
3. 6 less than x ______________
4. 15 less than x ______________
5. 4 increased by n ______________
6. n increased by 4 ______________
7. 12 decreased by n ______________
8. n decreased by 12 ______________
9. x less 8 ______________
10. 8 less x ______________
11. 5 less than x ______________
12. x less than 5 ______________
13. Twice an unknown number ______________
14. Twice an unknown number, less 5 ______________
15. 5 more than twice an unknown number ______________
16. 5 less than twice an unknown number ______________
17. 8 less than twice an unknown number ______________
18. Four times an unknown number less 3 ______________
19. Four times an unknown number, increased by 3 ______________
20. Four times an unknown number, decreased by 3 ______________

21. Five less than four times an unknown number ______________

22. Ten decreased by five times an unknown number ______________

23. If you have $50 and you spend $x, how much is left? ______________

24. If there are 50 marbles in a box, and you take out x marbles, how many are left? ______________

25. There are a total of 50 coins, some nickels and the rest are dimes. If there are x nickels, how many dimes are there? ______________

26. There are two accounts totaling $50,000 with $ x in the first account. How much money is in the second account? ______________

27. A piece of string is 50 centimeters in length. It is cut into two pieces, such that the first piece is x centimeters in length. How long is the second piece? ______________

28. There are a total of 38 coins, some nickels and the rest dimes. If there are x dimes, how many nickels are there? ______________

29. If you spend $ x out of $200, how much is left? ______________

30. If you have $ x, and you spend $200, how much is left? ______________

31. If you have $ x, and you spend $35, how much is left? ______________

32. If you spend $ x out of $35, how much is left? ______________

ANSWERS 1.09

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1. x+6; **2.** x+15; **3.** x-6; **4.** x-15; **5.** 4+n; **6.** n+4; **7.** 12-n; **8.** n-12; **9.** x-8; **10.** 8-x; **11. x-5**; **12.** 5-x; **13.** 2x; **14.** 2x-5; **15.** 2x+5; **16.** 2x-5; **17.** 2x-8; **18.** 4x-3; **19.** 4x+3; **20.** 4x-3; **21.** 4x-5; **22.** 10-5x; **23.** 50-x; **24.** 50-x; **25.** 50-x; **26.** 50000-x; **27.** 50-x; **28.** 38-x; **29.** 200-x; **30.** x-200; **31.** x-35; **32.** 35-x.