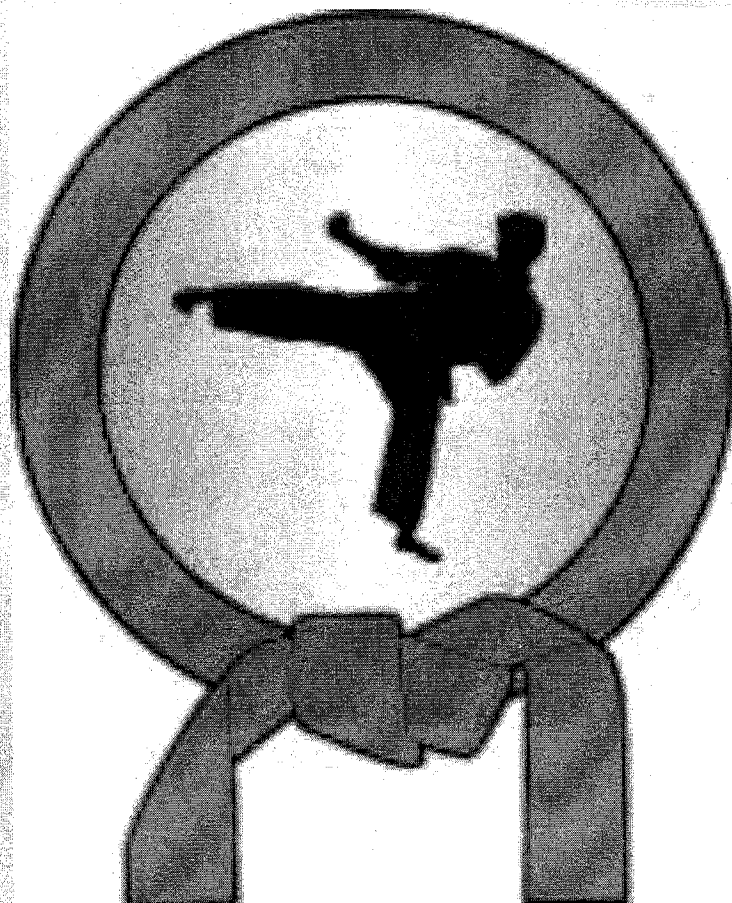


JUDO MATH



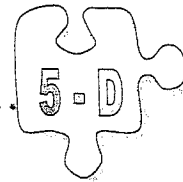
ORANGE BELT TRAINING

LINEAR EXPRESSIONS

ALGEBRA DISCIPLINE

5.3.2 How can I organize it?

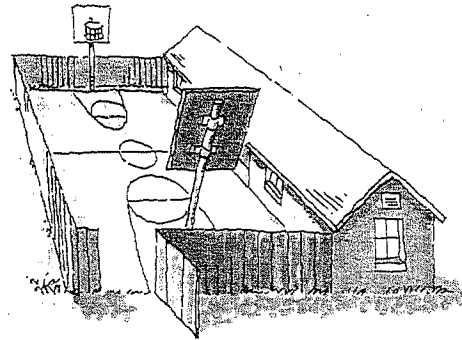
Solving a Word Problem



You have seen that being able to draw diagrams and describe relationships is helpful for solving problems. In this lesson, you will learn another way to organize your thinking as you solve word problems.

5-104. FENCING THE BASKETBALL COURT

The Parent Club at Post Falls Middle School needs 183 feet of fencing to go around the rectangular outdoor basketball court behind the school gym. The club volunteers will only need to place a fence on three sides of the court, because the wall of the gym will form the fourth side. The length of the court is 32 feet more than the width. One of the shorter sides will be 5 feet shorter than the other one to leave room for a gate.



Your Task: Determine how much fencing will be used on each side of the court. Be prepared to justify your answer and show all of your work. Be sure that someone who is not on your team can read and understand your work.

Discussion Points

What information do you know in the problem?

What do you need to figure out?

What diagram can you draw to represent this situation?

How did you organize your work?

How can a wrong answer help you revise your thinking?

- 5-105. If another team came to look at your paper for problem 5-104, could that team understand your work? Why or why not? What else could you do to make it so that someone else could make sense of your work just by looking at it?

Pg. 3

5-106. Daniel, Ronald, and Zeba decided to organize their thinking in a table using a method they call the 5-D Process. Get a Lesson 5.3.2A Resource Page from your teacher that shows their work. Then answer some of the following questions during the whole-class discussion.

Fencing the Basketball Court

Describe/Draw: The shape is a rectangle but we are only looking for three sides. This problem is about perimeter.

Total fencing: 183 ft

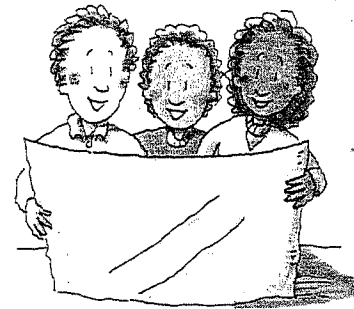
		Building				
		Define	Do	Decide		
		Side 1	Side 2	Side 3	Add the sides together	183?
Total 1	10	$10 + 5 = 5$	$10 + 32 = 42$	$10 + 5 + 42 = 57$		Too small!
Total 2	20	$20 + 5 = 15$	$20 + 32 = 52$	$20 + 15 + 52 = 87$		Too small!

Decide:

- "What are the students Describing and Drawing?"
- "What is in the Define column?"
- "What is the Do column used for?"
- "What are they trying to Decide?"
- "What might the Declare section be for?"

See Next Page for 5 D's

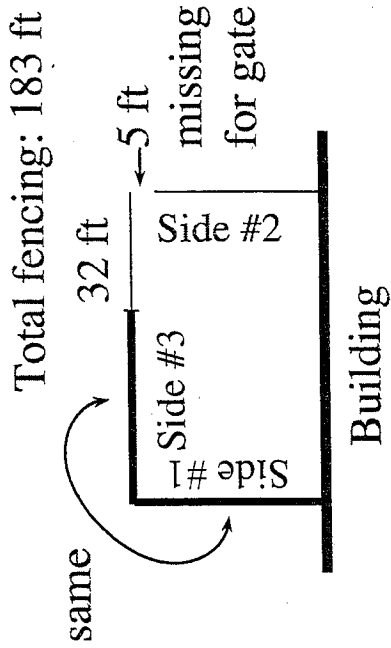
5-107. While one team was working on problem 5-104, the team members decided to see if a width of 30 feet would use all of the 183 feet of fencing. They figured out that, with a 30-foot width, the length would be 62 feet and the side with the gate would be 25 feet. Only 117 feet of fencing would be used.



What is a logical number that they should try next for the width so that all of the fencing is used? Explain your reasoning.

5-108. Finish problem 5-104 using the 5-D Process. Continue the table you looked at in problem 5-106 to find the answer.

Fencing the Basketball Court



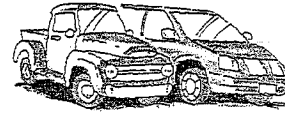
Describe/Draw: The shape is a rectangle, but we are only looking for three sides. This problem is about perimeter.

		Define		Do	Decide
		Side 2	Side 3	Add the sides together	183?
Trial 1:	10	$10 - 5 = 5$	$10 + 32 = 42$	$10 + 5 + 42 = 57$	Too small
Trial 2:	20	$20 - 5 = 15$	$20 + 32 = 52$	$20 + 15 + 52 = 87$	Too small

Declare:

5-109. Use the steps of the 5-D Process to organize and solve each of the questions below. The Lesson 5.3.2C Resource Page may help you set up your table. Be sure to show each of the "D" steps clearly in your solution process.

- a. Laura takes very good care of her vehicles. She owns a blue van and a red truck. Although she bought them both new, she has owned the truck for 17 years longer than she has owned the van. If the sum of the ages of the vehicles is 41 years, how old is the van and how old is the truck?

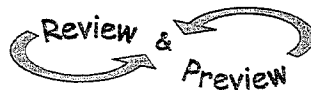


- b. Ryan is thinking of a number. When he multiplies this number by 6 and then subtracts 15 from the answer, he ends up with his original number. What number is Ryan thinking of?

Show work here:

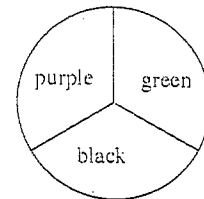
a.

b.



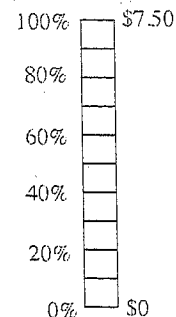
5-110. The spinner at right is spun twice. Make a table and calculate the probability of each of the following outcomes.

- a. Getting black twice.
b. Getting green twice.



5-111. The local theater is raising ticket prices by 20%.

- a. Assuming the current youth ticket price is \$7.50, use the diagram at right to find out how much more youth tickets will cost.
b. What will be the new youth ticket price?



5-112. Copy each expression below and simplify it using the order of operations.

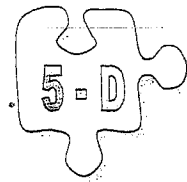
a. $6 + 4(2 + 3)^2$

b. $(6 + 4)(2 + 3)$

c. $6 + 4 \cdot 2^3 + 3$

5.3.3 How do I use the 5-D Process?

Strategies for Using the 5-D Process



Math is used to solve challenging problems that apply to daily life. For example, how much fresh water is on the planet? How many area codes for telephone numbers are needed in a city? Where should a city build transportation lines such as city-bus systems and subways to reduce traffic on the freeways? Mathematics can provide helpful insights for the answers to these questions.

When you are trying to solve a new and challenging problem, it is useful to have a strategy. The 5-D Process that you learned about in Lesson 5.3.2 will often work when you are trying to solve a problem you have not seen before.

In this lesson, you will practice using this process to solve more word problems. You will also compare the different ways that your classmates use the 5-D Process to help them. Be sure to write your work neatly and be prepared to justify your reasoning.

As you work using the 5-D Process, consider the questions below.

How can you describe the problem?

How can you decide how to label the columns?

How can you organize the columns?

How can you decide which quantity to start with?

Does it matter which one you choose?

How can you decide which number to try first?



At the end of this lesson, your team may be asked to present your responses to one or more of the target questions above.

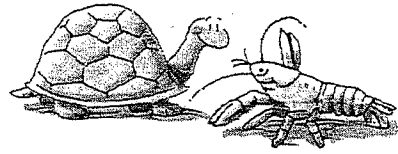
5-115. A **scalene triangle** has three unequal side lengths. The medium-length side is 7 cm longer than the shortest side. The longest side is twice as long as the shortest side. The total perimeter is 39 cm. What are the lengths of the sides of the triangle?

5-116. Travis and Angela were playing a "Guess My Numbers" game. Angela told Travis, "I'm thinking of two positive numbers. The difference of my numbers is 4, and the product of my numbers is 96. What are my numbers?" Help Travis find Angela's numbers.

5-117. The Potter Valley basketball team did not record how many baskets each player made during the last game. Jenny remembers that she made three times as many baskets as Grace. Alexis knows that she made six more baskets than Grace. Joan thinks that she made 4 fewer baskets than Grace. Tammy is sure that she made the same number of baskets as Joan. Altogether the five players made 40 baskets. How many baskets did each player make?

5-118. Ms. Pacheco, Mr. Edwards, and Mr. Richards are three math teachers at Turner Middle School. Ms. Pacheco is three years older than Mr. Richards. Mr. Edwards is twice as old as Mr. Richards. The sum of Mr. Richards' age and Mr. Edwards' age is 81. How old is each person?

5-119. Ramon was studying pond life in Doyle Park. In two hours, he counted four more frogs than turtles. The number of crayfish he counted was three more than twice the number of turtles. In total, he counted 54 turtles and crayfish. How many frogs were there?



5-120. Dawn is trying to find the dimensions of a parallelogram. She knows that the base is one unit less than twice the height of the shape. The area is 91 square units. How long are the base and height?

5-121. **Additional Challenge:** If one side of a square is increased by 12 feet and the side connected to it is decreased by three feet, a rectangle is formed. The perimeter of the rectangle is 62 feet. How long was the side of the original square?



MATH NOTES

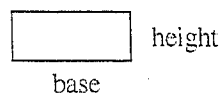
METHODS AND MEANINGS

Solving Problems with the 5-D Process

The **5-D Process** is an organized method to solve problems. The D's stand for Describe/Draw, Define, Do, Decide, and Declare. An example of this work is shown below.

Problem: The base of a rectangle is 13 centimeters longer than the height. If the perimeter is 58 centimeters, find the base and the height of the rectangle.

Describe/Draw: The shape is a rectangle and we are looking at the perimeter.

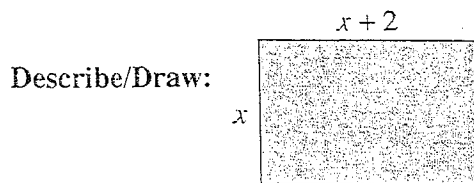


	Define	Do	Decide	
	Height (trial)	Base (height + 13)	Perimeter $2(\text{base}) + 2(\text{height})$	58?
Trial 1:	10	$10 + 13 = 23$		66 is too high
	↑ Use a trial value.	↙ Use the relationships stated in the problem to determine the values of the other quantities (such as base and perimeter).		↑ Decide if the answer is correct. Revise and make another trial until you find the correct answer.
Trial 2:	7	$7 + 13 = 20$	$2(20) + 2(7) = 54$	too low
Trial 3:	8	$8 + 13 = 21$	$2(21) + 2(8) = 58$	correct

Declare: The base is 21 centimeters and the height is 8 centimeters.



5-123. If the total area of the rectangle below is 168 square units, how long is each side? To find out how long the x side must be, copy the diagram and table and answer the questions that follow.



	Define		Do (Side one) · (Side two)	Decide Area = 168?
	Side #1	Side #2		
Trial 1:	10	12		
Trial 2:				

Declare:

- Describe how the lengths of the two sides are related to each other.
- Which side of the rectangle does Side #2 represent?
- Use the 5-D Process to complete the table. Find the lengths of the two sides of the rectangle.

5-124. Evaluate each expression.

a. $\frac{1}{2}(5+13) - 4 \cdot 5$ b. $(5+11) - (24-15) \cdot (3)$ c. $6^2 + 3 \cdot 7 - 9 \div 3$

5-125. Simplify the following variable expressions.

a. $2x + 5 + x - 6 + 3x$ b. $x - 8 + x - 5 + x + 1$

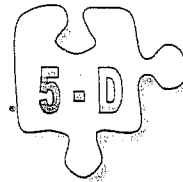
4-68. Kirk is helping his grandparents set up their new portable music players. His grandfather, Maude, has 1 jazz album, 2 country-western albums, and 5 heavy-metal albums. Kirk's grandfather, Claude, has 3 classical albums, 2 rap albums, and 7 heavy-metal albums.

If Kirk's grandparents' portable music players are on random shuffle mode, who has the greater chance of listening to a heavy-metal album? Explain how you know.

- 5-126. A radio station is giving away free t-shirts to students in local schools. It plans to give away 40 shirts at Big Sky Middle School and 75 shirts at High Peaks High School. Big Sky Middle School has 350 students, and 800 students attend High Peaks High School.
- What is the probability of getting a t-shirt if you are a student at the middle school?
 - What is the probability of getting a t-shirt if you are a student at the high school?
 - Are you more likely to get a t-shirt if you are a student at the high school, or at the middle school?
- 5-127. One student rewrote the expression $17 \cdot 102$ as $17(100+2)$. Then she simplified to get the expression $1700 + 34$.
- Are the three expressions equivalent? Justify your answer.
 - What property of numbers does this demonstrate?

5.3.4 How can I represent it?

Using Variables to Represent Quantities in Word Problems



Today you will continue to use the 5-D Process as you solve word problems. In this lesson, you will use a variable to represent the unknown value in the problem.

Think of these questions as you work on the problems today:

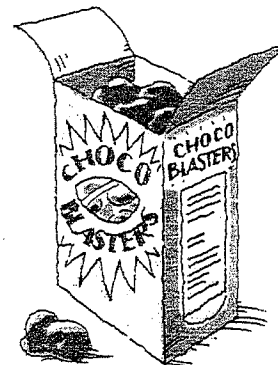
What is the problem asking?

What is the relationship between the quantities involved?

How can I choose which part of the problem to represent with a variable?

- 5-128. Mai has one mini-box of Choco-Blasters candy, and Warren gave her three more pieces. Samara has two mini-boxes of Choco-Blasters and gave six pieces to Will. Now Mai and Samara have the same number of Choco-Blasters.

How many Choco-Blasters are in a mini-box?
Assuming all mini-boxes of Choco-Blasters have the same number of pieces in them, use the 5-D Process to solve this problem.



5 D's for Problem 5-128, or use your own methods.

5-129. Allen's team was working on a problem but did not have time to finish it. They also did not follow the teacher's directions for showing work in the Define section. Discuss with your team what information you can get from Allen's table below.

	DEFINE		DO	DECIDE
	LENGTH	WIDTH	DOUBLE EACH SIDE AND ADD TOGETHER	TARGET PERIMETER = 36?
TRIAL 1:	3	9	$2(3) + 2(9) = 24$	TOO SMALL
TRIAL 2:	4	?		

- Is there enough information in Allen's table to finish the problem? Why or why not?
- What would you need to know in order to complete Trial 2? Explain your thinking.

5-130. Allen's teammate, Scott, was also working on problem 5-129, but he organized his table differently. As Scott explained his table to Allen, he used the pattern in the first two trials to represent the quantities in the third row with a variable, x .

Look at the table below.

- How is it different from Allen's table?
- What does the x in the table represent?
- In words, describe the relationship between the length and the width.
- Where did the expression $x + x + (2x + 3) + (2x + 3)$ come from? Explain your thinking.

	DEFINE		DO	DECIDE
	LENGTH	WIDTH	ADD ALL 4 SIDES TOGETHER	TARGET PERIMETER = 36?
TRIAL 1:	3	$2(3) + 3$	$3 + 3 + 9 + 9 = 24$	TOO SMALL
TRIAL 2:	6	$2(6) + 3$	$6 + 6 + 15 + 15 = 42$	TOO LARGE
	x	$2(x) + 3$	$x + x + (2x + 3) + (2x + 3)$	

(10) (14)

- 5-131. Izzy's team used a 5-D table to solve a problem that involved **consecutive integers**. Consecutive integers are integers that follow each other on a number line. The numbers 1, 2, 3, ..., 14, 15, 16, ..., or $-5, -4, -3, \dots$ are all examples of consecutive integers. The table below shows part of their work on the problem.

Continue Copy the table and finish the problem. After you find a solution, apply Scott's idea from problem 5-130 to add a row that uses a variable to summarize the problem's process.

	DEFINE			DO	DECIDE
	1 ST NUMBER	2 ND NUMBER	3 RD NUMBER	ADD ALL NUMBERS TOGETHER	TARGET SUM = 57
TRIAL 1:	15	15+1	15+2	15+16+17 = 48	TOO SMALL
TRIAL 2:	20	20+1	20+2	20+21+22 = 63	TOO LARGE

- 5-132. Meiko saw someone's expressions in the 5-D Process table below and wanted to reverse the process. The problem involved a bag of green, red, and blue marbles.

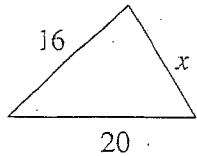
	DEFINE			DO	DECIDE
	GREEN	RED	BLUE	TOTAL MARBLES	TOTAL = 71?
TRIAL 1:	15				
	x	$x-2$	$2x+5$	$x+(x-2)+(2x+5)$	

- One of the variable expressions describes how the number of red marbles compares with the number of green marbles. How can you describe this relationship in words?
- Based on the variable expressions, use words to describe how the number of blue marbles compares with the number of green marbles.
- How many total marbles are in the bag?
- If there are 15 green marbles in the bag, how many red and blue marbles are in the bag? Show your work.
- Use the information in the table to find the number of green, red, and blue marbles.

Describe

5-133. Camille knew that a triangle had one side with a length of 16 inches and another side with a length of 20 inches. She did not know the length of the third side, but she did know that the perimeter was five times the length of the unknown side. How long is the unknown side? Copy the table below and complete the table. You may add as many rows as you need to solve the problem. Remember to summarize the relationships with a row that uses a variable and to complete the Declare sentence.

Describe/Draw:
Perimeter is 5 times unknown

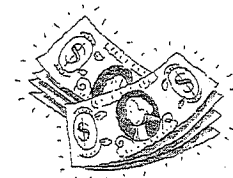


	DEFINE		DO	DECIDE
	UNKNOWN SIDE	PERIMETER	COMPARE SUM TO PERIMETER	SAME?
TRIAL 1:	5	5(5)	$5 + 16 + 20 = 25$ $41 \neq 25$	NO

Declare:

5-134. Margaret was working on the problem below.

Declan earned four times as much money last summer as his sister Gwen. Together they earned \$475. How much did each person earn?



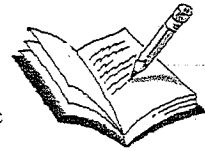
The table below shows the first two trials Margaret made. Based on the results, work with your study team to suggest a number she should try next. (You do not actually need to solve the problem.)

- Is it reasonable for different members of your team to suggest different numbers?
- Are there some numbers that would not be helpful? Explain.

	DEFINE		DO	DECIDE
	GWEN'S EARNINGS	DECLAN'S EARNINGS	ADD BOTH OF THEIR EARNINGS TOGETHER	TARGET SUM = \$475
TRIAL 1:	\$50	4(\$50)	$\$50 + \$200 = \$250$	TOO SMALL
TRIAL 2:	\$100	4(\$100)	$\$100 + \$400 = \$500$	TOO LARGE

Continue the table and see if you can figure out how much they earned!

In your Learning Log, describe how you decide which number to use as your first trial in the 5-D Process. Then explain how you use the results of your first trial to choose your next trial number. You may want to include an example from your recent work to help you explain. Title this entry "Defining and Deciding" and label it with today's date.



METHODS AND MEANINGS

Consecutive Integers

Consecutive integers are integers that come "one after another" in order (that is, without skipping any of them). For example: 11, 12, and 13 are three consecutive integers. The numbers 10, 12, 14, and 16 are four **consecutive even integers** because in counting up from 10, no even numbers are skipped. Likewise, 15, 17, and 19 are **consecutive odd integers**.

In algebra, it is sometimes necessary to represent a list of consecutive integers. To represent any list in general, you must use variables. It is common to let x represent the first integer. See the examples below of how to write a list of consecutive integers.

Three consecutive integers: $x, x+1, x+2$

Three consecutive odd integers: $x, x+2, x+4$

Three consecutive even integers: $x, x+2, x+4$

Note that consecutive even integers and odd integers look alike because both even integers and odd integers are two apart.



- 5-138. Think about the mathematical process you use as you solve the following problems. Show your work and your solutions.
- If there are 100 students in a room and 40 of them are boys, how many are girls?
 - If there are 17 blue and white stripes on a flag and 9 of them are blue, how many are white?

- c. If there are 250 pennies and dimes in a box and 130 of them are pennies, how many are dimes?
- d. Now it is time to generalize. Imagine you know how many items you have in a collection of two types of things. If you know how many of one of the items you have, how could you find how many of the other item you have?

Explain:

5-139. If you can travel 156 miles on 4 gallons of gasoline, how far can you travel on 12 gallons? How many miles on 6 gallons? A diagram may help you with your reasoning. Show your work and explain your thinking.

5-140. Use the Distributive Property to simplify the following expressions.

a. $4(x+2)$

b. $-5(9+x)$

c. $7(x-3)$

5-141. Evaluate the following expressions.

a. $-5+2(8-12)$

b. $(-5+2)(8-12)$

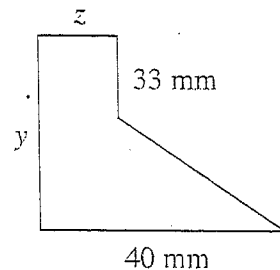
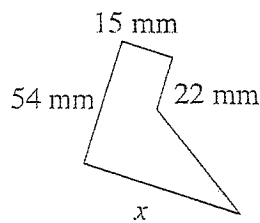
c. $-5+2 \cdot 8-12$

d. $\frac{1}{2}(-6)(4+10)$

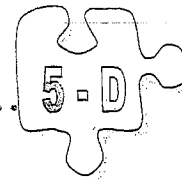
e. $-\frac{2}{3} \cdot 6+15+(-3)$

f. $(7-2)^2-5 \div 5$

5-142. Find the lengths of the missing sides on the similar shapes at right. What is the scale factor?



5.3.5 How can I solve it?



More Word Problem Solving

So far in Section 5.3, you have been using a 5-D Process as a way to organize and solve problems. Today you will continue using this process to solve problems in a variety of situations.

As you work, use the following questions to focus your team's discussion.

What is the problem asking?

What is the relationship between the quantities involved?

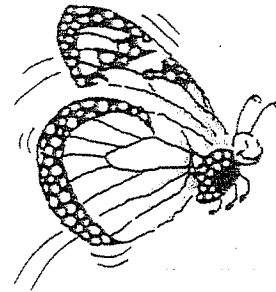
How can you decide which part of the problem to represent as x ?

What if a different quantity were represented by x ?

- 5-143. According to many sources, insects are the most diverse group of animals on the planet. The number of species is estimated at between six and ten million. Insects are said to represent more than half of all known living organisms and potentially over 90% of the differing life forms on Earth.

The following problems are about insects and other creepy-crawly creatures. You will use your math skills to find out some fascinating facts about them. Your teacher will assign your team one of the following problems to solve. Be prepared to present your solution, including all steps of your 5-D solving process, to the class.

- a. Many insects migrate (travel) between their summer and winter homes. The desert locust migrates about 800 miles farther than the Monarch butterfly every spring, and the pink-spotted hawk moth migrates about 200 miles less than four times the distance of the Monarch butterfly every spring. Laid end to end, the distances traveled by a Monarch butterfly, a desert locust, and a pink-spotted hawk moth is about 12,600 miles every spring. How far does each species travel?

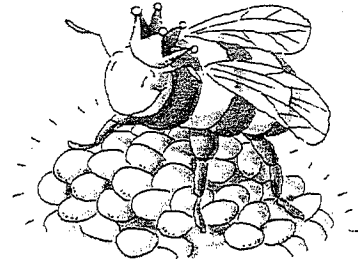


5D's → or your method:

5-143. *Problem continued from previous page.*

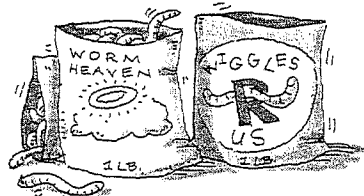
- b. Bees, wasps, and ants all live in colonies that have a queen. The queen of the colony is really the mother of all the insects in the colony. During the spring and summer, many eggs are laid in bee, wasp, and ant colonies all over the world.

Queen bees lay about double the number of eggs in a day that queen ants lay. Queen wasps lay about 600 fewer eggs a day than queen ants do. An average queen bee, ant, and wasp together lay about 2600 eggs a day. How many eggs would each type of queen lay in one day?



- c. Flies cannot see much farther than 24 to 36 inches away from their eyes, but that is not due to a lack of lenses – dragonflies have thousands of lenses! In one eye, dragonflies have two thousand more lenses than seven times the number of lenses that houseflies have in one eye. If one housefly eye and one dragonfly eye together have 34,000 lenses, how many lenses do houseflies have in one eye? How many do dragonflies have in one eye?

- d. Think you do not have enough room to farm? Think again. You could farm worms under your desk with a commercially available worm farm that measures 16" x 16" x 28". You can buy the worms online. At 1200 worms per pound, you could start your own business just as John did. He's not good at keeping his records, however, and he needs your help.

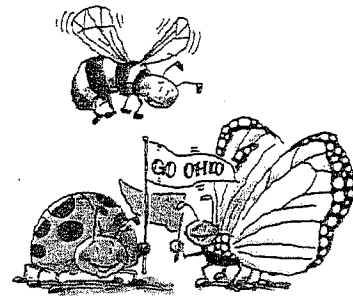


John buys his worms from two online stores, Worm Heaven and Wiggles R Us. John remembers that he ordered 1200 more than twice as many worms from Worm Heaven as he did from Wiggles R Us. He also knows he has 18,000 worms. How many worms did he order from each store?

- e. There are many kinds of animals that live in and on our bodies, called parasites. Some of the longest parasites live in our intestines. Two of these parasites are roundworms and tapeworms. Their lengths can be quite different, depending on how long they have been living in someone's body.

One of the longest tapeworms ever measured was three feet less than seven times the length of the longest roundworm ever measured. If you laid these two worms end to end, they would measure an amazing 69 feet! How long was the tapeworm and how long was the roundworm?

- f. Did you know that most of the states in this country have official state insects and butterflies? Out of 30 states, the three most common insects are Monarch butterflies, honeybees, and ladybugs. The number of states that have Monarch butterflies as their official insect is one more than the number of states that have ladybugs as their official insect. The number of states that have honeybees as their official insect is three times the number of states with ladybugs as their state insect minus one. How many states have each kind of insect as their state insect?



Review & Preview

- 5-144. The number of girls at Middle School Cyber Summer Camp was six more than twice the number of boys. There were a total of 156 middle school students at the camp. Use the 5-D Process to find the number of boys and the number of girls at camp.



5-146. **Multiple Choice:** Which of the following expressions could be used to find the average (mean) of the numbers k , m , and n ?

- A. $k+m+n$ B. $3(k+m+n)$ C. $\frac{k+m+n}{3}$ D. $3k+m+n$

5-147. The Giant Prize Wheel at the county fair is evenly divided into 10 sections. One is labeled "Large Prize," three are labeled "Small Prize," and the rest are labeled "No Prize."

- If you spin once, what is the probability of winning a large prize?
- If you spin once, what is the probability of winning any prize?
- If 50 people spin the prize wheel, approximately how many people should expect to win a prize of any kind?

5-148. This problem is a checkpoint for order of operations. It will be referred to as Checkpoint 5.



Evaluate each expression using the order of operations.

a. $16 - 2^3 \div 8 + 5$

b. $(-2 + 6)^2 - \left(\frac{3}{2}\right) \cdot 14 + 1$