Sect 1.8 - An Introduction to Problem Solving

Objective a: Problem-Solving Strategies

Here are some guidelines to follow when solving an application problem:

1) Read the problem several times. If there is a vocabulary word you do not understand, you will need to look up the definition.

2) Write down the given information and figure out what needs to be found. Draw a diagram, a figure, or a chart if appropriate. Determine what operation(s) are needed to solve the problem and make a plan of attack. Sometimes you can estimate a reasonable answer.

3) Implement your plan of attack and solve the problem.

4) Check your answer. Ask yourself is the answer reasonable and be sure to answer the question posed by the problem. Write your answer in words.

Objective b: Solving Application Problems Involving One Step.

Recall some key vocabulary words:

Addition

the total of 11 and 8	(11 + 8)
8 added to 12	12 + 8
7 more than 6	6 + 7
4 increased by 5	4 + 5
the sum of 8 and 3	(8 + 3)
15 plus 7	15 + 7
13 greater than 9	9 + 13
exceeds 5 by 6	5 + 6

Subtraction

6 minus 4	6 – 4
4 less 10	4 – 10
4 less than 10	10 – 4
the difference between 8 and 3	(8 – 3)
34 decreased by 5	34 – 5
3 subtract 5	3 – 5
3 subtracted from 5	5 – 3
56 reduced by 43	56 – 43
15 fewer than 61	61 – 15

Multiplication

6 times 9	$6 \bullet 9$
the product of 11 and 6	$(11 \bullet 6)$
$\frac{2}{5}$ of 5	$\left(\frac{2}{5}\right)(5)$
8 multiplied by $\frac{5}{6}$	$8 \bullet \frac{5}{6}$
twice 6	$2(6)$
triple 5	$3(5)$
double 7	$2 \bullet 7$

Division

7 divided into 21	$21 \div 7 = \frac{21}{7}$ or $7\overline{)21}$
7 divided by 21	$7 \div 21 = \frac{7}{21}$ or $21\overline{)7}$
the quotient of 15 and 3	$(15 \div 3) = \frac{15}{3}$ or $3\overline{)15}$
the ratio of 4 to 11	$4 \div 11 = \frac{4}{11}$
8 split into 4 equal parts	$8 \div 4 = \frac{8}{4}$ or $4\overline{)8}$

Power

the square of 9 or 9 squared	9^2
the cube of 4 or 4 cubed	4^3
5 raised to the 8^{th} power	5^8

<u>Use the chart below to solve exercises 1 & 2:</u>

Year	Total US Co2 Emissions (In Metric Tons)	Population
2001	5,807 million	285 million
2002	5,881 million	288 million
2003	5,939 million	290 million
2004	6,024 million	293 million
2005	6,032 million	296 million
2006	5,946 million	298 million
2007	6,022 million*	301 million

*-Preliminary.
Source: www.eia.doe.gov

Ex. 1 Find the total Co2 emissions for the years 2001 – 2005.

Solution:
Since the word "total" means to add, we will add the amounts of Co2 emissions from 2001 through 2005. Since there were about 6,000 million tons emitted during those years, our answer should be close to 6,000 × 5 = 30,000 million tons:

2 1 2
5,807
5,881
5,939
6,024
+ 6,032
29,683

So, from 2001 through 2005, the US emitted 29,683 million tons of Co2.

Ex. 2 On average, how many metric tons (to the nearest ton) of Co2 were emitted per person in the US in 2007?

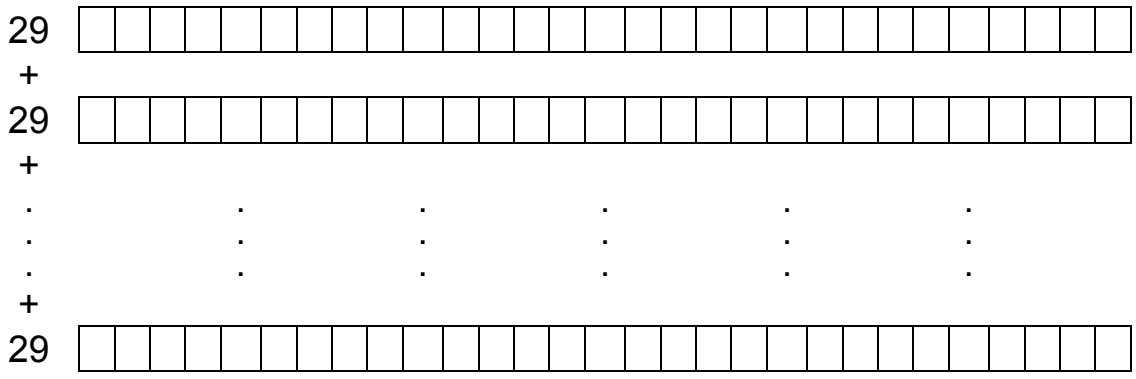
Solution:
Since the word "per" implies division, we will take the amount of Co2 emitted divided by the number of people. Since there were approximately 6,000 million tons emitted and about 300 million people, our answer should be close to 6000 ÷ 300 = 20 tons per person:

$$\begin{array}{r} 20\ R\ 2 \approx 20 \\ 301\overline{)6022} \\ -\ 602 \\ \hline 2 \end{array}$$

So, there were 20 metric tons of Co2 per person emitted in 2007.

Ex. 3 A rectangular classroom has 32 rows of tile with 29 tiles in each row on the floor. How many tiles cover the floor?

Solution:
Let's think about what the problem says: "32 rows of tile with 29 tiles in each row:"



Since we are adding thirty-two 29's together, we are using repeated addition. The shortcut for repeated addition is multiplication. Since there are approximately 30 rows with approximately 30 tiles in each row, $30 \times 30 = 900$ tiles should be reasonable close to the answer.

1	***2***	
29	29	29
$\times$ 32	$\times$ 32	$\times$ 32
58	58	***1***58
	870	+ 870
		928

There are 928 tiles that cover the floor.

Ex. 4 A set of tires was designed to last 50,000 miles. If they were installed when the car's odometer read 35,978 miles and replaced when the car's odometer read 84,194 miles, how long did they actually last? How many miles were they short of making it to 50,000 miles?

Solution:

We will need to subtract the beginning odometer reading from the ending odometer reading. Since the readings are approximately 84,000 and 36,000, then the answer should be close to $84,000 - 36,000 = 48,000$, which is 2000 miles short of 50,000.

	$7^{1}3^{1}1\ 8^{1}4$		$4\ 9,\ 9\ 9^{1}0$
84,194	~~8 4, 1 9 4~~	50,000	~~5 0, 0 0 0~~
– 35,978	– 3 5, 9 7 8	– 48,216	– 4 8, 2 1 6
	4 8, 2 1 6		1, 7 8 4

The tires lasted 48,216 miles. They were 1784 miles short of 50,000 miles.

Objective c: Solving Application Problems Involving Several Steps.

Solve the following:

Ex. 5 An Electrician bought four 600 Watt 3-Way Dimmer Switch Kits priced at $54 each and returned two 125 Volt Time Switches priced at $63 each. Assuming the sale was tax exempted, how much did the Electrician have to pay at the register?

Solution:

The total the Electrician will have to pay will be equal to the cost of the four dimmer switch kits minus the cost of the two time switches that were returned:

Cost of the four dimmer switches	–	Cost of the two time switches
4×54	–	2×63

Multiply first and then subtract:

	1	
	54	63
	$\times$ 4	$\times$ 2
	216	126

	$1^{\cancel{1}}1$	
216	~~2 1~~ 6	The Electrician had to pay $90
– 126	– 1 2 6	at the register.
	9 0	

Ex. 6 An Express Oil Change Facility has 956 quarts of 5w30 oil in stock on Monday at the beginning of the day. On average, the Facility uses 135 quarts of 5w30 oil in a given day and expects to receive a small shipment of 300 quarts of 5w30 oil on Tuesday. How much 5w30 oil will the Facility have left by the end of the day on the following Tuesday? Assume the Facility is open every day.

Solution:

The amount of oil that the facility will have available to use is the amount the start with plus the shipment. Starting the beginning of the day on Monday and going through the following Tuesday is a total of nine days. Thus, the facility will use 135×9 quarts of 5w30 oil in that time period. So, the oil left will be equal to:

Starting amount + shipment – oil used

956 + 300 – 135×9

= 956 + 300 – 1215

= 1256 – 1215

= 41

	3 4
	135
	$\times$ 9
	1215
	1256
	– 1215
	41

At the end of the following Tuesday, the facility will have 41 quarts of 5w30 oil left.

Ex. 7 An architect is designing a theater to seat 2105 people. The main floor has 33 rows of 45 seats in each row. If the balcony has 20 rows, how many seats must be in each row in the balcony?

Solution:

We first need to figure out the number of seats the balcony has. That number is equal to the total number of seats (2105) minus the

number of the seats on the main floor. Since there are 33 rows of 45 seats on the main floor, then that number is 33×45. Thus, the number of balcony seats is $2105 - 33 \times 45$. To find the number of seats in each row in the balcony, we need to take the number of balcony seats and divide by the number of rows (20):

$(2105 - 33 \times 45) \div 20$ (multiply 33 and 45)

$= (2105 - 1485) \div 20$ (subtract)

$= (620) \div 20$ (divide)

$= 31$

Each row in the balcony will have 31 seats.

Ex. 8 Juanita McMiller is preparing an estimate for a Wedding Reception. The Reception will require 8 work hours to prepare and 10 work hours on the day of the reception. For the preparation, Juanita plans to use one main chef at $25 per hour and three assistants at $15 per hour. During the day of the reception, Juanita plans to use one main chef at $25 per hour plus six wait staff at $12 per hour. If the food and drinks will cost $4,362 and she wants to make a $500 profit, what should the estimate be for the wedding reception?

Solution:

The estimate is equal to:

Prep Cost + Day of Reception Cost + Food Cost + Profit

We need to figure out each piece. Let's start with the Prep Cost. She will use one chef at $25 per hour plus three assistants at $15 per hour. So, for one hour, she'll have to pay $25 + 3 \bullet 15$. Since they will have to work for 8 hours, then the Prep Cost is $(25 + 3 \bullet 15) \bullet 8$

Next, let's compute the Day of Reception Cost. She will use one chef at $25 per hour plus six wait staff at $12 per hour. So, for one hour, she'll have to pay $25 + 6 \bullet 12$. Since they will have to work for 10 hours, then the Day of Reception Cost is $(25 + 6 \bullet 12) \bullet 10$. The Food Cost is $4,362 and the Profit is $500, so the estimate is:

$(25 + 3 \bullet 15) \bullet 8 + (25 + 6 \bullet 12) \bullet 10 + 4{,}362 + 500$ (multiply in parenth.)

$= (25 + 45) \bullet 8 + (25 + 72) \bullet 10 + 4{,}362 + 500$ (add in parenthesis)

$= (70) \bullet 8 + (97) \bullet 10 + 4{,}362 + 500$ (multiply)

$= 560 + 970 + 4362 + 500$ (add)

$= 6392$

Thus, the estimate for the wedding reception is $6,392