



Concept: Problem Solving

Name:

COMPUTER COMPONENT

Instructions: Select the computer program *Understanding Equations* (Neufeld)
Follow the instructions to the Main Menu.
Select *Problem Solving* from the Main Menu.



Work through all sections of this topic **in order**:

- *Words and Symbols*
- *The translation Machine*
- *The Trick Machine*
- *Expressions – The Language of Algebra*
- *Area of Walls*
- *Chemistry*
- *Pool Puzzler – The First Problem*
- *Perimeter Problem with Diagram*
- *Fish Problem with Diagram*

Notice: You will not be finishing the entire topic before stopping to complete some **OFF COMPUTER EXERCISES**.



As you work through the computer exercises, make your notes in the **NOTES** section of this page.

When you reach the end of the section *Fish Problem with Diagram* on the computer, move on to the **OFF COMPUTER EXERCISES** below.

NOTES:

Words and Symbols (Remember that words like (*Answers may vary and can include **difference, sum, double, product, fifteen, one half of*** etc can be translated into **Mathematical** symbols to solve problems.)

Write examples for the following:

(a) Three variables

(Answers may vary)

Answers may include: x, y, z, a

(b) Two operations

(Answers may vary)

Answers may include two of: $+, -, \times, \div$

(c) Three algebraic expressions

(Answers may vary)

Answers may include: $2x$

$$x - 4x$$

$$4a + 3b$$

$$-4y - (-8x)$$

(d) Two algebraic equations

(Answers may vary)

Answers may include:







$$\begin{array}{rcl} 4x & = & 8 \\ x + 7 & = & 3x + 14a + 3b \\ 8a + 12b & = & 2a + 5 \\ y + (-2x) & = & -6y - 4x \end{array}$$

Translation Machine

Fill in the chart.

	Statement in Words	Mathematical Translation
(a)	Nine less than a number	$x - 9$
(b)	Eight is four more than a number	$8 = y + 4$
(c)	Seven less than the total of a number and two	$(x + 2) - 7$
(d)	The sum of twice a number plus 16 is 30	$2a + 16 = 30$

The Trick Machine (Fill in the following chart.)

Words	Symbols	Pictures
Pick any number.	x	
Add 4 to it.	$x + 4$	
Double your answer.	$2x + 8$	
Subtract 6.	$2x + 8 - 6$ $= 2x + 2$	
Divide by 2.	$\frac{2x + 2}{2} = x + 1$	
Subtract the first number.	1	

Expressions - The Language of Algebra

For the class trip to the theater...

If: $58 =$ number of **students** on the trip $= s$

$26 =$ number of students from Mrs. **Jone's** class $= j$

$8 =$ number of students who seat in the **back** row $= b$

$16 =$ number of students who bought **pop** during intermission $= p$

Translate $j = s - 32$

- (a) The **number** of **students** in Mrs. **Jone's** class
is **32** less than the **number of students** on the trip.

Translate $b = p \div 2$

- (b) **Number** of **students seated** in **back row** is the
same as the **number** of **students** who
bought pop during intermission divided by 2.

Pool Puzzler (*Fill in the blanks and provide a full solution for his problem*)

The Solvers Baseball team wants to have a pool party. The fixed cost to hire a lifeguard is

\$75.00 Each ballplayer must also pay **\$2.75** for admission.

(a) The teams has \$114.75

How many players will that pay for?

Let C equal the total funds available

$$C = 114.75$$

Let b equal the number of players

$$\begin{array}{rcl}
 \bullet\bullet & C & = & 75.00 + 2.75b \\
 & 114.75 & = & 75.00 + 2.75b \\
 -75.00) & 114.75 - 75.00 & = & 75.00 - 75.00 + 2.75b \\
 & 39.75 & = & 2.75b \\
 \div 2.75) & \underline{39.75} & = & \underline{2.75b} \\
 & 2.75 & & 2.75 \\
 & 14.45 & = & b
 \end{array}$$

•• The number of players that \$114.75 will pay for is 14.

(b) But there are 19 players on the team. How much money do they need?

C = Total cost

b = number of players

$$\begin{array}{rcl}
 C & = & 75.00 + 2.75b \\
 & = & 75.00 + 2.75(19) \\
 & = & 75.00 + 52.25 \\
 & = & 127.25
 \end{array}$$

•• They need a total of 127.25 to pay for the party.

Analysis

Which part(s) of the four problems; Area, Chemistry, Perimeter Problem with Diagram or Fish Problem with Diagram was the most difficult. *Explain why.*

(Answer will vary)

OFF COMPUTER EXERCISES

1. For each of the following statements, translate the words into symbols.

(a) Three times a number less ten. **$3x - 10$**

(b) Eight times a number, decreased by ten is six. **$8b - 10 = 6$**

(c) Ten is subtracted from three times a number. **$3y - 10$**

(d) Six more than five times a number. **$5z + 6$**

(e) Half the sum of three and a number. **$\frac{3 + x}{2}$**

(f) When a number is decreased by ten and the result is tripled, the answer is ten.

$$\mathbf{3(x - 10) = 10}$$



2. Recall the Solvers baseball team that was planning a pool party. The fixed cost to hire a lifeguard remains at \$75.00, but each ballplayer must now pay only \$2.50 for admission.

(a) Find the equation to determine the total cost of the party.

Let C equal the total cost of the party.

Let b represent the number of players.

$$\therefore C = 75.00 + 2.50b$$

(b) Using the equation from (a), calculate the cost for 15 players.

$$\begin{aligned} C &= 75.00 + 2.50b \\ C &= 75.00 + 2.50(15) \\ C &= 75.00 + 37.50 \\ C &= 112.50 \end{aligned}$$

∴ They need \$112.50.

(c) The team has 125.00. How many players will that pay for?

Let M represent the funds available.

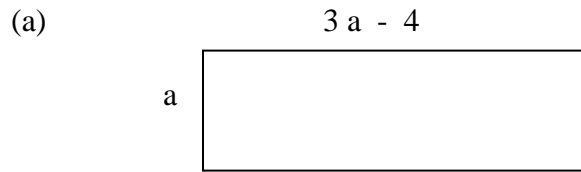
$$\therefore M = 125$$

Let b represent the number of players

$$\begin{array}{r} M = 75.00 + 2.50b \\ 125.00 = 75.00 + 2.50b \\ -75.00) \quad 125.00 - 75.00 = 75.00 - 75.00 + 2.50b \\ \quad \quad \quad 50.00 = 2.50b \\ \div 2.50) \quad \quad \underline{50.00} = \underline{2.50b} \\ \quad \quad \quad \quad \quad 2.50 \\ \quad \quad \quad \quad \quad 20 = b \end{array}$$

∴ The number of players that \$125.00 will pay for is 20.

3. Calculate the dimensions of the following rectangles. (*Provide full solutions.*)



$$P = 10 \text{ units squared}$$

$$\begin{array}{rcl}
 P & = & 2L + 2W \\
 10 & = & 2a + 2(3a - 4) \\
 10 & = & 2a + 6a - 8 \\
 10 & = & 8a - 8 \\
 +8) & 10 + 8 & = & 8a - 8 + 8 \\
 & 18 & = & 8a \\
 \div 8) & \underline{18} & = & \underline{8a} \\
 & 8 & = & 8 \\
 & 2.25 & = & a
 \end{array}$$

∴ The dimensions of the rectangle are:

$$\begin{aligned}
 \text{Length} &= a \\
 &= 2.25 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 \text{Width} &= 3a - 4 \\
 &= 3(2.25) - 4 \\
 &= 2.75 \text{ units}
 \end{aligned}$$

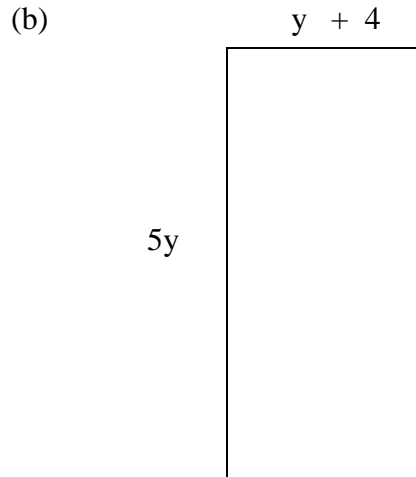
Perimeter is 10 units.

Check:

$$\begin{array}{l}
 \text{Given } P = 10 \\
 \text{Using } P = 2L + 2W
 \end{array}$$

$$\begin{aligned}
 \therefore P &= 2 \times 2.25 + 2 \times 2.75 \\
 &= 4.5 + 5.5 \\
 &= 10
 \end{aligned}$$

The solution is correct because the values of L and W create a rectangle with a perimeter of 10.



$$P = 20 \text{ units squared}$$

$$\begin{aligned}
 P &= 2L + 2W \\
 20 &= 2 \times 5y + 2(y + 4) \\
 20 &= 10y + 2y + 8 \\
 20 &= 12y + 8 \\
 -8) \quad 20 - 8 &= 12y + 8 - 8 \\
 12 &= 12y \\
 \div 12) \quad \underline{12} &= \underline{12y} \\
 12 &= 12 \\
 1 &= y
 \end{aligned}$$

∴ The dimensions of the rectangle are:

$$\begin{aligned}
 \text{Length} &= 5y \\
 &= 5 \times 1 \\
 &= 5 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 \text{Width} &= y + 4 \\
 &= 1 + 4 \\
 &= 5 \text{ units}
 \end{aligned}$$

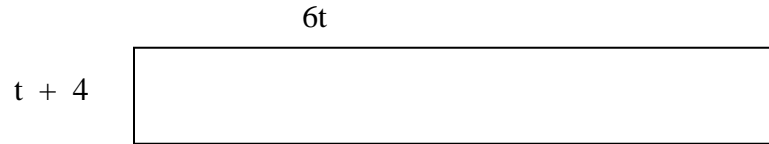
Check:

Substitute the calculated length and width in $P = 2L + 2W$

$$\begin{aligned}
 \therefore P &= 2 \times 5 + 2 \times 5 \\
 &= 10 + 10 \\
 &= 20
 \end{aligned}$$

Since the given perimeter was 20, the solution $L = 5$ and $W = 5$ is correct.

(c)



$$P = 22 \text{ units squared}$$

$$\begin{array}{rcl}
 P & = & 2L + 2W \\
 22 & = & 2(t + 4) + 2(6t) \\
 22 & = & 2t + 8 + 12t \\
 22 & = & 14t + 8 \\
 -8) & 22 - 8 & = & 14t + 8 - 8 \\
 & 14 & = & 14t \\
 \div 14) & \underline{14} & = & \underline{14t} \\
 & 14 & = & 14 \\
 & 1 & = & t
 \end{array}$$

∴ The dimensions of the rectangle are:

$$\begin{aligned}
 \text{Length} &= t + 4 \\
 &= 1 + 4 \\
 &= 5 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 \text{Width} &= 6t \\
 &= 6(1) \\
 &= 6 \text{ units}
 \end{aligned}$$

Check:

Substitute $L = 5$ and $W = 6$ into $P = 2L + 2W$.

$$\begin{aligned}
 \therefore P &= 2 \times 5 + 2 \times 6 \\
 &= 10 + 12 \\
 &= 22
 \end{aligned}$$

Since the given perimeter was 22, the solution $L = 5$ and $W = 6$ is correct.

4. If the perimeter of a rectangle is 50 cm and its length is 1 cm more than its width, *what is the width of the rectangle?*

**Let x represent the width of the rectangle.
Then the length can be represented by $x + 1$**

Since $P = 2L + 2W$

$$\begin{aligned} \therefore P &= 2L + 2W \\ &= 2(x + 1) + 2(x) \end{aligned}$$

$$\begin{aligned} \therefore 50 &= 2(x + 1) + 2(x) \\ 50 &= 2x + 2 + 2x \\ 50 &= 4x + 2 \end{aligned}$$

$$\begin{aligned} -2) \quad 50 - 2 &= 4x + 2 - 2 \\ 48 &= 4x \end{aligned}$$

$$\begin{aligned} \div 4) \quad \frac{48}{4} &= \frac{4x}{4} \\ 12 &= x \end{aligned}$$

\therefore The width of the rectangle is 12 cm.

Check:

Substitute $x = 12$ into $P = 2(x + 1) + 2(x)$.

$$\begin{aligned} \therefore P &= 2(x + 1) + 2(x) \\ &= 2(12 + 1) + 2(12) \\ &= 26 + 24 \\ &= 50 \end{aligned}$$

Since the given perimeter was 50, the solution (width = 12cm) is correct.

5. The cost in cents of making copies on a copying machine is given by the formula $C = 80 + 2n$, where n is the number of copies.

(a) *What is the cost of making 150 copies?*

$$\begin{aligned} C &= 80 + 2n \\ C &= 80 + 2(150) \\ C &= 80 + 300 \\ C &= 380 \end{aligned}$$

\therefore The cost of making 150 copies is 380 cents.

(b) How many copies can be made with \$22.00?

$$\text{C} = 80 + 2n$$

Since \$22.00 = 2200 cents

$$\begin{array}{r} \therefore \\ -80) \quad 2200 - 80 \\ \hline \quad 2120 \\ \div 2) \quad \underline{2120} \\ \quad \quad 2 \\ \quad \quad \underline{2} \\ \quad \quad \quad 1060 \end{array} \quad \begin{array}{l} = 80 + 2n \\ = 80 + 2n - 80 \\ = 2n \\ = \underline{2n} \\ = \underline{2} \\ = n \end{array}$$

\therefore \$22.00 can make 1060 copies.

6. I have picked a number. I double the number and add four to the result. I end up with the number 100. Use equations to find the number that I picked.

Let x represent the number.

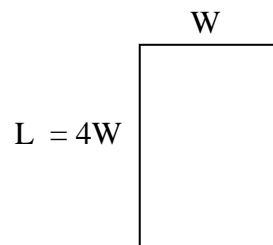
$$\begin{array}{r} 2x + 4 = 100 \\ -4) \quad 2x + 4 - 4 = 100 - 4 \\ \quad 2x = 96 \\ \div 2) \quad \underline{2x} = \underline{96} \\ \quad \quad 2 \quad \quad 2 \\ \quad \quad x = 48 \end{array}$$

\therefore The number picked was 48.

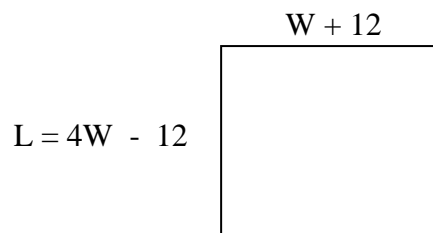
7. The length of a rectangle is four times its width. If the length is decreased by 12 m and the width is increased by 12 m, the rectangle becomes a square.

(a) Draw a diagram of the rectangle, marking the lengths and widths.

Original Rectangle:



New rectangle with length decreased by 12 m and width increased by 12m to make a square.



(b) Use an equation to help find the length of the original rectangle.

Since the new rectangle is a square

$$\begin{array}{rcl}
 \therefore & L & = & W \\
 \\
 \therefore & 4W - 12 & = & W + 12 \\
 -W) & 4W - W - 12 & = & W + 12 - W \\
 & 3W - 12 & = & 12 \\
 +12) & 3W - 12 + 12 & = & 12 + 12 \\
 & 3W & = & 24 \\
 \div 3) & \underline{3W} & = & \underline{24} \\
 & 3 & & 3 \\
 & W & = & 8
 \end{array}$$

Substitute $W = 8$ into the $L = 4W$ from the original rectangle

\therefore Length of original rectangle

$$\begin{array}{rcl}
 L & = & 4W \\
 L & = & 4(8) \\
 L & = & 32
 \end{array}$$

\therefore The length of the original rectangle is 32 m.

8. You caught a big fish on your first fishing trip. Your sister said that her fish was 20 cm longer than yours. Aunt Jenn said that she caught one four times as long as yours. If the total length of the three fish was 2 m, *calculate the length of each fish.*

Let x represent the length of your fish

Sister's fish is $x + 20$ long

Aunt Jenn's fish is $4x$ long

Total length of all three fish is $2\text{m} = 200\text{ cm}$

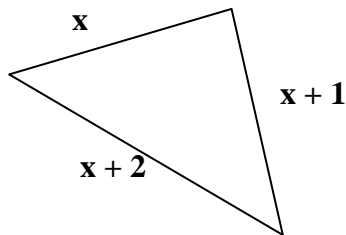
$$\begin{array}{rcl}
 \therefore & x + (x + 20) + 4x & = & 200 \\
 & x + x + 20 + 4x & = & 200 \\
 & 6x + 20 & = & 200 \\
 -20) & 6x + 20 - 20 & = & 200 - 20 \\
 & 6x & = & 180 \\
 \div 6) & \underline{6x} & = & \underline{180} \\
 & 6 & & 6 \\
 & x & = & 30
 \end{array}$$

∴ The length of your fish is 30 cm.

$$\begin{aligned} \text{The length of sister's fish is } x + 20 &= 30 + 20 \\ &= 50 \text{ cm.} \end{aligned}$$

$$\begin{aligned} \text{The length of Aunt Jenn's fish is: } 4x &= 4(30) \\ &= 120 \text{ cm.} \end{aligned}$$

9. The perimeter of a triangle is 51 cm. The lengths of its sides are three consecutive whole numbers in cm. *How long is each side?*



Let x represent the length of S_1

$$\begin{aligned} \therefore S_2 &= x + 1 \\ S_3 &= x + 2 \end{aligned}$$

Since the $P = 51$

$$\begin{aligned} \therefore P &= S_1 + S_2 + S_3 \\ 51 &= S_1 + S_2 + S_3 \\ 51 &= x + (x + 1) + (x + 2) \\ 51 &= x + x + 1 + x + 2 \\ 51 &= 3x + 3 \\ -3) \quad 51 - 3 &= 3x \\ 48 &= 3x \\ \div 3) \quad \underline{48} &= \underline{3x} \\ 16 &= x \end{aligned}$$

$$\begin{aligned} \therefore S_1 &= x \\ &= 16 \text{ cm} \end{aligned}$$

$$\begin{aligned} S_2 &= x + 1 \\ &= 16 + 1 \\ &= 17 \text{ cm} \end{aligned}$$

$$\begin{aligned} S_3 &= x + 2 \\ &= 16 + 2 \\ &= 18 \text{ cm} \end{aligned}$$

Therefore the sides of the triangle are 16cm, 17cm and 18cm.