



Problem of the Week

Problem A and Solution

Doing Chores

Problem

Oliver can earn money by doing chores each week. His parents made up the following chart:

Chore	Money Earned
Cleaning his room	\$1.00
Walking the dog	\$1.25
Clearing the table	\$0.50
Shovel snow from the deck	\$1.50

Over four weeks he did some of the chores. The first week he did everything except shovel the snow. The second week he cleaned his room and walked the dog. The third week he did everything except clean his room. The fourth week, he cleaned his room and shovelled the snow.

How much money did Oliver earn over these four weeks?

Solution

The solution can be computed in different ways. One way is to determine how much Oliver earned each week.

$$\text{Week 1: } \$1.00 + \$1.25 + \$0.50 = \$2.75$$

$$\text{Week 2: } \$1.00 + \$1.25 = \$2.25$$

$$\text{Week 3: } \$1.25 + \$0.50 + \$1.50 = \$3.25$$

$$\text{Week 4: } \$1.00 + \$1.50 = \$2.50$$

$$\text{Total earnings: } \$2.75 + \$2.25 + \$3.25 + \$2.50 = \$10.75$$

Another way to calculate it is to multiply each chore value by the number of weeks that the chore was done. Oliver cleaned his room three out of the four weeks. He walked the dog three out of the four weeks. He cleared the table two out of the four weeks. He shovelled snow two out of the four weeks.

$$\text{Amount earned from cleaning his room: } 3 \times \$1.00 = \$3.00$$

$$\text{Amount earned from walking the dog: } 3 \times \$1.25 = \$3.75$$

$$\text{Amount earned from clearing the table: } 2 \times \$0.50 = \$1.00$$

$$\text{Amount earned from shovelling snow: } 2 \times \$1.50 = \$3.00$$

$$\text{Total earnings: } \$3.00 + \$3.75 + \$1.00 + \$3.00 = \$10.75$$





Teacher's Notes

In their early introduction to mathematics, students learn simple operations: $+$, $-$, \times , and \div . Later, they learn more complex operations such as square root, logarithms, and modulus. In more advanced mathematics, students are introduced to an operation called *dot product*. Mathematicians use \cdot to represent this operation. A big difference between a dot product and the other operations mentioned is that, the operands of a dot product are not single values; they are collections of values known as *vectors*.

A vector is an ordered list of values. A dot product combines two vectors of the same length, where the values in the the same position within each vector are logically connected. To calculate the dot product you compute the products of each pair of numbers from the same relative position in each vector, and then add those products together. So for example, the dot product of the vectors $[a, b, c]$ and $[x, y, z]$ is:

$$[a, b, c] \cdot [x, y, z] = (a \times x) + (b \times y) + (c \times z).$$

The second solution to this problem could be written as a dot product. We could create vectors where the position of the values in each vector corresponds to a particular chore. So, we have two vectors in this problem.

Vector representing how many weeks each chore was done: $[3, 3, 2, 2]$.

Vector representing the money earned for each chore: $[1, 1.25, 0.5, 1.5]$.

To determine how much money Oliver earned overall, we calculate the dot product of these two vectors.

$$[3, 3, 2, 2] \cdot [1, 1.25, 0.5, 1.5] = (3 \times 1) + (3 \times 1.25) + (2 \times 0.5) + (2 \times 1.5) = 10.75$$

This is essentially the same calculation shown in the solution.

