Problem of the Week
Problem A and Solution
A Total Profit

Problem

Penny Saver found a great deal on tote bags. She bought a case of 47 bags for $517. Penny sold 19 of them online for $12 each, and the rest she sold to a store for $20 each. How much money did Penny Saver make from selling all the tote bags?

Solution

To calculate the amount of money Penny gets from selling the tote bags, we can multiply the number of tote bags by the sale price. For the online sales, we need to calculate $19 \times \$12$. One way to calculate this product is to use friendly numbers. For example, calculate 20×12 instead. We can skip count by 20s:

$$20,\ 40,\ 60,\ 80,\ 100,\ 120,\ 140,\ 160,\ 180,\ 200,\ 220,\ 240$$

to determine that this product is 240.

The total for 20 bags is $12 more (the price of 1 bag) than the total for 19. Now we can calculate the original product: $19 \times 12 = 240 - 12 = \$228$.

Next we need to calculate the total Penny received from the store sales. She sold $47 - 19 = 28$ bags in the stores. So the amount of money Penny receives from the store sales is $28 \times \$20$. Again, we could use skip counting to determine that the product is $560. Alternatively, we could use the friendly number 30 in a calculation, which is 2 more than 28. Since 2 bags sold in the stores would be a total of $40, the total amount made from selling 30 bags would be $40 more than the amount made from selling 28 bags.

Using friendly numbers we can do the following calculations:

$$30 \times 20 = \$600$$
$$2 \times 20 = \$40$$
$$28 \times 20 = 600 - 40 = \$560$$

The total amount collected by Penny in sales is: $228 + 560 = \$788$. Since she invested $517 initially, her total profit is: $788 - 517 = \$271$.

Teacher's Notes

When we use friendly numbers to calculate products, we are taking advantage of the *distributive property* of multiplication. This property allows us to write equivalent expressions such as:

$$a \times (b + c) = (a \times b) + (a \times c)$$

or

$$a \times (b - c) = (a \times b) - (a \times c)$$

Keeping this property in mind, when we are multiplying two large numbers we can rewrite one of the factors into a series of terms separated by addition or subtraction operators.

For example, in this problem, we want to multiply 19×12. We can rewrite this product in many ways.

We can replace 19 with $(20 - 1)$ and do this calculation:

$$(20 - 1) \times 12 = (20 \times 12) - (1 \times 12) = 240 - 12 = 228$$

We can rewrite 12 as $(10 + 2)$ and do this calculation:

$$19 \times (10 + 2) = (19 \times 10) + (19 \times 2) = 190 + 38 = 228$$

We can rewrite 12 as $(10 + 1 + 1)$ and do this calcuation:

$$19 \times (10 + 1 + 1) = (19 \times 10) + (19 \times 1) + (19 \times 1) = 190 + 19 + 19 = 228$$

In all cases, we get the same result.