Formulating Algebraic Equations In Word Problems

Objectives : Students will be able to

(1) formulate equations to solve word problems;

(2) understand different problem solving strategies;

(3) recognize the existence of multiple solutions to certain problems in daily life

Dimension : Number and Algebra

Key Stage 3 (Secondary 1 - 3)

Description of Exemplar :

This exemplar aims at fostering students' problem solving skills, communication skills and collaborative skills through the formulation of algebraic equations from word problems. Students are expected to experience different problem solving strategies in this exemplar, namely arithmetic methods, algebraic methods, "trial and error" methods and tabulation methods. They should discover that there is no single solution to the last problem and that this is usually the case with problems in daily life.

To start the activity, a context such as the following may be given to students:

> *Edmund buys some soft drinks and fried chicken wings for a tea party. Soft drinks cost $5 per can and chicken legs cost $8 each.*

Some problems may be posed for students. In the process of solving the problems, discussions among students are encouraged. Students are then asked to suggest methods and strategies for solving the problems. Comparison of the methods and comments from other students should be encouraged. After solving each problem, students need to verify the solution.

The following useful guiding questions may be used:

(a) What is / are the unknown(s)?

(b) What is / are given?

(c) Is it possible to solve the problem with the information given?

(d) Can you obtain the solution by inspection?

(e) Can you suggest a / some letter(s) for the unknown(s)?

(f) What strategy will you use to solve the problem?

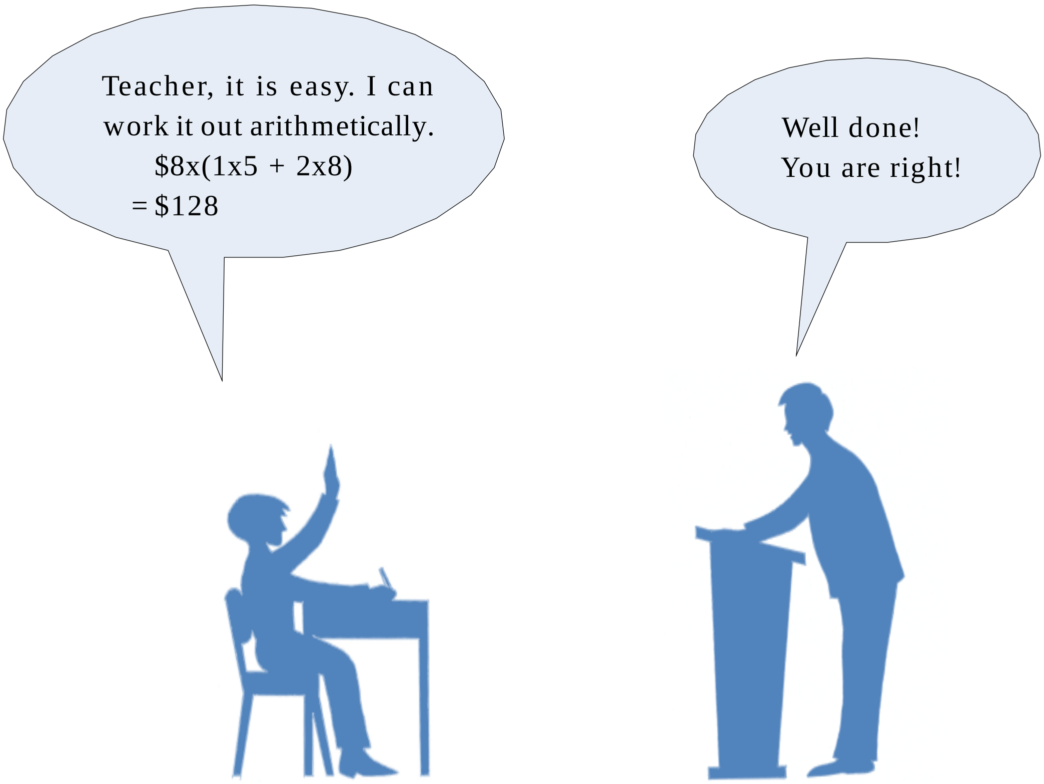
(g) Which method is the best to solve the problem?

(h) Is the solution reasonable with reference to the real situation?

(i) Is there any alternative approach to solving the problem?

To start the activity, the following question may be given.

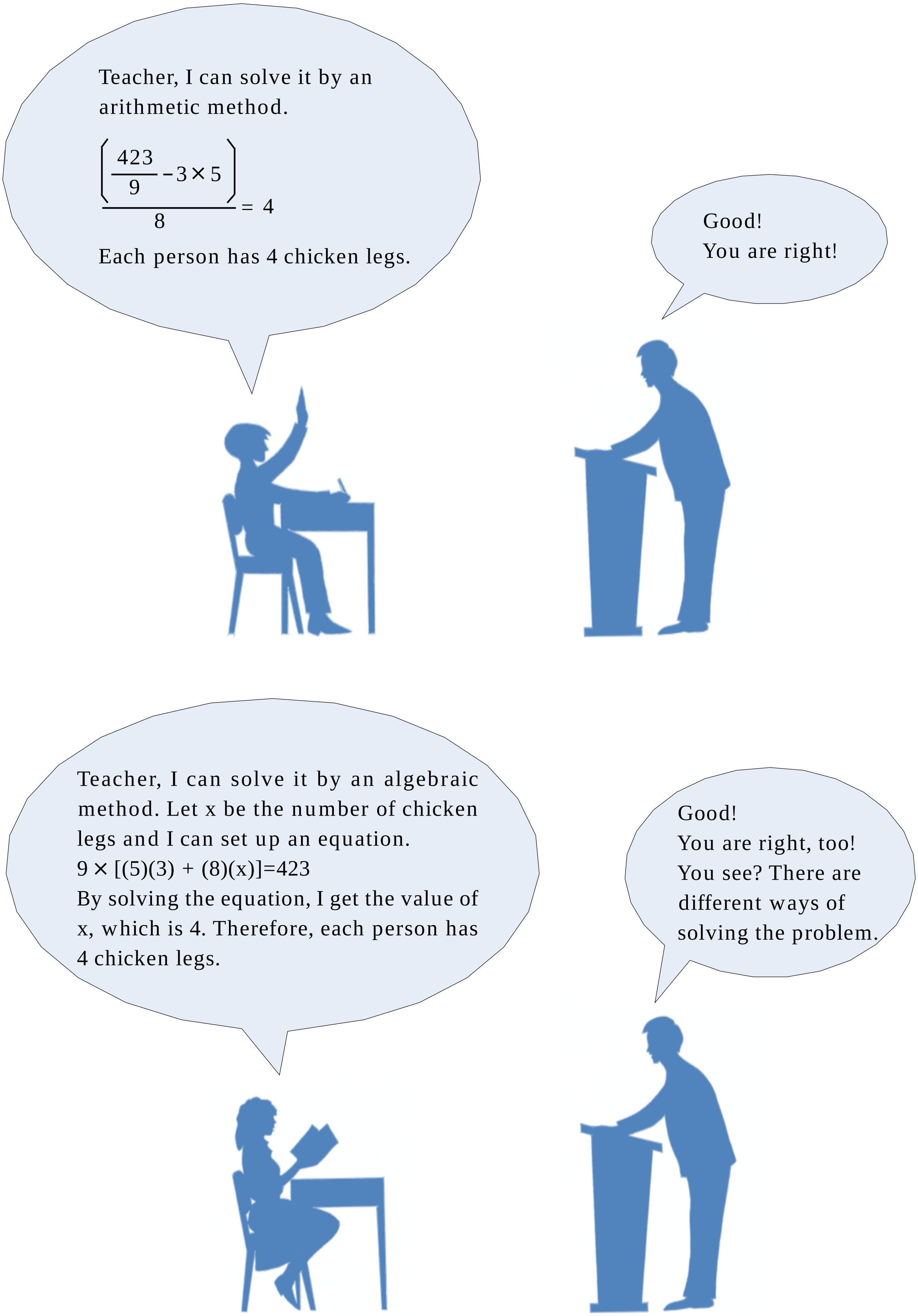
> Problem 1
>
> *Eight people including Edmund join the party and each person has 1 can of soft drink and 2 chicken legs. How much does Edmund pay to prepare for the party?*



The teacher then continues to introduce the following problems:

> Problem 2
>
> *Nine people including Edmund join the party and each one has 3 cans of soft drink and a certain number of chicken legs. Edmund has to pay $423. How many chicken legs does each one have?*

This problem requires more skills than Problem 1 and could be solved by using an arithmetic method or an algebraic method by setting up an equation.



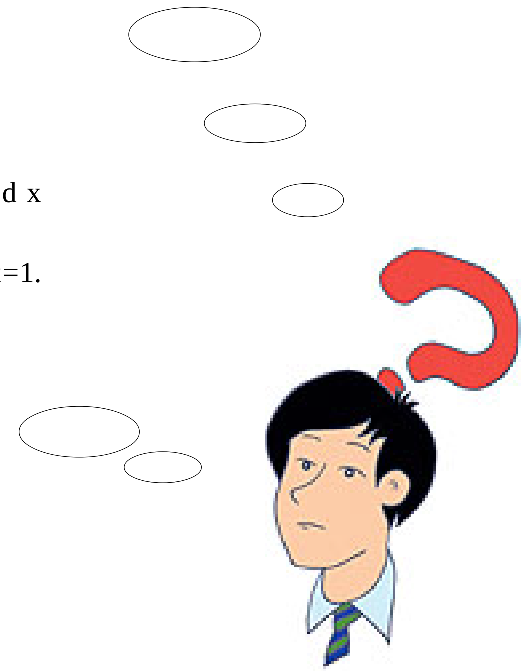
In solving this problem, students realize that there are **different ways of solving a problem**.

> Problem 3
>
> *There are n people including Edmund joining the party and each one has x cans of soft drinks and 2x chicken legs. Edmund pays $273.*
>
> *How many people are there?*
>
> *How many cans of soft drink and chicken legs does each one have?*

Students may try to solve the problem by "trial and error" or "setting up an equation". As there are two unknowns in one equation, the conventional way of solving equations cannot be applied. Students have to discover ways of finding the unknowns.

I can try different values of n and x, but it takes time.
If I set up an equation, I get n(5x+16x)=273.
Simplifying it, I get nx=13.
I have never solved an equation like this before.
There are two unknowns. How can I do it?

Can I consider possible combinations of n and x so that nx=13?
Yes! When n=1, then x=13. When n=13, then x=1.
But which pair is the right answer?

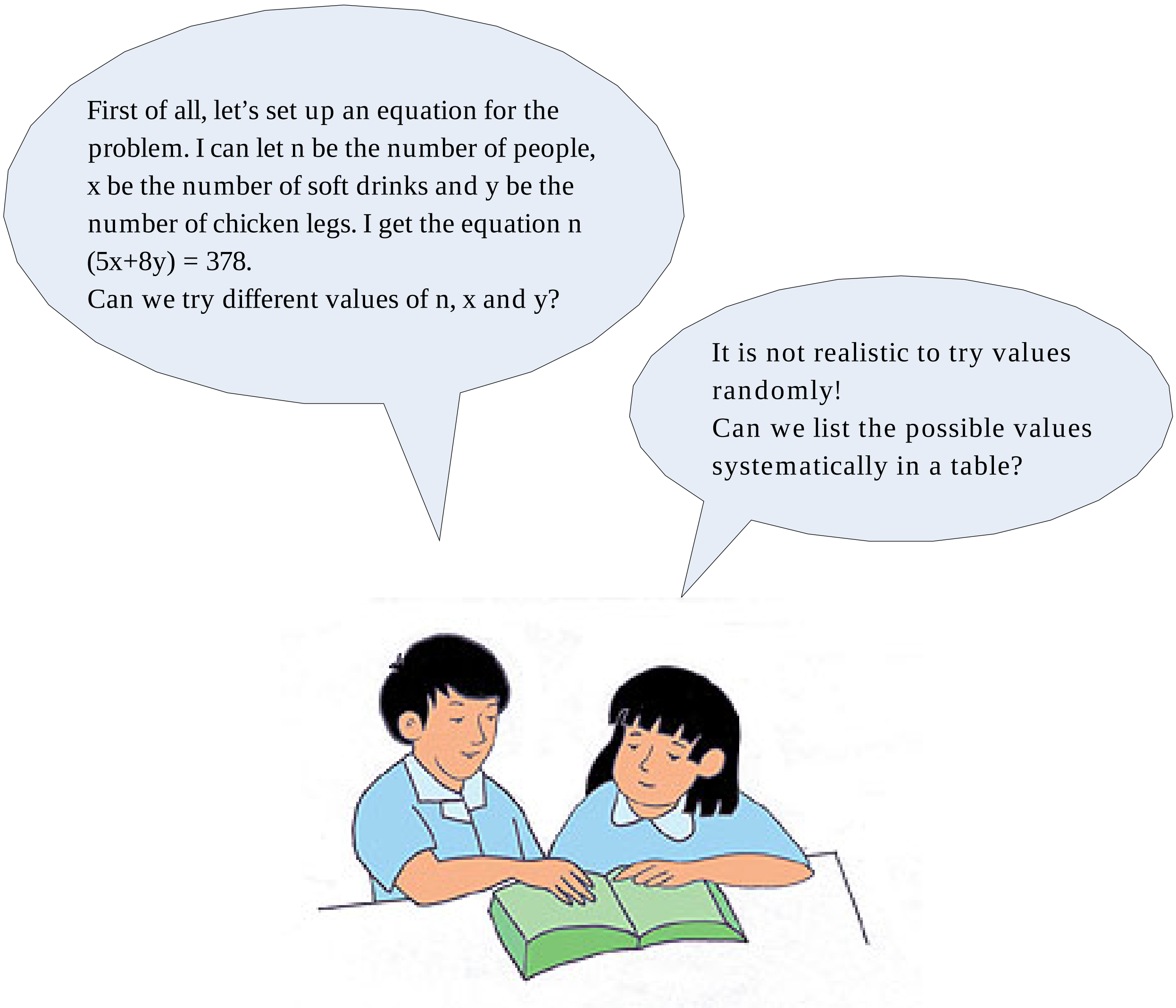


Here, students have to think critically and discuss which pair of values is the right answer. Both pairs of values are correct mathematically but one of them is not realistic.

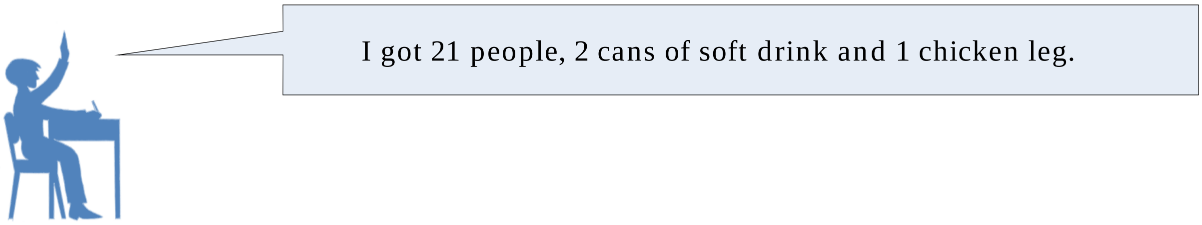
Problem 4

A group of people including Edmund go to the party and each one has the same number of soft drinks and same number of chicken legs as the others. Edmund pays $378. How many people are there? How many cans of soft drink and chicken legs does each one have?

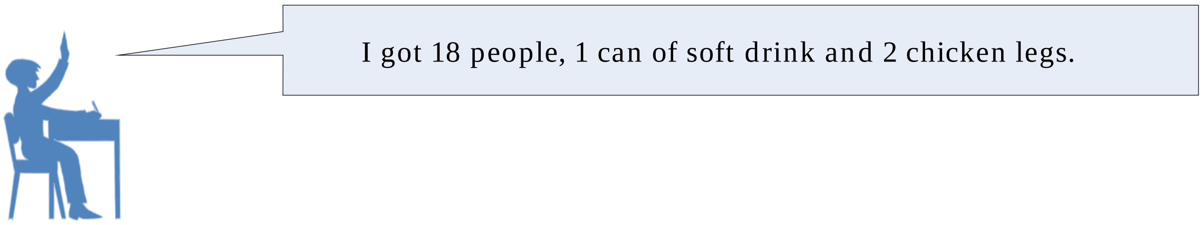
This is a more challenging problem as there are three unknowns in one equation.



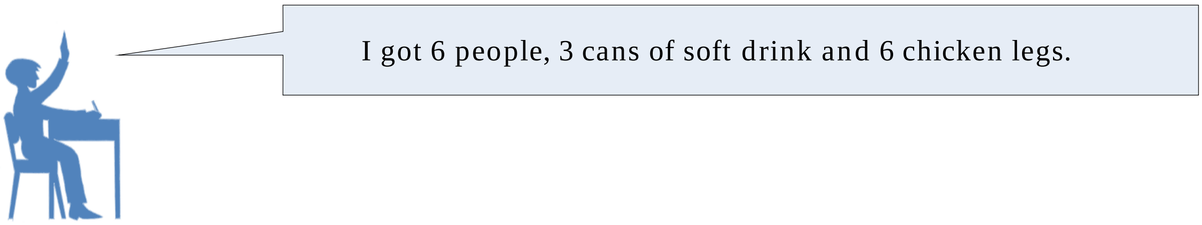
Students may find it helpful to solve this problem in a more collaborative way through discussion, proposing strategies, criticizing the practicability of strategies and accepting different ideas, etc. Students may also discover that a systematic tabulation of feasible solutions would be helpful.



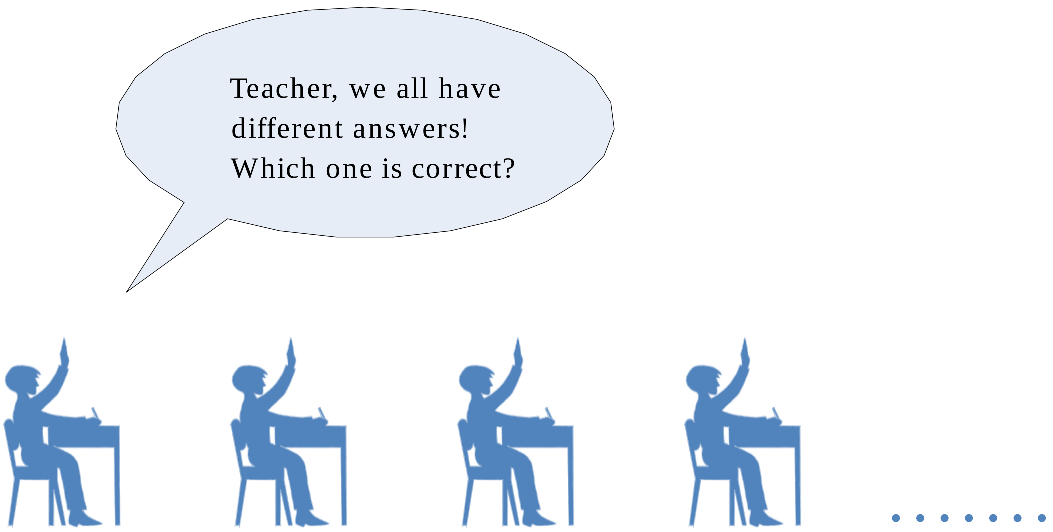
(Student A)



(Student B)



(Student C)



(Student D) (Student E) (Student F) (Student G) . . . .

In solving this problem, students realize that there is **no single solution to the problem** and similar situations may occur in real life.