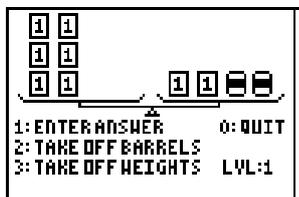**CALCULATOR SOFTWARE** **.CO** **.UK**

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## ▶ Summary

This is an equation solving tutor, adapted from a PC program by J Aczel.
There are 12 levels of difficulty to progress through, illustrated and described below.

## ▶ Features

All equations are randomly generated, subject to constraints.
All answers are positive integers, except for levels 6, 7, 11 and 12.

Level 1: Subtracting weights only.
The answer to this particular puzzle can be entered as "2" or "4/2"

> *Progression to the next level comes after answering 3 questions correctly first time. You may do unlimited barrel and weight movements.*
> *Answering incorrectly twice in a row will take you back down a level.*
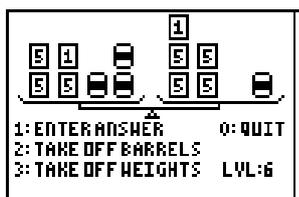> *Typing mistakes can be corrected by pressing the* **CLEAR** *button*

Level 2: Subtracting barrels only.

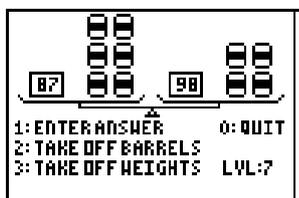Level 3: Subtracting weights and barrels. One-barrel difference.
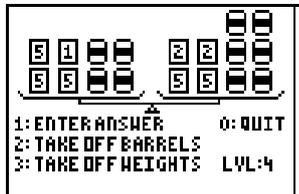
Level 4: Larger weights are used. Two-barrel difference between sides.

Level 5: A variety of barrel differences are used.

Level 6: Answer is either an integer, or includes halves.
Note that these can be entered as e.g. "5/2" or "2.5", but not "2 ½".

Level 7: Answer is either an integer, or includes halves or quarters. The weights are shown as a single block.

Level 8: Note the change to a single " SUBTRACT" option.

To subtract a weight of 14, chose subtract and type "14"
To subtract 7 barrels, chose subtract and type "7B", pressing the green **ALPHA** button to give the letter **B**.

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```
4=4 WEIGHTS   4B=4 BARRELS
PRESS ALPHA FOR LETTER 'B'

  25 + 18B = 31 + 16B

1:ENTER ANSWER    0:QUIT
2:SUBTRACT
                  LVL:9
```

```
4=4 WEIGHTS   4B=4 BARRELS
PRESS ALPHA FOR LETTER 'B'

  69 + -49B = -81 + -99B

1:ENTER ANSWER    0:QUIT
2:SUBTRACT
3:ADD             LVL:12
```

<u>Level 9</u>: The scales and the boxes around the weights have been removed.

<u>Level 10</u>: Uses larger numbers.

<u>Level 11</u>: Answers can be negative integers.

The algebraic manipulation interface will guide you towards a final line that has a positive "B" term on the left hand side of the equals sign.

<u>Level 12</u>: Negative signs appear in the equation and an option to "ADD" You may not add or subtract negative terms.

## ▶ Suggestions

It can often be beneficial for the teacher to spend the last 5/10 minutes of the previous lesson demonstrating via a viewpanel to the class, the program that they will subsequently be using themselves. This aids their familiarity with the task they will face and the menu options they will have to choose from, without the distraction of having a calculator in front of them at the time.

If the students are meeting solving equations for the first time, the teacher need not explain all the theory of "doing the same thing to both sides". Instead, start the students off on level 1 and let them progress through the levels. Instruct them that they need to get three questions correct in a row in order to go up a level, and that if they get too many wrong, it will drop them down a level - this helps reinforce the message that guesswork is not welcome in the lesson! It swiftly becomes clear who needs the extra explanation, as they tend to get stuck on the lower levels, without progressing.

This may seem a bit harsh, but you will be surprised by how willing they are to embrace this challenge and to speed ahead at it - often at a pace, and with an understanding, that soon leaves a more "traditional" exposition method of teaching this topic left standing….

When students hit level 8 for the first time, they only need guidance on reading the screen messages in order to type in the letter B for barrel. Other interesting discussion points come from when a barrel weighs zero, or even a negative number!

When students have reached at least level 10, they will have developed a good understanding of the process involved in solving equations as well as become familiar with algebraic shorthand notation. They should then be instructed to go back to level 6 and do the following process:

1. from the picture, write down in their jotters the algebraic version of the question

2. think what you would do first - take off barrels, or weights?

3. Record this process in their jotter and write down what the "new" equation should be

4. now do the process of removing weights/barrels on the calculator and see if your jotter workings match up with the newly drawn picture.

5. Continue in this manner of predicting the next line in your jotter, then checking it on the calculator until you have solved the problem

This approach eases the students into the habit of step-by-step recording of the stages of solving the problem. After a short time, they ought to be going straight from the initial image to an equation in their jotter, solving it in their jotter and then just entering in their answer on the calculator. Once they can do this, they have effectively taught themselves how to solve equations!