A SQUARE OF NUMBERS (Grades 4 to 7)

Can you put the numbers 1 to 8 each once and only once into the circles so that the four calculations are correct?

How many different solutions can you find?

SOLUTION

As we can only use distinct whole numbers the top line must be either
$8 \div 4 = 2$, $8 \div 2 = 4$, $6 \div 3 = 2$ or $6 \div 2 = 3$.
Note that any other combination would involve repeating one of the numbers.

Considering these in turn:

a) $8 \div 4 = 2$ links to $2 \times 3 = 6$ on the right hand side, $8 - 7 = 1$ on the left and $1 + 5 = 6$ on the bottom.
b) $8 \div 2 = 4$ does not give a solution because $4 \times ? = ?$ cannot be solved without repetition.
c) $6 \div 3 = 2$ links to $2 \times 4 = 8$ on the right hand side, $6 - 1 = 5$ on the left and $5 + 3 = 8$ on the bottom.
d) $6 \div 2 = 3$ does not give a solution because $3 \times ? = ?$ cannot be solved without repetition.

The two possible solutions are a) and c)

NOTES FOR TEACHERS

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For an interactive version see http://nrich.maths.org/2005

Why do this activity?

This activity gives an easy way for learners to try different possibilities and to get answers by 'trial and improvement' without worrying about making mistakes. The use of showboards (mini-whiteboards) will give the learners a good way of experimenting with the numbers until they find a solution. When the teacher asks the class to hold up their showboards she will be able to assess their progress very quickly. Explaining their methods and discussing the solutions will help the learners to understand the importance of working systematically.

Intended learning outcomes

To practise problem solving and working systematically.
To develop understanding of the operations of addition, subtraction, multiplication and division.
To develop understanding of factors and number bonds.

Suggestions for teaching

It would be a good idea to draw the diagram on the chalkboard so that it can be referred to easily. Talk about the challenge and give the learners some time to talk in pairs about how they might go about solving it.

Show learners a mini-whiteboard with the square of 8 circles drawn on it as large as possible Ask them to copy it on their own mini-whiteboards.

Explain that they can try writing different numbers in the circles until they find a solution, just erasing the numbers they don't want and not erasing the circle each time.

Check that everyone understands that each number must be used only once. Explain that you will want to know how they went about solving it, not just the answer, so you could ask them to keep a record of what they try. Listen out for those who give clear reasons for their suggestions and ask them to hold up their mini-whiteboards and repeat their explanations to the class. Share a few ideas among the whole group.

In the plenary, invite some learners to describe what they did to solve the problem, emphasising that there isn't one right way to go about it, but perhaps there are some ways that are more efficient than others? (You could label the circles with letters, or colour them using different colours, to help discussion.) Many learners might have started with a trial and improvement approach, which is very helpful, whereas others might have combined this with a system, for example trying the largest number in a particular circle first, then the next largest etc.

Key questions
Where will you put the 8 and the 6? Why?
What do you know about the factors of 8? How can you use them?
What do you know about the factors of 6? How can you use them?
Where will you put the 1? Why?
How will you keep a note of what you have tried?

Possible extension
Ask some learners to find all the different solutions and to justify that they haven't missed any out. You could also ask them to make up their own square puzzle like this one with the operations and the numbers in different places.

Possible support

Give a copy of this diagram to learners who struggle. Give them numbered counters so that they can move them around and work by trial and improvements to find the solution.