

Make 6

Activity:

This activity is about exploring different ways in which you can make 6.

0	1	2	3	4	5	6	7	8	9

You might begin by getting a student to come and start at a different number and drag it to 6. For example, drag 4 to 6. This will then show 4+2 in the blue square instead of 6. Pressing on the  button will show the equation 4+2=6. Other start numbers might bring a number of expressions into that square, including, for example, 9-3. Pressing on the  button again will bring 9-3=6 above the hundred square. Now press on the equals sign in that equation and the expressions will swap sides and it will show 6=9-3.

$$6 \begin{matrix} \uparrow \\ \text{=} \\ \downarrow \end{matrix} 9 - 3$$

If you now press on one of the arrows above and below the equals sign, the difference expressions which have landed in the 6 square will cycle through, with the equation showing that 6 is equal to each of these.

If it has not happened already, make a stopping-off point from one of the numbers to 6. For example, drag 9 to 8, release it and wait for the clock to stop. It will say 9-1. Then drag this into the 6 square to give 9-1-2. This might open the gates, so to speak, for students to be more inventive, realising that they could have one, two, or more stop-off points before ending up at 6. By pressing on the equals sign and the arrows, you can end up showing any two of the expressions are equal to each other.

$$1 + 4 + 4 - 8 + 3 + 3 - 5 + 4 \begin{matrix} \uparrow \\ \text{=} \\ \downarrow \end{matrix} 2 + 6 - 5 + 1 + 2$$

Ask them to think of some really crazy expressions which will still end up at 6, with several stop-off points. Get them to write these down. After a while, get some students to come up and make their expression by dragging and see whether they end up in the 6 square. Does 5+3-7+2+6-7-1+4+1 end up at 6?

Pressing the  button will restart the activity again with the expressions gone and just numbers in the first row will be seen.

Teaching considerations:

It can be helpful for students to see that there are many ways of making 6. All the expressions ending up in the 6 square are just as much 6 and the symbol '6' itself. Students can begin to get a sense that there is no limit to have many different ways there are to make 6. An early sense of the infinite. The beginnings of a proof might be possible as well. For example, supposing we have collected all the possible ways of making 6, and there are no more. Then, someone comes along and takes the one with the longer chain of additions and subtractions and adds on the end of it '+1-1'. Now there is a longer one which still equals 6. So, we did not have all of them after all!

There is much research which shows that the equals sign is viewed by many students as giving the 'answer', with the answer being a single number. This can cause difficulties later on when students begin to meet algebraic expressions, where they are expecting a single symbol on the right-hand side of the equals sign. This does not happen with such equalities as $a+b=b+a$, or $a(b+c)=ab+ac$. As such, it is beneficial for students to get used to the equals sign meaning that what appears on each side of the sign are equivalent, rather than 'gives the answer' or 'makes'. This activity has students meeting the equals sign as expressing that these expressions ended up in the 6 square and are equivalent to each other. They might see many equations which have different forms and not just the more common one where there is a single number on the right-hand side. For example:

$$6=4+2$$

$$9-1-2=6$$

$$8-2=3+2+1$$

$$9-2-5+4=6+1-1+1-1+1-1+1-1$$

This activity also encourages students to be creative with their mathematics. They are practising a lot of addition and subtraction at the same time. Rather than this practice just being a series of questions on a sheet, they are creating their own expressions, perhaps even 'harder' ones than they might be doing in a more traditional exercise.