INVESTIGATION

The answer is Zero

Think of a number → Multiply by 3 → Add 5 → Double the answer → Add 2 → Divide by 6 → Subtract the start number → Multiply by 5 → Subtract 10 → 0

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The Answer is Zero

Have you ever wondered how many ways you can get an answer?

That is what this investigation is about.

The Problem

Your job is to find as many ways as you can to get the answer 0.

This may sound easy, but have you thought of all the ways you could do this?

Good Advice:

Work in a logical way.

Try some ideas of your own.

Compare what you have done with your friends.

Enjoy your work and record your results properly.

Try writing your answers in tables, like this:

Sum	Answer
$^{-}1 + 1$	0
$^{-}2 + 2$	0
$^{-}3 + 3$	0
$^{-}4 + 4$	0
$^{-}5 + 5$	0

Try to find as many rules and patterns as you can.

Some ideas:

1. You could begin with some simple subtraction sums such as
8 – 8 = 0.
Write down a list of some of the subtraction sums that make 0.
Do they make a pattern?

2. Look at addition. How can you make zero using a simple addition sum? Do the answers make a pattern?

3. How can you make zero by multiplying?
Is it possible to make zero by dividing? Try this on your calculator.

4. What happens if you extend the above ideas to fractions and decimals?

5. You could try sums with more than one sign. Here is an example:

4 + 6 – 10 = 0

If **x + y – 12 = 0,** what can you say about x and y ?

Can you find any other interesting equations like this?

Can you draw a graph of the possible values for x and y in the above equation? Put the x numbers on the horizontal axis and the y numbers on the vertical axis.

6. What happens in part 5. if you replace the 12 with other numbers?

7. Can you use special types of numbers such as square numbers or cube numbers to make 0 ?

8. What happens if you change the question to 'The answer is 1' ?

Try some ideas of your own.

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Answer Guide

Here are some possible answers and notes for guidance.

This is the harder of two similar investigations. The other (The Answer is Ten) is intended for younger/less able pupils.

Children can use the examples in this investigation to look at a whole range of methods and ways of recording their findings (writing, use of tables, simple equations etc).

When carrying out investigations, many children get stuck in one line of thought and you can use the opportunities found here to remove the blinkers and ask children to think more widely about their work.

Try to find time to organise discussion about the children's work, so they can share ideas and learn what it means to be a 'creative mathematician'.

1. Simple subtractions of the type $x – x = 0$ are required here. This is more of a 'warm up' exercise.

2. Making zero using addition involves the use of negative numbers.
Examples are: $4 + {}^{-}4 = 0$, $3^1/_4 + {}^{-}3^1/_4$, $6.42 + {}^{-}6.42$

3. To make zero by multiplying, you must multiply by zero. Children who have not understood this will need to spend some time multiplying by other numbers to try to obtain zero. Wait for the penny to drop!

Making zero by dividing is not, of course, possible (unless one begins with zero: $0 \div 7 = 0$), but children can see what needs to be done to obtain a number near to zero. Why, for instance is $4 \div 6\,000$ nearer to zero than $4 \div 5\,000$?

4. When extended to fractions and decimals, the same rules apply as for whole numbers, but children need to discover this for themselves.

5. Drawing graphs is very revealing. Plot points (x,y) for $x + y = 12$ (eg. (1,11) (2,10), (3,9), (4,8) ... and then join them up. They make a straight line going from top left to bottom right.

6. Changing the number 12 in $x + y = 12$ gives similar graphs. These will be parallel to the $x + y = 12$ graph, but higher or lower on the axes according to the number substituted. Eg. $x + y = 14$ gives a higher graph.