

Does not use knowledge of doubles to find half of a number; for example, continues to find half by sharing using a 'one for you' approach and cannot apply knowledge of doubles

Opportunity for: applying previous knowledge

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Resources

- Cubes
- Bead strings
- Number cards to 20 or 30 (Resource sheets 1, 2 and 3)
- Number line to 20 or 30

Key vocabulary

half	doubling
halving	opposite
double	undoes

Teaching activity

Time 10–15 minutes

Explain to the child that today's activity will help them to be better at finding half of a number, and that at first they will be using some of the things which they already know about doubling.

? What do you think doubling a number means? Can you use these cubes to show me?

Follow on from what the child says. Try to establish how the child doubles a number such as nine.

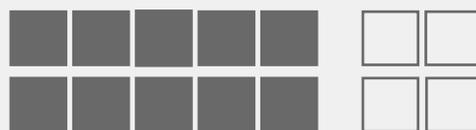
Do they use partitioning, splitting nine into five and four then doubling those numbers?

(See 4a and 4b Y2 \times/\div .)

If the child is struggling with this, ask them to make cube 'trains' of teen numbers with a ten part of one colour and the units a different colour (so thirteen might be ten red and three blue cubes).

Remind them of partitioning numbers into five and a bit to find doubles. (See 4a and 4b Y2 \times/\div .)

Demonstrate how to halve cube 'trains' into five and a bit.



'Half of fourteen is five and two more. If you double five and add double two you get back to fourteen.' Move the cubes to fit in with your words, showing halving undoing doubling.

Explore doubles and halves for a range of different numbers, using cubes or a bead string, and jot down some numbers which the child can double.

If the child is struggling with the doubling, use just a few low numbers for doubling, for example four, six, eight and ten.

Using fingers to show five and a bit numbers might help. So six is five fingers on one hand and one on the other. If you use your fingers too, you can show double six as $5 + 1$ added to $5 + 1$.

That will make one lot of ten and two more.

Then try doubling seven in the same way. Five fingers on one hand and two on the other. So double seven is $5 + 2$ added to $5 + 2$.

Record some of the doubles on paper in a range of sentences, using the key vocabulary above.

Five doubled is ten
Double five is ten
Ten is double five

Then move on to halving, at first using the numbers which the child seems most confident with.

? Can you tell me what half of six is? How will you work that out? How do you know you are right?

If the child can halve six, move on to some other even numbers, offering the child cubes.

Observe what the child does, then try a larger number.

If the child needs support (and followed the use of fingers to make five and a bit), return to that and record some of the halving they can do. Then make links to the larger numbers.

? How would you find half of twelve? ...eighteen? ...twenty-four? ...twenty-eight?

If the child uses the 'one for you' method of sharing, try to make links with other halves which the child knows. For example, if they know that half of ten is five, suggest to them that half of twelve must be very close to five, because twelve is so close to ten on the number line. Make the link from half of ten is five to half of twenty is ten, so half of eighteen must be close to ten.

Help children to make the links between what they said to you at the start of the lesson about doubling and the ideas that they seem to be struggling with now.

Look at the doubling written above with the child and then write a related sentence.

Five doubled is ten

Half of ten is five

Write some other halving sentences, always relating them to the doubling sentence. For example: 'Twenty halved is ten.', 'If you halve twenty you get ten.', 'If you double ten you get back to twenty.'

If the child seems not to understand, even with the lower numbers, you can demonstrate this with bead strings. 'Three doubled is six. Six halved is three.'



Do as many additional numbers with cube 'trains' or beads as you have time for.

You can record what the child does to remind them another time, or ask the child to record it in their own way. (This can often give you an insight into the child's thinking and any errors which they might still be making.)

? What would you like me to record about our lesson today?



? How would you use partitioning to help you to find half of a number? Would partitioning help you to find half of a number like thirty-seven?

Spotlight 1

Does not use knowledge of doubles to find half of a number; for example, continues to find half by sharing using a 'one for you' approach and cannot apply knowledge of doubles

Opportunity for: seeing connections between numbers

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Round and rounds

Time 10 minutes

Resources

- Cubes
- Bead strings
- Prepared 'round and rounds'
- Two sets of number cards 0–55 (Resource sheets 1, 2, 3 and 4)
- Top hat and toy rabbit (optional)

Key vocabulary

- | | |
|---------|----------|
| half | doubling |
| halving | opposite |
| double | undoes |

Teaching activity

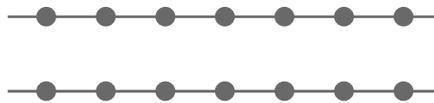
Explain that today we are going to explore some numbers and find something surprising about doubling and halving.

? Can you tell me what you already know about doubling and halving?

Have cubes or bead strings available and show the number seven.



Seven is half of fourteen.



? Can you show me how you can use the beads to show double seven? What happens if you halve the answer?

? Do you think that will happen with other numbers?

Try with some other numbers.

If the child is not seeing the relationship between the doubling and halving, use some smaller numbers, such as finding half of four or six.

If the child still seems a bit unsure, move on anyway, but keep to lower numbers and you might need to go back to *4a and 4b Y2 x/÷* to do some more 'five and a bit' halving and doubling.

Write one of the number sentences that the cubes or bead strings illustrate.

Ten doubled is twenty;
then if you halve twenty,
you get ten.

Make quite a bit of this! You could call it 'number magic' if you want to! Write another sentence but with spaces for number cards.

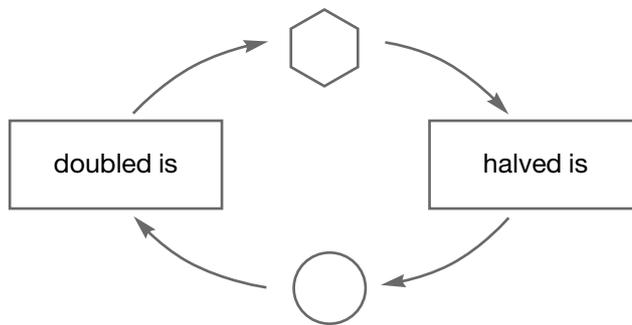
□ doubled is □ ;
 then if you halve □ , you get □ .

Spread the number cards out on the table.

? Can you find four number cards to fit in the spaces?

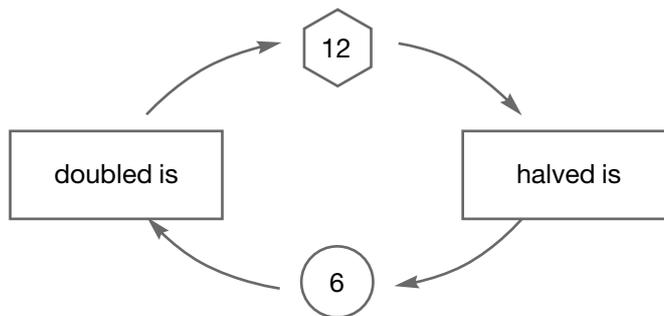
Establish that, although you needed four cards, you only used two numbers.

Introduce 'round and rounds', showing one 'round and round' with no numbers. Ideally pull a prepared one out of a top hat! (Keep the rabbit hidden for now.)



? Can you move just two of your cards from the number sentence to the 'round and round' and do some number magic? Now read the sentence to me, starting at the top in the hexagon.

Stress that you can keep on going round and round. Halving is the opposite of doubling. Doubling is the opposite of halving. Halving undoes doubling. Doubling undoes halving.



If the child doesn't seem to be coping with this, try more halving and doubling in odd moments of class time. (The rabbit and top hat might help. Each day you could put two number cards, such as 5 and 10, in the hat with the rabbit and ask the child to make a 'round and round', talking you through what they have done.)

? What did you learn today about halving and doubling numbers?



? Will 'round and rounds' work for any number? Why do 'round and rounds' work?

(Try to get at the idea that doubling and halving 'undo' each other.)

- ? Can you go around the other way on 'round and rounds'? (Yes.)**
- ? What would you need to change to make this work?**
- ? What 'number magic' could you do with one and a half and three?**
- ? Which other numbers could you use with one and three quarters to do some 'number magic'?**

Spotlight 2

Does not use knowledge of doubles to find half of a number; for example, continues to find half by sharing using a 'one for you' approach and cannot apply knowledge of doubles

Opportunity for: recognising patterns and relationships and developing mental images

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Half back jumps

Time 10–20 minutes

Resources

- Dominoes
- Cubes
- Number cards 0–10 (Resource sheet 1)
- Wipe-clean number line
- 'Washing line' and pegs (optional)
- Small character toy or puppet

Key vocabulary

- | | |
|---------|----------|
| half | doubling |
| halving | opposite |
| double | undoes |

Teaching activity

'We're going to do some half back jumps with this puppet to show jumping back halfway.'

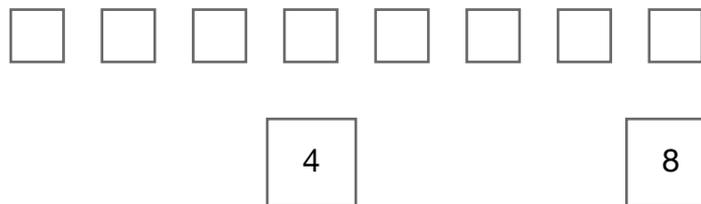
Ask the child to pick out the double dominoes.

- ? How did you know that was a double?**
- ? If each part of the domino has four spots, how many spots for double four?**
- ? How many spots for half of eight?**

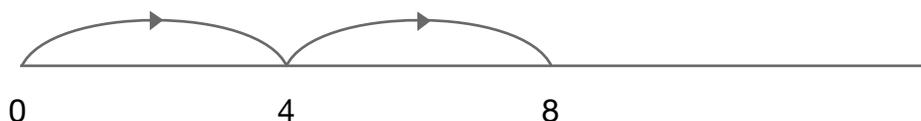
If the child is struggling with this, repeat with several different numbers. You could remind them of the 'round and rounds' they did before (see *Spotlight 1*).

Ask the child to put out cubes in the same pattern as a double four domino. 'Now move them into one long line.'

Lay number cards at the halfway point and at the end of the line.



Now link this to jumps along the number line with the puppet.



Ask the child to get the puppet to jump back halfway.

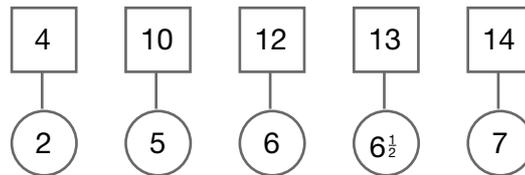
- ? What was the right number for your puppet to jump back to?**

? So what is special about four and eight?

If the child cannot explain that four is half of eight, do some more examples with low numbers, using the dominoes if that seems to help the child.

You could record these doubles and halves along a washing line, pegging the 'half' number underneath.

Continue the activity of jumping back along the number line, using numbers which the child can cope with most of the time, but always challenge (at least for some of the time).



? If the puppet stands on 14, where will it land if it takes a halfway back jump?



Ask the child to record in any way they want what they learned today.

Do some half back jumps for some larger numbers, as appropriate, for example 1000, 500 000, 1 000 000, 4254.



? Are some numbers easier to halve than others? Why? What is special about halving odd numbers?

Spotlight 3

Does not use knowledge of doubles to find half of a number; for example, continues to find half by sharing using a 'one for you' approach and cannot apply knowledge of doubles

Opportunity for: exploring real-life contexts

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Half each

Time 15–20 minutes

Resources

- Lengths of 2 cm squared paper (up to 40cm long)
- Coins (of various denominations)
- Teaching clock
- Metre ruler

Key vocabulary

half	doubling
halving	opposite
double	undoes

Teaching activity

Explain to the child that today they are going to do some doubling and halving, because that is an important thing to be able to do. Ask them to imagine that they have to share some money between themselves and a friend, and they want to share it equally.

Give the child a small amount of money that you think they could halve, for example, six pence.

? Can you find half of this? What will you do?

**? How do you know that three pence is half of six pence?
What if you double three pence? What happens?**

? Which other amounts of money could you halve?

If the child is happy halving amounts with just 1p coins, introduce some other coins and find half. Always make the link back to the amount of money which they started with being double the answer that they found when they halved, recording at least one of the calculations with the child.

? Which amounts of money do you find easy to halve?

? What is the biggest amount of money that you think you could halve?

Try to get to half of a pound and half of fifty pence.

Using a strip of 2 cm squared paper, for example, eighteen squares long (36 cm), ask the child to fold it in half.

? How many squares long is half? Now open it up so you get double the length.

? How many squares long is it now?

Repeat with a strip twenty squares long (40 cm).

If the child is struggling with the numbers, use shorter lengths of paper.

Now ask the child to shut their eyes and try to imagine a strip of paper twenty-two (or twenty-four or twenty-six) squares long.

? If you fold it in half, how many squares long will it be now?

If appropriate, using a teaching clock, show the hands at 12, then move them half way around.

Ask the child to put both hands at an o'clock time which they can read, for example, nine o'clock.

If the child is not familiar with reading an analogue clock, note that for a future time and move on.

Now ask the child to show half past nine. The long minute hand has gone half way around the circle.

You could count the minutes in fives if the child seems to know how to read some clock times. Start at 12 with zero, and count in fives to half past.

Confirm that this is thirty minutes past.

? How many minutes will there be to go around the other half of the clock?

? How many minutes are there altogether in one hour?

? Let's find 60 cm on this metre ruler. Can you find half of 60?

Finish by asking the child which numbers they can now find half of in their head.



Choose a 'difficult' amount of money, for example £17.39, and ask the children to find half of it.

Spotlight 4

Does not use knowledge of doubles to find half of a number; for example, continues to find half by sharing using a 'one for you' approach and cannot apply knowledge of doubles

Opportunity for: investigating numbers

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Numbers in my head

Time 10–15 minutes

Resources

- Cubes in 'ten trains' of all the same colour and units
- Large book or folder and two pots
- Number line

Key vocabulary

half	doubling
halving	opposite
double	undoes

Teaching activity

'Today we are going to do some games where you have to guess the number that I'm thinking of.' Stand a big book on the desk propped open to hide what you are doing with the cubes.

? I've got four cubes in this pot and four in this one. How many cubes have I got altogether?

Repeat with other numbers. Then give the child ten cubes.

? You have double the number of cubes I have in this pot. How many cubes are in this pot?

? What is half of ten? What is double five?

Repeat with some other numbers and record some doubles and halves for the child.

If the child is still finding it hard to find halves, let them make double and half 'trains' of cubes and keep these on display for a few days. For example, a 'train' of ten red and four blues, and half that, five red and two blues.

Give the child some 'ten trains' and single cubes and move on to some numbers that challenge the child.

? The number in my head is half of sixteen. What is my number?

? I doubled a number in my head and the answer was fourteen. What was my number?

? My number when it is halved then halved again is two. What is my number?

Remind the child that there are sixty minutes in an hour. Let them count out six 'ten trains'.

? How many is half of sixty? What is double thirty?

? The number in my head is half of a hundred so what is my number?

? The number in my head is half of two million. What is my number?

Talk with the child about other numbers on the 100-square that might be easy to halve.

? Can you explain why some numbers are easier for you to double and halve than others?



'Make a list of three numbers between one hundred and two hundred that have three different digits and are easy to halve, for example, one hundred and twenty-four.'

'Make a list of three different numbers also between one hundred and two hundred that are harder to halve.'

? Why are these numbers harder to halve?

Spotlight 5: a learning check

Does not use knowledge of doubles to find half of a number; for example, continues to find half by sharing using a 'one for you' approach and cannot apply knowledge of doubles

Opportunity for: discussing and explaining

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Doubles and halves game

Time 10–20 minutes

Resources

Check: does the child use key vocabulary?

- At least one other child
- One or two sets of number cards 1–20 but take out 11, 13, 15, 17, 19 (Resource sheets 1 and 2)
- Paper and pen to keep score
- Cubes, number lines or bead strings

half	doubling
halving	opposite
double	undoes

Teaching activity

'Today we are going to play **Doubles and halves**, so that you will become really good at remembering how to double and halve.'

Lay the number cards face up on the table. If you have space for two sets it will make the game a little longer; two sets will be needed for three or more players.

The aim of the game is to score the highest total.

How to play

'If you choose carefully, you can get a really high score if you pick up pairs of cards that are doubles and halves of each other. So if you want to pick up 5, you can pick up 10 as well because it is double five.'

1. Players take it in turns to pick up two cards (or just one) of their choice that are doubles and halves of each other, for example 2 and 4.
2. They must explain why they have chosen those numbers – but if they say the wrong thing, they must put the cards back on the table!

Players can use number lines, or other means, to show why their cards make a 'trick'.

If they say correctly why the cards make a trick (e.g. 'five is half of ten'), these two cards then make a trick and the player puts the trick in front of them.

3. Other players then take a turn, putting each trick on the table until all the cards are used, or no more tricks can be made. (You might want to play so that when there are just a few cards left, everyone takes only one card at a time.)

4. Everyone helps everyone else to find their score. Scoring is as follows:
- Two cards that are double and half of each other score 20.
 - A trick of three cards, for example 5, 10 and 20, scores 30.
 - A trick of four cards, for example 2, 4, 8 and 16, scores 40.
5. Keep the score carefully and play another round. Add each new score to make a running total and see if anyone can score over 200.

If a child seems not to be managing the game, play alongside them, or ask all the players to play with a partner. Use cubes, a number line or bead strings where support is needed.

? Why did you choose that number? Can you explain why those numbers make a trick?

Variations

- Pairs can cooperate to make the longest tricks they can. Use a set of cards for each pair.
- ↑ ● Extend the game to use other number cards, for example to 30. Put the 15 number card back in, but take out 21, 23, 27, 29.
- ↑ ● Sometimes play with all the numbers left in.

? When we leave all the numbers in, why do some numbers never get used for a trick?

? Can you continue with this halving sequence? 66, 33 ... You can use a calculator.

? What was the smallest number you got to? Will you get to a negative number eventually? (No.)

Learning outcomes

By the end of this set of activities, children should be able to:

- tackle related learning tasks with increased motivation and confidence;
- use and understand connected mathematical vocabulary;
- use knowledge of doubles to find half of a number;
- use a range of strategies for halving in real-life situations;
- begin to halve and double confidently, and know some by heart.