Some children – whether or not they are dyscalculic or dyslexic – find the whole idea of fractions very difficult and confusing. One reason for the difficulty is that classroom teaching often focuses on rules and procedures, with not nearly enough time and attention dedicated to helping children develop a sound understanding of the fundamental mathematical concepts. Further difficulties arise when some of the necessary pre-skills are not yet secure, or when teachers fail to point out explicitly the important connections between related aspects of a topic, links that may be obvious to the teacher but not to the child. For example, teachers can be so fixated on defining fractions as parts of a whole that they forget to explain that fractions are numbers. Or, teachers might fail to highlight the interconnections that exist between fractions and division.

In terms of pre-skills, one that is indispensable for a mastery of fractions is a sound conceptual understanding of multiplication and division but, as I have discussed elsewhere, multiplication and division often present a particular challenge for dyscalculic and dyslexic learners. If the child you are working with has a problem with times tables or multiplication/division concepts, there is no point in trying to forge ahead regardless. It would be better to make sure the foundation skills are secure, even if this entails going right back to first principles and teaching the area model of multiplication and division through concrete materials such as Cuisenaire rods. You can find plenty of detailed information about teaching and learning these foundation skills – at the concrete, diagrammatic and abstract levels – in Section 4 of ***The Dyscalculia Toolkit*** [Sage], and Part III of ***Overcoming Difficulties with Number*** [Sage], and in my ebook ***Understanding Times Tables*** [Apple Books].

The subject of 'fractions' contains many layers that need to be built up, gradually, before a child can hope to understand the topic as a whole. The early stages – addressed by the games in this document – include: an awareness of whole-to-parts and parts-to-whole relationships; investigations into how a number or a quantity can be built out of, or split into, smaller components; an acceptance of fractions as numbers in their own right and not just as parts of a whole; an opportunity not only to recognise or name fractions (a passive exercise) but also to create fractions concretely (a hands-on activity); practical experience in subdividing fractions into smaller pieces, and re-joining fragments or grouping them differently to create larger fractions, as a way of exploring equivalence and appreciating why fractions having the same value might be given different names; a chance to learn exactly what information the written fraction notation is able to convey; etc.

These early stages cannot be hurried. No real progress can be made unless and until the foundations are secure. I recommend that fractions be taught concretely at the early stages, through folding and subdividing paper strips (not circles). It is a good idea to vary the size of the strips on different occasions, so that children can begin to internalise the idea that it is possible for, say, half of a small strip of paper (or half of a quantity, or a number) to be smaller than a smaller fraction of a larger strip (or quantity, or number). It is essential to accompany the hands-on activities with plenty of explicit and detailed discussion, in which the learner is encouraged to do at least as much talking as the teacher. The important transition between the concrete and abstract stages is best achieved by using diagrams (again, of rectangles, not circles) until the child is familiar enough with the ideas to be able to visualise them as a way of supporting purely abstract strategies.

You can find much more about all these issues, and more, in the ebook ***Understanding Fractions*** [Apple Books].

Various games for practice with fractions

Introduction

No matter the topic, in my own teaching I like to use games as an enjoyable and productive way of providing extra practice in specific calculation techniques. In every case, they are techniques that I have previously taught my pupils and that they fully grasp but have not yet mastered. The important point is to make sure to teach children efficient strategies first, before presenting them with games that are designed to provide practice and reinforcement.

I have posted the following games on my website for anyone to use as an alternative to the kinds of worksheets that children are so often presented with: worksheets that are not only repetitive – and therefore demotivating – but that only encourage children to focus on the answers, which in turn prompts them to rehearse poorly-understood mechanical methods.

Of the four games that follow, one is pitched at the concrete level, one is designed to be played first at the concrete level and later at the diagrammatic (semi-abstract) level, one is based on the pictorial (semi-abstract) model of a number line and one is pitched at the purely abstract level. They are listed in order of difficulty. The concrete games are the easiest, in terms of what a child needs to know and understand about fractions, but even the simplest of these games should be preceded by some explicit teaching and plenty of hands-on experience of paper folding as a way of exploring the whole concept of fractions.

Three of these games, and many other games and activities, are published in the ebook ***Understanding Fractions*** [Apple Books].

The games provided below are:

Pot Luck

Race with . . . Halves & Quarters / Thirds & Sixths

Fractions on a Number Line

Combine Fractions to Make Whole Numbers

Pot Luck

What is the game about?

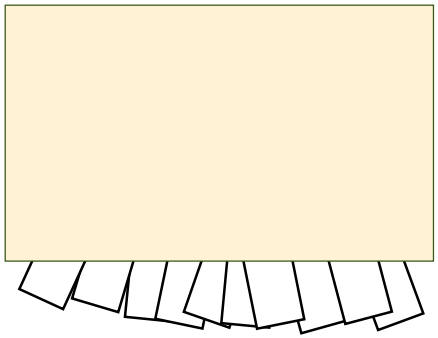
It is a concrete game about building 1 (a whole one) out of halves and quarters. It is a game of luck rather than skill, the aim being to become familiar with these very common fractions and see how 1 can be built from, or split into, smaller pieces.

Equipment and preparation needed

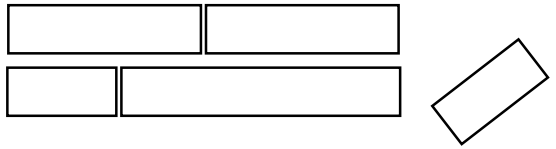
Six identical strips of paper, of any size. It is a good idea to vary the size each time you play the game. Four of the strips should be split into fractions as follows: cut two strips into halves, one into quarters, and one into one-quarter and three-quarters (ten unlabelled fractions in all). One larger piece of card, or a tray, to use as a screen.

Pot Luck

The set-up at the start of a game



A possible winning hand, on one round



Rules

Each player takes one of the complete strips to keep as a visual record of the size that represents 1 (i.e. one whole) in this game. The adult shuffles the ten fractions, aligns them at one end and fans them out under the screen, so that only the aligned ends protrude, and neither player can guess the size of each fraction.

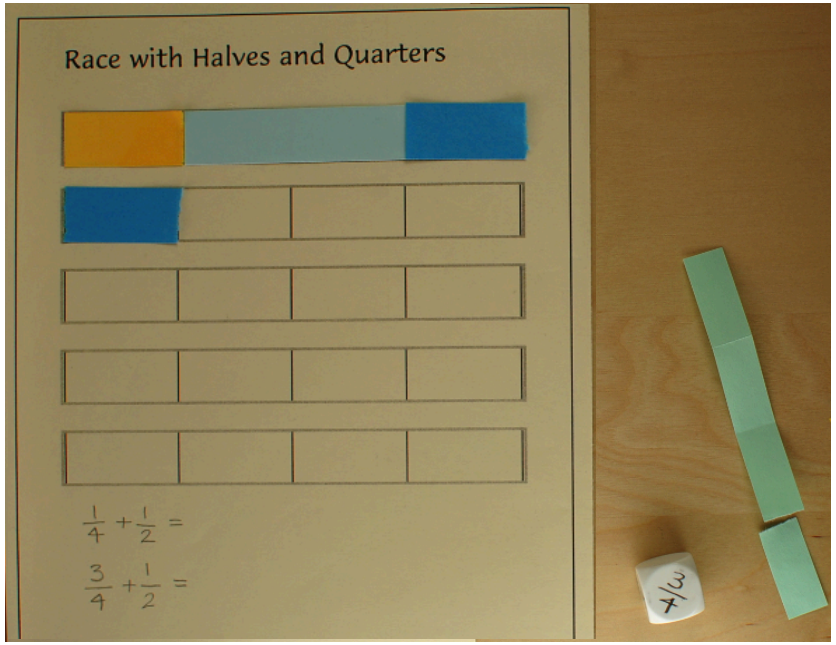
Players take turns to choose and remove one paper fraction from under the shield. When each player has five paper fractions, they must try to arrange them so as to create as many whole 1s as they can. Both players must name aloud the fractions used to build each 1, e.g. say, "This 1 is made of two halves (or a half and another half) and this 1 is built out of a quarter plus three-quarters".

The player who can create 2 wholes (i.e. two whole ones) scores 1 point for that round. Play 5 rounds to establish the winner.

This game, together with a demonstration video, appears in Ronit Bird's ebook 'Understanding Fractions' [Apple Books]

Race with Halves & Quarters (paper strips version)

A demonstration video of this game can be watched on YouTube.



What is the game about?

This game is about adding halves and quarters to each other, and to mixed numbers, and about subtracting half or quarters from 1. Using paper strips to support the addition and subtraction, players create $\frac{1}{2}$ from two quarters, or $\frac{3}{4}$ from half and a quarter, or a whole from either two halves or four quarters.

Equipment needed

- A game board (drawn on A4 paper) for each player, and a pencil.
- Strips of paper, the same size as on the game board, and adhesive.
- A 6-sided die (or spinner) showing these fractions twice: $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$.

Rules

Players take turns to roll the die and take a strip of paper. Each strip is worth 1.

Fold the strip and tear off the fraction you want to keep. Label the remainder (i.e. subtract the fraction from 1) before discarding it. Stick the fraction that matches the dice throw onto your game board. You may not begin a new row before completing the previous row.

On your second, and each subsequent turn, you must also record a fraction question on the blank portion of the game board. Write the question only, as addition, with nothing after the equal sign. E.g. if the first die throw is $\frac{1}{4}$ and the second is $\frac{1}{2}$, you will have two strips of paper covering three quarters of the top row on your board, and the numbers recorded as a sum with no answer (as pictured above). Each written sum should begin with the total so far, plus the latest dice throw.

The game is won by the first player to completely cover all 5 strips on the board. Finish the game by using a blank card to hide the fraction questions, sliding the card down gradually so that only one new question can be seen at a time (because each question begins with the previous line's answer). Fill in the answer by looking at your game board if necessary, or by visualising fraction strips.

Variations

- Play as a subtraction game, from 5 down to 0, sticking the strips on the board just as before but recording each action as subtraction.
- Both the addition and subtraction versions can be played as a solitaire challenge. E.g. how far can you get in only 7 throws of the die?

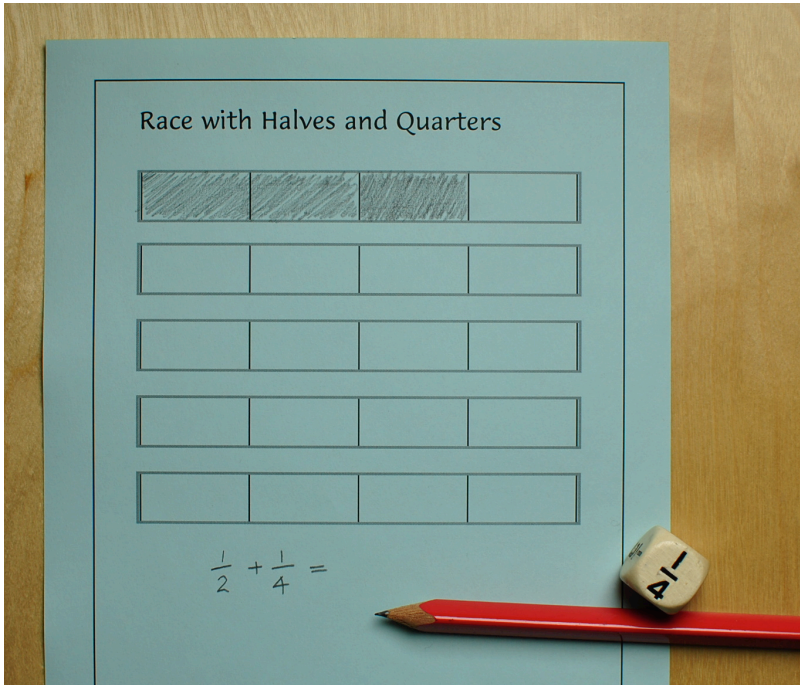
This game, together with a demonstration video, appears in Ronit Bird's ebook 'Understanding Fractions' [Apple Books]

Race with Halves & Quarters (shading-in version)

A demonstration video of the concrete (paper-folding) version of this game can be watched on YouTube.

What is the game about?

This game is about adding halves and quarters, using a diagram to support the addition. It shows that 2 quarters make a half, that 4 quarters make a whole, etc.



Equipment needed

- A paper game board for each player and a pencil.
- A 6-sided die (or spinner) showing these fractions twice: $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$.

Rules

Players take turns to roll the die and shade the fraction to match, on their own board. After this first turn, continue to take turns, but end each turn by recording the fraction question (but not the answer!) on the blank portion of your game board. E.g. if the first die throw was $\frac{1}{2}$ and the second was $\frac{1}{4}$, you will first shade in two quarters on the top strip, followed by a third quarter, and write $\frac{1}{2} + \frac{1}{4} = \square$.

Each written sum should begin with the total so far, plus the latest dice throw.

You may not start shading a new strip until the previous strip is complete.

Players race to be the first to complete, or exceed, 5 strips.

After the game is over, each player uses a blank card to hide the fraction questions, sliding the card down gradually so that only one new question can be seen at a time (because each question begins with the previous line's answer). Fill in the answer by looking at your game board if you need the support, or, if you can manage it, by just visualising fraction strips.

Variations

- Change the focus to a different set of fractions, e.g. halves, thirds and sixths.
- Play as a subtraction game, from 5 down to 0, shading from the top of the board, as before, but recording each move as subtraction.

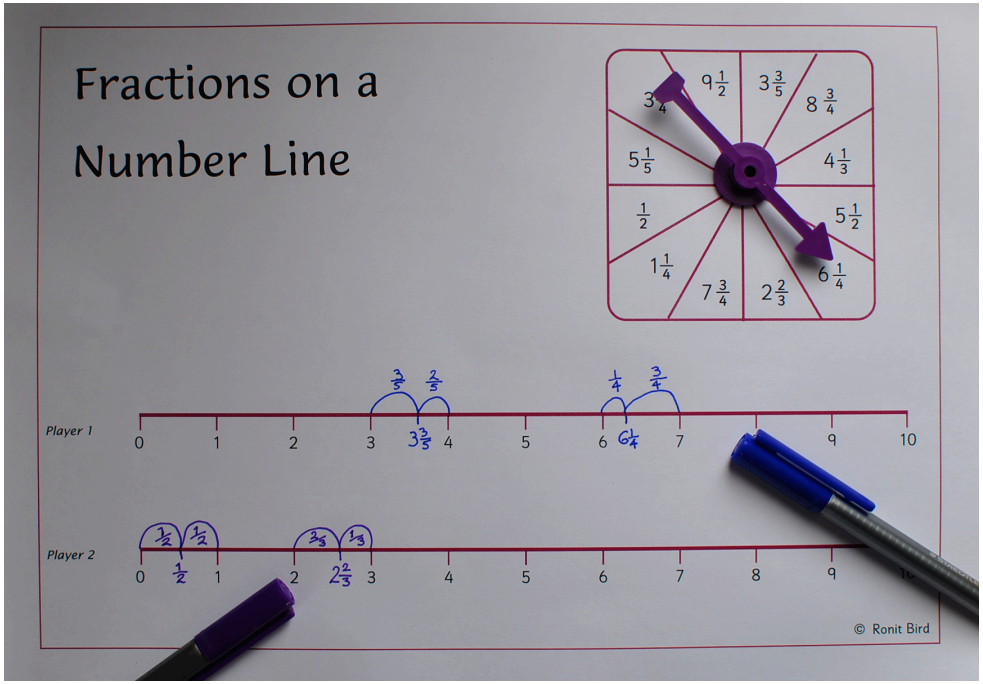
This game, together with a demonstration video, appears in Ronit Bird's ebook 'Understanding Fractions' [Apple Books]

Fractions on a Number Line

A demonstration video of this game can be watched on YouTube.

What is the game about?

To recognise that fractions are numbers, not just parts of a whole, and that each has its place on a number line, in relation to the sequence of whole numbers.



Equipment needed

A spinner and a paper board on which each player has a number line labelled with ten consecutive whole numbers (as pictured). A spinner base with mixed number fractions that lie within the span of the same ten whole numbers (as pictured).

Alternatively, instead of a spinner, make cards for whichever mixed numbers you choose, providing at least one that lies between every whole number on the number line.

Rules

Take turns to spin the spinner and mark the number in the appropriate place on your number line. Label the number below the line. Draw two jumps, above the line, from the fraction to the whole numbers on either side. Label the size of each jump.

If you spin the same number again, or get another fraction lying between the same two whole numbers, miss the turn.

The winner is the first player to draw jumps on four consecutive sections of the line, i.e. spanning 5 consecutive whole numbers.

Variations

- Choose new fractions for your spinner (or cards), with whatever denominators suit the players' level of understanding.
- Play on number lines that do not always start at zero, e.g. draw lines from 20 to 30, or 15 to 25, or starting at (or above) 100.

This game, together with a demonstration video, appears in Ronit Bird's ebook 'Understanding Fractions' [Apple Books]

Combine Fractions to Make Whole Numbers

A demonstration video of this game can be watched on YouTube.

What is the game about?

It is about adding fractions (e.g. $\frac{1}{2}+\frac{1}{4}$), changing simple fractions to equivalents (e.g. $\frac{1}{4}=\frac{2}{8}$, or $\frac{4}{4}=1$) and also trying out different ways of building 1 whole.
The targeted fractions are halves, quarters & eighths (see other variations, below).

Equipment needed

A spinner on a spinner base showing appropriate fractions (e.g. pictured right).
Paper and pencil for each player. Mark out six separate areas on your own page.

Rules

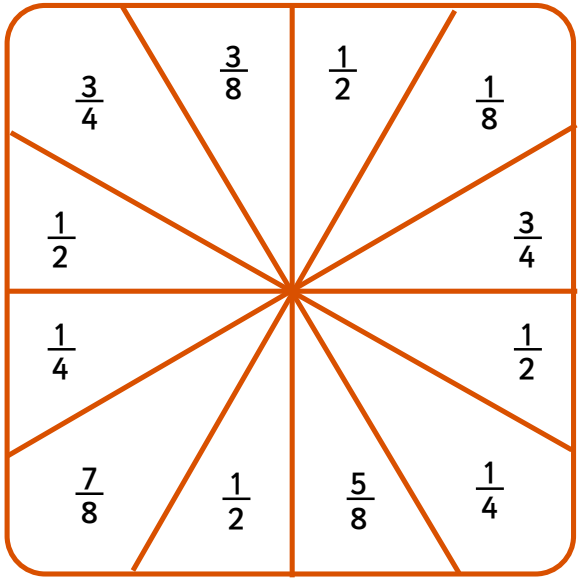
Take turns to spin the spinner. On your first turn, record the fraction as the beginning of an addition sum. On the next and each subsequent turn, either add the new number to one that you have already recorded, or use it to begin a new addition. The aim is to create sums that add up to a whole number. Each area on your page can contain several addends, but only one equation. Players may not cross out any fraction already recorded, but may choose not to record a fraction.

For example, if you spin $\frac{3}{4}$, you would record it as the start of a written sum, in the hope of spinning $\frac{1}{4}$ at a later stage. If you get $\frac{3}{4}$ again on the next turn, you could choose to add it to your previous number in the hope of getting $\frac{1}{2}$ at a later stage, or you could use it to begin a new sum (if you have an empty area).
Whenever you complete a sum that makes 1 or 2, announce the addition aloud.
E.g. *"Three quarters plus another three quarters is 1 and a half. Plus a half, makes 2."*

The winner is the first player with six recorded sums that add up to 1 or 2.

Variations (N.B. Make a different spinner base for each variation)

1. Target halves and quarters only, for a game at a much easier level.
2. Target halves, thirds and sixths only. 3. Target halves, fifths and tenths.



Combine Fractions to Make Whole Numbers

$\frac{1}{4}+\frac{3}{4}$	$=1$
$\frac{3}{4}+\frac{3}{4}+\frac{1}{2}$	$=2$
$\frac{1}{8}+$	$=$
$\frac{3}{8}+\frac{3}{8}+\frac{1}{4}$	$=1$
$\frac{1}{2}$	$=$
	$=$

Example of a player's recording sheet during a game.