Fractions - Introduction

Fractions in everyday use

The idea of dividing whole things into smaller pieces, fractions, is integral to our culture. It is embedded into our language in many ways: in the way we tell the time as 'quarter to' or 'half past' the hour; the way we write recipes with '½ a teaspoon' or 'a quarter of a cup' and how we buy our food using 'half or quarter kilos'. Understanding and using these terms in the everyday sense is an essential aspect of numeracy.

Unfortunately, fractions have often been dealt with in such an abstract way in secondary schools that many students fear the very word. By focussing on commonly used, everyday fractions such as ½ , ¼ , ¾, this sections revisits fractions in everyday use to build students' confidence in relation to fractions.

The section also outlines methods for using hands-on materials to clarify the meaning of fractions with a focus on how they are written in symbols and in words and how they are said. It also outlines activities to briefly explore how fractions relate to one another and what it means to combine or double quantities such as ½ or 1 ½ as they occur in practical situations, such as recipes.

Revisiting basic meanings in this way can also be very useful for students from other culture and language backgrounds who may not have learned about fractions in the past, or may have met them differently within their own languages and cultures.

Factions as a basis for decimals, percentages and measurement

The 'fraction' concept of dividing things into smaller pieces also underpins our 'decimal' or 10-based systems of money and measurement in which whole units such as dollars, metres, or litres are divided into hundredths (centimetres and cents) and thousandths (millilitres). Making sense of the relationships between these units of measurement is much easier for people who have a grasp of basic fraction concepts.

The idea of fractional parts also underpins 'percentages' which are so commonly used in our society for everything from analysing the population and their opinions, to advertising money-saving bargains.

Whilst the main focus of this section is on common usage of fractions, it also provides optional opportunities for looking at the fractions 1/10 and 1/100 and thus for making links between the decimal system for writing numbers and measurements later on.

These foundations also link directly to the percentages section which explores the meaning of percentages, makes links between common fractions and their percentage equivalents and uses the understanding of common fractions such as ½ and ¼ for 'in the head' or shortcut calculations of percentages.

The Meaning of Fractions

Overview

This activity:

- Uses hands on materials to explore the meaning of fraction words and symbols
- Begins with familiar, everyday fractions such as ½ , ¼ and ¾
- Extends the concept and notation to make sense of other fractions
- Uses circle shapes because it is the easiest to see when you have the whole

The circles can be thought of as cakes or pizzas and so build on the natural idea of sharing slices among people.

Skills and Knowledge

- Identifying simple fractions
- Naming fractions using words and symbols
- Relationship between some simple fractions

Preparing the Fraction Circle Kits for this activity does require time and effort. But they are a valuable teaching resource that can be used over and over again, so it is well worth the effort.

Preparation and Materials

Fraction Circle Kits
(Make 1 kit per 2 or 3 students.)

You will need 7 different colours of card or stiff paper.

Photocopy Activity Sheets 2 - 8 onto the card, using a different colour for each fraction, for example: white for the whole, red for halves; pink for quarters, green for thirds, etc

Cut the pieces and place each set in a labelled envelope so that each set contains 2 halves, 4 quarters, 3 thirds etc.

Photocopy Practice Sheet *Naming Fractions* (1 per student)

Collect some scrap A4 paper (at least 1 per student)

For later practice
Make 1 copy per students of Practice Sheets: *Fractions in the Kitchen* 1 & 2

Suggested Procedure

Arrange students into pairs (or the smallest groupings possible) to ensure they all have a chance to examine the fraction pieces and use the language of fractions by talking to each other.

Distribute one Fraction Circle Kit to each pair or group. Explain:

- *We are going to use the kits to explore a few things about fractions*
- *Some things you possibly know and some you may not*

Reassure your adult students that using the pieces may give them a different understanding of fractions than before. These are not childish things, adult students all over the world have used them and they find them very valuable.

Ask students to empty the kit onto the table and examine what is in it for a few minutes.

Encourage them to move pieces around and play with them before commencing the activity formally. [This allows them to become familiar with what's in the kit before they starting to use it. It also gives you a chance to circulate and listen to whether students use fraction language naturally.]

Introducing the activity: fraction concepts, words and symbols

Ask:

- *Arrange the pieces so that you have circles made of only one colour*

Explain:

- *We are going to use these circles so leave them on the table so you can see them clearly*

Pick up the whole circle and explain that this is the whole thing (you might want to imagine it as a whole pie, or cake or pizza).

Distribute Activity Sheet 1 (1 per student)

Copy the table onto the board for use in the activity.

Colour	*Symbol*	*Name*

Fill it in together as you ask learners the following type of questions.

Pick up a red piece (one half) and ask:

- *What do we call this in English?*
- *How do you say it?*
- *How do you spell it?*
- *How do you write it as a symbol?*
- *What does the symbol actually mean?*
- *What does it tell us?*

*You want students to understand that the symbol ½ means that the whole circle has been cut into 2 pieces, that they are **equal in size**, and this ½ piece is **one** of those pieces.*

Continue with all of the colours, filling in the table as you go. [Students for whom English is not a first language may need plenty of time to practice pronouncing the words for fractions, especially things like 'eighths' or 'tenths' but they usually have fun with that aspect.]

Extending the idea and language

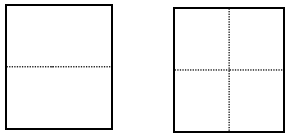
Suggest some 'what if' scenarios to consolidate the idea, until you are sure it is clear:

- *What if we had seven (or sixteen or twenty) pieces?*
- *What would you write?*
- *How would you say it?*

The table that you and the students have filled in should be kept for reference later - either in this session or another day, depending on students' familiarity with the ideas so far.

Check the concepts with a different shape

Take a piece of scrap A4 paper, and tell students you are going to make fractions with it.



Fold it in half, then in half again, asking as you go:

- *What fraction is this?*
- *And this?*

You might prefer to give the students the paper to fold themselves and circulate asking the questions individually.

Challenge them to see who can make the smallest fraction by halving each time.

It is a good idea to open the paper out so students can see the 4 quarters in the paper as a check.

Before making the next fold ask:

- *What fraction do you think we will get if I fold it again?*

Repeat this until it is not possible to go any further.

Encourage students to count the sections each time, and then decide on the fraction symbol and word. [You can't usually go further than 32 sections]

Extending to more than one piece

Focus again on the pieces of the Fraction Kit.

Pick up three of the one quarter pieces and ask:

- *What do we call this fraction – three of them together like this*?

Explain:

- *That when we write the fraction ¾, it means that the pieces are each ¼ in size*
- *And we have three of them*
- *In other words, the bottom number is telling us how big or what colour the pieces are, and the top number is telling us how many of them we have*

Ask students to:

- *Use the fraction pieces to make the following fractions:*

$^{3}/_{4}$ $^{5}/_{8}$ $^{3}/_{10}$ $^{4}/_{5}$ $^{2}/_{10}$

Check that all have the right idea before going further.

*If any students have heard the terms 'numerator' and 'denominator' before you might want to clarify them. The top number, the **numerat**or – 'numerates' or counts the number; the bottom number, the de**nom**inator – 'names' the type of fraction. But at this level the terms do not need to be used and may just cause bad memories for some learners.*

Same idea - different shape

Distribute some coloured pencils or textas and a piece of scrap A4 paper to each student. (They can use the paper they folded earlier if they did the folding themselves.)

The next segment could be done in two possible ways:

- One by one as a whole class (so students can listen to, and interpret the fraction as you say it aloud).
- Students working individually with your assistance from a list on the board (perhaps better if they differ greatly in ability).

Explain:

- *You will be using different colours to show some fractions on this paper*
- *You will need to fold the paper to make the fractions first*
- *Then colour and label the fractions:*
  - *one eighth*
  - *two eighths*
  - *three eighths*
  - *one sixteenth*
  - *two sixteenths*
  - *five sixteenths*

You may want to can draw students' attention to some fractions being equal to others during this exercise, for instance,2/8 is the same as a quarter and 2/16 is the same as one eighth. However, this is not intended to be turned into a lesson on equivalent fractions and their associated rules.

The idea of equivalence between fractions is explored in the Activity: Exploring Fraction Sizes.

Practice Sheets: *Naming Fractions 1 & 2* provide further practice at interpreting fraction symbols and names.

Practice Sheets: *Fractions in the Kitchen 1 & 2* require students to draw in the fraction lines to create fractions themselves.

Naming Fractions

Activity Sheet 1

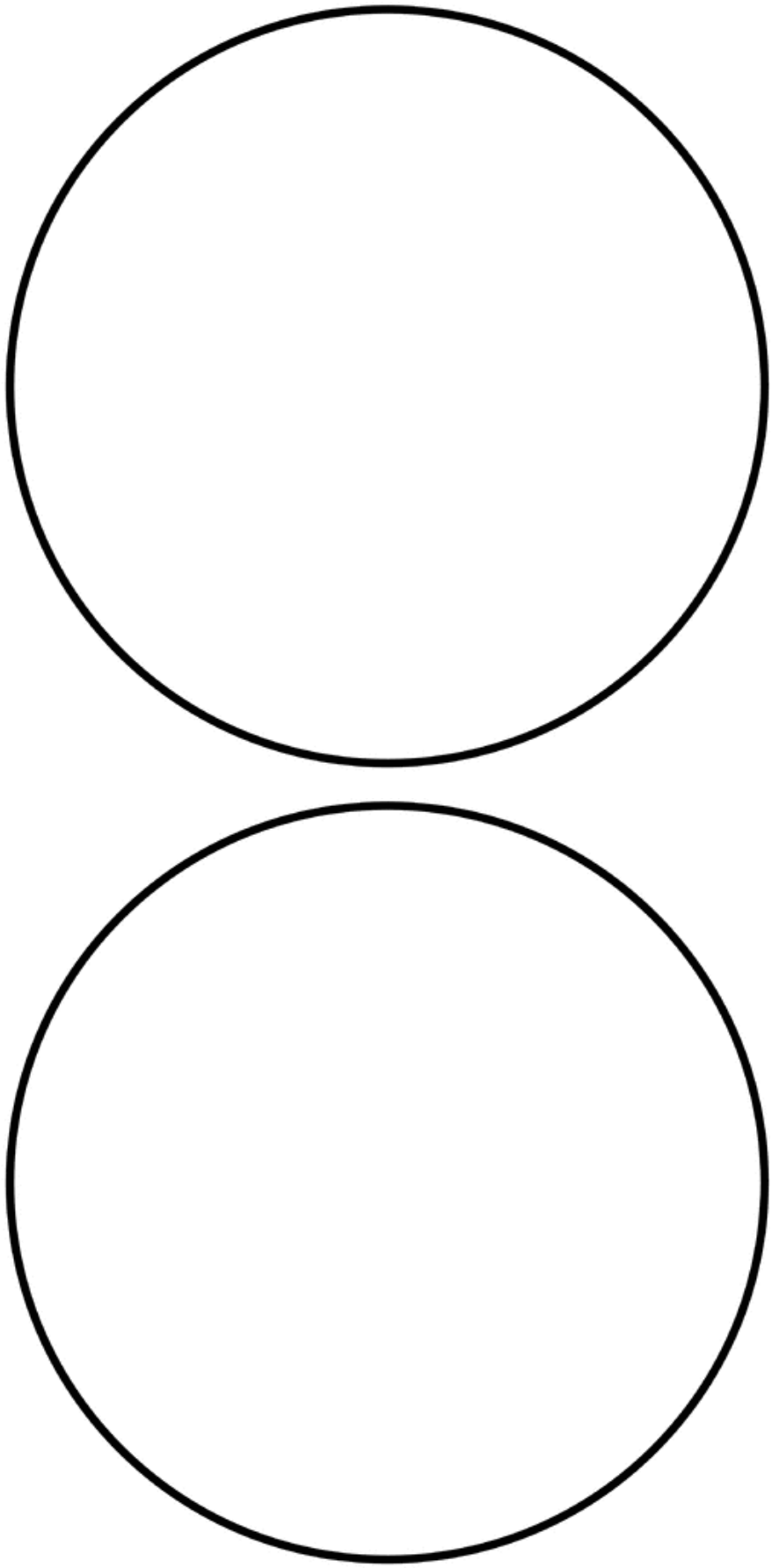
Fi in the table using the fraction pieces in your kit:

Colour	Symbol	Name
	1	one whole

Activity Sheet 2

1 whole

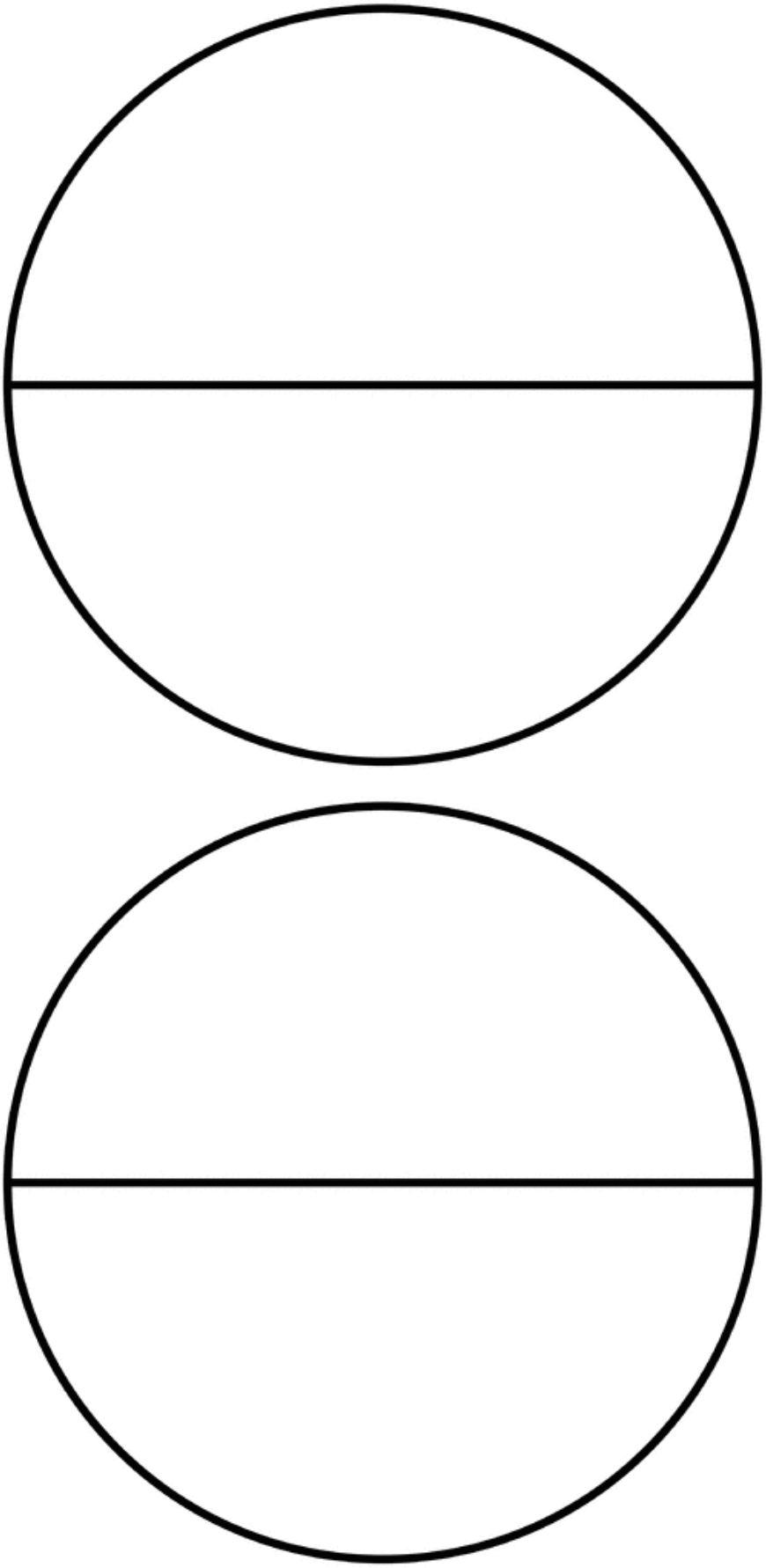
Naming Fractions



Activity

halves

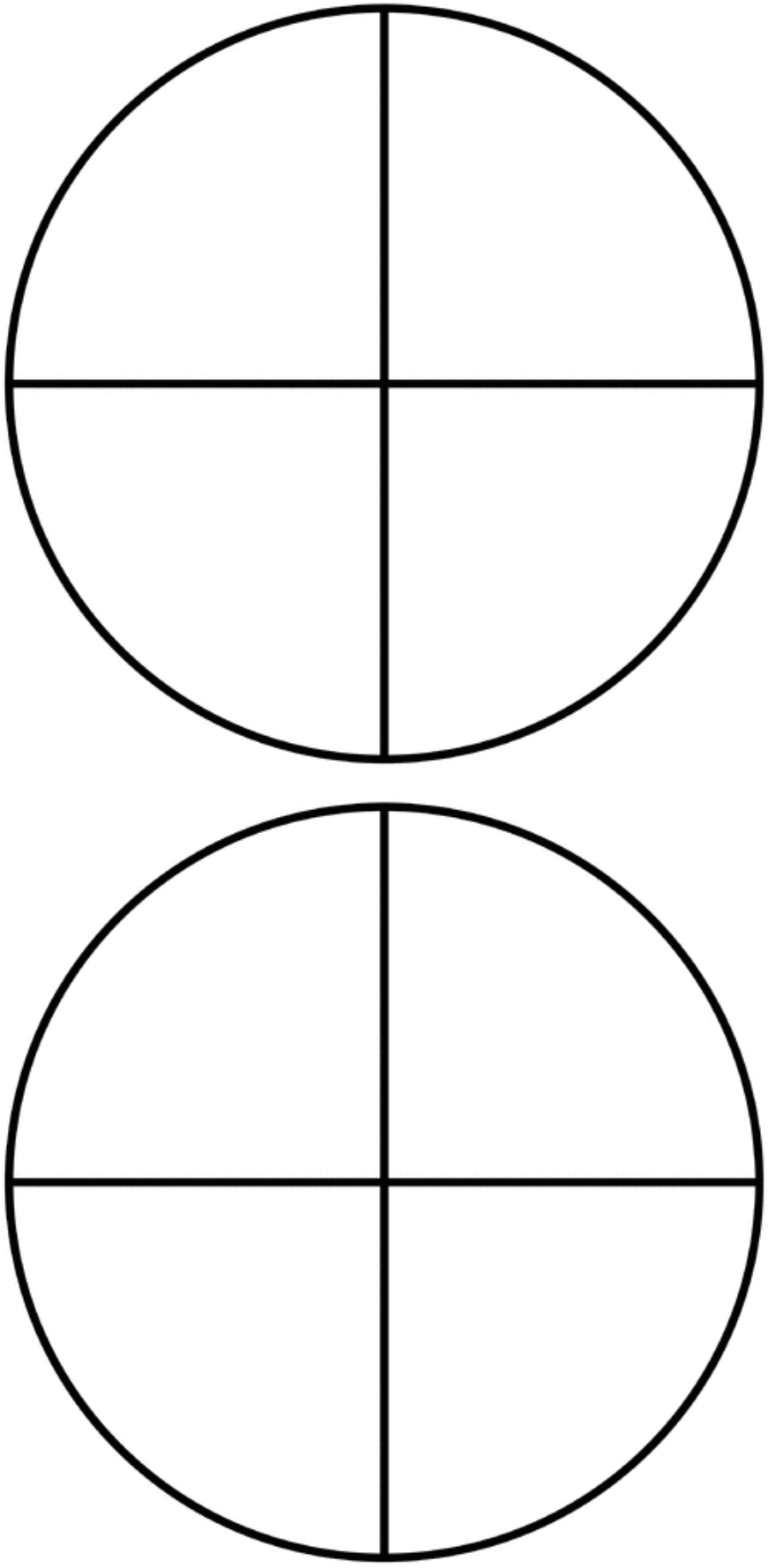
Naming Fractions



Activity Sheet 4

quarters

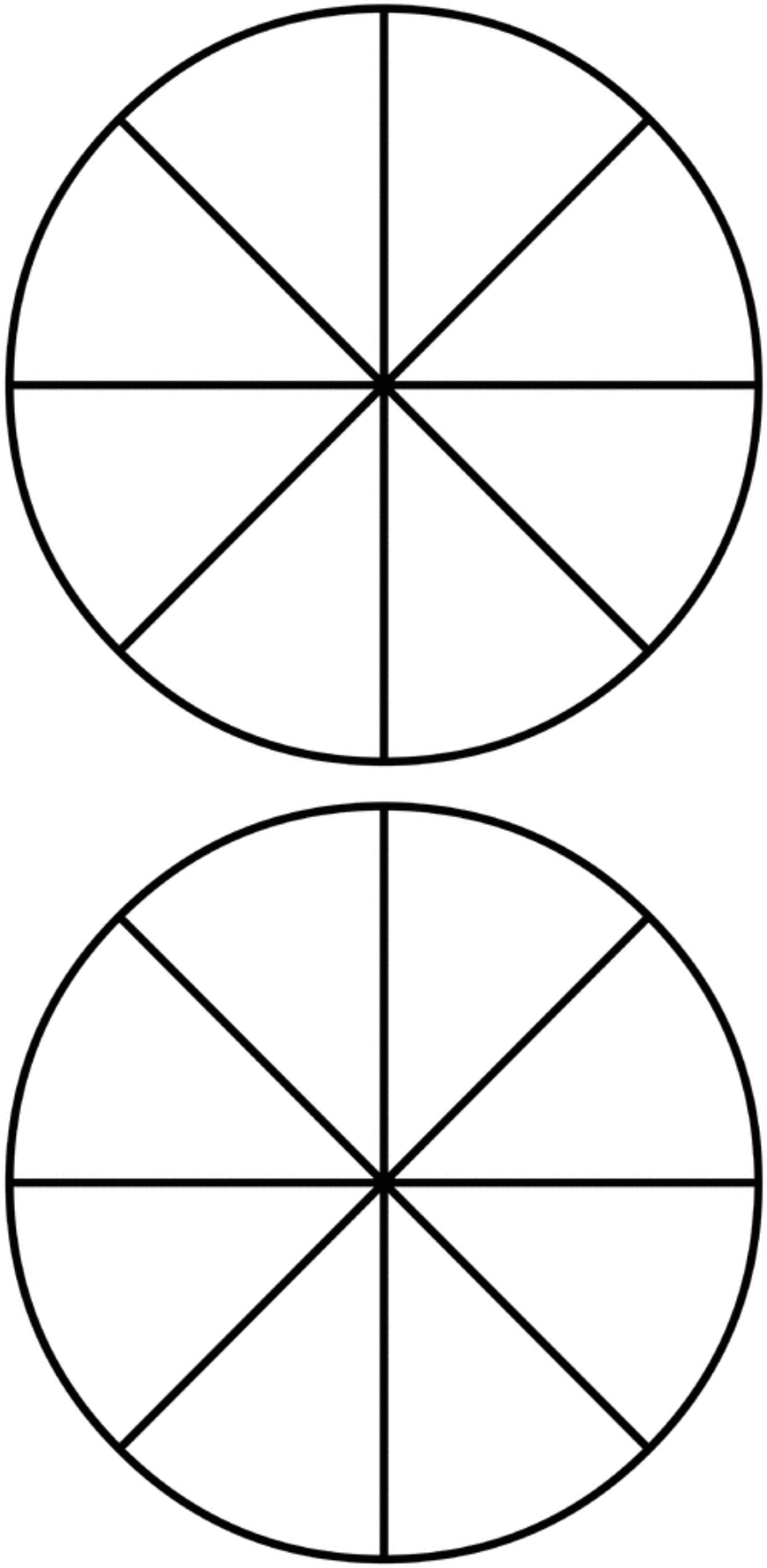
Naming Fractions



Activity Sheet 5

eighths

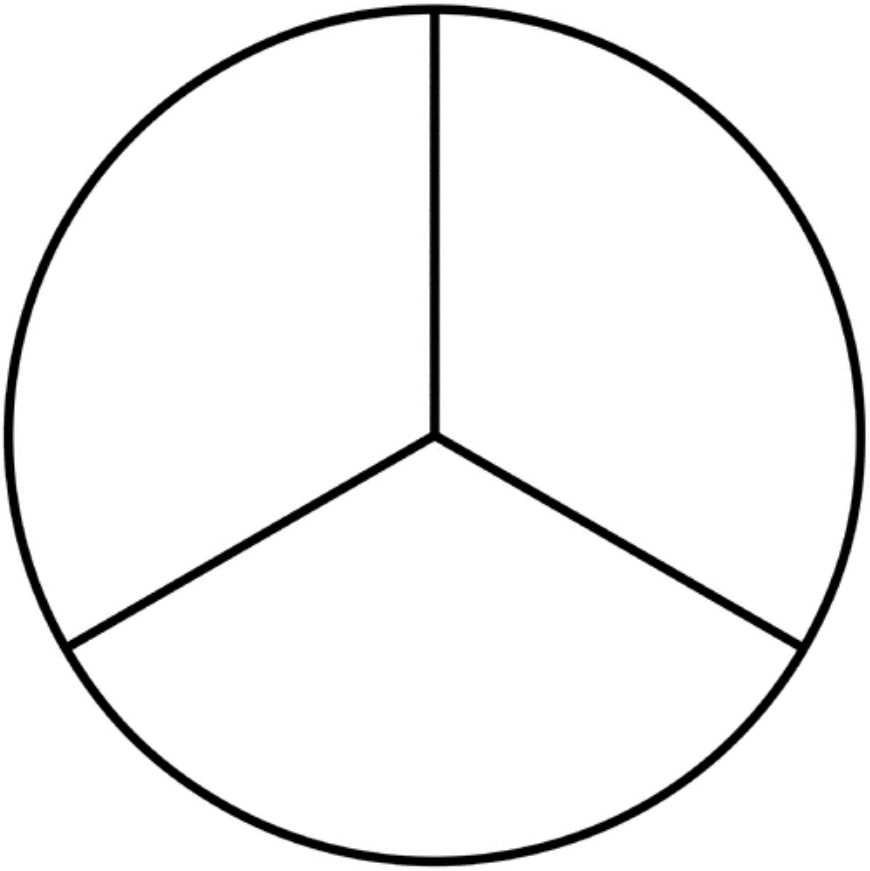
Naming Fractions

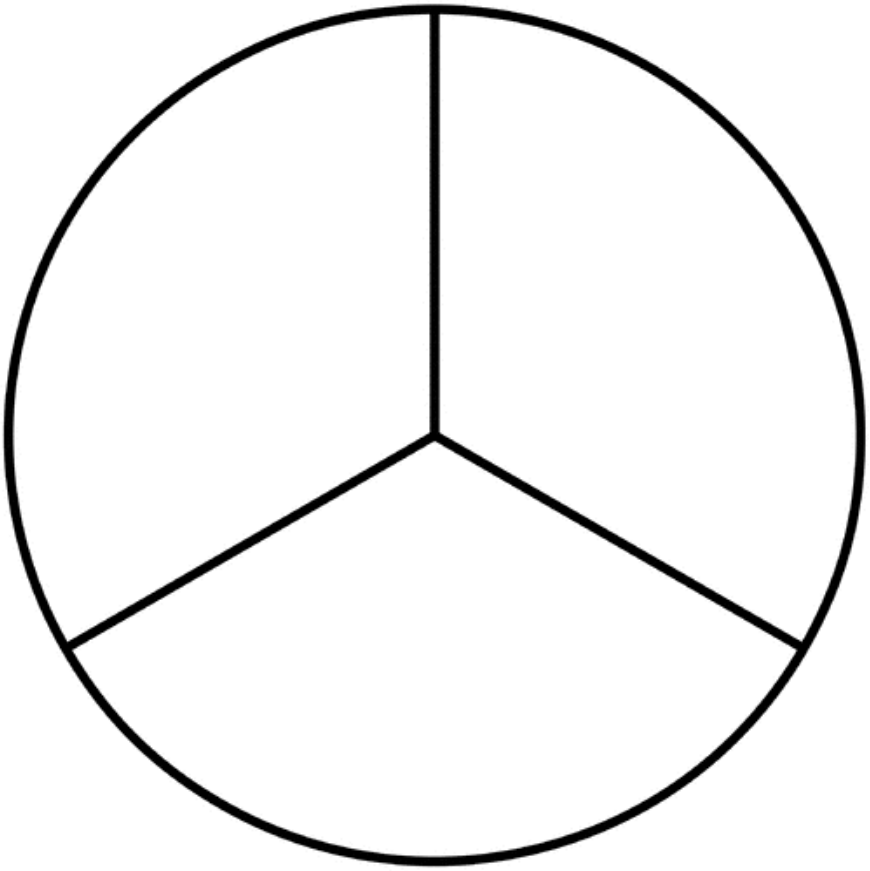


Activity Sheet 6

thirds

Naming Fractions

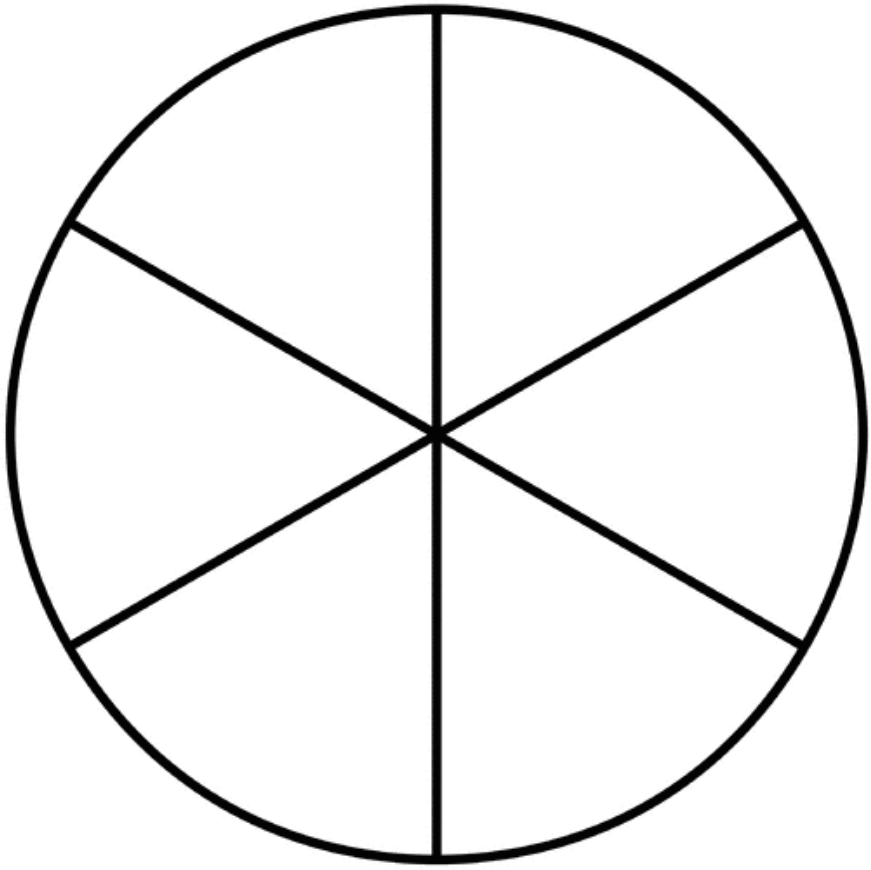


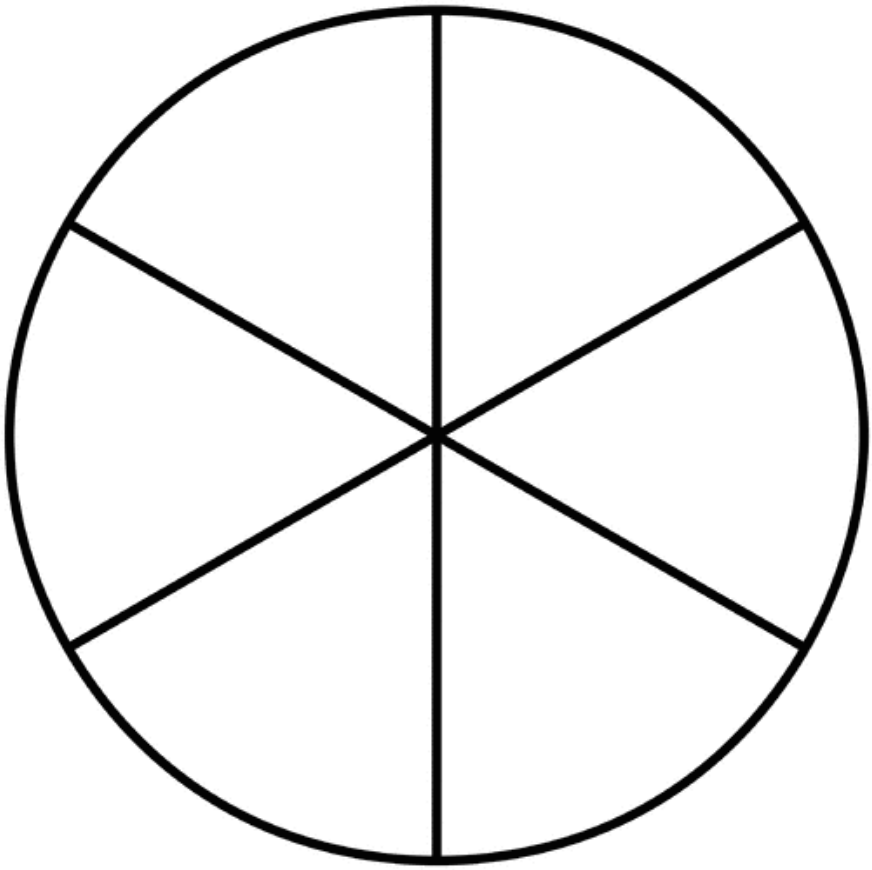


Activity Sheet 7

sixths

Naming Fractions

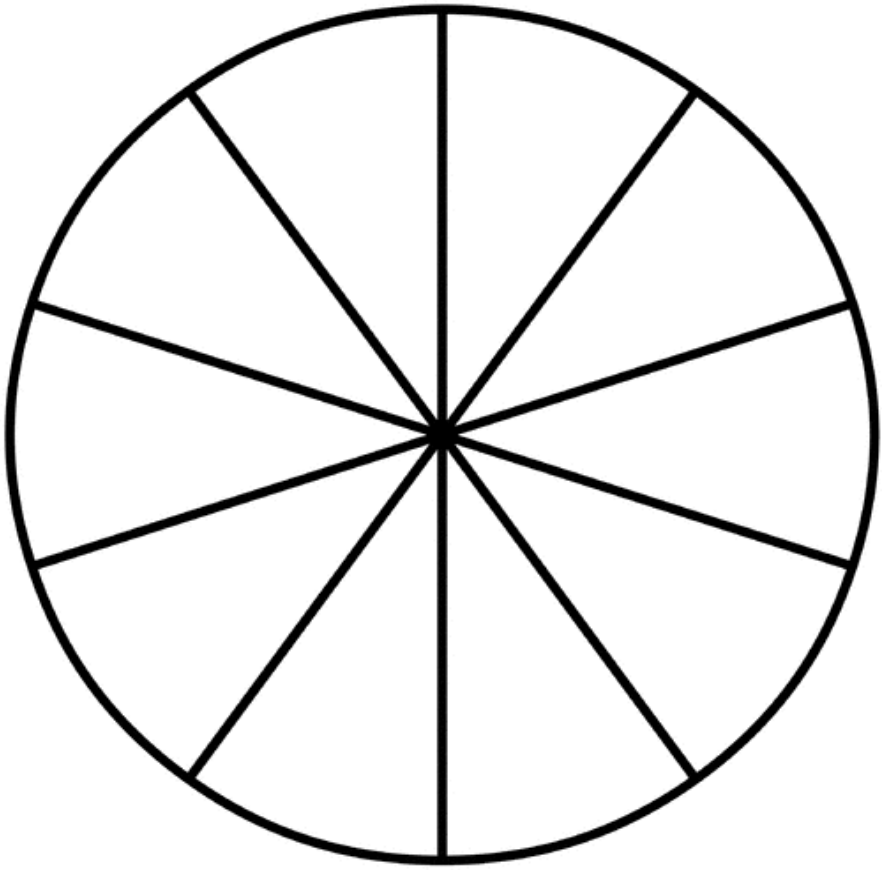


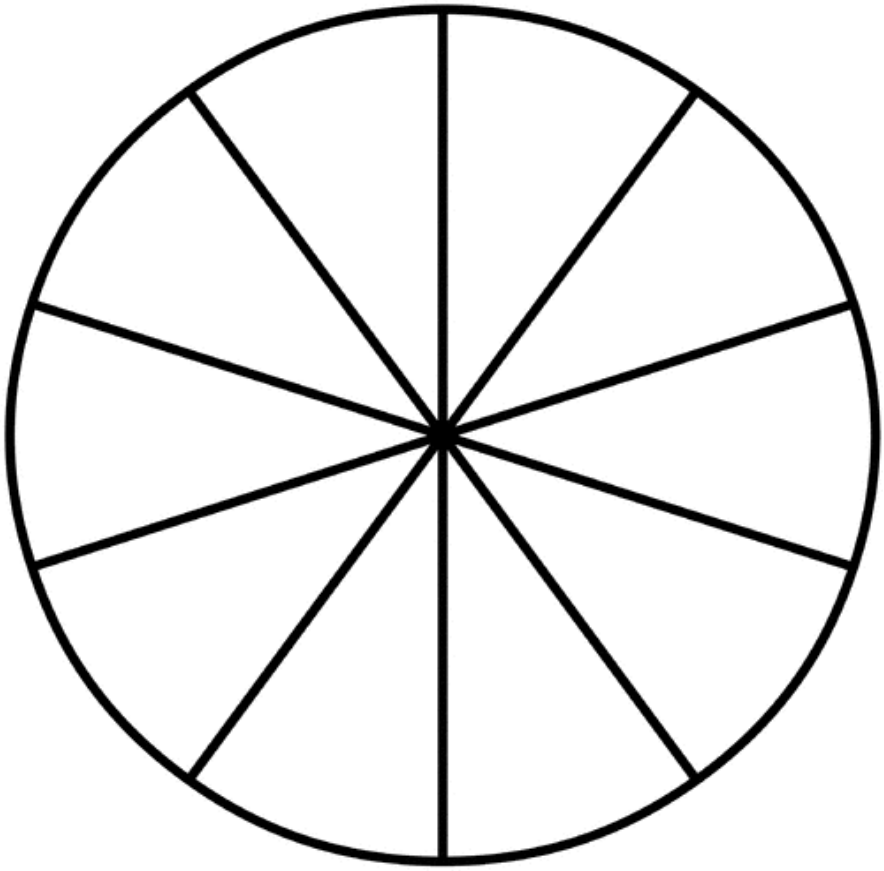


Activity Sheet 8

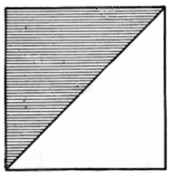
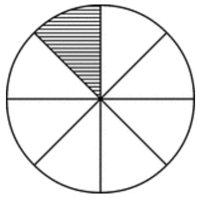
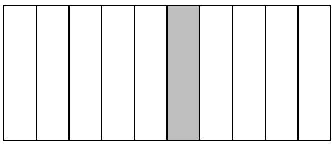
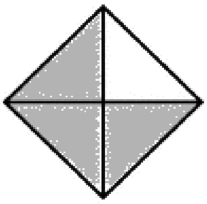
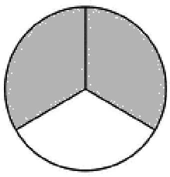
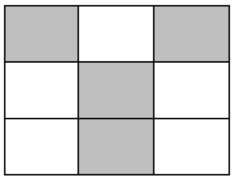
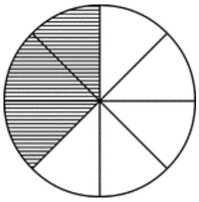
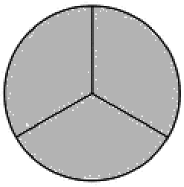
tenths

Naming Fractions





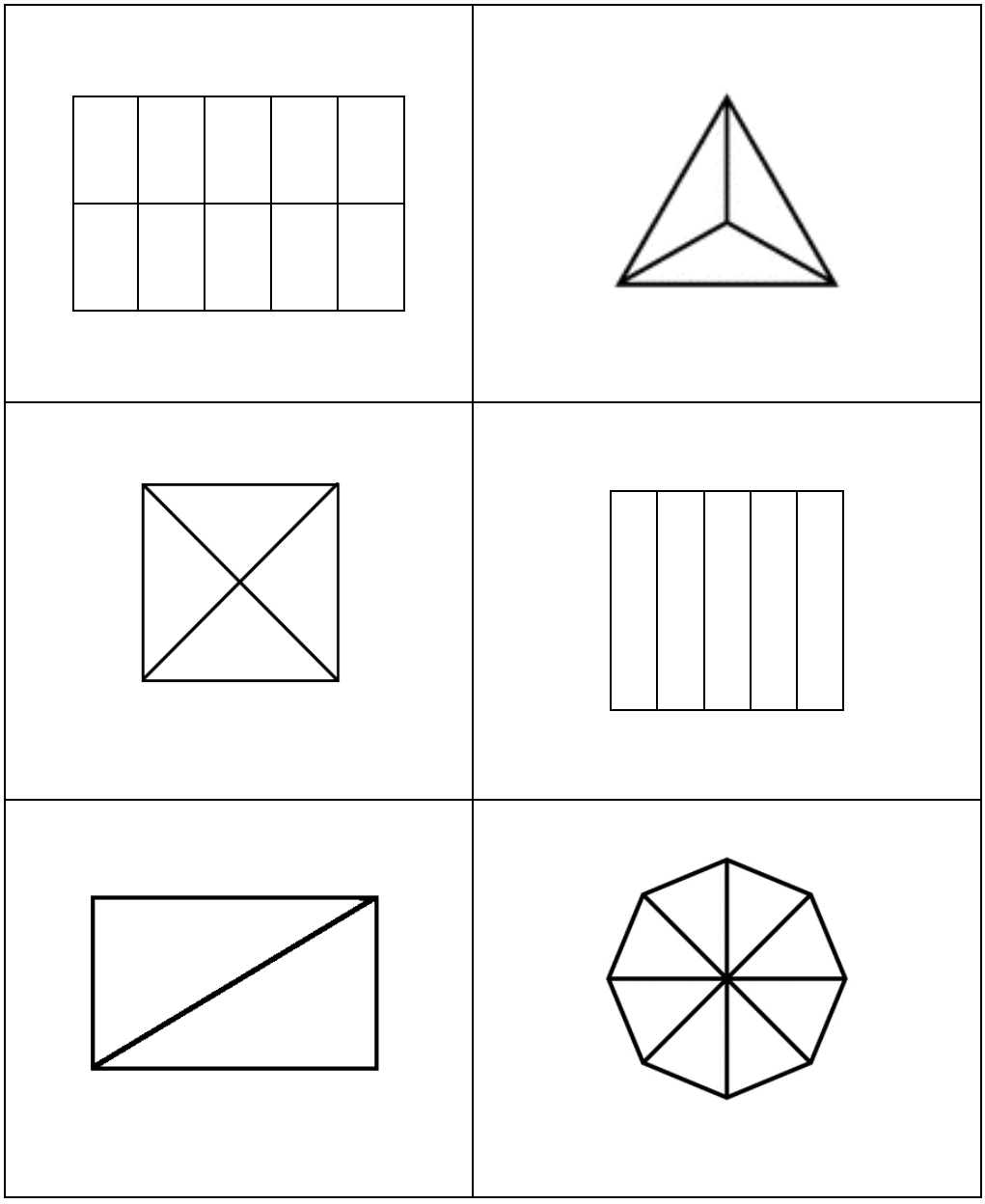
What fraction is shaded?

 Fraction symbol: …………… Word: ………………..	 Fraction symbol: …………… Word: ………………..	 Fraction symbol: …………… Word: ………………..
 Fraction symbol: …………… Word: ………………..	 Fraction symbol: …………… Word: ………………..	 Fraction symbol: …………… Word: ………………..
 Fraction symbol: …………… Word: ………………..	 Fraction symbol: …………… Word: ………………..	 Fraction symbol: …………… Word: ………………..

Naming Fractions

Practice Sheet 2

Choose the best shape and colour in these fractions: $^{1}/_{2}$ $^{2}/_{3}$ $^{3}/_{4}$ $^{3}/_{8}$ $^{4}/_{5}$ $^{1}/_{10}$



Fractions in the kitchen 1 Practice Sheet 3

Draw marks on the sides of these and then fill them to the fractions.

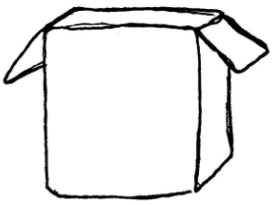
1/2 cup

1/4 cup

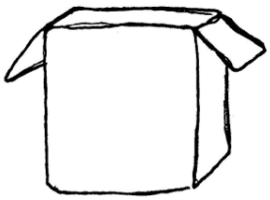
3/4 cup

1/3 cup

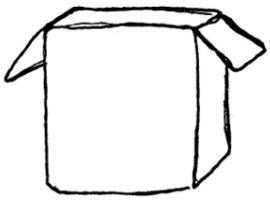
2/3 cup



1/4 box



1/5 box



2/5 box

1/2 bottle

2/3 bottle

4/5 bottle

2/4 bottle

Fractions in the kitchen 2 Practice Sheet 4

A litre holds 4 cups. 

Mark the level when it is filled with:

1 cup

Fraction: ……

2 cups

Fraction: ……

3 cups

Fraction: ……

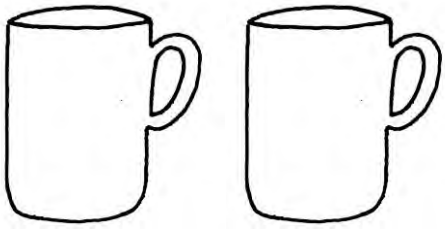
Here is a cake recipe:

$^1/_2$ cup butter	2 eggs
$^2/_3$ cup sugar	spices
$1^1/_2$ cups of flour	

Mark the levels on the cups

butter

sugar



flour

Four children share an apple. How much apple does each get? 

Matching Common Fractions

Overview

This activity is designed to be used with small groups or pairs:

- To revisit the fraction concepts and symbols introduced in *The Meaning of Fractions* activity.
- As an alternative introduction to the concepts and language of fractions for students with some prior knowledge.

Skills and Knowledge

- Words and symbols for Common Fractions
- Meaning of Common Fractions

Preparation and Materials

Copy Activity Sheet 1 *Matching Fractions 1* onto stiff paper or card, cut them into pieces and place in labelled envelopes (1 for each pair or small group of students).

Cut also some blank pieces of paper or card roughly the same size as the cards in the sets (4-6 per pair or small group of students).

Suggested Procedure

Introducing the activity

Arrange students in pairs or small groups and give one envelope of *Matching Fractions 1* to each group.

Ask learners to tip the contents onto the table and sort the cards into groups which show the same fraction in different ways.

Explain that there are some **spare diagrams** that do not go in any of the groups.

Circulate to observe students' current understanding of the words and concepts.

Encourage students to:

- Explain clearly why they have put the cards where they have
- Use the fraction words as much as possible

The emphasis should be on knowing how many pieces the whole has been divided into and how many of those are shaded.

Refer to *The Meaning of Fractions* Activity for other suggestions regarding fraction notation and language if you have not used that activity before.

Using the blanks

When all of the other cards are matched, each group of students should have two unmatched diagrams.

Distribute blank pieces of paper or card so that each group has at least two pieces to go with each of the diagrams (4 – 6 pieces per group).

Ask them to create cards (like the other sets) to go with each of these pictures.

Rounding off the activity

One way to finish this activity is to ask students to move around and look at the cards of at least one other group.

Ask:

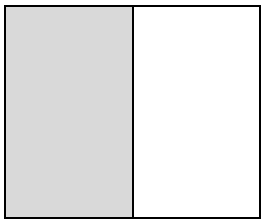
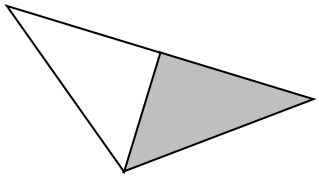
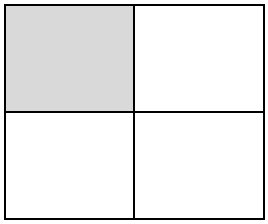
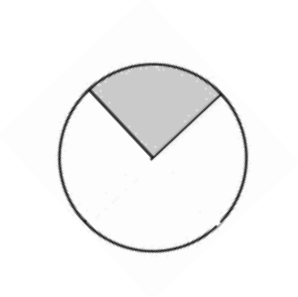
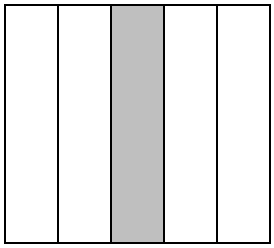
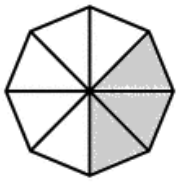
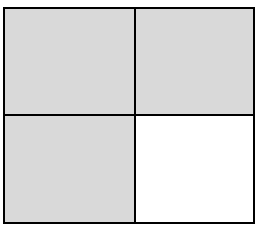
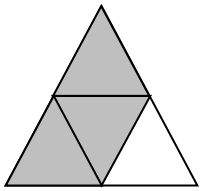
- *Are they all similar to yours?*
- *Do you agree that all their cards are correct?*

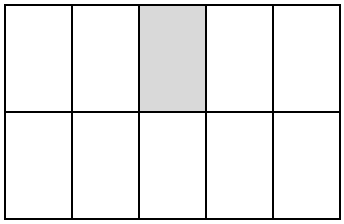
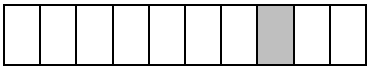
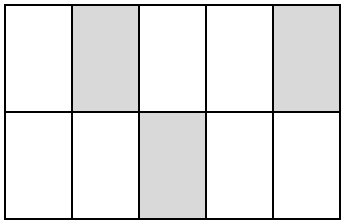
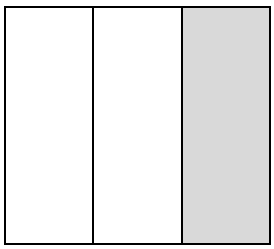
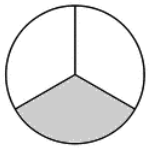
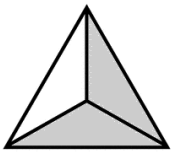
If the students have not yet used the Practice Sheets for *The Meaning of Fractions* then they will be a useful follow up for this activity.

Matching Common Fractions

Activity Sheet 1

Copy onto card and cut.

$\frac{1}{2}$	one half		
$\frac{1}{4}$	a quarter		
			
$\frac{3}{4}$	three quarters		

$\frac{1}{10}$	one tenth		
$\frac{3}{10}$	three tenths		
$\frac{3}{4}$	one third		
$\frac{2}{3}$	two thirds		

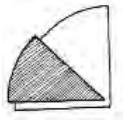
Comparing Fractions

Overview

This is a two part activity which follows from previous activity *The Meaning of Fractions*.

This activity:

- Uses fraction kits and folded paper
- Explores the relative sizes of fractions
- Introduces simple ideas of equivalence
- Provides further practice at naming fractions
- Builds understanding of fraction concepts and symbols.



Skills and Knowledge

- Relative sizes of fractions
- Recognise simple fraction equivalences

Preparation and Materials

Fraction Circle kits created for the *Meaning of Fractions* Activity (1 kit per pair or small group of students)

Scrap A4 paper (at least 1 per pair or small group)

Photocopy Activity Sheet 1 (1 per student)
Photocopy Practice Sheets 1 & 2 (1 per student).

Suggested Procedure

Students will need to refer to Activity Sheet 1: *Naming Fractions* (the table of fraction colours, names and symbols), which they used in the previous activity.

If they do not have their own, you could put a copy on the board so all can see it**.**

Comparing fraction sizes

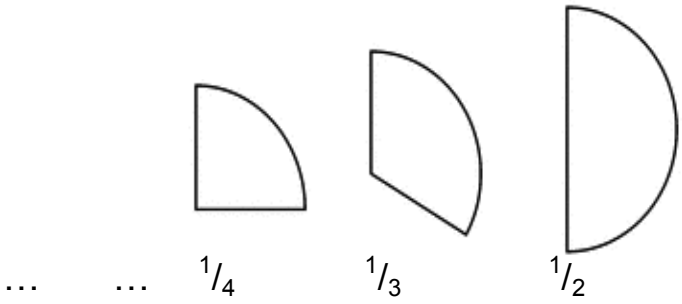
Arrange students in pairs or small groups.

Distribute a large sheet of paper to each student or group of students (see below).

Distribute a fraction kit to each group.

Explain:

- *Write 'smallest' on one end of a piece of paper and 'biggest' at the other.*
- *Then take one piece of each colour and put them in order from **smallest to largest** on the paper*
- *Now write the symbol for the fractions underneath each piece*



Ask:

- *Can you tell me anything about the numbers in the fractions*?

Or more explicitly:

- *As the fractions get bigger what happens to the numbers on the bottom?*
- *Why do you think that the fractions get bigger as the numbers get smaller?*
- *What does the number on the bottom tell us?*

It helps to use the cake or pizza analogy to clarify this.
Remember that the bottom number tells you how many pieces something is cut into.
If you imagine that you are sharing a cake or pizza, then the more slices you cut, the smaller the slices will be.

If students wish to keep a record of this learning activity give them each a sheet of paper and give them time to trace around the shapes to make their own copy.

Activity Sheet 1: *Comparing Fractions* provides a chance for students to use the fraction pieces while thinking further about these concepts.

Practice Sheet 1: *The Smallest Fraction*, gives students further practice using this concept.

Different names – same fraction

Ask students to spread the fraction pieces on the table in front of them.
Hold up one of the one half pieces.

Explain:

- *Put a one half piece like this on the table*
- *See if you can make the same shape out of different coloured pieces (not mixing the colours)*
- *Put the one half on top to check they are exactly the same size*

Ask: *Can you name the fractions you have made?*

As students tell you what colour pieces they have used and how many of each record it on the board:

1/2 is the same as: 2/4 3/6 4/8 6/12

Ask:

- *Can you see a pattern?*
- *If we had 20 on the bottom – what would be on the top?*
- *What about 10 on the bottom – what would be on the top?*
- *What about 100 on the bottom – what would be on the top?*

If students cannot make a prediction from these few pieces, then using a piece of A4 paper and folding it repeatedly, asking them how many pieces in the top half each time, may help them to see a pattern of halving and doubling emerging.

Note: Students do not always see the pattern the way mathematics teachers may expect, but if their pattern is true and leads to valid predictions then it should be accepted.

The last two fractions 5/10 and 50/100 are especially significant and possibly already familiar to the students as being the same as a half. It is worth drawing attention to them:

5/10 is 0.5 and 50/100 is 50%

The cake or pizza analogy may help make sense of this idea:

If you start with a half a cake you have one big piece. If you cut it again you get two pieces (the number on the top of the fraction is now 2) but they are now smaller (the number on the bottom is now 4). If you keep cutting the same half cake you will get lots more pieces (number on top increases) but they will get smaller (number on the bottom increases).

For the lower level numeracy students the main point to make from this activity is that one fraction can have a lot of different names. Also some of these names are useful for decimals and percentages.

A short look at adding fractions

This section briefly demonstrates how familiar some equivalent fractions are to most of us. It also provides a glimpse of how they may be used when adding fractions.

First look at some very simple additions of fractions;
For example:
1/3 + 1/3 = ? [Put two 1/3 pieces together to show this is 2/3]

1/5 + 2/5 = ? [Put one fifth piece and then two more fifth pieces together to show this is 3/5]

Note: This is not 3/10.
The number on the bottom of the fraction does not change because the shape is still the same size – there are just more of them when you add.

Ask students to show you how to add
1/10 + 3/10 [Answer 4/10]

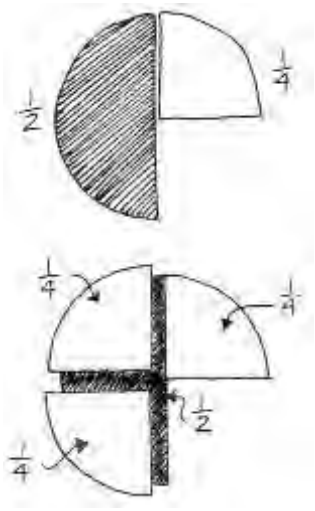
1/5 + 3/5 [Answer 4/5]
1/4 + 1/4 [Answer 2/4 – same as1/2]

1/2 + 1/2 {Answer 2/2 – same as 1]

Using equivalent fractions

Place one half piece and one quarter piece together and ask:

- *What fraction do we have now?*



Cover the 1/2 with two 1/4's

Record: *1/2 + 1/4 = 3/4*

Is the same as 2/4 + 1/4 = 3/4

The important thing is that all students see how this works with the concrete fractions in front of them.

Exploring more equivalent fractions (Optional extension)

For students who may need to understand more about equivalent fractions later on you can take these ideas a little further as follows.

Hold up one of the one third pieces
Explain:

- *Put a one third piece like this on the table*
- *See if you can make this fraction out of any other pieces just , you can't mix the colours like we did for the half*

As the students respond record on the board:

1/3 is the same as: 2/6 4/12

Again explore with students any pattern they can see.

Ask: *Can you make predictions for:*

- *?/24,*
- *?/30,*
- *?/15.*

For some students this exploration can be a startling revelation of previously mysterious rules.
But for others it may start to resemble the bad old fraction days at school. Don't push further than they need or want to go.

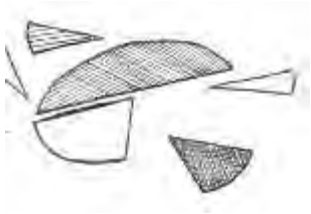
If you want to explore the idea even further you could use 2/3 and 3/4 as your starting points.

Fractions like these last are more likely to take you to the principle of multiplying top and bottom by the same number (as the pieces get smaller – the number of them increases by the same factor.)

Comparing Fractions

Activity Sheet 1

Work with a partner if you can.



For each pair of fractions on this page:

- First put a circle around the one you think is the **smallest**
- Then put the fraction pieces together and check if your guess is correct

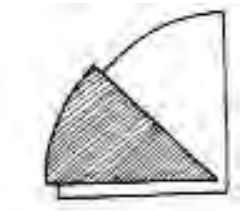
1	$\frac{1}{4}$	$\frac{1}{3}$
2	$\frac{1}{12}$	$\frac{1}{2}$
3	$\frac{1}{3}$	$\frac{1}{8}$
4	$\frac{1}{2}$	$\frac{1}{3}$
5	$\frac{1}{6}$	$\frac{1}{12}$
6	$\frac{1}{8}$	$\frac{1}{4}$
7	$\frac{1}{3}$	$\frac{1}{12}$
8	$\frac{1}{4}$	$\frac{1}{2}$
9	$\frac{1}{8}$	$\frac{1}{6}$
10	$\frac{1}{4}$	$\frac{1}{6}$

The Smallest Fraction

Practice Sheet 1

Put a circle around the fraction you think is the **smallest** in each group of fractions

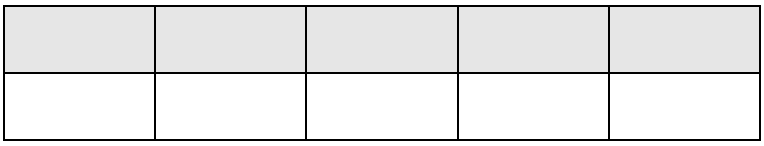
If you are not sure draw a picture or fold some paper to see the fractions.



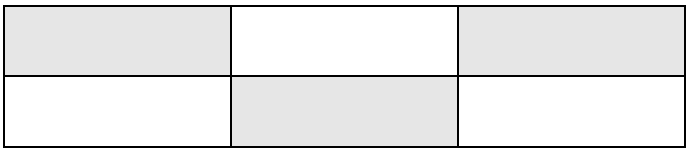
1	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{2}$
2	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{12}$
3	$\frac{1}{5}$	$\frac{1}{10}$	$\frac{1}{2}$
4	$\frac{1}{100}$	$\frac{1}{10}$	$\frac{1}{20}$
5	$\frac{3}{6}$	$\frac{3}{10}$	$\frac{3}{3}$
6	$\frac{2}{3}$	$\frac{2}{10}$	$\frac{2}{100}$
7	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{4}{4}$

Same Name - Different Fraction

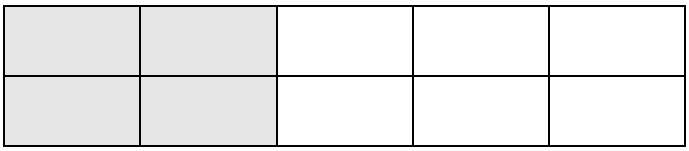
Practice Sheet 2



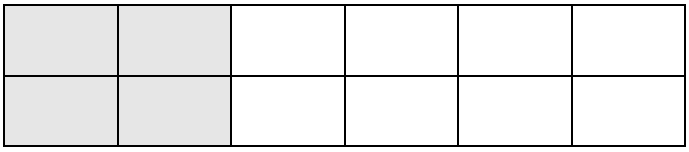
1. What fraction is coloured? …… Is this the same as ½? Yes / No



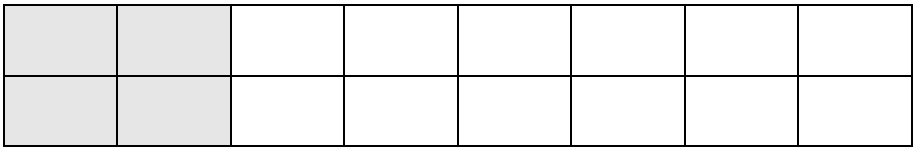
2. What fraction is coloured? …… Is this the same as ½? Yes / No



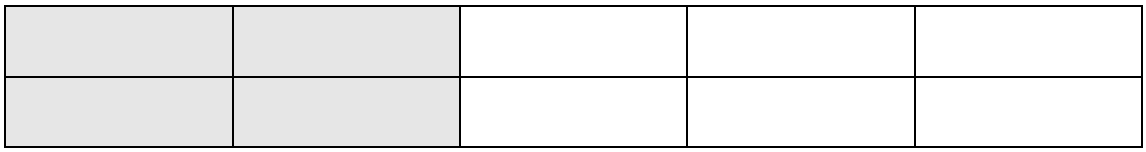
3. What fraction is coloured? …… Is this the same as ½? Yes / No



4. What fraction is coloured? …… Is this the same as ½? Yes / No



5. What fraction is coloured? …… Is this the same as 1/4? Yes / No



6. What fraction is coloured? …… Is this the same as 1/4? Yes / No

Sorting Fractions of ...

Overview

This sorting activity forms a bridge between the concept of fractions of single shapes and fractions of a number. It uses familiar quantities such as 'half an hour = 30 minutes' to link the process of dividing numbers and finding a fraction of them.

It is designed for pairs or small groups to encourage discussion and sharing knowledge, but can be done individually if necessary.

Skills and Knowledge

- Linking simple fractions and familiar quantities
- Calculating fractions such as ½ ; ¼ ; ¾
- Linking minutes and fractions of an hour

Preparation and Materials

Photocopy: Activity Sheet 1 (1 per small group) [Optional - see below]

Copy Activity Sheet 2 *Sorting Fractions of...*' onto stiff paper or card, cut them into pieces and place in labelled envelopes (1 for each pair or small group of students).

Collect a small pile of pens, pencils, paper clips, identical coins or counters (enough to demonstrate halving a group of objects)

Optional (see below):
Cut also some blank pieces of paper or card roughly the same size as those in the sets (4 – 8 per pair or small group of students).

Follow up practice
Photocopy Practice Sheets 1 – 4 (1 per student)

Suggested Procedure

Note: These cards could be used as an open-ended sorting exercise or as a more structured activity. Hints for both methods are included below. How you use them depends on your preference and the ability of your student group.

Introducing the activity

Arrange students in pairs or small groups and give one envelope of *Sorting Fractions of..* to each group.

Explain:

- *You are not expected to know everything about these cards by yourself*
- *You are working together to share what you know*
- *This activity will help you learn more about fractions*

Ask learners to tip the contents of the envelope onto the table.

An open-ended approach

Ask learners to sort the cards into 4 groups that **they think** should go together.

Circulate:

- to observe how familiar these quantities are to the learners
- to encourage students to explain clearly why they have grouped the cards

This beginning could lead to the structured approach, as described below, or could take you on a different journey altogether, according to the students' choice of groupings, particularly if you insist on four groups only.

Arranging the cards into fraction groups – structured approach

Distribute Activity Sheet 1. (You could just write the fractions on the board and ask students to copy them on to a blank page.)

Ask students to:

- *Sort the cards into the four corners of the paper to go with the fraction shown.*

Extension for early finishers

If some pairs finish early, give them some of the blank cards and suggest that they create some new cards to go in each fraction group.

Discussing the ideas

The follow series of suggested questions is intended to assist you get the maximum from the activity. Their main aim is to clarify that finding a fraction of a number is the same as dividing.

These questions could be used:

- In a whole class discussion
- As questions to pairs or individuals
- By asking students to create the appropriate cards to go with their sets

½ of ... = ÷ 2

Pick up a card in the ½ set (50 cents, 30 mins or 6 months)
Ask:

- *How did you know to put this card here?*
- *For example, how could we explain that..*
  - *50 cents is ½ of a dollar?;*
    30 mins is ½ of an hour?

You want to establish that finding ½ of is the same as dividing by 2.

Possible prompts:

- *If you wanted to find ½ of this pile of things (... pens, paper clips, coins...) show me how you would do it*
  [you share or 'divide' them into two piles]
- *When you work it out is it like adding, multiplying ..... ?*
- *What would you get if you divided 100 by 2 ... or 60 by 2 ... or 12 by 2?*

Writing it in symbols

Ask:

- *How many different ways can you think of to write what we are doing?*

Indicate on the board several ways it can be expressed and emphasize they **mean the same thing**.

$\frac{1}{2}$ *of 100* $\qquad \frac{100}{2} \qquad$ *100 ÷ 2*

¼ of ... = ÷ 4

Repeat these type of questions for ¼ to establish that ¼ of something is the same as dividing it by 4.

Note – for students who find division by 4 difficult it may be easier to halve then halve again. Many of your students may do this instinctively rather than even think of division. It is an effective method, but it is useful to make them aware that they are, in effect, dividing by 4.

For example 'quarter of an hour'

$\frac{1}{4}$ *of 60* $\qquad \frac{60}{4} \qquad$ *60 ÷ 4*

Calculating more halves and quarters

Distribute some blank cards to each group.

Pick up the **one metre** measure in the first group of cards.

Explain:

- *There is no card with a tape measure like this in the ½ group.*

Ask:

- *If we were going to make one, how many centimetres should it show?*

Prompts:

- *How many centimetres in a metre?*
- *So how many centimetres in a ½ of 100 cm?*

[½ metre = 50 cm]

Get students to make a card with the tape showing 50 cms at half way and add it to their ½ group.

Repeat this for several cards in the ½ and ¼ groups, either working as a class and considering them one by one, or by asking by students in groups or pairs to free wheel and create their own new cards.

Some examples:

- *What about litre jug ½ filled?*
  - *How many millilitres would it be?*
  - *How many millilitres in one litre? .. so half is?*

- *What about litre jug ¼ filled?*
  - *How many millilitres would it be?*

[1/2 of 500 ml = 250 ml]

- *What about this ¼ time at the footy – how many minutes is that?*
  - *The whole game is?*

[100 mins for AFL]

  - *How many equal parts do you need for a quarter?*
  - *So ¼ is ... ?*

[25 mins for AFL]

  - *How many minutes would they have played by half time?*

Practice sheets 1 & 2 provide further examples of finding a half and a quarter of a number.

The activity *Doubling and Halving* also looks in the head methods for finding a quarter by halving then halving again and provides further practice for finding a half and a quarter of quantities.

Calculating ¾

Explain:

- *Let's look again at the football game*
- *We know a whole game is 100 minutes*
- *And we worked out 25 minutes was one quarter*

Ask:

- *How many minutes of play by ¾ time?*
- *How could you work it out?*

Some students may suggest adding ½ and ¼ (50 + 25 mins).

Either of these methods is helpful. Students should be encouraged to use whichever feels comfortable to them.

Others may realise that it is 3 lots of one quarter or 3 x ¼ (3 x 25 mins)

If you know some students will go on to higher levels of numeracy then it is worth emphasising the 3 x ¼ method with them and extending it to other fractions – see below.

Ask:

- *How many months is ¾ of a year?*
  - *We know ¼ is 3 months, so 3 of these ¼ s would be ..?*
    or
  - *We know ¼ is 3 months, and ½ is 6 months so ...?*

Continue with other possible ¾ amounts: 75 cms, 750 mls, 750 grams.

Broadening the discussion

An activity like this could take you in many different directions according to the group of students. For example, to be more inclusive you may want to discuss a range of sports.

Suggested questions:

- *What other sports do you like? eg Soccer, basketball, netball, rugby*
- *Do they have quarters? – How long are they?*
- *Do you hear any other fraction words in sport?*
- *What do you think they mean?*

To relate the fractions to common percentages ask:

- *What percentage goes with each group?*

Extending the mathematical concepts

For students who are likely to progress to higher numeracy levels it is probably a good time to emphasise the idea of division. But don't push too hard at this point, especially if they are not yet comfortable with the other fractions.

Suggested questions:

- *How many minutes in 1/3 of an hour?*
- *What about 2/3?*
- *How many cents would be one fifth of a dollar?*
- *What about 2/5 of a dollar?*

Extension Activity – One tenth cards

With students in pairs or small groups, give them some blank cards and ask them to:

- *Make your own set of cards for the fraction 1/10*
- *Use the other sets as your model.*

This extension should make it clear whether or not students have understood the ideas discussed.

It also lays valuable **foundation for decimals** and for shortcut percentage calculations.

For students who are receptive mention that 1/10 = .1 and 1/10 = 10%.

1. Ticket prices

Children pay half-price when they go to the Circus or the Movies. How much would they pay:

TO the Movies  Adults: $14 Children: ……	 *CIRCUS* *Adults $17* *Children pay: …….*

2. Celery is sold in half sticks. How much will half a stick of celery cost?

$3.00

3. How much for the cabbages?

 Cabbage $4.20	 Half a cabbage Price: ……..	 Quarter a cabbage Price: …….

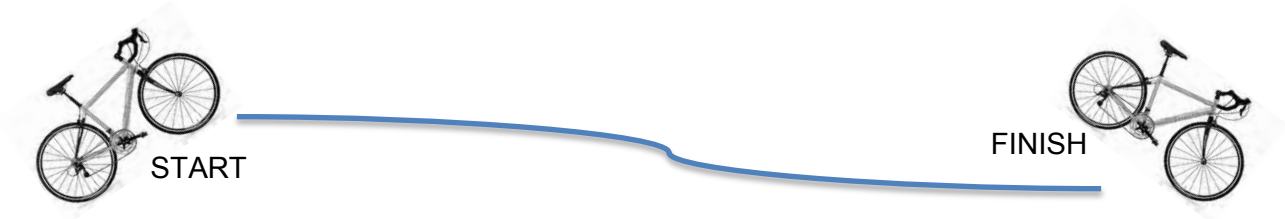
Fractions of: Sales

Practice Sheet 2

How much will these clothes be?

How much will these cost?

20 Km Bike Ride



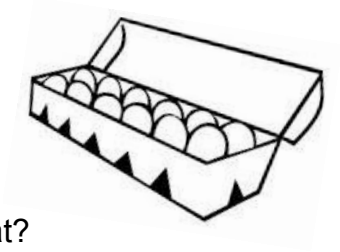
You need to organise some breaks on a 20 km bike ride. Show:

1. A break $^1/_4$ of the way.
   How many km? …….

2. A break $^1/_2$ of the way.
   How many km? …….

3. A break $^3/_4$ of the way.
   How many km? …….

EGGS!!!



How many eggs in $^1/_2$ a dozen?

How many eggs in $^1/_4$ a dozen?

A rich fruitcake uses $^3/_4$ of a dozen eggs. How many is that?

How many eggs in $1^1/_2$ dozen?

NUTS A kilogram is 1000 g.

¼ kilogram of nuts = …… grams.

¾ kilogram of nuts = …… grams.

Mark the position of the minute hand after it has moved:

1. Half an hour

How many minutes?

……. minutes

2. $^{1}/_{4}$ of an hour

How many minutes?

……. minutes

3. $^{3}/_{4}$ of an hour

How many minutes?

……. minutes

At the Footy

When the siren goes for the first break in an AFL match, how much of the game has been played?

When the siren goes for the second break, how much of the game has been played?

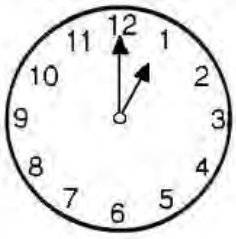
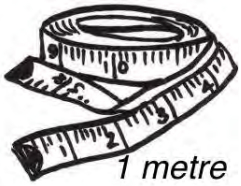
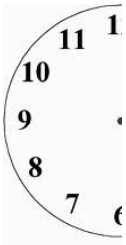
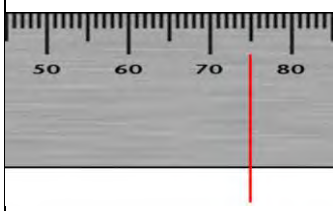
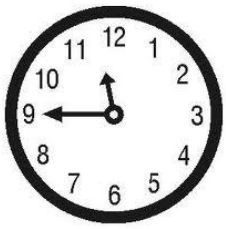
When the siren goes for the third break, how much of the game has been played?

1	$1/2$
$1/4$	$3/4$

Sorting Fractions of

Activity Sheet 2

Copy onto card and cut.

		100%	1 year
		6 months	30 MINUTES
			
9 MONTHS	3 months	15 minutes	75 cents
	750 grams		45 MINUTES

Exploring Mixed Numbers

Overview

This activity presents a brief explanation of fractions, such as $^{3}/_{2}$ and $^{9}/_{4}$ and their more familiar meanings as 1½ and 2¼.

It introduces the idea that you can have fractions great than 1.

Skills and Knowledge

Links between simple improper fractions and mixed numbers.

Preparation and Materials

Fraction circle kits prepared in *The Meaning of Fractions* activity.

Alternatively:

3 or 4 coloured circles cut into one half pieces.

3 or 4 differently coloured circles cut into one quarter pieces.

Photocopy Practice Sheets: *Exploring Mixed Numbers 1, 2, & 3* (1 per student).

Suggested Procedure

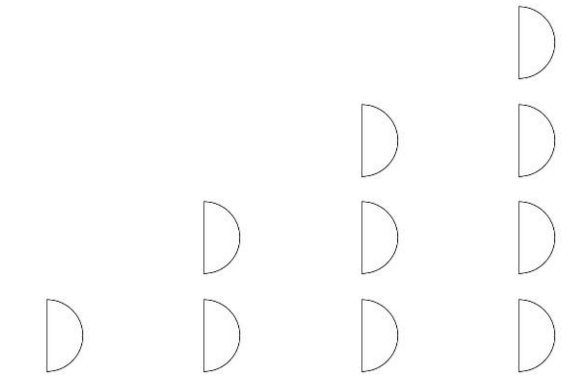
Introducing the activity

If possible get students to sit around a table or flat surface for this activity. This makes it easier for them to see the cut out shapes without you having to hold up a lot of pieces at once. Alternatively you could use BlueTak to hold them on to the board.

Explain:

- *We often see fractions like 1½ in recipes*
- *These are called mixed numbers*
- *This activity will help you to understand them better*

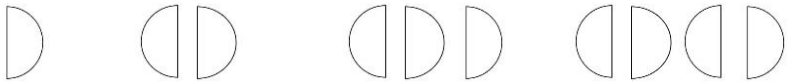
Using **all** the half pieces made, ask students to lay them out on the table, one by one, counting by halves as they go:



1 half *2 halves* *3 halves* *4 halves*

As they count, record the fractions: $^1/_2$, $^2/_2$, $^3/_2$, $^4/_4$.

Now, by rearranging the pieces, they can be counted in a different way: ie *a half, one whole, one and a half, two wholes:*



½ *1* *1 ½* *2*

As students count record the new numbers under the old.

Different ways of writing the same fraction

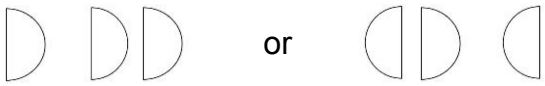
Compare the different ways to write the same number, depending on how we look at it, or how we arrange the pieces:

1 is the same as $^2/_2$
1 $^1/_2$ is the same as $^3/_2$
2 is the same as $^4/_2$

Draw students' attention to:

- The meaning of a fraction like $^2/_2$, where the numerator (or top number) and denominator (or bottom number) are the same
- The fact that fractions greater than one **do** exist
- The fact that these fractions can be written as:
  - **improper fractions** (like $^3/_2$) or as
  - **mixed numbers** (like $1^1/_2$).

Note: This can be emphasised visually by laying the circle halves out and getting students to tell you how they would write the number for each configuration.

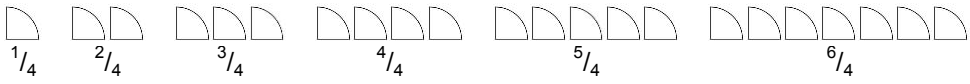


$^3/_2$ $1^1/_2$

Repeat this for the 2 halves and four halves.

Looking at the quarters

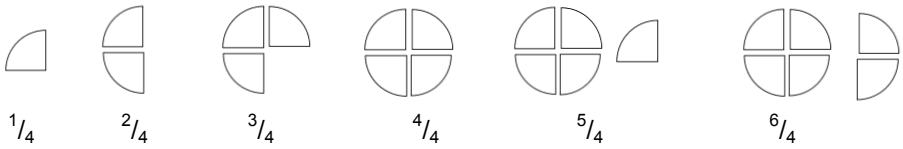
Repeat the above counting exercise using only the quarter pieces. This time counting by quarters:



$^1/_4$ $^2/_4$ $^3/_4$ $^4/_4$ $^5/_4$ $^6/_4$

Continue with $^7/_4$, $^8/_4$, $^9/_4$ …

Then by rearranging the pieces, count as:



$^1/_4$ $^2/_4$ $^3/_4$ $^4/_4$ $^5/_4$ $^6/_4$

Again compare the different ways of arranging and writing the same fraction. For example demonstrate:

- $^2/_4$ is the same as $^1/_2$
- $^4/_4$ is the same as 1
- $^5/_4$ is the same as $1^1/_4$ etc.

Draw students attention to:

- equivalent fractions like $^2/_4$ and $^1/_2$
- the meaning of fractions like $^4/_4$ and $^8/_8$
- mixed number notation and improper fraction notation e.g. $1^1/_4$ and $^5/_4$.

Practice Sheets 1 & 2 provide further practice with these ideas.

Once again, these concepts can be emphasised visually by the layout of the circle pieces. At this stage there is no need to look for the formal rules governing these relationships unless some of the students spot them for themselves and are easily able to use them.

Combining mixed numbers

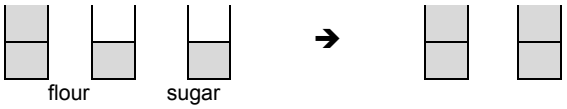
Explain to students:

- *Recipes often use $^1/_2$ and $^1/_4$ in them, for example $^1/_2$ cup of flour or sugar*
- *Sometimes we need to double a recipe or only make half of it*
- *It's good to understand what to do.*

Ask:

- *If a recipe says $^1/_2$ a cup of sugar and $1^1/_2$ cups of flour, how many cups of the mix will I have?*

Draw the situation to help students see that it will be two cups:



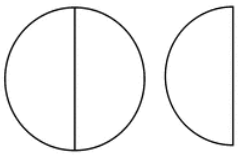
Ask:

- *What if I want to double the recipe?*
- *How many cups of sugar would I need?*
- *How many cups of flour?*
- *How many cups would I then have altogether?*

Exploring Mixed Numbers

Practice Sheet 1

1. Write the fraction 2 different ways under each picture.



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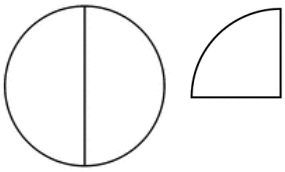
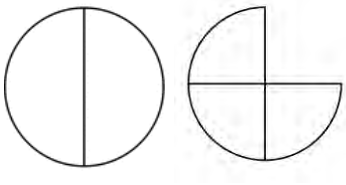


..... = ...



..... = ...

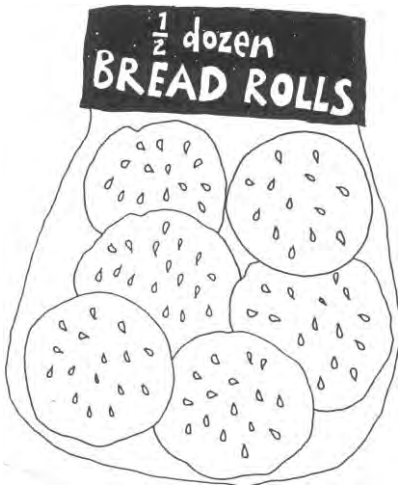
2. Draw lines between the fractions and the mixed numbers that are the same.

$1\frac{1}{2}$	$\frac{5}{4}$
$1\frac{1}{4}$	5 halves
$2\frac{1}{4}$	$\frac{4}{4}$
$1\frac{3}{4}$	4 halves
$2\frac{1}{2}$	$\frac{3}{2}$
1	four thirds
2	9 quarters
$1\frac{1}{3}$	7 quarters

Exploring Mixed Numbers

Practice Sheet 2

These bread rolls are sold in half dozen bags.



Children like to eat $^1/_2$ a roll each.

1. How many children will one bag feed?
2. How many rolls will 4 children eat?
3. How many rolls will 7 children eat?

At a childcare centre each child drinks $^1/_4$ of a litre of orange juice.

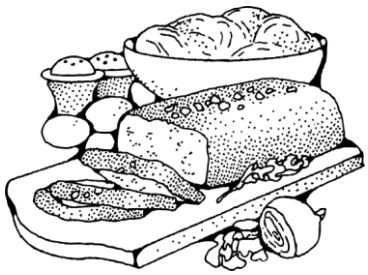
1. How many children will 3 litres serve?
2. If there are 6 children how many litres will you need?

Exploring Mixed Numbers

Practice Sheet 3

1. Here are the ingredients for a nut loaf:

$1\frac{1}{2}$ cups flour
pinch salt
$\frac{3}{4}$ cup butter
1 teaspoon mixed spice
$\frac{1}{4}$ cup sugar
$\frac{1}{2}$ cup chopped walnuts
$\frac{1}{3}$ cup sultanas
1 beaten egg
$\frac{1}{2}$ cup milk



Freda wants to make a double loaf. What will her ingredients be?

2. Here is Anna's muesli recipe.

3 ½ cups rolled oats
1 ½ cups wheat germ
¼ cup bran
½ cup sultanas
¾ cup sunflower seeds
1 ¼ cups mixed nuts
½ cup coconut

She wants to make twice as much. What will she need?