

Fractions, decimals and percentages (Year 8)

Introduction

These two lessons, each 50 to 60 minutes long, could form part of the unit Number 2 in the *Sample medium-term plans for mathematics* (DfES 0504/2001) towards the beginning of the autumn term in Year 8.

The lessons provide an opportunity to draw together pupils' understanding of the equivalence of fractions, decimals, percentages, ratio and proportion. They are key lessons within the unit and are intended to help teachers review the progress pupils have made in Year 7 in this crucial area of the Year 8 teaching programme.

Year 7 teachers might have used two similar lessons. If so, pupils will have completed some assessment sheets: N5b 'Mystery functions', N5e 'Peanut problems', and N5f 'How well am I doing?'. The sheets will highlight any errors and misconceptions that need to be addressed and should help Year 8 teachers to pitch work at a suitable level in these lessons on fractions, decimals and percentages in the autumn term.

The Year 8 assessment sheets N2d and N2e are designed to help teachers to pitch work at a suitable level when using the Year 8 multiplicative relationships unit in the file *Interacting with mathematics in Key Stage 3* (Year 8: DfES 0220/2002; Year 9: DfES 0588/2002).

Preparation

Lesson N2.1

- Operation cards (optional)
- Resource N2a, 'Matching 72', cut into cards for sorting; one set per three or four pupils
- 1–100 cards
- Calculators (for support)

Lesson N2.2

- Resource N2b 'Cake ingredients', cut up to sort, one set per three or four pupils
- Resource N2c 'Cake costs', cut up to sort, one set per three or four pupils
- Assessment N2d 'Odd one out', one per pupil
- Assessment N5e 'How well am I doing?', one per pupil

N2.1

Fractions, decimals and percentages (Year 8)

Objectives

- Begin to **use the equivalence of fractions, decimals and percentages to compare proportions.**
- Recall known facts, including fraction to decimal conversions; use known facts to derive unknown facts, including products such as 0.7 and 6, and 0.03 and 8.
- Consolidate and extend mental methods of calculation, working with decimals, fractions and percentages; solve word problems mentally.

Starter

Vocabulary

convert
equivalent
mixed number
improper

Resources

operation cards
(optional)

Draw a line on the board. Say that this line will be used to record equivalent operations. Label the ends with $\times 0$ and $\times 3$. Invite pupils to choose fraction, decimal or percentage operators to write on the line (or show where fraction, decimal and percentage operation cards should be placed on the line). Encourage pupils to use mixed number, proper and improper fraction, decimal and percentage operation equivalences.

Q Where should you place $\times 0.8$, $\times 1\frac{1}{3}$, $\times 1\%$, $\times 2.125$, ...?

Q How do you decide where the number should go?

Q Which operators does $\times 1.37$ come between?

Q How can you write this as a fraction operator? as a decimal operator? as a percentage operator?

Main activity

Vocabulary

equivalent
convert
numerator
denominator

Resources

N2a, cut into cards for sorting; one set per three or four pupils

1–100 cards

calculators (as support)

Write 0.8×35 on the board. Referring to the operation line used in the starter, explain that you can ask the same question in different ways, such as 80% of 35 or $\frac{4}{5} \times 35$.

Ask pupils to answer the question and to explain their methods, encouraging mental strategies.

Repeat with different questions. Cover questions that may lead to misconceptions, such as $\times 30\%$ being seen as the equivalent of $\times \frac{1}{3}$.

Q How else could you write 225% of 52? $1\frac{1}{3}$ of 210?

Matching 72

Give out the sets of cards from **resource N2a**, 'Matching 72'. Ask pupils to work in pairs to find which calculations are equivalent and to group the cards into sets. Ask pupils to answer the questions and to discuss different strategies for calculating proportions of 72.

Support: Use fewer cards. Using calculators may help some pupils identify groups of equivalent calculations.

Collect answers and discuss pupils' approaches in a mini-plenary.

Q Which calculations did you find difficult?

Q Were you surprised to find that any of the particular calculations were equivalent?

Making decisions

Write these or similar lists on the board:

$$\frac{4}{5} \quad 35$$

$$0.8 \quad 40$$

$$80\% \quad 23$$

Pose questions from the list, for example:

Q What is $\frac{4}{5} \times 35$, $\frac{4}{5} \times 40$, $\frac{4}{5} \times 23$?

Ask two or three pupils to explain how they tackled the questions.

Repeat for 0.8 and for 80%.

Q Are some questions easier to answer than others?

Ask pupils, working in pairs, to use sets of 1–100 cards to practise making decisions.

First ask them to write each of the three operations ($\times \frac{4}{5}$, $\times 0.8$, $\times 80\%$) on a blank piece of paper. Now they should choose a card in turn from the 1–100 number cards and decide which of the calculations, $\times \frac{4}{5}$, $\times 0.8$ or $\times 80\%$, they would use to tackle the question. They place the card in the appropriate pile.

In a mini-plenary, ask pupils to consider the connections between the numbers they have placed and the decisions they have made.

Q What made you decide between using $\times \frac{4}{5}$, $\times 0.8$ and $\times 80\%$?

Q Would a different fraction change your decision?

Differentiate the activity by changing the range of 1–100 cards that pupils work with.

Plenary

Ask pupils if they can explain the connection between fractions, decimals and percentages.

Q Can you explain why 20% of 35, $\frac{1}{5} \times 35$ and 0.2×35 give the same answer?

Q Can you think of a new set of equivalent fraction, decimal and percentage operators which you did not know at the start of this lesson?

Remember

- It is useful to remember some key equivalences. For example:
 $\frac{1}{10} = 0.1 = 10\%$ $\frac{1}{100} = 0.01 = 1\%$
 $\frac{1}{5} = 0.2 = 20\%$
- When you calculate with fractions, decimals or percentages, choose the operator that makes the calculation easy.

N2.2

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Starter

Vocabulary

equivalent

Write in the middle of the board:

$$0.7 \times 6 = 4.2$$

Invite pupils to give connected calculations, for example:

$$0.07 \times 6 = 0.42$$

$$0.7 \times 3 = 2.1$$

$$42 \div 0.6 = 70$$

Remind pupils that this is an example of using known facts to work out related facts.

Main activity

Vocabulary

proportion
per

Explain that in this lesson pupils are going to use their mental calculation strategies for decimals, fractions and percentages to solve some problems. They are solving a mystery. As in most thinking skills activities, pupils work collaboratively in groups (see *Training materials for the foundation subjects*, module 11, 'Principles for teaching thinking'; ref: DfES 0350/2002).

Resources

N2b and N2c, cut into cards for sorting; one set per three or four pupils

Cake problems

Ask pupils to work in groups of four. Ask each group to nominate a recorder and a chair (*Literacy across the curriculum*, session 7, 'The management of group talk'; ref: DfES 0235/2001).

Share out a set of cards from **resource N2b**, 'Cake ingredients', between the members of each group. Ask pupils to work together to use the information on the cards to work how much of each ingredient is used for the batch of ten cakes.

Circulate to observe the calculation strategies. Use the assessments you have received from Year 7 to probe pupils' understanding and to help them extend and refine their strategies.

Use a mini-plenary to discuss results and strategies, for example by asking:

- Q Which ingredients did you work out first?
- Q Did it matter in which order you worked on the different ingredients?
- Q Were any calculations difficult to do mentally?
- Q What information did you use to check that your results were right?

Give each group a copy of **resource N2c**, 'Cake costs'. Say that groups will be using this information to calculate the cost of the cakes. Again ask each group to nominate a chair and a recorder and to ensure pupils work together to find the cost of each of the ingredients and the total cost of the ten cakes.

Use another mini-plenary to collect answers and discuss pupils' approaches.

Q Which calculations were easy to work out?

Q How have you checked whether your calculations are correct?

plenary

Resources

N2d, one per pupil

N2e, one per pupil

Hand out **assessment N2d**, 'Odd one out', and **assessment N2e**, 'How well am I doing?'. Remind pupils that these should be familiar as they are similar to sheets they completed at the end of Year 7.

Remember

- Read the question (say it to yourself) and decide what information you need to use.
- Choose a calculation strategy that is easy to use with the numbers in the problem.
- Decide how you will check your work.