Guidance for Summer Numeracy Schools

Set 2

To support sessions 2 and 4

Rehearsing number facts using games and activities (with one-to-one support for individuals or small groups)

Set 2 contains 30 units supporting the rehearsal of number facts in sessions 2 and 4. Each session lasts 45 minutes. The units consist of games and activities for pupils to work on in small groups or pairs.

During the session, one teacher can demonstrate games and activities to the class and help and support pupils who are playing them. At the same time, the other teacher and teaching assistants should take individual pupils or small groups aside and give them focused teaching and support to help them achieve their individual or group targets.

Each unit sets out how the activity should be introduced and organised. When a game or activity is first used it should be demonstrated to the whole or part of the class before pupils play in pairs or small groups. Once some pupils know the rules, they can teach them to other pupils.

It is best to provide no more than four different activities in a session. This allows enough variety from one session to the next, and enough familiarity for pupils to get to know the rules.

Each unit provides possible simplification or extension of the main activity. This should allow you to choose the most appropriate games and activities for the pupils attending your summer school.

Some games and activities are dependent on commercial software and other material. Where this is the case, we provide both details of the software and the material and where they can be purchased. The decision to use these rests with the summer school.

Objectives

Unit	Objectives
2.1	**Cross-number puzzles 1 and 2** • read and write numbers in figures and words
2.2	**Number – place value** • read and write numbers in figures and words
2.3	**Tenners** • multiply and divide whole numbers and decimals by 10 or 100 and explain the effect
2.4	**Dominoes – multiplying decimals** • multiply whole numbers and decimals by 10 or 100 and explain the effect
2.5	**Guess the number** • order a given set of positive and negative integers
2.6	**Boxes – six in order** • order a given set of positive and negative integers
2.7	**Make 100 calculator game** • recognise decimals that total 1 and two-digit pairs that total 100
2.8	**Complements** • recognise decimals that total 1 and two-digit pairs that total 100
2.9	**MiniMax** • add or subtract mentally any pair of two-digit numbers • use known number facts and place value to consolidate mental addition and subtraction
2.10	**Darts** • add or subtract mentally any pair of two-digit numbers • use known number facts and place value to consolidate mental addition and subtraction
2.11	**Pass it on (addition and subtraction)** • know that an addition fact can be interpreted as a subtraction fact and vice versa
2.12	**Subtraction snake** • use known number facts and place value to consolidate mental addition and subtraction
2.13	**Making target numbers** • use known number facts and place value to consolidate mental addition and subtraction • use known facts, place value and a range of mental calculation strategies to multiply and divide mentally
2.14	**Four in a line – expressions** • use known number facts and place value to consolidate mental addition and subtraction • use known facts, place value and a range of mental calculation strategies to multiply and divide mentally

Unit	Objectives
2.15	**Zeros and nines** • calculate mentally differences such as 8006 – 2993
2.16	**Pass it on (multiplication and division)** • understand and use division as the inverse of multiplication
2.17	**Persistence numbers** • know by heart all multiplication facts up to 10 × 10 and derive quickly corresponding division facts
2.18	**Multiplication golf** • know by heart all multiplication facts up to 10 × 10 and derive quickly corresponding division facts • use known facts, place value and a range of mental calculation strategies to multiply and divide mentally
2.19	**Tables** • know by heart all multiplication facts up to 10 × 10 and derive quickly corresponding division facts
2.20	**Sevens** • derive quickly corresponding division facts
2.21	**Loop cards – doubles and halves** • derive quickly doubles and halves of whole numbers 1 to 100
2.22	**Four in a line – square numbers** • recall square numbers, including squares of multiples of 10, eg 60 × 60
2.23	**Square numbers investigation** • recall square numbers, including squares of multiples of 10, eg 60 × 60
2.24	**Happy numbers** • recall square numbers, including squares of multiples of 10, eg 60 × 60
2.25	**Dominoes – equivalent fractions** • recognise the equivalence of simple fractions • reduce a fraction to its simplest form
2.26	**Fraction codes** • recognise the equivalence of simple fractions • reduce a fraction to its simplest form
2.27	**Towers** • order a set of mixed numbers such as 2, $2\frac{3}{4}$, $1\frac{3}{4}$, $2\frac{1}{2}$, $1\frac{1}{2}$ and position them on a number line
2.28	**Decimal pelmanism** • use decimal notation for tenths and hundredths
2.29	**Loop cards – fractions, decimals and percentages** • relate fractions to their decimal representations
2.30	**Percentage bingo 1 and 2** • find simple percentages of small whole number quantities

Resources

A list of the resource materials you will need is given for each activity. Other resources will be provided by the Summer Numeracy School. Details are given in the chart below.

Units	Resources provided with the lesson, from which multiple copies may need to be made, or an OHT	Resources to be provided by the summer school
2.1	• Sheet 2.A1: 'Cross-number puzzle 1' • Sheet 2.A2: 'Cross-number puzzle 2' • Sheet 2.B: 'Numbers in words'	• none
2.2	• Sheet 2.B: 'Numbers in words'	• one computer per pair of pupils • ATM Developing Number software: 'Number' (Tasks 1, 2 and 4)
2.3	• none	• one computer per pair of pupils • MicroSMILE for Windows Pack 8: 'Numeracy' (program: 'Tenners')
2.4	• Sheet 2.C: 'Dominoes'	• none
2.5	• none	• one computer per pair of pupils • MicroSMILE for Windows Pack 3: 'A Sense of Number' (program: 'GuessN')
2.6	• none	• one computer per pair of pupils • MicroSMILE for Windows Pack 3: 'A Sense of Number' (program: 'BoxN') • large cards showing '+' and '–' • large 0–9 number cards
2.7	• none	• OHP • one calculator per pair of pupils • OHP calculator • blank 100-grid • pencil and paper
2.8	• none	• one computer per pair of pupils • ATM Developing Number software: 'Complements' grids A–D
2.9	• none	• one computer per pair of pupils • MicroSMILE for Windows Pack 3: 'A Sense of Number' (program: 'MiniMax') • 0-9 dice or large 0-9 number cards for demonstration
2.10	• Sheet 2.D: 'Darts'	• one computer per pair of pupils • MicroSMILE for Windows Pack 8: 'Numeracy' (program: 'Darts') • pencil and paper • OHP
2.11	• Sheets 2.E1 and 2.E2: 'Pass it on (addition and subtraction)' • Sheets 2.K1 and 2.K2: 'Pass it on (multiplication and division)' (optional)	• none
2.12	• Sheet 2.F: 'Subtraction snake' board	• two dice • counters (two colours) • OHP

Units	Resources provided with the lesson, from which multiple copies may need to be made, or an OHT	Resources to be provided by the summer school
2.13	• Sheet 2.G: 'Making target numbers'	• four dice
2.14	• Sheet 2.H: 'Four in a line – expressions'	• three dice for each group • counters (four colours)
2.15	• Sheet 2.I: 'Zeros and nines record sheet – thousands' • Sheet 2.J: 'Zeros and nines record sheet – hundreds'	• four dice for each pair of pupils • one calculator per pair of pupils • timer (optional)
2.16	• Sheets 2.K1 and 2. K2: 'Pass it on (× and ÷)'	• none
2.17	• Sheet 2.L: 'Persistence numbers'	• pencil and paper • large 100-grid for demonstration • individual 100-grids
2.18	• Sheets 2.M1 and 2.M2: 'Multiplication golf – score sheet'	• OHP
2.19	• none	• one computer per pair of pupils • ATM Developing Number software: 'Tables'
2.20	• Sheet 2.N: 'Sevens' board	• dice • counters • OHP
2.21	• Sheets 2.P1–4: 'Loop cards – doubles and halves'	• none
2.22	• Sheet 2.Q: 'Four in a line – square numbers'	• ten-sided dice or 1–10 number cards • coloured counters for each player • OHP
2.23	• Sheet 2.R: 'Square numbers investigation'	• OHP
2.24	• none	• pencil and paper
2.25	• Sheets 2.S1–5: 'Dominoes – equivalent fractions'	• none
2.26	• Sheet 2.T: 'Fraction codes 1' • Sheet 2.U: 'Fraction codes 2'	• none
2.27	• none	• one computer per pair of pupils • MicroSMILE for Windows Pack 3: 'A Sense of Number' (program: 'Towers')
2.28	• none	• set of decimal playing cards for each group • decimal playing cards on OHTs • OHP
2.29	• Sheets 2.V1 and 2.V2: 'Loop cards – fractions, decimals and percentages'	• none
2.30	• Sheets 2.W1 and 2.W2 • Sheets 2.X1 and 2.X2: 'Percentage bingo 1' • Sheets 2.Y1 and 2.Y2: 'Percentage bingo 2'	• counters

Cross-number puzzles 1 and 2

Individual

Resources

Sheet 2.A1: 'Cross-number puzzle 1'
Sheet 2.A2: 'Cross-number puzzle 2'
Sheet 2.B: 'Number in words'

Language

one, two...
hundred, thousand, million

Objective

- read and write numbers in figures and words

Introduction and organisation

Introduce this activity by explaining that the numbers written in figures give the answers to the clues.

Demonstrate by saying a few numbers and asking pupils to tell you how to write them in figures.

Questions to ask:

How would you write this number?
What does this digit mean in this number?

Simplifications

Provide Sheet 2.B: 'Numbers in words' for those who find the reading difficult.

'Cross-number puzzle 1' (Sheet 2.A1) limits the numbers to four digits and gives practice with 'teen' numbers.

Challenge

'Cross-number puzzle 2' (Sheet 2.A2) includes seven-digit numbers.

Answers for 'Cross-number puzzle 1'

1 5	0	2 3	3 1	■	4 1	4	5 1	6 2	■
3 0	■	7 6	4	8 8	6	■	9 2	4	■
10 2	11 1	0	■	0	■	12 3	8	1	13 1
■	0	■	14 4	6	■	15 4	3	5	2
16 1	9	■	17 1	3	8	1	■	■	■
18 8	7	3	■	■	■	19 1	20 1	■	21 6
■	■	■	22 1	3	■	■	0	■	0
23 3	0	7	1	■	■	■	24 3	25 4	1
0	■	■	26 3	27 5	28 8	■	29 6	5	2
30 9	2	6	■	31 1	7	■	■	9	■

Clues Across

1. Five thousand and thirty-one
4. One thousand, four hundred and twelve
7. Six thousand, four hundred and eighty-six
9. Twenty-four
10. Two hundred and ten
12. Three thousand, eight hundred and eleven
14. Forty-six
15. Four thousand, three hundred and fifty-two
16. Nineteen
17. One thousand, three hundred and eighty-one
18. Eight hundred and seventy-three
19. Eleven
22. Thirteen
23. Three thousand and seventy-one
24. Three hundred and forty-one
26. Three hundred and fifty-eight
29. Six hundred and fifty-two
30. Nine hundred and twenty-six
31. Seventeen

Clues Down

1. Five hundred and two
2. Three hundred and sixty
3. Fourteen
4. Sixteen
5. One thousand, two hundred and eighty-three
6. Two thousand, four hundred and fifteen
8. Eight thousand and sixty-three
11. One thousand and ninety-seven
12. Three thousand, four hundred and eleven
13. Twelve
14. Forty-one
16. Eighteen
20. One thousand and thirty-six
21. Six thousand and twelve
22. One hundred and thirteen
23. Three hundred and nine
25. Four hundred and fifty-nine
27. Fifty-one
28. Eighty-seven

Answers for 'Cross-number puzzle 2'

1 4	6	2 2	3 8	■	4 2	0	5 7	6 9	1
0	■	7 9	0	8 4	1	■	9 6	7	■
10 5	11 1	0	■	0	■	12 1	0	6	13 4
■	0	■	14 5	2	■	15 9	4	2	6
16 9	4	■	17 2	9	0	4	■	5	■
18 8	0	0	4	7	■	19 2	20 9	■	21 6
■	■	■	22 6	8	0	7	1	■	0
23 5	0	0	2	■	■	■	24 4	25 9	7
6	■	■	26 6	27 4	28 2	6	2	0	3
29 4	6	0	■	30 3	0	■	31 5	9	0

Clues Across

1. Four thousand, six hundred and twenty-eight
4. Twenty thousand, seven hundred and ninety-one
7. Nine thousand and forty-one
9. Sixty-seven
10. Five hundred and ten
12. One thousand and sixty-four
14. Fifty-two
15. Nine thousand, four hundred and twenty-six
16. Ninety-four
17. Two thousand nine hundred and four
18. Eighty thousand and forty-seven
19. Twenty-nine
22. Sixty eight thousand and seventy-one
23. Five thousand and two
24. Four hundred and ninety-seven
26. Six million, four hundred and twenty-six thousand, two hundred and three
29. Four hundred and sixty
30. Thirty
31. Five hundred and ninety

Clues Down

1. Four hundred and five
2. Two hundred and ninety
3. Eighty
4. Twenty-one
5. Seven thousand, six hundred and four
6. Ninety seven thousand, six hundred and twenty-five
8. Four hundred and two thousand, nine hundred and seventy-eight
11. One thousand and forty
12. Nineteen thousand, four hundred and twenty-seven
13. Forty-six
14. Five hundred and twenty-four thousand, six hundred and twenty-six
16. Ninety-eight
20. Ninety-one thousand, four hundred and twenty-five
21. Sixty thousand, seven hundred and thirty
23. Five hundred and sixty-four
25. Nine hundred and nine
27. Forty-three
28. Twenty

Number – place value

Unit 2.2

Resources

one computer per pair of pupils
ATM Developing Number software: 'Number' (Tasks 1, 2 and 4)
Sheet 2.B: 'Numbers in words'

Language

one, two...
hundred, thousand

Groups of 2 or Individuals

Objective

- read and write numbers in figures and words

Introduction and organisation

Introduce this program by explaining the different tasks and doing a few examples on the board. Include examples which have zero as a place holder, such as 2048.

Task 1 presents the number in words and the pupil has to make it using numbers from a place value chart.

Task 2 presents the number in words and the pupil has to type in the number in figures.

Task 4 presents a number in figures and the pupil has to select the words for the number. Each task has four levels of difficulty.

Pupils can work in pairs or individually at the computer.

Questions to ask:

How would you write this number?
What does this digit mean in this number?

Simplification

Provide Sheet 2.B: 'Numbers in words' for those who find the reading difficult.

Challenge

Go to level 4 on each task.

Unit 2.3

Tenners

Resources

Groups of 2

one computer per pair of pupils
MicroSMILE for Windows Pack 8: 'Numeracy' (program: 'Tenners')

Language

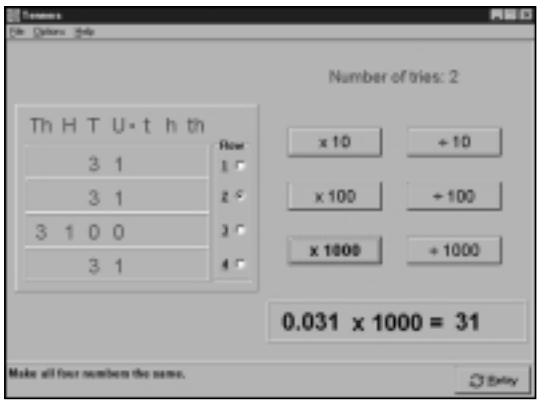
decimal point, digits, place, tenths hundredths

Objective

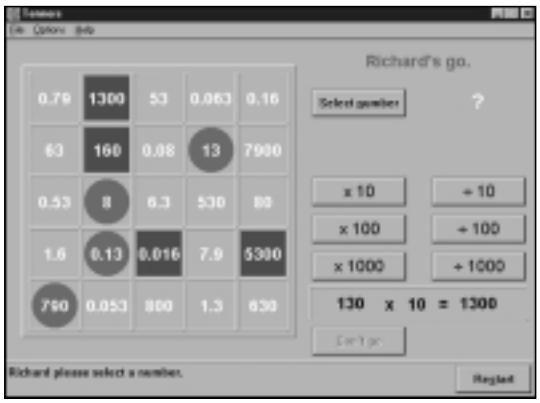
- multiply and divide whole numbers and decimals by 10 or 100 and explain the effect

Introduction and organisation

Demonstrate the program 'Tenners'. Pupils work in pairs to make the given four decimal numbers equal by multiplying or dividing by 10, 100 or 1000.



After a few practice games encourage pupils to play the three-in-a-line game.



Questions to ask:

What happens when you multiply this number by 10?... By 100?... By 1000?
What happens when you divide this number by 10?... By 100?... By 1000?

Simplification

Allow pupils to work with a calculator to begin with so that they see what happens when they multiply or divide by 10, 100 and 1000.

Challenge

There are challenges built into the program, once the pupils have played some games without errors.

Dominoes – multiplying decimals

Unit 2.4

Resources

Sheet 2.C: 'Dominoes'

Language

multiply, divide, place value, thousands
hundreds, tens, units, tenths
decimal point

Groups of 2–4

Objective

- multiply whole numbers and decimals by 10 or 100 and explain the effect

Introduction and organisation

This game is played as a normal domino game.

Before playing the game check that pupils can multiply decimal numbers by 10 or 100.

If four pupils are playing, all the dominoes are dealt. If fewer are playing, then six dominoes are dealt to each player and the remainder left upside down on the table for picking up during the game. The players take it in turns to place a domino. The first player who has a double lays it down to start the game. If no players have doubles they take turns to pick up one of the concealed dominoes until a double is found.

Placement of a domino can be challenged. If the challenge is correct, then the player who put down the incorrect domino misses that go. If the challenge is incorrect, the challenger misses a go. The winner is the player who uses up their dominoes first.

Questions to ask:

What will happen to this digit/number when you multiply/divide by 10?... By 100?... By 1000?

Will this number get bigger or smaller when you multiply/divide by 10?... By 100?... By 1000?

Simplifications

Before playing the game, pairs of pupils can practise with the dominoes until they can correctly make a sequence of five or six dominoes with everything matched correctly.

A calculator could be used to check players' moves until pupils are more confident.

Challenge

The group could try to finish the game more quickly than their previous record.

Unit 2.5

Guess the number

Resources

Groups of 2

one computer per pair of pupils

MicroSMILE for Windows Pack 3:
'A Sense of Number' (program: 'GuessN')

Language

one, two...
negative one, negative two...
positive, negative, too small, too big

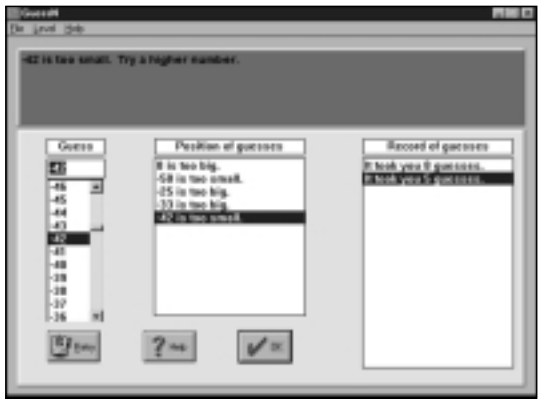
Objective

- order a given set of positive and negative integers

Introduction and organisation

Play 'Guess the number' as a class. Choose a number between 0 and 100. The aim is to guess the number in the minimum number of guesses. Pupils take turns to guess the number and are given the feedback 'too big' or 'too small'. Record on the board. Point out when guesses don't take into account the information already given. Discuss strategies – guessing 'middle numbers' generates the most information.

In pairs, pupils play 'GuessN' on the computer.



Questions to ask:

What would be a sensible next guess?

Simplification

'Guess' provides the same activity with numbers between 0 and 100, then 0 and 1000.

'GuessD' uses decimal numbers between 0 and 10, firstly with one decimal place, then two and three decimal places.

For 'GuessN', provide a number line with positive and negative numbers on so that pupils can see how they are ordered.

Challenge

There is a higher level, which uses numbers between –10 and +10 with 1 decimal place.

'BoxN' has more difficult activities on the same theme.

Boxes – six in order

Unit 2.6

Resources

one computer per pair of pupils
MicroSMILE for Windows Pack 3:
'A Sense of Number' (program:'BoxN')
large cards showing '+' and '–'
large 0–9 number cards

Language

one, two...
negative one, negative two...
positive, negative

Groups of 2

Objective

- order a given set of positive and negative integers

Introduction and organisation

Demonstrate the activity on the board using $-30 < \square < \square < \square < \square < +30$.

Explain that the aim of the game is to get six numbers in order. (Generate numbers by picking up a card from each of three piles. The first pile has '–' or '+', the second '0', '1' or '2', the third any digit. Combine the three cards to make a positive or negative integer lying between –30 and +30.)

Discuss which box to place the two-digit number in. Repeat for three more numbers. Discuss strategies when placing numbers.

Pupils work in pairs on the computer program 'BoxN', or try 'BoxD' which uses decimal numbers between 0 and 10, firstly with one decimal place, then two and three decimal places.

Questions to ask:

Where will you put this number? How did you decide?
Is this number larger or smaller than the last number?

Simplification

Play 'GuessN' first for familiarity with ordering directed numbers.

'Box' provides the same activity with numbers between 0 and 100, then 0 and 1000.

Challenge

The higher levels involve directed decimal numbers.

Encourage pupils to better their previous best scores.

Unit 2.7

Make 100 calculator game

Groups of 2

Resources

OHP
calculators
pencil and paper
OHP calculator
blank 100-grid

Language

complement

Objective

- recognise decimals that total 1 and two-digit pairs that total 100

Introduction and organisation

Introduce the game by demonstrating it with an OHP calculator.

Pupils play this game in pairs. Pupil A puts a two-digit number into the calculator. Pupil B has to add the number which will make 100. For example: A puts in '43'; B has to key in '+ 57 =' to gain a point.

Pupils can keep the score for their pair.

Questions to ask:

How did you work that out?

Simplifications

Start with complements to 10 or 20.
The first number to be entered must be less than 10 (or 20).

Provide a blank 100-grid to assist those who would find the mental calculation of complements to 100 too difficult.

Challenge

Use pairs of decimals with one decimal place which total 10, then pairs of decimals with two decimal places which total 1.

Complements

Unit 2.8

Resources

one computer per pair of pupils

ATM Developing Number software: 'Complements' grids A–D

Language

subtract, minus, complement
difference between, multiple
nearest

Groups of 2 or Individual

Objective

- recognise decimals that total 1 and two-digit pairs that total 100

Introduction and organisation

Demonstrate by doing a few examples on the board.

Pupils can start with grid A: 1–100. There are eight levels in this program from complements to 10 (Stage 1) through complements to 100 (Stage 3) with progressively more difficult numbers.

The program also features:

— grid B: 10–1000
— grid C: 0.1–10
— grid D: 0.01–1

Each grid has eight levels of difficulty.

Questions to ask:

How can the grid help you to find the difference between these numbers?
What multiple of 10 is nearest to this number?
How many tens numbers are there between this?

Simplification Use the supportive grid and work with grid A.

Challenge Work with decimal numbers in grids C and D.

Unit 2.9

MiniMax

Resources

one computer per pair of pupils
MicroSMILE for Windows Pack 3:
'A Sense of Number' (program: 'MiniMax')
0-9 dice or large 0-9 number cards, for demonstration

Language

digit, units place, tens, hundreds

Groups of 2

Objectives

- add or subtract mentally any pair of two-digit numbers
- use known number facts and place value to consolidate mental addition and subtraction

Introduction and organisation

Demonstrate the program by drawing an array on the board: □ □ □ + □ □.
Roll the dice or turn over a number card to generate a digit. The pupils suggest where to place the digit in the array. Generate and place four more digits in the same way. The aim is to make the maximum possible answer to the calculation, using five digits and addition.

You can also model using subtraction, multiplication and division, and making the minimum possible version.

Pupils work in pairs on the computer program.

Questions to ask:

What is the best place for a small digit in this sum?
What is the best place for a large digit in this sum?

Simplification Provide teacher support.

Challenge Use the multiplication and division version.

Darts

Unit 2.10

Resources

one computer per pair of pupils
MicroSMILE for Windows Pack 8: 'Numeracy' (program: 'Darts')
pencil and paper
Sheet 2.D: 'Darts' on an OHT
OHP

Language

double, treble, subtract

Groups of 2

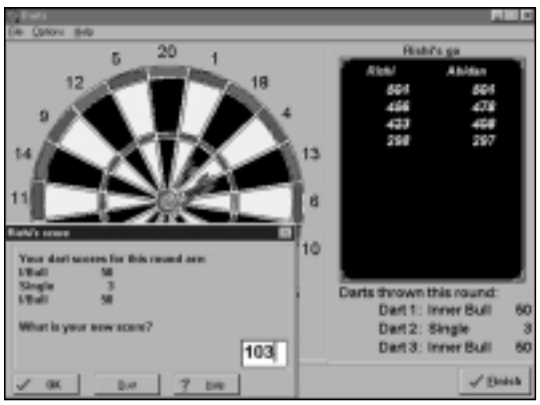
Objectives

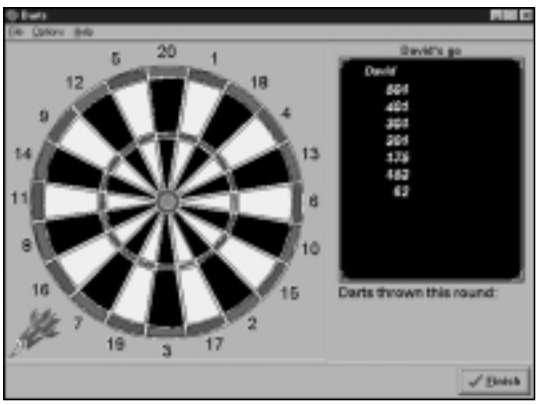
- add or subtract mentally any pair of two-digit numbers
- use known number facts and place value to consolidate mental addition and subtraction

Introduction and organisation

Demonstrate the non-computer game 'Darts' (Sheet 2.D) on an OHP. Start with a score of 101, and choose the landing places of three darts: one treble (inner coloured ring), one double (outer coloured ring) and one single. Model working out the score, subtracting from 101. Work out how to reach 0 exactly.

Pupils work in pairs on the computer program 'Darts'.





Questions to ask:

What score do you need to win the game?
How could you get that score with three darts?
Are there other ways to get that score?
Can you win if you don't get any doubles or trebles on this round?

Simplification

Support for calculations is provided in the program.

Challenge

Challenges are built into in the program.

Unit 2.11

Pass it on (addition and subtraction)

Groups of 3

Resources

Sheets 2.E1 and 2. E2: 'Pass it on (addition and subtraction)'

Sheets 2.K1 and 2.K2: 'Pass it on (multiplication and division)' (optional)

Language

addition, subtraction, inverse operation

Objective

- know that an addition fact can be interpreted as a subtraction fact and vice versa

Introduction and organisation

Introduce on the board by showing a line representing an addition calculation:

37	
12	25

Write one of the addition sentences and ask pupils for the other. Write one of the subtraction sentences and ask pupils for the other. Emphasise that for any addition sentence, there are three other number sentences which can be generated.

Play the game 'Pass it on', following the rules on the sheet. The game is played like Consequences.

Questions to ask:

What is the other addition sentence here?
Which number will you start your subtraction with?

Simplification

Use numbers under 30.
Use number lines to support calculations using two-digit calculations.

Challenge

Use Sheet 2.K: 'Pass it on (× and ÷)'

Subtraction snake

Unit 2.12

Resources

two dice
counters (two colours)
Sheet 2.F: 'Subtraction snake' board for each pair
Sheet 2.F: 'Subtraction snake' board on an OHT
OHP

Language

digit, subtract, minus, difference

Groups of 2

Objective

- use known number facts and place value to consolidate mental addition and subtraction

Introduction and organisation

To introduce this game, demonstrate with the 'Subtraction snake' board (Sheet 2.F) on an OHP. For example, if the dice give the four digits

2	4	6	3

a total of 12 positive differences can be made. Answers to five of these are on the 'Subtraction snake' board, for example:

46 – 23 = 23 and 63 – 42 = 21

Place a counter on one of the answers on the board.

Pupils play this activity in pairs. The game is finished when one player gets four in a line.

Questions to ask:

Can you make a different number with these digits?
How many different numbers can you make with these digits?

Simplifications

Encourage pupils to use a number line to do the calculations.

Use three dice. Make a two-digit number and subtract the third.

Challenge

For pupils who find the subtraction easy, encourage them to see how many different numbers they can cover up with the minimum number of throws.

Unit 2.13

Making target numbers

Individual

Resources

Sheet 2.G: 'Making target numbers'
four dice

Language

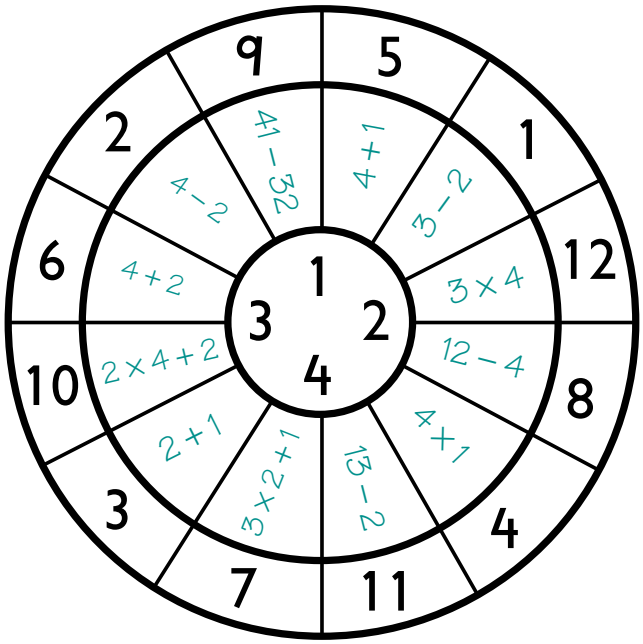
operation, add, subtract, multiply
divide, product

Objectives

- use known number facts and place value to consolidate mental addition and subtraction
- use known facts, place value and a range of mental calculation strategies to multiply and divide mentally

Introduction and organisation

Demonstrate the game according to the rules on the sheet.



Questions to ask:

Which totals can you make using only addition?
Is there a product which would be useful here?
Can you use something you've already done to help you here?

Simplification

Use a calculator.

Challenges

Ask for as many ways as possible for each target number.

Make a similar puzzle for a partner.

Four in a line – expressions

Unit 2.14

Resources

three dice for each group
counters (four colours)
Sheet 2.H: 'Four in a line – expressions'

Language

digit

Groups of 4

Objectives

- use known number facts and place value to consolidate mental addition and subtraction
- use known facts, place value and a range of mental calculation strategies to multiply and divide mentally

Introduction and organisation

Introduce by demonstrating with three dice and showing how to make a variety of different numbers. For example, 4, 5 and 2 could be used to make 52 ÷ 4 = 13. Continue throwing the three dice to make different numbers on the board.

If the answer matches a number on the board, cover the number with a counter.

The aim is to get four counters in a line horizontally, vertically or diagonally.

Questions to ask:

What different expressions can you make with these three digits?
[To pupils who consistently only use one or two operations] Can you use multiplication or division to make different numbers?

Simplification

Use a calculator.

Challenge

Impose time limits on each throw. For a given throw, all pupils in the group try to make an expression. The one with the highest total can put their own counter on the number generated.

Unit 2.15

Zeros and nines

Groups of 2

Resources

four dice for each pair of pupils
calculators
timer (optional)
Sheet 2.I: 'Zeros and nines record sheet – thousands'
Sheet 2.J: 'Zeros and nines record sheet – hundreds'

Language

nearest 1000

Objective

- calculate mentally differences such as 8006 – 2993

Introduction and organisation

For each round, four dice are thrown. The largest number is put in the first box on the record sheet. The other three numbers can be put in any of the other three empty boxes. This will give a calculation like '6004 – 4992 =' which pupils should work out mentally.

Demonstrate this on the board using the same format as on the record sheet. Show how different subtractions can be made from four digits and model finding the answer. Ask pupils for their methods of finding the answer and demonstrate how the empty number line can be used (see below). When they have found all the possible calculations (six if there are no duplicate digits), they throw the dice again to generate some more numbers.

When they have completed the sheet, they check their answers with a calculator and gain a score out of 24. They could also time themselves and try to beat their previous best time.

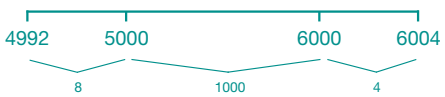
Questions to ask:

What is the nearest thousand?
How many to the nearest thousand?

Simplification

Play with three-digit numbers (for example, 405 – 297). Use the record sheet for hundreds so that pupils learn the strategy of using the nearest hundreds before moving on to the thousands.

Encourage pupils to draw blank number lines to help with the concept of calculating to the nearest 1000.



Answer: 1012

Challenges

Use eight-sided dice for a greater selection of numbers. Encourage speed and accuracy to better the previous best score and time.

Play with five-digit or six-digit numbers (for example, 30006 – 19995).

Pass it on (multiplication and division)

Unit 2.16

Resources

Sheets 2.K1 and 2.K2:
'Pass it on (multiplication and division)'

Language

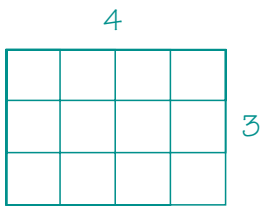
multiplication, division, inverse operation
factor, multiple, product, quotient

Groups of 4

Objective

- understand and use division as the inverse of multiplication

Introduction and organisation



Introduce the activity on the board. Show a rectangular array representing a multiplication. Write one of the multiplications and ask pupils what the other one is. Then write one of the corresponding divisions and ask them for the other one. Emphasise that for any multiplication, there are four calculations which can be generated. Introduce the inverse operation.

The game is played in the same way as Consequences. Player 1 begins by filling in a number in the first box. They pass on the paper in a clockwise direction. Player 2 fills in the second number and passes on again. Player 3 fills in the answer and passes it on. Each paper arrives back where it started. The group now has to find the other three calculations which correspond to the original multiplication. After a specified time limit, say one minute, the calculations are checked. The group receives a point for each one correct. Three rounds are played starting with multiplication and then three rounds starting with division. In the division rounds the second person must fill in a number which is a factor of the first number. The winner is the one with the most points at the end.

Questions to ask:

What is the other multiplication here?
Which number will you start your division calculations with?

Simplification

For multiplication, restrict the numbers in the multiplication to the numbers 2, 3, 4, 5 and 10. In the division, start with a number under 50 which is a multiple of 2, 3, 4, 5 or 10. Encourage pupils to draw rectangular arrays as support.

Challenge

For multiplication insist on numbers above 5, and for division the first number should be between 30 and 100.

Unit 2.17

Persistence numbers

Whole Class or Groups of 2

Resources

pencil and paper
large 100-grid for demonstration
individual 100-grids
Sheet 2.L: 'Persistence numbers'

Language

multiply, product, digits

Objective

- know by heart all multiplication facts up to 10 x 10 and derive quickly corresponding division facts

Introduction and organisation

To demonstrate this activity choose any number less than 100. Then multiply the number of tens by the number of units until your answer is a single digit. Now, count how many times you multiplied. This is the persistence of the number that you started with.

72 → 7 x 2 = 14 → 1 x 4 = 4
'persistence 2'

88 → 8 x 8 = 64 → 6 x 4 = 24 → 2 x 4 = 8
'persistence 3'

Ask the pupils to choose a new number, then apply the rule to discover its 'persistence'.

Questions to ask:

What is the biggest number you can find with 'persistence 1'?
What is the smallest number with 'persistence 2'?
Can you find other 'persistence 2' numbers?
Can you find numbers of 'persistence 1, 3, 4' or more?
Do any numbers have 'persistence 0'?

Simplification

This activity can be done by groups of pupils or by the whole class with the 'persistence' of the numbers recorded, in different colours, on a large 100-grid.

Challenge

How would you adapt the rule to be able to investigate numbers greater than 99?

Multiplication golf

Unit 2.18

Resources

Sheet 2.M1: 'Multiplication golf – score sheet' for each pair
Sheet 2.M1: 'Multiplication golf – score sheet' on an OHT
Sheet 2.M2: 'Multiplication golf – score sheet', blank
OHP

Language

multiply, product

Groups of 2 or Individual

Objectives

- know by heart all multiplication facts up to 10 x 10 and derive quickly corresponding division facts
- use known facts, place value and a range of mental calculation strategies to multiply and divide mentally

Introduction and organisation

To introduce this game explain the game of golf and that different numbered golf clubs can hit balls different distances when hit with different strengths. Sheet 2.M1: 'Multiplication golf – score sheet' gives the number of holes to be played and the distance the ball has to travel for each hole. There is a list of the different number golf clubs and the strengths the player may use to wield the clubs.

If the player selects club number 2 and chooses to wield it with strength 6, the ball will travel a distance of 12 (that is, 2 x 6). If this distance is not enough to get the ball to the hole, the player may hit the ball again – with a different club if necessary. The object of the game is to get the ball into the hole with the minimum number of strokes.

Clubs 2 5 8 Strengths 1 6 7

Hole	Length	Distance travelled at each stroke	Number of strokes
1	26	2 x 7 = 14 2 x 6 = 12	2
2	44	5 x 7 = 35 2 x 1 = 2 5 x 1 = 5 2 x 1 = 2	4

Questions to ask:

Have you used the least number of strokes?
Is there another way of getting the ball into the hole?

Simplification

Use the tables the pupils know well to fill in appropriate club numbers and strengths on the blank score sheet, Sheet 2.M2.

Challenge

Vary the length of the holes and change the numbers of the clubs and the strengths on Sheet 2.M2.

Unit 2.19

Tables

Resources

one computer per pair of pupils
ATM Developing Number software: 'Tables'

Language

multiply, divide, division, table, product

Groups of 2 or Individual

Objective

- know by heart all multiplication facts up to 10 x 10 and derive quickly corresponding division facts

Introduction and organisation

Practise the chosen times table as a class, chanting it forwards and backwards and answering questions which include the division facts.

Explain that the program will help the pupils to practise the table in different ways and give them timed challenges.

For each times table there are six stages possible:

Stages 1–4: simple times table questions with progressively less help.

Stages 5–6: questions presented in different ways including as division facts.

Pupils work in pairs or individually at the computer.

Questions to ask:

How many 6s are there in 30?
What is 6 x 7?
Do you know 7 x 7?
Could you work out 6 x 7 from 7 x 7?
What is a quick way of working out 8 x 7?

Simplification — Choose simple multiplication tables (2, 3, 4, 5, 10) and Stages 1–4.

Challenge — Choose more difficult tables (6, 7, 8) and Stages 5–6.

Sevens

Resources

dice
counters
Sheet 2.N: 'Sevens' board for each pair
Sheet 2.N: 'Sevens' board on an OHT
OHP

Language

digits, divide, remainder

Groups of 2

Objective

- derive quickly corresponding division facts

Introduction and organisation

Demonstrate this game with the 'Sevens' board (Sheet 2.N) on an OHP. To play the game you throw the dice. The number thrown is the remainder when a number is divided by seven.

For example, if you throw a 4, a counter could be placed on 11, or on 18, or on any other number on the board that when divided by 7 gives a remainder of 4.

Pupils can play in pairs and take turns to throw the dice. The winner is the first to cover all the numbers on their board.

Questions to ask:

How many different numbers can you cover with a throw of 4?… Of 2?

Simplification

If the children are unsure of the seven times table, let them start by having a copy of the table to refer to, but later encourage them to do without it.

Challenge

Devise a way of playing the game with different times tables, by changing the numbers on the playing boards. The boards should leave a remainder of 1 to 6 when divided by the 'tables number'. Choose three with remainder 1, three with remainder 2, and so on.

Unit 2.21

Loop cards – doubles and halves

Whole Class or Groups of 4–6

Resources

set of loop cards made from Sheets 2.P1–4: 'Loop cards – doubles and halves' (several sets of the same cards could be made from different coloured card)

Language

double, half, halve

Objective

- derive quickly doubles and halves of whole numbers 1 to 100

Introduction and organisation

Demonstrate the game to the class. Deal all the cards out, giving some pupils more than one if necessary. Take a card and read out the bottom statement. The pupil who has the card with the answer on it reads out the top statement. Repeat this until the group arrives back at the starting point on the initial card.

Questions to ask:

How do you work out half of a number?
How do you work out double a number?

Simplifications

Make a secret mark on the easier answer cards and make sure pupils are given appropriate cards.

Replay the game with the same cards so that pupils get practice.

Challenge

Set time targets, reshuffling the cards between each round.

Four in a line – square numbers

Unit 2.22

Resources

ten-sided dice or 1–10 number cards
coloured counters for each player
Sheet 2.Q: 'Four in a line – square numbers' for each pair
Sheet 2.Q: 'Four in a line – square numbers' on an OHT
OHP

Language

square number, horizontal vertical, diagonal

Groups of 2–4

Objective

- recall square numbers, including squares of multiples of 10, eg 60 × 60

Introduction and organisation

Demonstrate by showing the 'Four in a line – square numbers' board (Sheet 2.Q) on an OHT. Throw a ten-sided dice, square the number and choose which square on the board with that number you will cover.

Each player in turn throws a dice or picks a number card, squares the number and puts a counter on one of the square numbers. Play continues, each player trying to make a line of four counters horizontally, vertically or diagonally, and also trying to block the other players.

Questions to ask:

What is the square of… ?

Simplifications

Try to make three in a line.

Change the board so that only the squares up to 36 appear and use a six-sided dice.

Challenges

Try to make five in a line.

Include number cards with negative numbers on them.

Unit 2.23

Square numbers investigation

Groups of 2 or Individual

Resources

Sheet 2.R: 'Square numbers investigation' for each pupil
Sheet 2.R: 'Square numbers investigation' on an OHT
OHP

Language

square number, diagonal

Objective

- recall square numbers, including squares of multiples of 10, eg 60 × 60

Introduction and organisation

To introduce this activity, show an OHT version of Sheet 2.R ('Square numbers investigation'). Start the pattern off by colouring in the squares when reaching the next square number.

Pupils follow instructions on the sheet to write the numbers in a spiral formation, colouring in squares as they reach a square number. The resulting pattern shows how each square is made from the square before, adding on the next odd number, so 16 = 9 + 7, 25 = 16 + 9, and so on. Square numbers appear in diagonal lines with the odd numbers in one diagonal and the even numbers in another.

Questions to ask:

Can you find a pattern between one square number and the next square number?

What do you notice about the squares you have coloured in? [Even squares lie centrally within even squares, odd squares centrally within odd squares.]

Simplifications

Some pupils may need help to keep the numbers going in the correct spiral.

Stop at 49 or 64.

Challenges

After doing the first hundred, predict where the next square numbers are going to come.

Investigate the opposite corners of each square for other patterns in the progression of the squares.

Happy numbers

Unit 2.24

Resources
pencil and paper

Language
square numbers, sum, total

Groups of 2 or Individual

Objective
- recall square numbers, including multiples of 10, eg 60 × 60

Introduction and organisation

To demonstrate this activity choose any two-digit number. To find out if a number is a 'happy number' you take the two digits and square each of them to make a new number. Then find the sum of these square numbers. Keep repeating the process until you get to 1.

For example:

Is 23 a 'happy number'?

23
4 + 9
13
1 + 9
10
1 + 0
1

Therefore 23 is 'happy'!

Set the pupils the task of finding other 'happy numbers'.

Questions to ask:

Do you need to trial every number?
When do you know that a number is never going to be happy?

Simplification Give the pupils who are unsure of their square numbers a list of them.

Challenge Use numbers that are greater than a hundred.

Unit 2.25

Dominoes – equivalent fractions

Groups of 2–4

Resources

set of dominoes made from Sheets 2.S1–5: 'Dominoes – equivalent fractions', for each group

Language

equivalent, numerator, denominator
multiply, divide, simplest form, cancel

Objectives

- recognise the equivalence of simple fractions
- reduce a fraction to its simplest form

Introduction and organisation

To play this game pupils should be familiar with equivalent fractions and the concept of multiplying or dividing the numerator and denominator by the same number to find equivalent fractions. The concept of the simplest form should also have been established.

Introduce the game by giving out all the dominoes and using them to play a 'follow-me' game around the class.

Pupils should play the game in groups. If four people are playing, all the dominoes are dealt. If fewer are playing, then six are dealt to each player and the remainder left upside down on the table for picking up during the game. The player on the left of the dealer begins (or the player with the largest denominator). Pupils take turns to play. If they cannot play, they pick up an extra domino if there are any, and the turn passes around the table in a clockwise direction. The first player to get rid of all their dominoes is the winner.

Note: Placement can be challenged. If the challenge is correct, then the player who put down the incorrect domino misses that turn. If the challenge is incorrect, the challenger misses a go.

Questions to ask:

What could you divide both the numerator and denominator by?
What is the simplest form of this fraction?

Simplification

Ask pupils to generate lists of equivalent fractions and use them as a support when playing the game.

Challenge

Challenge pupils to better their previous time without errors.

Fraction codes

Unit 2.26

Resources

Sheet 2.T: 'Fraction codes 1'
Sheet 2.U: 'Fraction codes 2'

Language

fraction, equivalence, numerator denominator, simplest form

Individual

Objectives

- recognise the equivalence of simple fractions
- reduce a fraction to its simplest form

Introduction and organisation

Demonstrate the activity by doing the example below:

C	Q	E	A	Y	P	R	N	H	F
$\frac{5}{10}$	$\frac{3}{4}$	$\frac{2}{4}$	$\frac{21}{42}$	$\frac{1}{3}$	$\frac{3}{5}$	$\frac{6}{12}$	$\frac{3}{6}$	$\frac{4}{7}$	$\frac{5}{10}$

You need to pick out all the fractions which are equivalent to $\frac{1}{2}$ and re-arrange the letters to make a country. The answer is 'France'.

Questions to ask:

What is the simplest form of these fractions?
What could you divide both the numerator and the denominator by?

Simplification

Ask the pupils to make a list of equivalent fractions to use as reference.

Challenge

Ask the pupils to make up some fraction codes of their own.

Unit 2.27

Towers

Resources

one computer per pair of pupils
MicroSMILE for Windows Pack 3:
'A Sense of Number' (program: 'Towers')

Language

fraction, numerator, denominator

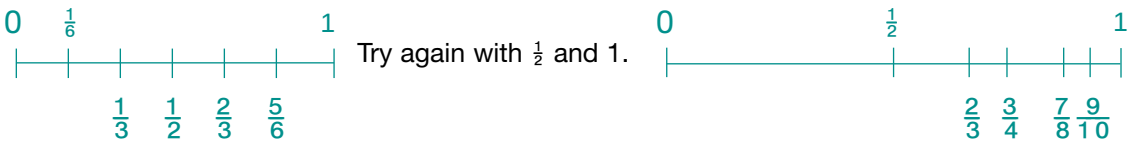
Groups of 2

Objective

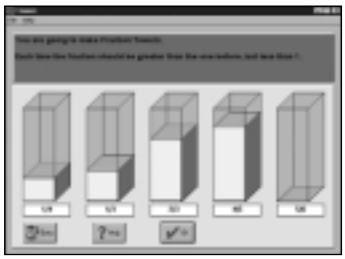
- order a set of mixed numbers such as 2, $2\frac{3}{4}$, $1\frac{3}{4}$, $2\frac{1}{2}$, $1\frac{1}{2}$ and position them on a number line

Introduction and organisation

Demonstrate by writing $\frac{1}{6}$ and 1 on the board with four spaces in between. Discuss as a class which fractions could be written in the spaces.



Pupils then work together at a computer, trying to find fractions which fall between given fractions. There are six progressively more difficult games. The first game requires four fractions between $\frac{1}{10}$ and 1. The last game requires four fractions between $\frac{1}{4}$ and $\frac{1}{2}$.



Questions to ask:

What might the denominator be for this next fraction?
How could you use a calculator to check that this fraction is bigger than that one?
How can you tell if a fraction is greater than 1?

Simplification

If pupils make one or two mistakes in any game they can be offered the opportunity to repeat that game before moving on to the next one. If pupils make more than two mistakes they must repeat that game before moving on.

Challenge

Challenge pupils to get through without making any errors.

Restrict the choice of fractions. For example, on the first game, make a rule that no unit fractions are allowed (unit fractions are those with 1 as their numerator – $\frac{1}{2}$, $\frac{1}{4}$ and so on).

Decimal pelmanism

Unit 2.28

Resources

set of decimal playing cards for each group
decimal playing cards on OHTs
OHP

Language

decimal point, tenths, hundredths

Groups of 2–4

Objective

- use decimal notation for tenths and hundredths

Introduction and organisation

Show OHTs of the set of cards chosen. Explain how the cards represent the same decimal. If pupils are not familiar with pelmanism, gather them around a table to demonstrate the first moves of the game.

Lay the set of cards face down in a grid formation. Pupils pick up two cards at a time and turn them face up so that all can see them. If they represent the same decimal they are taken up and kept by the player. If they are not a pair, they are replaced face down and the next player takes a turn. This continues until all the cards have been paired up. The winner is the player with the most pairs.

Questions to ask:

How would you say this decimal?
What is this decimal?
How would you write this decimal in figures?

Simplifications

The game can be made simpler by choosing a subset of the pack of cards, using just two of the representations of decimals, such as decimals written in figures and decimals written in words.

Challenge

If all four representations are used (number, word, square, line) the game is quite challenging. For a further challenge impose a time limit.

Unit 2.29

Loop cards – fractions, decimals and percentages

Whole Class or Groups of 4–6

Resources

set of loop cards made from Sheets 2.V1 and 2.V2: 'Loop cards – fractions, decimals and percentages', for each group (several sets of the same cards could be made from different coloured card)

Language

fraction, decimal, percentage, equivalent

Objective

- relate fractions to their decimal representations

Introduction and organisation

This game is designed to practise the equivalences between fractions, decimals and percentages. It should be used only when pupils are confident with these equivalences.

To introduce this game give out all the cards and play the game as a class with the teacher starting with their card. If pupils have played other loop games as a class refer back to them and demonstrate with only a few cards.

Questions to ask:

How do you work out what the percentage is from a decimal?
How do you work out what a fraction is as a decimal?
What do you notice about decimals and percentages?

Simplifications

Make a secret mark on the easier answer cards and make sure they are given to appropriate pupils.

Provide number lines showing some of the main equivalences, such as 10%, 25%, 50%. Gradually withdraw help.

Replay the game with the same cards so that each pupil gets practice with the same set of questions.

Challenge

Set time targets, reshuffling the cards between each round.

Percentage bingo 1 and 2

Unit 2.30

Resources

counters

bingo cards made from Sheets 2.W1 and 2.W2, for each group

Sheets 2.X1 and 2.X2: 'Percentage bingo 1'

Sheets 2.Y1 and 2.Y2: 'Percentage bingo 2'

Language

percentage, half, quarter

Groups of 4

Objective

- find simple percentages of small whole number quantities

Introduction and organisation

Demonstrate the game. Play it once with the whole class. Read out the cards and get pupils to cover correct answers with a counter.

The game has enough cards for four players. A pupil or assistant can take responsibility for selecting and reading the cards. Alternatively, the cards can be shuffled and placed in the centre of the table, and pupils can take turns to pick one up and read it to the others.

Questions to ask:

What does 50% mean?
Which fraction is the same as 50%, 25%?
How can you work out 25% quickly?
What do you do to work out 10%?
How can you work out 20% quickly?
If you know 10%, can you use that to work out 20%?

Simplification

Give pupils a prompt card to help them work out the different percentages.

Challenge

Use 'Percentage bingo 2' which is a more difficult game using the same percentages.

Resources

The computer software can be obtained from

- The SMILE Centre,
  108a, Lancaster Road,
  London W11 1QS
  tel: 020 7243 1570
  email: smile@rmplc.co.uk
  MicroSMILE for Windows – Pack 3: 'A Sense of Number'; Pack 8: 'Numeracy'

- Association of Teachers of Mathematics,
  7 Shaftesbury Street,
  Derby DE23 8YB
  tel. 01332 346599
  ATM 'Developing Number' software

The decimal playing cards can also be obtained from the SMILE Centre.