Curriculum for Excellence

Numeracy

A Guide for Parents
as to how topics
involving numbers
are taught within
Stromness Academy

Basics

When pupils come to secondary school they start a lot of different subjects and have a lot of new interests but it is still important that they practise their basic number work which may not be reinforced as often as it was in primary school.

Every pupil should know their tables, particularly as they go up the school. Their six, seven, eight, and nine times tables are very important and can be practised at home.

Primary School learning about place value is often forgotten and can be reinforced at home.

Remember

hundreds	tens	units	Decimal Point	tenths	hundredths
3	5	6	.	7	5

Reading and writing large numbers is a common difficulty that you can help with.
3 678 023
reads
three million, six hundred and seventy eight thousand, and twenty three.

Pupils can be made aware at home of metric and imperial weights and measures and their own height and weight in both. Familiar objects in the food cupboard or shopping trolley could be investigated.

They can practise estimating sensibly and the getting the feel of large and small weights heights and distances, and using money in a practical way.

The better your child knows the basics, the easier it will be for him or her to make progress.

Introduction

It is hoped that use of the information in the booklet will help you understand the way number topics are being taught to your children in the school, making it easier for you to help them with their homework, and as a result improve their progress.

Index

Page	Topic	Page	Topic
1	Bar Graphs	10	Pie Charts
2	Co-ordinates	11	Proportion
3	Data Analysis	12	Rounding
4	Equations	13	Scientific Notation
5	Estimating	14	Subtraction
6	Fractions	15	Time Calculations
7	Line Graphs	16	Using Formulae
8	Order of Operations	17	Multiplication
9	Percentages	18	Division

This booklet has been produced by the Stromness Academy, Numeracy across the Curriculum working group

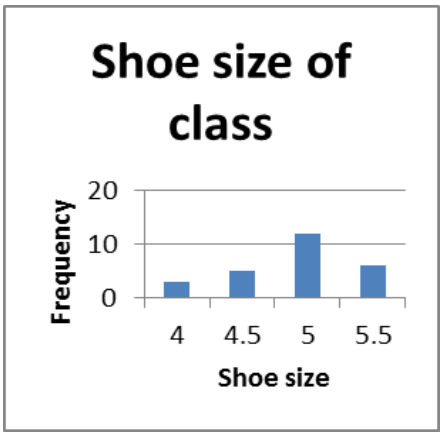
Bar Graphs

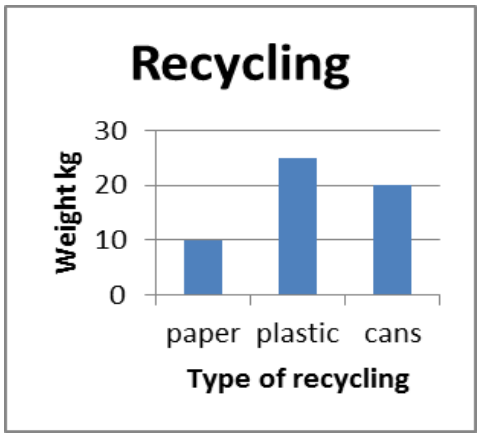
As they progress we expect pupils to

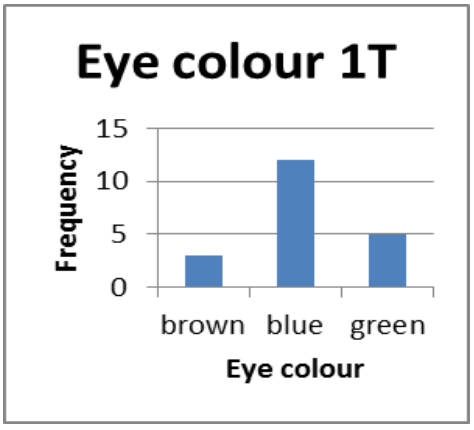
- use a pencil
- give the graph a title
- label the axes
- label the bars in the centre of the bar (each bar has an equal width)
- label the frequency (up the side) on the lines not on the spaces
- make sure there are **spaces** between the bars

Construct bar graphs with frequency graduated in single units
Construct bar graphs with frequency graduated in multiple units
Construct construct bar graphs involving simple fractions or decimals

WORKED EXAMPLES:







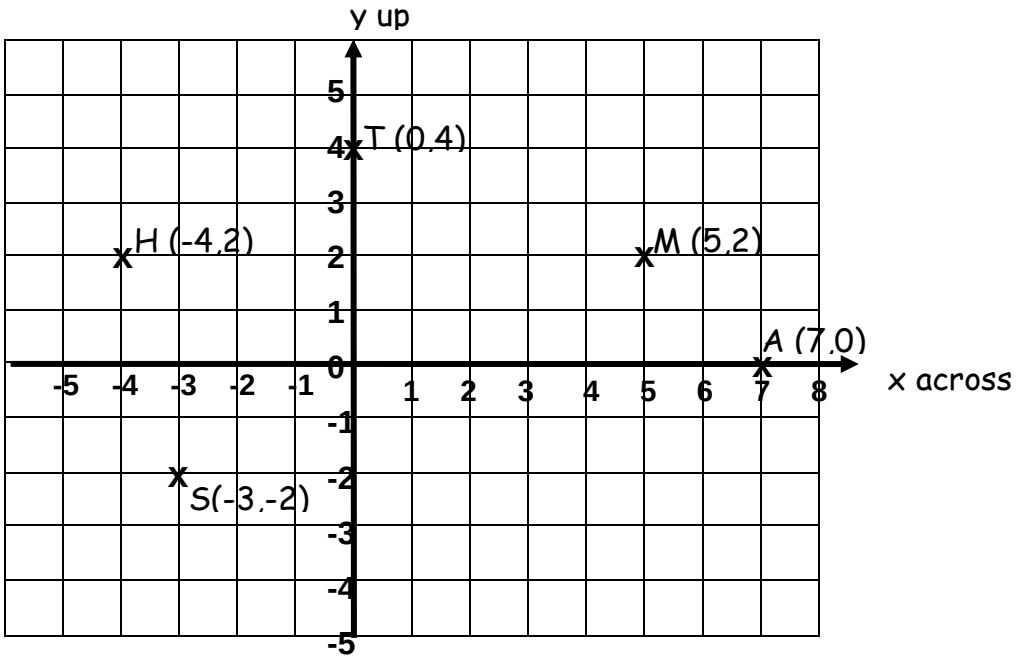
Co-ordinates

As they progress we expect pupils to

- use a co-ordinate system to locate a point on a grid
- number the grid lines rather than the spaces
- use the terms across/back and up/down for the different directions
- use brackets and a comma to separate as follows : 3 across 4 up = (3,4)
- use co-ordinates in all four quadrants to plot positions

WORKED EXAMPLE**:**

Plot the following points: M (5,2), A (7,0), T (0,4), H (-4,2), S (-3,-2)



Data Analysis

As they progress we expect pupils to

- analyse ungrouped data using a tally table and frequency column or an ordered list
- calculate range of a data set. In Maths this is taught as the difference between the highest and lowest values of the data set.
  (Range is expressed differently in Biology)

- calculate the mean (average) of a set of data.

- use a stem and leaf diagram
- calculate the mean (average)
- median (central value of an ordered list)
- mode (most common value) of a data set.
- obtain these values from an ungrouped frequency table.

Correlation in scatter graphs is described in qualitative terms.
e.g.
“The warmer the weather, the less you spend on heating” is negative correlation.
“The more people in your family, the more you spend on food” is positive correlation.

Probability is always expressed as a fraction

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}}$$

WORKED EXAMPLE
The results of a survey of the number of pets pupils owned were

3, 3, 4, 4, 4, 5, 6, 6, 7, 8

Mean = (3 + 3 + 4 + 4 + 4 + 5 + 6 + 6 + 7 + 8) ÷ 10 = 5
Median = the middle = (4 + 5) ÷ 2 = 4.5
Mode = most common = 4
Range = highest – lowest = 8 – 3 = 5

Equations

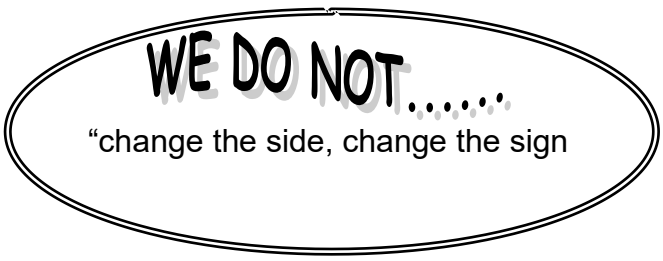
As they progress we expect pupils to solve simple equations by …….

- "Balancing"
- performing the same operation to each side of the equation
- doing "Undo" operations e.g
  undo + with -, undo – with +
  undo x with ÷, undo ÷ with x
- encouraging statements like:
  "add something to both sides"
  "multiply both sides by something"
- We prefer
  the letter x to be written differently from a multiplication sign
  one equals sign per line
  equals signs beneath each other
  we discourage bad form such as 3 x 4 = 12 ÷ 2 = 6 x 3 = 18

WORKED EXAMPLES:

$2x + 3 = 9$	take away 3 from both sides
$2x = 6$	divide by 2 both sides
$x = 3$	

$3x + 6 = 2(x - 9)$	
$3x + 6 = 2x - 18$	(subtract 6 from both sides)
$3x = 2x - 24$	(subtract $2x$ from both sides)
$x = -24$	



Estimating

As they progress we expect pupils to

- estimate height and length in cm, m, 1/2m, 1/10m

  e.g. length of pencil = 10cm

  width of desk = 1/2m

- estimate small weights, small areas, small volumes

  e.g. bag of sugar = 1kg

- estimate areas in square metres, lengths in mm and m

  e.g. area of a blackboard = $4m^2$

  diameter of 1p = 15mm

Fractions

As they progress we expect pupils to

- calculate simple fractions of 1 or 2 digit numbers e.g
  $\frac{1}{3}$ of 9 = 3 (9 ÷ 3); $\frac{1}{5}$ of 70 = 14 (70 ÷ 5)
- calculate simple fractions of up to 4 digit numbers
  $\frac{3}{4}$ of 176 = 132 (176 ÷ 4 x 3)
- use equivalence of widely used fractions and decimals
  e.g. $\frac{3}{10}$ = 0.3
- find widely used fractions mentally
- find fractions of a quantity with a calculator
- use equivalence of all fractions, decimals and percentages
  add, subtract, multiply and divide fractions with and without a calculator

WORKED EXAMPLES

Add and Subtract	Multiply	Divide
Make the denominators equal	Multiply top and multiply bottom	Invert the second fraction and multiply
$\frac{1}{2} + \frac{1}{3}$ $= \frac{3}{6} + \frac{2}{6}$ $= \frac{5}{6}$	$\frac{2}{3} \times \frac{3}{4}$ $= \frac{6}{12}$ $= \frac{1}{2}$	$\frac{3}{4} \div \frac{2}{5}$ $= \frac{3}{4} \times \frac{5}{2}$ $= \frac{15}{8} = 1\frac{7}{8}$

Line Graphs

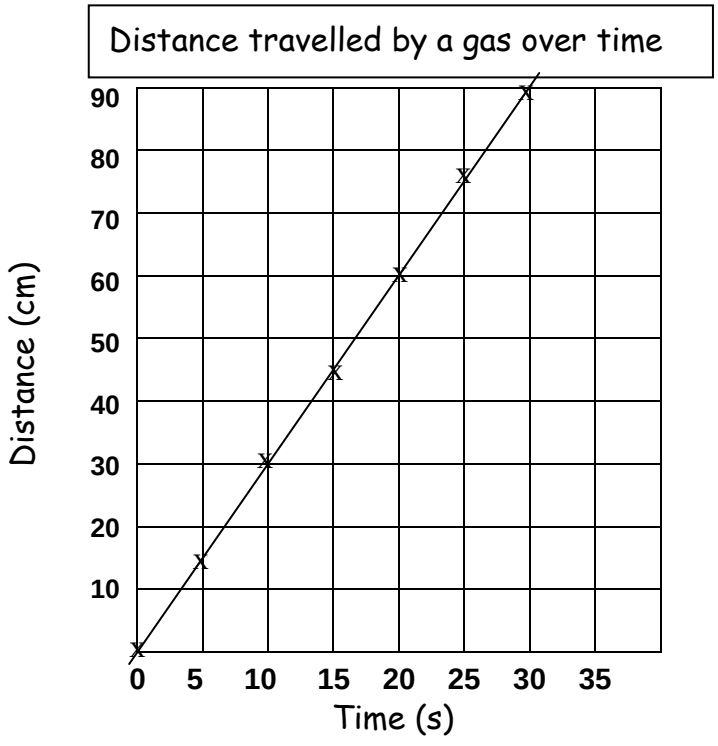
As they progress we expect pupils to

- use a sharpened pencil and a ruler
- choose an appropriate scale for the axes to fit the paper
- label the axes
- give the graph a title
- number the lines **not** the spaces
- plot the points neatly (using a cross or dot)
- fit a suitable line

- if necessary, make use of a jagged line to show that the lower part of a graph has been missed out.

WORKED EXAMPLES: The distance a gas travels over time has been recorded in the table below:

Time (s)	0	5	10	15	20	25	30
Distance (cm)	0	15	30	45	60	75	90



Order of Operations or Bodmas

BODMAS is the mnemonic which we teach in maths to enable pupils to know exactly the right sequence for carrying out mathematical operations.

Scientific calculators use a rule to know which answer to calculate when given a string of numbers to add, subtract, multiply, divide etc.

For example

What do you think the answer to 2 + 3 x 5 is?
Is it (2 + 3) x 5 = 5 x 5 = 25 ? or 2 + (3 x 5) = 2 + 15 = 17 ?

We use BODMAS to give the correct answer.:

(B)rackets (O)rder (D)ivision (M)ultiplication (A)ddition (S)ubtraction

According to BODMAS, multiplication should always be done before addition, therefore 17 is the correct answer according to BODMAS and should also be the answer which your calculator will give if you type in 2 + 3 x 5 <enter>.

Order means a number raised to a power such as 2^2 or $(-3)^3$.
The power is also called the index leading to an alternative mnemonic BIDMAS but both mean the same thing.

Worked example

Calculate $4 + 70 \div 10 \times (1 + 2)^2 - 1$ according to the BODMAS rules.

Brackets gives $4 + 70 \div 10 \times (3)^2 - 1$

Order gives $4 + 70 \div 10 \times 9 - 1$

Division gives $4 + 7 \times 9 - 1$

Multiplication gives $4 + 63 - 1$

Addition gives $67 - 1$

Subtraction gives 66

Answer 66

Percentages

As they progress we expect pupils to

- we expect pupils to
  find 50%, 25%, 10% and 1% without a calculator and use addition to find other amounts.

- we expect pupils to find percentages with a calculator
  (e.g 23% of £300 = 300 ÷ 100 x 23 = £69)
  and to recognise that "of" means multiply.

- we expect pupils to
  express a fraction as a percentage via the decimal equivalent.

For example

- Find36% of £250
  10% is £25
  30% is £75 (x 3)
  5% is £12.50 (10% ÷ 2)
  1% is £ 2.50 (10% ÷ 10)
  36% is **£90** (30% + 5% + 1%)

- Express two fifths as a percentage
  $\frac{2}{5} = \frac{4}{10} = \frac{40}{100} = 40\%$

- You buy a car for £5000 and sell it for £3500. What is the percentage loss?
  Loss = £5000 – £3500 = £1500
  $\frac{1500}{5000} = \frac{15}{50} = \frac{30}{100} = 30\%$

- Increase £350 by 15%
  15% of 350 = 350 ÷ 100 x 15 = £52.50 (…… to find the increase)
  (then add on for the new total ….) £350 + £52.50 = £402.50

WE DO NOT…… use the % button on the calculator because of inconsistencies between models

Pie Charts

As they progress we expect pupils to

- use a pencil
- label all the slices or insert a key as required
- give the pie chart a title

- construct pie charts involving simple fractions or decimals
- construct pie charts of data expressed in percentages
- construct pie charts of raw data

WORKED EXAMPLES:

Basic

30% of pupils travel to school by bus, 10% by car, 55% walk and 5% cycle.
Draw a pie chart of the data.

10% of 360º =36º

Bus 30% = 3 x 10% = 108º

Car 10% = 1 x 10% = 36º

Walk 55% = 5.5 x 10% =198º

Cycle 5% = 0.5 x 36% = 18º

More difficult

20 pupils were asked "What is your favourite subject?"
Replies were Maths 5, English 6, Science 7, Art 2
Draw a pie chart of the data.

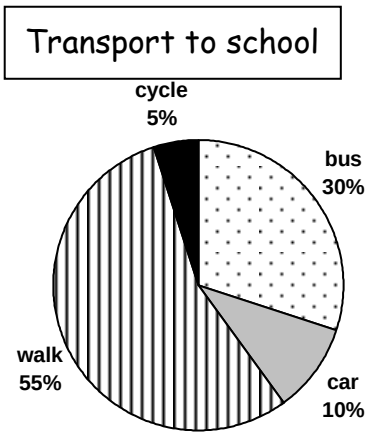
360 ÷ 20 (the total) = 18º

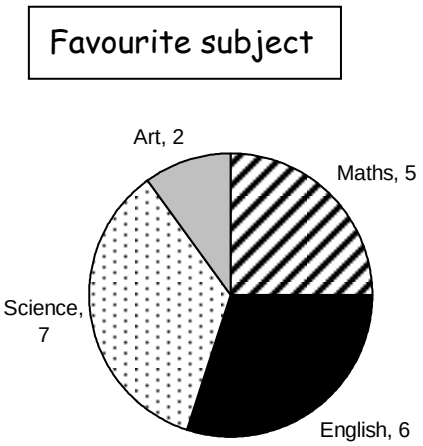
Maths 5 5 x 18 = 90º

English 6 6 x 18 = 108º

Science 7 7 x 18 = 126º

Art 2 2 x 18 = 36º





Proportion

As they progress we expect pupils to

- identify direct and inverse proportion
- record appropriate “headings” with the unknown on the right
- use the unitary method (i.e. find the value of ‘one’ first then multiply by the required value)
- if rounding is required we do not round until the last stage

WORKED EXAMPLES:

A. Direct Unitary Method

If 5 bananas cost 80 pence, then what do 3 bananas cost?

bananas		cost (pence)
5	→	80
1	→	80 ÷ 5 = 16
3	→	16 x 3 = 48

B. Inverse Unitary Method

The journey time at 6o km/h = 30 minutes, so what is the journey time at 50km/h?

Speed (km/h)		Time (mins)
60	→	30
1	→	30 x 60 = 1800 minutes
50	→	1800 ÷ 50 = 36 minutes

Rounding

As they progress we expect pupils to

- round 2 digit whole numbers to the nearest 10
- round 3 digit whole numbers to the nearest 10
- round any number to the nearest whole number, 10 or 100
- round any number to 1 decimal place
- round to any number of decimal places or significant figures

Note: We always round up for 5 or above

WORKED EXAMPLES:

74 to the nearest 10 → 70 386 → to 390

347.5 → to 348 (to nearest whole number);
or → to 350 (to nearest ten);
or → to 300 (to nearest hundred)

7.51 (to 1 decimal place) → to 7.5
8.96 (to 1 decimal place) → to 9.0

3.14159 (to 3 decimal places) → to 3.142;
or 3.14 (to 2 decimal places);
or 3.14 (to 3 significant figures)

Scientific notation or Standard Form

In mathematics we introduce scientific notation in S1 /S2.

It is also taught at the beginning of S3.

In maths we teach that a number in scientific notation consists of a number between one and ten multiplied by 10 to some power.

For example

$24{,}500{,}000 = 2.45 \times 10^{7}$

$0.000988 = 9.88 \times 10^{-4}$

Other subjects may approach this topic differently.

we introduce the terms:

- Kilo meaning one thousand
- Milli meaning one thousandth.

As they progress we expect pupils to be able to use powers and square roots.

Subtraction

As they progress we expect pupils to

- subtract using decomposition (as a written method)
- check by addition
- we promote alternative mental methods where appropriate

WORKED EXAMPLES

- Decomposition:

$$\begin{array}{r} {\scriptstyle 6}\\ 2\,\not{7}^{1}1 \\ 3\,8 \\ \hline 2\,3\,3 \end{array} \qquad \begin{array}{r} {\scriptstyle 3\,9}\\ 4\,\not{0}^{\not{1}}0 \\ 7\,4 \\ \hline 3\,2\,6 \end{array}$$

- Counting on:

  To solve 41 – 27, count on from 27 until you reach 41

- Breaking up the number being subtracted:

  e.g.To solve 41 – 27, subtract 20 then subtract 7

Time Calculations

As they progress we expect pupils to

- convert between the 12 and 24 hour clock (2327 = 11.27pm)
- calculate duration in hours and minutes by counting up to the next hour then on to the required time
- convert between hours and minutes
  (multiply by 60 for hours into minutes)

WORKED EXAMPLES:

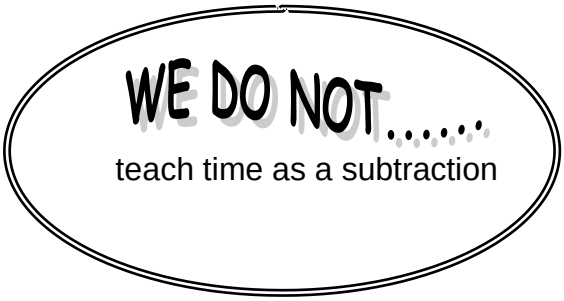
How long is it from 0755 to 0948?

0755 → 0800 → 0900 → 0948
(*5 minutes*) + (*1 hr*) + *(48 minutes)*

Total time 1 hr 53 minutes

Change 27 minutes into hours equivalent

27 minutes = 27 ÷ 60 = 0.45 hours



Using Formulae

As they progress we expect pupils to construct and use simple formulae by

- writing down the formula first
- rewriting the formula replacing the letters by the appropriate numbers (substitution)
- solving the equation
- interpreting the answer and putting the appropriate units back into context

WORKED EXAMPLES:

The length of a string S millimetres with a weight of W grams per millimetre is given by the formula:

$$S = 16 + 3W$$

(a) Find S when W = 3 grams

S = 16 + 3W (*write formula*)
S = 16 + 3 x 3 (*replace letters by numbers*)
S = 16 + 9
S = 25
Length of string is 25 mm (*interpret result in context*)

(b) Find W when S = 20.5 mm

S = 16 + 3 W (*write formula*)
20.5 = 16 + 3W (*replace letters by numbers*)
4.5 = 3W (*solve the equation – by doing and undoing*)
1.5 = W
The weight is 1.5 g (*interpret result in context*)

WE DO NOT.....

- Rearrange the formula before substitution (*too difficult*)
- State the answer only. Working must be shown

Multiplication

As they progress we expect pupils to

- multiply single numbers using all the tables from one to ten without a calculator
- multiply whole numbers by 10, 100, and 1000 without a calculator
- multiply decimal numbers by 10, 100, and 1000 without a calculator
- multiply whole numbers up to four digits by a single digit whole number
- multiply decimal number up to two decimal places by a single digit whole number
- multiply whole and decimal numbers by multiples of 10 and 20
- use a calculator to multiply any pair of whole numbers up to 3 decimal places.
- This is extended to multiplying decimal numbers by decimal numbers without a calculator

WORKED EXAMPLES

$$\begin{array}{r} 25 \\ \times\ 6 \\ \hline 150 \\ \hline {\scriptstyle 3} \end{array} \qquad \begin{array}{r} 12.3 \\ \times\ \ \ 4 \\ \hline 49.2 \\ \hline {\scriptstyle 1} \end{array}$$

16 x 20 = 16 x 2 x 10
= 320,

£1.50 x 400 = 1.50 x 100 x 4
= £600

0.7 x 0.3 = 7 x 3 ÷ 10 ÷ 10
= 0.21

32.5 x 60 000 = 195 x 10 000
= 1 950 000

Division

As they progress we expect pupils to

- divide whole numbers by 10, 100, and 1000 without a calculator.
- divide decimal numbers by 10, 100, and 1000 without a calculator.
- divide whole numbers up to four digits by a single digit whole number (whole number answer).
- divide decimal numbers up to two decimal places by a single digit whole number (decimal answer).
- divide simple whole and decimal numbers by multiples of 10 and 20.
- use a calculator to divide any pair of whole numbers up to 3 decimal places.
- This is extended to dividing decimal numbers by decimal numbers without a calculator.

WORKED EXAMPLES:

$$\begin{array}{r} 8\ 2 \\ 3\overline{)\,2\ \overset{2}{4}\ 6} \end{array} \qquad \begin{array}{r} 9\ .\ 3\ 5 \\ 5\overline{)\,4\ \overset{4}{6}\ .\ \overset{1}{7}\ \overset{2}{5}} \end{array}$$

$16 \div 20 = 16 \div 2 \div 10$
$= \underline{0.8}$

£1.50 ÷ 50 = 1.50 ÷ 10 ÷ 5
= 3p

0.8 ÷ 0.2 = 8 ÷ 2 x 10 ÷ 10
= 4

32.5 ÷ 500 = 32.5 ÷ 5 ÷ 100
= 6.5 ÷ 100
= 0.065