Programme 1

Worksheet 1: **Order It Now!**

1. Which numbers between 1 and 20 would these expressions produce if they were fed into the Poke-It Calculator?

(a) 4 + 4 + 4 ÷ 4 =

(b) (4 + 4 + 4) ÷ 4 =

(c) 4 + (4 + 4) ÷ 4 =

(d) 4 x (4 + 4) ÷ 4 =

(e) (4 x 4 + 4) ÷ 4 =

(f) 4 x (4 + 4 ÷ 4) =

(g) 4 x 4 – (4 + 4) =

(h) 4 x (4 – 4) + 4 =

(i) 4 x 4 – 4 + 4 =

(2) Work out the following pairs of expressions mentally:

(a)	(5 x 4) + 7 =	5 x (4 + 7) =
(b)	(6 x 11) – 3 =	6 x (11 – 3) =
(c)	(15 + 6) – 3 =	15 + (6 – 3) =
(d)	(18 ÷ 2) + 4 =	18 ÷ (2 + 4) =
(e)	(24 ÷ 6) – 3 =	24 ÷ (6 – 3) =
(f)	(7 + 3) x 5 =	7 + (3 x 5) =
(g)	(12 – 7) + 1 =	12 – (7 + 1) =
(h)	(5 x 6) ÷ 3 =	5 x (6 ÷ 3) =
(i)	(12 ÷ 3) x 2 =	12 ÷ (3 x 2) =
(j)	(12 – 9) ÷ 3 =	12 – (9 ÷ 3) =

For which pairs do your answers differ?

Are brackets always necessary?

Make up five more similar pairs of expressions.

Programme 1

Worksheet 1: **Order It Now!**

3. Place the brackets in the following statements:

(a) 3 x 5 + 7 = 36

(b) 1 + 4 x 8 = 40

(c) 48 ÷ 2 x 4 = 6

(d) 12 – 9 ÷ 3 = 1

(e) 17 – 7 + 1 = 9

(f) 11 + 9 x 3 = 60

(g) 15 – 2 x 7 = 1

(h) 5 – 3 – 2 = 4

(i) 20 ÷ 2 x 5 = 50

(j) 14 + 8 ÷ 2 = 11

4. Try to place mathematical signs between the digits to make the following statement true. (There is more than one way of doing this.)

1 2 3 4 5 6 7 8 9 = 100

1 2 3 4 5 6 7 8 9 = 100

1 2 3 4 5 6 7 8 9 = 100

How many solutions can you find?

Programme 1

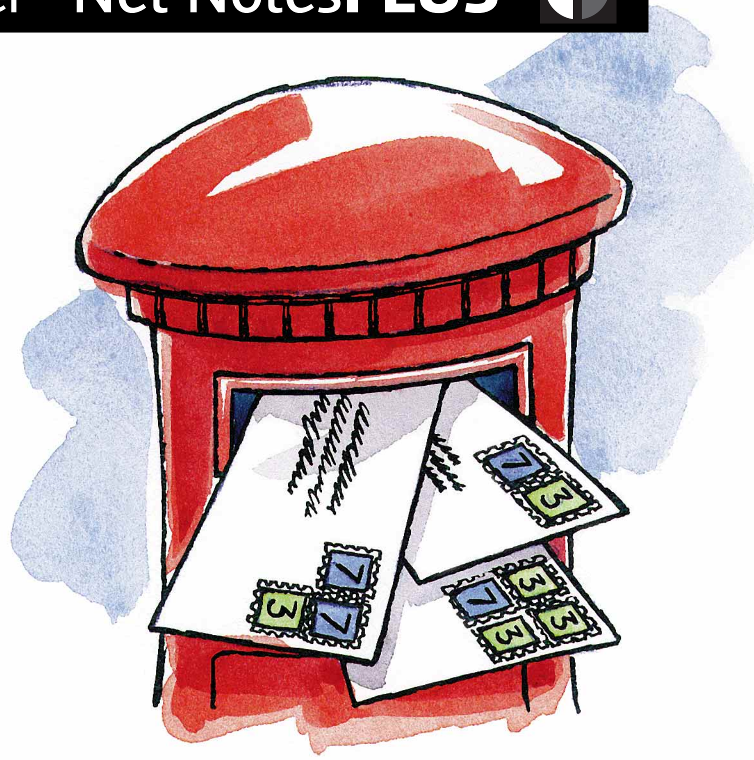
Worksheet 2: **The Wizard's Challenge**

The Wizard thought that it would be possible to make all the numbers up to 40 using just the digits 1, 2, 3 and 4, the operators, +, −, x and ÷, and brackets.

How many of the numbers can you make?

Programme 1

Worksheet 3: **Mail Order**



The Post Office needs to decide which denominations of stamps to issue. The values of the stamps must be chosen so that it is possible to use them in different combinations to pay different charges.

If, for example, it was decided that only 3 pence and 7 pence stamps would be issued, could all letters costing between 20p and 40p be stamped?

(a) Comment on the practicality of using only these two values.

(b) What would be the best combination of 7p and 3p stamps if they were to be sold in a 50p book? What about a £1 book?

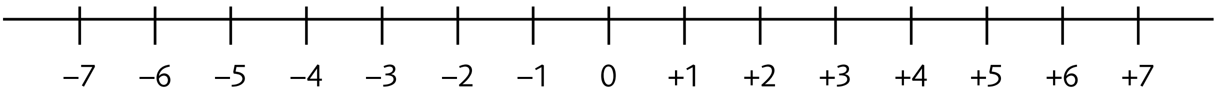
(c) Investigate other possible pairs of values. Describe your conclusions.

(d) What if you introduce a third stamp to your set? What would be a sensible value?

(e) Find out about current postal charges and stamps issued.

Programme 2

Worksheet 1: **Back and Forth**



(a) Use the number line above (and Lisa's method) to work out the following:

(1) –2 + +5 = □

(2) +7 + –3 = □

(3) +5 – +7 = □

(4) –2 + –3 = □

(5) –1 – +5 = □

(6) +2 – –4 = □

(7) –1 + +4 + –5 = □

(8) –3 – –6 = □

(9) –8 – –8 = □

(10) +3 + –7 = □

(11) 0 – –5 = □

(12) +4 – (+3 – +7) = □

(b) Make up and solve five more similar problems.

____

____

____

____

____

(c) Work out which numbers should go in the following expressions:

(1) –6 + □ = –2

(2) +3 – □ = –6

(3) +4 – □ = +7

(4) –7 – □ = –2

(5) –4 – □ = –6

(6) □ + –3 = +5

(7) □ + –3 = –7

(8) □ – –2 = +6

(9) –7 + □ = –7

(10) □ – –2 = –3

Programme 2

Worksheet 2: **Grid of Enlightenment**

(1) The Wizard made a grid to help him work out the rules for multiplying positive and negative numbers. The multiplication grid below should help you to understand how multiplication works for numbers 'less than nothing'.

second number

first number

X	−5	−4	−3	−2	−1	0	1	2	3	4	5
5											25
4											
3								6			
2								4			
1											
0											
−1											
−2											
−3											
−4											
−5											

(a) Complete the shaded section of the grid, filling each cell with the result of multiplying its row and column numbers.

(b) Look at the patterns in the shaded square. Consider how each row and column is decreasing, and continue these patterns.

(c) To complete the grid, look again at the patterns of numbers in each row and column you have filled in, and continue the patterns so that all cells are filled.

You should be able to see that the rules the Wizard found for multiplying pairs of directed numbers work for all the values in your grid. Check that:

positive x positive = positive
positive x negative = negative
negative x positive = negative
negative x negative = positive

Programme 2

Worksheet 2: **Grid of Enlightenment**

(2) Use your grid to work out the following:

(a)	+3 x –4	=	
(b)	–3 x +4	=	
(c)	+2 x +5	=	
(d)	–2 x –5	=	
(e)	–5 x +2	=	
(f)	0 x –3	=	
(g)	–4 x –1	=	
(h)	4 x –2	=	

(3) Use the same rules to work out:

(a)	+4 x –6	=	
(b)	–8 x +2	=	
(c)	+3 x –9	=	
(d)	–4 x –7	=	
(e)	+10 x –3	=	
(f)	–8 x 0	=	
(g)	–9 x –6	=	
(h)	+12 x –15	=	

Programme 2

Worksheet 3: **Backward Thinking**

The following results were obtained by adding together five single-digit numbers in pairs.

1 7 11 5 10 −1 0 5 2 −4

What are the five numbers?

Make up a similar problem to challenge your classmates.

Programme 2

Worksheet 4: **Backhand Games**

-4	-4	-4	-3	-3
-3	-2	-2	-2	-1
-1	-1	1	1	1
2	2	2	3	3
3	4	4	4	0

Programme 2

Worksheet 4: **Backhand Games**

Cut out the set of cards containing three each of –4, –3, –2, –1, 1, 2, 3 and 4, and one 0.

(a) Play this simple card game with a partner or a small group.

Place the shuffled number cards in a pile and draw three each.

Combine the three cards using one + and one – sign (one addition and one subtraction), and write down the largest answer you can get.

Compare your scores with the other players.

The winner is the player with the highest score.

(b) Investigate ways of changing the rules to make the game more interesting or skilful.

What happens if…?

- the winner is the player with the lowest score
- you draw four cards and select three to make your total
- you draw five cards and select three, but calculate the product of your numbers
- you combine the cards with two – signs
- you are allowed to choose three signs and four cards to achieve your total
- you are allowed to exchange a card with the pack, or pass a card on to another player

(c) Think about strategies for making a winning combination.

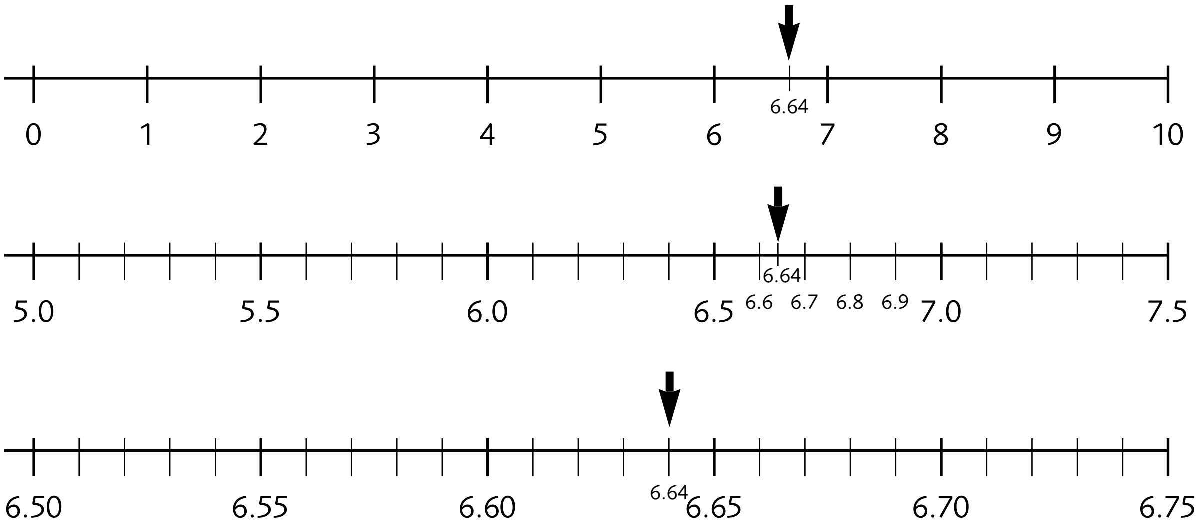
Devise your own variations of the game.

Why is there only one 0 card?

Would a different set of cards produce a more interesting game?

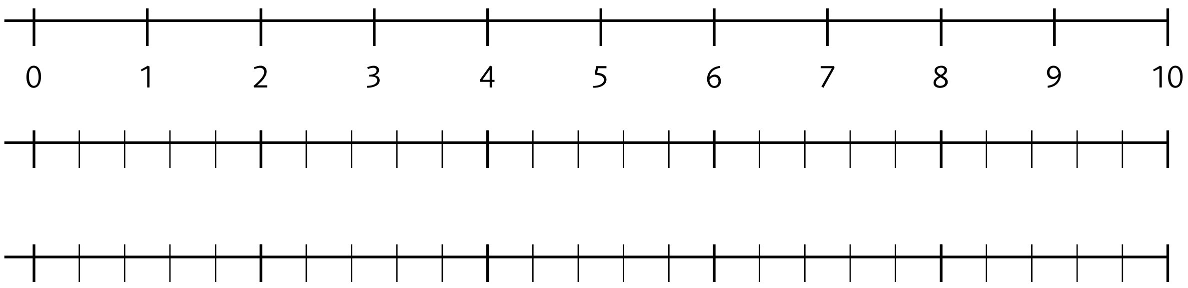
Programme 3

Worksheet 1: **Zooming In**

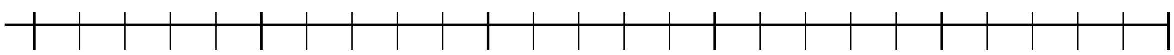


(1) In the programme, Lisa found the combination to open the lock with 10 guesses.
See if you can use her method to guess another combination with 10 guesses or less.

Work with a partner. One of you chooses a number between 0.00 and 9.99. The other should try to guess the number. After each guess, say whether it is too big or too small (or correct). You can record your guesses on number scales like the ones above. As you make each guess, shade out the parts of the scales where you know the answer cannot be.



How many guesses did you use to find the number?
Swap over and play again.
Try the same activity again, but choose a number between 0.000 and 0.999.



Programme 3

Worksheet 1: **Zooming In**

(2) The Wizard knew that 25% is the same as $\frac{1}{4}$ (because 100 ÷ 25 = 4) and that this is useful for doing calculations in your head. Complete the table below to find some other useful equivalents.

Fraction	Percentage	Decimal
	25%	0.25
		0.5
$\frac{1}{10}$		
	$33\frac{1}{3}\%$	
		0.2
	12%	
$\frac{3}{5}$		
		0.03

(3) Place these fractions in order, smallest first.

$\frac{1}{3}$ ____________________

$\frac{3}{10}$ ____________________

$\frac{4}{15}$ ____________________

$\frac{128}{321}$ ____________________

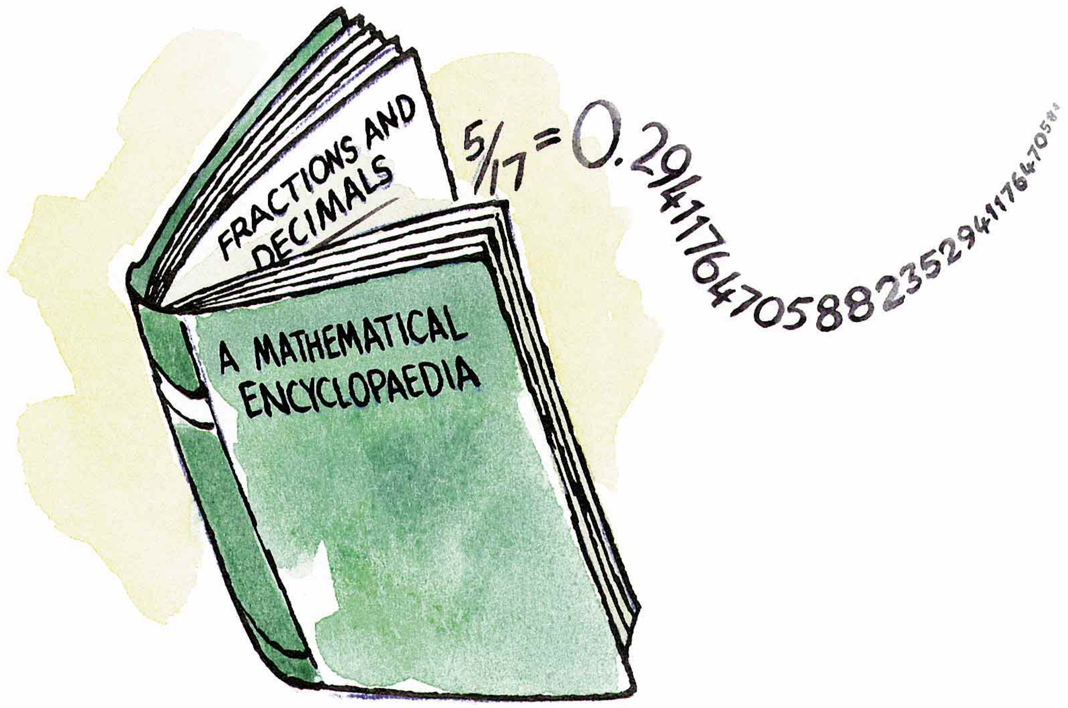
$\frac{19}{50}$ ____________________

$\frac{347}{1000}$ ____________________

(4) Two different numbers added together make 15. When the same numbers are multiplied together their product is 30. Try to find the approximate values of the two numbers.

Programme 3

Worksheet 2: **On and On…**



Explore the results of converting the family of fractions $\frac{1}{7}$ $\frac{2}{7}$ $\frac{3}{7}$ and so on to decimals.

What do you notice about the first 6 digits after the point? Describe the patterns that you find.

$\frac{1}{7}$ produces a recurring decimal.

Investigate which other fractions give patterns of recurring decimals and which terminate. You could begin with halves, then thirds, quarters, fifths, sixths and so on.

Programme 3

Worksheet 3: **Pair Them Up**

Work with a partner or in a small group. Collect two sets of cards from your teacher.

Shuffle the cards and then lay them randomly face down on the table.

Players takes turns to turn over pairs of cards. If the two cards have equivalent numbers on them the player picks them up and keeps them. If they are not equivalent, the cards are left in place and turned back over.

The winner is the player who finds the most pairs.

Extension

Try and invent your own game using these cards.

Programme 3

Worksheet 3: **Card Set (Decimals)**

0.1	**0.3333...**	**0.04**
0.25	**0.75**	**0.5**
0.4	**0.005**	**1.5**
0.06	**0.15**	**1.2**
0.125	**0.2**	**0.001**

Programme 3

Worksheet 3: **Card Set (Fractions)**

$\frac{1}{10}$	$\frac{1}{3}$	$\frac{1}{25}$
$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{2}$
$\frac{2}{5}$	$\frac{1}{200}$	$1\frac{1}{2}$
$\frac{3}{50}$	$\frac{3}{20}$	$1\frac{1}{5}$
$\frac{1}{8}$	$\frac{1}{5}$	$\frac{1}{1000}$

Programme 3

Worksheet 3: **Card Set (Percentages)**

10%	**$33\frac{1}{3}$%**	**4%**
25%	**75%**	**50%**
40%	**$\frac{1}{2}$%**	**150%**
6%	**15%**	**120%**
$12\frac{1}{2}$%	**20%**	**0.1%**

Programme 4

Worksheet 1: **Pike Lengths and Trollurches**

(1) One of the kite-prodding sticks that the Wizard offered the Guard cost 2 florins per trollurch. How much would you pay for a stick of the same type, with length...?

(a) 4 trollurches ____________

(b) $\frac{1}{2}$ trollurch ____________

(c) $3\frac{1}{2}$ trollurches ____________

(2) The same stick measured 2 pike lengths, which was the same as 3 trollurches. How many trollurches are the same as...?

(a) 1 pike length ____________

(b) 3 pike lengths ____________

(c) $\frac{1}{2}$ pike length ____________

(3) How many florins would you pay for a stick of this type measuring...?

(a) 1 pike length ____________

(b) 3 pike lengths ____________

(c) $\frac{1}{2}$ pike length ____________

(4) The Guard's pike is approximately 9 feet long. Roughly how many feet are...?

(a) 2 pike lengths ____________

(b) 1 trollurch ____________

(c) 4 trollurches ____________

(5) The Wizard did not show Lisa and the Guard his 'deluxe' range of sticks. These are priced at 6 florins per pike length – a bit expensive for the Guard. How much would the Wizard charge for a stick in this range measuring...?

(a) 3 trollurches ____________

(b) 1 trollurch ____________

(c) 2 trollurches ____________

(d) $\frac{1}{2}$ trollurch ____________

What can you say about the price of this type of stick compared with the other?

____

____

(6) How tall do you think you are, measured in...?

(a) trollurches

(b) pike lengths

(7) Give three examples of things that could sensibly be measured in trollurches, and three examples of things that you would not measure in trollurches.

____

____

____

____

____

____

Programme 4

Worksheet 1: **Pike Lengths and Trollurches**

(8) The old system of measurement that the Guard and the Wizard mentioned included other units called *trollspans* and *trolldigits.* The Guard often works in *pikelets*.

What do you think these might be?

For each of these units of measurement, write a paragraph describing:

- what you imagine the unit is
- what types of measurement you think it is used for
- how you would convert from these units to our own metric system

Programme 4

Worksheet 2: **Supermarket Goods**

At your local supermarket, investigate the cost of loose and ready-packed fruit and vegetables.

What units are used for different types of items?

Find examples of different methods of pricing.

How can you compare prices of similar items, to decide which offer the best value for money?

What information does the supermarket give you to help you compare prices? Is this helpful?

How can you compare prices of other types of products, like kitchen roll, drinks or biscuits?

Programme 4

Worksheet 3: **How Long Is a Stick?**

As a class or in small groups, collect information and resources about measurement. Decide how you are going to put the information together. You could make a folder, a wall display or a web page. For example:

- Different units of length (or weight, volume, area).
- The development of the metric system.
- The imperial system of measurement.
- The history of measurement – how did the Egyptians or the Romans measure?
- Using parts of the body to measure with.
- Unusual or old-fashioned words used in measurement – meanings and origins.
- Measuring very large or small quantities.

Programme 5

Worksheet 1:
Priming the Grid

Lisa found the multiple pathways on the grid in the programme. Mark the numbers on this grid in the same way to reveal the first members of the mysterious set of prime numbers. Remember: *Never take the first step!*

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102

Programme 5

Worksheet 2:
Consecutive Sums

In this puzzle Lisa's task was to cross out all the numbers that could be expressed as a sum of consecutive numbers. On this grid, try to discover for yourself the patterns that helped her to solve the puzzle.

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102

Programme 5

Worksheet 3: **Consecutive Products**

Take any two consecutive numbers and multiply them together.

Repeat with different pairs

What do you notice about the answers?

Explain your observation.

Now explore what happens when you multiply three consecutive numbers together.

Do your results all have a common factor?

What is the highest common factor of all the results?

Can you explain this?

See what happens for the product of four consecutive numbers.

What is the highest common factor of all your results?

Explain why this should be.

Programme 5

Worksheet 4: **Generation Games**

(a) Marin Mersenne suggested the formula $M_x = 2^x - 1$, for generating candidates for prime numbers.

Investigate Mersenne's formula for $x = 1$ to 12.
Which values of x give a result that is prime?

(b) Investigate the following formulae for generating prime numbers:

$x^2 + x + 17$

$x^2 + x + 41$