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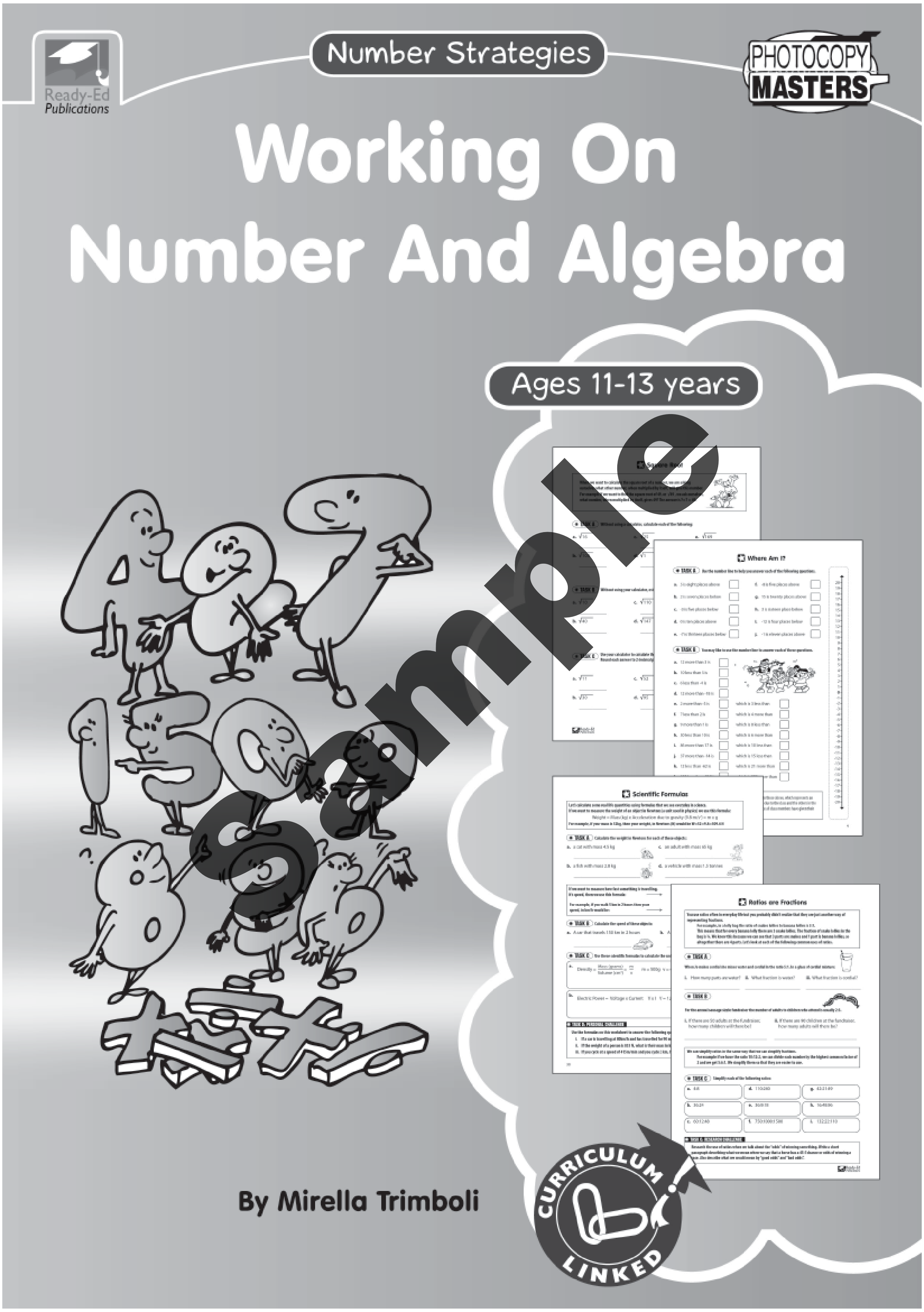

Contents

Integers

Imagining Negative Numbers
This activity exposes students to the real life uses of negative numbers in two contexts. Students can further extend their understanding by a study of international temperatures, as given in Task C.

Where Am I?
In this activity students have the opportunity to familiarise themselves with the concept of a number line. Students should be able to fluidly explain the position of certain numbers relative to other numbers on the number line. Students can consolidate their understanding with Task C, and can make a game of it.

Integer Addition
This activity teaches students a method for adding directed numbers. For example, -3 + 7 means to start at -3 on the number line, turn towards the positive direction and move 7 spaces up the number line to 4. As another example, 4 – (-3) means to start at 4, turn towards the negative direction and then turn again (the second negative reverses the direction) and move 3 spaces up the number line to 7. Task C is an extension activity that students may like to explore using their calculators.

Integer Subtraction
Similar to the previous activity, students use the strategy of moving up and down the number line to subtract directed numbers. For example, -5 – 7 means starting at -5, turning towards the negative direction and moving 7 spaces down the number line to -12. Task C is an opportunity for students to test their skills with one of the numerous free maths games available on the internet.

Walking Up and Down the Number Line
This is a page of mental maths questions for students to practise their grasp of the addition and subtraction of directed numbers. Students are to be encouraged to attempt this task without using a number line, to help them develop their mental visualisation.

Which is Larger?
This activity allows students to practise their understanding of ordering and analyzing directed numbers. Students are also encouraged to use the correct inequality symbols. Task C provides students with another internet resource to practise their skills.

Multiplication of Signed Numbers
This activity is an investigative task for students to explore the rules behind multiplying and dividing directed numbers. Task B allows students to summarise their findings and develop a set of rules. Task C is an important task for students to explore to ensure they understand that the same rules apply for division as for multiplication.

Multiply and Divide
This is another mental maths task for students to test their skills with multiplication and division. This task can be used as an assessment task to test the progress achieved by students to date.

Imagining Negative Numbers

Part 1

TASK A **The hilly town of Siena in Tuscany has a special sort of multi-level shopping centre. Look at the store directory sign right and study it carefully before answering the following questions.**

a. What number could you use to represent the level that the Butcher and Bakery are on?

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b. What do the negative level numbers represent?

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c. If you park in Car Park A and travel on the lift to the Medical Centre, how many floors will you pass?

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d. You leave the Post Office and travel 4 levels down on the lift. Do you arrive at the Laundromat?

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e. If you leave the Laundromat and travel up the lift 5 floors, where do you end up?

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f. Maria parks in Car Park A, travels up 4 floors, then up 3 more floors, down one floor, up 3 floors and then down 9 floors. Write down all the places that she visited.

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g. Gianni starts on level G, travels to level -2, then to level 3, followed by level 1, then back to level G. Describe Gianni's movements on the lift.

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Siena Shopping Village Directory

Store	Level
Appliances	5
Medical Centre	4
Post Office/Newsagent	3
Greengrocer	2
Supermarket	1
Butcher/Bakery	G
Delicatessen	-1
Laundromat	-2
Customer Service	-3
Car Park A	-4

Teachers' Notes

Indices, Squares and Square Roots

Using Index Numbers
This activity explores how index numbers can be used to simplify numerical expressions. Task A asks students to simplify expressions while Task B asks students to expand simplified expressions. Task C can be used to allow more capable students further exploration of the index laws.

Place Value Revisited
Students are encouraged to explore how place value can be expressed using index notation. This task will help students progress to using and understanding scientific notation. Task C allows students to explore how the powers of 10 are used in real life to explore the scale of our universe. This might be a nice activity to explore as a class.

Expressions with Indices
This activity extends using index notation in a more generalised context, using variables to represent numbers. Task B is more advanced and will demonstrate whether students have a strong grasp of these concepts. Task C allows students to use their creativity while also demonstrating their success in consolidating these core concepts.

Prime Factor Trees
This task allows students to revisit their use and understanding of prime factor trees. This activity extends this understanding further by asking students to simplify their answers using index notation.

Easy Calculations Using Prime Factors
This activity exposes students to the power of expressing numbers in terms of their prime factors. By expressing two numbers in a multiplication calculation by their prime factorisation, the calculation can be made easier and more efficient.

A Different Approach to the Lowest Common Multiple
Many students determine the LCM for two or more numbers by the more inefficient method of listing numbers. Here students are shown how Prime Factor Trees can make the task easier and more efficient.

A Different Approach to the Highest Common Factor
Many students determine the HCF for two or more numbers by the more inefficient method of listing numbers. Here students are shown how Prime Factor Trees can make the task easier and more efficient.

Square Numbers
This activity serves as a refresher exercise for looking at square numbers. Task A is a simple recall task while Task B allows students to explore the x^2 function on their calculator. Task C is slightly more challenging, allowing students to explore a pattern involved in squaring a particular type of number. Discussion of their findings with the class is encouraged.

Square Root
In this activity students explore the inverse of the squaring operation, namely the square root. Students are encouraged to estimate values and also employ technology to calculate values to an appropriate number of decimal places.

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Using Index Numbers

Instead of writing out long calculations, we can sometimes use index numbers or powers to write a shorter expression.

TASK A **For each of the following expressions, write a shorter, simplified expression. Questions a and c has been partially completed for you.**

a. $2\times2\times3\times2\times3\times3\times2 = 2^4 \text{ x }$

b. $5\times5\times6\times5\times5\times7\times7\times6\times5 =$

c. $\dfrac{3x3x2x3x2x4x2}{2x2x3x4} = 3^2 \text{ x }$

d. $\dfrac{10x10x4x10x4x4x6x6}{10x4x4x6x10} =$

e. $\dfrac{7x7x7x2x2x3x7x2}{3x3x2x7x7x3} =$

f. 3x2x3x3x4x2 x 4x2x3x2x4 =

g. $6x4x2x6x6x4x4x2 \text{ x } 4^3x6^4x2^5$ =

h. $\dfrac{5^5x3^2x4^7}{3x3x4x4x4x3x5x5x5x5} =$

TASK B **Write each of the following expressions (which are in index form) in expanded form. In other words, write them as they would appear before they are were simplified.**

a $4^3 \text{ x } 5^2 \text{ x } 6^7$

b $(-3)^4 \text{ x } 12^2 \text{ x } 7^3$

c $\dfrac{3^6 \text{ x } 10^3 \text{ x } 15^2}{10^2 \text{ x } 15^4}$

d $(2^3 \text{ x } 6^2)^2$

e $(7^2 \text{ x } 4^{5\,\text{x}}\, 3^3)^4$

f $\dfrac{(4^2 \text{ x } 11^3)^2}{(3^4 \text{ x } 7^2)^3}$

TASK C: RESEARCH CHALLENGE

In the work that you have done in Task A and Task B, you have discovered a few of what we call the Index Laws. In small groups, research as many Index Laws as you can find. Create a poster showing all these Index Laws and make sure that you include some examples to show how each one works.

Teachers' Notes

Calculations and Algebraic Generalisations

How We Calculate
This activity exposes students to the correct use of BIMDAS in conducting calculations. Students are very strongly encouraged to show all their working out to ensure that they can demonstrate the method clearly.

Get the Order Right
This activity builds on the previous activity and allows students to further practice using the correct order of operations. Task B will help students understand the benefit of showing all their working out. Students are to examine these "solutions" for errors and to then correct the errors that they see. Students will have achieved excellent consolidation with their success in this task.

Calculations with Formulas
This task shows students the real life use of formulas. Task A teaches students how to substitute into formulas and calculate correctly using BIMDAS. Task B exposes students to a variety of different formulas. Task C is a research task where students can explore various financial formulas.

Scientific Formulas
This activity builds on the skills learned in the previous task. Students will use and substitute into a variety of real scientific formulas which will complement the work that they undertake in the science curriculum. Task C extends these concepts by asking students to informally solve equations. This concept is visited in detail in the final section of the book.

Create Your Own Formula
In this activity students are asked to read information and transform it into a formula. Many of these formulas appear in real life and contexts which students can understand. Translating real life mathematical processes into mathematical symbols is an important higher order skill.

Catching a Taxi
The first activity allows students to explore the visual representation of a commonly used function and exposes students to the fact that functions are represented by an equation, a table of values and a graph. This activity makes a strong introduction to future function work.

Electrician and the Plumber
Similar to the "Catching a Taxi" task, this activity provides students with another readily accessible example of the various representation of functions.

How We Calculate

When we have a few calculations to perform, all in the same question, how do we know which ones to do first? We follow the mathematical rules of BIMDAS.

For example, if we want to calculate $\mathbf{-10 \div 5 \times 3 + (7 - 4)^2}$, we follow the rules of BIMDAS as shown below.

$= -10 \div 5 \times 3 + (3)^2$ ⟵ Inside the brackets first.
$= -10 \div 5 \times 3 + 9$ ⟵ Use the power, calculate 3^2.
$= -2 \times 3 + 9$ ⟵ Working left to right, we divide first.
$= -6 + 9$ ⟵ Multiply next.
$= 3$ ⟵ Calculate last.

Brackets
Indices (powers)
Multiplication
Division
Addition
Subtraction

Remember: When there is a string of addition and subtraction or a string of multiplication and division, we simply calculate from left to right.

Calculate each sum below using the laws of BIMDAS. Set out your working as shown above.

a. $2 - (5-2)^3$

b. $-7 + 2 \times (-4) - 5$

c. $2^3 - 10 \div 5$

d. $14 \times (-2) \div 7 - 8 \times 3$

e. $100 \div 20 \times -3 - 5^2$

f. $10 - 3 + 4 - 2 \times (-12)$

g. $(4 \times 5 - 13)^2 + 3 \times (-2)$

h. $12 - 24 \div (-3) \times 2$

i. $5 \times (-6) \div 15 - 7 - 3 + 12$