Ready-Ed Publications

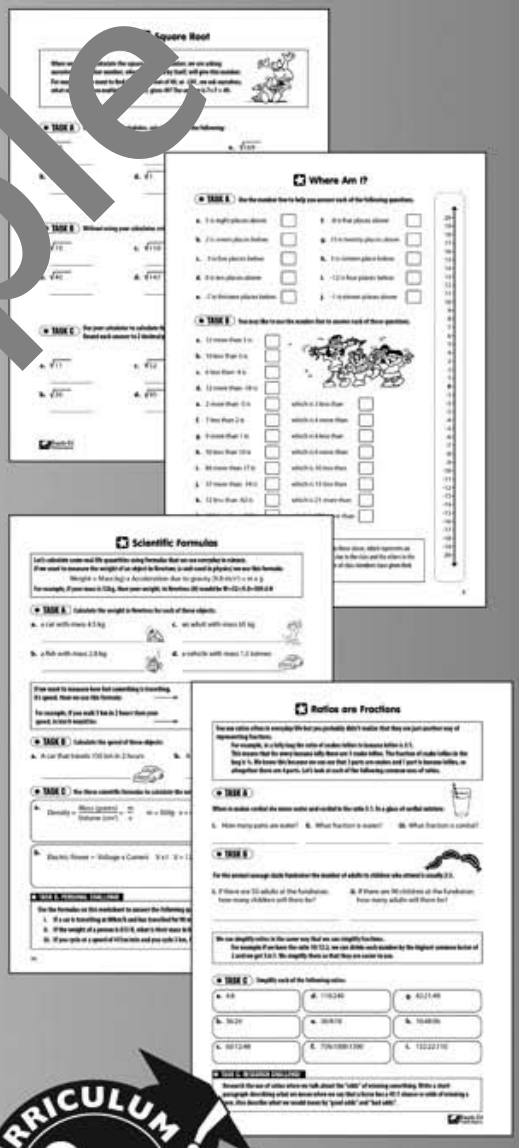
Number Strategies

PHOTOCOPY MASTERS

# Working On Number And Algebra

Aligned with the Australian National Curriculum

Ages 11-13 years






CURRICULUM LINKED

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# Contents

# *Teachers' Notes*

This resource focuses on the Number and Algebra Strand of the Australian Curriculum for students in aged between 11 and 13 years old.

Each section provides students with the opportunity to explore a key area of their numerical and algebraic understanding, often with the opportunity to explore their real life contexts or extend their exploration further.

The section entitled *Integers* exposes students to working with directed numbers and examines their uses in calculations and their real life applications. Students are encouraged to work on this section using mental skills and may check their solutions with a calculator.

The section entitled *Indices, Squares and Square Roots* teaches students the use of index numbers to simplify calculations and expressions. Students may also practice finding the lowest common multiple and the highest common factor using prime factors and index notation.

The section *Calculations and Algebraic Generalisations* focuses on calculating using the correct order of operation (BIMDAS) and the real life use of formulas. Students learn the use of formulas, the ability to substitute into formulas and how to derive their own formula from given information.

*Fractions, Decimals and Percentages* is the next section it encourages students to move fluidly between each of these three representations of numbers. Students will learn a variety of skills to deal with each type of representation mentally and to perform calculations in real life situations.

*Linear Equations* is the final section. It exposes students to the difference between expressions and equations. Students will learn to solve linear equations using a variety of strategies and also to apply these strategies to real life problems.

Each section is also prefaced by a Teachers' Notes page, explaining the idea and purpose behind each activity. Included here are methods to extend the activities or modify the activities based on individual student ability.

The majority of activities are scaffolded into two sections: Task A introduces the general skills to be mastered, usually enabling students competence in a given skill or an understanding of the basic number sequence. Task B explores the skill further with a more in-depth investigation or consideration and often extends the concept further.

Most activities contain a challenge at the bottom of the page. These challenges range from individual challenges, through to research and small group challenges. Each of these are designed to complement the activity page, yet extend the material. They are designed to engage student interest and appreciation for mathematics as well as expose students to the idea that mathematics can be a creative and investigative pursuit. Challenges can be included in the lesson of the day, or used as a stand-alone lesson when time permits. Many can be set as homework or assignment tasks over a longer period of time. Research tasks do tend to include the use of internet resources and it is advisable that computer resources are organized in advance.

It is hoped that *Working On Number And Algebra* will be used to help guide teachers in their teaching strategies and methods of presentation. While some activities are designed to be extra practice for students, many others can be used to present and teach students new concepts.

# 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?

_____

**b.** What do the negative level numbers represent?

_____

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

_____

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

_____

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

_____

**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.

_____

_____

_____

**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.

_____

_____

_____

**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 |
| Car Park A | -3 |

# 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.** $2\times2\times3\times2\times3\times3\times2 = 2^4 \times$

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

**c.** $\frac{3\times3\times2\times3\times2\times4\times2}{2\times2\times3\times4} = 3^2 \times$

**d.** $\frac{10\times10\times4\times10\times4\times4\times6\times6}{10\times4\times4\times6\times10} =$

**e.** $\frac{7\times7\times7\times2\times2\times3\times7\times2}{3\times3\times2\times7\times7\times3} =$

**f.** $3\times2\times3\times3\times4\times2 \times 4\times2\times3\times2\times4 =$

**g.** $6\times4\times2\times6\times6\times\ldots\times2 \times 4^3\times6^4\times2^5$
$=$

**h.** $\frac{5\ldots3^2\times4^7}{3\times3\times\ldots4\times4\times3\times5\times5\times5\times5} =$

## ✱ 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** $4^3 \times 5^2 \ldots 6^7$

**b** $(-3)^4 \times 12^2 \times 7^3$

**c** $\frac{3^6 \times 10^3 \times 15^2}{10^2 \times 15^4}$

**d** $(2^3 \times 6^2)^2$

**e** $(7^2 \times 4^{5\times} 3^3)^4$

**f** $\frac{(4^2 \times 11^3)^2}{(3^4 \times 7^2)^3}$

## ✱ 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.

# 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 $-10\div5\times3+(7-4)^2$, we follow the rules of BIMDAS as shown below.

$=-10\div5\times3+(3)^2$ ⟵Inside the brackets first.
$=-10\div5\times3+9$ ⟵Use the power, calculate $3^2$.
$=-2\times3+9$ ⟵Working left to right, we divide first.
$=-6+9$ ⟵Multiply next.
$=3$ ⟵Calculate last.

**B**rackets
**I**ndices (powers)
**M**ultiplication
**D**ivision
**A**ddition
**S**ubtraction

**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.** $2^3-10\div5$

**d.** $14\times(-2)\div7-8\div8$

**e.** $100\div20\times-3-5^2$

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

**g.** $(4\times5-13)^2+3\times(-2)$

**h.** $12-24\div(-3)\times2$

**i.** $5\times(-6)\div15-7-3+12$

# Multiplying and Dividing Fractions

**Multiplying two fractions together is easier than adding two fractions together!**
**All you need to do is multiply the numerators together and multiply the denominators together.**
**Then just simplify your answer.**
**For example, if we want to multiply $\frac{2}{3}$ and $\frac{3}{5}$ we can work out the answer like this:** $\frac{2\times3}{3\times5} = \frac{6}{15} = \frac{2}{5}$

## ✳ TASK A Calculate each of the following:

**a.** $\frac{1}{4} \times \frac{2}{5} =$

**b.** $\frac{5}{8} \times \frac{2}{6} =$

**c.** $\frac{3}{4} \times \frac{4}{7} =$

**d.** $\frac{6}{8} \times \frac{2}{9} =$

**e.** $\frac{3}{11} \times \frac{4}{6} =$

**f.** $\frac{5}{10} \times \frac{5}{6} =$

**g.** $1\frac{1}{45} \times 1\frac{2}{3} =$

**h.** $2\frac{1}{2} \times 3\frac{5}{7} =$

**i.** $4\frac{1}{6} \times 2\frac{3}{4} =$

**Dividing two fractions is easy! We simply flip the second and multiply.**
**For example, if we want to divide $\frac{4}{5}$ by $\frac{1}{2}$ we can work out the answer like this:** $\frac{4}{5}\times\frac{1}{2}=\frac{4\times2}{5\times1}=\frac{8}{5}=1\frac{3}{5}$

## ✳ TASK B Calculate each of the following:

**a.** $\frac{4}{5} \div \frac{2}{3} =$

**b.** $\frac{3}{4} \div \frac{1}{6} =$

**c.** $\frac{5}{9} \div \frac{2}{7} =$

**d.** $\frac{5}{11} \div \frac{1}{3} =$

**e.** $\frac{7}{8} \div \frac{1}{4} =$

**f.** $\frac{10}{12} \div \frac{2}{5} =$

**g.** $1\frac{1}{3} \div \frac{1}{4} =$

**h.** $2\frac{5}{8} \div 1\frac{1}{2} =$

**i.** $10\frac{3}{5} \div 2\frac{1}{5} =$

## ✳ TASK C: PERSONAL CHALLENGE

**Use your skills learned on this page to calculate, without a calculator, this sum:**

$$\frac{2}{5} \times \frac{5}{3} \times \frac{4}{10} \div \frac{1}{10} \times \frac{3}{4} \times \frac{4}{10} \div \frac{4}{6} \times \frac{2}{6}$$