Problem-based learning is a powerful alternative to drill-and-practice or skills-based learning, especially within maths, but it can be difficult to source rich materials that engage an entire class.

The Creative Activities in Mathematics series provides a wealth of investigations and open-ended active learning activities, designed to engage students and develop their problem-solving, collaboration and mathematical skills.

- Fun class activities based in the Australian Curriculum: Mathematics.
- Linked to Number and Algebra, Measurement and Geometry and Statistics and Probability curriculum strands.
- Includes teaching notes and staged lesson plans.
- Appropriate for students of differing ability in the same class, or students across different year levels.

BOOK 1: LOWER AND MIDDLE PRIMARY
Part 1: Number and Algebra
- Chapter 1: Numbers and words
- Chapter 2: Cats and dogs
- Chapter 3: Difference and sum problems
- Chapter 4: Arks and Tarks
- Chapter 5: The farmyard problem
- Chapter 6: The 12 game

Part 2: Measurement and Geometry
- Chapter 7: Classroom shapes
- Chapter 8: Jenny’s jellybean problem
- Chapter 9: Horrible Hal’s humungous hall

Part 3: Statistics and Probability
- Chapter 10: The longest name
- Chapter 11: Penny’s pet shop
- Chapter 12: The teddies’ race

BOOK 2: UPPER PRIMARY
Part 1: Number and Algebra
- Chapter 1: Hours in a day
- Chapter 2: Magimaths
- Chapter 3: Mr Mac’s iPhone

Part 2: Measurement and Geometry
- Chapter 4: Hubcaps
- Chapter 5: Goats and wheels
- Chapter 6: Boxes and more boxes

Part 3: Statistics and Probability
- Chapter 7: Sports shots
- Chapter 8: Roman gamblers
- Chapter 9: The school fete

BOOK 3: LOWER AND MIDDLE SECONDARY
Part 1: Number and Algebra
- Chapter 1: Number puzzles
- Chapter 2: The Tower of Hanoi
- Chapter 3: Nim-like games

Part 2: Measurement and Geometry
- Chapter 4: Hidden treasure
- Chapter 5: Tesselations
- Chapter 6: How high is a building?

Part 3: Statistics and Probability
- Chapter 7: Greedy Pig
- Chapter 8: Pascal’s triangle
- Chapter 9: Monty Hall’s problem
CHAPTER 1: HOURS IN A DAY

Initial problem

What are a day and a year on Earth? How long are they and why?

Background Information

This activity is based on the concept of ratio, but it has links throughout to Core Measurement and Geometry.

At Level 1, the work is based on days and years in the solar system with a strong connection to science. Level 1 is aimed at all students from Years 4 to 7, and it is suggested that you integrate this with elements of your science teaching. Level 2 will work well in Year 5 and 6 whilst Level 3 will begin to extend Year 5 students, but is accessible to Year 6 and 7 students.

The activity is based on the concept of ratio, but it has links throughout to aspects of Measurement and Geometry. This activity is based on the concept of ratio, but it has links throughout to aspects of Measurement and Geometry.

Each chapter is a fun, open-ended investigation designed to engage the entire class in the activity.

Activities are explicitly linked to the Australian Curriculum.

Big ideas

- How the solar system works, especially the notions of day and year
- Ratio and its use in real situations
- Rounding of decimals, ratio and their use in real situations
- Place value

Problem aims

- Ratio

Key concepts

- Rounding

Possible heuristics/strategies

- Make a table
- Draw a diagram
- Use a calculator

Breakdowns of key ideas, concepts and skills

Staged lesson plans help you customise classes for students of different abilities or different year levels.

<table>
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<th>Problem</th>
<th>Content descriptions</th>
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| Level 1: A day in the solar system | Year 4
Count by quarters, halves and thirds, including with mixed numerals. Locate and represent these fractions on a number line (ACMNA078)
Use am and pm notation and solve simple time problems (ACMMG086)
Year 5
Use estimation and rounding to check the reasonableness of calculations (ACMNA099)
Year 7
Solve problems involving division by a one-digit number, including interpreting the remainder (ACMNA140)

Level 2: The 12-hour day (teacher's choice)

Problem
Is a day being 24 hours built into the universe, or was the number chosen by someone at some stage in history?

As noted on p. 13, the work at this level can be done just as well by using 8 hours, 6 hours, division by 3, 6 hours, division by 5, or division by 12. You could even assign different day-lengths to different students depending on their ability.

Problem
How can students convert the schedule for a day's programs for a TV channel of their choice to another system?

Problem steps

Step 1
Hold a discussion about this. We'll use hours in mind that students have not had a chance to look at similar problems and may require extra time for the work to be completed, and times will be converted, given that 100 minutes to the hour is an extra complication.

Let the students try some simple conversions from 24-hour time to UNtime, first of hours and half hours. As noted on p. 13, the work at this level can be done just as well by using 8 hours, 6 hours, division by 3, 6 hours, division by 5, or division by 12. You could even assign different day-lengths to different students depending on their ability.

Step 2

Can the class give some examples of leap years? (2012, 2016, 2020, 2024 etc.) From this we'll talk about a day in Step 4. In the meantime, what is a leap year?

Step 3

Due to the vagaries of the solar system, it takes about 365 1/4 days for the Earth to go round the Sun. You might get your class to look this up online.

Step 4

An extra day is inserted to allow for the time it takes the Earth to go round the Sun. This is a leap year. The 'leap day' is 29 February. The extra day is stirred in to make a 366-day year.

Step 5

Can your class list some other countries that still use some non-decimal measurement systems: systems for length, volume, weight, temperature and so on, although the United States standard decimal number system. The vast majority of modern cultures use decimal measurement systems. If you are going to use this data for class discussion, you'll have to discuss it.

Level 3: A 10-hour day

Problem
In a spirit of decimalisation, the UN has decided that the world should shift to a 10-hour day with each hour being 100 minutes long.

How can students convert the schedule for a day's programs to another system?
ABOUT THE AUTHORS

DEREK HOLTON worked in New Zealand for almost 25 years, where he was part of the group that prepared students to take part in the international Mathematical Olympiad. An honorary Professor at the Melbourne Graduate School of Education, Derek is now retired but still works with students and teachers at every opportunity. He has never lost interest in showing students what he enjoys about mathematics.

CATH PEARN is a Senior Research Fellow in the ACER Institute. In this role she has written, delivered and reviewed programs for Australian primary and secondary classroom teachers. As a lecturer in Mathematics Education at the University of Melbourne, Cath teaches early childhood, primary, secondary and special education students at postgraduate level. Cath has been involved in research projects investigating how students learn mathematics at all education levels, particularly students mathematically ‘at risk’.

DUNCAN SYMONS is a Lecturer of Science and Mathematics Education at the University of Melbourne. His research interests include inquiry-based and investigative approaches to mathematics education in the primary years. He is also interested in how mathematics can be embedded within the broader curriculum. Duncan currently facilitates a program for Teacher Candidates at the University of Melbourne that focuses on the adoption and promotion of Science, Technology, Engineering and Mathematics (STEM) as a means to achieve integration.

CHARLES LOVITT has directed several Australian national and state projects such as Mathematics Curriculum and Teaching Program (MCTP) and Initiative 5.4 for Maths and Science. He was Director of Maths Projects for the Australian Curriculum Corporation and generated such projects as the Maths Task Centre Project, the Chance and Data project and more recently the Maths 300 project. Charles is now a consultant and a regular keynote and workshop presenter, both in Australia and abroad.

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