MATHEMATICS AND CAREER EXPLORATION YEAR 7

These resources are proudly supported by Toyota Community Trust, Australian Mathematical Sciences Institute, Australian Centre for Career Education, Aurecon Group, and Champion Data.

How to Use These Resources

The following lesson plans are supported by additional resources including:

- Student activity sheet PDFs. These can be completed digitally or printed.
- Supporting PowerPoint presentation including relevant videos.
- AMSI 2024 Teacher Professional Learning in Industry Day recordings. Hear from industry professionals and recent graduates and discover where mathematics can take you.

The lesson plans contain multiple activities that can be used to structure a class or series of classes. The activities can also be used separately to support your own lesson content, or assigned as homework.

Year 7 Lesson Plans	
Learning Intention:	• To understand and represent natural numbers as products of powers of prime numbers using exponent notation. • To explore the importance of prime numbers in real-world applications, such as encryption.
Success Criteria:	• Students can identify and explain what prime numbers are. • Students can decompose natural numbers into their prime factors. • Students can represent natural numbers as products of powers of prime numbers using exponent notation. • Students understand the application of prime numbers in encryption.

Australian Curriculum Links:	**AC9M7N02** Represent natural numbers as products of powers of prime numbers using exponent notation.
Australian Blueprint for Career Development:	**Phase: 3 – Starting Out** **Learning Area B: Learning and Work Exploration.** • Participate in lifelong learning supportive of career goals. • Locate and use career information effectively. • Understand the relationship between work, society and the economy. • Understand the changing nature of life and work roles.
Prior Knowledge/ Concepts/ Skills:	• Basic understanding of multiplication and division. • Understanding of prime numbers (from Year 6).
Equipment/ Resources required:	• Whiteboard and markers. • Access to computers/tablets for article reading. • Prime factorisation tree templates. • Calculators (optional). • Video - careers.amsi.org.au/cryptography/ • ABC Article *How Prime numbers keep your encrypted messages safe* **-** tinyurl.com/ABCEncryption • ICE-EM Mathematics text Year 7 (or equivalent – all Year 7 textbooks will have exercises on this topic). - schools.amsi.org.au/ice-em-mathematics-textbooks/
Useful Links:	• Myfuture - myfuture.edu.au • Your Career Occupations - yourcareer.gov.au/occupations Skills - yourcareer.gov.au/skillscourseseeker.edu.au • AMSI Career Videos - careers.amsi.org.au/all-videos/ • Visual Patterns - visualpatterns.org

Lesson Description:

Introduction:

- Discussion on prime numbers, explaining that a prime number is a number greater than 1 that has no divisors other than 1 and itself.
- Show examples of prime numbers (e.g., 2, 3, 5, 7, 11, 13). Also show non examples.
- ICE-EM Mathematics text Year 7 – Exercise 2C.

Career Link: Cryptography.

Note: This video is included in the Year 7 PowerPoint presentation.

- Video: careers.amsi.org.au/cryptography/
- Introduce the concept of prime factorisation and explain that every natural number greater than 1 can be expressed as a product of prime numbers.
- Introduce exponent notation and explain how it is used to represent repeated multiplication of prime factors.

Activity: Prime Factorisation.

- Demonstrate the prime factorisation of a number on the whiteboard using a factor tree.

Example: Factorise 60.
Prime factorisation: 60 = 22 x 31 x 51

- *ICE-EM Mathematics text Year 7* Ch 2D, 2E, 2F. Students practise prime factorisation and express the use of exponent notation.
- Encourage students to work in pairs to complete the factor trees and write the prime factorisation.

Activity: Real-World Application.

Note: This article and activity is included in the Year 7 PowerPoint presentation.

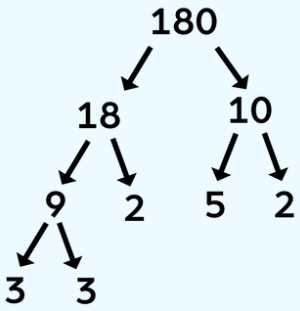
- *Ask students to read the article Prime numbers keep your encrypted messages safe – here's how. By Belinda Smith, ABC Science.*

Lesson Description:

- The RSA algorithm was named after the three mathematicians who first publicly unveiled it in 1977.
- Discuss how the RSA algorithm uses prime numbers to protect data.
- Facilitate a class discussion on the importance of prime numbers in technology and cybersecurity.

Application and Reflection:

- Provide an additional challenge problem for students to factorise and express using exponent notation. Is the answer always the same? Can you find a number that CAN'T be expressed in its prime factors?
  - Example: Factorise 180.



Prime factorisation: 180 = 22 x 32 x 51

- Ask students to reflect on the lesson and write a short paragraph on how understanding prime numbers can be useful in real life, particularly in technology.

Conclusion:

Recap the key points of the lesson:

- Definition of prime numbers.
- Prime factorisation and exponent notation.
- The role of prime numbers in encryption.
- Answer any remaining questions and provide additional resources for further practice.

Activity: Problem solving exercise. How many dollar coins?

Note: Download and distribute the activity sheet 'Sharing Money'. Use the Year 7 PowerPoint presentation to support the activity.

Lesson Description:

Pose the following problem:

"I have some dollar coins in my pocket. I noticed that when I shared them equally between two groups there was one left over. When I shared them between three groups there were two left over. How many dollar coins might I have in my pocket?"

Questions and prompts:

- Would materials help you solve this problem?
- How might you represent this problem?
- Can you think of more than one solution?
- What do you know about numbers that could help you?
- Do you notice any patterns?
- What is an odd/even number?
- Do all odd numbers work?
- Can you think of a generalisation for this problem?
- Can you create another problem like this but change the number of coins or the number of people they need to be shared with?

Students can go on a Gallery Walk to see how others are solving the problem.

Solutions:

The first discovery students make is generally that it must be an odd number. Some students are naturally more systematic than others when working out possible solutions. A good way to prompt the systematic mindset is to ask for the lowest number, then the next, etc. The students then need to organise their results and can easily determine patterns.

Most students will end up with something like this:

Trial no:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Numbers of coins:	5	11	17	23	29	35	41	47	53

Lesson Description:

Further questions:

What is the 10th number in the sequence? What is the 43rd? (We use this because students tend to multiply by 100 for the 100th – a good conversation starter!)
How do we determine ANY number in the sequence?

Students will come up with the following observations:

- 6 is added to the previous number in the sequence
- This is only helpful if we have the previous number though.
- If reminded of their algebra unit, students should realise that if the difference between each number is 6, then the equation must be y= 6x. The rest of the equation can be determined by looking at each of the values and working out what makes it true.
  - e.g. trial 1: x=1 y=5
  - 5 = 6 x 1 -1 So the formula is y = 6x – 1

Career links:

Engineers at Aurecon need to observe patterns and predict what will happen in all aspects of engineering, energy, advising and STEM. aurecongroup.com

Note: This is explored further in the Research activity: What is engineering? (Page 7).

Activity: Jobs of the future.

The careers landscape is constantly changing. While we see some jobs disappear new ones will take their place. New jobs are being created all the time.

Ask '*What do you think a…does?*'

- Cryptographer.
- Financial analyst.
- Meteorologist.

Visit myfuture and view the Careers Bullseye poster for Mathematics to discover more about where studying mathematics can take you. Discuss not only the wide range of occupations covered but also industries.

Teacher Notes:

The key message of this lesson is that new jobs (jobs of the future) will involve innovation, critical thinking and problem solving skills.

New jobs are appearing every day. They will require the workforce of tomorrow to be adaptive and quick to respond to change.

- Some trends that will impact jobs in the future.
- New technology is being developed all the time.
- People are living longer.
- The skills of people around the world are improving.

Lesson Description:

Research activity: What is engineering?

Note: This activity is included in the Year 7 PowerPoint presentation.

Engineering uses mathematics and other sciences to design, construct, maintain and problem solve.

Organisations like **Aurecon** use many different branches of engineering in their work accross all sorts of industries, and mathematics makes it all possible.

In groups or pairs, students can use Aurecon's 'About Us' page and **YourCareer**'s Occupation page to discover how a career in engineering can begin by studying mathematics at school.

Record or discuss in groups:

- How many different types of engineers can you see?
- What industries do they work in?
- What type of mathematics might be used in different fields of engineering?

Lesson Description:	• Search for engineering occupations on YourCareer. Discuss:
	  ○ Average salary.
	  ○ Future demand (workers needed in the future).
	  ○ Primary industries.
	  ○ Day to day tasks.
	  ○ Qualifications required.
	
	Optional: Students create a profile of an engineering occupation and present their findings.

Extension Activites or Homework Activities:	***Download and distribute the Year 7 worksheets available as part of these resources. The worksheet activities are also included in the Year 7 PowerPoint presentation.*** • Year 7 Worksheet 1 – *Finding multiples and common multiples.* • Year 7 Worksheet 2 – *Using clues to identify a number.*

Further Information:	Encourage students to explore more about prime numbers and their applications in fields such as cryptography, computer science, and mathematics.
	
	Games:
	
	• Factors and Multiples Game – nrich.maths.org/factorsandmultiples
	• Stars – nrich.maths.org/2669
	  ○ A good introductory activity to highlight the importance of factors and multiples.
	• Ben's Game – nrich.maths.org/bensgame
	  ○ Requires some simple knowledge of fractions and multiples and demands some strategic thinking.
	• Take Three From Five – htnrich.maths.org/1866
	  ○ This problem looks like a number task, possibly involving revision about multiples, but it becomes a question about establishing why something can never happen, and creating a convincing argument to show this.

Further Information:	○ Students are used to considering the cases where numbers are either odd or even, and here they are being introduced to the idea that numbers can also be categorised into: ▪ 1 more than. ▪ 2 more than. ▪ Exactly a multiple of 3. ○ This provides an introduction to number theory and a possible springboard to the ideas of modulo arithmetic. **At the end of EACH lesson** 1. Reconvene as a whole class and have each group present their solutions and findings. 2. Facilitate a discussion on different careers and the mathematical skills required for each. 3. Encourage students to reflect on their own interests and strengths in mathematics and potential career applications. 4. Provide additional information on educational pathways and opportunities for pursuing math-related careers. (Option: Design a poster/flyer.)