MATHEMATICS AND CAREER EXPLORATION YEAR 10

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 10 Lesson Plans	
Learning Intention:	• To explore the practical applications of mathematics in various careers. • To understand the relevance of mathematical concepts in real-world scenarios. • To inspire students to consider potential career paths that involve mathematics. • Use mathematical modelling to solve applied problems involving growth and decay. • Interpret solutions in terms of the situation; evaluate and modify models as necessary. • Interpret and use logarithmic scales in applied contexts involving small and large quantities and change. • Understand the importance of logarithmic scales in various careers, including epidemiology and finance.

Australian Curriculum Links:	**AC9M10A04** Use mathematical modelling to solve applied problems involving growth and decay; interpret solutions in terms of the situation; evaluate and modify models as necessary and report assumptions, methods, and findings. **AC9M10M02** Interpret and use logarithmic scales in applied contexts involving small and large quantities and change.
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.
Textbook References:	While the AMSI ICE-EM textbooks are referred to in this Unit, all Year 10 textbooks will have the exercises mentioned. Adapt to suit your prescribed text. schools.amsi.org.au/ice-em-mathematics-textbooks/
Equipment/ Resources required:	• Whiteboard and markers. • Worksheets or handouts. • Access to internet and computers/tablets.
Useful Links:	• Myfuture - myfuture.edu.au • Your Career - yourcareer.gov.au/occupations • AMSI career videos - careers.amsi.org.au/all-videos/ • Jobs and Skills Atlas - jobsandskills.gov.au/jobs-and-skills-atlas-dashboard
Lesson Duration:	60 minutes. ***Note: These activities can be used individually as components of a lesson or can be used over multiple lessons.***

Lesson Description:

The following lesson plans integrate mathematical concepts with real-world applications, emphasising the importance of modelling and logarithmic scales in various careers. The activities and resources from AMSI provide a robust framework for engaging students in meaningful learning experiences.

Introduction careers activity (15-20 mins):

Download and distribute the Year 10 worksheet 'Labour Market Exploration'.

1. The labour market is where workers trade their labour to an employer for a wage. Like any market, it is subject to forces such as supply and demand.
   - For an introduction to the concept view The Labour Market and Unemployment from the Reserve Bank of Australia.

2. As a class or in groups discuss occupations that will involve mathematics in some way *(Hint: It's probably more than you think!)*

3. Visit Jobs and Skills Australia and explore the Jobs and Skills Atlas.
   - Jobs and Skills Atlas provides an overview of the labour market at national, state and regional level by occupations, skills and industries.

4. Using the Occupations tab in the Atlas, search for the occupations the class or group decided on. Record and discuss the:
   - Median weekly earnings.
   - Median age.
   - Shortage and future demand.
   - Most recent estimated vacancies.

Ask: How do the weekly earnings compare to the national average? Is the workforce for that occupation young or old/what does this mean for the future? Where does that occupation rank on the Skills Priority List?

Introduction to Growth and Decay Models.

Equipment/Resources:

- Whiteboard and markers.
- Graph paper.
- Computers/tablets with internet access.
- AMSI textbook ICE-EM Year 10, Chapter 9. schools.amsi.org.au/ice-em-mathematics-textbooks/
- Video: Spread of Disease - careers.amsi.org.au/spread-disease
  - ***Note: This video is included in the Year 10 PowerPoint presentation.***
- Activities: NRICH
  - nrich.maths.org/public/topic.php?group_id=7&code=-109#results
  - amsi.org.au/teacher_modules/Indices_and_Logarithms.html

Lesson Description:

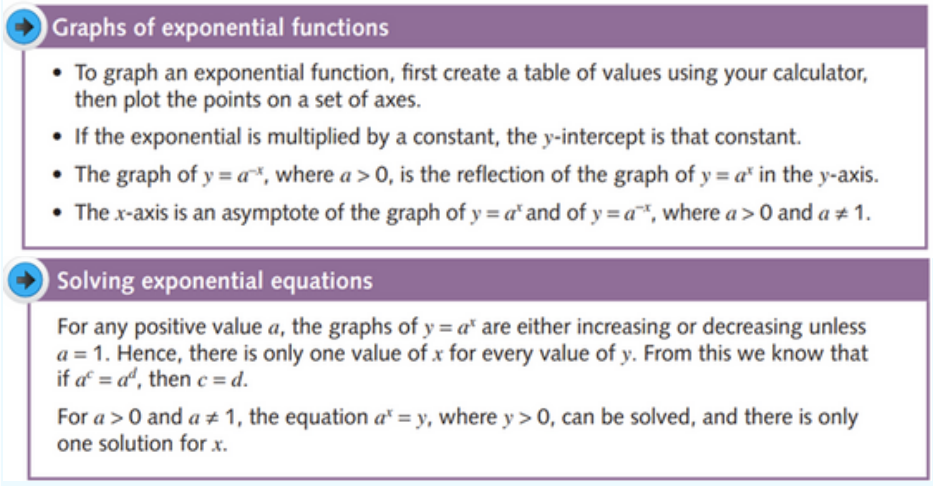
Introduction:

- Begin with a discussion on growth and decay, explaining real-world examples such as population growth, radioactive decay, and disease spread.
- Show the video Spread of Disease. careers.amsi.org.au/spread-disease
- Explain that the mathematical models shown were vital during the COVID-19 pandemic for predicting the spread of the virus and informing public health decisions.

Main Activity:

1. **Exploring Exponential Growth and Decay.**
   - Introduce exponential growth and decay models using examples from Chapter 9 of the AMSI textbook. (Ex 9D).
   - Work through a sample problem with the class, demonstrating how to set up and solve the equation for exponential growth/decay.

Lesson Description:



Graphs of exponential functions

- To graph an exponential function, first create a table of values using your calculator, then plot the points on a set of axes.
- If the exponential is multiplied by a constant, the y-intercept is that constant.
- The graph of $y = a^{-x}$, where $a > 0$, is the reflection of the graph of $y = a^x$ in the y-axis.
- The x-axis is an asymptote of the graph of $y = a^x$ and of $y = a^{-x}$, where $a > 0$ and $a \neq 1$.

Solving exponential equations

For any positive value a, the graphs of $y = a^x$ are either increasing or decreasing unless $a = 1$. Hence, there is only one value of x for every value of y. From this we know that if $a^c = a^d$, then $c = d$.

For $a > 0$ and $a \neq 1$, the equation $a^x = y$, where $y > 0$, can be solved, and there is only one solution for x.

2. **NRICH Activities.**

   - Students work individually or in pairs on the NRICH activities. (Choose most appropriate for the class.) nrich.maths.org/public/topic.php?group_id=7&code=-109#results
   - Encourage students to think about the assumptions made in the problem and how the model could be modified for different scenarios.

Conclusion:

- Discuss students' findings from the NRICH activities.
- Possible homework: Solve an additional problem from Chapter 9 of the AMSI textbook. schools.amsi.org.au/ice-em-mathematics-textbooks/

Introduction to Logarithmic Scales.

Equipment/Resources:

- Whiteboard and markers.
- Graph paper.
- Computers/tablets with internet access.
- AMSI textbook ICE-EM Year 10, Chapter 15 (or equivalent). schools.amsi.org.au/ice-em-mathematics-textbooks/

Lesson Description:	**Introduction:** • Review exponential growth and decay from the previous lesson. • Introduce logarithmic scales, explaining how they are used to represent large ranges of values and changes. **Main Activity:** 1. **Understanding Logarithmic Scales.** ◦ Use examples from Chapter 15 of the AMSI textbook to explain how logarithmic scales work. ◦ Demonstrate how to convert between exponential and logarithmic forms. ▪ amsi.org.au/teacher_modules/Indices_and_logarithms.html 2. **Real-World Applications.** ◦ Discuss careers that use logarithmic scales, such as epidemiology, finance, and seismology. ◦ Provide real-world data (e.g., COVID-19 case numbers, earthquake magnitudes, pH values) and have students create logarithmic scale graphs. ◦ Interpret the graphs and discuss how they help in understanding the data. **Conclusion:** • Summarise the importance of logarithmic scales in interpreting data. • Possible homework: Chapter 15 - solve related problems.

EXPONENTIAL GRAPHS

We can use the calculator to find approximate values of for various rational values of 2^x. We place these in a table and we can then plot the ordered pairs $(x, 2^x)$to produce a graph of $y = 2^x$.

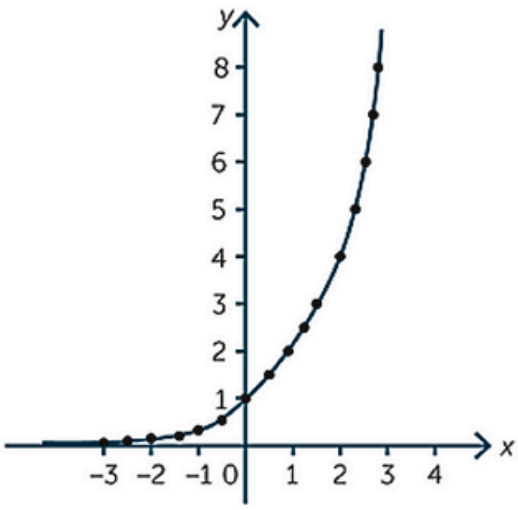
EXAMPLE

Produce a table of values for the function $y = 2^x$ and use it to draw its graph.

SOLUTION

A table of approximate values follows:

x	-3	−2.5	−2	−1.5	−1	−0.5	0	0.5	1	1.5	2	2.5	3
y	0.125	0.177	0.25	0.354	0.5	0.707	1	1.414	2	2.828	4	5.657	8



amsi.org.au/teacher_modules/Indices_and_logarithms.html

Lesson Description:

Applying Growth and Decay Models.

Equipment/Resources:

- Whiteboard and markers.
- Graph paper.
- Computers/tablets with internet access.
- AMSI textbook ICE-EM Year 10, Chapters 9 and 15 (or equivalent). schools.amsi.org.au/ice-em-mathematics-textbooks/

Introduction:

- Review growth and decay models and logarithmic scales.
- Discuss the importance of modelling in making predictions and informed decisions.

Main Activity:

1. **Case Study Analysis:**
    - Present a case study involving exponential growth or decay (e.g. population growth, radioactive decay).
    - Guide students through the process of setting up the mathematical model, solving it, and interpreting the results.
2. **Group Activity:**
    - Divide students into small groups and assign each a different applied problem involving growth and decay.
    - Students create models, solve the problems, and present their findings, including assumptions and modifications needed.

Conclusion:

- Discuss the different approaches and solutions presented by the groups.
- Highlight the importance of evaluating and modifying models based on real-world data.

Lesson Description:

Using Logarithmic Scales in Different Contexts.

Equipment/Resources:

- Whiteboard and markers.
- Graph paper.
- Computers/tablets with internet access.
- AMSI textbook ICE-EM Year 10, Chapter 15 (or equivalent). schools.amsi.org.au/ice-em-mathematics-textbooks/

Introduction:

- Review logarithmic scales and their importance in various fields.
- Introduce the concept of interpreting logarithmic scales in different contexts.

Main Activity:

1. **Exploring Different Contexts.**
    - Provide examples of logarithmic scales in different contexts (e.g. sound intensity, pH levels, earthquake magnitudes).
    - Students choose a context and create a logarithmic scale representation of given data.
2. **Justifying and Interpreting Visualisations.**
    - Students present their logarithmic scale graphs to the class.
    - Discuss the appropriateness of the chosen scales and the insights gained from the visualisations.

Conclusion:

- Summarise the lesson and the importance of choosing appropriate scales for data representation.
- Possible homework: Write a reflection on how logarithmic scales are used in a career of interest.

Lesson Description:

Integration and Project Work.

Equipment/Resources:

- Whiteboard and markers.
- Graph paper.
- Computers/tablets with internet access.
- AMSI textbook ICE-EM Year 10, Chapters 9 and 15 (or equivalent). schools.amsi.org.au/ice-em-mathematics-textbooks/

Introduction:

- Review key concepts from previous lessons: growth and decay models, logarithmic scales, and their applications.

Main Activity:

1. **Project Work.**
    - Students choose a real-world problem involving growth and decay or requiring logarithmic scale interpretation.
    - Students develop a mathematical model, create appropriate visualisations, and write a report detailing their assumptions, methods, and findings.
2. **Peer Review.**
    - Students exchange projects and provide feedback on each other's models and visualisations.
    - Discuss the feedback as a class, focusing on strengths and areas for improvement.

Conclusion:

- Reflect on the importance of mathematical modelling and logarithmic scales in solving real-world problems.
- Encourage students to consider how these skills can be applied in their future careers.

Further Information:	**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 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.)