

Formula substitution

Year 11-12 Mathematics

Renewable energy power from wind turbines

1. About the lesson plan

Grade Level	Year 11-12
Discipline	Mathematics Algebra
Topic(s) in Discipline	Formula substitution
Australian Curriculum Code	ACMEM035: substitute numerical values into algebraic expressions ACMEM036: substitute given values for the other pronumerals in a mathematical formula to find the value of the subject of the formula
Climate Topic	Renewable energy power from wind turbines
Cross Curriculum Priority	Sustainability
Lesson Length	50 min

2. Brief introduction to the Lesson Plan

Global warming due to fossil fuel emissions is one of the causes of climate change. Therefore, there is an increased interest in the use of renewable and cleaner sources of energy. This lesson plan will help improve students' literacy in clean energy sources while enabling them to practice Formula Substitution. It includes resources to teach your students about the **components of formulas**, and **substitution in a formula** using the **energy equation for wind turbines**, to enable them to understand the energy available from wind.

3. Learning Outcomes

The tools in this lesson plan will enable students to:

- Substitute given values for the other pronumerals in a mathematical formula to find the value of the subject of the formula.
- Substitute numerical values into an algebraic expression to evaluate the expression.

4. Introduced Climate Science Concepts

The tools in this lesson plan will help students find answers to:

- What is wind energy? How can it be harnessed to produce electricity?
- What are the advantages and challenges of producing electricity from a wind turbine?
- How can we compute the energy available from wind?

5. Presumed Knowledge

- Arithmetic with real numbers and the use of index notation (ACMNA150, ACMNA153, ACMNA183 and ACMNA154).
- Substitute values into formulas to determine an unknown (ACMNA234).
- Use units of energy to consumption of electricity (ACMEM031).
- Convert from one unit of energy to another (ACMEM034).

6. Teaching Resources

Tool ID	Type of Tool	Name and web link to the Teaching Resources	Brief Description	Credits
R1	Online document	<p>TIMES. Module 36: Number and Algebra: Formulas - teacher guide</p> <p>http://www.amsi.org.au/teacher_modules/Formulas.html</p> <p>This resource is also available at Scootle. Teachers need to sign in to scootle, and enter ACMNA234 in the search space</p>	A guide for teachers on teaching Formulas	<p>The Improving Mathematics Education in Schools (TIMES) Project</p> <p>The University of Melbourne on behalf of the International Centre of Excellence for Education in Mathematics (ICE-EM), the education division of the Australian Mathematical Sciences Institute (AMSI)</p>
R2	Video	<p>Wind power</p> <p>https://www.youtube.com/watch?v=Z5c50-hcD0</p>	A short video on wind power.	<p>Student Energy</p> <p>www.studentenergy.org</p>
R3	PowerPoint slides	<p>A teaching exercise on renewable energy</p> <p>https://www.monash.edu/mcccrh/projects/climate-classrooms</p>	A PowerPoint presenting a word problem that uses Formulas to compute the wind energy that enters the wind turbine. The working out of the answers appear step by step on mouse click.	<p>Dr. Roger Dargaville, Monash University</p>

7. Step-by-step lesson plan activities

Teacher activities and student tasks	Tool ID	Timing
<p>Group practice</p> <p>Students identify the variables, numbers and constants in a set of formulas</p> <p>(e.g. $A = \pi r^2$, $E = m c^2$, $F = G \frac{m_1 m_2}{r^2}$)</p> <p>They recall the elements of a Formula i.e. Variables, Numbers and Constants.</p> <p>They give examples of formulas they know.</p>	R1	5 min
<p>The teacher plays a video on wind power, then guides students to find the link between the content of the video and their Math topic.</p>	R2	3 min
<p>Guided practice</p> <p>The teacher goes through a worked example that uses substitution in formulas to calculate how much wind power a turbine receives.</p>	R3	5 min
<p>Independent practice</p> <p>Students solve a selection of questions from their textbook as advised by the teacher.</p>		37 min

8. Additional Resources:

If you or your students would like to explore the topic further (e.g. homework), these additional resources will be useful.

Type of Tool	Name and web link to the Additional Teaching Tool	Brief Description	Credits
YouTube Video	Maths solutions. Algebra - substitution into a formula	Worked examples on substitution into a formula	Leeds University Library

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