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# Lesson Plan: The Tiny House Architect Challenge

## Materials Needed:

- Graph paper (A3 or A4)
- Pencil and eraser
- Ruler
- Calculator
- Computer/tablet with internet access (for research and inspiration)
- Coloured pencils or markers (optional, for final design)
- 'Client Brief' and 'Building Materials Pricelist' worksheets (provided below)

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## 1. Learning Objectives

By the end of this lesson, the student will be able to:

- Apply knowledge of scale to create an accurate floor plan.
- Calculate the area of composite shapes to determine flooring and wall covering needs.
- Calculate the total surface area and volume of 3D objects (prisms).
- Apply mathematical skills to a real-world financial problem by creating and adhering to a budget.

## 2. Alignment with NSW Year 9 Mathematics Syllabus

- **MA5.1-8MG:** Applies formulas to find the surface areas of right prisms and the volumes of right prisms and cylinders.
- **MA5.1-9MG:** Interprets and uses scale factors to solve problems.
- **MA5.1-4NA:** Solves financial problems involving earning, spending and investing money.

## 3. Lesson Structure and Activities (Approx. 90-120 minutes)

### Part 1: The Spark - Introduction (10 minutes)

**Goal:** To engage the student and introduce the project concept.

1. **Watch & Discuss:** Watch a short (3-5 minute) video tour of a creative tiny house. Search "Amazing Tiny House Tour" on YouTube for inspiration.
2. **Discussion Questions:**
    - "What did you like about that design?"
    - "What do you think are the biggest challenges of living in a small space?"
    - "Imagine you were the architect. What maths would you need to know to design and build this?" (Guide them towards thinking about measurements, area, budget, angles, etc.)

### Part 2: The Client Brief - The Challenge (10 minutes)

**Goal:** To establish the parameters of the project and set the student up for success.

1. **Hand out the 'Client Brief' worksheet.** Read through it together. This is their design challenge!
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2. **Clarify the Rules:** Ensure the student understands the constraints (maximum size, budget, required rooms). This is the core problem they need to solve.

Worksheet Example: Client Brief

Client: The Explorer

Project: Design a modern, off-grid tiny house on wheels.

Constraints:

- **Maximum Base Dimensions:** 8 metres long by 2.5 metres wide.
- **Maximum Height:** 4 metres.
- **Total Budget for Materials:** $20,000
- **Required Areas:** Must include a designated space for sleeping (can be a loft), a small kitchen area, a bathroom, and a living/work area.
- **Your Task:** Create a design portfolio that includes a scaled floor plan, calculations for materials, and a final budget report.

Part 3: The Blueprint - Scale & Area (30-40 minutes)

Goal: To apply scale drawing and area calculation skills.

1. **Set the Scale:** Decide on a suitable scale for the graph paper (e.g., 1 cm on paper = 0.5 metres in real life, or 1:50). Write this scale clearly on the paper.
2. **Draft the Floor Plan:** The student draws a top-down floor plan of their tiny house on the graph paper. They must include the required areas and label the dimensions of each space.
3. **Calculate Flooring:** The student calculates the total floor area needed. This will likely involve breaking the floor plan into simpler rectangles (composite shapes).
4. **Budget Check #1:** Using the 'Building Materials Pricelist', the student calculates the cost of their chosen flooring and subtracts it from the $20,000 budget.

Part 4: Raising the Walls - Surface Area & Volume (30-40 minutes)

Goal: To calculate surface area for materials and volume for living space.

1. **Calculate Wall Area:** Assuming a standard interior wall height (e.g., 2.4 metres), the student calculates the total surface area of the interior walls. They'll need to remember to subtract the area for any windows or doors they plan to include.
2. **Budget Check #2:** Using the pricelist, the student calculates the cost of interior wall panels and exterior cladding and subtracts it from their remaining budget.
3. **Calculate Living Volume:** The student calculates the total volume of the main living space (Length x Width x Height). Discuss: "Why would knowing the volume be important?" (e.g., for choosing an air conditioner or heater).

Worksheet Example: Building Materials Pricelist

- **Laminate Flooring:** $45 per square metre
- **Bamboo Flooring:** $90 per square metre
- **Interior Pine Wall Panels:** $30 per square metre
- **Exterior Metal Cladding:** $110 per square metre
- *(Add a few other simple items like windows at a fixed price, e.g., $500 each)*

Part 5: The Final Pitch - Presentation & Reflection (10 minutes)

Goal: To summarise the project and reflect on the application of maths.

1. **Present the Design:** The student presents their final design portfolio (floor plan, calculations, and final budget).
2. **Reflect:** Ask questions like:
    - "What was the hardest part of staying within budget?"
    - "If you had another $5,000, what would you change?"
    - "Where else in real life would you need to use these kinds of calculations?"

4. Assessment Methods

- **Formative Assessment:** Ongoing observation and questioning during the design process. Checking calculations at each "Budget Check" stage to catch errors early.
- **Summative Assessment:** The completed 'Design Portfolio' is the main assessment piece. It will be evaluated based on:
    - **Accuracy:** Correct use of scale and correct calculations for area, surface area, volume, and budget.
    - **Completion:** All required elements from the Client Brief are included.
    - **Clarity:** Calculations are shown clearly and the floor plan is easy to read.

5. Differentiation and Inclusivity

- **For Support:**
    - Provide a pre-made template on graph paper with the maximum outline already drawn.
    - Provide a formula sheet with all the necessary formulas for area and volume.
    - Work through the first budget calculation together as a guided example.
- **For Extension:**
    - Challenge the student to design a roof with a pitch (a triangular prism) and calculate its surface area.
    - Ask them to research the real-world cost of a major component (like a solar panel system or a composting toilet) and incorporate it into their budget.
    - Have them calculate the volume of a custom-designed piece of furniture (e.g., a storage sofa that is a composite prism).

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