ONTARIO COUNCIL FOR TECHNOLOGY EDUCATION

Technology and the Skilled Trades

Grade 10/TAS20 or TCJ20 or TDJ20

July 2024

Students will research, design and build a model of a Tiny Home.

takeTECH

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Introduction

Course Code: TAS2O / TCJ2O / TDJ20
Destination: Open
Grade Level: 10

BBT(s) Covered in the Activity: Technology and Skilled Trades, Construction and/or Technological Design

This hands-on course enables students to apply the engineering design process and other technological knowledge and skills introduced in earlier grades. Students will design and safely create prototypes, products, and/or services, working with tools and resources from various industries.

As students develop their projects to address real-life problems, they will apply technological concepts such as quality control and health and safety standards. Students explore opportunities for job skills programs and education and training pathways, including skilled trades, that can lead to various careers.

Project Outline

- This project is designed for Construction students. However, creating the models using cardboard, paper, etc. (materials that do not require machines) could also be used in a technological design setting. You could also combine both BBT areas to have students do the design and research work in technological design and then build the models in a construction setting. The models could also be built using Google Sketchup or other computer-aided drafting software.
- Students will be given a scenario and parameters in which they will design and build a tiny home based on their own unique tastes. The project could be done in pairs or groups as teachers could break students into crews (i.e. kitchen team, bathroom design groups, exterior finishes, etc.)

Prior Knowledge

- No prior knowledge is required.
- Students may need to be able to use basic modelling tools such as scissors, modelling knives and hot glue guns.
- Students will be trained on any software or machinery that is required.

Student Activities

1. Students will begin by watching two videos to familiarize themselves with Tiny Homes.
2. Secondly, they will then research options, features and finishes they would like in their own home.
3. Third, they will ideate by sketching a seres of ideas for their home.
4. Next, they will create working drawings for their project.
5. Finally, they will build a model of their home.
6. Extension Activity: Using Technology

Ideation Session - Tiny Home House Hunters

Complete the questions below after watching the video House Hunters - Downsizing In Maryland.(April 03, 2019).

1. What seven items are on the client's wish list for their tiny home?
    - On wheels
    - Modern Rustic
    - Staircase
    - Artistic space
    - Fireplace
    - Regular toilet
    - Office space
    - Two lofts
    - Granite Countertops
    - Shower
    - Skylight
    - Stove
2. What four negatives were mentioned about the first home?
    - Over budget
    - New roof required
    - Colour
    - Composting toilet
    - Missing cabinets

- No lofts
- Small doorway
- Fixer upper
- Dark and cramped bedroom
- Lack of windows

3. What is the budget for Katie's home?
    - $50,000
    - $60,000
    - $70,000
    - $80,000
4. What is the square footage of the second place Katie looked at?
    - 260
    - 270
    - 280
    - 290
5. What was the asking price of the first place she looked at?
    - $50,000
    - $60,000
    - $70,000
    - $80,000
6. What four cool features did the last home have?
    - Trundle bed
    - Hot tub
    - Multi-use table
    - Composting toilet
    - Multi-functional stool
    - Skylight
    - Staircase
    - Cutting board/cooktop
    - Air conditioning

7. Which home did Katie end up choosing?
    - House #1
    - House #2
    - House #3
8. What did she end up paying for the house?
    - $50,000
    - $60,000
    - $70,000
    - $80,000
9. What modifications did she make to the house?
    - Colour change
    - Added windows
    - Added stairs to the loft
    - Garage door
    - In-floor storage
    - Skylight
    - Table for dining
    - Exterior deck
    - Air conditioning
10. What three features would you insist on for your own tiny home?

Building a Tiny Home from Start to Finish

Complete the questions below after watching the video, Building A Tiny House From Start To Finish!

1. Find four features that make the Foundation trailer special.
    - Mainframe is built out of tube steel
    - D rings on all four corners
    - Built-in plumbing pipes
    - Structural fenders
    - Belly pan

- Comes pre-insulated
- Extra wide

2. True or false, with a 16' house, the builders can literally pick up the walls and set them on the trailer.
    - True
    - False
3. What did they use to put the roof on?
    - Crane
    - Forklift
    - Scissor lift
    - Forkhoist
4. What are the wall studs and roof joists made of?
    - Steel
    - Wood
    - Aluminum
    - Fibreglass
5. What do they have to put in the wall studs to stop the wires from getting damaged as they pull them through?
    - Grommets
    - Washers
    - Flanges
6. Why do you want to regulate air and moisture inside of a home? (choose the best answer)
    - To prevent mould
    - To clean the air
    - To stop leaks
    - To keep out critters
7. What did they put on the interior walls?
    - Drywall
    - Tongue and groove pine

- Panelling
- Stucco

8. What did they cover the main floor with?
    - Laminate
    - Hardwood
    - Vinyl
    - Tile
9. Where did they create storage space?
    - In the loft
    - Under the bed
    - Created closets
    - Ceiling cabinets
10. What product did they use to clad the walls and cover the roof?
    - Cedar siding
    - Standing seam metal
    - Plywood
    - Vinyl siding

Tiny House Design Assignment

Create a slideshow and include all of the information requested below in each slide.

Tiny home demand up during pandemic as people seek change

Tiny House Design Assignment - Evaluation

Slide #	Requirements	Marks
1	• Name • Picture of a tiny home • Date • Teacher Name	/4
2	• Find SIX images (three interior and three exterior) of tiny homes that will inspire your design	/6
3	• Find an exterior wall covering you would like (ie. siding, brick, stone, etc.) • Provide an image(s) of the covering • Include the manufacturer for your wall covering	/3
4	• Find a style of front door • Provide an image of f the door • Include the manufacturer for your front door	/3
5	• Find a roof covering you would like • Provide an image • Include a manufacturer and the warranty provided for your roof covering	/4
6	• Choose a style of cabinet for the kitchen • Provide an image of the cabinets • Provide additional details - material and style	/3
7	• Choose a countertop for the kitchen • Provide an image of the countertop • Provide additional details - material and style	/3

8	● Choose a style of cabinet for the bathroom ● Provide an image of the cabinet ● Provide additional details - material and style	/3
9	● Choose countertops for the bathrooms ● Provide an image of the countertops ● Provide additional details - material and style	/3
10	● Choose a kitchen sink and faucet ● Provide dimensions of the sink ● Provide images of both ● Provide details on finishes	/4
11	● Choose a bathroom sink and faucet ● Provide dimensions of the sink ● Provide images of both ● Provide details on finishes	/4
12	● Choose a wall colour for the main room walls and ceiling ● Include a sample on the slide, labelled with which room it is for and who the manufacturer is	/4
13	● Choose interior doors for all of the rooms ● Provide an image	/2
14	● Find a suitably sized fridge for your home. ● Provide an image ● Provide dimensions	/3
15	● Find a suitably sized stove or stove top for your home. ● Provide an image ● Provide dimensions	/3
16	● Find a chemical toilet for your home.	/3

	● Provide an image ● Provide dimensions	
17	● Find a suitably sized shower for your home. ● Provide an image ● Provide dimensions	/3
18	● Find one additional appliance for your home (i.e. microwave, dishwasher, etc.). ● Provide an image ● Provide dimensions	/3
	TOTAL	/61

Tiny House Rough Sketches Assignment

Upon completion of this assignment, scan or photograph and submit the following Four rough sketches and Two refined sketches:

- Ideation Sketches - 4 In Total
    - two different floor plans
    - two different elevations

Once you have completed these ideation sketches then, you will create more refined rough sketches as per below:

- Floor Plan(S) Sketches - main floor and additional plan showing the loft
- Side Elevation Sketches

The trailer you will be designing your tiny house on will be 8’ wide x 16’ long.

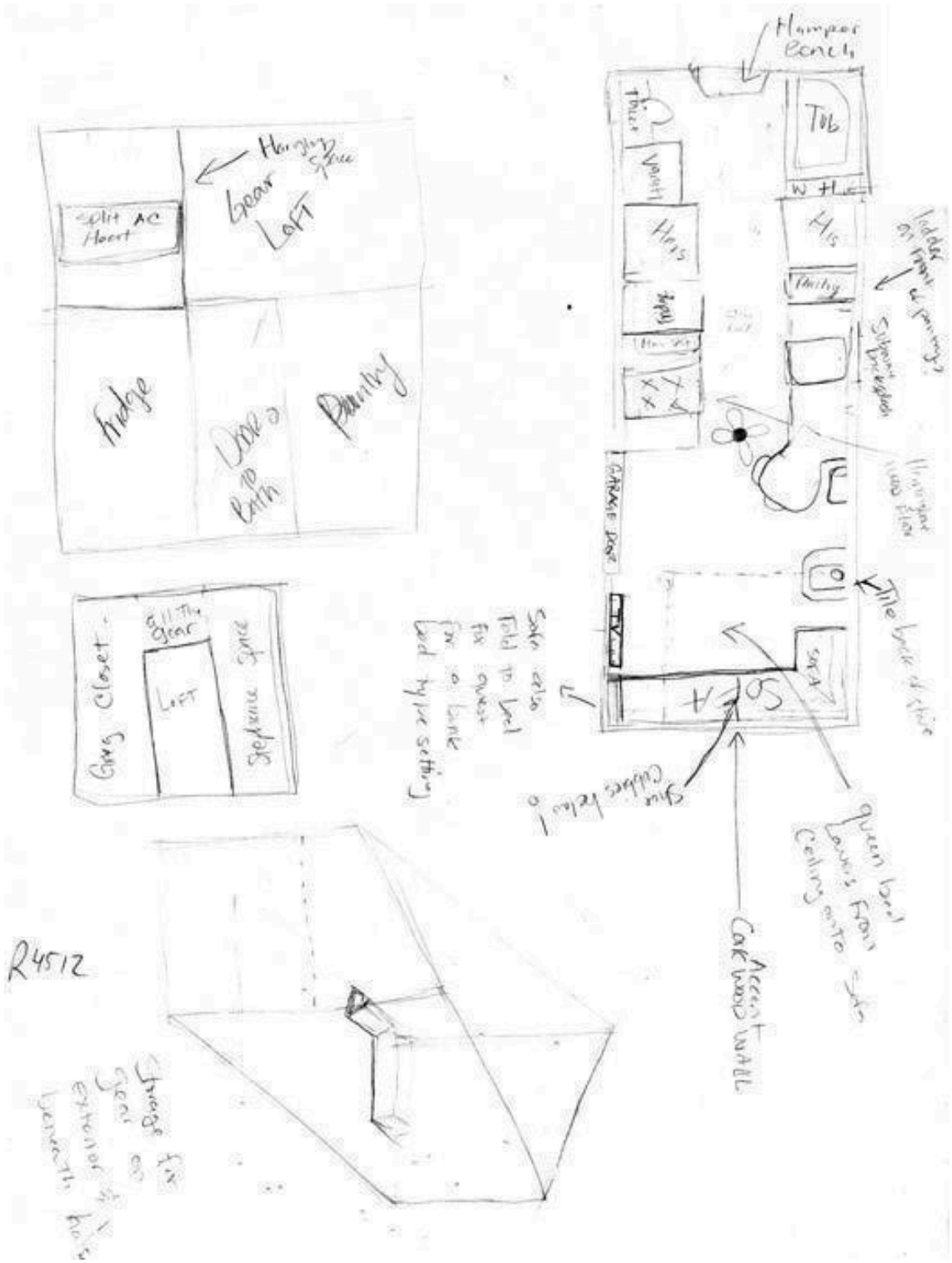
Your rough sketches do not have to be to scale, but you should attempt to have some sense of proportion (ie. the building will be twice as long as it is wide). You Do Not Need To Include Any Dimensions With Rough Sketches.

Using your ideas from yesterday’s assignment, try to incorporate all the Big Ideas and must-haves that you want in your home.

Start with your Floor Plan(s).

Your first rough design attempts (it may take more than one sketch to figure out how things will come together).

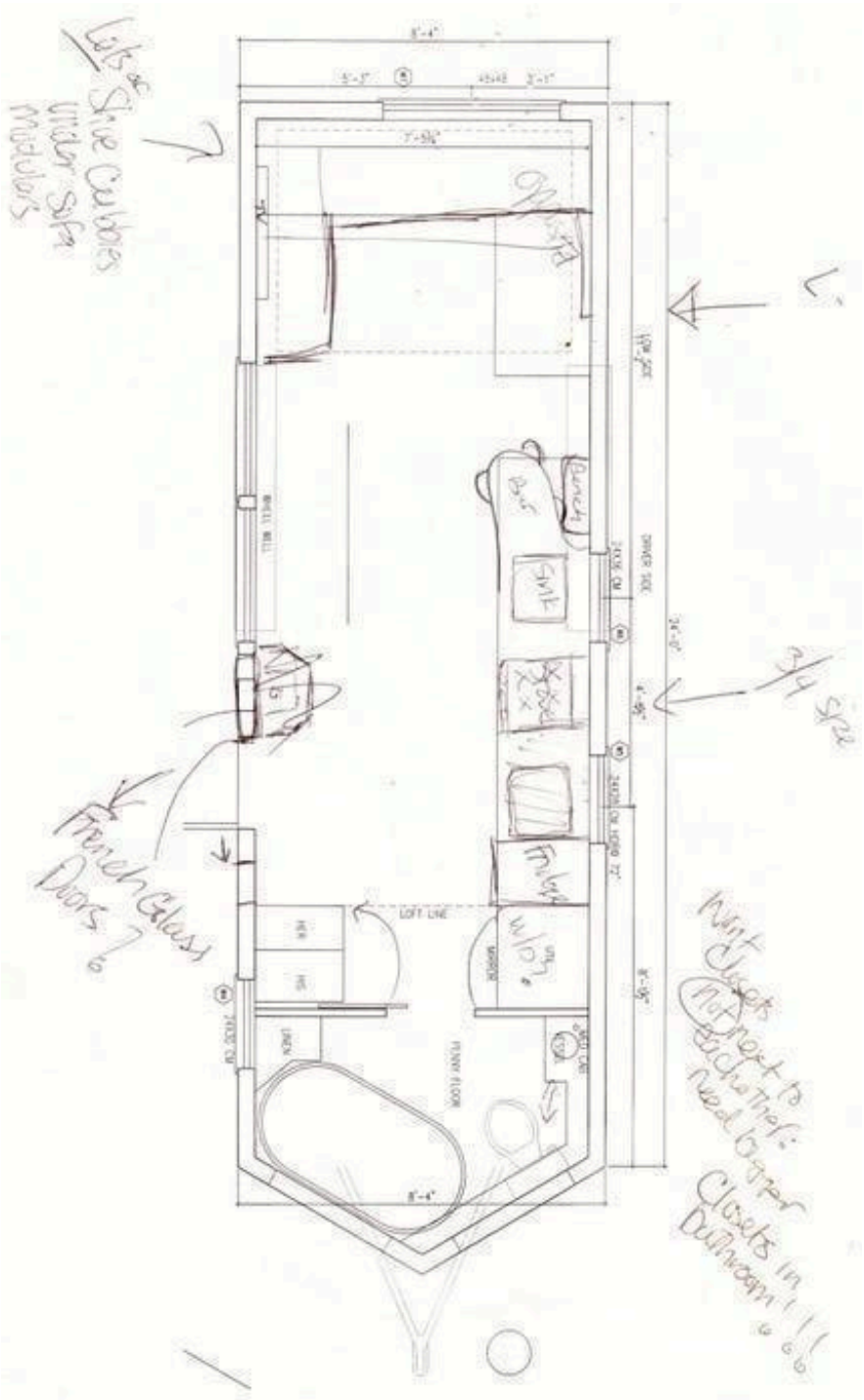
Sketch #1 (Example)



Courtesy of Greg Parham [Inside the Design and Build of a Tiny Home]

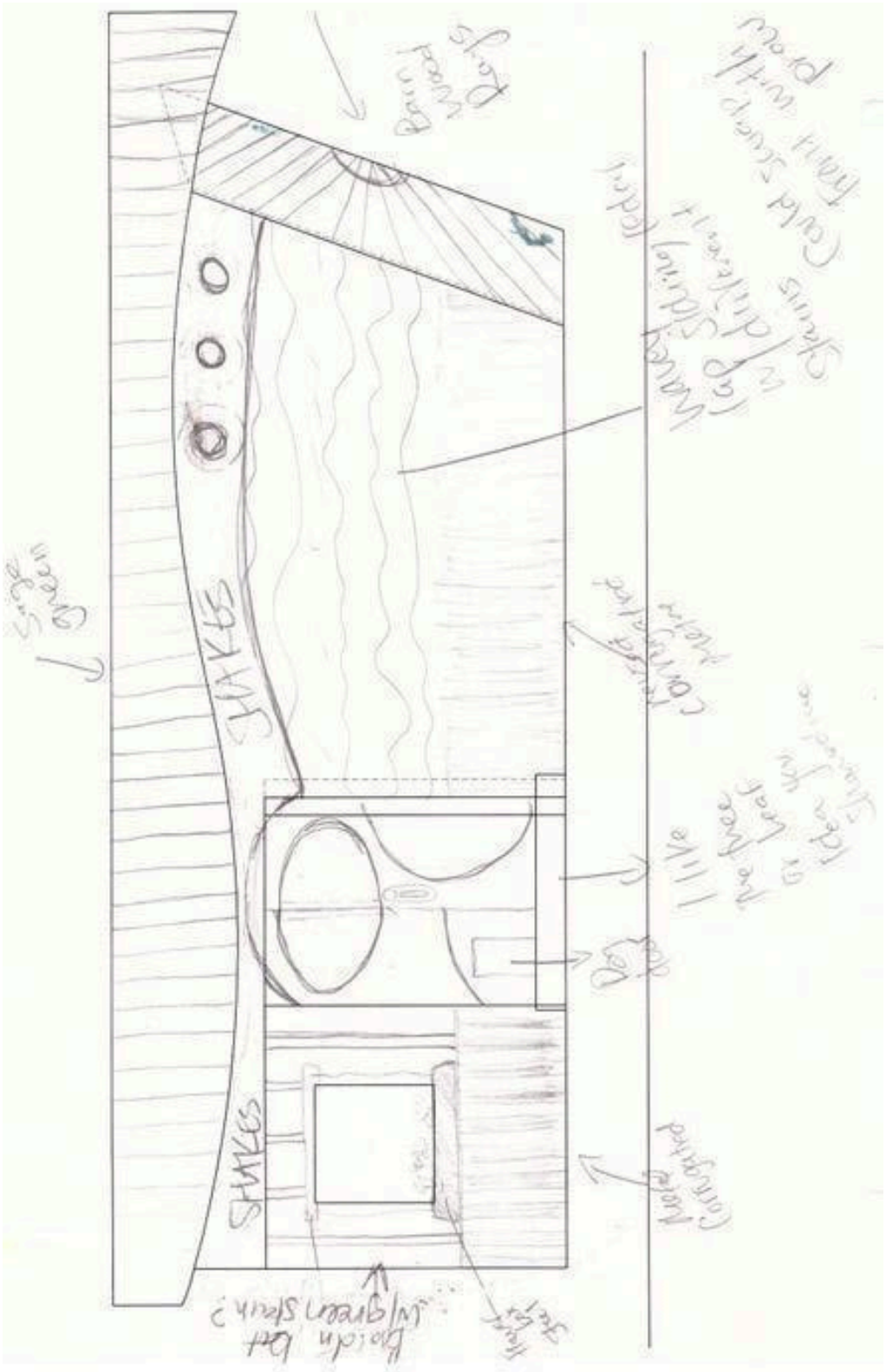
After an ideation session and some failed attempts, you will come up with a rough sketch that is ready for the next step.

Sketch #2 (Example)



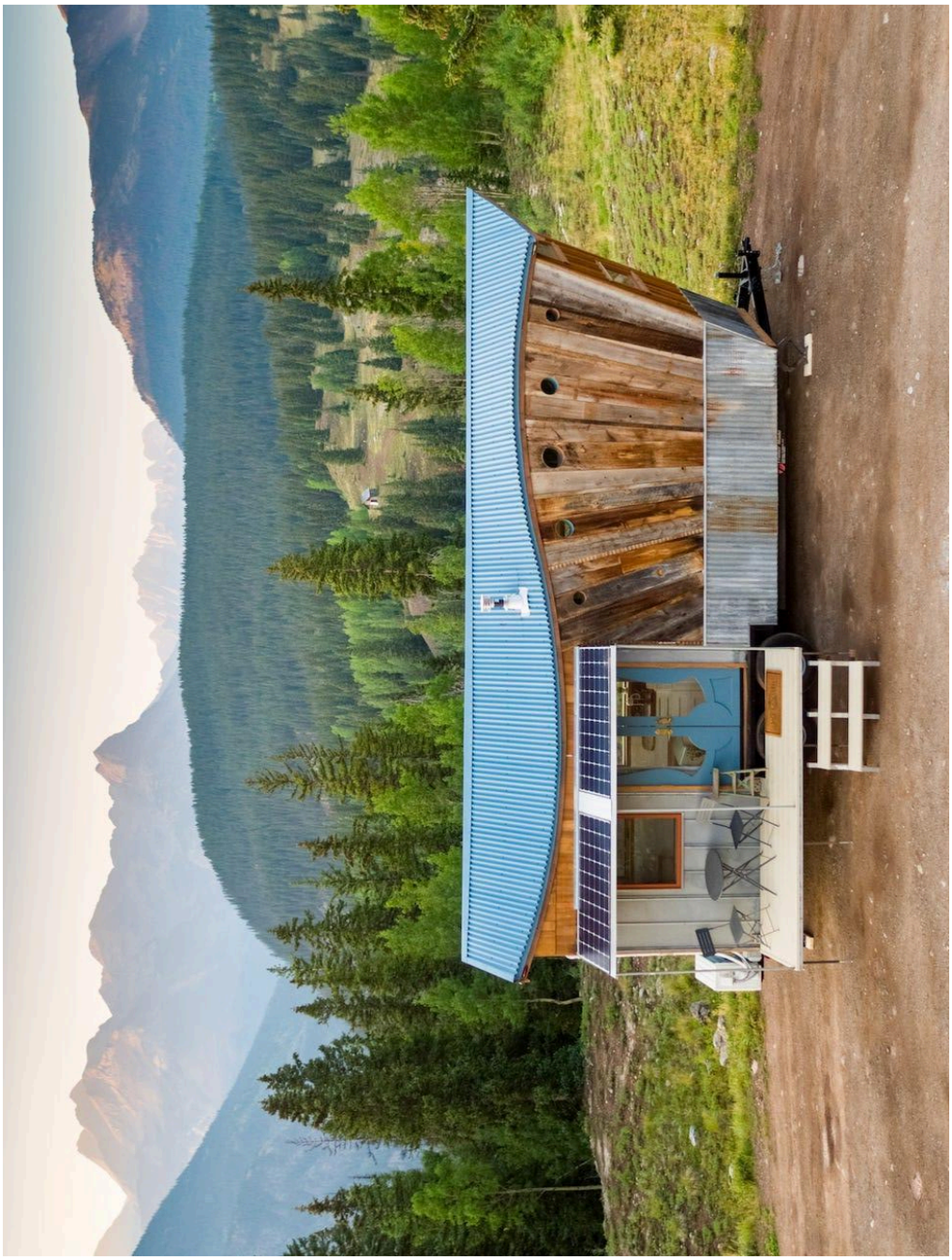
Courtesy of Greg Parham [Inside the Design and Build of a Tiny Home]

Sketch #3 (Example)



Courtesy of Greg Parham [Inside the Design and Build of a Tiny Home]

Image #4 (Example)



Courtesy of Greg Parham [Inside the Design and Build of a Tiny Home]

REPEAT the process for Main Floor And Loft Sketches

You'll now repeat this process for a side elevation of your tiny home. An elevation is a two-dimensional view of the structure.

Tiny House Rough Sketches Assignment - Outline and Evaluation

Categories	Level 1	Level 2	Level 3	Level 4
Thinking				
Ideation Images	• student has created one ideation image	• student has created two ideation images	• student has created three ideation images	• student has created four ideation images
Communication				
Floor Plan Sketch	• student has created a sketch that contains limited detail and thought	• student has created a sketch that contains a little detail and thought	• student has created a sketch that contains some detail and thought	• student has created a sketch that contains a lot of detail and thought
Elevation Sketch	• student has created a sketch that contains limited detail and thought	• student has created a sketch that contains a little detail and thought	• student has created a sketch that contains some detail and thought	• student has created a sketch that contains a lot of detail and thought

Tiny House Blueprints Assignment

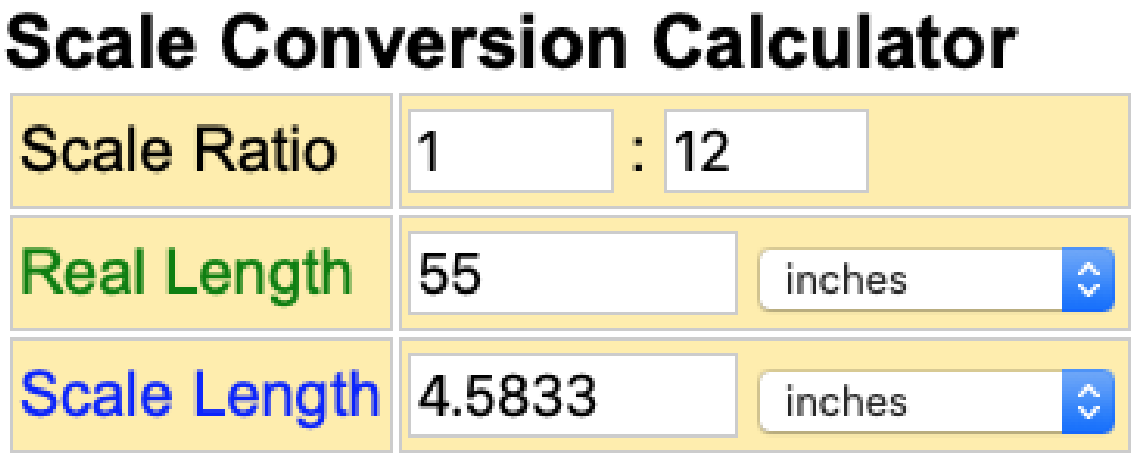
Create the following working drawings or blueprints:

- FLOOR PLAN(S) - main floor and additional plan showing the loft
- SIDE ELEVATION

Using both your sketches and your Design Assignment, you will now begin to create blueprints for your Tiny House.

- Your drawing will be done using a 1 inch = 1 foot scale.
- You can tape together 2 pieces of 8-1/2” x 11” papers or use an 11” x 17” sheet (if available)
- Your floor plan and elevation will be on two different pages (the equivalent of 2 @ 11 x 17 sheets)
- Make sure to use a ruler!
- You may also use software like Google Sketchup, TinkerCAD, Floorplanner or AutoCAD to create your blueprints if you are comfortable using these.
- YOUR TINY HOUSE IS TO BE MOUNTED ON AN 8’ X 16’ TRAILER, SO USE THESE DIMENSIONS FOR THE OUTSIDE DIMENSIONS OF THE HOUSE

Blueprint Drawing Steps



If needing to calculate “scale ratio” use the Scale/Conversion website.

Steps:

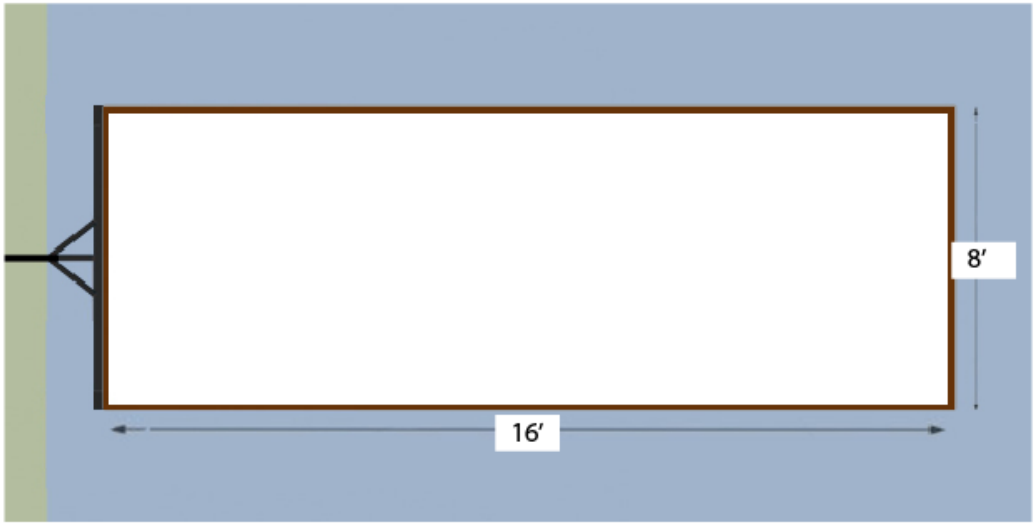
1. Start by drawing the exterior walls of your house.

   You can use the Scale/Conversion website to help with conversions from actual size to drawing size.
   Make sure you convert all actual measurements to inches (i.e. 8 feet = 96 inches) and set the converter, as shown in the picture.

The outside measurements of the house are 8 feet by 16 feet. When drawing on a 1:12 scale, your house will be 8 inches x 16 inches on the drawing.

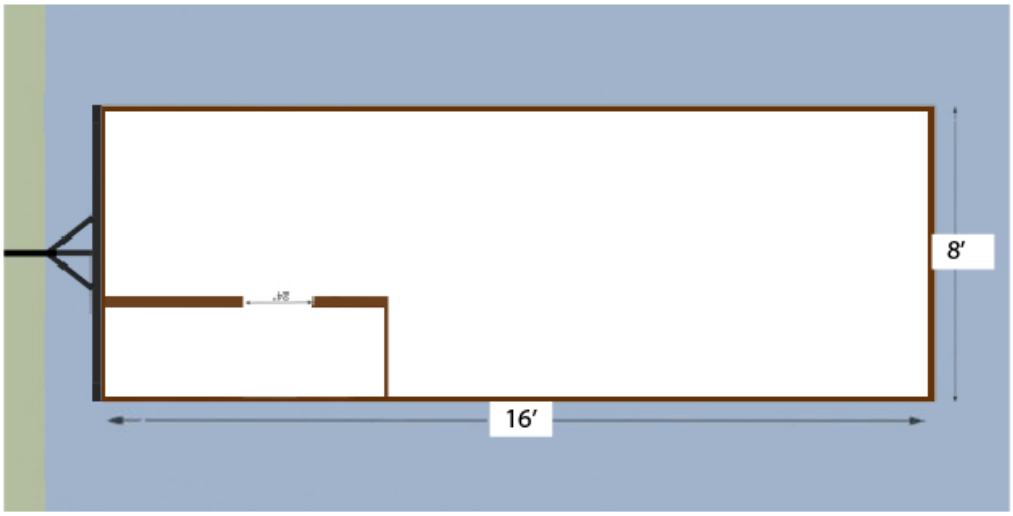
MAKE SURE TO CENTRE THE DRAWING.

Allow for 6-inch (ACTUAL SIZE) thick exterior walls. This allows for framing along with interior and exterior coverings.

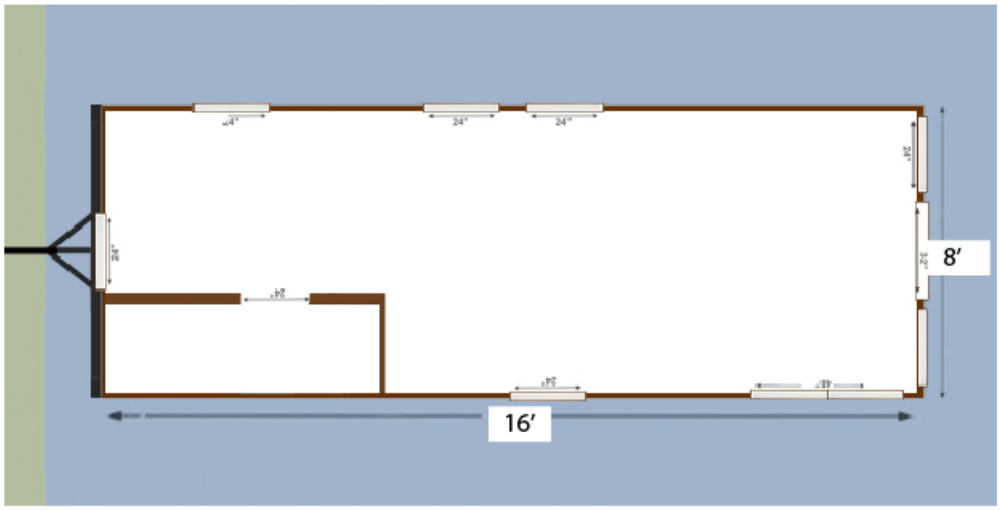


2. Next, you will add the interior walls. Allow for 4-1/2 inch (ACTUAL SIZE) thick interior walls.

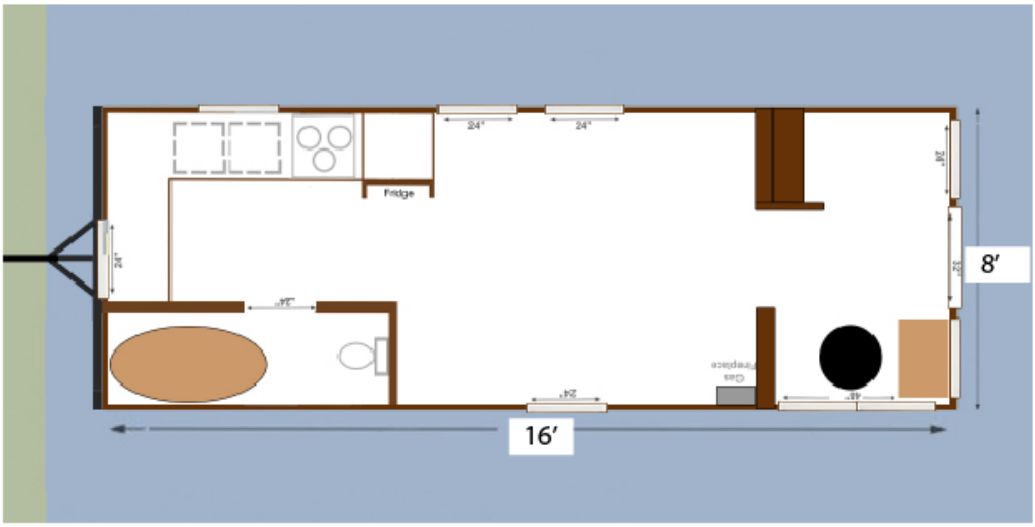
   Draw walls around any bathroom, stairwell or ladder areas. This is especially important if you are building a sleeping loft that will have some sort of permanent staircase structure. If there is no physical wall (or partition) around the stairwell, simply draw a faint dotted line. Draw staircases (or ladders) within these walls. Draw an arrow labelled “up” in the up direction of the stair.



3. The next step as you make your own blueprint is to draw your doors and windows onto the floor plan. For each door, window or wall opening on your floor plan: Draw the appropriate door or window symbol using the blueprint symbols on this page as your guide.



4. Using all of the research in your Design assignment, place all appliances (sink, fridge, stove, fireplace, etc.), plumbing fixtures and furniture.



5. The next step to make your own blueprint is to draw accurate measurements in the form of dimension lines. You will need to draw dimension lines for: Each room (although most tiny houses do not have “rooms,” per se)
    - Closets
    - Cabinet depths and/or bookshelf depths
    - Distances from wall to back of toilet (known as the rough in dimension)
    - Sizes of tub/shower unit

    From here you will do the same thing over again for any lofts /sleeping areas you have included in your designs/rough sketches.

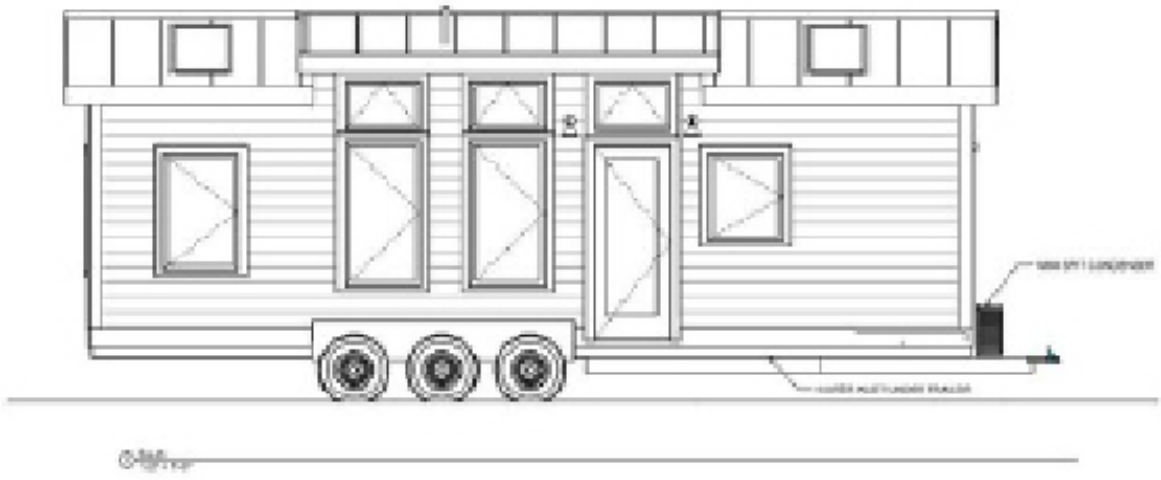
6. Now that your floor plans are completed, it is time to tackle the side elevation. Pick one of the long sides of your Tiny House and create a scale drawing of what it will look like. Note: You do not have to include a picture of the actual trailer; you just need to include the structure.

    Your maximum height will be twelve feet (ACTUAL SIZE).

    Be sure to transfer any windows/doors found on the floor plans.

    Add labelling for the type of roofing and exterior wall finishes.

    Below is an example of what different elevations might look like.



Tiny House Blueprints Assignment - Outline and Evaluation

Application Floor Plan Drawings	
	Floor Plan(s) has been drawn to the correct scale (1:12)
	Student has used a ruler
	Floor Plan(s) have been centred on page
	Exterior width is correct on floor plan(s)
	Exterior length is correct on the floor plan(s)
	Exterior walls are the correct thickness
	Interior walls are the correct thickness
	Floor Plan windows have been drawn as per the example provided
	Floor Plan doors have been drawn as per the example provided
	Toilet has been drawn as per the example provided
	Shower has been drawn as per the example provided
	Kitchen Sink has been drawn as per the example provided
	Stove has been drawn as per the example provided
	A bed has been included in the Floor Plans
	Notes have been included on Floor Plan(s)
	Notes are in CAPITALS and are clear and easy to read
	Dimensions have been included on Floor Plan
Elevation Drawings	
	Elevation has been drawn to the correct scale (1:12)
	Elevation has been centred on the page
	Elevation windows have been drawn as per the example provided
	Elevation doors have been drawn as per the example provided
	Exterior width is correct on the elevation drawing
	Exterior length is correct on the elevation drawing
	Exterior height is correct on the elevation drawing

	Notes have been included on the elevation drawing
	Dimensions have been included on the elevation drawing
/26	Total

Tiny House Fabrication Assignment

Watch the following videos for guidance and tips on building your house:

- How to Build a Tiny House Model
- Build a Tiny House Model with a 2 x 4

Using your Blueprints and your Design Assignment, you will create a scale model for your Tiny House.

- Your model will be using offcuts and any other available materials in the shop (plexiglass, dowelling, etc.), or if you are in a regular classroom, you will use cardboard or foam core
- Note: If you use a knife instead of scissors (not recommended), it is advised to cut while standing up (proven safer method than sitting down).
- it will be built at a 1:12 scale, the same as your blueprint
- be sure to include scale models of all furniture, plumbing fixtures, cabinets, and appliances
- make sure the roof is removable
- cut-out windows, skylights, etc.
- you may add additional details for exterior finishes (sandpaper or peeled-back cardboard makes for good roofing or siding material simulation

Tiny House Fabrication Assignment - Outline and Evaluation

Application	
	Model has been built to correct scale (1:12)
	Windows have been cut out
	Door(s) have been created
	A roof has been built
	The roof is removable
	A roof covering or shingle has been applied
	An exterior finish or siding has been applied
	Kitchen cabinets have been built and included
	A bed has been built and included
	Bathroom fixtures and cabinet has been built and included
	Stove has been laid out in kitchen
	A fridge has been built and included
/12	Sub-Total
10	• that the student demonstrated great understanding to achieve a truly exceptional result
8	• that the student demonstrated above-average understanding to achieve a very good result
6	• that the student demonstrated average understanding to achieve a moderate result
4	• that the student demonstrated below-average understanding to achieve a mediocre result
2	• that the student demonstrated weak understanding to achieve a poor result
/10	Sub-Total
/22	Total

Categories	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding				
Safety	• student is beginning to use the equipment for the intended purpose	• student occasionally uses the equipment for the intended purpose	• student usually uses the equipment for the intended purpose	• student always uses the equipment for the intended purpose
Set-up and operation of tools and equipment	• student demonstrates a beginning skill for set-up and operation of equipment and use of machines in proper order and process	• student demonstrates a developing skill for set-up and operation of equipment and use of machines in proper order and process	• student demonstrates good skill for set-up and operation of equipment and use of machines in proper order and process	• student demonstrates exemplary skill for set-up and operation of equipment and use of machines in proper order and process
Application				

Efficient and effective working skills	• Is beginning to plan and use class time wisely and efficiently	• Occasionally plans and uses class time wisely and efficiently	• Usually plans and uses class time wisely and efficiently	• Always plans and uses class time wisely and efficiently
Communication				
Order of Operations	• student has assembled a step-by-step Order of Operations that is missing many details	• student has assembled a step-by-step Order of Operations that is missing some details	• student has assembled a step-by-step Order of Operations	• student has assembled a detailed step-by-step Order of Operations

Order of Operations

While laying out and constructing your project, keep a detailed account of each step taken during the process and which tools were used (i.e. Step #1 - Milled lumber to finished thickness using the Jointer and the Planer). This can be done in sentence or point form on the lines below. After this, spend a few moments reflecting and then make notes on things you would do differently and discuss problems that arose that you had to overcome.

Task Description	Machine or Tool Used
Reflection Space	

Reflection of learning

Upon the conclusion of these lessons, activities, and assignments, the teacher is encouraged to reflect with their learners about:

- What did you feel was most successful?
- What areas could be improved?
- At what stage were you most engaged?
- How could this assignment be enhanced?
- What advice would you give to someone before starting this work?
- Provide one example of something that you learned.
- The students will be expected to complete an Order of Operations, journaling their work and reflecting on it upon completion.

Resources

The resources in this document include handouts, examples, appendices, pictures and step-by-step instructions. Students will use whatever resources are available to them, whether in a conventional classroom or Technological Design. room and/or Construction shop.

Planning Notes

- Teachers should consult with students throughout the activities.
- If required, permission forms should be created and signed by parents/guardians.
- Some safety lessons could be used depending on which direction the teacher wishes the project to go.
- A review of Imperial/Metric measurements may help.

Overall and Specific Expectations Covered

Overall Expectations

A1. Initiating and Planning - demonstrate an understanding of fundamental technological concepts and related skills by initiating and planning projects

A2. Designing and Performing - develop projects that involve creating products and/or services, using a variety of resources and techniques, and record the development of their projects

A3. Analyzing and Refining - evaluate and refine processes, products, and/or services

A4. Following Health and Safety Practices - apply an understanding of health and safety practices and procedures when using materials, tools, and equipment.

B1. Fundamentals of Technological Development - demonstrate an understanding of how various needs and underlying social, economic, and environmental factors drive the evolution of technology

B3. Careers and Pathways in Technology and the Skilled Trades - explore and describe careers in technological fields and the skilled trades, and pathways for entering them

Specific Expectations

A1.1 investigate and describe fundamental technological concepts, and explain how they are relevant to developing products and/or services in a variety of broad-based technology areas.

A1.2 apply an understanding of fundamental technological concepts, design considerations, and science, technology, engineering, and mathematics (STEM) concepts as appropriate in developing projects involving the creation of products and/or services.

A1.4 communicate design ideas for various purposes and audiences, using appropriate industry terminology.

A1.5 establish evaluation criteria for products and/or services being developed, including qualitative and/or quantitative measures, making connections to relevant fundamental technological concepts

A2.1 use project management skills to develop a process to create a product and/or service

A2.3 describe properties and characteristics, including sustainability, of materials, and justify the selection of the materials and other resources they are using in the creation of products and/or services

A2.4 select, use, and maintain tools and equipment appropriately as part of creating products and/or delivering services.

A2.7 select appropriate units of measure and tools to make accurate measurements using relevant measurement systems, such as the metric and imperial systems

A3.1 identify challenges they encounter in the process of developing their projects and apply critical thinking skills to address these challenges.

A3.3 identify potential refinements to the design of products and/or services based on an analysis of data collected throughout the development process.A3.4 communicate project-related challenges, performance analyses, and proposals for refinements for a specific audience, using appropriate formats and terminology.

A4.1 describe relevant health and safety regulations for the classroom and workplace, including mandated roles and responsibilities
A4.3 use tools and equipment safely, including using personal protective equipment and safety devices as appropriate
A4.4 follow practices that support physical and mental health and well-being
A4.5 follow proper procedures for the safe handling, storage, and disposal of materials and waste products
A4.6 demonstrate a safety mindset by making safety a priority at all times and by engaging in industry-specific safety procedures

B1.1 investigate and describe interrelationships between user needs and the development of various technological solutions
B1.4 describe ways in which diverse communities, including First Nations, Métis, and Inuit, have applied their understandings, practices, beliefs, and experiences in their approach to technological problem solving

B3.2 research and identify programs, including in-school job skills programs and community-based programs, related to pathways and careers in technological fields and the skilled trades

Skilled Trade, Apprenticeship and Career Opportunities

- Architect
- Architectural Technologist
- Construction Engineering Technician
- Construction Craft Worker
- Engineer
- Inspector
- Electrician
- HVAC Technician
- General Carpenter
- Mechanic
- Plumber
- Welder

Universal Design for Learning

The personalized design and build project aligns with the Universal Design for Learning (UDL) framework by offering multiple means of engagement, representation, and action and expression. Students choose their designs, ensuring relevance and motivation, while collaborating and receiving peer feedback. This project provides diverse resources in various formats, supporting different learning preferences. Key concepts are explained through multiple representations to aid understanding. Students demonstrate their knowledge through varied methods, with scaffolded support and progressive skill development. Additionally, the project ensures accessibility and encourages cultural inclusivity, making it suitable for all students.

Teachers are encouraged to visit https://udlguidelines.cast.org/ for more information.

Instructional Strategies

- Independent, guided research
- Open-ended problem solving
- Supervision and feedback
- In-person discussions
- Brainstorming

Motivational Strategies

- A real-life scenario is used to allow students to imagine that they are building a home for themselves
- This project could be done in partners or groups
- Students are integral to the design and build process

Learning Goals and Success Criteria

By the end of this project, students will be able to:

- Demonstrate an in-depth knowledge of what a Tiny Home along with the pros and cons of living in one
- Demonstrate an understanding of the safe use of tools and equipment.
- Demonstrate the ability to complete scale drawings.
- Demonstrate the ability to communicate ideas and information through technical sketches and presentation software.
- Will be able to fabricate a product using simple or more advanced machines
- Will use keywords in an internet search.
- Will demonstrate learning skills that include Responsibility, Organization, Independent Work, Initiative, and Self-Regulation

Differentiation of the Project / Activity

There are a number of ways in which this project can be differentiated for instruction. They include:

- The project can be completed using simple tools or more complex machinery and automation.
- The presentation technique may change to video or live video discussion.
- Teachers may give a student a specific design to try.
- Extension activities may be used to enhance projects or substitute parts of projects.
- Teachers may allow students to work with partners.

Engineering Design Process

The engineering design process will allow students to demonstrate their learning through a design process connected to the broad based technology classes.

This engineering design process has been modified from the Ministry of Educations model and as part of the expectations this step-by-step guide was developed to help the educator meet those expectations This engineering design process is to use as the basis of the activity below.

Students will go through the process of Initiating and Planning, Designing and Performing, and Analysing and Refining a project based on a real world problem.

Any engineering design process can be used. Connect with your board to implement the engineering design process that is currently being used in your district.

Fundamental Technological Concepts

The fundamental technological concepts covered in this assignment include, but are not limited to:

- describe the components and systems of buildings, the properties of various building materials, and the processes in which those materials are used;
- demonstrate an understanding of the safe and correct use of construction tools, equipment, and techniques;
- use correct terminology to describe building components and construction materials, tools, equipment, and processes.
- design construction projects, individually or in small groups, applying a design process to plan and develop the projects and other problem-solving processes to address various related problems and challenges;
- use drawings to represent design ideas and solutions to technological challnges, and interpret drawings accurately when working on construction projects;
- apply the mathematical skills required to plan and build construction projects.

- use tools, equipment, and techniques correctly and safely when preparing materials for a project;
- use fabrication and assembly techniques safely, accurately, and in the correct sequence

Indigenous ways of knowing, doing and learning

Tiny Homes are a great way to help provide suitable housing in remote communities where many Indigenous people can be found. Through classroom discussion, we will research videos and articles on how this model has been successful.

- GTA Students Building Tiny Homes for Indigenous Communities
- Indigenous community celebrates land gift for tiny home village

Potential For Community Partnership

- Investigate to determine if there are any Tiny Home builders or structures in your community. This could provide an opportunity for a field trip.
- Look for guest speakers who could come in and discuss the unique challenges/benefits of building and/or living in a Tiny Home.
- Work in conjunction with community members to build a Tiny Home.
- Research cooperative education partners and/or chances for students to volunteer.

Innovation and Emerging Technologies

Investigate whether you have a 3D printer or CNC technology in your school or classroom. Students could use these to build the models in sections or add intricate details to their projects.

Students could also look into ways to take their home “off the grid.” This could involve investigating solar technology (shingles), reusing rainwater, compostable toilets, etc.

Assessment and Evaluation

- As part of assessment for learning, teachers provide students with descriptive feedback and coaching for improvement. Teachers engage in assessment as learning by helping all students develop their capacity to be independent, autonomous learners who can set individual goals, monitor their own progress, determine next steps, and reflect on their thinking and learning.
- Multiple rubrics and checklists have been woven throughout this resource to allow students to track their progress throughout the assignments and for teachers to give constructive feedback to allow students to re-submit assignments to improve their learning and marks.

- Overall and Specific Expectations that support the project are identified that both teachers and students can use to track their learning and progress

Experiential learning

This hands-on project uses experiential learning by immersing students in a Tiny Home model's designing and building process. Students actively engage in the design process, from conceptualizing their ideas to executing them using various building and planning techniques. They experience real-world applications of design principles, receive immediate feedback from peers and instructors, and iterate on their work to improve their skills.

Health and Safety Considerations

- If required, permission forms should be created and signed by parents/guardians.
- Depending on the class or shop used, extensive safety training must be administered
- Students may use modelling tools like modelling knives and hot glue guns. Applicable safety should be covered. Proper PPE should be worn, including safety glasses.

Applicable SAFEDocs and ToolSAFE Videos

- Exploring Technologies SAFEDocs (OCTE), 2013
- Construction Technology SAFEDocs (OCTE), 2013
- Technological Design SAFEDocs (OCTE), 2013
- ToolSAFE TDJ Modelling Tools, (OCTE), 2015
- ToolSAFE TDJ Hot Glue Gun (OCTE), 2015

Appendix

Appendix A - Ideation Session - Tiny Home House Hunters

Complete the questions below after watching the video House Hunters - Downsizing In Maryland.(April 03, 2019).

1. What seven items are on the client's wish list for their tiny home?
    - On wheels
    - Modern Rustic
    - Staircase
    - Artistic space
    - Fireplace

- Regular toilet
- Office space
- Two lofts
- Granite Countertops
- Shower
- Skylight
- Stove

2. What four negatives were mentioned about the first home?
    - Over budget
    - New roof required
    - Colour
    - Composting toilet
    - Missing cabinets
    - No lofts
    - Small doorway
    - Fixer upper
    - Dark and cramped bedroom
    - Lack of windows
3. What is the budget for Katie's home?
    - $50,000
    - $60,000
    - $70,000
    - $80,000
4. What is the square footage of the second place Katie looked at?
    - 260
    - 270
    - 280
    - 290
5. What was the asking price of the first place she looked at?
    - $50,000

- $60,000
- $70,000
- $80,000

6. What four cool features did the last home have?
    - Trundle bed
    - Hot tub
    - Multi-use table
    - Composting toilet
    - Multi-functional stool
    - Skylight
    - Staircase
    - Cutting board/cooktop
    - Air conditioning
7. Which home did Katie end up choosing?
    - House #1
    - House #2
    - House #3
8. What did she end up paying for the house?
    - $50,000
    - $60,000
    - $70,000
    - $80,000
9. What modifications did she make to the house?
    - Colour change
    - Added windows
    - Added stairs to the loft
    - Garage door
    - In-floor storage
    - Skylight
    - Table for dining

- Exterior deck
- Air conditioning

10. What three features would you insist on for your own tiny home?

Appendix B - Ideation Session - Tiny Home House Hunters (Answer Sheet)

Complete the questions below after watching the video, Building A Tiny House From Start To Finish!

1. What seven items are on the client's wish list for their tiny home?
    - ~~On wheels~~
    - ~~Modern Rustic~~
    - ~~Staircase~~
    - ~~Artistic space~~
    - Fireplace
    - ~~Regular toilet~~
    - Office space
    - ~~Two lofts~~
    - Granite Countertops
    - ~~Shower~~
    - Skylight
    - Stove

2. What four negatives were mentioned about the first home?
    - ~~Over budget~~
    - New roof required
    - ~~Colour~~
    - ~~Composting toilet~~
    - Missing cabinets
    - ~~No lofts~~
    - Small doorway
    - Fixer upper
    - Dark and cramped bedroom
    - Lack of windows

3. What is the budget for Katie's home?
    - $50,000
    - $60,000
    - ~~$70,000~~
    - $80,000

4. What is the square footage of the second place Katie looked at?
    - 260
    - 270
    - ~~280~~
    - 290

5. What was the asking price of the first place she looked at?
    - $50,000
    - $60,000
    - $70,000
    - ~~$80,000~~

6. What four cool features did the last home have?
    - ~~Trundle bed~~
    - Hot tub
    - Multi-use ~~table~~
    - Composting toilet
    - ~~Multi-functional stool~~
    - Skylight
    - Staircase
    - ~~Cutting board/cooktop~~
    - Air conditioning

7. Which home did Katie end up choosing?
    - House #1
    - ~~House #2~~
    - House #3

8. What did she end up paying for the house?
    - $50,000
    - ~~$60,000~~
    - $70,000
    - $80,000

9. What modifications did she make to the house?
    - ~~Colour change~~
    - Added windows
    - ~~Added stairs to the loft~~
    - Garage door
    - In-floor ~~storage~~
    - Skylight
    - ~~Table for dining~~
    - Exterior deck
    - Air conditioning

10. What three features would you insist on for your own tiny home?

    Student's choice

Appendix C - Building a Tiny Home from Start to Finish

Complete the questions below after watching the video, Building A Tiny House From Start To Finish!

1. Find four features that make the Foundation trailer special.
    - Mainframe is built out of tube steel
    - D rings on all four corners
    - Built-in plumbing pipes
    - Structural fenders
    - Belly pan
    - Comes pre-insulated
    - Extra wide
2. True or false, with a 16' house, the builders can literally pick up the walls and set them on the trailer.
    - True
    - False
3. What did they use to put the roof on?
    - Crane
    - Forklift
    - Scissor lift
    - Forkhoist
4. What are the wall studs and roof joists made of?
    - Steel
    - Wood
    - Aluminum
    - Fibreglass
5. What do they have to put in the wall studs to stop the wires from getting damaged as they pull them through?
    - Grommets
    - Washers
    - Flanges

6. Why do you want to regulate air and moisture inside of a home? (choose the best answer)
    - To prevent mould
    - To clean the air
    - To stop leaks
    - To keep out critters
7. What did they put on the interior walls?
    - Drywall
    - Tongue and groove pine
    - Panelling
    - Stucco
8. What did they cover the main floor with?
    - Laminate
    - Hardwood
    - Vinyl
    - Tile
9. Where did they create storage space?
    - In the loft
    - Under the bed
    - Created closets
    - Ceiling cabinets
10. What product did they use to clad the walls and cover the roof?
    - Cedar siding
    - Standing seam metal
    - Plywood
    - Vinyl siding

Appendix D - Building a Tiny Home from Start to Finish (Answer Sheet)

Complete the questions below after watching the video, Building A Tiny House From Start To Finish!

1. Find four features that make the Foundation trailer special.
    - Mainframe ~~is built out of tube steel~~
    - ~~D rings on all four corners~~
    - Built-in plumbing pipes
    - ~~Structural fenders~~
    - ~~Belly pan~~
    - Comes pre-insulated
    - Extra wide

2. True or false, with a 16' house, the builders can literally pick up the walls and set them on the trailer.
    - ~~True~~
    - False

3. What did they use to put the roof on?
    - Crane
    - Forklift
    - Scissor lift
    - ~~Forkhoist~~

4. What are the wall studs and roof joists made of?
    - ~~Steel~~
    - Wood
    - Aluminum
    - Fibreglass

5. What do they have to put in the wall studs to stop the wires from getting damaged as they pull them through?
    - ~~Grommets~~
    - Washers
    - Flanges

6. Why do you want to regulate air and moisture inside of a home? (choose the best answer)
    - ~~To prevent mould~~
    - To clean the air
    - To stop leaks
    - To keep out critters

7. What did they put on the interior walls?
    - Drywall
    - ~~Tongue and groove pine~~
    - Panelling
    - Stucco

8. What did they cover the main floor with?
    - ~~Laminate~~
    - Hardwood
    - Vinyl
    - Tile

9. Where did they create storage space?
    - In the loft
    - ~~Under the bed~~
    - Created closets
    - Ceiling cabinets

10. What product did they use to both clad the walls and cover the roof?
    - Cedar siding
    - ~~Standing seam metal~~
    - Plywood
    - Vinyl siding

Appendix E - Tiny House Design Assignment

Create a slideshow and include all of the information requested below in each slide.

[Tiny home demand up during pandemic as people seek change]

Appendix F - Tiny House Design Assignment - Evaluation

Slide #	Requirements	Marks
1	• Name • Picture of a tiny home • Date • Teacher Name	/4
2	• Find SIX images (three interior and three exterior) of tiny homes that will inspire your design	/6
3	• Find an exterior wall covering you would like (ie. siding, brick, stone, etc.) • Provide an image(s) of the covering • Include the manufacturer for your wall covering	/3
4	• Find a style of front door • Provide an image of f the door • Include the manufacturer for your front door	/3

5	● Find a roof covering you would like ● Provide an image ● Include a manufacturer and the warranty provided for your roof covering	/4
6	● Choose a style of cabinet for the kitchen ● Provide an image of the cabinets ● Provide additional details - material and style	/3
7	● Choose a countertop for the kitchen ● Provide an image of the countertop ● Provide additional details - material and style	/3
8	● Choose a style of cabinet for the bathroom ● Provide an image of the cabinet ● Provide additional details - material and style	/3
9	● Choose countertops for the bathrooms ● Provide an image of the countertops ● Provide additional details - material and style	/3
10	● Choose a kitchen sink and faucet ● Provide dimensions of the sink ● Provide images of both ● Provide details on finishes	/4
11	● Choose a bathroom sink and faucet ● Provide dimensions of the sink ● Provide images of both ● Provide details on finishes	/4
12	● Choose a wall colour for the main room walls and ceiling ● Include a sample on the slide, labelled with which room it is for and who the manufacturer is	/4

13	● Choose interior doors for all of the rooms ● Provide an image	/2
14	● Find a suitably sized fridge for your home. ● Provide an image ● Provide dimensions	/3
15	● Find a suitably sized stove or stove top for your home. ● Provide an image ● Provide dimensions	/3
16	● Find a chemical toilet for your home. ● Provide an image ● Provide dimensions	/3
17	● Find a suitably sized shower for your home. ● Provide an image ● Provide dimensions	/3
18	● Find one additional appliance for your home (i.e. microwave, dishwasher, etc.). ● Provide an image ● Provide dimensions	/3
	TOTAL	/61

Appendix G - Tiny House Rough Sketches Assignment

Upon completion of this assignment, scan or photograph and submit the following Four rough sketches and Two refined sketches:

- Ideation Sketches - 4 In Total
    - two different floor plans
    - two different elevations

Once you have completed these ideation sketches then, you will create more refined rough sketches as per below:

- Floor Plan(S) Sketches - main floor and additional plan showing the loft
- Side Elevation Sketches

The trailer you will be designing your tiny house on will be 8’ wide x 16’ long.

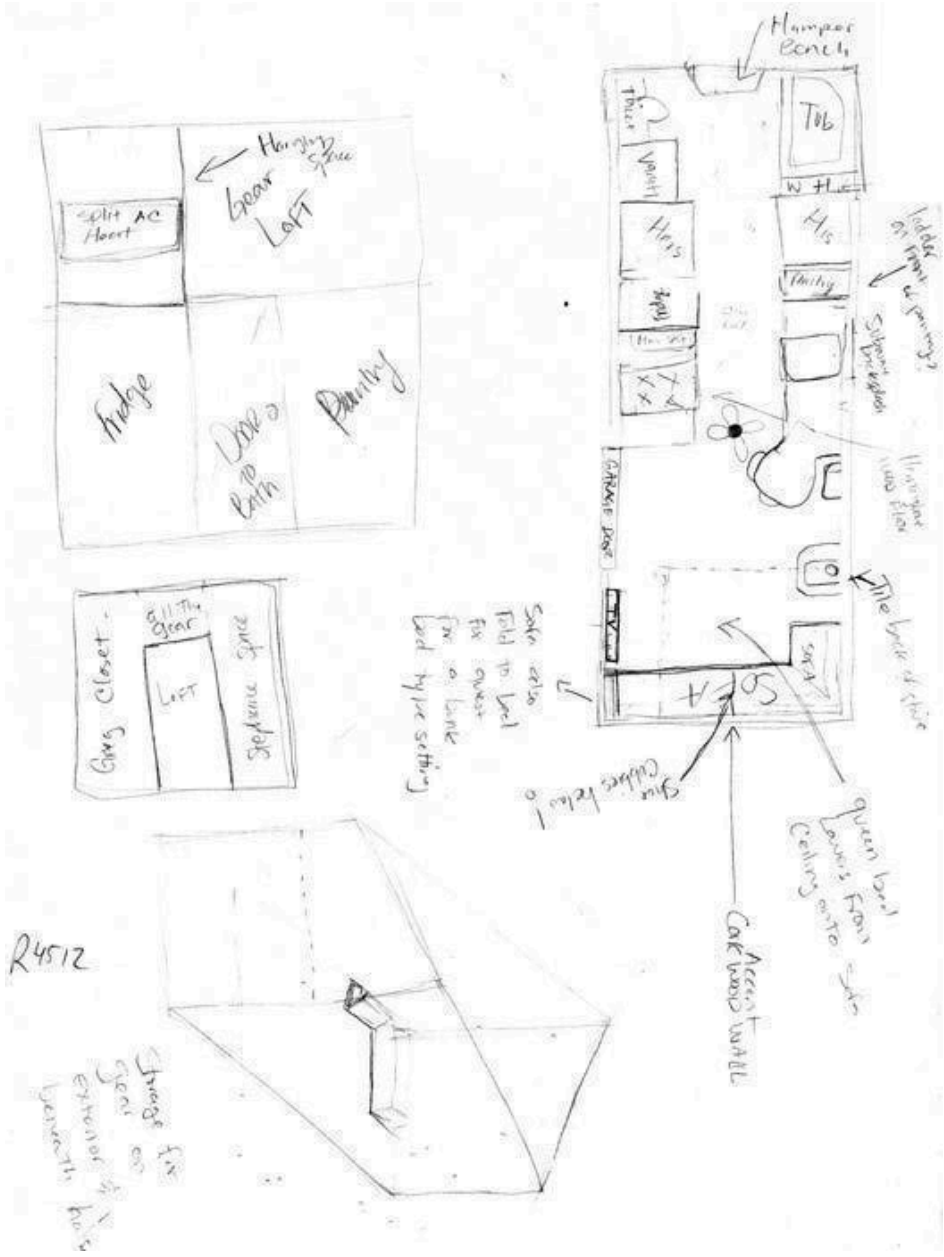
Your rough sketches do not have to be to scale, but you should attempt to have some sense of proportion (ie. the building will be twice as long as it is wide). You Do Not Need To Include Any Dimensions With Rough Sketches.

Using your ideas from yesterday’s assignment, try to incorporate all the Big Ideas and must-haves that you want in your home.

Start with your Floor Plan(s).

Your first rough design attempts (it may take more than one sketch to figure out how things will come together).

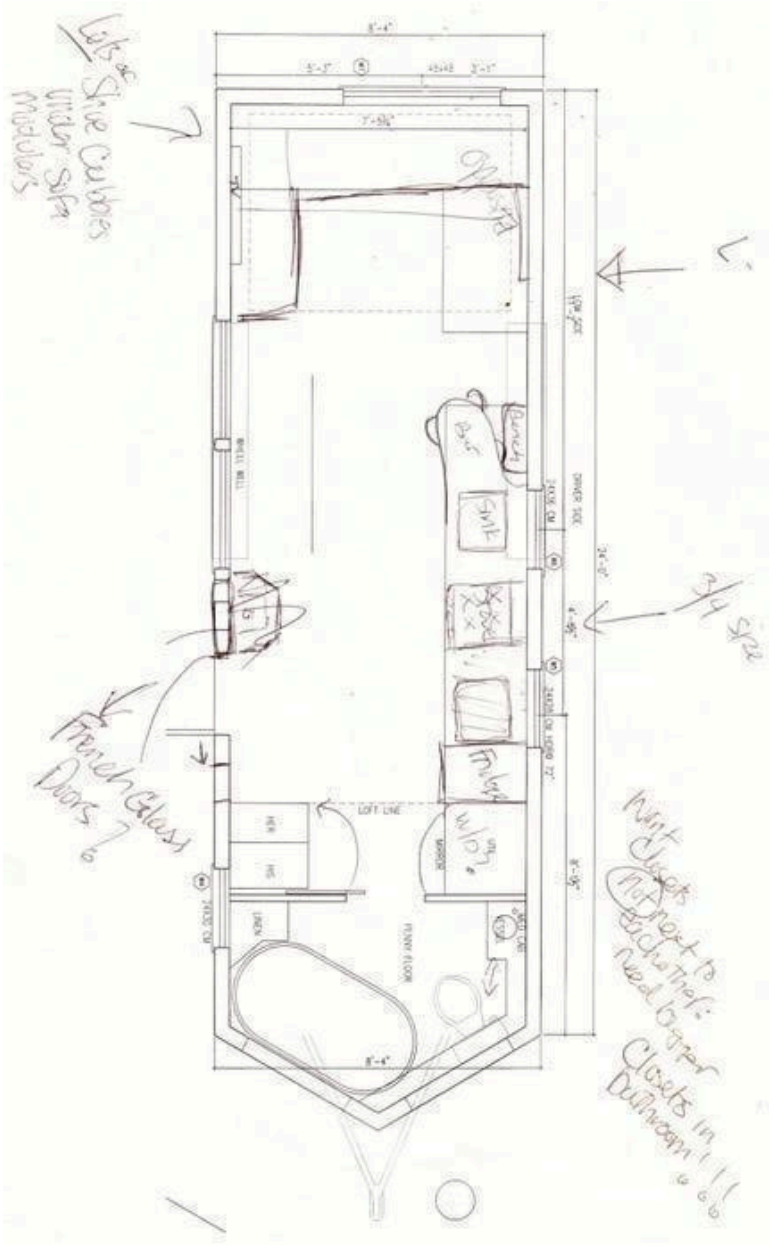
Sketch #1 (Example)



Courtesy of Greg Parham [Inside the Design and Build of a Tiny Home]

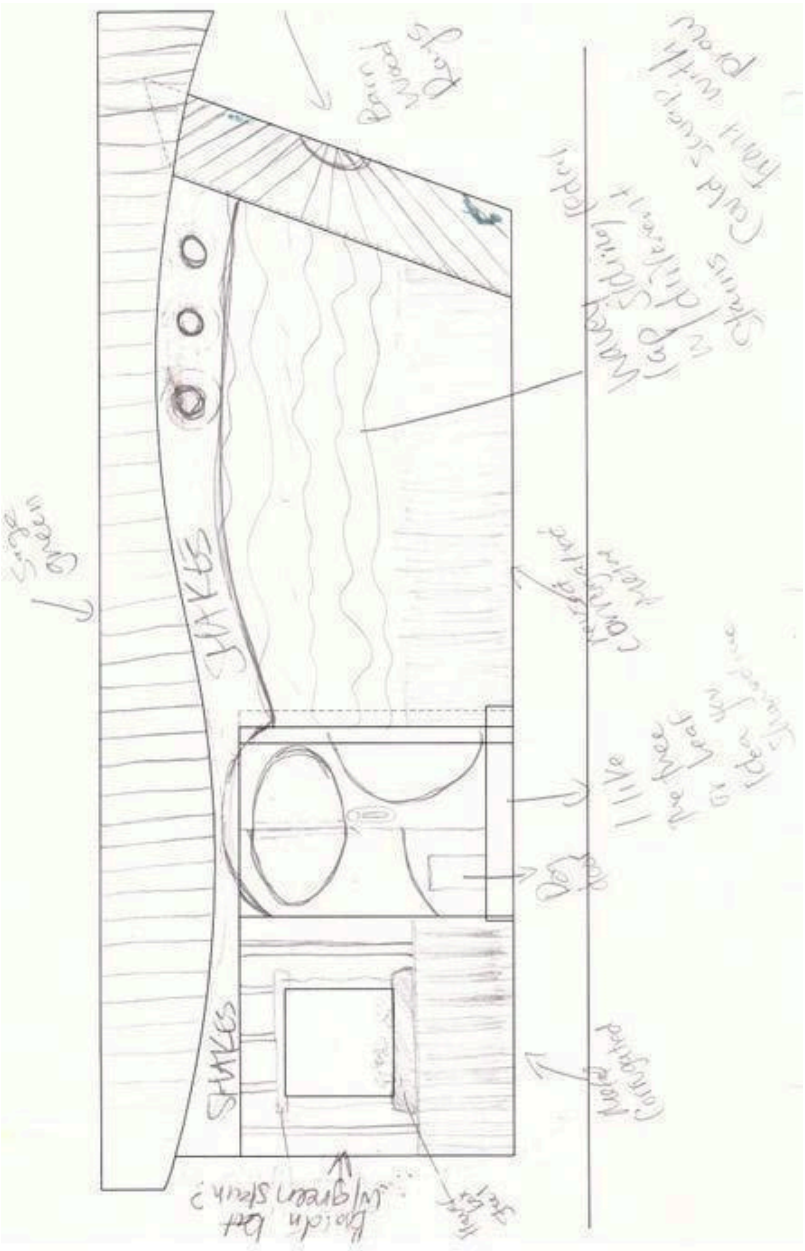
After an ideation session and some failed attempts, you will come up with a rough sketch that is ready for the next step.

Sketch #2 (Example)



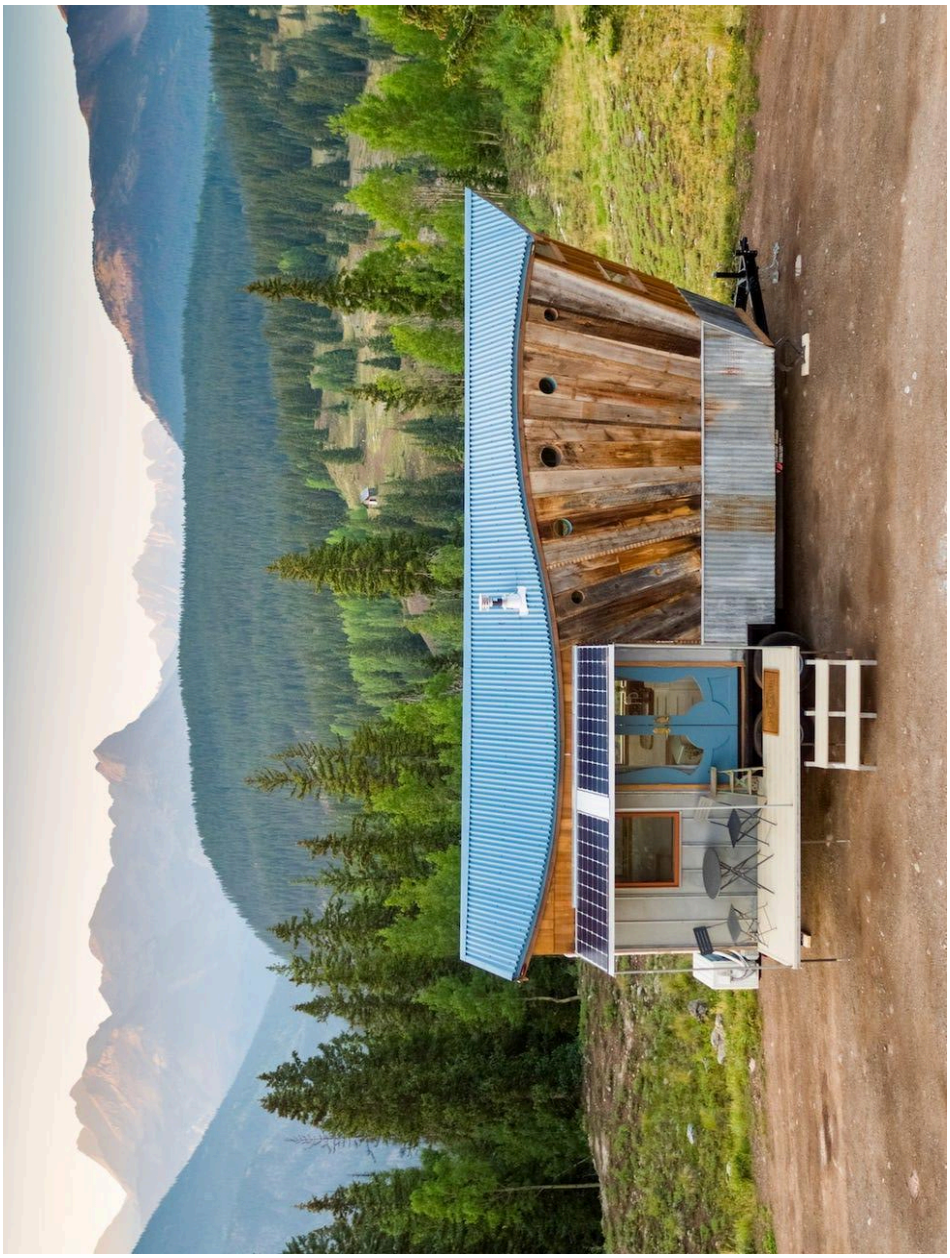
Courtesy of Greg Parham [Inside the Design and Build of a Tiny Home]

Sketch #3 (Example)



Courtesy of Greg Parham [Inside the Design and Build of a Tiny Home]

Image #4 (Example)



Courtesy of Greg Parham [Inside the Design and Build of a Tiny Home]

REPEAT the process for Main Floor And Loft Sketches

You'll now repeat this process for a side elevation of your tiny home. An elevation is a two-dimensional view of the structure.

Appendix H - Tiny House Rough Sketches Assignment - Outline and Evaluation

Categories	Level 1	Level 2	Level 3	Level 4
Thinking				
Ideation Images	• student has created one ideation image	• student has created two ideation images	• student has created three ideation images	• student has created four ideation images
Communication				
Floor Plan Sketch	• student has created a sketch that contains limited detail and thought	• student has created a sketch that contains a little detail and thought	• student has created a sketch that contains some detail and thought	• student has created a sketch that contains a lot of detail and thought
Elevation Sketch	• student has created a sketch that contains limited detail and thought	• student has created a sketch that contains a little detail and thought	• student has created a sketch that contains some detail and thought	• student has created a sketch that contains a lot of detail and thought

Appendix I - Tiny House Blueprints Assignment

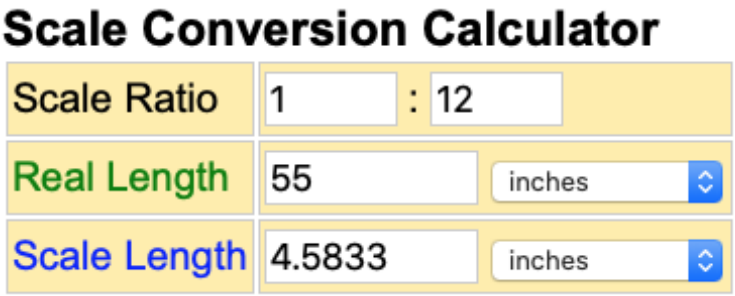
Create the following working drawings or blueprints:

- FLOOR PLAN(S) - main floor and additional plan showing the loft
- SIDE ELEVATION

Using both your sketches and your Design Assignment, you will now begin to create blueprints for your Tiny House.

- Your drawing will be done using a 1 inch = 1 foot scale.
- You can tape together 2 pieces of 8-1/2" x 11" papers or use an 11" x 17" sheet (if available)
- Your floor plan and elevation will be on two different pages (the equivalent of 2 @ 11 x 17 sheets)
- Make sure to use a ruler!
- You may also use software like Google Sketchup, TinkerCAD, Floorplanner or AutoCAD to create your blueprints if you are comfortable using these.
- YOUR TINY HOUSE IS TO BE MOUNTED ON AN 8' X 16' TRAILER, SO USE THESE DIMENSIONS FOR THE OUTSIDE DIMENSIONS OF THE HOUSE

Blueprint Drawing Steps



If needing to calculate "scale ratio" use the Scale/Conversion website.

Steps:

1. Start by drawing the exterior walls of your house.

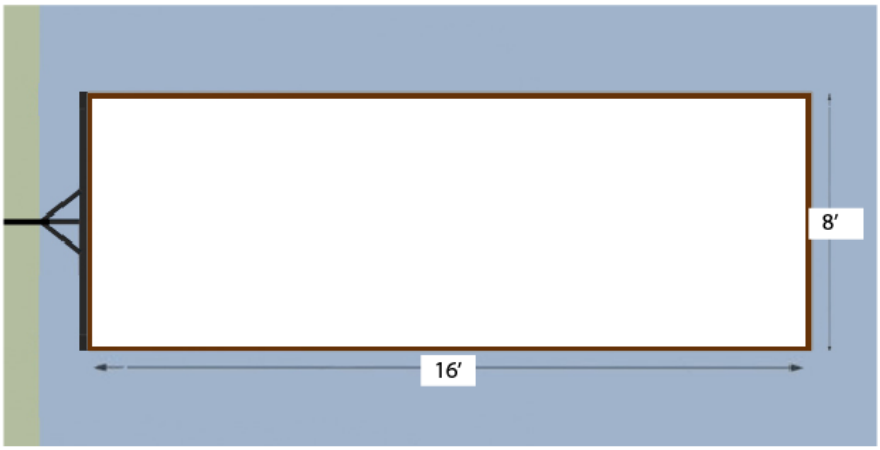
   You can use the Scale/Conversion website to help with conversions from actual size to drawing size.

   Make sure you convert all actual measurements to inches (i.e. 8 feet = 96 inches) and set the converter, as shown in the picture.

The outside measurements of the house are 8 feet by 16 feet. When drawing on a 1:12 scale, your house will be 8 inches x 16 inches on the drawing.

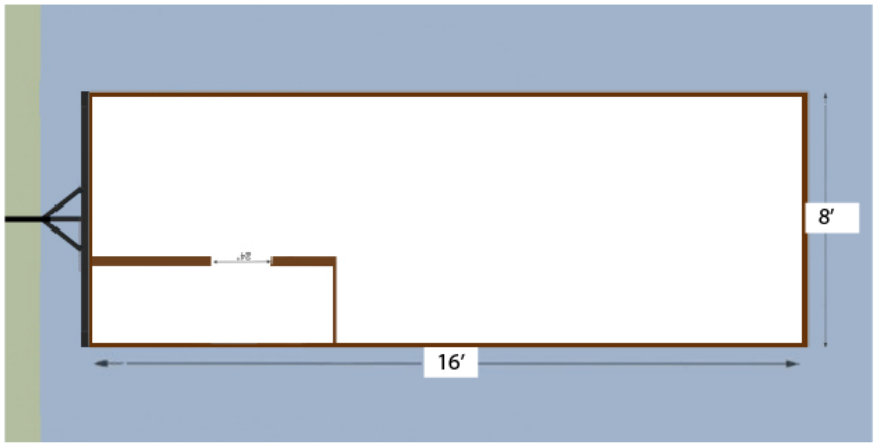
MAKE SURE TO CENTRE THE DRAWING.

Allow for 6-inch (ACTUAL SIZE) thick exterior walls. This allows for framing along with interior and exterior coverings.

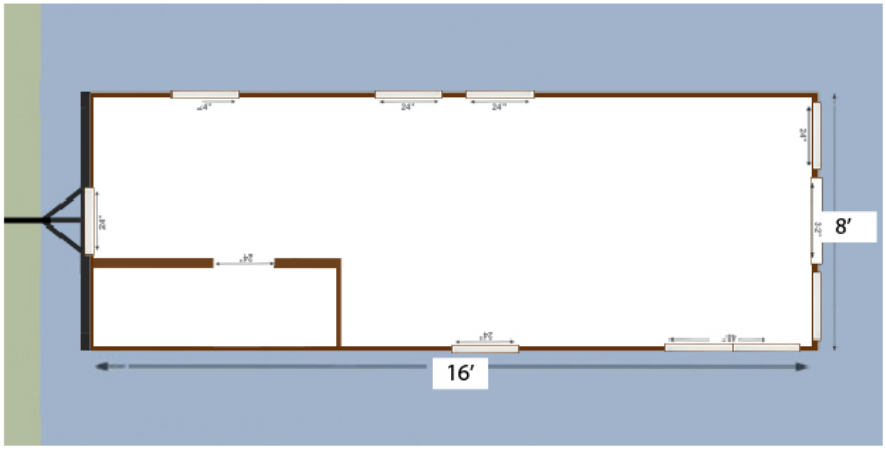


2. Next, you will add the interior walls. Allow for 4-1/2 inch (ACTUAL SIZE) thick interior walls.

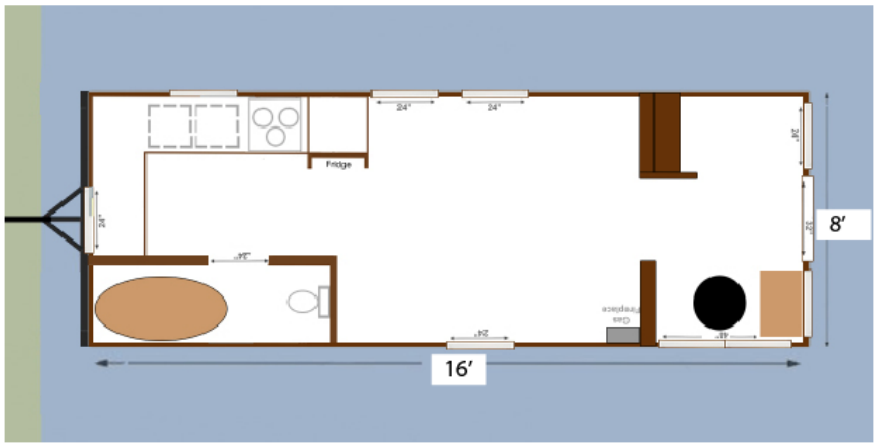
   Draw walls around any bathroom, stairwell or ladder areas. This is especially important if you are building a sleeping loft that will have some sort of permanent staircase structure. If there is no physical wall (or partition) around the stairwell, simply draw a faint dotted line. Draw staircases (or ladders) within these walls. Draw an arrow labelled “up” in the up direction of the stair.



3. The next step as you make your own blueprint is to draw your doors and windows onto the floor plan. For each door, window or wall opening on your floor plan: Draw the appropriate door or window symbol using the blueprint symbols on this page as your guide.



4. Using all of the research in your Design assignment, place all appliances (sink, fridge, stove, fireplace, etc.), plumbing fixtures and furniture.



5. The next step to make your own blueprint is to draw accurate measurements in the form of dimension lines. You will need to draw dimension lines for: Each room (although most tiny houses do not have “rooms,” per se)
    - Closets
    - Cabinet depths and/or bookshelf depths
    - Distances from wall to back of toilet (known as the rough in dimension)
    - Sizes of tub/shower unit

    From here you will do the same thing over again for any lofts /sleeping areas you have included in your designs/rough sketches.

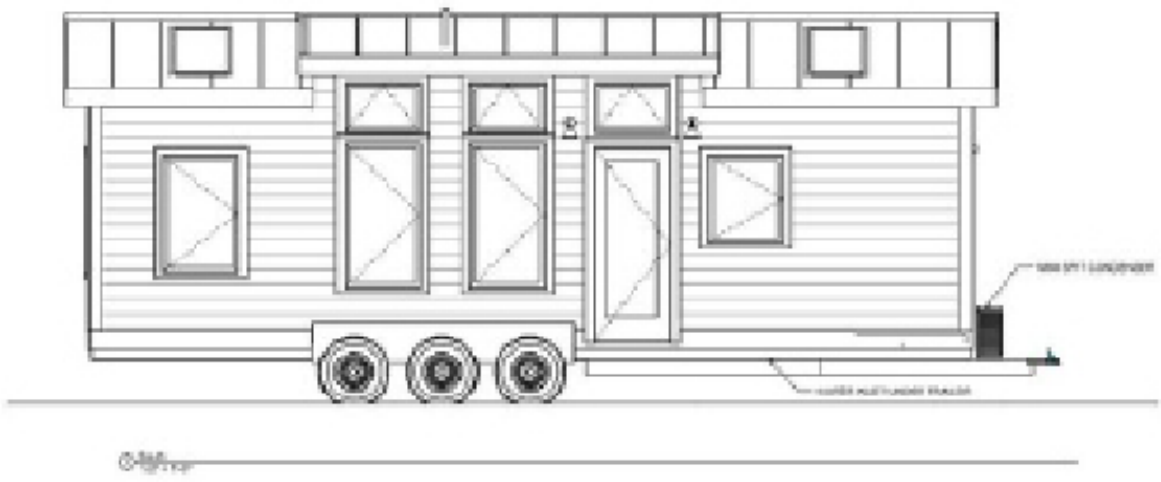
6. Now that your floor plans are completed, it is time to tackle the side elevation. Pick one of the long sides of your Tiny House and create a scale drawing of what it will look like. Note: You do not have to include a picture of the actual trailer; you just need to include the structure.

   Your maximum height will be twelve feet (ACTUAL SIZE).

   Be sure to transfer any windows/doors found on the floor plans.

   Add labelling for the type of roofing and exterior wall finishes.

   Below is an example of what different elevations might look like.



Appendix J - Tiny House Blueprints Assignment - Outline and Evaluation

Application Floor Plan Drawings	
	Floor Plan(s) has been drawn to the correct scale (1:12)
	Student has used a ruler
	Floor Plan(s) have been centred on page
	Exterior width is correct on floor plan(s)
	Exterior length is correct on the floor plan(s)
	Exterior walls are the correct thickness
	Interior walls are the correct thickness
	Floor Plan windows have been drawn as per the example provided
	Floor Plan doors have been drawn as per the example provided
	Toilet has been drawn as per the example provided
	Shower has been drawn as per the example provided
	Kitchen Sink has been drawn as per the example provided
	Stove has been drawn as per the example provided
	A bed has been included in the Floor Plans
	Notes have been included on Floor Plan(s)
	Notes are in CAPITALS and are clear and easy to read
	Dimensions have been included on Floor Plan
/17	Sub-Total (Floor Plan)

	Application Elevation Drawings
	Elevation has been drawn to the correct scale (1:12)
	Elevation has been centred on the page
	Elevation windows have been drawn as per the example provided
	Elevation doors have been drawn as per the example provided
	Exterior width is correct on the elevation drawing
	Exterior length is correct on the elevation drawing
	Exterior height is correct on the elevation drawing
	Notes have been included on the elevation drawing
	Dimensions have been included on the elevation drawing
/9	Sub-total (Elevation)
/26	Total

Appendix K - Tiny House Fabrication Assignment

Watch the following videos for guidance and tips on building your house:

- How to Build a Tiny House Model
- Build a Tiny House Model with a 2 x 4

Using your Blueprints and your Design Assignment, you will create a scale model for your Tiny House.

- Your model will be using offcuts and any other available materials in the shop (plexiglass, dowelling, etc.), or if you are in a regular classroom, you will use cardboard or foam core
- Note: If you use a knife instead of scissors (not recommended), it is advised to cut while standing up (proven safer method than sitting down).
- it will be built at a 1:12 scale, the same as your blueprint
- be sure to include scale models of all furniture, plumbing fixtures, cabinets, and appliances
- make sure the roof is removable
- cut-out windows, skylights, etc.
- you may add additional details for exterior finishes (sandpaper or peeled-back cardboard makes for good roofing or siding material simulation

Appendix L - Tiny House Fabrication Assignment - Outline and Evaluation

Application	
	Model has been built to correct scale (1:12)
	Windows have been cut out
	Door(s) have been created
	A roof has been built
	The roof is removable
	A roof covering or shingle has been applied
	An exterior finish or siding has been applied
	Kitchen cabinets have been built and included
	A bed has been built and included
	Bathroom fixtures and cabinet has been built and included
	Stove has been laid out in kitchen
	A fridge has been built and included
/12	Sub-Total
10	• that the student demonstrated great understanding to achieve a truly exceptional result
8	• that the student demonstrated above-average understanding to achieve a very good result
6	• that the student demonstrated average understanding to achieve a moderate result
4	• that the student demonstrated below-average understanding to achieve a mediocre result
2	• that the student demonstrated weak understanding to achieve a poor result
/10	Sub-Total
/22	Total

Categories	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding				
Safety	• student is beginning to use the equipment for the intended purpose	• student occasionally uses the equipment for the intended purpose	• student usually uses the equipment for the intended purpose	• student always uses the equipment for the intended purpose
Set-up and operation of tools and equipment	• student demonstrates a beginning skill for set-up and operation of equipment and use of machines in proper order and process	• student demonstrates a developing skill for set-up and operation of equipment and use of machines in proper order and process	• student demonstrates good skill for set-up and operation of equipment and use of machines in proper order and process	• student demonstrates exemplary skill for set-up and operation of equipment and use of machines in proper order and process
Application				
Efficient and effective working skills	• Is beginning to plan and use class time wisely and efficiently	• Occasionally plans and uses class time wisely and efficiently	• Usually plans and uses class time wisely and efficiently	• Always plans and uses class time wisely and efficiently
Communication				
Order of Operations	• student has assembled a step-by-step Order of Operations that is missing many details	• student has assembled a step-by-step Order of Operations that is missing some details	• student has assembled a step-by-step Order of Operations	• student has assembled a detailed step-by-step Order of Operations

Appendix M - Order of Operations

While laying out and constructing your project, keep a detailed account of each step taken during the process and which tools were used (i.e. Step #1 - Milled lumber to finished thickness using the Jointer and the Planer). This can be done in sentence or point form on the lines below. After this, spend a few moments reflecting and then make notes on things you would do differently and discuss problems that arose that you had to overcome.

Task Description	Machine or Tool Used
Reflection Space	

References

Construction Technology SAFEDocs (OCTE), 2013

TAS2O Technology and Skilled Trades - Secondary Curriculum

Exploring Technologies SAFEDocs (OCTE), 2013

Building A Tiny House from Start to Finish

Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, First Edition, Covering Grades 1 to 12, 2010

Learning for All – A Guide to Effective Assessment and Instruction for All Students, Kindergarten to Grade 12, 2013

Pythagorean Theorem and Math Worksheets (Math-Aids), 2020

Technological Design SAFEDocs (OCTE), 2013

The Ontario Curriculum, Grades 9 and 10: Technological Education, 2009 (revised)

The Ontario Curriculum, Grades 11 and 12: Technological Education, 2009 (revised)

ToolSAFE TDJ Hot Glue Gun (OCTE), 2015

ToolSAFE TDJ Modelling Tools, (OCTE), 2015

Indigenous Knowledge and Our Connection to the Land

Construction Training and Apprenticeship Ontario (CTAO)

Inside the Design and Build of a Tiny Home - Courtesy of Greg Parham

Tiny home demand up during pandemic as people seek change

House Hunters - Downsizing in Maryland

How to Build a Tiny House Model!

Build a Tiny House Model with a 2 x 4

GTA Students Building Tiny Homes for Indigenous Communities