# Designing and Building Scale Models: Applying Mathematical Concepts for Grade 7 and 8 Students

## Introduction to Scale Models

*Welcome to this exciting lesson on designing and building scale models! In this activity, you will apply mathematical concepts to real-world problems, developing problem-solving skills, critical thinking, and collaboration. You will learn about proportions, measurements, and geometry, and how to use these concepts to design and build scale models of buildings, bridges, and other structures.*

Scale models are smaller versions of real-world objects or structures, used to represent their proportions and features. They are commonly used in architecture, engineering, and design to visualize and test ideas before constructing the actual building or structure. In this lesson, you will learn how to design and build scale models using mathematical concepts, and apply them to real-world problems.

## Understanding Proportions

*Read the following scenario: "A building is 100 meters tall, and you want to build a scale model that is 1:100. How tall will your model be?"*

To find the height of the model, you need to divide the height of the building by the scale factor. In this case, the scale factor is 1:100, so you would divide 100 meters by 100. This gives you a model height of 1 meter.

## Measuring and Scaling

*Measure the length, width, and height of a small object, such as a book or a toy.*

Use a ruler or measuring tape to measure the length, width, and height of the object. Record your measurements in a table or chart. Then, calculate the scale factor of the object using the measurements.

| Length | Width | Height |
|---|---|---|
| | | |

## Designing a Floor Plan

*Design a floor plan of a simple room using graph paper and a ruler.*

Use graph paper to draw a floor plan of a simple room. Include the length, width, and height of the room, as well as any features such as doors, windows, and furniture. Use a ruler to ensure that your drawing is accurate and to scale.

## Building a Bridge

*Design and build a bridge using popsicle sticks, glue, and weights.*

Use popsicle sticks and glue to build a bridge. Test the bridge to see how much weight it can hold. Use geometry and measurement to ensure that the bridge is stable and strong.

> **Group Task:**
>
> Work in groups to design and build a bridge. Use popsicle sticks, glue, and weights to test the strength of your bridge.

## Creating a Scale Model of a Building

*Choose a famous building, such as the Eiffel Tower or the Taj Mahal. Research the building's dimensions and calculate the scale factor.*

Use the internet or books to research the dimensions of the building. Calculate the scale factor using the dimensions. Then, draw a scale model of the building using the scale factor.

## Mathematical Concepts

*What is the formula for calculating the area of a rectangle?*

The formula for calculating the area of a rectangle is length x width. For example, if the length of a rectangle is 5 cm and the width is 3 cm, the area would be 5 x 3 = 15 square cm.

## Real-World Applications

*How are scale models used in architecture and engineering?*

Scale models are used in architecture and engineering to visualize and test ideas before constructing the actual building or structure. They are used to identify potential problems and make changes before construction begins.

## Reflection

*What did you learn about mathematical concepts and scale models in this lesson?*

Reflect on what you learned in this lesson. Think about how you applied mathematical concepts to real-world problems, and how you used scale models to visualize and test ideas.

**Individual Reflection:**

1. What was the most challenging part of this lesson for you?
2. What did you learn about mathematical concepts and scale models?
3. How can you apply what you learned in this lesson to real-world problems?

## Conclusion

*Congratulations on completing this lesson on designing and building scale models!*

You have applied mathematical concepts to real-world problems, developing problem-solving skills, critical thinking, and collaboration. Remember to always use proportions, measurements, and geometry to design and build scale models, and to think creatively and critically about mathematical concepts.

## Differentiated Activities

*For students who need extra support:*

Use pre-made templates and instructions to design and build a simple scale model. Provide additional guidance and support as needed.

> **Group Task:**
>
> Work in groups to design and build a simple scale model. Use pre-made templates and instructions to guide you.

## For students who need a challenge:

*Design and build a more complex scale model, such as a bridge or a skyscraper.*

Use more advanced mathematical concepts, such as trigonometry or calculus, to design and build a more complex scale model.

## Advanced Concepts

In this section, we will explore more advanced concepts related to designing and building scale models. We will delve into the world of architecture and engineering, and examine how scale models are used in these fields to design and test buildings, bridges, and other structures.

### Case Study: The Burj Khalifa

The Burj Khalifa, located in Dubai, is the tallest building in the world, standing at a height of 828 meters. The building's design and construction required the use of advanced scale models to test and refine the design. The scale models were used to test the building's aerodynamics, structural integrity, and other factors that could affect its stability and safety.

#### Activity: Designing a Skyscraper

*Design and build a scale model of a skyscraper, taking into account the advanced concepts discussed in this section.*

Use graph paper and a ruler to design the skyscraper, and then build a scale model using materials such as cardboard, foam board, or 3D printing. Consider factors such as aerodynamics, structural integrity, and sustainability when designing your skyscraper.

## Sustainability and Environmental Impact

As we design and build scale models, it is essential to consider the sustainability and environmental impact of our creations. We must think about the materials we use, the energy we consume, and the waste we generate. In this section, we will explore ways to make our scale models more sustainable and environmentally friendly.

### Example: Sustainable Materials

One way to make our scale models more sustainable is to use eco-friendly materials. For example, we can use recycled cardboard, bamboo, or sustainable wood instead of plastic or metal. We can also use energy-efficient lighting and reduce waste by reusing and recycling materials.

**Group Task:**

Work in groups to design and build a sustainable scale model of a building or structure. Consider the environmental impact of your design and use eco-friendly materials whenever possible.

## Presentation and Communication

Once we have designed and built our scale models, it is essential to present and communicate our ideas effectively. In this section, we will explore ways to present our scale models, including verbal presentations, written reports, and visual displays.



### Case Study: Presenting a Scale Model

When presenting a scale model, it is essential to consider the audience, the purpose of the presentation, and the key messages we want to convey. We must also think about the visual aids we will use, such as diagrams, charts, and images, and how we will use them to support our presentation.

#### Activity: Presenting a Scale Model

*Prepare a presentation of your scale model, including a verbal presentation, a written report, and a visual display.*

Use the skills and knowledge you have gained in this course to create a clear, concise, and engaging presentation. Consider the audience, the purpose of the presentation, and the key messages you want to convey, and use visual aids to support your presentation.

## Conclusion and Next Steps

In this final section, we will summarize the key concepts and skills we have learned in this course. We will also explore next steps and how to apply what we have learned to real-world problems.

**Reflection:**

1. What did you learn in this course?
2. How can you apply what you learned to real-world problems?
3. What are your next steps, and how will you continue to develop your skills and knowledge?

**Group Task:**

Work in groups to create a plan for applying what you have learned in this course to real-world problems. Consider how you can use scale models to design and test solutions to environmental, social, and economic challenges.

## Assessment and Evaluation

In this section, we will discuss how to assess and evaluate the effectiveness of our scale models. We will explore different methods of assessment, including peer review, self-assessment, and formal evaluation.

### Example: Peer Review



One way to assess and evaluate our scale models is through peer review. We can ask our peers to review our models, provide feedback, and suggest improvements. This can help us identify areas for improvement and develop our skills and knowledge.

### Activity: Assessing and Evaluating a Scale Model

*Assess and evaluate a scale model, using methods such as peer review, self-assessment, and formal evaluation.*

Use the skills and knowledge you have gained in this course to assess and evaluate a scale model. Consider the effectiveness of the model, its strengths and weaknesses, and areas for improvement.

## Future Directions and Emerging Trends

In this final section, we will explore future directions and emerging trends in the field of scale modeling. We will discuss new technologies, innovative materials, and cutting-edge techniques that are changing the way we design and build scale models.

### Case Study: Emerging Trends in Scale Modeling

One emerging trend in scale modeling is the use of 3D printing and additive manufacturing. These technologies allow us to create complex and detailed models quickly and efficiently, and are being used in a wide range of fields, from architecture to engineering.

**Group Task:**

Work in groups to research and discuss emerging trends and future directions in the field of scale modeling. Consider how these trends and directions may impact the way we design and build scale models, and how we can apply them to real-world problems.

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