55-70 min.
Grades 3-5
Easy

Lesson 4: Scale and Floor Layout

Objective

21st Century Architects will explore scale by identifying the best models for their client's structures. Students will learn how to read a floor layout and they will use their floor layout to compute scale and build a model that is either scaled to 1.50, 1.100 or 1.200. Students will understand the concept that scale can vary.

Students will be able to

- Define scale
- Compare different scales
- Create an Arckit model of a floor layout that was drawn

Materials

- 3 different scaled squares
- Arckit scale ruler (included in the Edu kit)
- Calculators
- Arckit Scale models
- Arckit
- Client Brief Cards (from previous lesson)
- Understanding Scale ***(Resource 1)***
- Vocabulary Glossary
- Floor Plan Sample ***(Resource 2)***
- Site Plan Samples ***(Resource 3)***
- The Scale Sheet (included in the Edu kit)

Teacher Prep

1. Before class begins, have 3 different sized squares (you can use Arckit modules) on each students desk and an Arckit scale ruler
2. Have calculators available for students
3. Students will need to work in groups of three for this lesson

Guiding Questions

1. What is scale?
2. How do we find scale?
3. How is an architectural scale different from a ruler?
4. Why is scale important to building design?

Vocabulary

Scale
Floor layout
Site Plan

Standards

Next Gen Science Standards
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Math CC Standards
CCSS.MATH.CONTENT.3.OA.A.3
Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.1
CCSS.MATH.CONTENT.4.OA.A.2
Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison
CCSS.MATH.CONTENT.5.NBT.B.5
Fluently multiply multi-digit whole numbers using the standard algorithm.

Architecture Concept:
Floor layout and Scale

Warm-up

5 min.

Before class begins, have 3 different size squares on each student's desk (2 inch sides, 4 inch sides and 6 inch sides). When students are all sitting, explain to them that the Parksville Planning Committee has supplied 21st Century Architects with special architectural measuring tools. Each architect will be responsible for their architect scale and will use it to create sketches and prototypes and to find area and perimeter!

- Tell students that the architect scale has 12 inches just like our school rulers, but it is divided into 1/16th increments.
- Tell students to look at and explore the new measuring tool for a minute.
- Then, they can measure one side of each of the three squares and write the length of the side in inches on paper.
- What is the measurement of each side?
- What is the difference in length between each of the 3 squares?
- Do you see a pattern?

Mini-Lesson

20 min.

Engagement

Tell students that knowing the appropriate scale to use depends on what they are designing and that their Parkville Clients have made some requests for models of some new structures they'd like us to build. To figure out which model to use for their structures, we need to first figure out what will be the best scale to use.

Vocabulary

In order to better understand how architects scale their sketches and models to the actual structures they build, we will need to define the following words:

- **Scale:** The relationship between the size of a sketch or prototype compared to the actual size of the structure.
- **Floor layout:** a floor layout is a drawing that shows a view from above or a structure and is drawn to scale
- **Site Plan:** a site plan is a drawing that shows a view from above outside structures and is drawn to scale

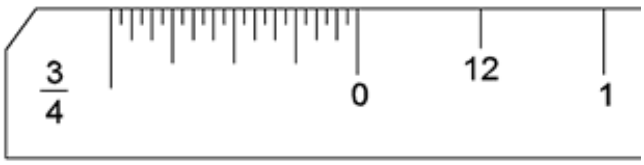
Mini-lesson

Inform students that scaled drawings allow architects to accurately represent a building or space to a more practical size than what the actual structure will be. Architects can use floor layouts or site plans to show their plans to their clients.

When a drawing "is to scale" it means that each wall, door, window etc. is in the same proportion to the size of the real structures. For example in real life one meter is equal to one meter, or one foot is equal to one foot. But it would be really difficult to build models that use the same scale as real life...because then it would be like we're building the real thing and not a model!

When architects submit their plans to their clients, they need to present a sketch or a model to their client that shows the size and shape of each room in the structure. This sketch will have a key on it that explains what the scale is.

- **For example, the key might say 1in = 1ft or ¼ in=1ft**



3/4" = 1' - 0"

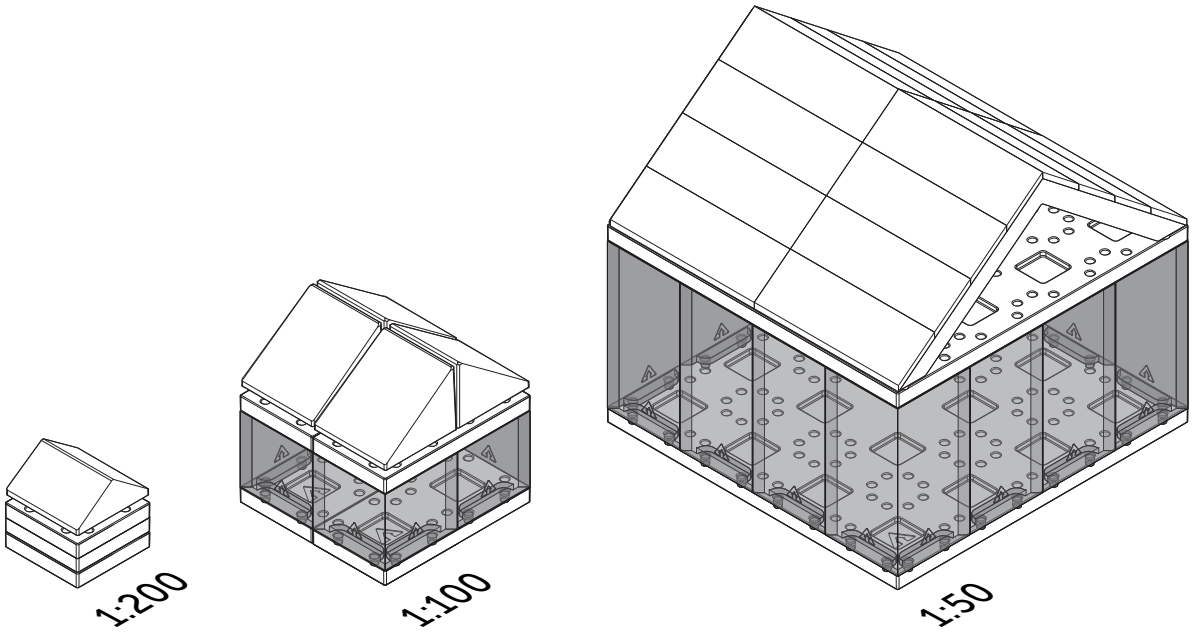
An architect might pick a model, like this Arckit wall and say I want to use the scale 1:50 or 1:100. What a scale of 1 to 50 really means is that the structure will be 50 times larger in real life! A scale of 1:100 means that the structures will be 100 times larger in real life.

1 x 50 = 50
1 x 100 = 100

Write these numbers on the board or chart paper and ask students to guess what a scale of 1:200 would be. If students don't guess correctly, inform them that the structures would be 200 times larger in real life!

1 x 200 = 200

Show the Arckit Scale models below to provide a visual. For every 1 unit in the model, it's actually 200 units in real life! (Building instructions available: **Resource 7**)



Model

The teacher should inform the class that for their Client Brief cards today they are going to do four things:

1. Record their work on their worksheet
2. Determine which will be the best scale to use to design their clients structures
3. Calculate how tall the client's structure will be in real life
4. Build a model of your structure using the correct scale

Use a Design Brief card to model with. And model thinking through which will be the best scale to choose.
Some things you may want to think out loud are:

- Picking the right scale is like picking the right amount of zoom on a picture or on a digital map. It depends on what you want to see.
- How much detail do we need to see of the structure the client wants?
- If we want to build a town then a larger scale might be better so we can more easily see multiple houses, buildings, roads, trees, and other structures. We would use a site plan for this.
- A 1:200 scale would be better for this structure
- If we want to build a house or a more specific structure we will want to see room layouts and if the house is a one story house or two story house. We would use a floor layout for this.
- A scale of 1:100 will allow us to build out the house in more detail.
- If we want to build the layout of a specific room, in the house like a kitchen then we want to go even smaller. We would use a floor layout for this.
- We can try a scale of 1:50 so we can focus more on the details of just this part of the house

After selecting the best scale for your client card, proceed to calculate how large the structure will be in real life.

For example:
A house with 1:100 scale
Walls measure 5 cm

5cm x 100 =500cm or 16.5ft

Group Work/Content Practice

20 min.

Explain to students that they will get into groups of three and will read through three Client Brief Cards. Students will discuss what will be the best scale for each structure, calculate how tall the structure will be, and collaborate to build the structure. Students can work together to build the same structure or they can choose from any of the six client structures. Encourage students to communicate and collaborate, think creatively and critically as they are working.

Differentiation:

Support:

- Teacher should meet 1:1 with students or groups who need extra help determining the right scale
- Students can use the Understanding Scale (Resource 1) sheet to help them determine scale or calculate scale
- Teacher should choose the groups of 3 to be in mixed ability levels
- Consider assigning Client Brief Cards with a scale that is at the appropriate level of a students' multiplication abilities

Extensions:

- Students who finish their client structures early can design a structure according to a scale of their choosing. They can also calculate how tall the structure will be in real life.

Assessment:

The teacher can circulate and informally assess students during group work to determine which students are able to understand scale. The teacher can also review the group worksheet and the group work's models.

Reflection

5 min.

Call on a few students to answer some of these questions on scale:

Potential questions to ask students:

- How do we find scale?
- Why is scale important to building design?
- How did you use critical thinking in today's lesson?
- How did you use collaboration in today's lesson?

Clean-up

5 min.

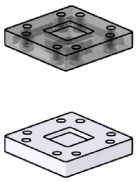
A calm and productive clean-up closing section is important to keep your tools in a good condition.

- Students should carefully take apart their models and put away the Arckit Components
- Students should clean up their workspace and return any usable materials/tools.

Understanding Scale

House Scale 1:200 (1/16”)

1.



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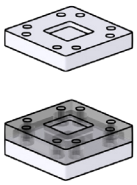

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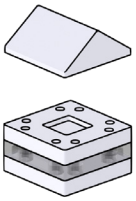

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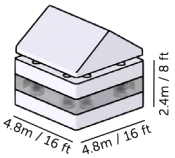
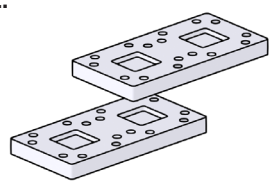


House Scale 1:100 (1/8”)

1.



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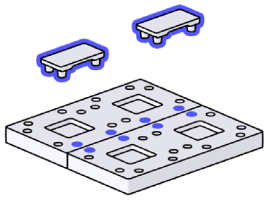

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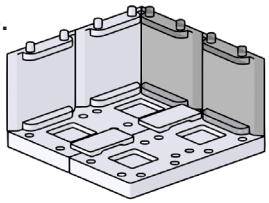

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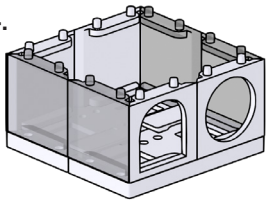

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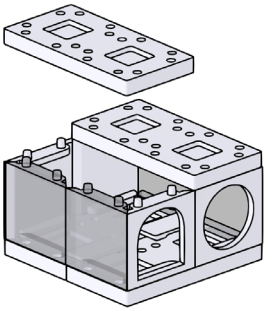

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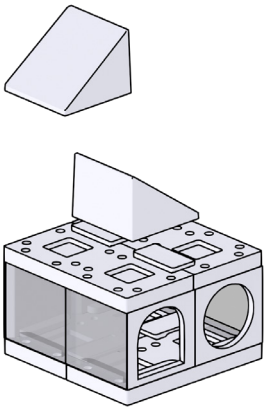

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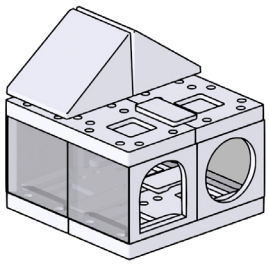

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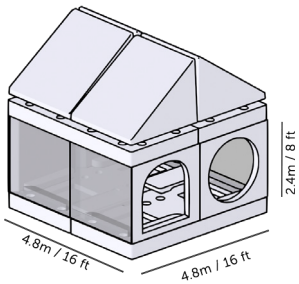
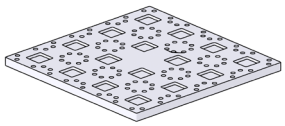


House Scale 1:50 (1/4”)

1.



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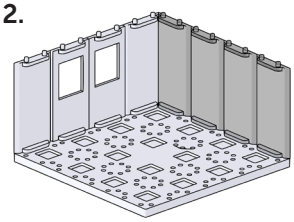

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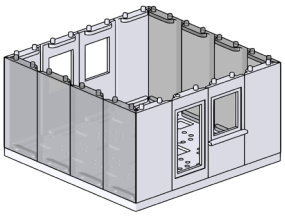

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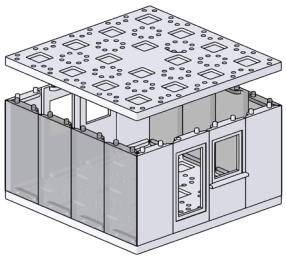

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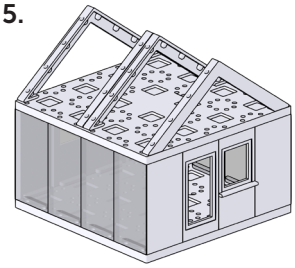

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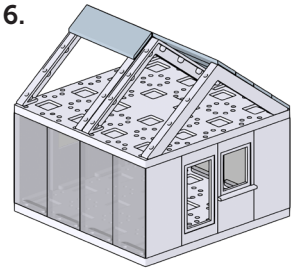

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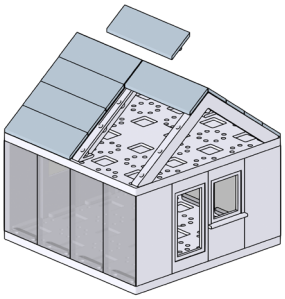

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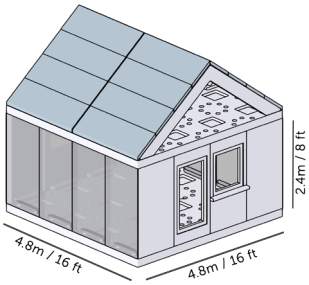

Floor Plan Sample

Site Plan Sample

Honey Park Development, Dun Laoghaire, Dublin

Planned layout for housing development