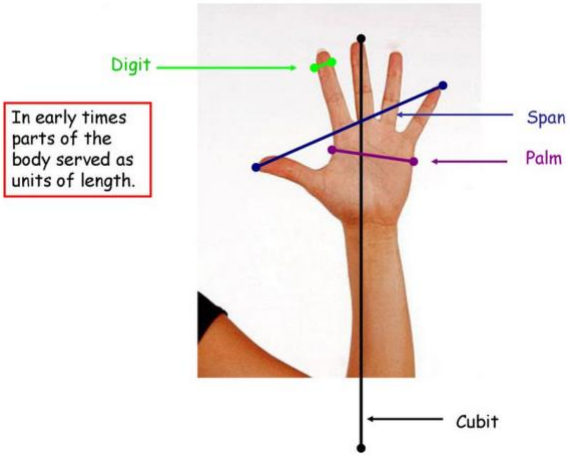
DRAW AND CALCULATE LIKE AN ARCHITECT (LEVEL 2)

Description	Learners use body parts in scale drawing of floor plans and calculate area using simple counting methods
Leading Question	How can you draw floor plan sketches and calculate areas using your body parts as measuring tools?
Total Time Required	~6 hours over 4 days
Supplies Required	Paper and pencil
Learning Outcomes	1. Practice scale drawing using simple conversion of Foot to Digit 2. Use multiplication to find areas of rectangles 3. Practice divisions and apply it on word problems 4. Practice giving directions verbally 5. Apply mathematical knowledge and skills in a real-life scenario
Previous Learning	- Counting and simple addition. - *It is preferred that learners do the "Beauty in Shapes and Measurements" project before this one.

DAY 1

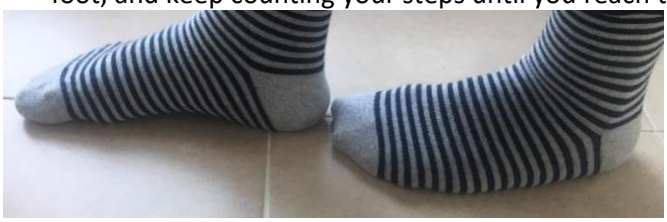
Today you will learn about creating your own house!

Suggested Duration	Activity and Description
20 minutes	● Introduction: In this project, we will learn how an Architect draws floor plans, and what methods they use to calculate the size of rooms or houses. ● Let's start by measuring the floor dimensions of this room. ● As you may know from a previous project, in ancient times people used their body parts to measure lengths.



- For this project you will use mainly your Foot, and your Digit which is the width of your finger. Of course, you know that your foot size is smaller than the actual Foot unit used on measuring tapes (as different people have different foot sizes!)

  - Pick one of the house rooms with a rectangular floor shape, preferably the smallest room in the house.
  - Stand on one corner of the room, and walk by the wall, step by step, to reach the other corner.
  - You must start with the back of your foot touching the wall behind, and then place the other foot right in front of and touching the other foot, and keep counting your steps until you reach the facing wall.



  - Repeat with the 4 sides of the room, and write down the measures in a table like the one below

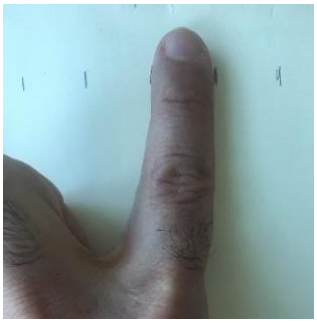
Room side 1	
Room side 2	

Room side 3	
Room side 4	

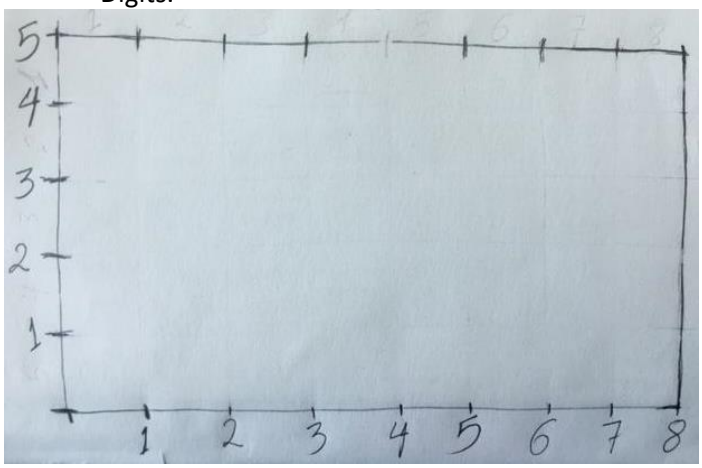
- Is any of the sides equal in length to another side? Does this apply to all rectangles?
- In a rectangle, usually the measure of the longer side is called length (L); and the measure of the shorter side is called width (W).

15 minutes

- On a piece of paper, you will draw a sketch of the room
- The room is much bigger than the sheet of paper, so architects usually draw a smaller sketch that looks like the actual room but smaller (something like a photograph of you compared to the real size of you).
- See below how to do it:
- To do this, instead of using your Foot to draw the sides of the rectangle, you use your finger: Digit.



- In the example below, see a sketch of a room whose Length L = 8 feet, and width W= 5 feet. The actual size of the sketch is 8 Digits by 5 Digits.

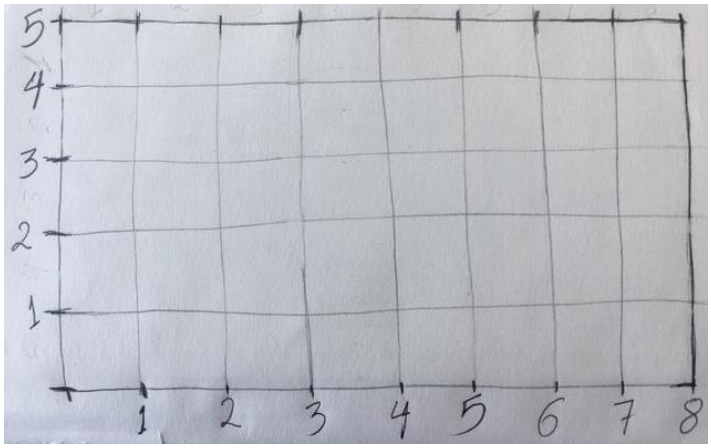


- As you also notice, we do not need to write the sizes of the other sides, as in a rectangle opposite sides are equal in size.

- Now draw the sketch of the room on a sheet of paper.

15 minutes

- On your sketch, create a grid using the Digit marks, as shown below:



- Count the number of squares in your diagram.
- Notice that the side length of the small square is 1 digit, so we call it a unit square.

15 minutes

- The number of squares inside the sketch is called the **Area** of the sketch.
- **Area** is the size of the floor surface inside a certain shape, which is the count of unit squares enclosed within.
- In the example above, we saw that the sketch has 40 unit squares within, so its area is 40 **squared Digits**, and we conclude that the area of the room is 40 **Squared Feet**.
  - What is the area of your sketch? (in squared Digits)
- What is the area of your room? (in squared feet)

*Foot measure used here is the Learner's foot size and not the universal Foot scale.

30 minutes

- In scale drawing, you can choose any scale you like and mention that on your drawing. For example, in some maps the scale can be 1:10'000, which is 1 centimetre represents 100 meters.
- Try to answer the questions on the Day 1 Worksheet without using a calculator.
- Criteria: Questions are answered correctly using the skills learned in this project

10 minutes

- Show your answers and discuss them with one of your parents

DAY 2

Today you will draw the sketch of your house floor map.

Suggested Duration	Activity and Description
5 minutes	● Today you will draw a sketch of the house floor map using a Digit to represent 1Foot. ● When doing this, Architects imagine that the roof of the house is transparent, and we draw the map as if we are looking at the house from the top like a flying bird. ● As an example, below is a simple floor map.  **Source:** https://www.tuko.co.ke/276066-3-bedroom-house-plans-designs-kenya.html - Notice that: The walls are drawn on the map There are some arcs to represent doors The function of each room is marked (bedroom, kitchen, bathroom…) - Not all measures are marked, so better you add that to your map.
45 minutes	● The learner will draw a floor map of the house and then presents it to the family. ● Criteria: - The floor map is up to scale (each 1 Foot of actual measure is represented by 1 Digit) - The map accurately represents the actual rooms of the house - The name of each room or space is written on the map (like bathroom, kitchen...etc.)
10 minutes	● Learners present the floor map to their parents

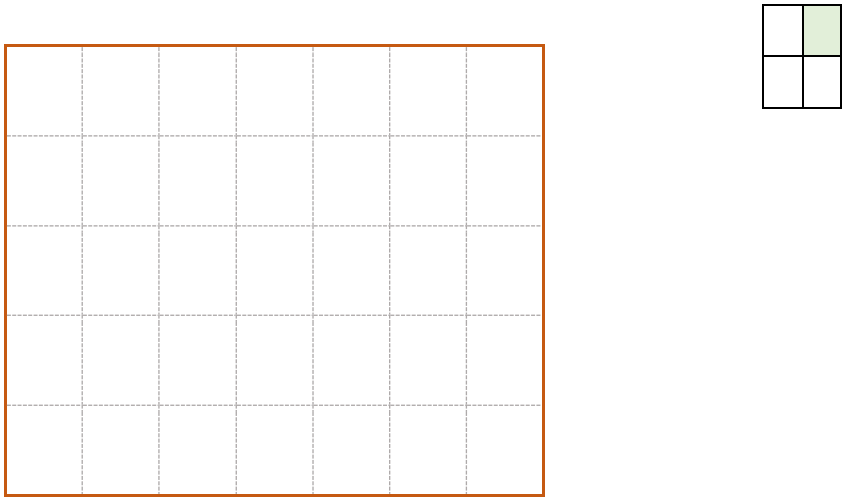
10 minutes	• Learners calculate without using a calculator the overall area of the house using the floor map: this is done by adding the areas of the different rooms or spaces inside the house. • Learners will also calculate without using a calculator the Perimeter of the house.
5 minutes	• Present answers to one of the parents • Criteria: - Followed the methods used in this lesson, or logically deducted an own method - The answers are correct

DAY 3

Today you will practice division.

Suggested Duration	Activity and Description
30 minutes	• Division: it is like distribution, so dividing 6÷3 is like distributing 6 candies on 3 children, how many candies will each child have? • Make 3 bags, one for each child: - Then start by giving every child 1 candy, and repeat again until you run out of candies: - The answer is 2 candies for every child. If you notice, division is about giving an equal share to everybody. - Try distributing 15 candies to 3 children, how many will each get? - (The learner has to figure out. *Answer is 5*) - Example: Distribute 7 pizzas on 3 families. How many will each family get? - 7÷3= **2** Pizzas per family, with a **remainder of 1 Pizza** - Another way of solving this, is to actually cut the remaining pizza and distribute it evenly on the three families. So, 1 pizza cut into 3 equal shares will result in a fraction that is $\frac{1}{3}$ - This way, the answer is written as $2\frac{1}{3}$ because each family got 2 whole pizzas and one third of a pizza.
30 minutes	• Solve the Day 3 Worksheet Question 1 without using a calculator.
10 minutes	• Architects use the different measurements of the house to calculate the material needed to complete the house construction. For example: using the area, they can calculate how many tiles they need to cover the floor.

- For example: A room of L 7m and W 5m, is to be covered by square tiles of S= 0.5; how many tiles are required?



- If you notice on the sketch above, each unit square will take 4 tiles of side 0.5.
- So, the number of tiles can be calculated in 2 steps:

First calculating the room Area = 7 x 5 = 35 squared m.
Then multiplying the area by 4, 35 x 4 = 140 tiles.

- Another Method

First calculating the room Area = 7 x 5 = 35 squared m.
Then calculating the tile area = 0.5 x 0.5 = 0.25
Then dividing the Area of the room by the area of the tile: 35 ÷ 0.25

- As you know 0.25 is $\frac{25}{100}$

  $35 \div 0.25 = 35 \div \frac{25}{100} = 35 \times \frac{100}{25} = 35 \times 4 = 140$ tiles.

- As you see above, we solved a division problem using multiplication.

15 minutes	• Now it is your turn to calculate <u>without using a calculator</u>: if you were to change the tiles in your house with square tiles of side 0.5 foot, how many tiles would you need?
5 minutes	• Show your solution and answer to one of the parents. • Criteria: - The method is correct with logical steps - The answer is correct
10 minutes	• Solve Questions 2 and 3 on the Day 3 Worksheet <u>without using a calculator</u>, and show your work and answers to one of your parents

DAY 4

Today you will do a treasure hunt!

Suggested Duration	Activity and Description
30 minutes	• Learners will hide 3 items around the house and will mark where they hid them on the floor map. They will ask 3 family members to find one of the hidden items each. • If that was too easy, they can make it harder by hiding smaller items, and giving an approximate location.

30 minutes	• Learners will explore how we could help people navigate using verbal instructions.
	• Learners will imagine how they would help a blind person who could not see the map. They will blindfold one of their family members and give them directions to go from one location to another in the house using the following verbal directions only:
	  ○ Move (a number of) steps forward
	  ○ Turn to the left
	  ○ Turn to the right

10 minutes	• For discussion
	  - How good your directions were to guide the blindfolded member?
	  - Did you have to correct any of the directions you gave? Why?
	  - How do you think boats navigate their way in the sea without using technology?
	  - Imagine ways to help sailors navigate in the oceans when they are unable to see land. Hint: Learners can be prompted to look out into the sky and imagine the north star (the brightest star in the sky) and the direction that the sun rises (east) and sets (west).

10 inutes	• Reflection questions
	  - What did you like the most about this project?
	  - Using what you have learned in this project, what floor maps would you like to draw? (probing: playground, your school, another house, …etc)
	  - If you were the architect to design this house, what would you change while keeping the same total area of the house?

ASSESSMENT CRITERIA

- The house floor map is accurate and clear
- Worksheet questions are answered correctly using methods and skills introduced in earlier activities
- Learners are engaged and show grit while working on project tasks
- Learners give good verbal instructions as directions

ADDITIONAL ENRICHMENT ACTIVITIES

Draw the floor map of another space (School, playground…) and calculate how many tiles it will require.

MODIFICATIONS TO SIMPLIFY

Simpler version of this project can be to learn how to draw floor mapping of a rectangular space using simple conversion of Foot to Digit and counting the unit squares enclosed to find the Area

DAY 1 WORKSHEET

Answer the below questions without using a calculator

1. Draw a floor map of a room whose Length is 14 Feet, and Width is 12 Feet, using the scale 2 Foot is represented by 1 Digit

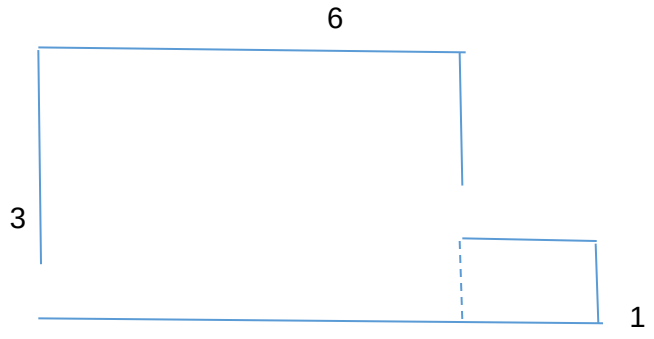
   Then find the area of this room in Squared Feet.

2. A rectangle has an area of 20 Squared Feet. Its Length is 5 Feet. What is its width?

Hint: use the formula A = L x W,

20 = 5 x ?

3. A rectangle has an area of 35 Squared Feet. One of its sides measures 5 Feet, can you find the measure of the other side?
4. Find the Area and Perimeter of the house in the sketch below. Each unit on the sketch represents 1 meter.



EAA welcomes feedback on its projects in order to improve, please use this link: https://forms.gle/LGAP9k17fMyJrKJN7

DAY 3 WORKSHEET

Answer the below questions without using a calculator

1. Find the answer to the below division problems.

9÷3=

18÷3=

18÷6=

12÷2=

13÷2=

24÷3=

25÷3=

11÷5=

23÷5=

17÷4=

23÷6=

31÷5=

19÷2=

14÷3=

29÷6=

2. The perimeter of a rectangular room is 20 m. Its Width is 4 m, what is its Length?

3. A rectangular room is 12m by 7m. How many square tiles of side 0.5 m are required to cover the floor?