

ARCHITECTURAL DESIGN

AT A GLANCE Explore architectural design and act as architects to create a floor plan of a redesigned classroom.

OBJECTIVES:

Students will:

- Use prior knowledge to discuss functions of various architectural structures.
- Understand the difference between the job of an architect and the job of an engineer.
- Explain what a floor plan is and how architects use them.
- Be able to draw a floor plan to scale.
- Create a floor plan of their classroom.

KEY VOCABULARY

Architect, Engineer, Floor Plan, Scale Drawing, Dimension Line

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Obtaining, evaluating and communicating information

CROSCUTTING CONCEPTS

- Patterns
- Cause and effect
- Scale, proportion and quantity

DISCIPLINARY CORE IDEAS

- Patterns
- Cause and effect
- Scale, proportion and quantity

PACE YOURSELF:

- Two 60-minute periods



ADVANCE PREPARATION

1. Copy the Architectural Design Student Worksheet for each student as well as several graph sheet pages.
2. Make sure there are enough materials for each pair of students to have a ruler, meter stick, tape measurer, plain paper and graph paper.



MATERIALS

Per pair:

- At least five pictures of different buildings
- Pencil
- Ruler
- Meter stick
- Tape measure
- 3-4 sheets of graph paper
- 3-4 sheets of plain paper

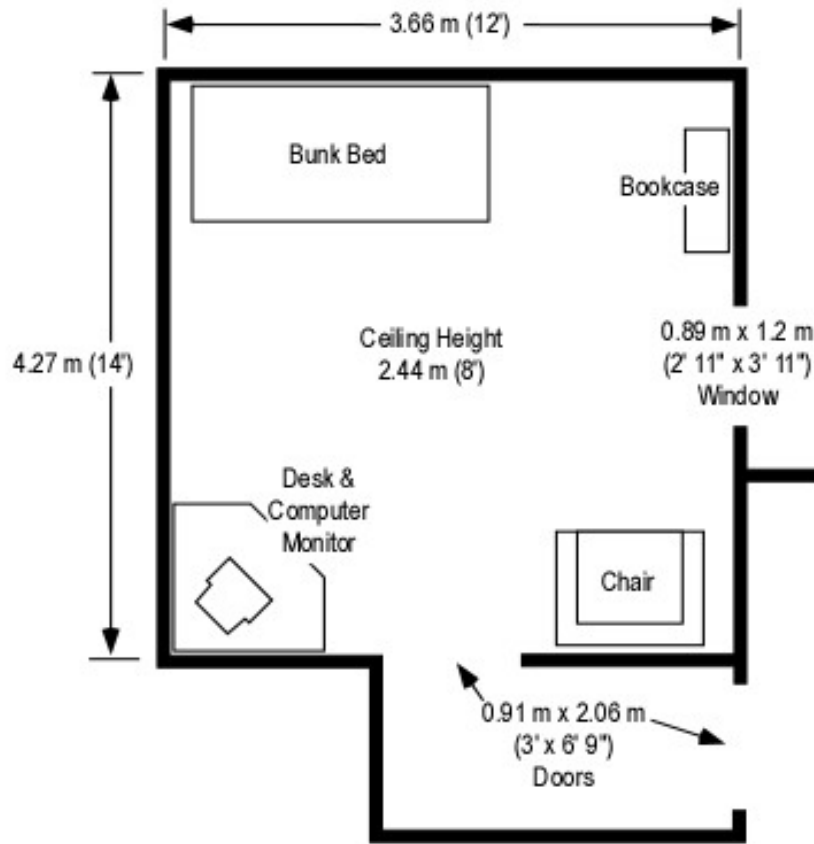


WHAT YOU NEED TO KNOW

The job of architects and engineers involves planning and designing structures and then overseeing their construction. Architects create drawings and designs that are used to give engineers the information they need to build structures. Drawing plans with pens, pencils or computers is called drafting. Architects decide on the size and shape of the structures they are designing and what materials should be used in the building of the structure. These designs need to be accurate so the engineers know exactly what to build. Such designs must take everything into account, including the purpose of the structure, the setting, materials being used and energy sources. Plans for structures must be very detailed using exact measurements. Architects draw and construct floor plans and models both by hand and by using sophisticated computer programs.

A floor plan is a drawing that shows a room as seen from above. Everything looks flat when drawn in a floor plan. Architects use floor plans to design rooms or whole buildings. Floor plans usually show measurements (called dimension lines) for how long things are in real life. Dimension lines show the lengths of windows, walls, doorways, closets and distances between these objects. Floor plans must be drawn to scale which means reducing the size of a drawing so a whole room or building can fit on one piece of paper. Common scales

used are 1 inch = 1 foot or inch = 1 foot. Below is an illustration showing a simple floor plan of a bedroom drawn with dimension lines.



Helpful vocabulary words and definitions:

- Architect - A person who plans and designs how a building looks; the art of the building.
- Engineer - A person who plans the structure of a building including materials used and how the building will support its weight; the science of building.
- Floor plan - A drawing that shows a room seen from above.
- Scale drawing - A drawing that represents a real object reduced in size.
- Dimension line - A line showing a measurement in a scale drawing.



WARM UP

1. Discuss with the students what makes up a city and have them share their ideas. Tell them that in addition to people, businesses and trees, buildings are a major part of a city and they will be taking a closer look at the different types of buildings that make up a city.
2. Give each group of students at least five pictures of different types of buildings and ask them to categorize them. Tell them to take a few minutes to look over the pictures and make a list of the types of buildings represented. They may write down specific building names (i.e. the Willis Tower and the Art Institute) or they may think more generally (i.e. office building, museum).
3. After a few minutes of brainstorming, have each group share their list. Write down their ideas on a board or chart paper.
4. After each group has shared their ideas, work together to create a general list of the types of buildings found. For example, if they say the Willis Tower, have them categorize it as an office building or skyscraper. Also guide them to think of other types of buildings that may not be represented in the pictures: grocery stores, schools, train stations, etc.
5. Once they have created a fairly large list, ask them: Why do you think there are so many different types of buildings? Why is a house so different from a skyscraper? Encourage students to think about the purpose of these different kinds of buildings. A house has a different purpose than a skyscraper, and so they look different. A house also has different things inside it compared to a skyscraper. Ask the students to make comparisons between the two.
6. Typically, the inside and general look of a house and a skyscraper are different. But, ask the students, are there any similarities in how they are constructed? Who designs these types of buildings?



ACTIVITY

1. Talk to the students about architects and engineers and how their jobs are related but different. An architect's job is to come up with the design concept of a building, while an engineer's job is to do the actual building. Explain that it is important for architectural drawings to be accurate, because the engineers and builders must be able to follow them exactly. Careful measurements must be used to be certain that the building will turn out the way the architect wants it to be built.
2. Show students the Student Information Sheets illustrating two types of floor plans. Floor plans can be drawn with pictures of the actual objects or with line drawings.
3. Give students graph paper and decide on a scale for them to use. Graph paper lends itself to use the scale $\frac{1}{4}$ inch=1 foot. Each square of graph paper is $\frac{1}{4}$ inch long. Explain to students that something that is $\frac{1}{4}$ inch long in a floor plan is 1 foot long in real life. For example, if a classroom wall is 20 feet long, students can divide by 4 and draw a line 5 inches long, or they can count 20 boxes on the graph paper.
4. Have students practice measuring objects such as a textbook, pencil or desk and then drawing them to scale on their graph paper.
5. Organize the class to work in pairs to draw a floor plan of their classroom. Ask each pair to create a sketch of their classroom on plain paper which includes the location of walls, windows, doorways and closets.
6. After they are finished sketching, ask each pair to measure the length and width of the classroom and record it on their sketch.

7. Next, ask each pair to measure the length and width of any doorways, windows or closets. Remind students they don't need to worry about height because in a floor plan everything is flat.
8. Once students have the measurements of the classroom, they are ready to make their floor plans. Students should begin by drawing the classroom walls with thick lines. They can then add in windows, doorways or closets by erasing the thick lines to make openings or draw new, thin lines.
9. After the students are finished drawing the classroom, they can add dimension lines and a key. Students can also draw in other objects in the classroom such as furniture if they would like. The amount of detail included can be determined by the skill level of the class.
10. Discuss the drawings. What was difficult to represent? What was easy about the drawings?



CHECK FOR UNDERSTANDING

Have students answer the following questions in their teams or as a whole group discussion.

- Why do you think there are so many different types of buildings?
- Why is a house so different from a skyscraper?

As student groups are working on their floor plans, walk around and ask them to explain what they are drawing. Ask them to show you where the doors, windows, closets, etc. are located and have them show you their dimension lines. Check to be sure they are making their floor plans to scale.



WHAT'S HAPPENING

In architecture and building engineering, a floor plan is a drawing to scale, showing a view from above, of the relationships between rooms, spaces and other physical features at one level of a structure.

Dimensions are usually drawn between the walls to specify room sizes and wall lengths. Floor plans may also include details of fixtures like sinks, water heaters, furnaces, etc. Floor plans may include notes for construction to specify finishes, construction methods or symbols for electrical items.



DIFFERENTIATED INSTRUCTION

- More advanced students can design their “dream classroom.” Ask students to think about what they would like their ideal classroom to look like and sketch it on plain paper. How big would the classroom be? What would they include in their classroom? After they have a sketch of their dream classroom, ask them to make a floor plan including measurements of the room.
- Ask students to make a sketch of their classroom and practice measuring the walls, windows, doorways, etc. Include the measurements in the sketch.



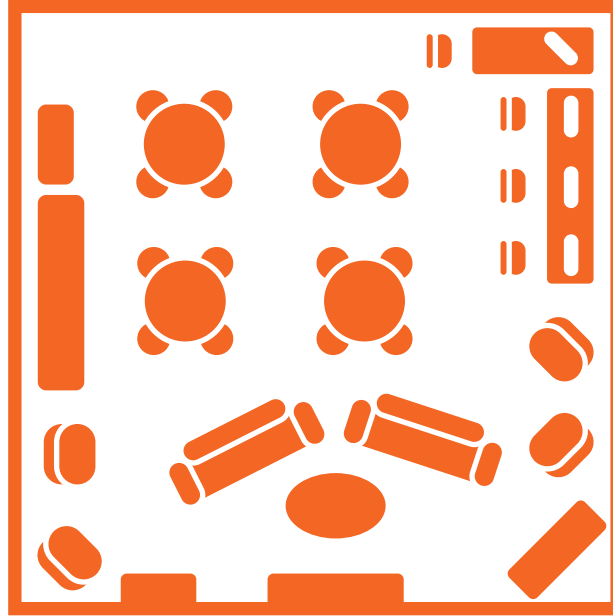
EXTENSIONS

- Ask students to write an essay describing a design for their perfect bedroom. If they could have a bedroom all to themselves and include anything they like, what would it look like? Students should include a drawing of the room.
- Have students do research on architects and engineers. What are the specific jobs of each of these careers? How are they similar? How are they different? Ask students to write a paper describing which career they feel they would be more suited for and why.
- Reading a floor plan is similar to reading a map. You need to understand measurements and scale. Have students search for architectural floor plans on the internet and examine them. In what scale did the architect design? What other details and measurements are important?
- Have students practice conversion skills by converting the floor plan measurements into the metric system.
- Have students draw a floor plan on cardstock, cut out all the furniture and movable objects, and rearrange them to make a new floor plan. How else could you arrange the room while including all the same features?
- The Incas built an incredible city called Machu Picchu. Show PBS NOVA's "Ghosts of Machu Picchu — Chapter 5: Remarkable Engineering." Discuss some of incredible feats of engineering, e.g. how to access fresh water that the Incas used to create this once thriving city. What types of tools did they use?

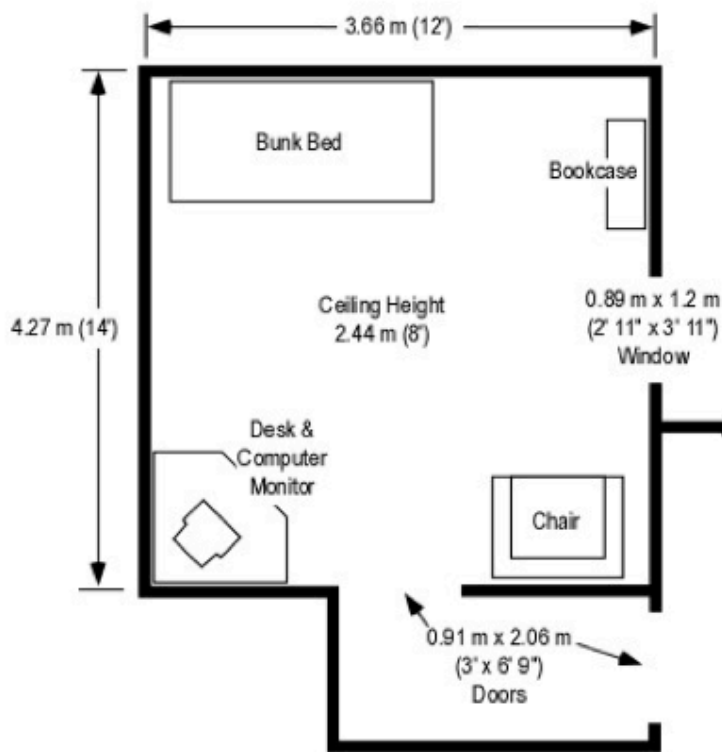
ARCHITECTURAL DESIGN STUDENT WORKSHEET

NAME _____

Floor plans can be drawn with pictures of the actual objects such as the following:



Floor plans can also be line drawings:



Use the graph paper below to draw a detailed floor plan of your classroom.

