

## Activity name: Apartment Planning

Big Idea(s)/ Concept(s)/major math area(s): Managing area and represent living spaces.

Grade level(s): 9-12 Geometry

### Math (and science?) Standards included:

G.TS.6: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

**Brief summary** of how this unit fits into year's curriculum and storyline (e.g preceding and post activity/units)

Students will be exposed to lots of different shapes in Geometry. This activity can be developed into a larger unit where students take what they know about shapes, develop techniques for finding area of irregular shapes, create models of living spaces and explore how scaling works. This activity would fit well after students have studied properties of quadrilaterals and polygons but before they have studied connections between area and volume.

### Procedure overview/ teacher directions

#### Part 1 Initial whole group discussion - setting the scene

- Teacher will show the outside of new apartment buildings being built near the school. Teacher will ask students why they think the buildings are being built, how big they think they are, and how many people could live in them. (5 minutes). **A bit longer...? X2 ? In general, you should choose a leading question which leads the students to think about all the others.. e.g. What factors are important in deciding to build an apartment building – or it might be a retail store (in or out of a shopping mall), or an office building – the students could develop lists of possible types, and then different groups could focus on the different types – the next step could then lead to geometric design needs...your part 2...**

#### Part 2 Student group activity/pre-activity (with/without whiteboard)

Whole group discussion of part 1 activity - conclusions to be drawn from discussions about activity - these may be only qualitative or just introducing the “big ideas” - being developed by the students, with teacher guidance.

- Teacher will display an apartment unit to demonstrate how we can show floor plans for apartments. Apartments should be chosen from 3 parts of the city to demonstrate differences in building structures and also blueprint styles. (2 minutes) **A bit longer...? X2 ?**

#### Part 3 Student group activity (with/without whiteboard)

Whole group discussion of part 1 activity - usually a quantitative proof of the “big idea(s)”; conclusions to be drawn from discussions.

These become mathematically quantitative - verified by the student-acquired data.

- Students (**lead them to choose by whole group eg some small unit to begin with...**) will be given the task: Create a 1 bedroom apartment that is around 1200 square feet. (**Students could estimate a size that would be in line with the questions below**) Provide students with a copy of common furniture/appliances with sizes. (15 minutes)
  - Questions to ask as teacher walks around (**try to get these questions asked before going into groups**)
    1. What do you need to have in an apartment?

2. What rooms would you want?
  3. What is the biggest room going to be?
  4. How can you clearly label the walls, doors, and windows?
  5. Is the room big enough to fit a (bed, table, stove...) in?
- Potential concerns
    1. Not knowing what square feet are
    2. Rooms not being set up in a way that fits what goes in the rooms.
- Discussion: What things do you want to have in your apartment? What do you think we have to have? Let's make a chart separating these. (5 minutes) **Is this a whole group discussion? Yes – probably more like 10 minutes...**
  - Now try to keep all the things you had, but create a floor plan for an apartment that is 1000 square feet. Don't start from scratch unless you have to. (5 minutes then 5 minutes to share with class)
    - Is there anything you have to drastically change?
    - Can you rearrange things to make it all still fit?
  - Now try to keep all the things you had, but create floor plan for an apartment that is 700 square feet. (5 minutes then 5 minutes to share with class)
    - What things did you have to give up?
    - Did you give up anything you thought you had to have before?
  - Now try to keep all the things you had, but create a floor plan for an apartment that is 400 square feet. (5 minutes then 5 minutes to share with class)
    - How many different rooms do you need to have?
    - Is there something you're giving up that you don't want to but just don't have the space for?

**Part 4** Student group follow-up activity, etc - there might be several of these, as the topic is extended in the unit...

- Over time, we can develop a model that should be used by Indianapolis to decide the size new apartments must be to receive funding from the state to build.
- Students can be given a plot of land and decide how many buildings could be built on the land, how many people can live there, and what can be done to maximize space and living area.
- Main focus can be: What is a fair living space?
  - Students come up with features that should be available
  - Students decide on how big certain features should be for one, two, four, or six people. How does scaling work in both area and volume of buildings?
  - Create a way to decide how many people can live in the apartment. (what would the square feet per person be?)
  - Create a way to decide how much the apartment should cost based on features.

**Part 5 Final discussion** (with/without whiteboard)

Generalizations, connections to other math topics (**calculating shapes, 2D, 3D areas, volumes – using estimates and approximations...**), connections to real life – **discuss examples, are there any design games that students already play...**

(next day activities – **extending the model within this math unit...limits on designs in other areas – how about an airport? A city park, passenger compartments: the inside of a car, airplane, hotel room... How about**

interlocking design patterns such as squares, hexagons and other regular and irregular figures – design their own quilts....) Ask the students what they think they learned in this or these lessons...