



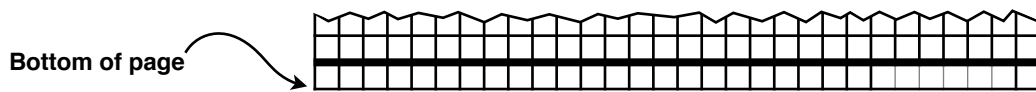
Buildings and Shadows

A real estate developer has decided to purchase a plot of land in downtown Brooklyn and construct a high-rise apartment building. The community, believing that a new skyscraper would ruin the neighborhood, sued to keep the real estate developer from building. During the trial, many arguments were made – including from one urban farm a few blocks away that was worried the shadow created by the building would affect the productivity and livelihood of the farm and its employees. In the end, the judge allowed the construction of the high-rise to continue as long as two conditions were met. First, 10% of the building's rentals would be designated as affordable housing for low-income families. Second, the developer could only raise a building that would not cast a shadow on the urban farm. Since the farm is directly north of the proposed building site, the architect designing the building needs to only worry about shadows at noon when the sun is at its highest point in the sky. As an architect, your job is to determine how tall a building you can build without creating a shadow on the urban farm.

Instructions

Using a piece of graph paper, create a diagram to represent the building and the farm.

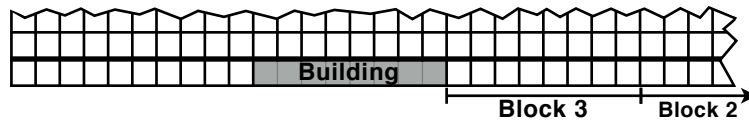
1. Turn the paper sideways and draw a line along the bottom to represent ground level



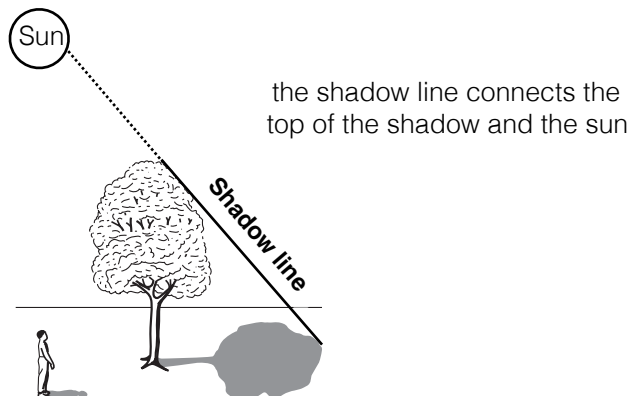
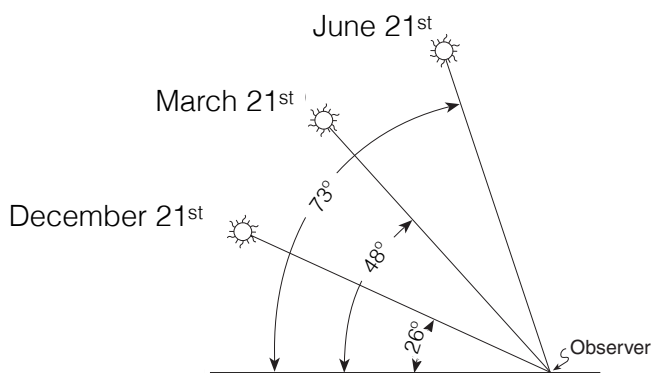
2. On the right hand side, below the line you just drew, mark off the location of the urban farm. it should be 6 squares long.



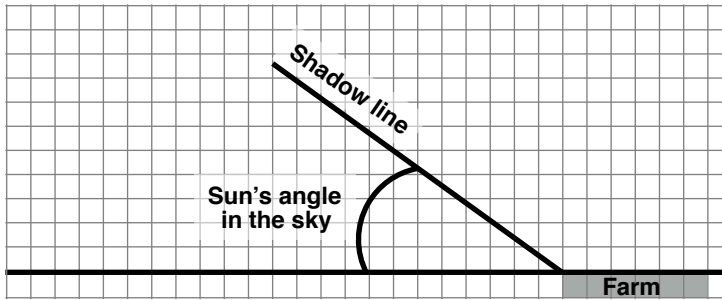
3. Each city block in this neighborhood is 8 squares long. The new building is 3 blocks away. Count the number of blocks and then mark off the location of the building. It should be 8 squares long as well.



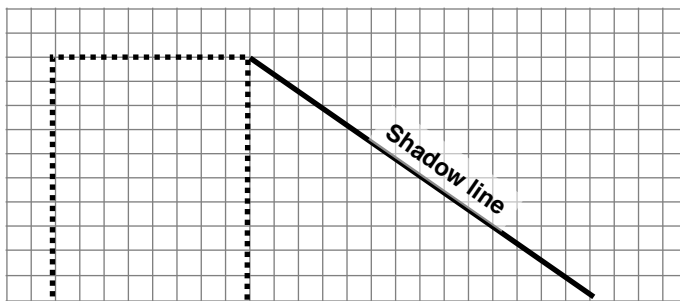
4. To determine the length of the shadow, one must first know the angle of the sun is in the sky at noon. The architects consult an astronomer and discover that the two extremes are June 21st (the summer solstice), when the sun is highest in the sky, and December 21st (the winter solstice), when the sun is at its lowest angle (see below left). Which position will create the longest shadow? If you need help, try to use a flashlight to help you determine the answer. **Circle the correct date.**



5. Use the angle you determined for the longest shadow (from Step 3) to create a shadow line from the edge of the farm.



6. Extend the line to the left until you have reached the right side of the building location. If each square upward represents a floor, what is the highest floor a rectangular building can reach without casting a shadow on the farm?



Highest possible height for this rectangular building :

_____ floors



7. The real estate developer appealed the court decision, arguing that the farm didn't plant and grow crops between March and September. The judge agreed. How much taller can the *rectangular* building be using the March 21st sun angle?

Highest possible height for this rectangular building : _____ floors

8. Each floor of the proposed building has 8 boxes, each box represents 2 apartments in the building. If the building was rectangular you would have 16 apartments per floor. Using the graph paper diagram you created for March 21st, can you create a new non-rectangular design that will have more apartments than the original rectangle without casting a shadow on the farm?

Most effective design: _____ floors _____ apartments (2 x squares)

The judge said 10% of the apartments had to be designated for low-income families. How many low-income apartments have you created? _____ **apartments (2 x squares)**

9. Discuss what you learned from this design process.
