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Pre-Algebra

1 Teaching Objectives:

- The students will describe the attributes and component parts of 2-D representations of 3-D objects.
- The students will develop spatial visualization skills by analyzing perspective views of 3-D objects.
- The students will use spatial reasoning to position objects in a perspective view.

2 Instructional Activities (This lesson is designed to take 2 fifty minute class periods.)

Day 1

Mirror Images

- Show students a picture of the NYC Skyline (Attachment 1) on the overhead.
- Ask: "If I told you the tallest building in the picture is 500' tall, the next is 480', the next tallest is 440', and so on, would you be able to tell me how many 1 sq. ft. cubes could fit inside the buildings? Why?  
Expected Answer: No. Because we can only see the front of the buildings. We do not know how deep the buildings are.
- Say: We need to see all sides of the building in order to know how many cubes will fit.
- Ask: If you were looking at the buildings from the side you are sitting on now, and I was directly opposite of you on the other side, what would the buildings look like to me?
- Expected Response: It would be turned the other way. A mirror image.
- Talk about mirror images with students.  
Mirror image: a mirror image of an object is the image formed by reflection in a mirror. Or, in this case, a mirror image is also obtained when looking at a 3-D image from the other side.
- Ask: What are some examples of mirror images that we see every day?  
Responses will vary. (i.e. a printed t-shirt worn inside out, paper printed on one side and looked at from the other side while holding it to the light) Put examples of mirror images on the overhead. (Attachment 2)
- Explain to students that today we are going to create and use mirror images to help us construct some 3-D buildings.

### Building Practice

- Pass out 15 cubes and a Building Mat (Attachment 3) for each student.
- Display a Transparency of the Building Mat (Attachment 3).
- Ask students to construct a random structure on the building mat. Explain the Purpose of the Mat. Building on the Mat allows you to turn the building and look at it from all sides. Always position the mat so that the word FRONT is towards you.
- Allow time for students to build a structure and observe its view from each side of the Building Mat.
- Display a transparency of Building 1 Base View (Attachment 4).
- Explain that the base view is the view of the building from the top. The numbers tell you how high each stack of cubes should be.
- Tell students to take 7 cubes and build the building.
- Assist students who are having trouble building the building.
- Tell students to turn their mat to look at the building from all sides, noting the differences and similarities in the views.
- Cover the view labels and display the transparency of Building 1 looking at it from all sides. (Attachment 5)
- Point to the FRONT view and Ask: What side was the person standing on when he drew this picture?
- Point to the remaining pictures and ask what view the picture was drawn from. As the students get the views right, uncover the labels.
- Ask: Is there any relationship between the Front and Back view? The left and right view?  
Expected Response: Yes, they are mirror images.
- Explain that the front and back views of a building will always be exact mirror images to each other. As well as the Right and Left views.

### Worksheet Activity

- Hand out Worksheet A (Attachment 6) and 6 pieces of grid paper to each student.
- Complete #1 on Worksheet A on the overhead.
- Instruct students to:
  - draw the base plan for each building on the grid paper.
  - after the base plan is drawn, draw and label the front, back, left and right sides of the building.
- Instruct students to finish Worksheet A for homework if they do not complete it in class.

## Day 2

### Review of Day 1

- Review Previous Day's Activities by checking homework for completeness and by asking students to work the problems on the board.
- Ask students to explain the drawings of the buildings they figured out for reinforcement for other students.
- Place Worksheet A answers on the overhead. Help with exercises students may have had problems with.
- Review procedures for building and drawing.

### Grading Assignment

- Give out a copy of "Architect: Is it in You?" (Attachment 7) to each student.
- Read the directions out loud to the students and answer questions from students who may not understand.
- Explain that you are able to guide students towards the correct drawings, but that this activity is for a grade.
- Take up papers at the end of the class period.

## 3. Materials

- Attachment 1, NYC Skyline
- Attachment 2, Mirror Images
- Attachment 3, Building Mat
- Attachment 4, Building 1 Base View
- Attachment 5, Building 1 Sides View
- Attachment 6, Worksheet A
- Attachment 7, "Architect: Is it in you?"
- 15 Building cubes for each student
- Grid Paper

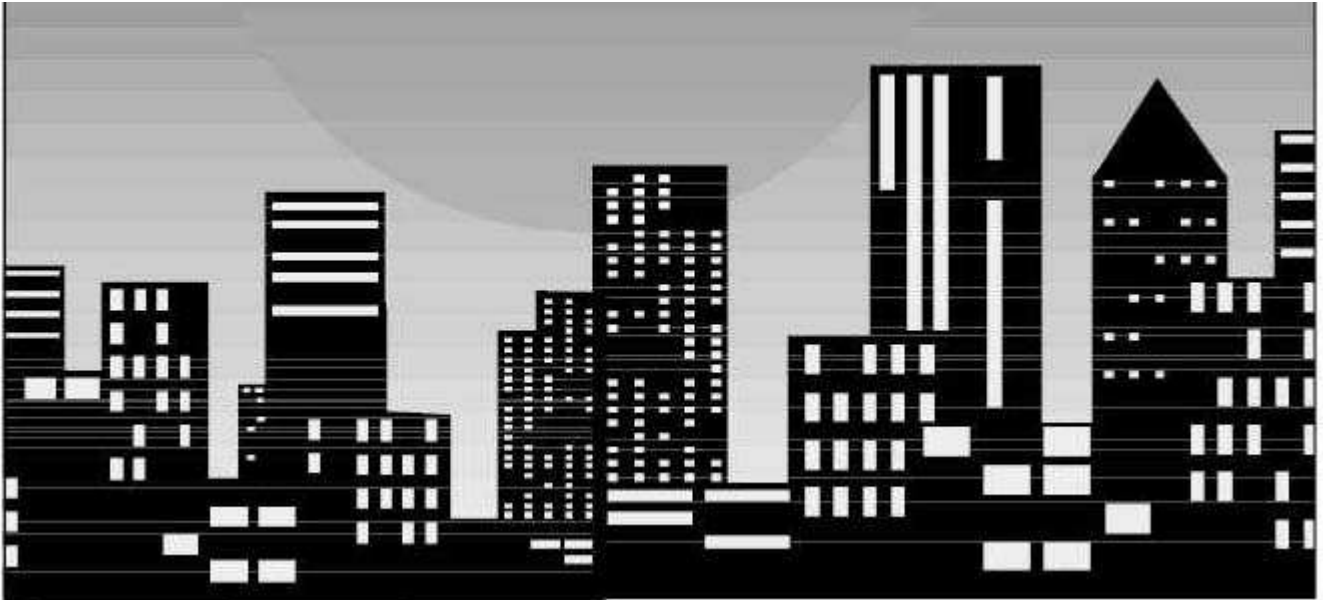
\*\*Attachments 1-6 should be made into transparencies for the overhead, as well as copies for the students\*\*

### Resources

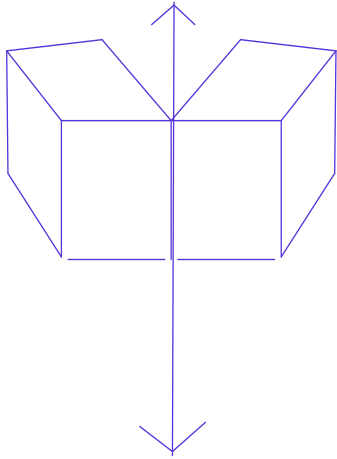
- Adapted by Carley Jefcoat from "What the Camera Sees". Spatial Visualization. Winter, M.J., et al. Addison-Wesley Publishing Company, Inc. 1986.
- NYC Skyline. <http://www.fbi.gov/publications/leb/2002.jan02x9x1.jpg>

#### 4. Assessment

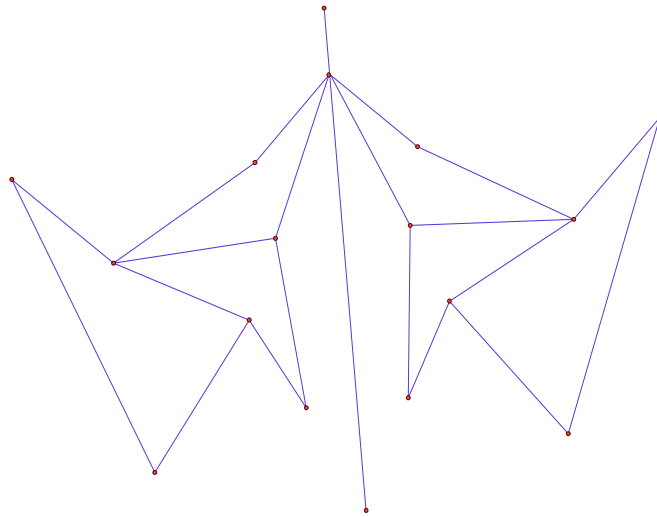
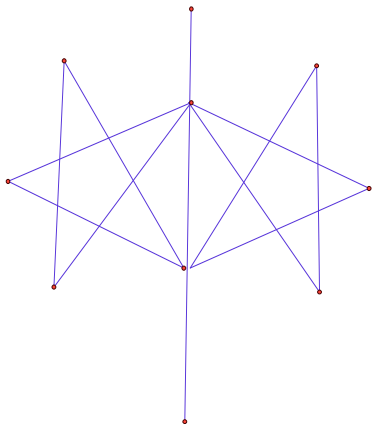
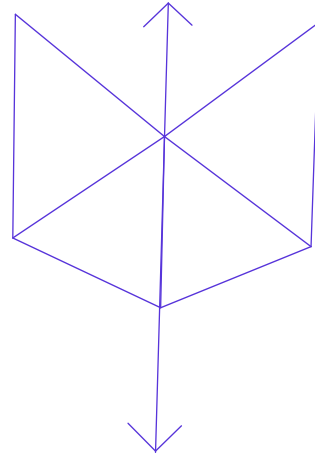
- Worksheet A will be checked for completeness for a homework grade.
- “Architect: Is it in you?” Activity will be turned in and graded by the teacher.
- The Teacher will observe students working on their tasks.



## Mirror Image Examples



## Attachment 2

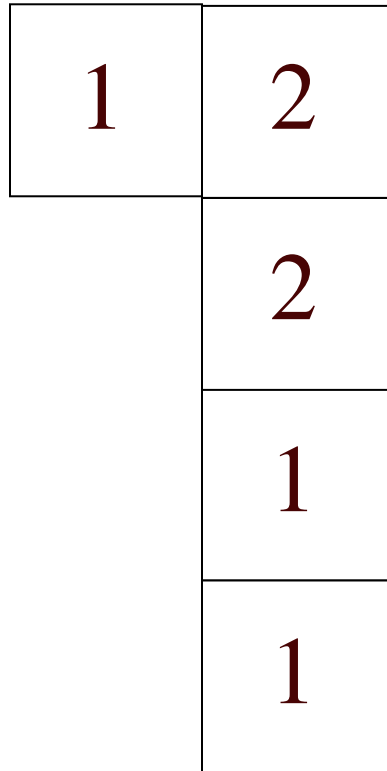


Back

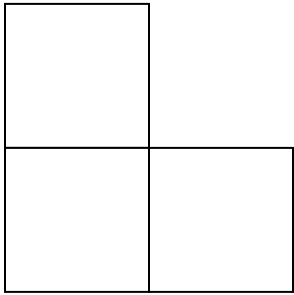
Left

Right

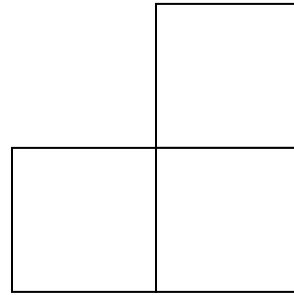
Front



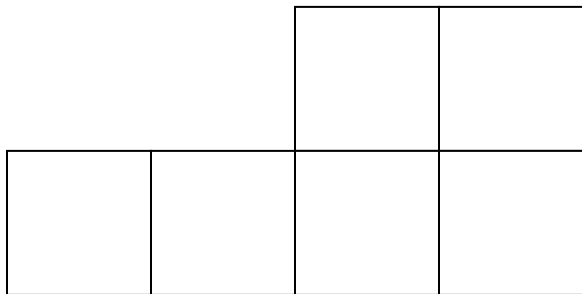




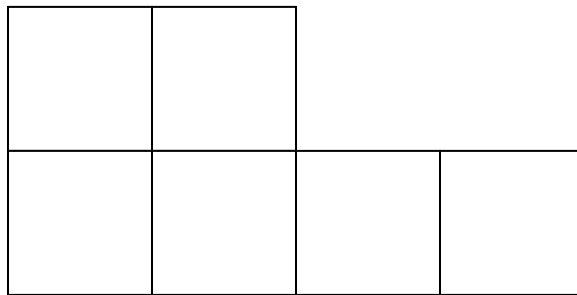
BACK



FRONT



RIGHT



LEFT

Handout A

BACK

1	
1	
2	1

FRONT

Attachment 6 (1 of 2 pages)

BACK

1	1	
2	1	3

FRONT

BACK

2		
3	1	2
1		1

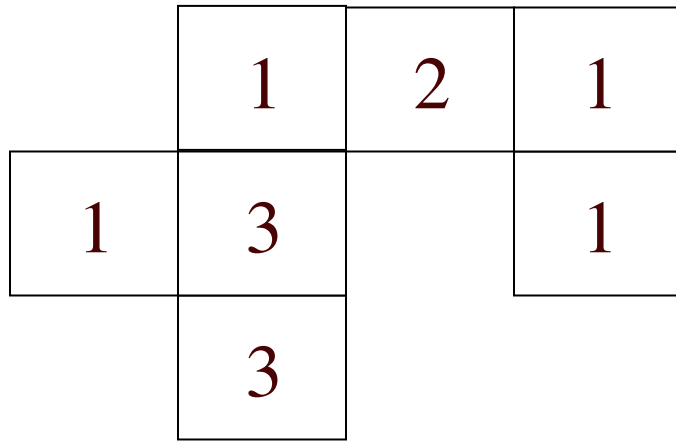
FRONT

BACK

1		
2	1	
3	2	1

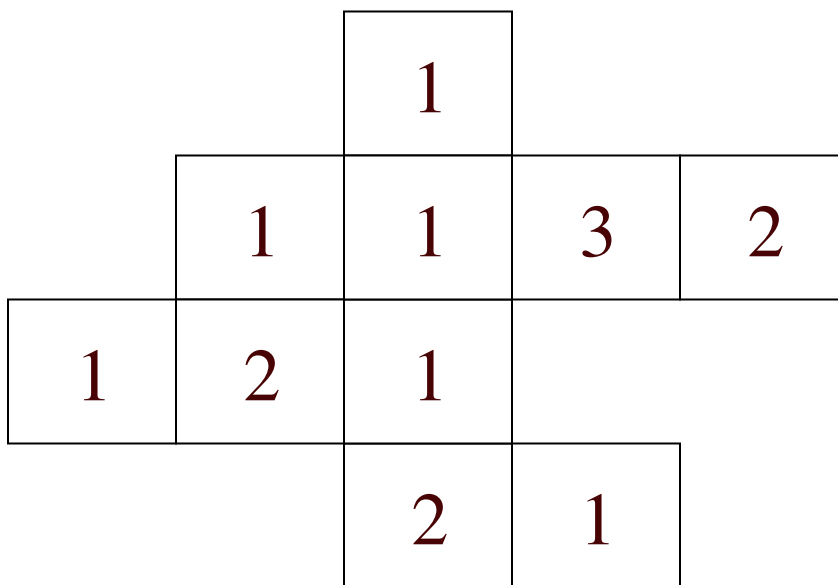
FRONT

BACK



FRONT

BACK



FRONT

You are a sophomore in college and your dream is to become an architect. You apply to the Division of Architecture at the local University. The first part of the interview process is a building challenge. You are to use the building mats to develop the plans for a set of office buildings.

- Look at the base mat for each building and draw it on the grid paper provided.
- By looking at the Base Plan, draw the Front, Back, Right, and Left views of each building.
- You may use the cubes to build the buildings before you draw them.
- Draw 1 building with the base mat, and all four side views on 1 page. Each building should be on a different page.
- Turn in the drawings for a grade.

1.

	1	1
	2	
2	3	2

2.

2	2
1	
2	1

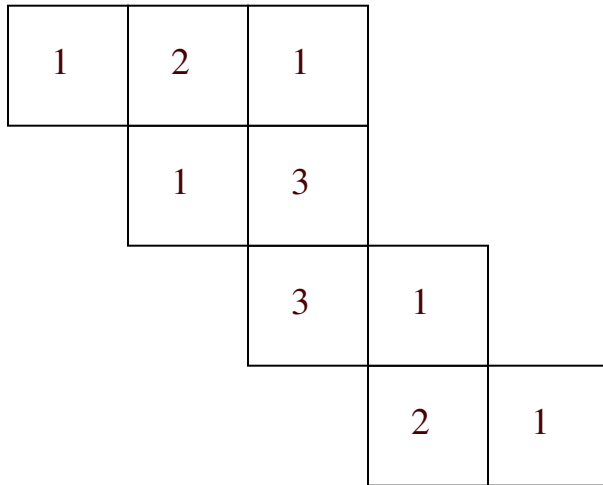
3.

	1	
	2	
	3	
2	2	1

4.

1	3	1	
		2	1
		2	2

5.



6.

