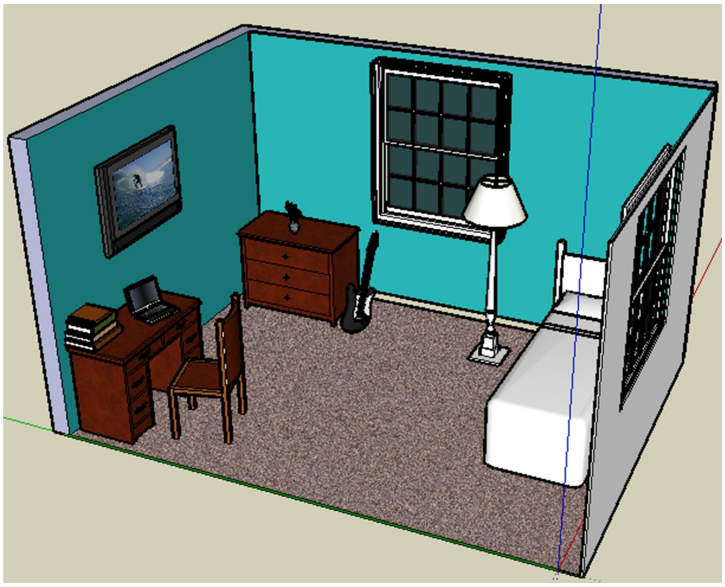
Math Infusion



Student Lab Book

Name _____

Introduction to Bedroom Design Activity

Problem Situation

You are moving to a new house that is being built for you. The architect that is being used needs information regarding your living style to determine the best design. You have a challenge to design the optimal furnished bedroom. It can be a dream bedroom and you have a budget of $27,500 to design a rectangular bedroom with minimum dimensions of 120 square feet. However, the budget increases to $30,000 if you design a non-rectangular bedroom with a minimum area of 120 square feet.

The Challenge

Design a virtual furnished bedroom using Google-sketch and construct an actual scale model of the bedroom design including furnishings.

The Design Specification and Constraints

- The window area must be equal to at least 20% of the floor area.
- The minimum room size is 120 square feet. The minimum height of all ceilings is 8 feet and the maximum is 12 feet.
- The bedroom will have two outside walls and two interior walls. In the model one interior wall can be removed for ease of access and seeing the design.
- The budget is $27,500 for a rectangular bedroom and $30,000 for a non-rectangular bedroom.
- The cost of basic construction is estimated at $150 per square foot of floor area.

Video Clip

After watching the video make a list of many, varied and unusual facts about the video.

- _____
- _____
- _____
- _____
- _____
- _____

Building Codes

Use the Internet to research the following questions.

1. What do building codes refer to?

   _____

   _____

2. Why are building codes important to the community or the neighborhood that you live in?

   _____

   _____

3. Who would you contact to discuss building codes? What is the mail address?

   _____

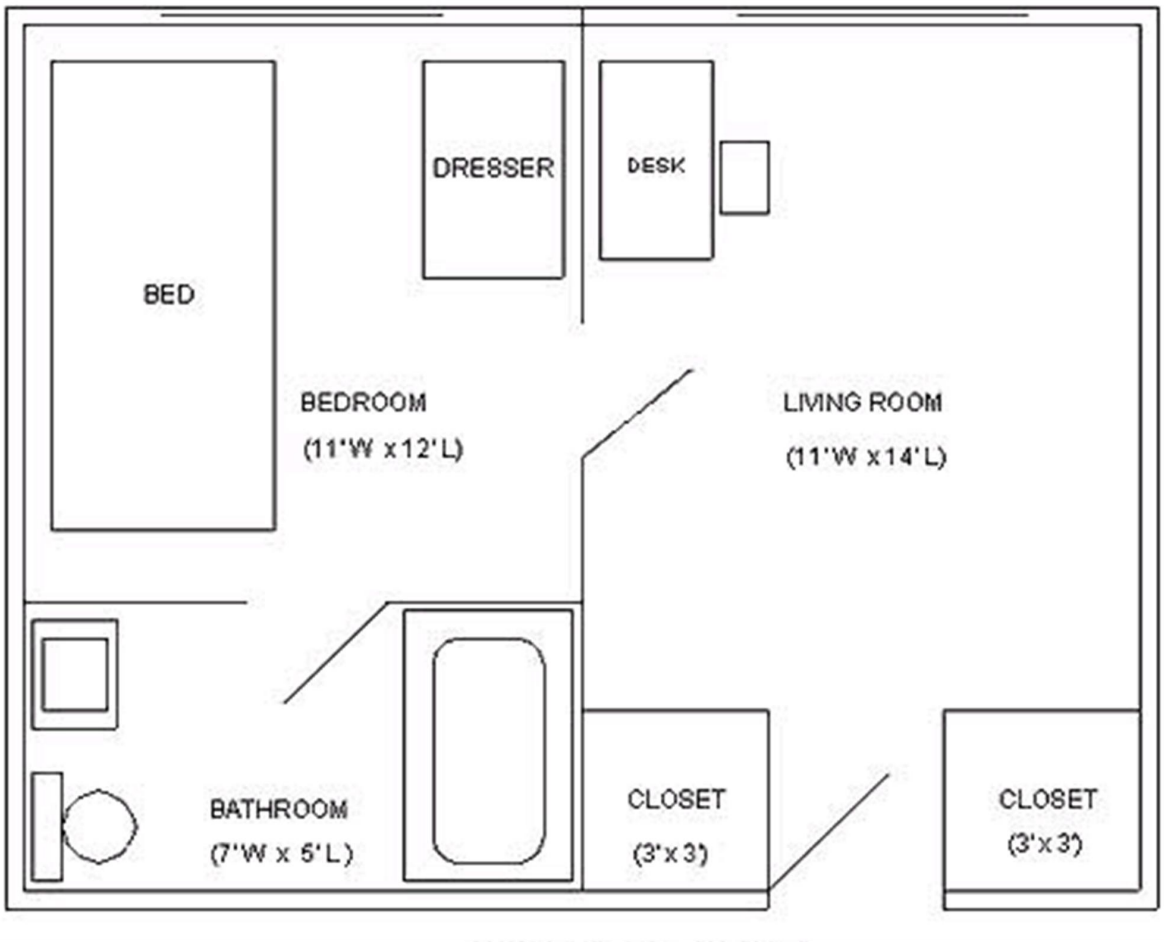
   _____

4. What town, township, county and state will you need the building codes?

   _____

   _____

Floor Plans

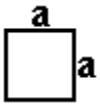


How big are the rooms?

- Living room _____
- Bedroom _____
- Bathroom _____

Area Formulas

Bedroom Design – Date _____

square = a^2 

"ab" means "a" multiplied by "b". "a2" means "a squared", which is the same as "a" times "a".

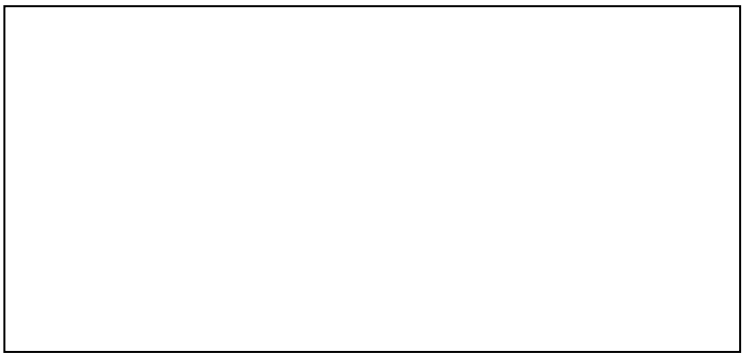
A square foot is a unit of area measurement equal to a square measuring one foot on each side.

Area is measured in "square" units. The area of a figure is the number of squares required to cover it completely, like tiles on a floor.

Area of a square = side times side. Since each side of a square is the same, it can simply be the length of one side squared.

If a square has one side of 4 inches, the area would be 4 inches times 4 inches, or 16 square inches. (Square inches can also be written in2.)

Be sure to use the same units for all measurements. You cannot multiply feet times inches, it doesn't make a square measurement.



10’

25’

What is the area of the rectangle? _____

How many square feet is the rectangle? _____

Be careful!! Units count. **Use the same units for all measurements.**

Introduction to Construction Costs

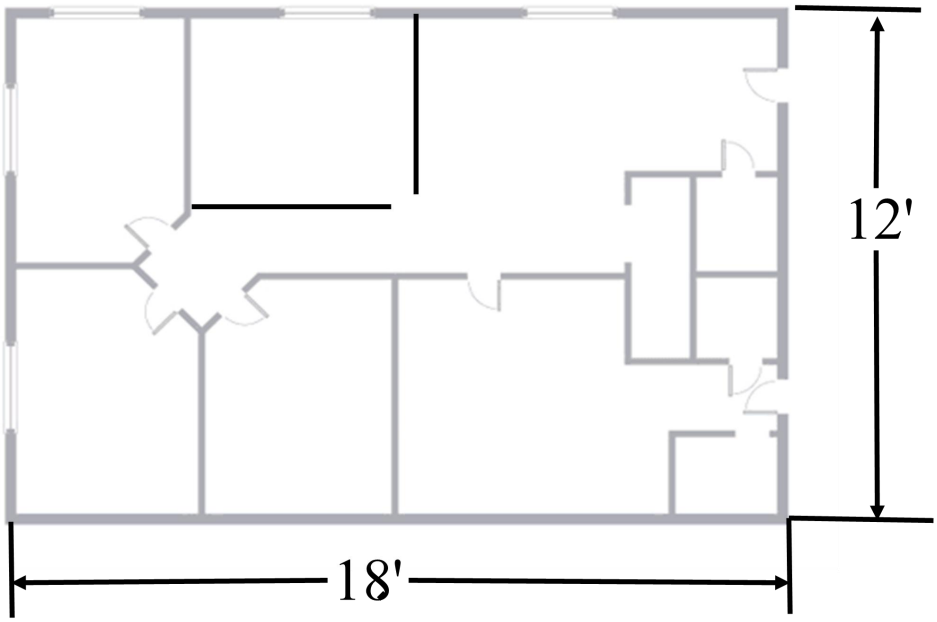
Figure… 10’ X 12’ = _____sq ft

Show your work!

Cost = $3.75 per sq ft

What is the cost of the 10’ X 12’ room? _____

Here is an example floor plan for a small office:



Here is an example floor plan for a small office.

How many square feet is the office? _____sq ft

Cost = $15.75 per sq ft

Show your work!

What is the cost of per sq ft for the office? _____

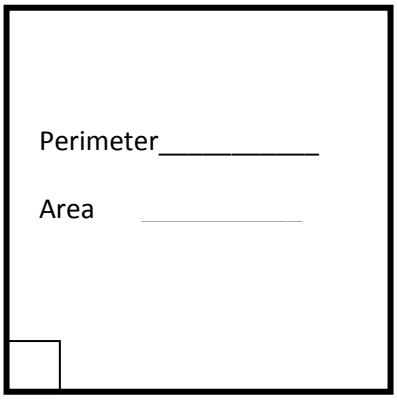
Bedroom Design – Date _____

Area and Perimeter of Geometric Shapes

Measure the dimensions of the following shapes, in inches, and determine their perimeters (in inches) and their areas (in square inches). Round dimensions to the nearest half-inch.

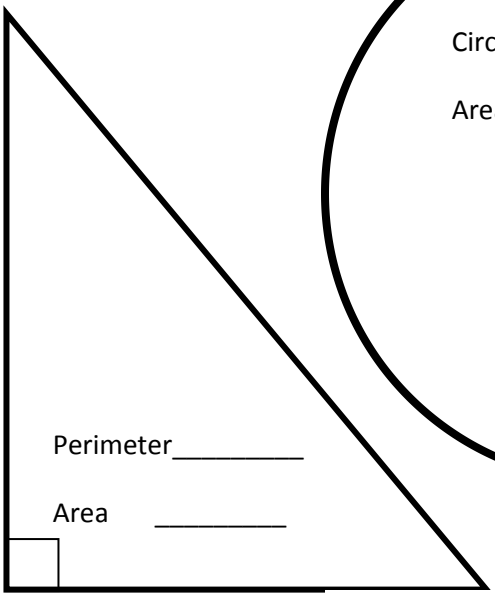
Area Formulas [Rectangle **A = lw**, Triangle **A = ½bh**, Circle **A = π r²**, Trapezoid **A = ½ (b1+b2)h**]

Perimeter of Polygons: **Sum of measures of all sides** Circumference of Circle: **C = πd**



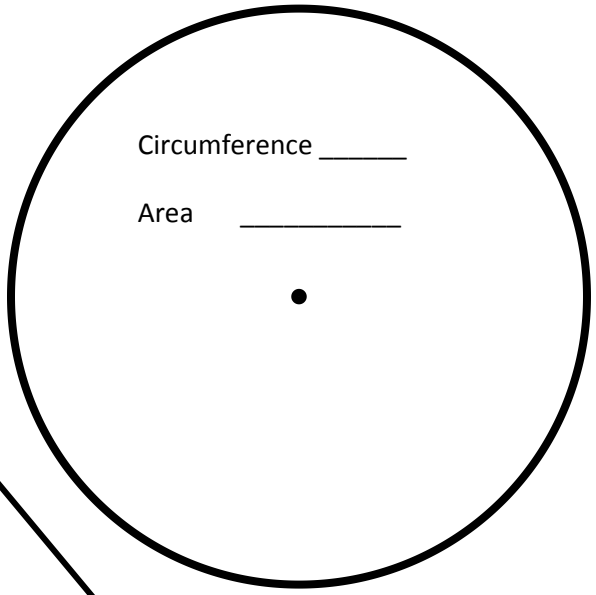
Perimeter_____

Area _____



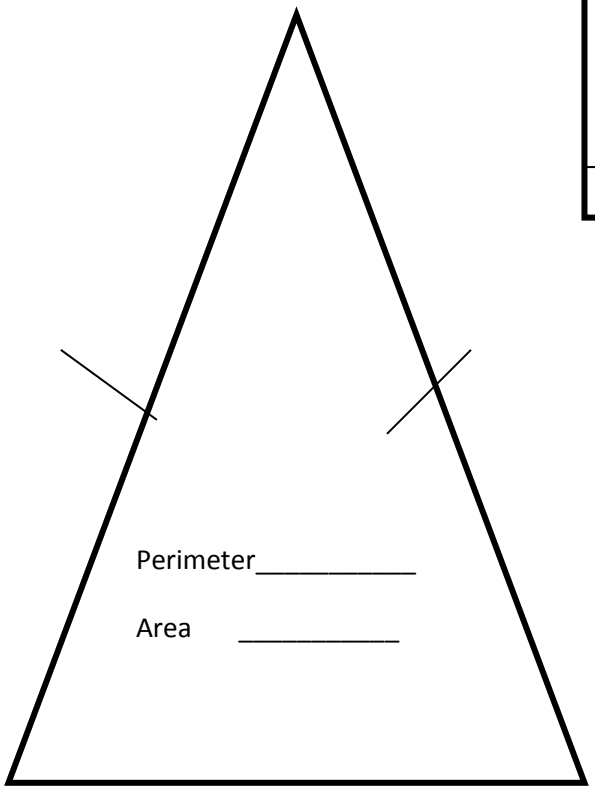
Perimeter_____

Area _____



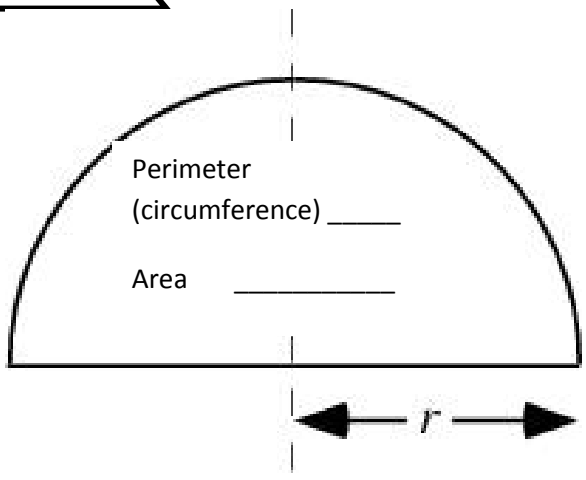
Circumference _____

Area _____



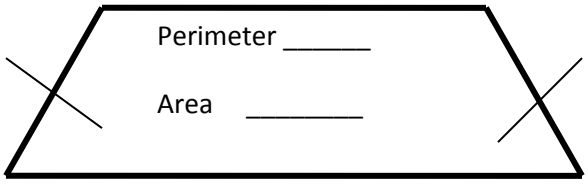
Perimeter_____

Area _____



Perimeter
(circumference) _____

Area _____



Perimeter _____

Area _____

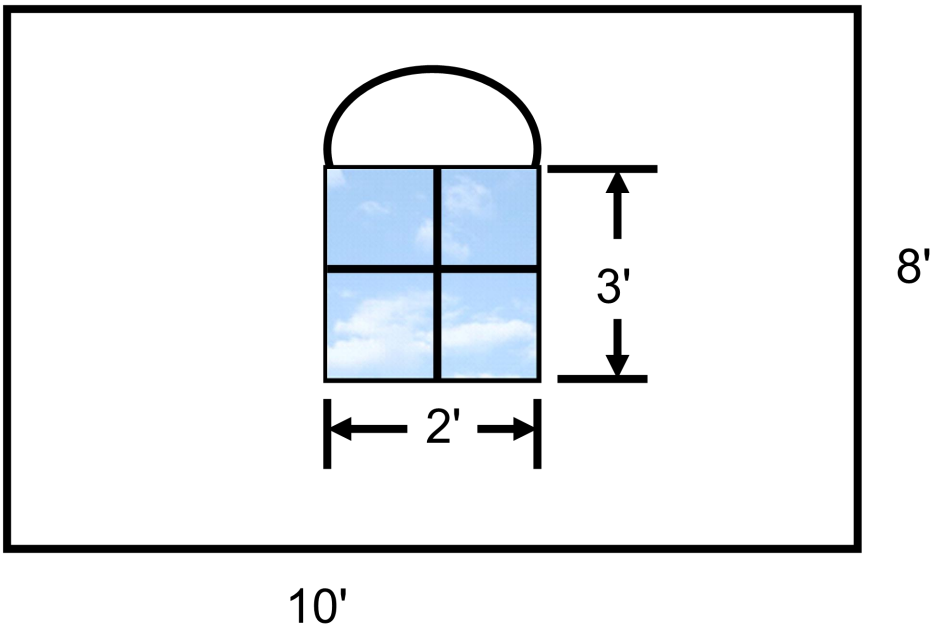
What size is technology room?

Floor size _____ total square feet _____

The cost per sq ft for the technology room is $287.50 per sq ft.

Show your work!

What is the cost per sq ft for the technology room? _____



What is the area of the wall? _____

What is the perimeter of the wall? _____

What is the area of the window? _____

What size is Your Bedroom?

- Measure your floor area, walls, and windows.

  Floor _____

  - How many square feet is the floor? _____

  Walls _____

  - What are the total square feet for the walls? _____

  Windows _____

  - What are the total square feet for the windows? _____

What size is your furniture?

- Measure your bed, dresser, desk, and nightstand.

  Dresser _____

  Desk _____

  Night Stand _____

Bedroom Design – Date _____

Draw a sketch of your room – include the furniture. Be sure to label the sketch.

Percentage

Window must
be at least 20%
of the area of the floor.

Nick floor 8 x 12 ft

Nick's floor 96 ft^2

A(floor) = 96 ft^2

$$\frac{x}{96} \geq \frac{20}{100}$$

$$\frac{100x}{100} \geq \frac{1920}{100}$$

$$x \geq 19.2\ ft^2$$

Window:
4 x 5 ft
Area = 20 ft^2

Can Nick use this window that measures 4' X 5' with a floor area of 96 sq ft? _____

Percentage

1. Guidelines recommend that windows represent at least 20% of the square footage of a room. How might you find 20% of 180 square feet? Show your work!

2. What is 20% of 180 square feet? _____

3. Assume that a room you are designing has dimensions of 12 feet by 15 feet. What is the floor area? _____

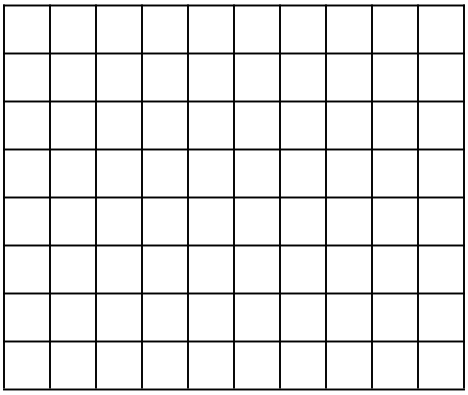
4. Assume you are designing a trapezoidal room with a height of 12 feet and bases of 10 feet and 20 feet. What is the floor area? _____

5. Assume you are designing a semicircular room with a diameter of 21.4 feet. What is the floor area? _____

Select one of the above shapes for your room, and use the 20% of floor area rule for the problems:

6. What could be the dimensions of a square window?
   _____

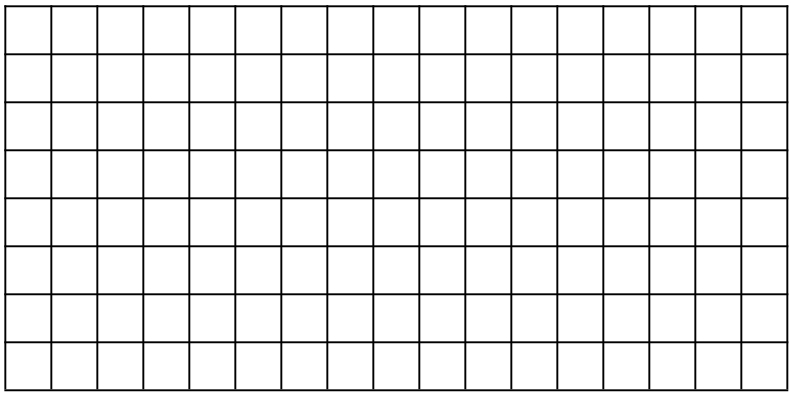
Sketch a possible square window on the grid below, using a scale of ¼" = 1 foot.



7. What could be the logical dimensions of a non-square rectangular window?

   _____

8. Sketch a possible rectangular window on the grid below, using a scale of ¼" = 1 foot.



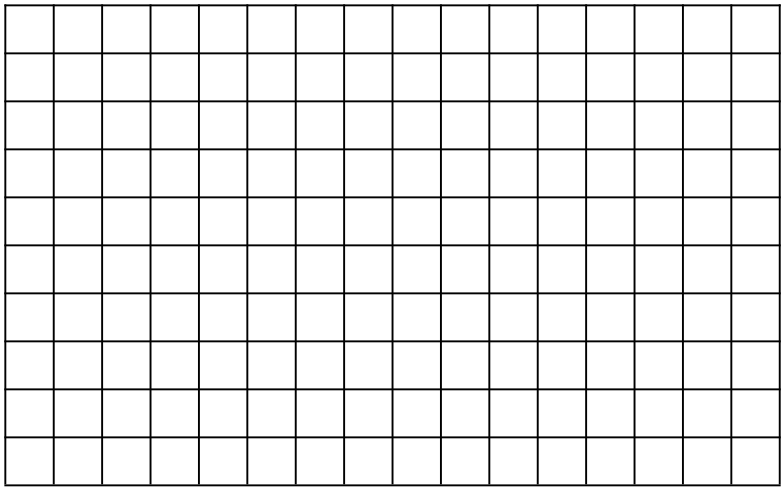
Bedroom Design – Date _____

Pick one of the following two problems and complete:

9. What could be the logical dimensions of a triangular window?

   _____

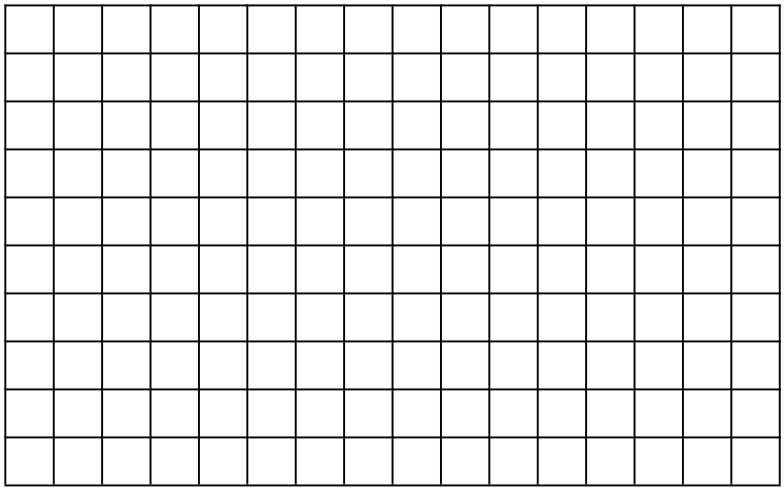
10. Sketch a possible triangular window on the grid below, using a scale of ¼" = 1 foot.



11. What could be the logical dimensions of a trapezoidal window?

    _____

12. Sketch a possible trapezoidal window on the grid below, using a scale of ¼" = 1 foot.



Percentage

1. You have a room that is 11' X 15' what is the smallest size window you can have?

   Size _____ Area of window _____

   Show your work!

   What is the area of the room? _____

2. You have a room that is 9' X 12' what is the smallest size window you can have?

   Size _____ Area of window _____

   Show your work!

   What is the area of the room? _____

3. Your own room window size is _____ Your window area = _____

   Show your work!

   Your own room floor area = _____

   What percentage is your window to the floor area? _____

4. Are your windows at least 20% of the floor area? _____

Geometric Shapes

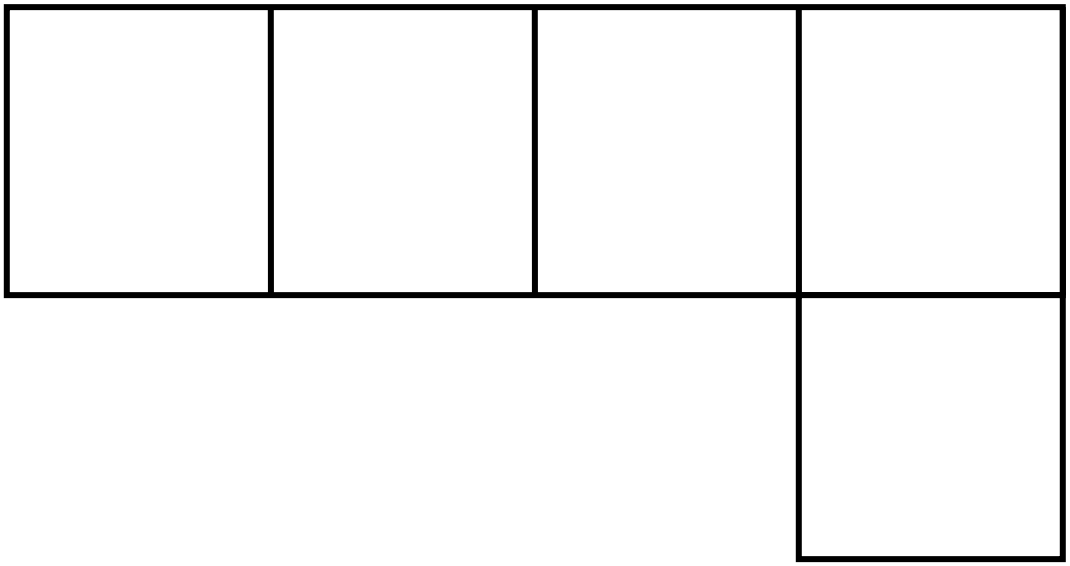
Match the name with the shape then write the properties.

Rectangular pyramid, cone, cylinder, cube, rectangular prism, cylinder

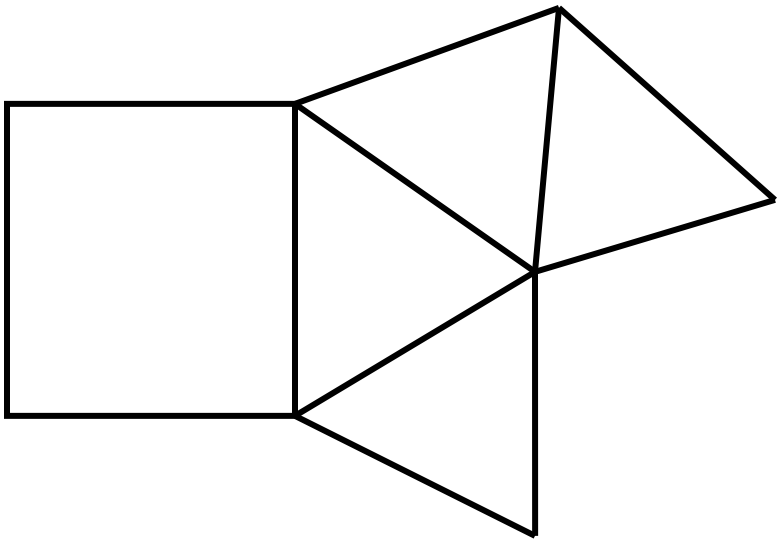
Shape	Name	Properties
		
		
		
		
		

Nets

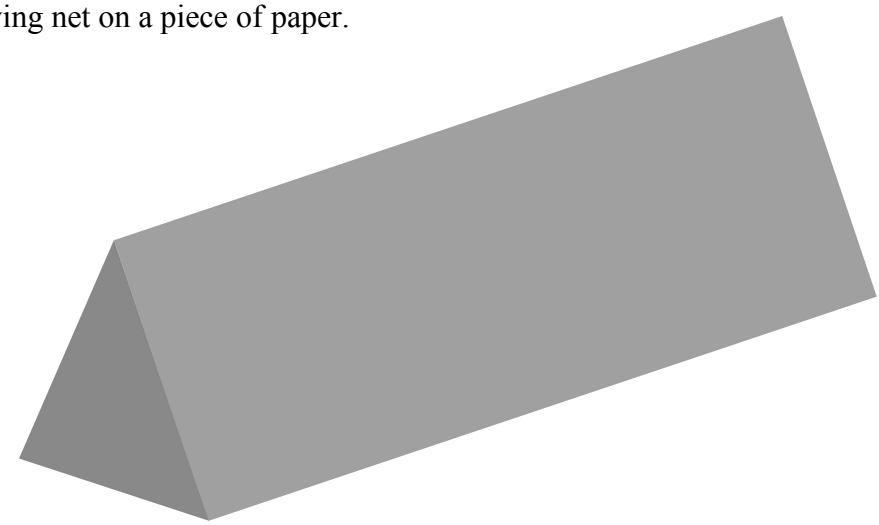
1. Draw the following net on a piece of paper and fold it, taping the edges. What shape is it?



2. Draw the following net on a piece of paper and fold it, taping the edges. What two-dimensional geometric shapes form this net and what is the formed shape? _____

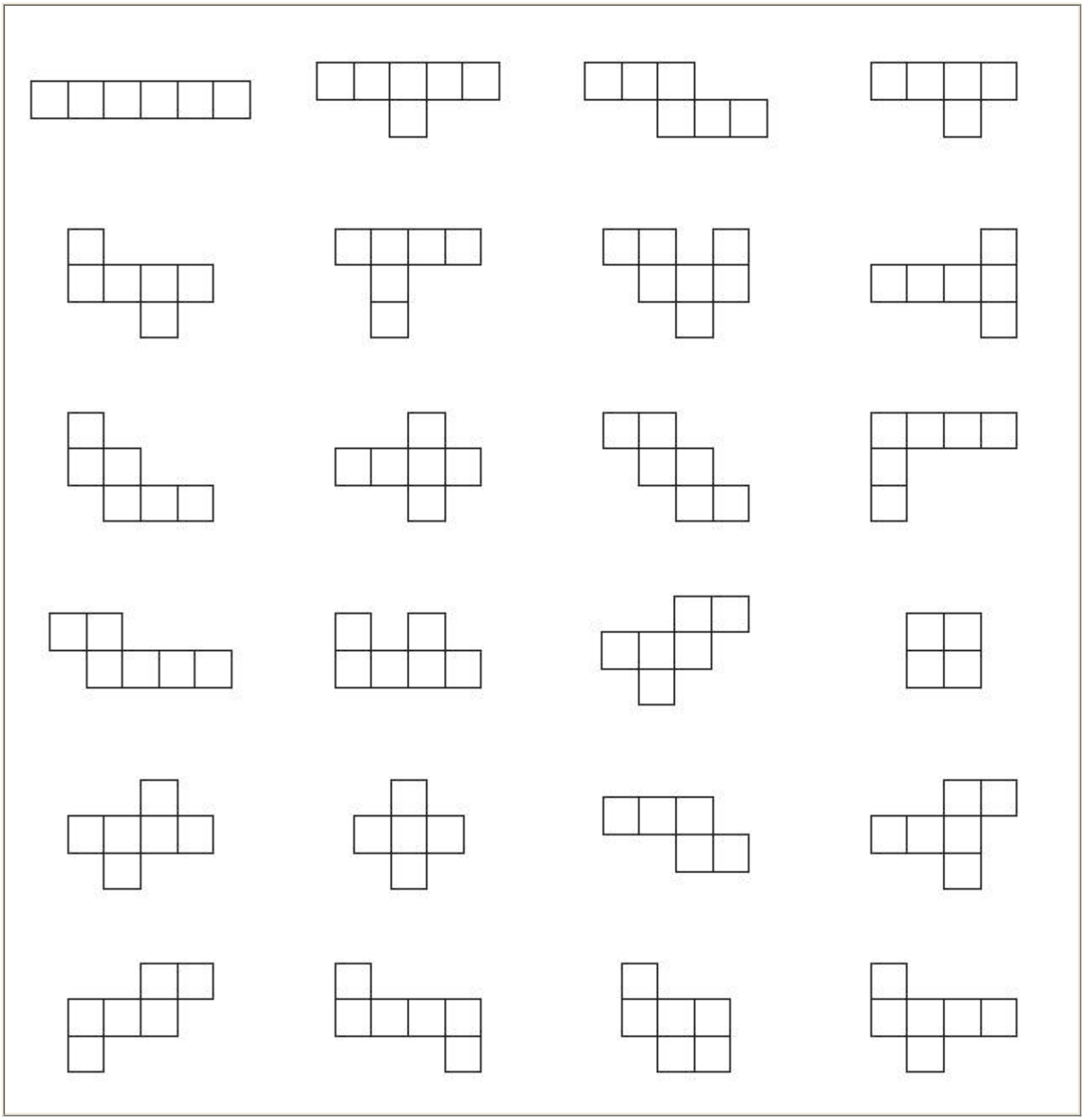


3. What is this solid figure below called? _____ Draw the following net on a piece of paper.



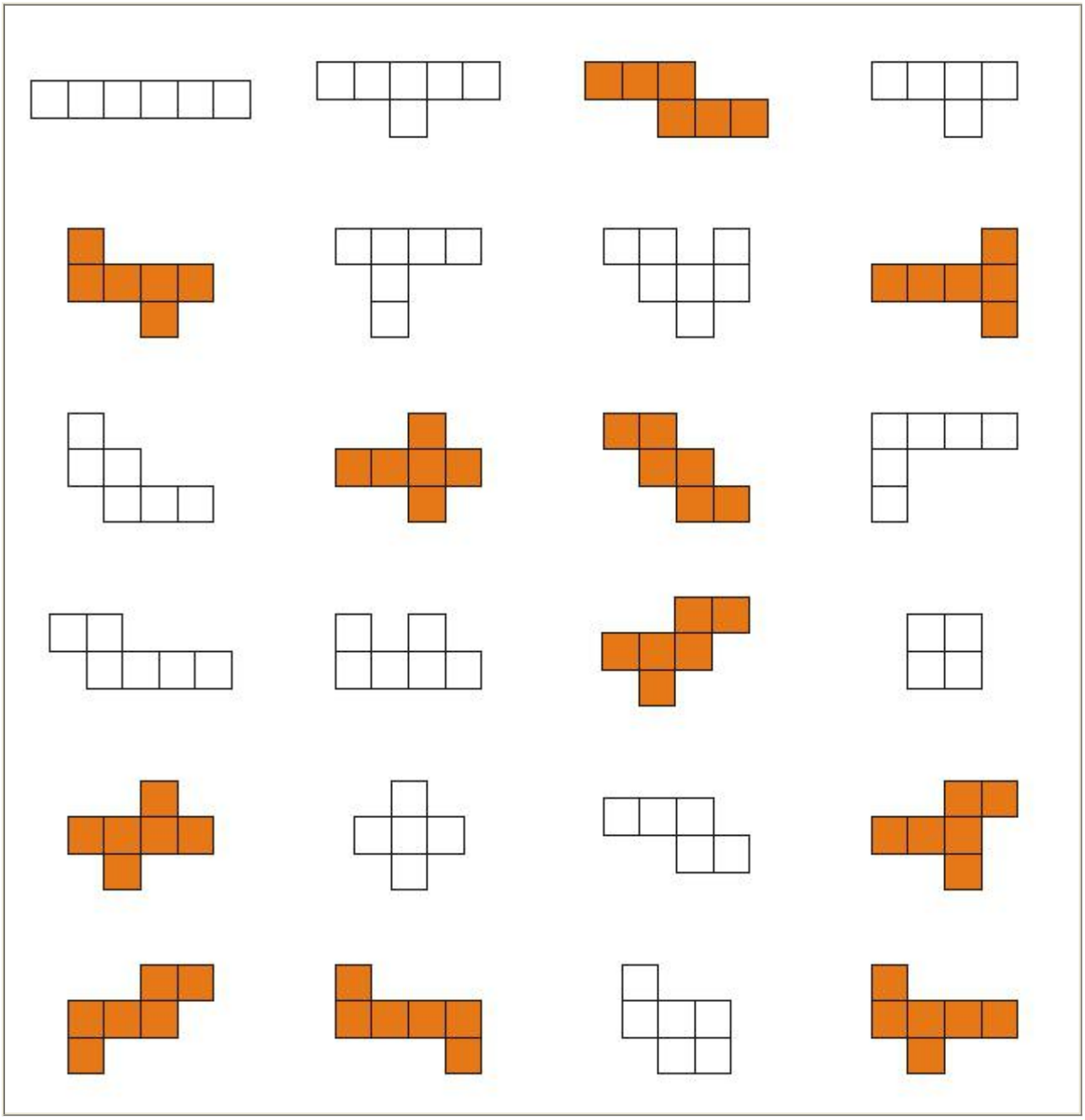
Nets

A net is a two-dimensional figure that can be folded into a three-dimensional object. There are exactly eleven nets that will form a cube. Circle the figures below that can be folded into a cube?



http://illuminations.nctm.org/activitydetail.aspx?ID=84

Answer Key

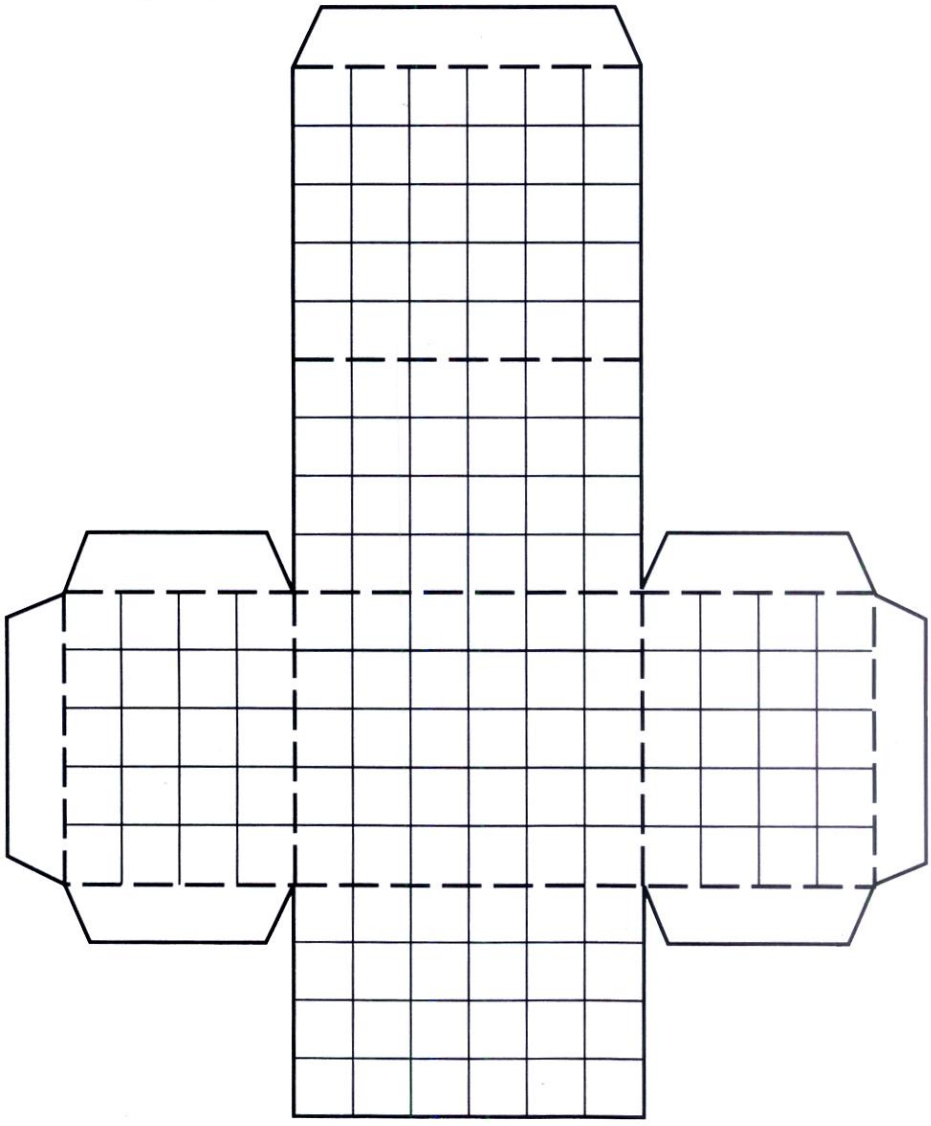


Cube Pattern

Cut along the heavy black lines.
Fold on the dashed lines.
Tabs can be taped or glued.

Rectangular Prism Pattern

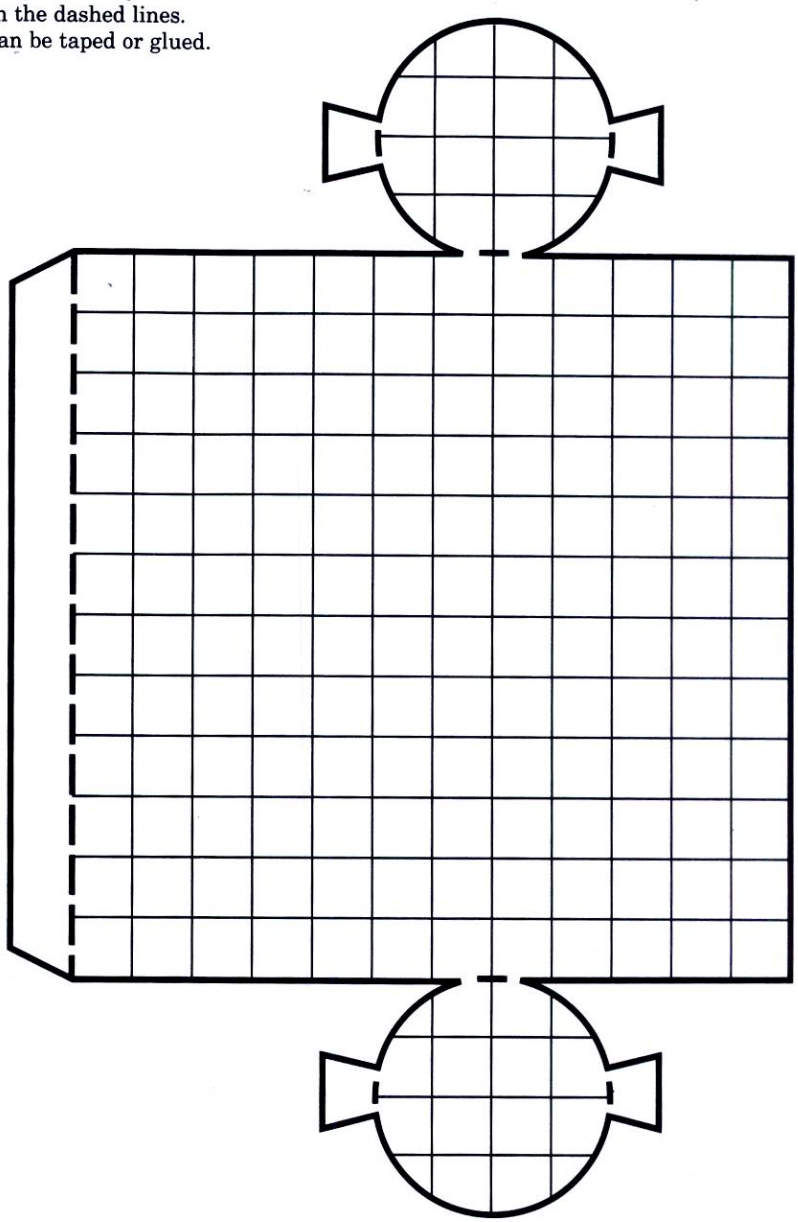
Cut along the heavy black lines.
Fold on the dashed lines.
Tabs can be taped or glued.

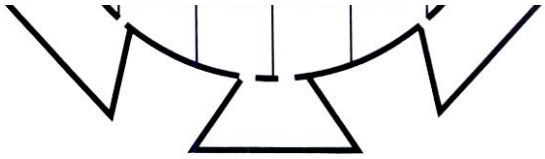


Bedroom Design – Date _____

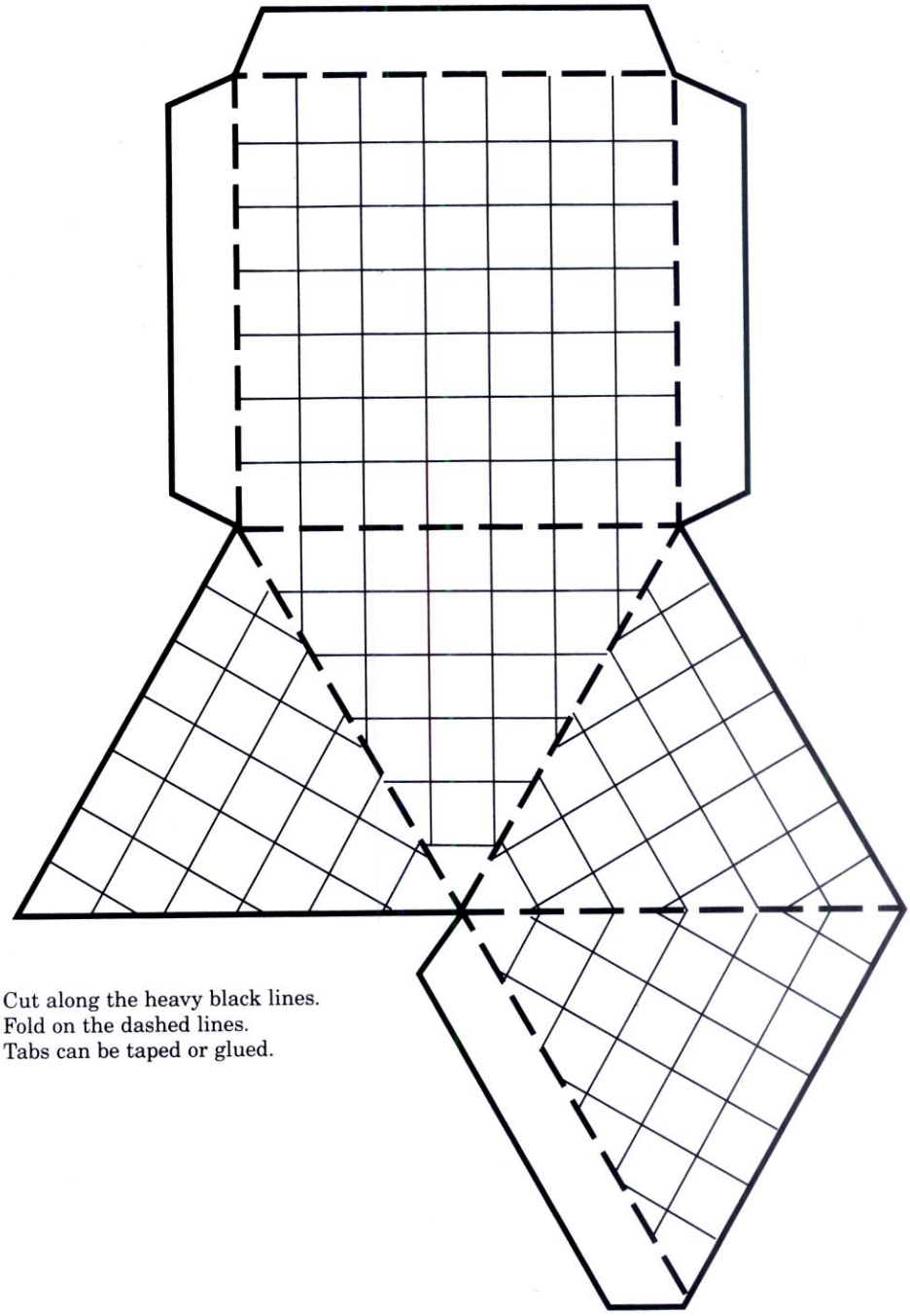
Cylinder Pattern

Cut along the heavy black lines.
Fold on the dashed lines.
Tabs can be taped or glued.





Pyramid Pattern



Cut along the heavy black lines.
Fold on the dashed lines.
Tabs can be taped or glued.

Geometric Shapes Compared

Where do you fine geometric shapes?

1. In what types of buildings do you see examples of these shapes? (houses of worship, homes, warehouses, skyscrapers, schools)

   _____

2. What parts of buildings have some of these shapes? (steeples, roofs, doors, chimneys)

   _____

3. How will understanding the creation and folding of nets help us improve project results?

   _____

   _____

4. Use the paper on the next page to create a net so when it is folded it can be used a model for a dresser in the bedroom design. Use the following scale and measurements.

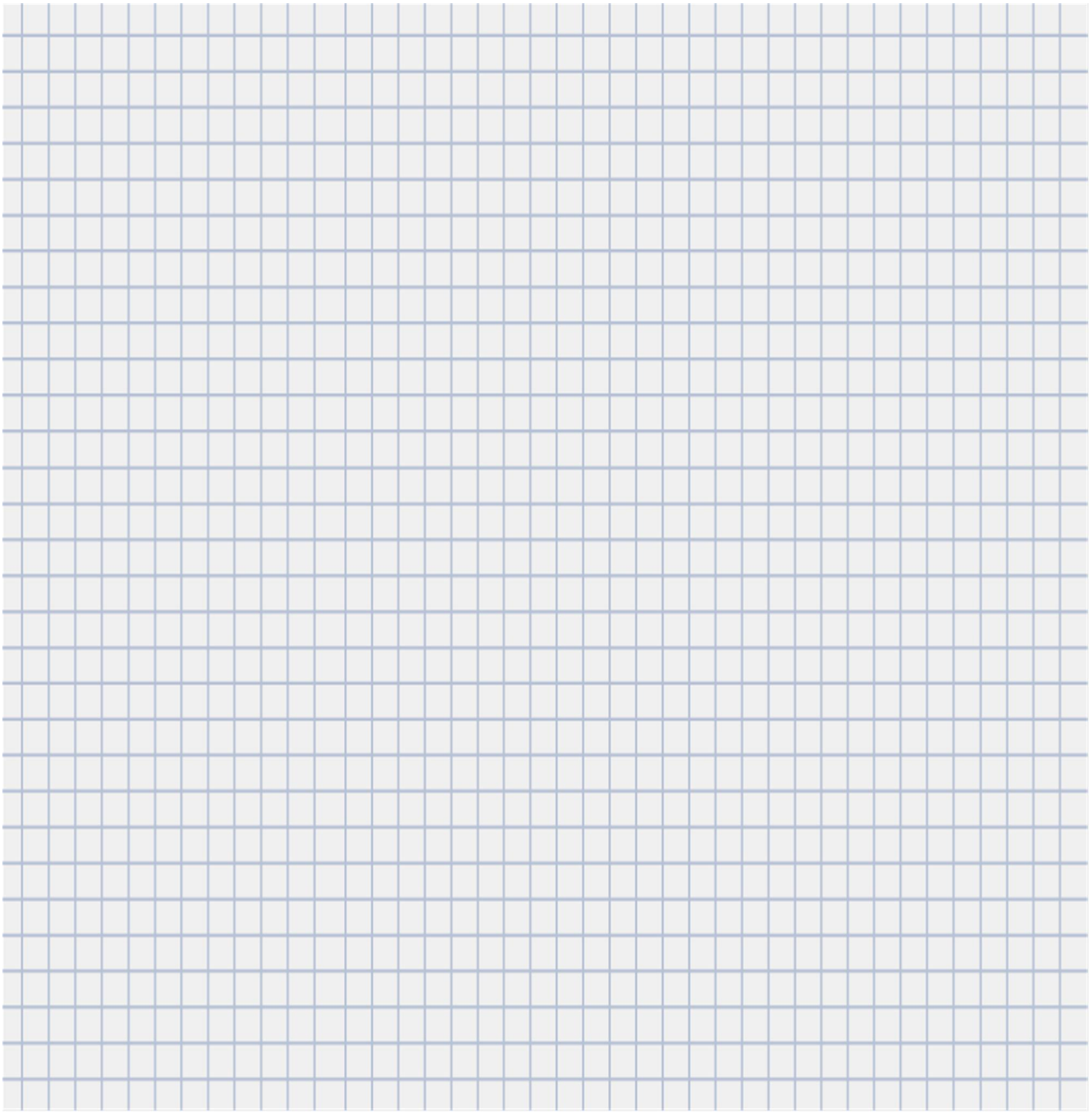
   Scale: 4 squares = 12”

   Height = 48”

   Width = 36”

   Depth = 24”

Sample Net – Dresser



Scale

A scale model is a representation or copy of an object that is larger or smaller than the actual size of the object . Very often the scale model is smaller than the original and used as a guide to making the object in full size. Scale models are built or collected for many reasons.

1. A scale drawing of a room that measures 12 feet by 15 feet is to be created. Which of the following scales would require paper with the largest dimensions?

A) ½ inch = 1 foot B) 1 inch = 1 foot C) 2 inches = 1 foot

2. On separate sheets of paper make three scale drawings of a room that measures 12 feet by 15 feet, using the scales above.

3. Which scale drawing can provide the most detail? Why?

_____

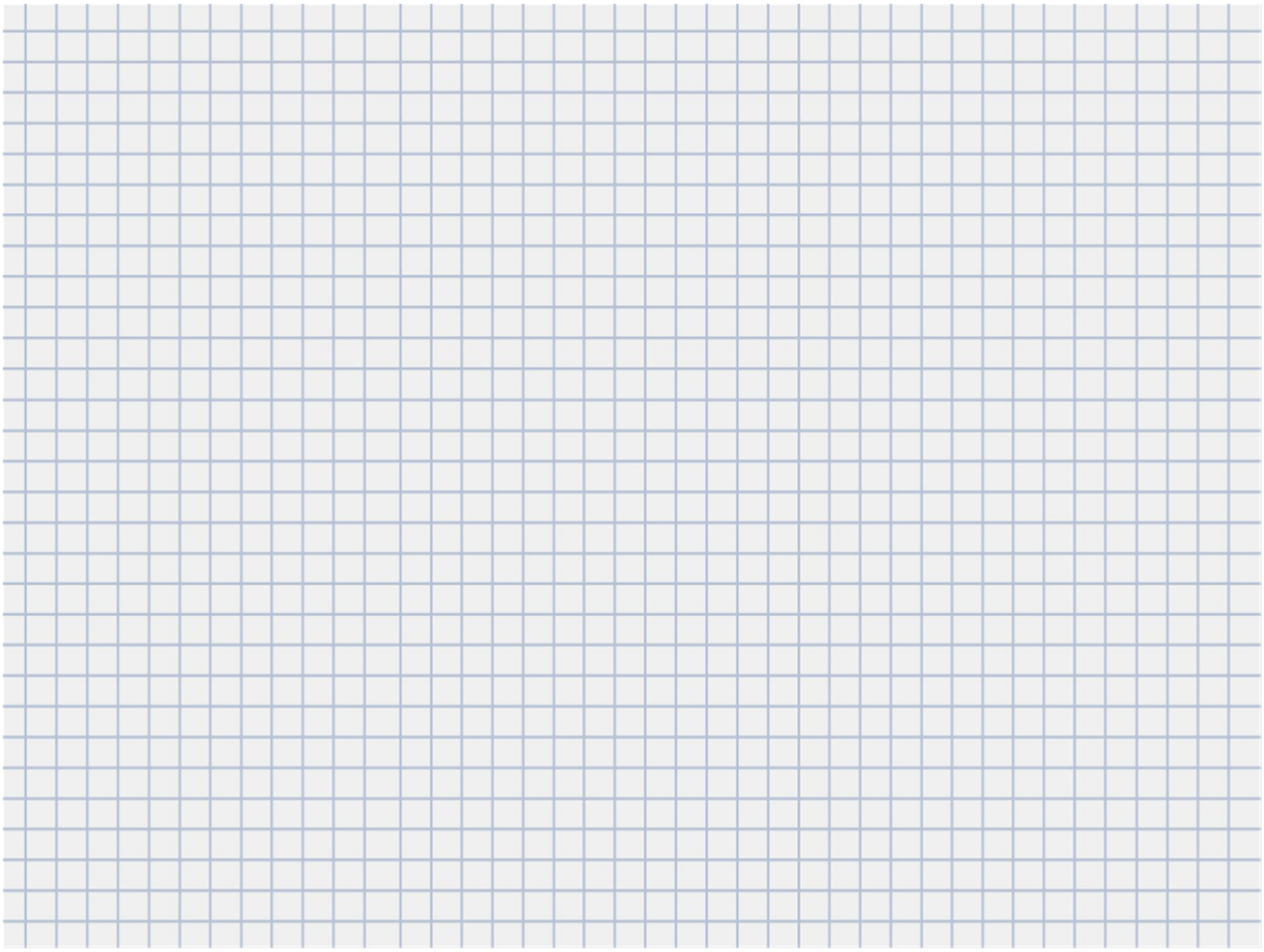
_____

4. If you were forced to represent the drawing on a sheet of letter-size paper (8.5" x 11"), which would you choose? Why?

_____

_____

5. Martin has an office with a floor shaped like a rectangle, 12 feet by 20 feet. He has a desk that is positioned against one of the 12-foot walls. Desk measures 8 feet by 6 feet. On the grid below, draw a scale diagram of Martin's office floor plan. Make sure to include and label his desk in the drawing in a correct place . Be sure to provide the that you used to draw your diagram.



Aesthetics

1. What is the atmosphere you would like to create in your bedroom? Will it be vibrant and alive? Quiet and cozy? The shape and design of your furnishings and the location of windows and skylights can have a great effect. Describe the atmosphere you want. Indicate your preferences for the shape and design of furnishings and the placement of windows.

   _____

   _____

2. Choose a color scheme. You can use pleasing color combinations wherever you like.

   - What color(s) should your room be?

     _____

   - What color should the floor be? _____
   - What color(s) should the furnishings be? _____

3. What aesthetic qualities do you want your bedroom to reflect?

   _____

   _____

4. What components are necessary for a complete bedroom?

   _____

   _____

5. How do colors affect your mood?

   _____

   _____

Spreadsheets and Pricing Information

- Open Microsoft Excel to open the "Pricing Information" file containing the budget.
- Students have $27,500 budget is spent on construction.
- Students use Excel to calculate areas for shapes with various dimensions and to calculate costs.
- Students can make decisions about some things—window size, for example—but they may change their minds later.
- Once the variable cost calculations have been completed
- The fixed cost items have been listed in the second half of the spreadsheet.
- Students may find items to complement their rooms through the Internet or other research; however, they are responsible for recording the description, dimensions, and costs for their group budget.
- Ask students to complete this spreadsheet with their partner.
- Instruct them to copy and paste into Microsoft Word any pictures they would like to print out and use in their constructed room.

Optimizing Existing Drawings and Budgets

Summary Questions

1. Are all designs and spreadsheets completed? If no what is needed to completed the designs?

   _____

   _____

2. Are all furnishing drawn to the correct scale? If no what is needed to completed the designs?

   _____

   _____

3. Did your group stay within budget constraints and develop an optimal design? Why or why not? What trade-offs did you make?

   _____

   _____

   _____

4. Is your group under budget? Why did your group choose to be under budget?

   _____

   _____

Physical Model

1. What building strategies do you plan on using to construct your room?

   _____

   _____

2. What is everyone's assigned job/task?

   _____

   _____

3. What do your responsibilities within the group entail?

   _____

   _____

4. What is the role of scale in your physical model?

   _____

   _____

5. How many days do you have to complete construction? _____