

Unit D: Design and Measurement

Half Course V

HALF COURSE V

Unit D: Design and Measurement

Hours: 11

General Learning Outcome:

Analyze objects, shapes, and processes to solve cost and design problems.

The intent of this unit is for students to use geometric concepts in the design and cost-analysis of construction projects.

Specific Learning Outcomes

- D-1 Draw simple objects as oblique projections.
- D-2 Sketch simple objects in “exploded” format.
- D-3 Draw the constituent parts of a simple object to scale.
- D-4 Describe the differences among oblique projections, “exploded” diagrams, and constituent parts diagrams for objects.
- D-5 Solve problems involving estimation and costing for objects, shapes, or processes when a design is given.
- D-6 Plan the construction of an object within a specified budget.

Instructional Materials

- *Essentials of Mathematics 12*
- metric and imperial rulers
- quarter-inch graph paper
- 0.5-cm graph paper
- a variety of examples of diagrams of simple objects drawn in built and exploded format, and showing the constituent parts
- Blackline Masters

DESIGN AND MEASUREMENT

Unit Overview

This unit involves extensive use of scale diagrams. For our purposes, we will accept certain latitudes with the scales. Such scales as 1 cm: 1 foot, or 1 square: 1 foot will be accepted.

The requirements of this unit include determining the costs of a project, and three basic types of drawings:

- oblique projections
- exploded diagrams
- constituent parts

The assigning of a project involving students' creations, shown in 3-D and exploded form, along with the constituent parts and the approximate costs, is encouraged. The complexity of work will vary widely but it is the scale drawings, exploded views, oblique drawings, and construction costs that are directly related to the learning outcomes.

Students should be able to determine what an object would look like given the exploded diagram. Teachers with interests unique to this unit, such as sewing, model airplanes, or carpentry are encouraged to apply their knowledge to enrich their students' experiences with design and measurement.

Given a scaled diagram, students should be able to determine the actual measurements of an object. Students should be able to "sketch" (not exact measurements) exploded diagrams of objects. Each constituent part needs to be drawn only once, with the number of each part identified on it.

Oblique drawings are pictorial representations of three-dimensional objects. They are not intended to be exact scale drawings of objects. Those in industries using such drawings employ a variety of strategies, including software programs, to create diagrams.

For the purposes of students learning to draw and sketch objects, the following standards will be used:

- drawings will show actual dimensions through the use of labels (that is, measurements will be labelled, such as 6' or 50 cm)
- oblique lines showing the depth of objects will be drawn at 45° to the face
- sketches (not exactly to scale) of exploded views are acceptable

**PRESCRIBED LEARNING
OUTCOMES**

General Outcome

Analyze objects, shapes, and processes to solve cost and design problems.

Specific Outcome(s)

D-1 draw simple objects as oblique projections

SUGGESTIONS FOR INSTRUCTION

The concept of seeing and drawing objects in perspective has been dealt with in previous mathematics courses, including *Senior 2 Consumer Mathematics*. Review the three possibilities for perspective drawing:

1. eye-level horizon as shown in Figure A
2. horizon above the object as shown in Figure B
3. horizon below the object as shown in Figure C

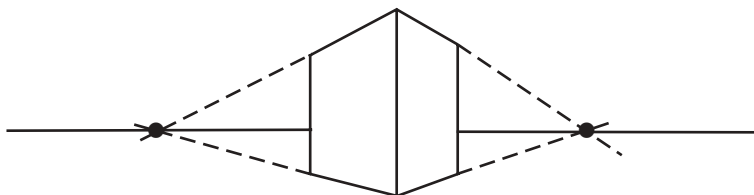


Figure A: Eye-Level

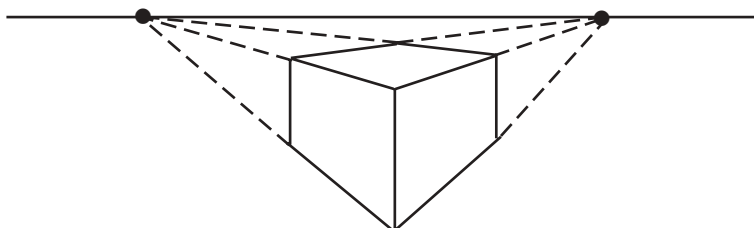


Figure B: Upper Horizon

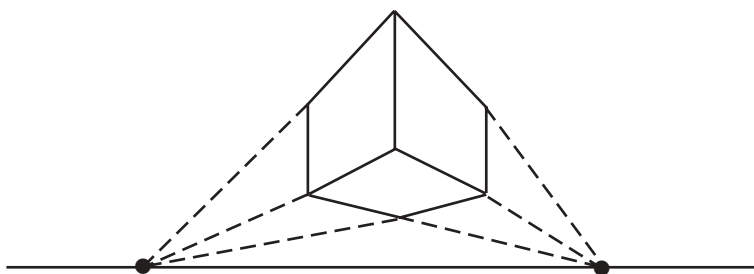


Figure C: Lower Horizon

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|-------------------------------------|--------------------|
| ✓ Communications | ✓ Patterns |
| Connections | Problem Solving |
| Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | Visualization |

— *continued*

SUGGESTIONS FOR ASSESSMENT	SUGGESTED LEARNING RESOURCES
<p>Students can draw simple objects within the classroom in perspective.</p>	<p>Print</p> <p><i>Senior 4 Consumer Mathematics (45S) Part V: A Course for Distance Learning.</i> Winnipeg, MB: Manitoba Education, Training and Youth, 2002. — Module 3, Lessons 1, 2</p> <p>Baron, C., et al. <i>Essentials of Mathematics 12.</i> Victoria, BC: British Columbia Ministry of Education, 2003.</p> <p>Advertisements and flyers from different stores may be used to update price lists and to provide ideas for projects.</p> <p>Internet</p> <p>Various websites have cost-analysis programs for basic building projects. Two such sites are the IKEA and Home Depot websites.</p> <p>Software</p> <p>Various computer-aided design programs can be used by students to design their objects. One such program is Key CAD Complete.</p>

PRESCRIBED LEARNING
OUTCOMES

D-1 draw simple objects as
oblique projections
– *continued*

SUGGESTIONS FOR INSTRUCTION

This unit explains “perspective” and “vanishing points” in a particular context. When building, two types of projections are often used. The first type of projection shows objects with horizontal lines at 30° to the horizon line and vertical lines remain vertical. This is called an isometric projection. Figure D below shows a cube drawn in this way. Recall that isometric projections were covered in *Senior 2 Consumer Mathematics*.

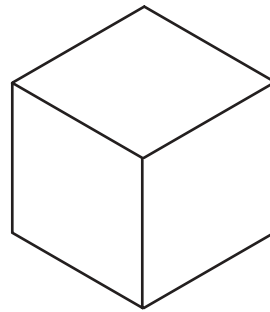


Figure D: Isometric Projection of a Cube

Note that when using this type of perspective drawing, all vertical and horizontal lengths on the diagram are equal to the actual lengths (or are scaled down using a specified scale factor). A builder can look at a sketch like this and determine length and width measurements. Objects more complicated than cubes can be drawn like this; however, lines that are not vertical or horizontal will not be equal to actual lengths or will be scaled down versions of the lengths (distortions occur).

— *continued*

SUGGESTIONS FOR ASSESSMENT

Students can draw simple objects within the classroom as oblique projections.

**SUGGESTED LEARNING
RESOURCES**

PRESCRIBED LEARNING OUTCOMES

D-1 draw simple objects as oblique projections
– *continued*

SUGGESTIONS FOR INSTRUCTION

Oblique projections are pictorial representations showing the depth of an object. Three common types of oblique projections are shown in Figure E. In a “cavalier” drawing, the depth is shown to full scale. The distortion in this method may be excessive. The “cabinet” drawing shows the oblique at exactly half the scale. The “general oblique” drawing uses any reasonable scale which allows the depth perception to look more natural.

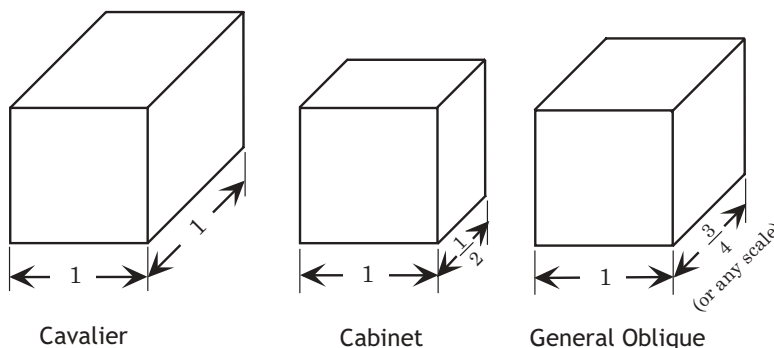
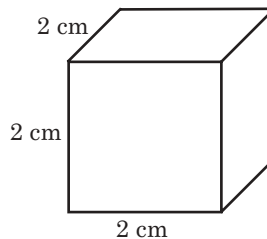


Figure E: Oblique Projections

The face of the object is drawn exactly to scale. The oblique, or slanted line, is best drawn using graph paper, and moving diagonally from one corner to the opposite corner on a 45° angle. Students should place the actual measurements along the sides, indicating exactly how long each measurement will be in the actual object.

This example is a 2-cm cube drawn in an oblique cabinet projection. Notice that the face is drawn at 2 cm for each dimension. The oblique is drawn at half the scale, or 1 cm to achieve the proper perspective.



Oblique Cabinet Projection of a Cube

Students should draw many examples of oblique projections to ensure mastery of this concept before moving further into this unit.

— *continued*

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING
RESOURCES**Mental Math**

1. Given a scale of 1:20, how long would a line be drawn if it was actually
 - a) 60 cm long?
 - b) 230 cm long?
 - c) 10 cm long?
2. On a map, 3 inches represents 960 miles. What are two ways to write this scale?
3. You are drawing the floor plan of a 12 ft. x 15 ft. room. What scale could you use to fit the drawing on a piece of paper measuring $8\frac{1}{2}$ x 11 inches?

Problem

If you were drawing the floor plan of your dream home, what scale would you use to fit the drawing on a piece of paper measuring $8\frac{1}{2}$ x 11 inches? Justify your answer.

**PRESCRIBED LEARNING
OUTCOMES**

D-1 draw simple objects as oblique projections
– *continued*

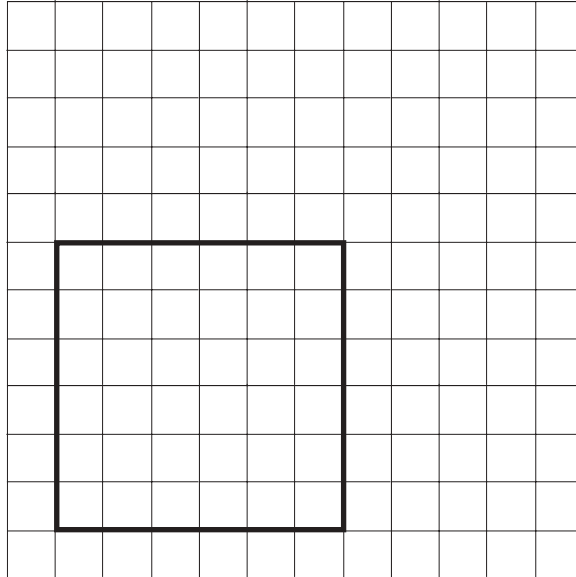
SUGGESTIONS FOR INSTRUCTION

Example 1

Draw a cube measuring 6 inches on each side using an oblique cavalier drawing.

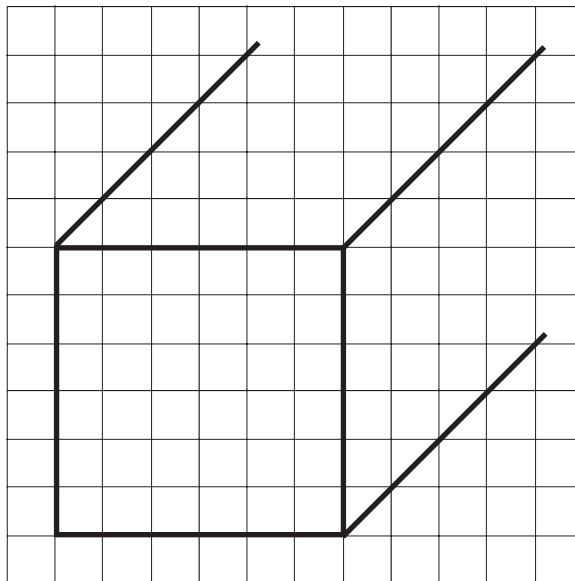
Scale: 1 square: 1 inch

a) Draw the face.



Note: Assume graph paper is one-quarter inch.

b) Draw the oblique lines to scale.



Note: Depth measurement: $6 \times \frac{1}{4}'' = 1\frac{1}{2}''$ for depth.

– *continued*

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| ✓ Communications | ✓ Patterns |
| Connections | Problem Solving |
| Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | Visualization |

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING
RESOURCES**Problem**

Using quarter-inch graph paper (as in the Blackline Master), have students draw the following rectangular solids using an appropriate scale:

- a) $8 \times 5 \times 4$
- b) $10 \times 6 \times 6$
- c) $6 \times 4 \times 2$
- d) $12 \times 8 \times 6$

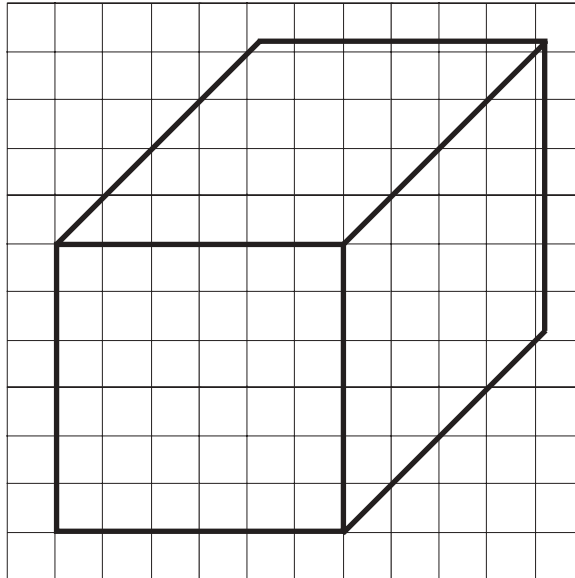
Students should have a minimum of one cavalier, one cabinet, and one general oblique drawing.

**PRESCRIBED LEARNING
OUTCOMES**

D-1 draw simple objects as oblique projections
– *continued*

SUGGESTIONS FOR INSTRUCTION

c) Complete the cube, measuring 6 inches on each side.

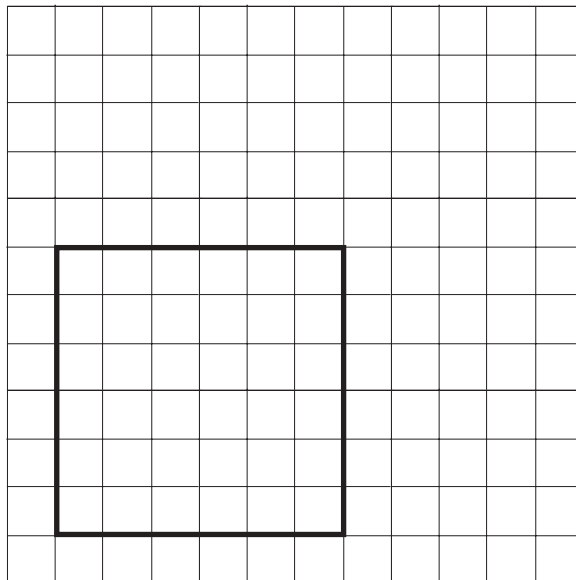


Example 2

Draw a cube measuring 6 inches on each side using an oblique cabinet drawing.

Scale: 1 square: 1 inch

a) Draw the face.



Note: Assume graph paper is one-quarter inch.

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| ✓ Communications | ✓ Patterns |
| Connections | Problem Solving |
| Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | Visualization |

SUGGESTIONS FOR ASSESSMENT

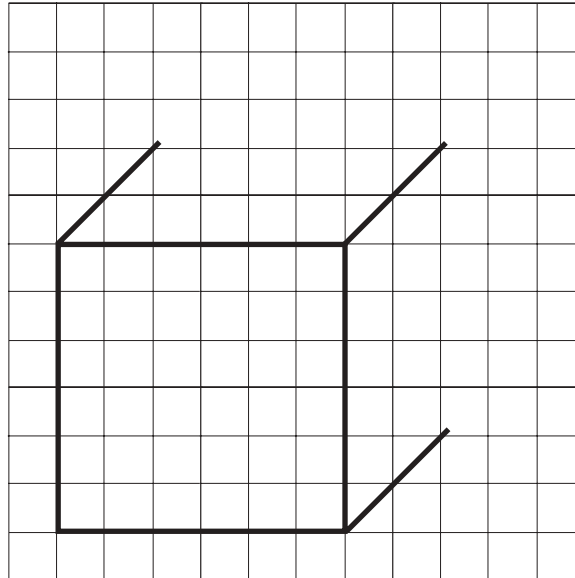
SUGGESTED LEARNING
RESOURCES

**PRESCRIBED LEARNING
OUTCOMES**

D-1 draw simple objects as
oblique projections
– *continued*

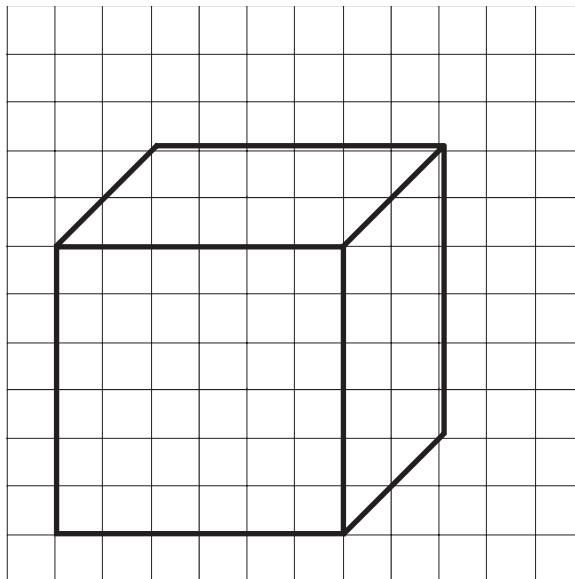
SUGGESTIONS FOR INSTRUCTION

b) Draw the oblique lines to scale.



Note: Actual depth in drawing:
 $6" \div 2 = 3"$ (half depth)

c) Complete the cube, measuring 6 inches on each side.



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| ✓ Communications | ✓ Patterns |
| Connections | Problem Solving |
| Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | Visualization |

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SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING
RESOURCES

**PRESCRIBED LEARNING
OUTCOMES**

D-1 draw simple objects as oblique projections
– *continued*

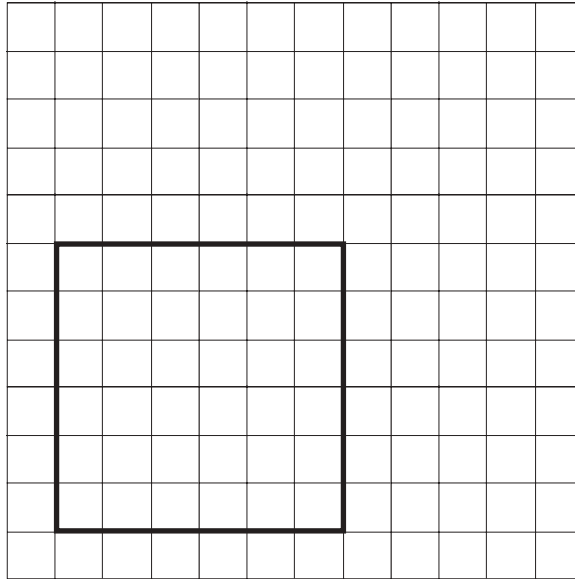
SUGGESTIONS FOR INSTRUCTION

Example 3

Draw a cube measuring 6 inches on each side using a general oblique drawing.

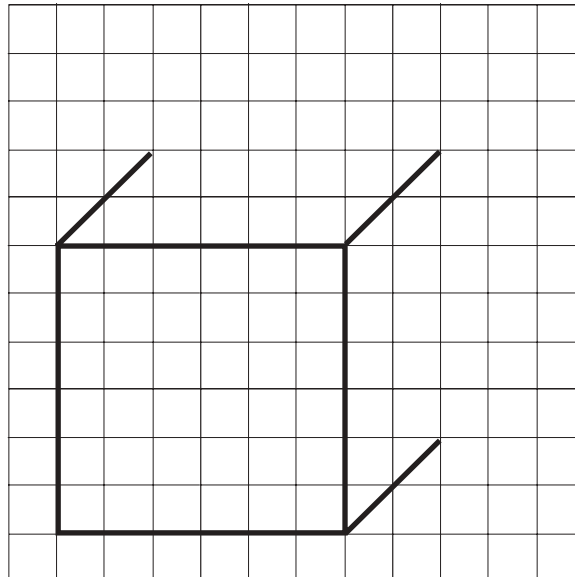
Scale: 1 square: 1 inch

a) Draw the face.



Note: Assume graph paper is one-quarter inch.

b) Draw the oblique lines at 45°. Choose a suitable scale. For example, the scale below is 2 diagonals = 6 units.



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| ✓ Communications | ✓ Patterns |
| Connections | Problem Solving |
| Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | Visualization |

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SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING
RESOURCES

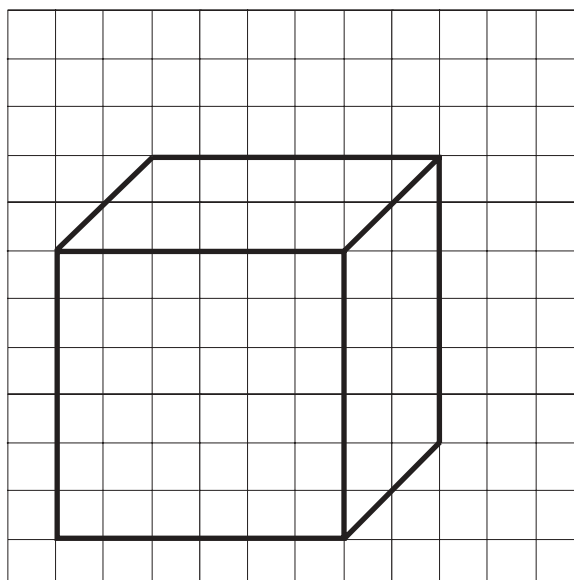
PRESCRIBED LEARNING OUTCOMES

D-1 draw simple objects as oblique projections – *continued*

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|--|---|
| ✓ Communications
Connections
Number Sense | ✓ Patterns
Problem Solving |
| ✓ Organization and Structure | ✓ Reasoning
Technology
Visualization |

SUGGESTIONS FOR INSTRUCTION

c) Complete the cube, measuring 6 inches on each side.



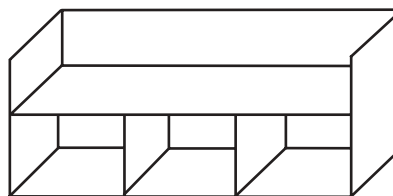
D-2 sketch simple objects in “exploded” format

- | | |
|--|---|
| ✓ Communications
Connections
Number Sense | Patterns
Problem Solving |
| ✓ Organization and Structure | ✓ Reasoning
Technology
Visualization |

Students should be given a diagram of a 3-D object, and asked to draw an exploded view of the object. This view is used to show how the constituent parts connect.

The following is a diagram of a desk organizer. Students should be able to “pull apart” the various pieces, creating an exploded view. The use of graph paper is recommended! Students may, but do not need to, provide a scale for exploded views.

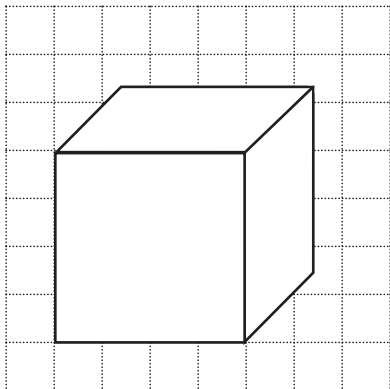
Further, many diagrams have arrows or dotted lines directing the parts together.



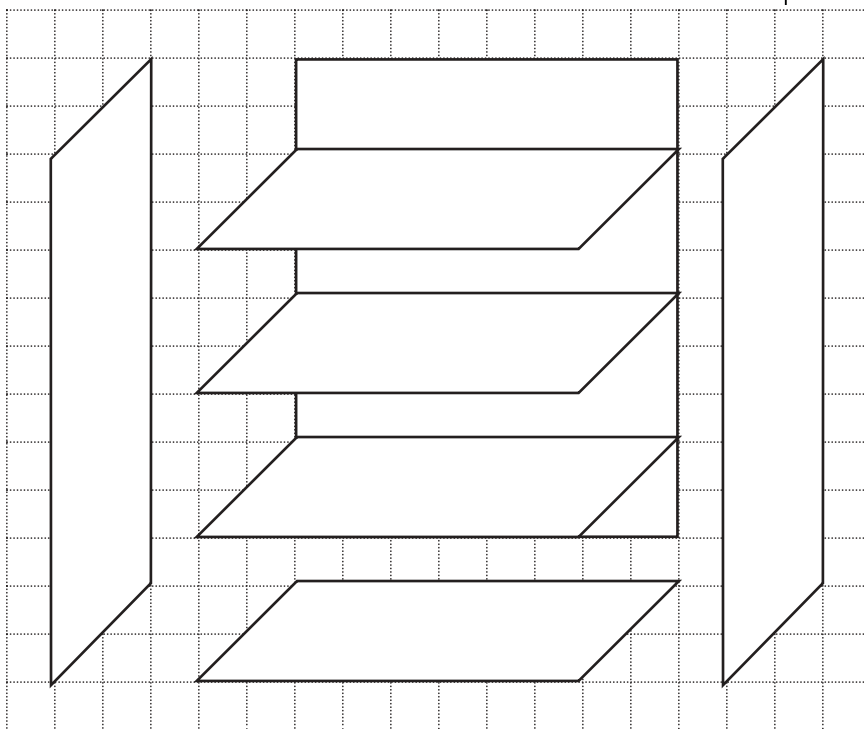
— *continued*

SUGGESTIONS FOR ASSESSMENT

1. Below is a diagram of a simple cube or box. Sketch this object in exploded format.



2. The drawing below is in exploded format.
 - a) What does it represent?
 - b) Make a drawing of the object in "built" form.
 - c) Suggest an appropriate scale for this diagram that would indicate its actual measurements. Hint: The object is about 33 inches tall and about 24 inches wide.



— continued

SUGGESTED LEARNING RESOURCES

Print

Senior 4 Consumer Mathematics (45S) Part V: A Course for Distance Learning.
 Winnipeg, MB: Manitoba Education, Training and Youth 2002.
 — Module 3, Lesson 3

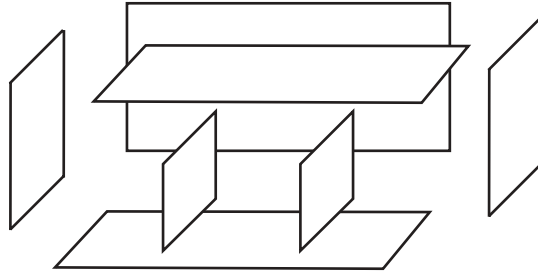
Essentials of Mathematics 12
 Chapter 2: Design and Measurement

PRESCRIBED LEARNING OUTCOMES

D-2 sketch simple objects in "exploded" format – *continued*

SUGGESTIONS FOR INSTRUCTION

Solution



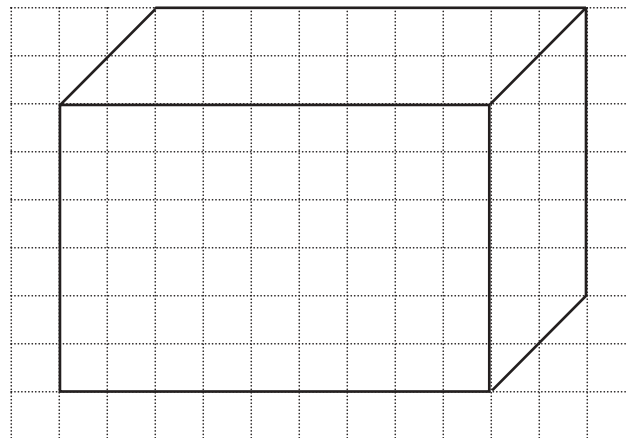
D-3 draw the constituent parts of a simple object to scale

The measurements of this box are length 36", width 24", and depth 12" (1 square = 4").

Draw the constituent parts.

Note:

- a) constituent parts should be drawn to scale
- b) each part needs to be drawn only once with the number of that part included in the diagram



Communications	Patterns
Connections	Problem Solving
✓ Number Sense	Reasoning
✓ Organization and Structure	✓ Technology
	✓ Visualization

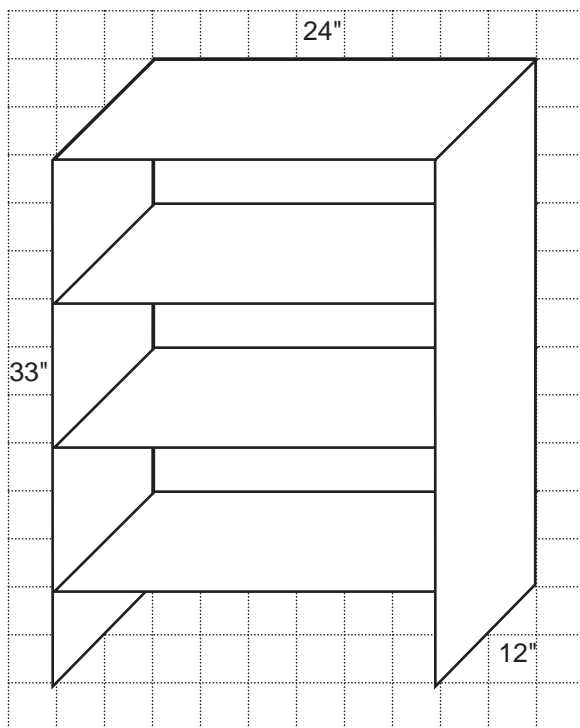
— *continued*

SUGGESTIONS FOR ASSESSMENT

Solution

a) bookshelf

b)



c) 1 square: 3" or 1": 12"

Problem

Set an appropriate scale and draw on graph paper the constituent parts for boxes measuring:

- a) 36" height, 24" width, and 18" depth
- b) 6' height, 4' width, and 2' depth
- c) 20' height, 15' width, and 10' width

SUGGESTED LEARNING RESOURCES

Print

Senior 4 Consumer Mathematics (45S) Part V: A Course for Distance Learning.
 Winnipeg, MB: Manitoba Education and Training, 2000.
 — Module 3, Lesson 4

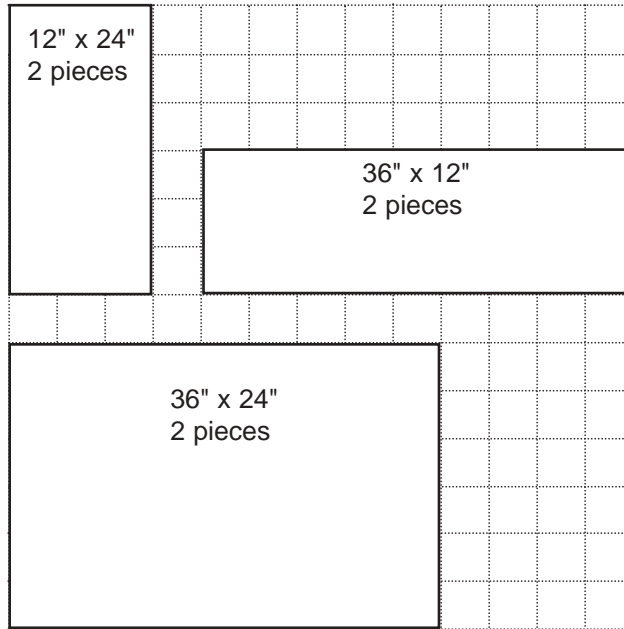
PRESCRIBED LEARNING OUTCOMES

D-3 draw the constituent parts of a simple object to scale
– *continued*

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|------------------------------|-----------------|
| Communications | Patterns |
| Connections | Problem Solving |
| ✓ Number Sense | Reasoning |
| ✓ Organization and Structure | ✓ Technology |
| | ✓ Visualization |

SUGGESTIONS FOR INSTRUCTION

Solution



D-4 describe the differences among oblique projections, “exploded” diagrams, and constituent parts diagrams for objects

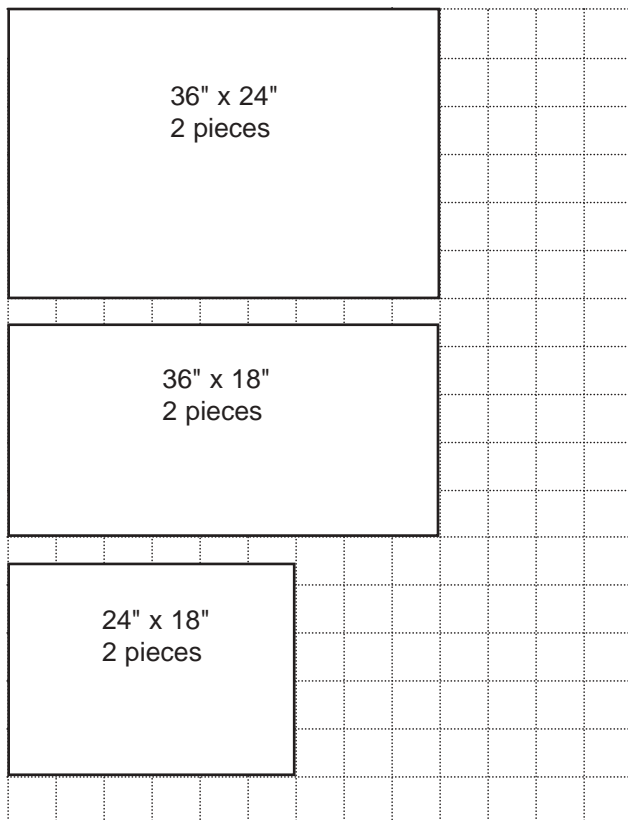
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|------------------------------|-------------------|
| ✓ Communications | Patterns |
| ✓ Connections | ✓ Problem Solving |
| ✓ Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | ✓ Technology |
| | ✓ Visualization |

Discuss with students the differences among these terms. It may be helpful to have students draw an example of each in their notebooks using a relatively simple object.

SUGGESTIONS FOR ASSESSMENT

Solutions

Scales may vary: 1 square: 4"



SUGGESTED LEARNING RESOURCES

Print

Senior 4 Consumer Mathematics (45S) Part V: A Course for Distance Learning.
Winnipeg, MB: Manitoba Education, Training and Youth, 2002.
— Module 3, Lessons 2, 3, 4

**PRESCRIBED LEARNING
OUTCOMES**

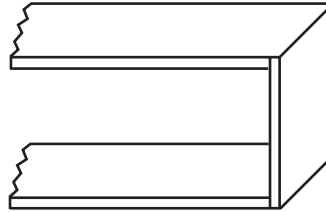
D-5 solve problems involving estimation and costing for objects, shapes, or processes when a design is given

SUGGESTIONS FOR INSTRUCTION

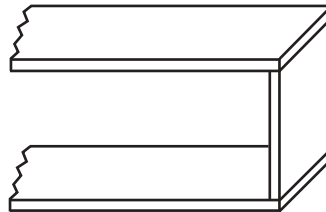
Special Note

In building an object the thickness of the material needs to be taken into consideration, as well as how the pieces will be joined.

Example



Here, the side piece is on the outside of the top and bottom pieces.



Here, the side piece is between the top and bottom pieces.

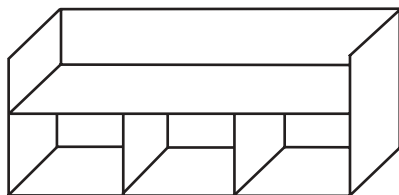
- | | |
|------------------------------|-------------------|
| ✓ Communications | Patterns |
| ✓ Connections | ✓ Problem Solving |
| ✓ Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | ✓ Technology |
| | ✓ Visualization |

— *continued*

SUGGESTIONS FOR ASSESSMENT

Problem

Give the students the drawing of the desk organizer with the following measurements.



The holes in the bottom (for letters) are each 8" wide, 4" high, and 10" deep (internal measurements). The two sides of the desk organizer are each 8" high. Plywood used is $\frac{3}{6}$ ".

Decide with the students how the pieces will be placed (i.e., will the sides be outside the bottom and shelf pieces, or will it sit on the bottom, etc.).

There are lots of possibilities but it is easier to have the class use the same choices.

Once the class has decided on how the pieces will fit together, give the following hands-on assignment.

Draw and cut out the pieces of the desk organizer to a scale of 1:4. Make the object. (Tape cut-out pieces together.)

SUGGESTED LEARNING
RESOURCES

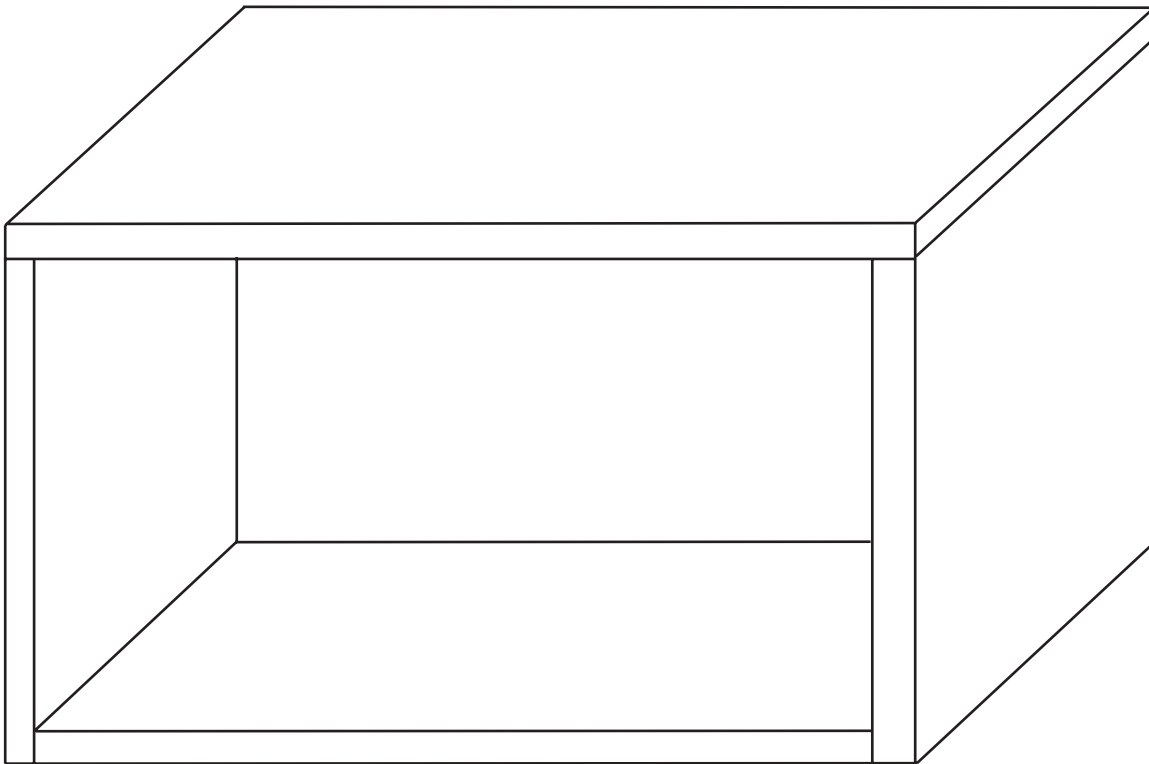
PRESCRIBED LEARNING OUTCOMES

D-5 solve problems involving estimation and costing for objects, shapes, or processes when a design is given
– *continued*

SUGGESTIONS FOR INSTRUCTION

The container shown below (distorted) is made of 5 parts (2 sides, a top and bottom, and the back). The actual measurements of the container are width 4', height 3', and depth 2'.

- a) Draw an oblique projection of the object using a scale of 1 square: 6 inches.
- b) Use graph paper and the scale to draw the exploded view, and the constituent parts.
- c) If wood is sold in 4' x 8' sheets, at a cost of \$42.95 each (plus taxes), find the cost of constructing this object.
- d) How many sheets would be required to construct three (3) of these objects?

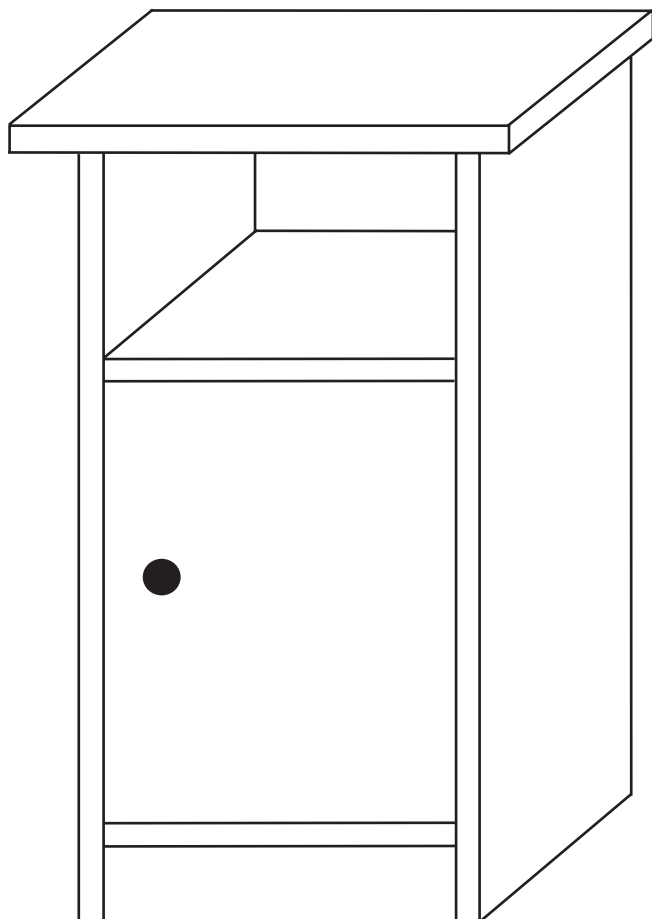


Note: Students should be exposed to questions that require the calculation of waste and cost of the wasted material(s).

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|------------------------------|-------------------|
| ✓ Communications | Patterns |
| ✓ Connections | ✓ Problem Solving |
| ✓ Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | ✓ Technology |
| | ✓ Visualization |

SUGGESTIONS FOR ASSESSMENT

Here is an example of an oblique projection of a bedside table. The top slot has no backboard. The cupboard has a backboard and one shelf inside. Assume the diagram is accurate and represents an actual height of 37 inches.



- a) Draw the oblique projection using an appropriate scale.
- b) Sketch the table in "exploded" format.
- c) Draw each rectangular piece using a scale of 1:4 and mark on each piece its actual length.
- d) The pieces for the table are to be cut from a sheet of plywood 4 feet x 8 feet. Arrange the pieces in such a manner as to have minimum waste material. Sketch your arrangement.
- e) How many tables could be made from three sheets of 4 feet x 8 feet plywood?
- f) If the sheets of wood cost \$42.95 each, the nails cost \$3.95, glue costs \$4.69, and the handle costs \$12.75, find the total cost including taxes.

SUGGESTED LEARNING RESOURCES

**PRESCRIBED LEARNING
OUTCOMES**

D-6 plan the construction of an object within a specified budget

SUGGESTIONS FOR INSTRUCTION

Students should select a project of their own choosing. Before embarking on the drawings, students should determine the amount they want to spend on the project, and then estimate the total cost of the materials required to build their creation. This could involve a trip to the local lumberyard (or material store) to determine actual prices. Using flyers or Internet sites is also helpful.

Students can choose objects such as

- decks
- birdhouses
- doghouses
- duck nests
- clothes
- roof trusses
- other objects

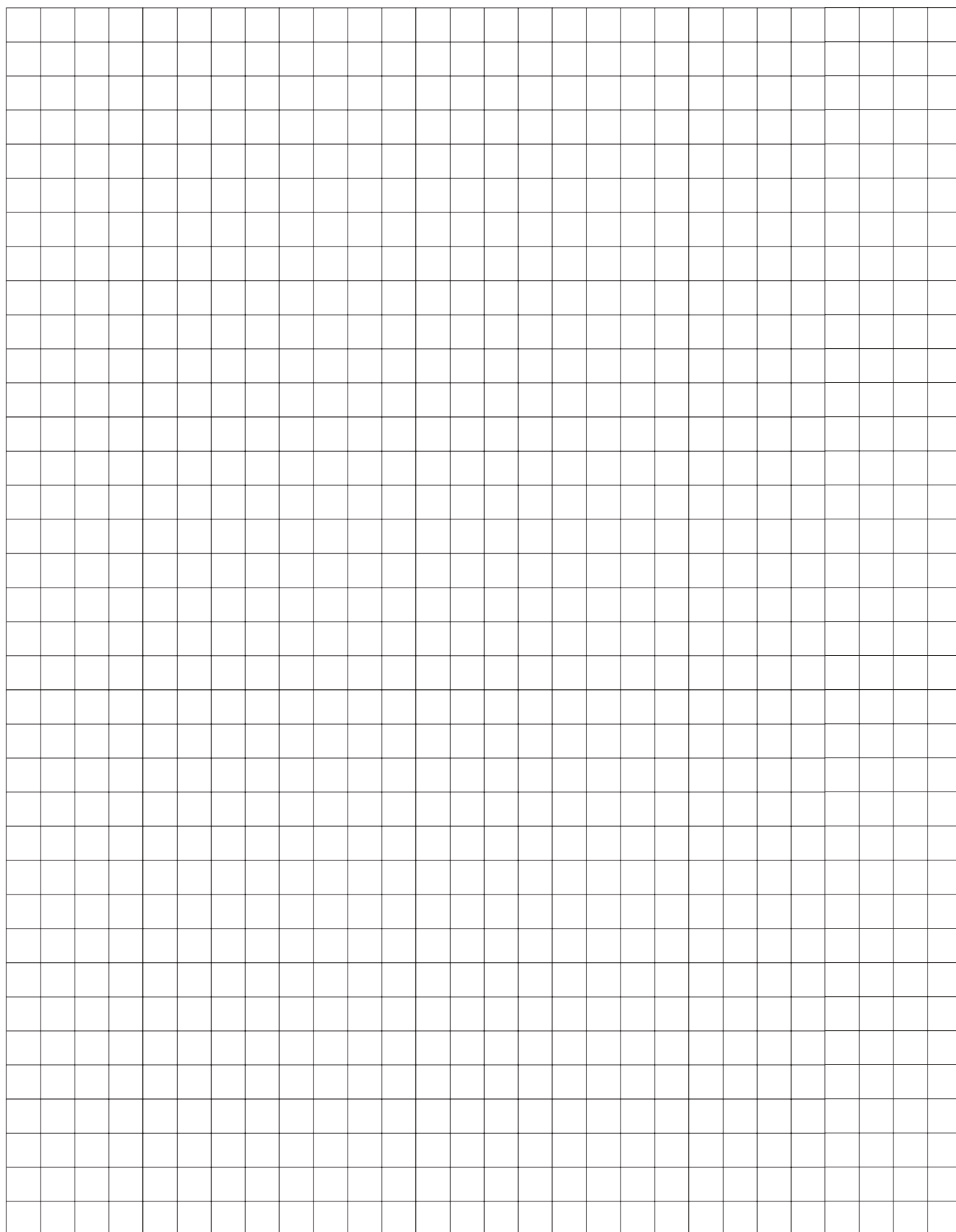
The Blackline Masters include a price list for use with this mini-project.

- | | |
|-------------------------------------|------------------------|
| ✓ Communications | ✓ Patterns |
| ✓ Connections | Problem Solving |
| Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | ✓ Visualization |

SUGGESTIONS FOR ASSESSMENT	SUGGESTED LEARNING RESOURCES
<p>Student Project</p> <p>Students will submit a three-part project demonstrating their understanding of design and measurement.</p> <p>Part A</p> <p>The following could be combined:</p> <ul style="list-style-type: none"> • labelled, scaled drawing of object • 3-D drawing of object <p>Part B</p> <ul style="list-style-type: none"> • sketch an exploded view of how the pieces fit together • draw each of the constituent parts to scale <p>Part C</p> <ul style="list-style-type: none"> • list all the materials needed to build this project • list the actual prices of these materials (phone around, or drop in to the stores) • calculation of waste and cost of wasted materials • students should provide pictures of their objects • include an estimation of the costs of incidental supplies such as glue, nails, etc. <p>Creativity is encouraged! Neatness and accuracy in diagrams are important.</p>	

Blackline Masters

Blackline Master 1: ¼-inch Graph Paper



Blackline Master 2: Price List

The following price list shows costs for various building materials at a particular store as of April 2003. It may be used by students for their Design and Measurement project.

Walls:

Plain tile (6 in. x 8 in.)	\$1.74/sq. ft.
Plain tile (8 in. x 8 in.)	\$2.24/sq. ft.
50 lb. multipurpose mortar	\$13.95 ea.
10 lb. tile grout	\$10.50 ea.
Flat interior paint (sold in 3.78 L buckets)	\$20.98 ea.
Wallpaper (sold in 15 ft. spools)	\$30.99 ea.
Solid core door (28 in. x 80 in.)	\$144.00 ea.
Drywall (4 ft. x 8 ft. x 0.5 in.)	\$8.95 ea.
R-20 fiberglass insulation (15 in. x 47 in. x 6 in.; sold in 49 sq. ft. bundles)	\$20.77 ea.

Floors:

Residential ceramic tile (12 in. x 12 in.)	\$1.99/sq. ft.
Textured carpet	\$2.80/sq. ft.
Oak strip flooring (sold in 20 sq. ft. packages)	\$4.99/sq. ft.
Parquet (wood "tiles") flooring (sold in 10 sq. ft. packages)	\$2.09/sq. ft.
Plain baseboard (0.5 in. x 3.25 in.)	\$0.70/ft.

Miscellaneous:

Standard spruce plywood (4 ft. x 8 ft. x 3/8 in.)	\$37.77 ea.
Multipurpose board (2 in. x 2 in. x 8 ft.)	\$4.98 ea.
Nails	\$1.99/lb.

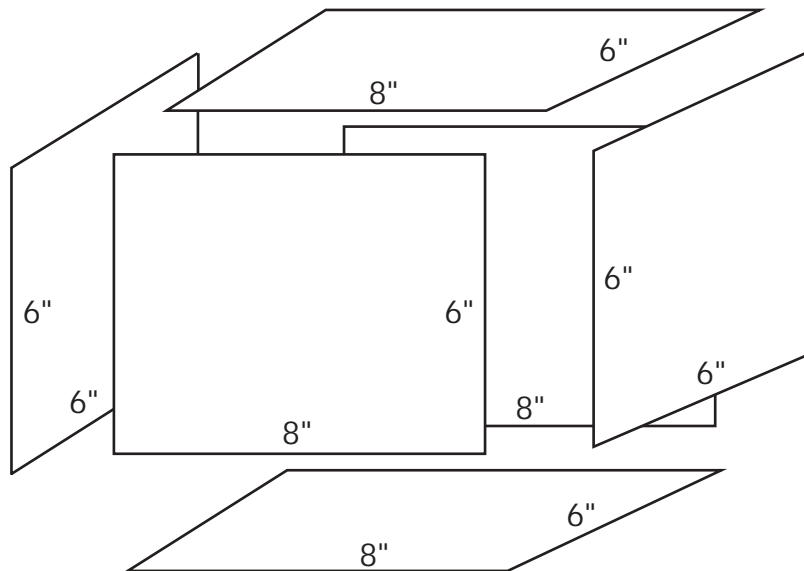
Blackline Master 3: Example Problem

Example

You are asked to build boxes with dimensions 6" x 6" x 8" for a woodworking project. You need to draw the box using an exploded format, a constituent parts diagram, and an oblique projection (choose from cabinet, cavalier, or general and identify your choice). You also need to determine how many boxes can be made from one sheet of 4' x 8' plywood.

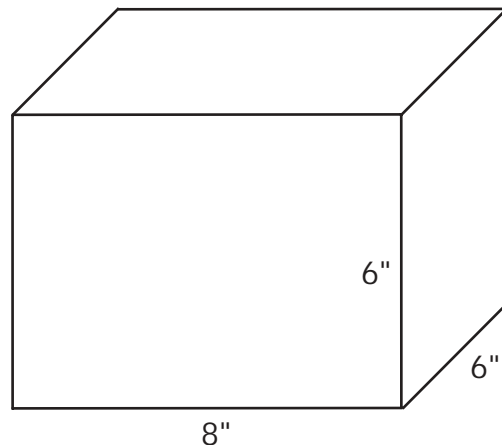
Exploded Format

When the box is to be drawn as an "exploded" diagram, the constituent parts are shown (in perspective) with distance between them. The diagram should be drawn in such a way as to let the viewer see what the object would look like if all the pieces were pushed together to form the object. Exploded format pictures are "rough" but reasonable sketches of the object. (No specific scale is used.) Below is a picture of the box in exploded format.



Oblique Projection

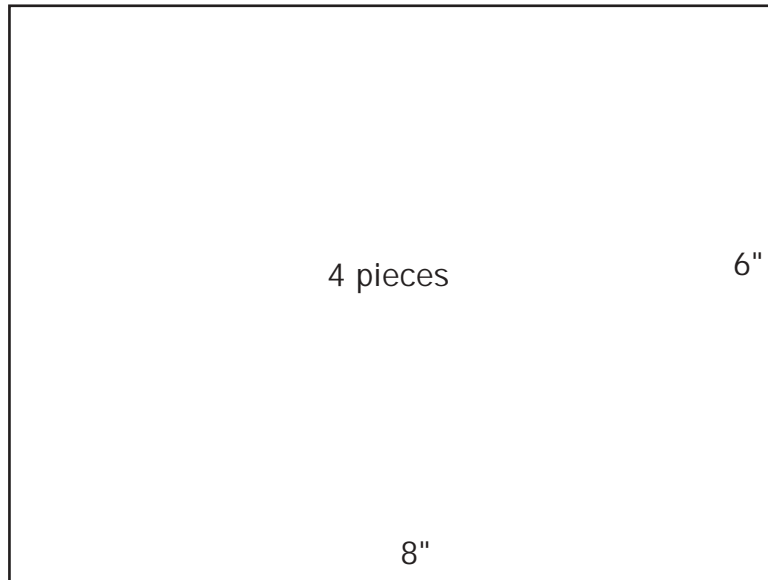
When the box is to be drawn as an oblique projection, the "front" surface of the object is shown fully. To show the third dimension, other surfaces are inclined at a 45° angle to the front surface. The diagram to the right is an example of the box drawn as an oblique cabinet projection using a scale of 1:4.



Blackline Master 3: Example Problem (continued)

Constituent Parts Diagram

If the box's constituent parts are to be drawn, each part is drawn "flat" using a specific scale. Below is a picture of the box's constituent parts using a scale of 1:2.



Blackline Master 3: Example Problem (continued)

To find out how many boxes we can make, we need to picture how to position the constituent parts of the box on the plywood to minimize the amount of plywood wasted and to maximize the number of boxes produced. A diagram can help. Looking at our constituent parts diagram on the previous page, we see that each box requires two square pieces (6" x 6") and four rectangular pieces (6" x 8").

The square pieces can be grouped to take up a one-foot-square area, as shown in Figure A. The rectangular pieces can be grouped to take up a two-foot by one-foot area, as shown in Figure B.

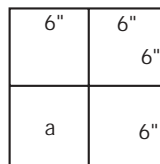


Figure A

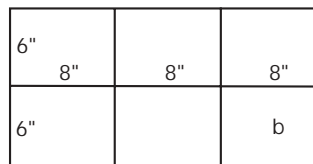


Figure B

To answer the problem, we have to fit the constituent parts onto the plywood like puzzle pieces. When finished, the diagram could look like Figure C below.

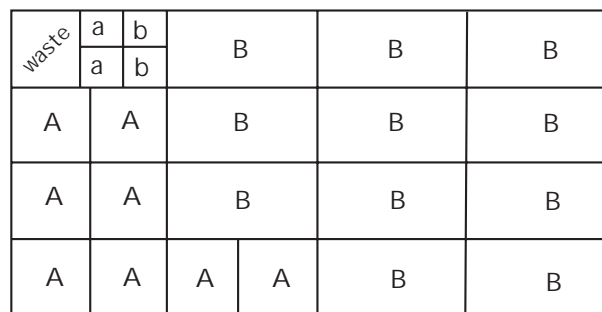


Figure C

Notice that in the diagram above, there are 11 sections of the same size as Figure B. These sections yield 66 rectangular 6" x 8" pieces, enough for 16.5 boxes.

There are eight sections the same size as Figure A. These sections yield 32 square 6" x 6" pieces, enough for 16 boxes.

The top left-hand corner of Figure C shows how two more rectangular 6" x 8" pieces and two more square 6" x 6" pieces can be cut, allowing enough extra pieces for the completion of the seventeenth box.

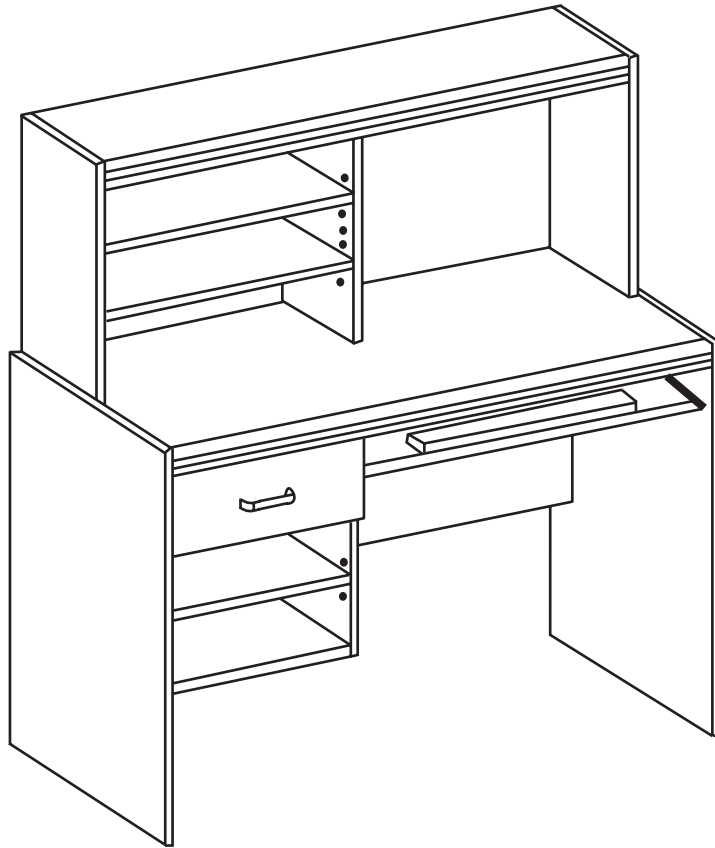
Therefore, the number of boxes that can be created from one sheet of plywood is 17.

Blackline Master 4: Sample Question—Enrichment

The following computer desk is drawn to scale. The depth of the desk (front to back) is 24 inches. The wood is three-quarters of an inch thick.

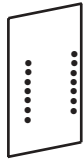
The keyboard platform is 15 inches deep.

The back of the shelving and monitor station is open.



1. Sketch and label the dimensions of all pieces of wood used in the construction of this desk.
2. If you were to construct this desk out of 4' x 8' x $\frac{3}{4}$ " sheets, how many sheets would you need? What would be the amount of waste?

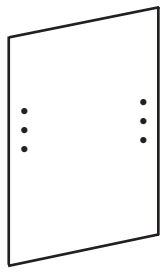
Blackline Master 5: Constituent Parts from Sample Question



(A)—left top upright panel



(B)—right top upright panel



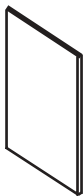
(C)—left bottom upright panel



(D)—right bottom upright panel



(E)—top partition



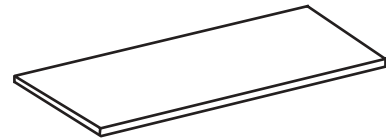
(F)—bottom partition



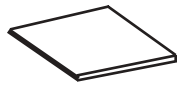
(G)—top shelf



(H)—adjustable shelves



(I)—top



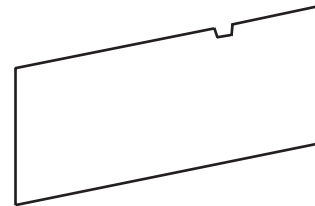
(J)—stationary shelf



(K)—adjustable shelf



(L)—keyboard shelf



(M)—modesty panel



(O)—top moulding



(P)—bottom moulding



(Q)—drawer front



drawer bottom



left drawer side



right drawer side



(R)—drawer back



drawer brace



foam wrist rest



handle