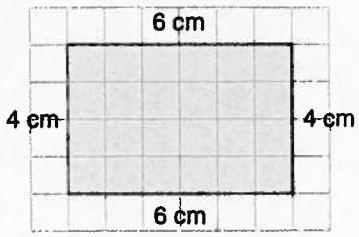
Connect

➤ Here are two different rules for finding the perimeter of a rectangle.
Each rule can be expressed by a **formula**.

A formula is a short way to state a rule.

To find the perimeter of a rectangle:
Multiply the length by 2.
Multiply the width by 2.
Then add.

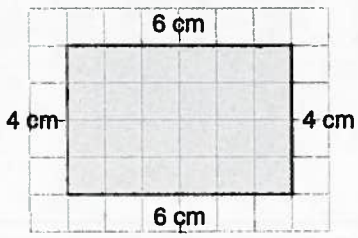


$2 \times 6 = 12$
$2 \times 4 = 8$
$12 + 8 = 20$
Perimeter = 20 cm

Formula

Perimeter = 2 × length + 2 × width

To find the perimeter of a rectangle:
Add the length and width.
Then multiply by 2.



$6 + 4 = 10$
$10 \times 2 = 20$
Perimeter = 20 cm

Formula

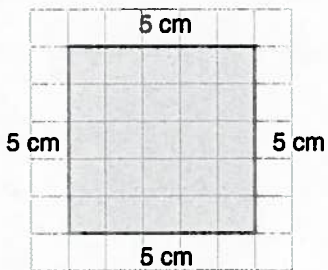
Perimeter = (length + width) × 2

The brackets show that you add the length and width, then multiply the sum by 2.

➤ Here is a shortcut to find the perimeter of a square.

To find the perimeter of a square, I multiply the side length by 4.

$5 \times 4 = 20$
Perimeter = 20 cm



Formula

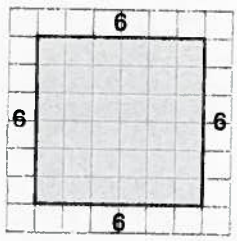
Perimeter = side length × 4

Math Link

Number Sense

To find the perimeter of a square, use repeated addition or multiplication. The perimeter is:

$6 + 6 + 6 + 6 = 4 \times 6$
$= 24$



This shows that repeated addition is the same as multiplication.

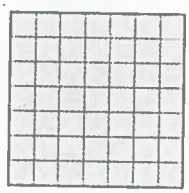
Practice

1. Use Colour Tiles. Make each rectangle.
Find its perimeter in units. Show your work.

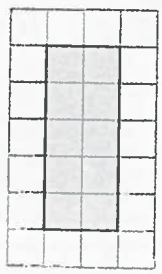
a) 

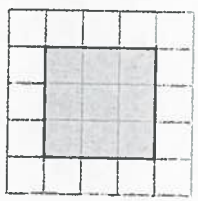
b) 

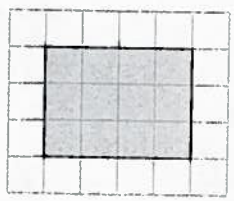
c) 

d) 

2. Draw each rectangle on 1-cm grid paper.
Find the perimeter of each rectangle. Show your work.

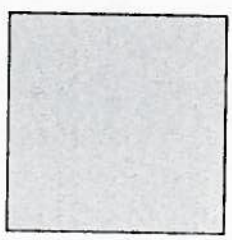
a) 

b) 

c) 

3. Use the dimensions of each rectangle to find its perimeter.
Then write each perimeter in a different unit.

a) 18 mm



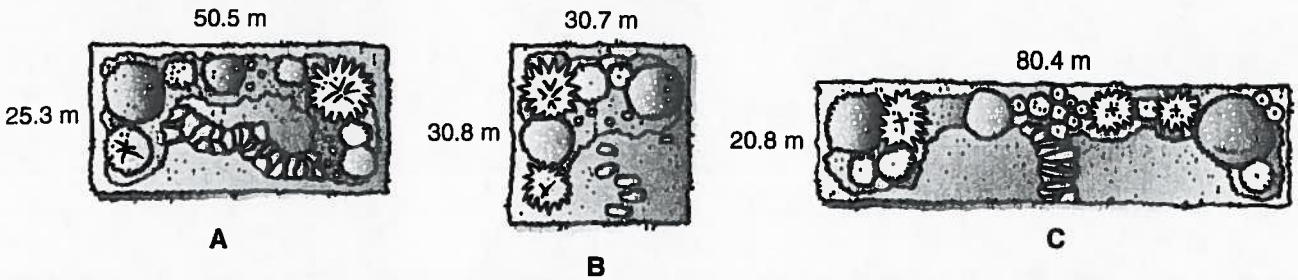
b) 6.4 m

c) 25.3 cm

Recall that:
1 cm = 10 mm
100 cm = 1 m

4. Measure the length and width of a rectangular table to the nearest unit. Use these dimensions to find the perimeter of the table. Show your work.

5. Which garden needs the most fencing to enclose it? Explain how you know.

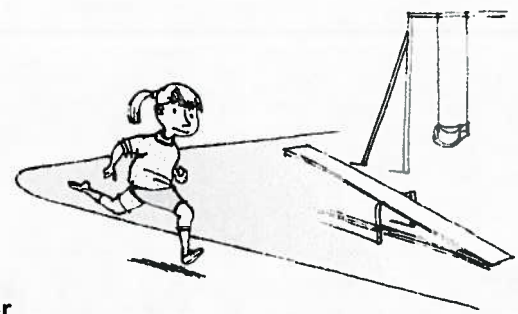


6. The playground at the Community Centre is rectangular. Its length is 60 m. The perimeter is 180 m. What is the width of the playground?

7. The perimeter of Tony's rectangular apple orchard is 1 km. How long might each side be?

8. The perimeter of a square patio is 12.8 m. How long is each side? Explain how you know.

9. Royanna jogs laps around a park playground. The playground is 90 m long and 35 m wide. How many laps will it take her to jog 1 km?



10. A square and a rectangle have the same perimeter. The shorter side of the rectangle is one-half the side length of the square. Each perimeter is between 30 cm and 35 cm. What are the dimensions of the square and the rectangle?

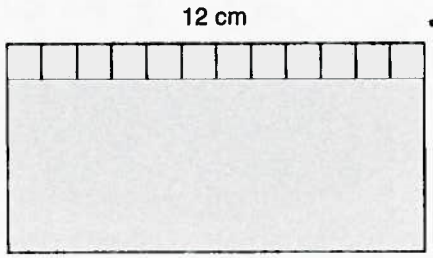
Reflect

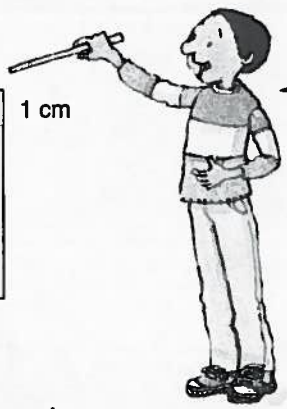
Draw a square on 1-cm grid paper. Label it with its side length. Use two different formulas to find the perimeter of the square. Which formula do you prefer? Explain.

Connect

➤ Here is one way to find the area of a rectangle.

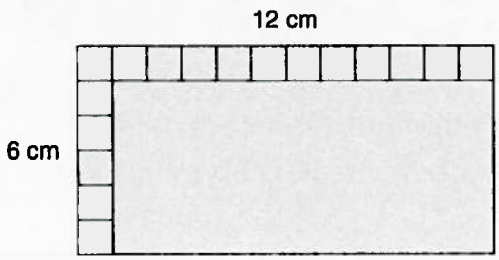
Measure the length of the rectangle.





The length tells how many 1-cm squares fit along it. The length is 12 cm. So, twelve 1-cm squares fit along the length.

Measure the width of the rectangle.



The width tells how many rows of 1-cm squares fit in the rectangle. The width is 6 cm, so there are 6 rows.

Multiply the length by the width.
$12 \times 6 = 72$
So, the area of the rectangle is 72 cm^2.

To find how many 1-cm squares fit in the rectangle, we multiply the length of a row by the number of rows.

We can write this rule:
To find the area of a rectangle, multiply the length by the width.

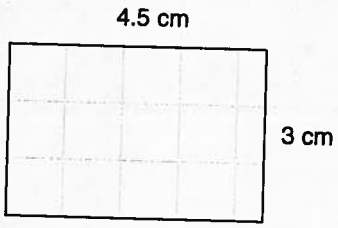
This rule can be expressed as a formula.

Area = length × width
Using variables, a formula is:
$A = \ell \times w$

length, ℓ

Area = length × width or $A = \ell \times w$	width, w

➤ We can use the same method when the dimensions are not whole numbers.



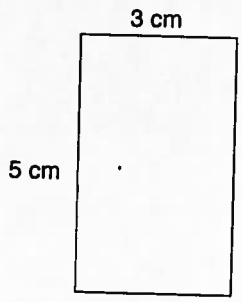
The rectangle is drawn on a 1-cm grid.
4.5 squares fit along the length.
There are 3 rows.
The area is $4.5 \times 3 = 13.5$.
The area is 13.5 cm^2.

Remember that area is measured in square units.

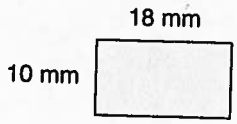
Practice

1. Find the area of each rectangle.

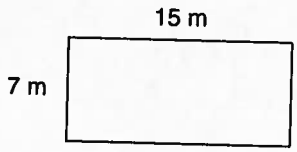
a)



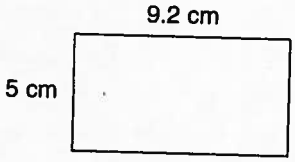
b)



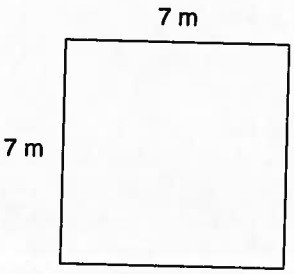
c)



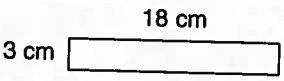
d)



e)

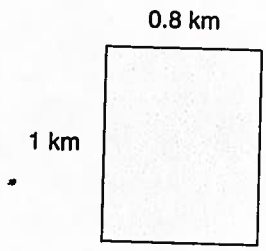


f)

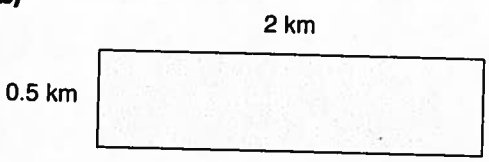


2. Find the area of each rectangle.

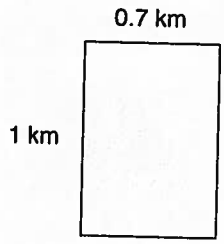
a)



b)



c)



3. Order the areas in question 2 from least to greatest.

4. Measure the length and width of your math book to the nearest unit.
Use these dimensions to find the area of the cover of your math book.
Show your work.

5. The area of Toby's rectangular garden is 56 m^2.
The length of the garden is 8 m.
What is the width of the garden?
Write the number sentence that shows your thinking.

6. Murray's parking pad is rectangular and 4 m long.
It has an area of 10 m^2.
How wide is the parking pad?

7. A square sandbox has an area of 4 m^2.
How long is each side?

8. Two rectangles have the same width but different areas.
Rectangle A has area 24 cm^2.
Rectangle B has area 32 cm^2.
What are the length and width of each rectangle?
How many different answers can you find?
Show your work.

9. A square and a rectangle have the same area.
The side length of the square is one-third the length of one side of the rectangle.
The rectangle has area 81 cm^2.
a) What is the side length of the square?
b) What are the dimensions of the rectangle?

10. The side length of a square is s.
Write a formula for the area, A, of a square with this side length.

Reflect

How can you find the length of a rectangle when you know its width and area?
Use an example to explain.

Number Strategies

Use a number line.
Order these fractions from least to greatest.

$\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{6}$, $\frac{3}{10}$

ME6-19: Measuring Perimeter

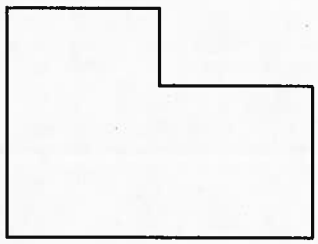
1. Measure the perimeter of each figure in cm using a ruler.

a) 

Perimeter: _____

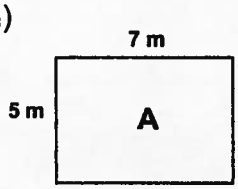
b) 

Perimeter: _____

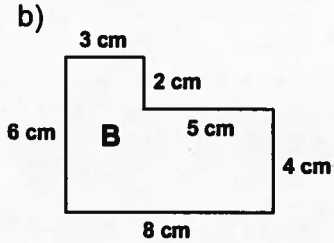
c) 

Perimeter: _____

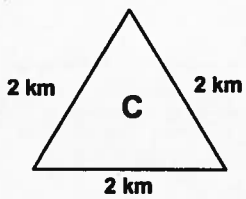
2. Find the perimeter of each shape. Be sure to include the units in your answer.

a) 

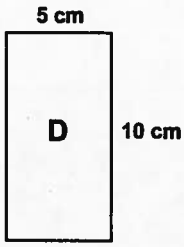
Perimeter: _____

b) 

Perimeter: _____

c) 

Perimeter: _____

d) 

Perimeter: _____

e) Write the letters of the shapes in order from greatest perimeter to least perimeter.
HINT: Make sure you look at the units!

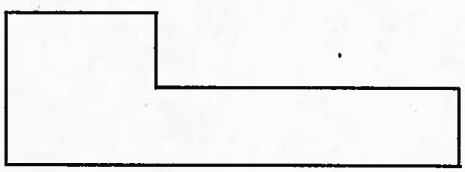
_____

3. Your little finger is about 1 cm wide. Estimate, then measure, the perimeter of each shape in cm.

a) 

Estimated Perimeter: _____

Actual Perimeter: _____

b) 

Estimated Perimeter: _____

Actual Perimeter: _____

4. Show all the ways you can make a rectangle using ...
   a) 10 squares b) 12 squares c) Can you make a rectangle with 7 squares?
   d) Which of the rectangles in b) has the greatest perimeter? What is the perimeter?

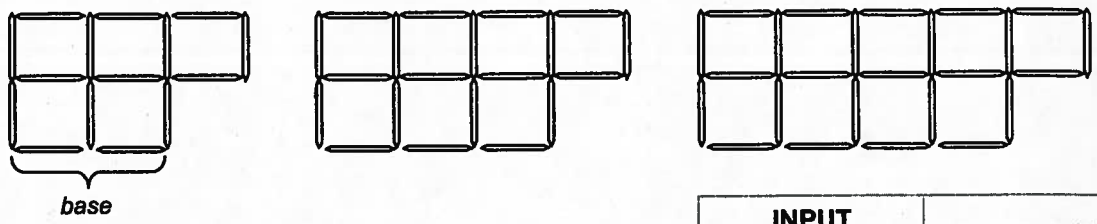
5. Draw three different figures with perimeter 10.
   NOTE: The figures don't have to be rectangles.

6. A rectangle has perimeter 1 m. Each longer side is 36 cm. How long is each shorter side?

7. A rectangle is twice as long as it is wide.
   What is the ratio of the width to the perimeter of the rectangle?

ME6-20: Investigating Perimeter

1. Mark makes a sequence of figures with toothpicks.



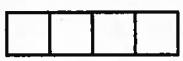
a) Complete the chart.

b) Complete the rule that tells how to make the OUTPUT numbers from the INPUT numbers.
Multiply the INPUT by _____ and add _____.

c) Use the rule to predict the perimeter of a figure with a base of 10 toothpicks: _____

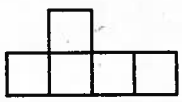
INPUT *Number of toothpicks in base*	**OUTPUT** *Perimeter*
2	10

2. Add one square to the figure so that the perimeter of the new figure is 12 units.
NOTE: Assume all edges are 1 unit.

a) 

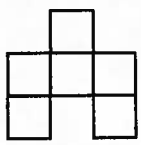
Original Perimeter = ____ units

New Perimeter = 12 units

b) 

Original Perimeter = ____ units

New Perimeter = 12 units

c) 

Original Perimeter = ____ units

New Perimeter = 12 units

3. Find all rectangles with the given perimeter (with lengths and widths that are whole numbers).

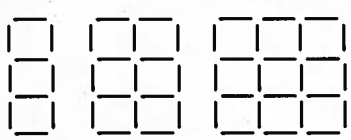
Width	Length
Perimeter = 6 units	

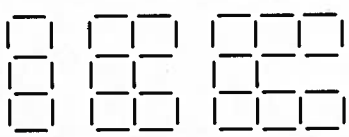
Width	Length
Perimeter = 12 units	

Width	Length
Perimeter = 16 units	

Width	Length
Perimeter = 18 units	

4. Repeat steps a) to c) of Question 1 for the following patterns.

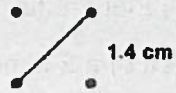
a) 

b) 

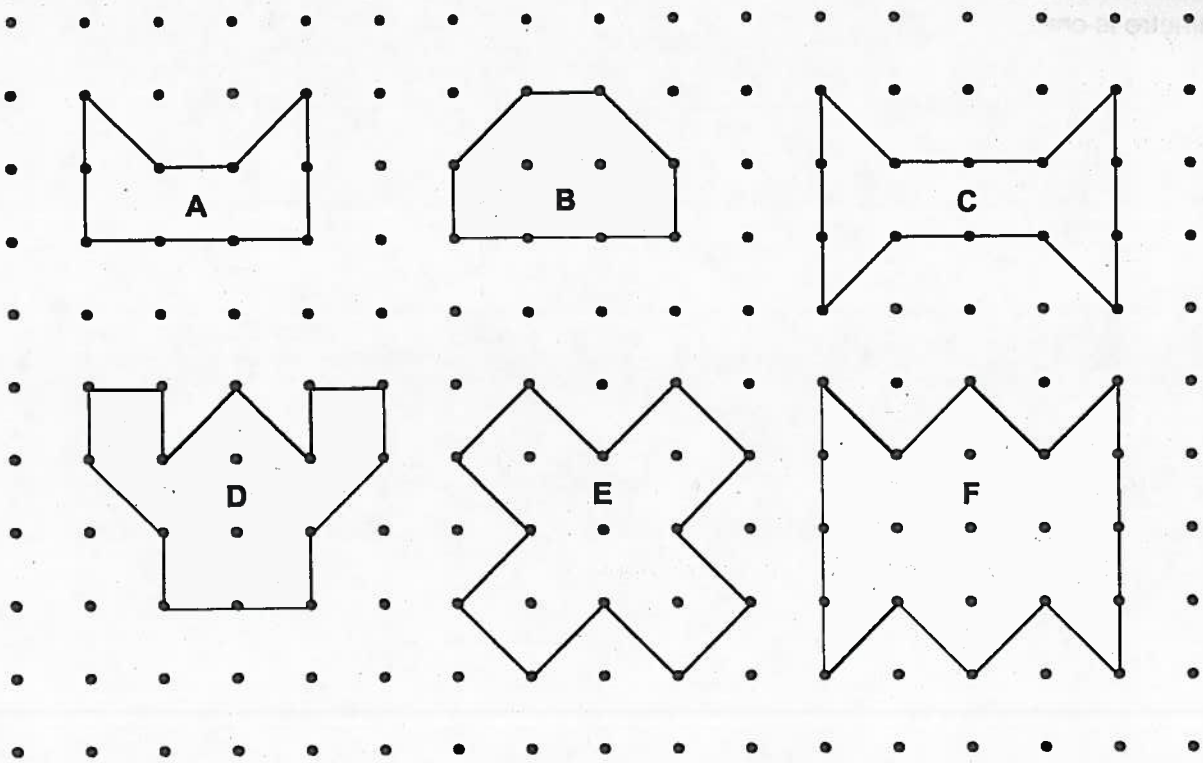
5. Emma says the formula 2 × (length + width) gives the perimeter of a rectangle. Is she correct?

ME6-21: Circles and Irregular Polygons

1. The horizontal and vertical distance between adjacent pairs of dots is 1 cm. The diagonal distance is about 1.4 cm.



Find the approximate perimeter of each figure by counting diagonal sides as 1.4 cm.
HINT: How can multiplication help you sum the sides of length 1.4 cm?



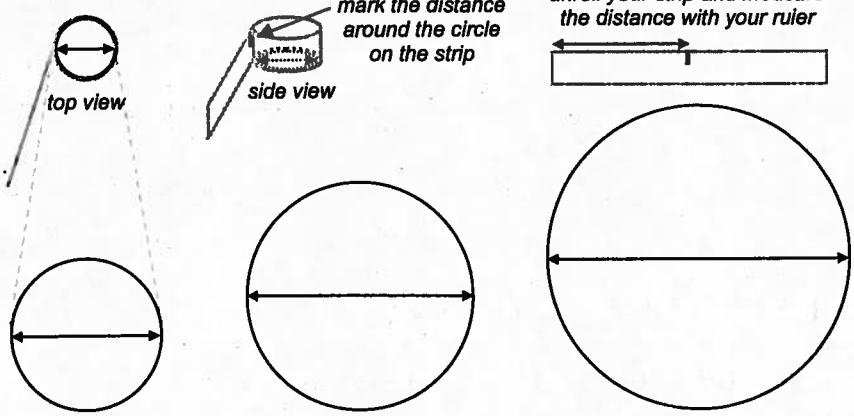
Perimeter of **A**: _____ Perimeter of **B**: _____ Perimeter of **C**: _____

Perimeter of **D**: _____ Perimeter of **E**: _____ Perimeter of **F**: _____

2. The distance around the outside of a circle is called the **circumference**.

a) Measure the circumference of each circle to the nearest **cm** using a strip of rolled up paper and a ruler. Record the width and circumference in the chart.

Width	Circumference



b) About how many times greater than the width is the circumference? _____

ME6-22: Area in Square Centimetres

Shapes that are flat are called **two-dimensional** (2-D) shapes.

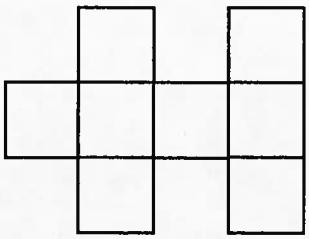
The **area** of a 2-dimensional shape is the amount of space it takes up.

A **square centimetre** is a unit for measuring area. A square with sides of 1 cm has an area of one square centimetre. The short form for a square centimetre is cm^2.

= 1 cm^2

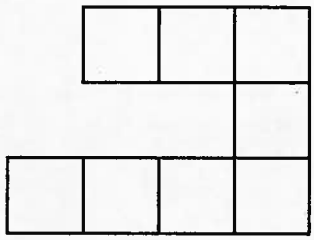
1. Find the area of these figures in square centimetres.

a)



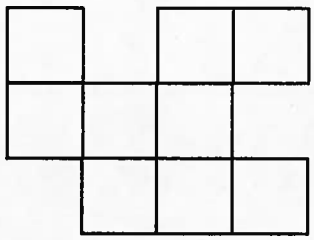
Area = _____ cm^2

b)



Area = _____ cm^2

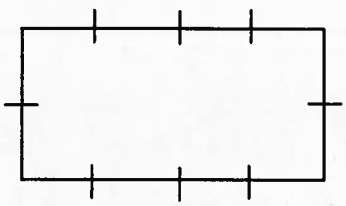
c)



Area = _____ cm^2

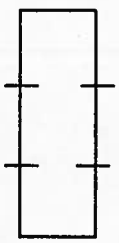
2. Using a ruler, draw lines to divide each rectangle into square centimetres.

a)



Area = _____ cm^2

b)

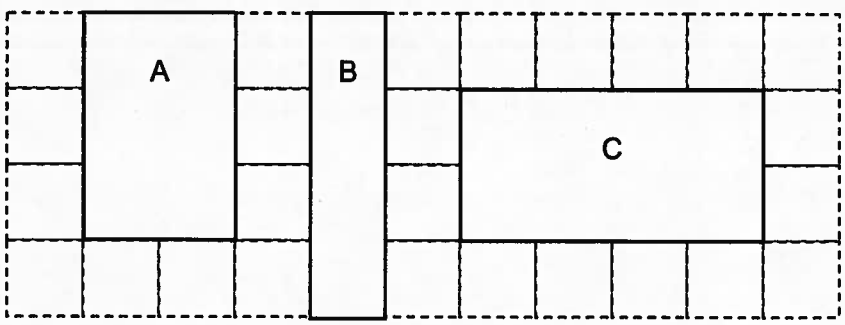


Area = _____ cm^2

c)

Area = _____ cm^2

3. How can you find the area (in square units) of each of the given shapes?



Area of **A** = _____ Area of **B** = _____ Area of **C** = _____

4. Draw three different shapes that have an area of 10 cm^2 (the shapes don't have to be rectangles).

5. Draw several shapes and find their area and perimeter.

6. Draw a rectangle with an area of 12 cm^2 and perimeter of 14 cm.

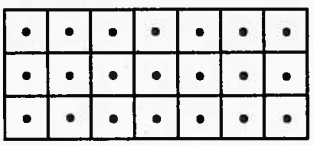
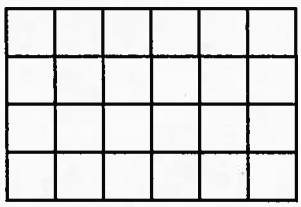
ME6-23: Area of Rectangles

1. Write a multiplication statement for each array.

a)  b)  c)  d) 

_____ _____ _____ _____

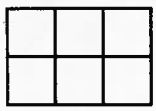
2. Draw a dot in each box. Then write a multiplication statement that tells you the number of boxes in the rectangle.

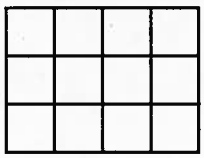
a)  b)  c)  d) 

3 × 7 = 21 _____ _____ _____

3. Write the number of boxes along the width and length of each rectangle.
Then write a multiplication statement for the area of the rectangle (in square units).

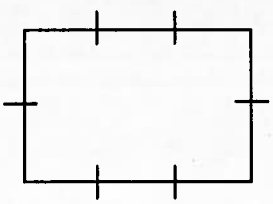
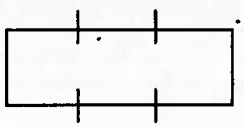
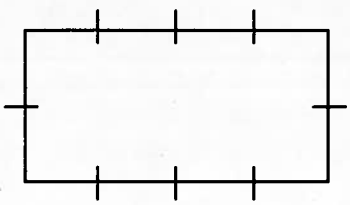
a)  Width = ____ Length = ____

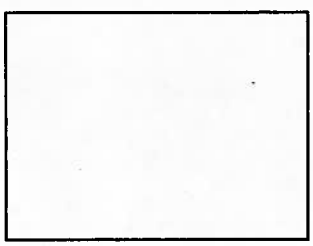
b)  Width = ____ Length = ____

c)  Width = ____ Length = ____

_____ _____ _____

4. Using a ruler, draw lines to divide each rectangle into squares.
Write a multiplication statement for the area of the boxes in cm^2.
NOTE: You will have to mark the last row of boxes yourself using a ruler.

a)  b)  c) 

d)  e) 

5. If you know the length and width of a rectangle, how can you find its area?

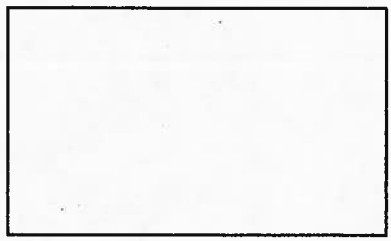
_____

ME6-24: Exploring Area

1. Measure the length and width of the figures then find the area.

a) 

b) 

c) 

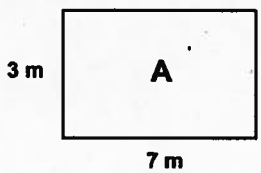
_____ _____ _____

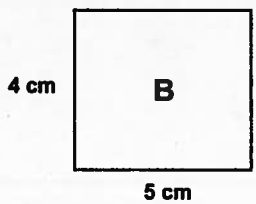
2. Find the area of a rectangle with the following dimensions:

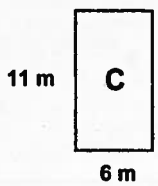
a) width: 6 m length: 7 m b) width: 3 m length: 7 m c) width: 4 cm length: 8 cm

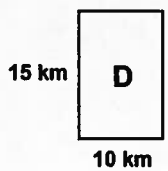
_____ _____ _____

3. a) Calculate the area of each rectangle. Be sure to include the units.









Area: _____ Area: _____ Area: _____ Area: _____

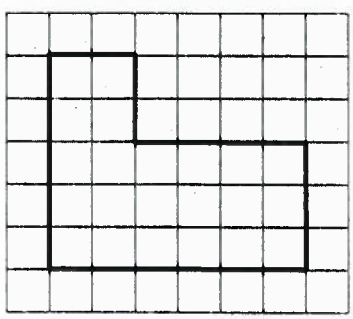
b) By letter, create an ordered list of the rectangles from <u>greatest</u> to <u>least</u> area: _____

4. A rectangle has an area of 18 cm^2 and a length of 6 cm. How can you find its width?

_____

5. A rectangle has an area of 24 cm^2 and a width of 8 cm. What is its length? _____

6. A square has an area of 25 cm^2. What is its width? _____

7. 

a) Write the lengths of each side on the figure.

b) Divide the figure into two boxes.

c) Calculate the area by finding the area of the two boxes.

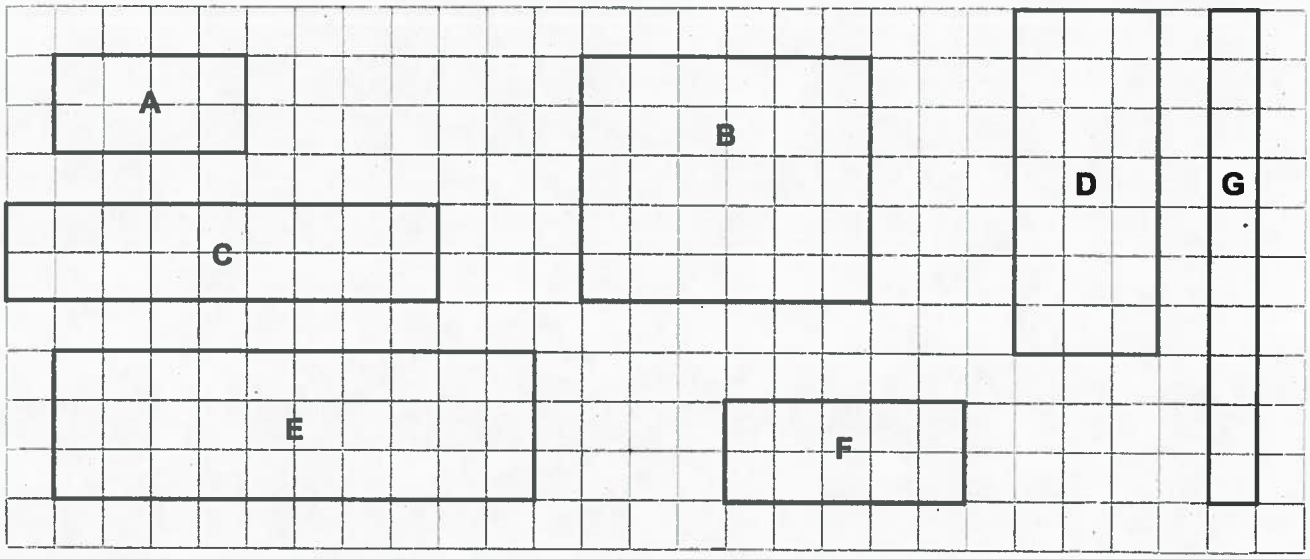
Area Box 1: _____ Area of Box 2: _____

TOTAL Area: _____

8. Using grid paper or a geoboard, create two different rectangles with an area of 12 square units.

ME6-25: Comparing Area and Perimeter

1. For each shape below, calculate the perimeter and area of each shape, and write your answers in the chart below. The first one has been done for you.
NOTE: The edge of each grid square represents 1 cm.



Shape	Perimeter	Area
A	2 + 4 + 4 + 2 = 12 cm	2 x 4 = 8 cm^2
B		
C		
D		
E		
F		
G		

2. Shape C has a greater perimeter than shape D. Does it also have greater area? _____

3. Name two other shapes where one has a greater perimeter and the other, a greater area:

_____

4. Write the shapes in order from greatest to least perimeter: _____

5. Write the shapes in order from greatest to least area: _____

6. Are the orders in Questions 4 and 5 the same? _____

7. What is the difference between perimeter and area? _____

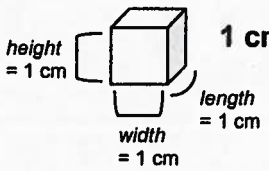
_____

_____

ME6-2: Volume

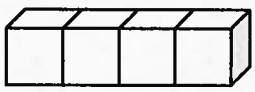
Volume is the amount of space taken up by a three dimensional object.

To measure volume, we can use 1 cm blocks. These blocks are uniform cubes, with length, width and height all 1 cm long:



1 cm block

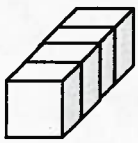
The volume of a container is based on how many of these 1 cm blocks will fit inside the container:



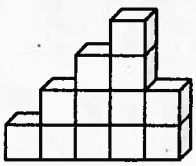
This object, made of centimetre cubes, has a volume of 4 cubes or 4 cubic centimetres (written 4 cm^3).

---

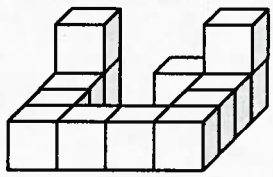
1. Using "centicubes" as your unit of measurement, write the volume of each object:

a) 

Volume = _____ cubes

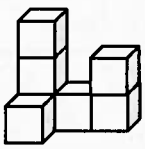
b) 

Volume = _____ cubes

c) 

Volume = _____ cubes

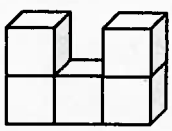
2. Given a structure made of cubes, you can draw a "mat plan" as shown:

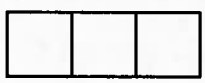


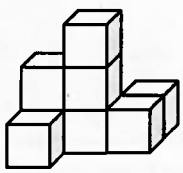
3	1	2
1		

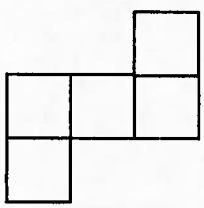
The numbers tell you how many cubes are stacked in each position.

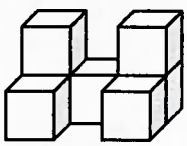
For each figure below, fill in the missing numbers in the mat plan:

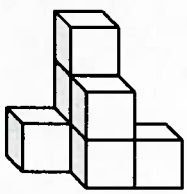
a) 

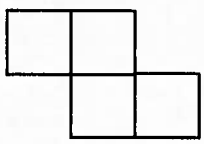


b) 

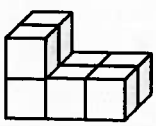


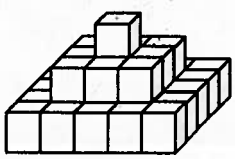
c) 

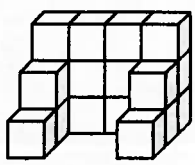
d) 



3. On grid paper, draw a mat plan for each of the following structures (use cubes to help):

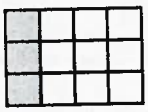
a) 

b) 

c) 

ME6-3: Volume of Rectangular Prisms

1. Use the number of blocks in the shaded column to write an addition statement and a multiplication statement for each area:

a) 

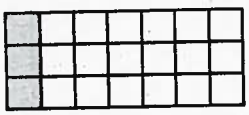
3 + 3 + 3 + 3 = 12

3 × 4 = 12

b) 

___ + ___ + ___ + ___ + ___ = _____

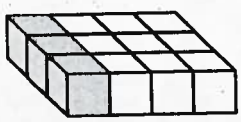
___ × ___ = _____

c) 

___ + ___ + ___ + ___ + ___ + ___ + ___ = _____

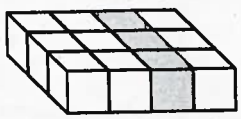
___ × ___ = _____

2. How many 1 cm^3 blocks are in each shaded row? (Blocks are not shown to scale)

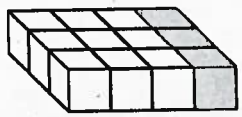


_____blocks

_____blocks

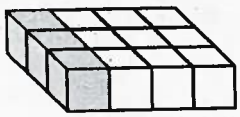


_____blocks



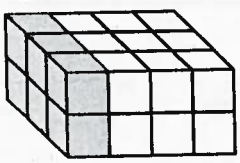
_____blocks

3. a) Write an addition statement for the volume of the shape:



___ + ___ + ___ + ___ = _____ cm^3

b) Write a multiplication statement for the same volume: ___ × 4 = _____ cm^3

4. 

a) How many blocks are shaded? _____

b) Write an addition statement for the volume of the shape:

____ + ____ + ____ + ____ = _____ cm^3

c) Write a multiplication statement for the same volume:

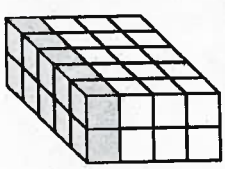
____ × 4 = _____ cm^3

5. Write an addition and multiplication statement for each volume:

a) 

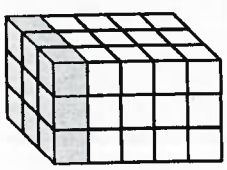
____ + ____ + ____ = _____ cm^3

____ × 3 = _____ cm^3

b) 

____ + ____ + ____ + ____ = _____ cm^3

____ × ____ = _____ cm^3

c) 

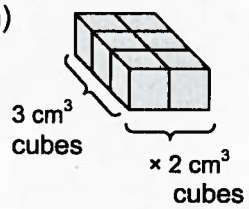
____ + ____ + ____ + ____ + ____ = _____ cm^3

____ × ____ = _____ cm^3

ME6-3: Volume of Rectangular Prisms *(continued)*

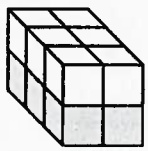
6. Claire stacks blocks to make a tower.

   She finds the number of cubes in each tower by multiplying the number of cubes in the base by the number of layers.

a) 

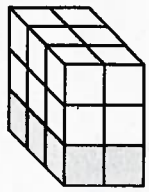
$2\ cm^3 \times \underline{3}$

$= \underline{6}\ cm^3$

b) 

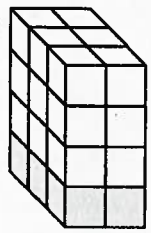
$2\ cm^3 \times 3 \times \underline{2}$

$= \underline{\quad}\ cm^3$

c) 

$2\ cm^3 \times 3 \times \underline{\quad}$

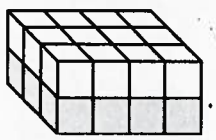
$= \underline{\quad}\ cm^3$

d) 

$2\ cm^3 \times 3 \times \underline{\quad}$

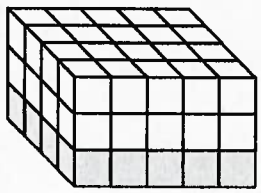
$= \underline{\quad}\ cm^3$

7. Find the volume of each prism.

a) 

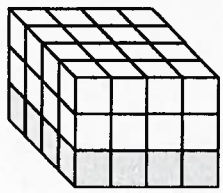
$\underline{\quad} \times \underline{\quad}$

$= \underline{\quad}\ cm^3$

b) 

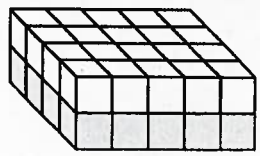
$\underline{\quad} \times \underline{\quad}$

$= \underline{\quad}\ cm^3$

c) 

$\underline{\quad} \times \underline{\quad}$

$= \underline{\quad}\ cm^3$

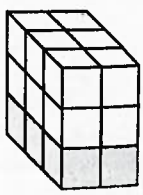
d) 

$\underline{\quad} \times \underline{\quad}$

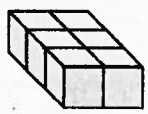
$= \underline{\quad}\ cm^3$

8. Peter notices that the area of the base of a rectangular prism is the same number as the volume of the base layer of blocks.

   He calculates the volume of the prism by multiplying the area of the base layer by the number of layers. Will his method work for all rectangular prisms?

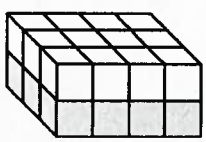


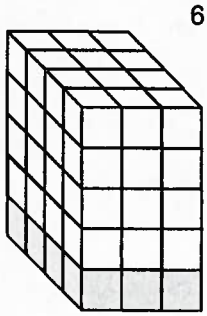
Area of base
6 cm²

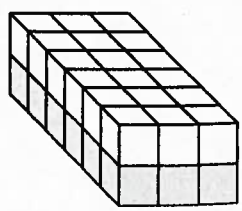


Volume of base
6 cm³

9.

A 

B 

C 

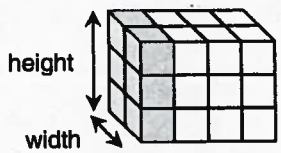
a) What is the area of the base of each structure?

b) What is the volume of the base layer?

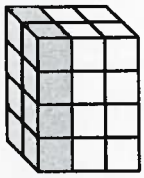
c) What is the volume of the structure?

ME6-3: Volume of Rectangular Prisms *(continued)*

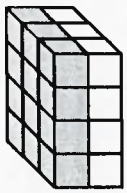
10. How many blocks are on the end of each prism?

a) 

Number of blocks on end
= height × width
= 3 × 2 = 6

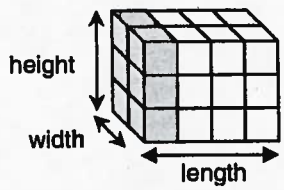
b) 

Number of blocks on end
= height × width
= ____ × ____ = ____

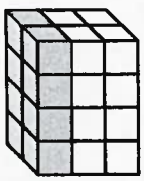
c) 

Number of blocks on end
= height × width
= ____ × ____ = ____

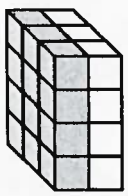
11. How many blocks are in each prism?

a) 

Number of blocks in prism
= height × width × length
= ___ × ___ × ___ = ___

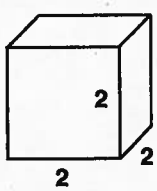
b) 

Number of blocks in prism
= height × width × length
= ___ × ___ × ___ = ___

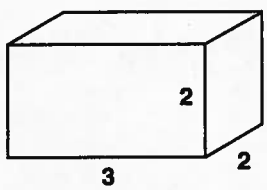
c) 

Number of blocks in prism
= height × width × length
= ___ × ___ × ___ = ___

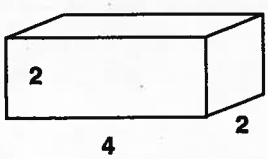
12. Find the volume of each box with the indicated dimensions (assume all units are in metres):
HINT: V = H × L × W

a) 

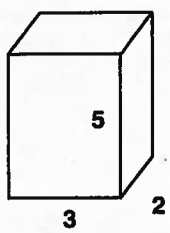
Width: _____
Length: _____
Height: _____
Volume = _____

b) 

Width: _____
Length: _____
Height: _____
Volume = _____

c) 

Width: _____
Length: _____
Height: _____
Volume = _____

d) 

Width: _____
Length: _____
Height: _____
Volume = _____

13. Find the volumes of the rectangular prisms from the mat plans shown below:

a)

5	5	5
5	5	5

Width: ____
Length: ____
Height: ____
Volume = ____

b)

3	3
3	3

Width: ____
Length: ____
Height: ____
Volume = ____

c)

10	10	10	10	10
10	10	10	10	10

Width: ____
Length: ____
Height: ____
Volume = ____