What Is This Module About?

Suppose that you and your four brothers inherited a tract of land with a length of 400 meters and a width of 250 meters. The land was equally divided into five parts. What is the area of the land? How many square meters of land will each of you get?

In multiplying the length and width of the land, you are actually computing area. Knowing how to solve for the area of planar figures and of various geometric shapes can be very useful to you. For example, knowing the area of your land will help you decide what structures to build. If the area of your land is big, you may want to build a basketball court for the out-of-school youth in your neighborhood.

In this module, you will learn how to solve and compute for the area of planar figures and various geometric shapes. You will also learn the different units of measurement and how to convert one unit to another as you solve for the area.

This module contains two lessons. These are:

Lesson 1 – *Units of Area*

Lesson 2 – *Planar Figures, Solids and Irregular Planar Figures*

What Will You Learn From This Module?

After studying this module, you should be able to:

- give examples to show what area is;
- identify the units used in measuring area;
- compute the areas of various geometric shapes;
- convert units of area in the metric system to the English system and vice versa; and
- use your knowledge of area to solve everyday problems.

Let's See What You Already Know

Before you start studying this module, take the following test first to find out how will you know the topics to be discussed.

A. Match the objects in Column A with their appropriate units of measurement in Column B.

	A		B
_____	1. shoe box	a.	mm^2
_____	2. small tract of land	b.	$ft.^2$
_____	3. beach	c.	ha
_____	4. small floor tile	d.	cm^2
_____	5. bus	e.	m^2
_____	6. province	f.	km^2
		g.	$in.^2$
		h.	dm^2

B. Identify each of the following figures and write the appropriate formula for the area of the figure.

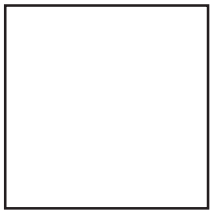
1. 

Figure: _____

Formula: _____

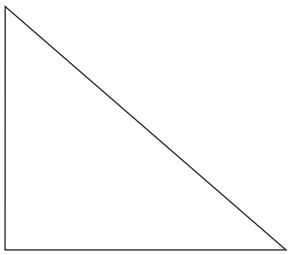
2. 

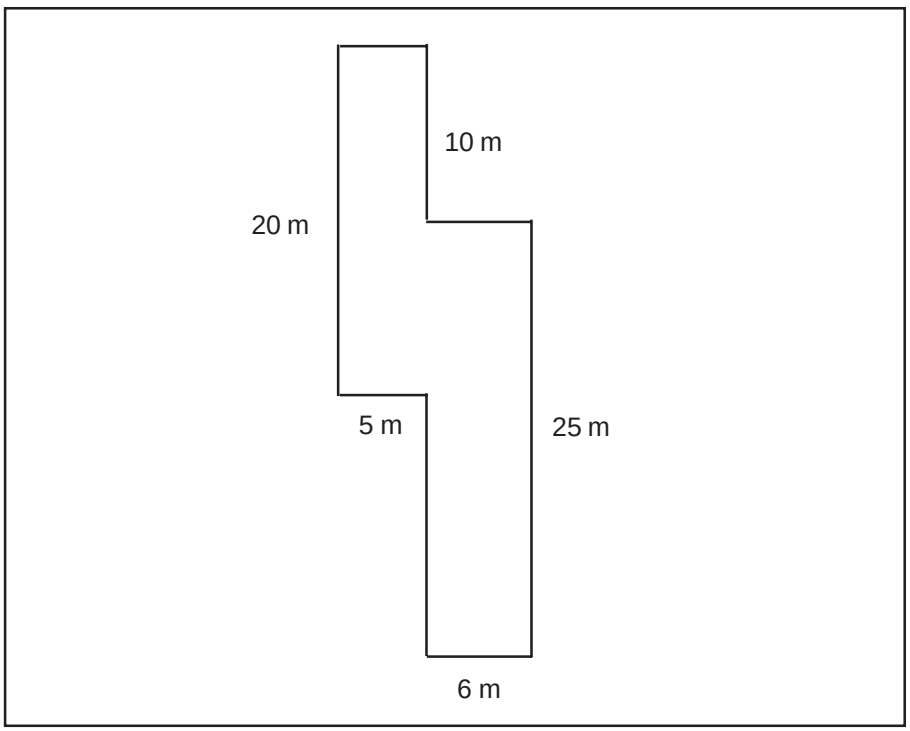
Figure: _____

Formula: _____

C. Solve the following problems.

1. A businessman has a land with an area of 555 square meters (m^2). If the land tax rate is two pesos per square foot ($ft.^2$), compute the amount of real estate tax the businessman has to pay.

2. Look at the diagram below.



A businessman has a fishpond shaped like the figure above. He figured that he needs at least a 200-square meter pond for his business to be profitable. If the businessman's fishpond has dimensions like the dimensions of the figure above, will it be profitable?

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on pages 33 to 35 to find out.

If all your answers are correct, very good! This shows that you already know much about the topics to be discussed. You may still study the module to review what you already know. Who knows, you might learn a few more new things as well.

If you got a low score, don't feel bad. This only means this module is for you. It will help you understand some important concepts that you can apply in your daily life. If you study this module carefully, you will learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page to begin Lesson 1.

Units of Area

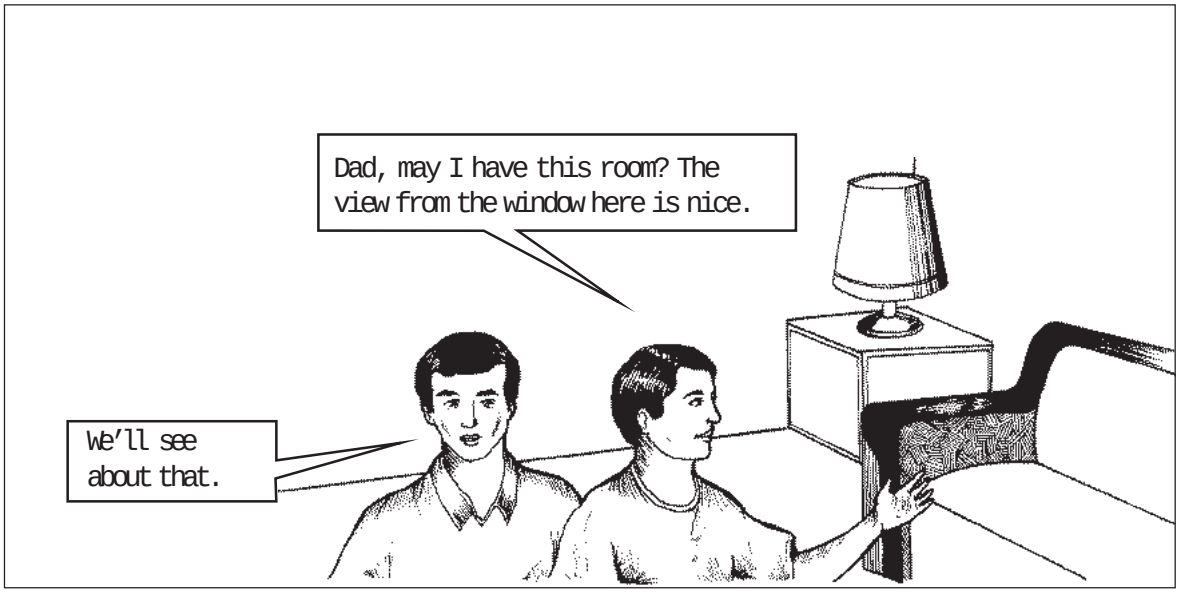
As you have read at the very start of this module, the concept of area is very important because of its many different applications. For instance, your knowledge of area is useful in finding the ground or surface covered by a poultry farm, fishpond or even the floor area of your house! In measuring area, you also need to know how to convert one unit of measurement to another because there are various units used in measuring area.

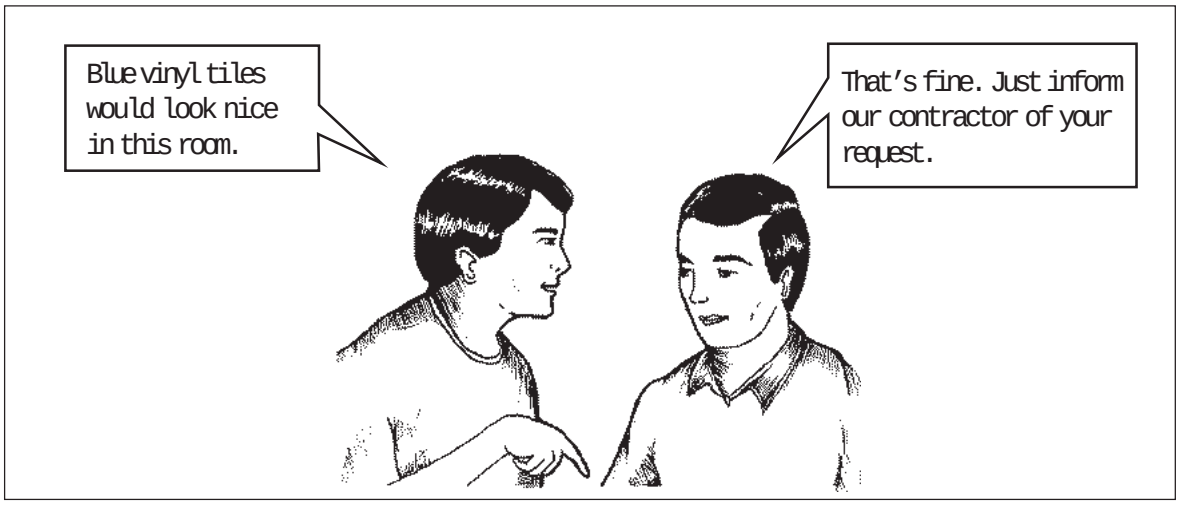
After studying this lesson, you should be able to:

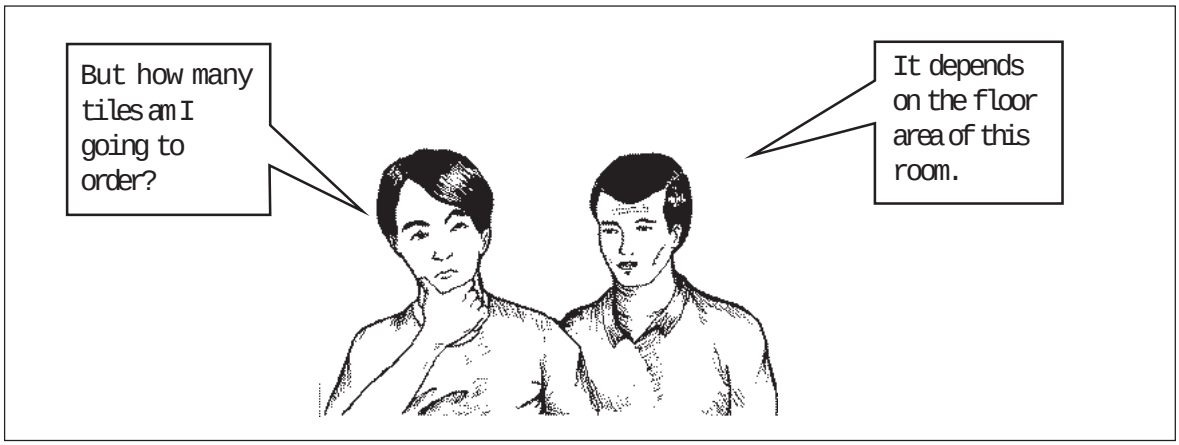
- explain the meaning of area;
- identify and use the different units of measurement of area; and
- convert a unit of area to another.

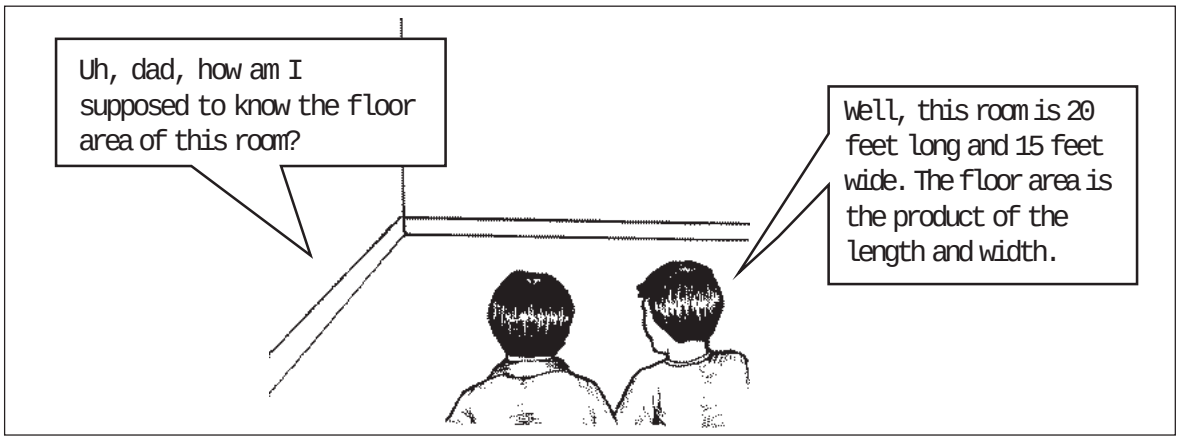
Let's Read

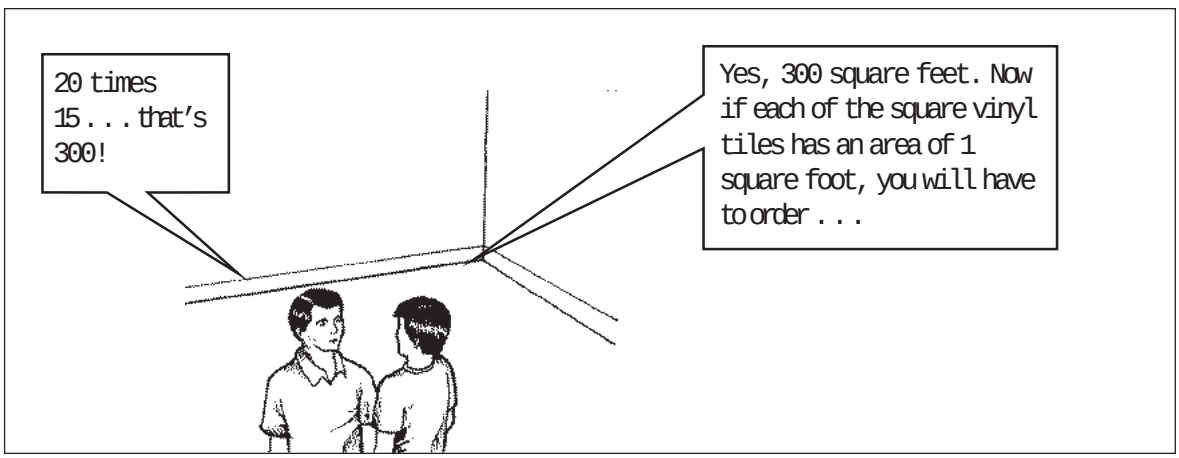
Eric and his father are doing the rounds in their newly built house.

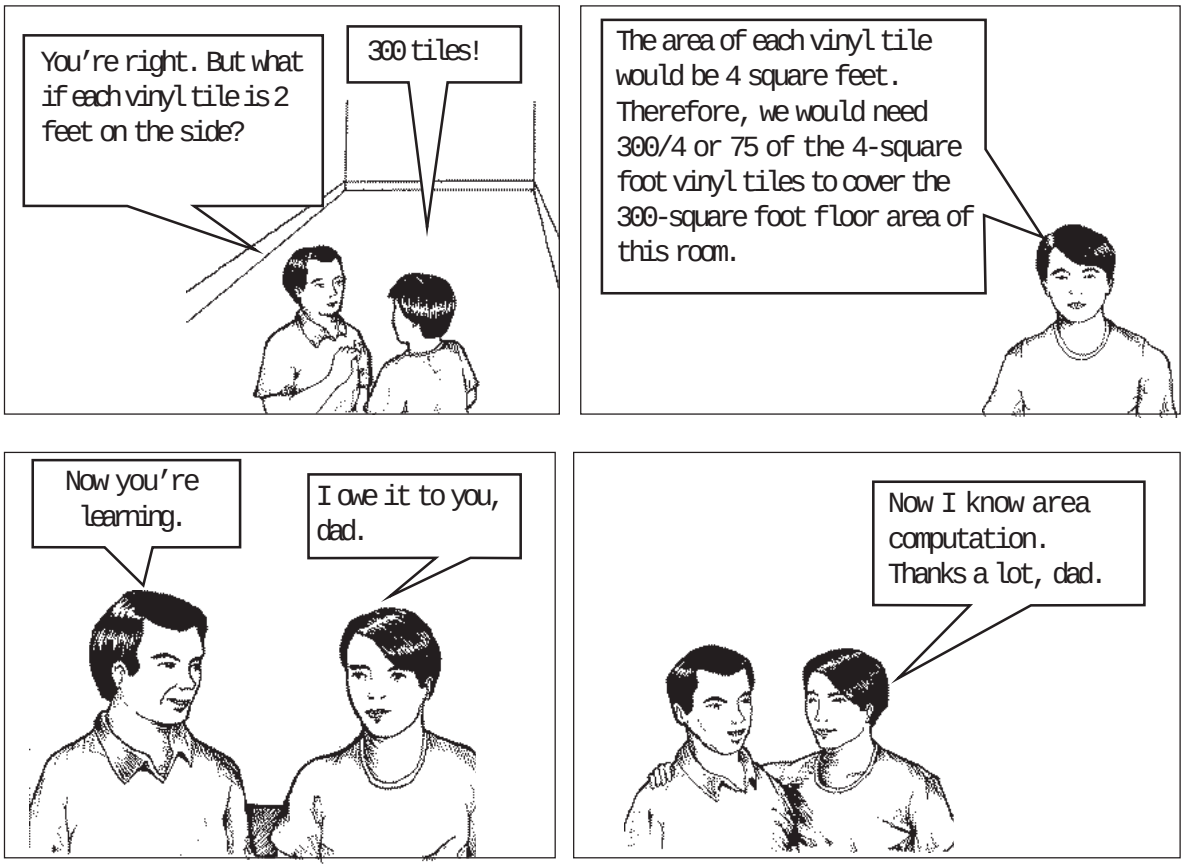



Blue vinyl tiles would look nice in this room.
That's fine. Just inform our contractor of your request.


But how many tiles am I going to order?
It depends on the floor area of this room.


Uh, dad, how am I supposed to know the floor area of this room?
Well, this room is 20 feet long and 15 feet wide. The floor area is the product of the length and width.


20 times 15 . . . that's 300!
Yes, 300 square feet. Now if each of the square vinyl tiles has an area of 1 square foot, you will have to order . . .



Let's Think About This

1. What is area?

   _____
   _____
   _____

2. Give an example of an object whose area is to be measured and explain what it means.

   _____
   _____
   _____

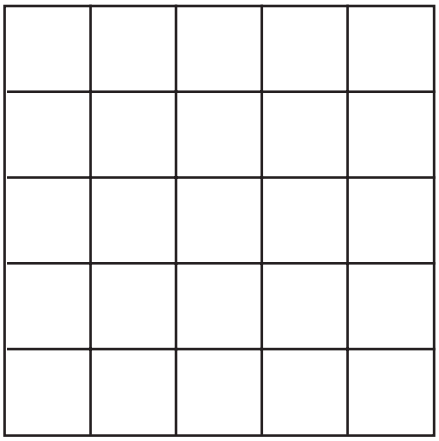
Compare your answers with those in the *Answer Key* on page 36.

Let's Learn

Do you already know what **area** means?

To understand the meaning of area, try to gather all your books that are similar in size. Now try to cover the surface of a rectangular table with the books you have gathered. Suppose it took 30 books to cover the table, what do you think this means? It means that the table has an **area** equivalent to 30 books.

Look at the figure below.



Try to count the square units in the figure. How many square units were you able to count? What do you think it means? Did you know that finding the area of a surface means knowing how many square units can be placed on the surface to cover it? It is comparing the surface whose area is to be measured with the surface covered by one square unit. So if it takes 25 square units to cover the surface of the figure above, the area of the figure is 25 square units.

So if we say that the area of a room is 50 square meters, we mean that if we had squares each with a side of 1meter, it would take 50 of these squares to cover the whole room.

Conversion

It is important to know the relationship between units of measurement of area and length. Their relationship can be used to convert one unit of measurement to another.

The followng is a table of measurements that can help you convert one unit of measurement of area to another. It is advisable that you memorize the table to be able to convert units of measurement faster.

The standard unit of area in the metric system is the square meter.

1 square kilometer (km^2) = 1000000 square meters (m^2)

1 km^2 = 100 hectares (ha)

1 ha = 10000 m^2

1 m^2 = 100 square decimeters (dm^2)

1 dm^2 = 100 square centimeters (cm^2)

1 cm^2 = 100 square millimeters (mm^2)

Listed are units of area not commonly used:

1 square foot ($ft.^2$) = 144 square inches ($in.^2$)

1 $in.^2$ = 6.4516 cm^2

1 m^2 = 9 $ft.^2$

The units square millimeter, square centimeter, square decimeter and square inch are used to measure areas of small objects, figures or shapes. Some examples of such small objects are lighters, matchboxes, small floor tiles, shoe boxes, books and paper.

The units square foot and square meter are better used in measuring areas of bigger objects, figures or shapes. Examples of such objects are small tracts of land, vehicles and floor areas of houses.

The units hectare and square kilometer are used in measuring areas of massive or large objects, figures or shapes. Some examples are resorts, large bodies of water, agricultural lands, beaches, provinces, regions and countries.

A sample problem is presented to help you further understand the conversion of units of measurement.

EXAMPLE 1

A farmer needs 12 ha of land to plant his mango trees. The land he owns has an area of 125000 m^2. Does the farmer have enough land to plant his mango trees in?

SOLUTION:

STEP 1 Identify the conversion factor to be used.

$$1\,\text{ha} = 10000\,\text{m}^2$$

STEP 2 Express the conversion factor as a ratio with the unit of measure to be cancelled out in the denominator.

$$\frac{1\,\text{ha}}{10000\,\text{m}^2}$$

STEP 3 Multiply 125000 m^2 by the conversion factor in ratio form to convert square meters to hectares.

$$125000\ \cancel{m^2} \times \frac{1\ ha}{10000\ \cancel{m^2}} = 12.5\ ha$$

STEP 4 Make your conclusion.

The farmer has enough land for a mango orchard.

Let's Try This

PROBLEM 1 A carpenter was asked to place floor tiles in a bathroom. Each floor tile has an area of 48 $in.^2$. If the bathroom has an area of 309676.8 cm^2, how many tiles are needed by the carpenter?

SOLUTION:

STEP 1 Identify the conversion factor to be used.

STEP 2 Express the conversion factor as a ratio, making sure that the unit of measure to be cancelled out is in the denominator.

STEP 3 Convert the area of each bathroom tile to square centimeters.

Compute how many tiles are needed to fill the bathroom floor.

STEP 4 Make your conclusion.

PROBLEM 2 A man wants to run his own bakery business . He needs a store with an area of at least 45 m^2. One day, he saw a sign which read "For rent: store space with a floor area of 450 $ft.^2$." Can the businessman start his bakery?

SOLUTION:

STEP 1 Identify the conversion factor to be used.

STEP 2 Express the conversion factor as a ratio with the unit to be cancelled out in the denominator.

STEP 3 Convert the unit of measurement.

STEP 4 Make your conclusion.

Compare your answers with those in the *Answer Key* on pages 36 and 37.

Let's See What You Have Learned

A. Match each object in Column A with the appropriate unit(s) of area in Column B.

	A		B
_____ 1.	lighter	a.	mm^2
_____ 2.	television set	b.	$ft.^2$
_____ 3.	beach resort	c.	ha
_____ 4.	matchbox	d.	cm^2
_____ 5.	food tray	e.	m^2
_____ 6.	farmland	f.	km^2
		g.	$in.^2$
		h.	dm^2

B. Solve the following problems.

1. A businessman needs at least 3 ha of land to start his poultry farm. His family owns a tract of land measuring 40000 m^2, which will be divided equally among him and his three brothers. Will the businessman be able to start his business?

2. A room has five windows. Each window has an area of 18 $ft.^2$. If the material for making curtains for the windows has an area of 10 m^2, is the material large enough to make curtains for all the windows?

Compare your answers with those in the *Answer Key* on pages 37 to 39. Did you get a perfect score? If you did, that's very good. If you did not, that's okay. Just review the parts of the lesson you did not understand very well before you move on to Lesson 2.

Let's Remember

- Area is the number of square units that is equal to the measure of a surface.
- The basic unit of area in the metric system is the square meter. A unit of area can be converted to another by looking at how they are related to each other.

Conversion of Units of Measurement of Area

1 square kilometer (km^2) = 1000000 square meters (m^2)

1 square kilometer (km^2) = 100 ha

1 hectare (ha) = 10000 square meters (m^2)

1 square meter (m^2) = 100 square decimeters (dm^2)

1 square decimeter (dm^2) = 100 square centimeters (cm^2)

1 square centimeter (cm^2) = 100 square millimeters (mm^2)

The following are units of area not commonly used:

1 square foot ($ft.^2$) = 144 square inches ($in.^2$)

1 square inch ($in.^2$) = 6.4516 square centimeters (cm^2)

1 square meter (m^2) = 9 square feet ($ft.^2$)

- In converting a given unit of measurement to another, always remember to do the following steps:
  - Identify the conversion factor from the table of units of measurement.
  - Express the conversion factor as a ratio such that the unit of measurement to be cancelled out is in the denominator.
  - Multiply the given unit of measurement by the conversion factor.

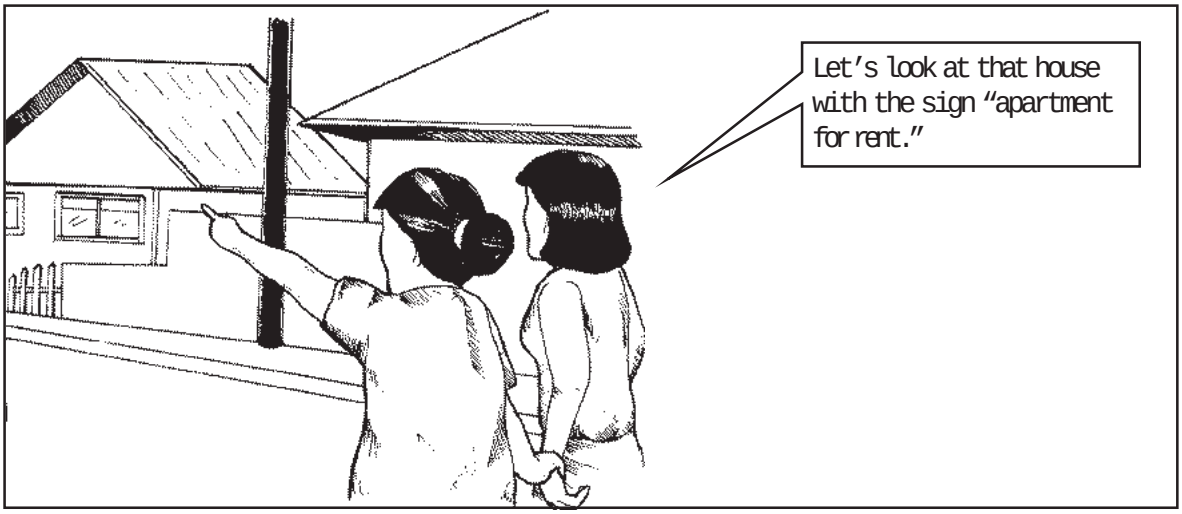
Planar Figures, Solids and Irregular Planar Figures

In computing the area, it is very important to identify the figure or object. There are three types of figures—planar figures, irregular planar figures and solids. The area of each type of figure is computed using a different formula.

After studying this lesson, you should be able to:

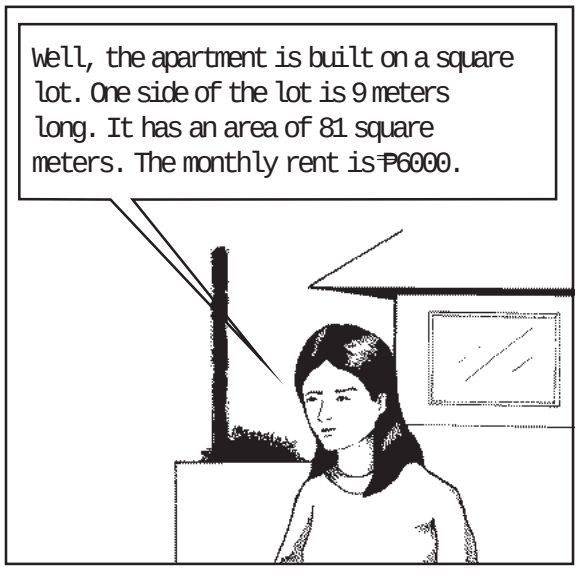
- identify different planar figures and irregular solids;
- use the appropriate formula in computing the area of planar figures, solids and irregular planar figures; and
- solve for the area of planar figures, irregular planar figures and solids.

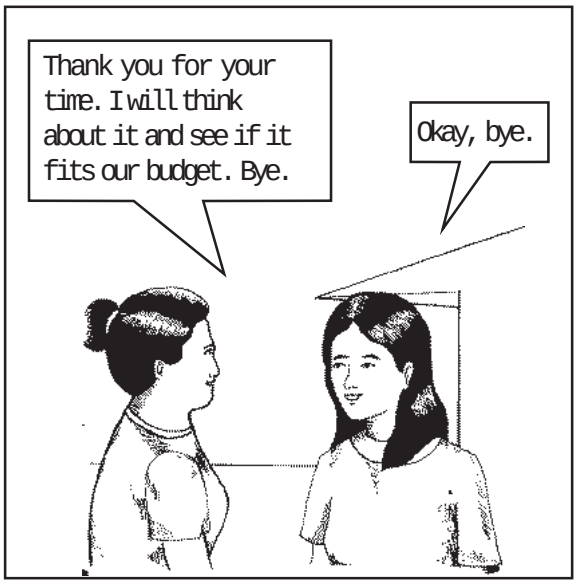
Let's Read




Glo, play with the other kids while I talk with the landlady.
Yes, 'Nay.


Good afternoon! I would like to know more about the apartment. What is the land area of the apartment and how much is the monthly rent?


Well, the apartment is built on a square lot. One side of the lot is 9 meters long. It has an area of 81 square meters. The monthly rent is ₱6000.


Thank you for your time. I will think about it and see if it fits our budget. Bye.
Okay, bye.


'Nay, I overheard your conversation with the landlady. 'Nay, what is the shape of the land and how did she solve for its area?

Let's Think About This

How do you think the landlady was able to compute the lot area?

_____

_____

_____

Compare your answer with that in the *Answer Key* on page 39.

Let's Learn

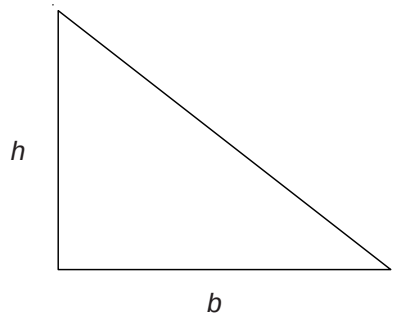
Area of a Planar Figure

Before solving for the area of a figure, it is important to know if the figure is a planar figure, a solid or an irregular planar figure. The areas of planar figures, solids and irregular planar figures are computed based on different formulas.

Planar figures have flat level surfaces. Planar figures include the square, rectangle, triangle, rhombus and circle. Irregular planar figures, on the other hand, are made up of planar figures. How about solid figures? A solid figure has thickness and is thus said to have three dimensions.

The following are the formulas for determining the area of different planar figures.

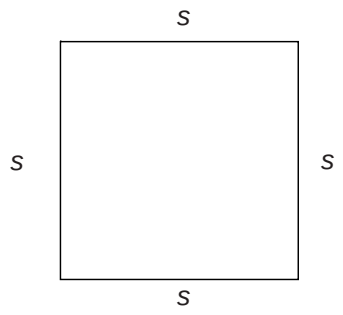
Triangle



$$\text{Area of a triangle} = \frac{(b \times h)}{2}$$

where:
b is the base of the triangle; and
h is the height of the triangle.

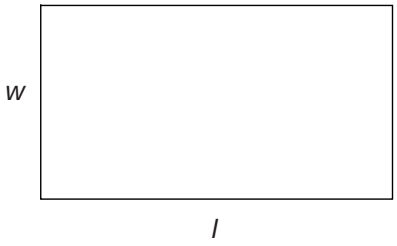
Square



$$\text{Area of a square} = s \times s = s^2$$

where:
s stands for the side of a square

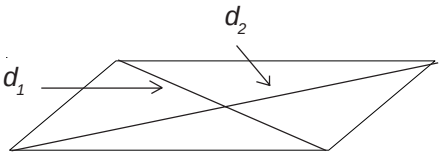
Rectangle



$$\text{Area of a rectangle} = l \times w$$

where:
l is the length or longer side of the rectangle; and
w is the width or the shorter side of the rectangle.

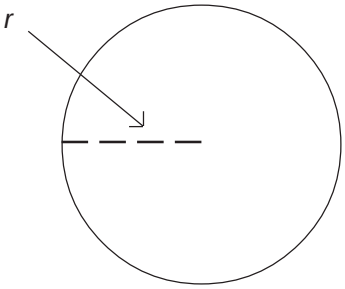
Rhombus



$$\text{Area of a rhombus} = \frac{d_1 \times d_2}{2}$$

where:
d_1 is the first diagonal of the rhombus; and
d_2 is the second diagonal of the rhombus.

Circle



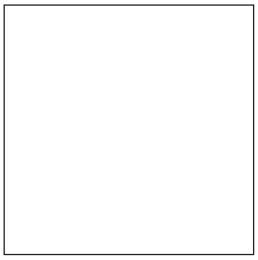
$$\text{Area of a circle} = \pi r^2$$

where:
r stands for the radius of the circle; and
$\pi = 3.14$.

Let's Try This

To understand better how to compute the area of planar figures, let's try solving problems using the appropriate formulas.

EXAMPLE 1 Look at the figure below.



A farmland shaped like the figure above measures 600 m on one side. If the recommended concentration of fertilizer to be used on the land is 30 kilograms (kg) per hectare, compute the total amount of fertilizer to be used.

SOLUTION:

After identifying the given facts and what is asked for in the problem, let's do the following steps:

STEP 1 Solve for the area of the farmland by using the formula:

$$\text{Area of a square} = s^2$$

Substituting the given value:

$$\begin{aligned} A &= (600\ \text{m})^2 \\ &= 600^2\ \text{m}^2 \\ &= 360000\ \text{m}^2 \end{aligned}$$

STEP 2 Convert 360000 m^2 to hectares by identifying the conversion factor:

$$1\,\text{ha} = 10000\,\text{m}^2$$

STEP 3 Express the conversion factor as a ratio such that the unit to be cancelled out is in the denominator.

$$\frac{1\,\text{ha}}{10000\,\text{m}^2}$$

STEP 4 Multiply 360000 m^2 by the conversion factor in ratio form.

$$\overset{36}{\cancel{36000\,\text{m}^2}} \times \frac{1\,\text{ha}}{\cancel{10000\,\text{m}^2}} = 36\,\text{ha}$$

STEP 5 Compute the amount of fertilizer to be used if the amount needed is 30 kg per hectare.

$$36\,\cancel{\text{ha}} \times \frac{30\,\text{kg}}{1\,\cancel{\text{ha}}} = 1080\,\text{kg of fertilizer}$$

EXAMPLE 2 Look at the figure below.

A rice field shaped like the figure above has a length of 4000 m and a width of 1000 m. If the recommended number of seedlings to be planted per hectare is 10000, what is the number of seedlings needed to plant the whole area?

After identifying the given facts and what is asked for in the problem, let's do the following steps:

STEP 1 Compute the area of the rice field by using the formula:

$$\text{Area of a rectangle} = l \times w$$

Substituting the values:

$$A = 4000\ \text{m} \times 1000\ \text{m}$$
$$= 4000000\ \text{m}^2$$

STEP 2 Convert 4000000 m^2 to hectares by using the conversion factor:

$$1\ \text{ha} = 10000\ \text{m}^2$$

STEP 3 Express the conversion factor as a ratio such that the unit to be cancelled out is in the denominator.

$$\frac{1\ \text{ha}}{10000\ \text{m}^2}$$

STEP 4 Multiply 4000000 m^2 by the conversion factor in ratio form.

$$\overset{400}{\cancel{4000000\ \text{m}^2}} \times \frac{1\ \text{ha}}{\cancel{10000\ \text{m}^2}} = 400\ \text{ha}$$

Therefore, 4000000 m^2 = 400 ha

STEP 5 Compute the total number of seedlings needed to plant the whole area given the ratio:

$$\frac{10000\ \text{seedlings}}{1\ \text{ha}}$$

$$400\ \cancel{\text{ha}} \times \frac{10000\ \text{seedlings}}{1\ \cancel{\text{ha}}} = 4000000\ \text{seedlings}$$

EXAMPLE 3 A triangular piece of plyboard has a base of 42 inches and a height of 56 inches. What is its area?

SOLUTION:

After identifying the given facts and what is asked for in the problem, let's do the following steps:

STEP 1 Identify the formula for finding the area.

$$\text{Area of a triangle} = \frac{b \times h}{2}$$

STEP 2 Substituting the values in the formula:

$$A = \frac{42\text{ in.} \times 56\text{ in.}}{2}$$

STEP 3 Compute the area of the triangle. (You may use a calculator if you have one.)

$$A = \frac{2.352\text{ in.}^2}{2}$$
$$= 1176\text{ in.}^2$$

EXAMPLE 4 A circular cake has a radius of 6 in. What is its area?

SOLUTION:

After identifying the given facts and what is asked for in the problem, do the following steps:

STEP 1 Identify the formula for finding the area.

$$\text{Area of a circle} = \pi r^2$$

STEP 2 Substituting the values in the formula:

$$\text{Area of a circle} = 3.14\left(6\text{ in.}\right)^2$$

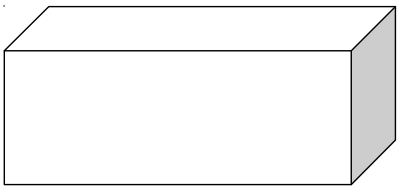
STEP 3 Compute the area of the cake.

$$A = 3.14\left(36\text{ in.}^2\right)$$
$$= 113.04\text{ in.}^2$$

Let's Learn

Surface Area of a Solid

There is a need to know how to compute the surface area of the following solids so we will know, for instance, the size of gift wrapper needed for a rectangular box or a cube. If we want to make a cylindrical tin can, we will need to know how many sheets of tin are needed to make a particular size of tin can.



Rectangular solid

$SA = 2[(w \times h) + (h \times l) + (l \times w)]$

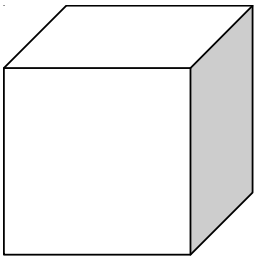
where:

SA is the surface area;

h is the height;

w is the width; and

l is the length.



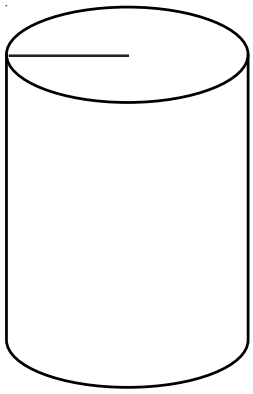
cube

$SA = 6e^2$

where:

6 is the number of faces; and

e is the edge.



Cylinder

$SA = 2\pi r^2 + 2\pi rh$

where:

$\pi = 3.14$;

r is the radius; and

h is the height.

and where:

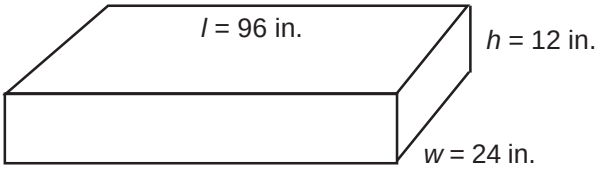
$2\pi r^2$ is the area of the top and the base; and

$2\pi rh$ is the area of the body of the cylinder.

Let's Try This

To further understand how to compute the area of a solid, study the following examples. Read and study the problems carefully.

EXAMPLE 1 Look at the illustration.



A carpenter was asked to build a box with an area of not more than 7500 in.^{2}. The box he built has a length of 96 in., a height of 12 in. and a width of 24 in. Is the area of the box not more than 7500 in.^{2}?

SOLUTION:

After identifying the given facts and what is asked for in the problem, let's do the following steps:

STEP 1 Identify the formula for finding for the surface area of a rectangular solid.

$$SA = 2[(w\times h)+(h\times l)+(l\times w)]$$

where: w is the width;
h is the height; and
l is the length.

STEP 2 Substitute the given values :

$$SA = 2[(24\,\text{in.}\times 12\,\text{in.})+(12\,\text{in.}\times 96\,\text{in.})+(96\,\text{in.}\times 24\,\text{ir}$$

STEP 3 Compute the area by performing the indicated operations:

$$\begin{aligned} A &= 2\left[\left(288\,\text{in.}^2\right)+\left(1152\,\text{in.}^2\right)+\left(2304\,\text{in.}^2\right)\right] \\ &= 2\left[3744\,\text{in.}^2\right] \\ &= 7488\,\text{in.}^2 \end{aligned}$$

STEP 4 The box has an area of less than 7500 in.^{2} because its area is only 7488 in.^{2}.

EXAMPLE 2 A sheet of gift wrapper has an area of 864 in.^{2}. How many sheets are needed to wrap a square box with an edge of 20 in.?

SOLUTION:

After identifying the given facts and what is asked for in the problem, do the following steps:

STEP 1 Identify the formula to be used.

$$\text{Surface area of a cube} = 6e^2$$

STEP 2 Substitute the given values in the formula.

$$SA = 6(20 \text{ in.})^2$$

STEP 3 Compute the area:

$$SA = 6\left(400 \text{ in.}^2\right)$$
$$= 2400 \text{ in.}^2$$

STEP 4 Compute how many sheets of gift wrapper are needed to wrap the square box by multiplying the surface area of the box by the ratio of 1 sheet of gift wrapper to the area of the wrapper.

$$2400 \cancel{\text{in.}^2} \times \frac{1 \text{ sheet of gift wrapper}}{864 \cancel{\text{in.}^2}} = 2.77 \text{ or } 3 \text{ sheets}$$

EXAMPLE 3 A sealed cylindrical water tank in a subdivision is made of concrete. Its outer radius is 3.2 m and its height is 8 m. If the tank is painted on the exterior, what is the total surface area to be painted?

SOLUTION:

After identifying the given facts and what is asked for in the problem, do the following steps:

STEP 1 Identify the formula to be used.

$$\text{Surface area of a cylinder} = 2\pi r^2 + 2\pi rh$$

STEP 2 Substitute the given values in the formula.

$$SA = 2(3.14)(3.2 \text{ m})^2 + 2(3.14)(3.2 \text{ m})(8 \text{ m})$$

STEP 3 Compute the surface area.

$$SA = 2(3.14)(10.24 \text{ m}^2) + 2(8.384 \text{ m}^2)$$
$$= 2(32.15 \text{ m}^2) + 160.768 \text{ m}^2$$
$$= 64.3 \text{ m}^2 + 160.768 \text{ m}^2$$
$$= 225.268 \text{ m}^2$$

STEP 4 The total surface area to be painted is 225.3 m^2.

Let's Learn

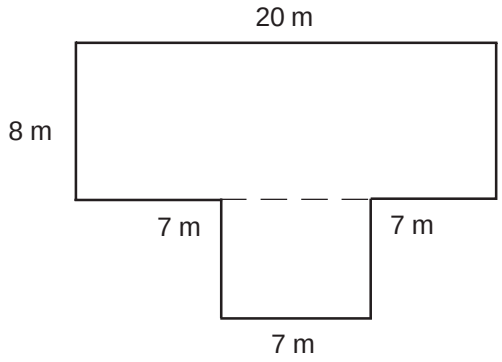
Area of an Irregular Planar Figure

Do you have an idea how the area of an irregular planar figure is determined? As we have already discussed earlier, irregular planar figures are made up of planar figures.

To solve for the area of an irregular planar figure, divide the figure into regular planar figures (rectangles, squares, rhombuses or triangles). Solve for the area of each planar figure and add up all the areas to get the area of the irregular planar figure.

To further understand how to compute the area of an irregular planar figure, study the following example.

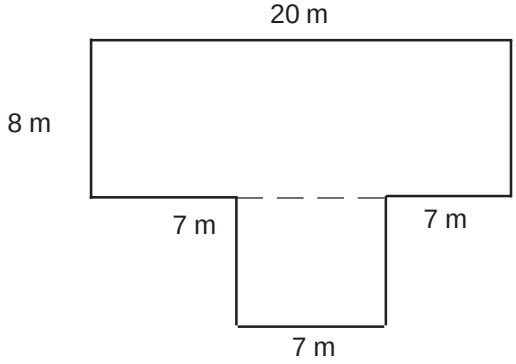
EXAMPLE 1 Look at the picture below:



A farmer wanted to plant camote in his backyard. He needs to use at least 200 m^2 for his garden to gain profit. His backyard is shaped like the figure above. Will he gain profit if he uses his backyard as his garden?

SOLUTION:

STEP 1 Divide the irregular planar figure into regular planar figures. The figure can be divided into two. The first figure, a rectangle, is named F_1 and the second figure, a square, F_2.



STEP 2 Solve for the area of each separate figure. F_1 is a rectangle, right? The formula for finding its area is $l \times w$. Look at F_2. It is a square, right? The formula for finding its area is $A = s^2$.

$$\begin{aligned}\text{Area of } F_1 &= l \times \text{w} \\ &= 20\,\text{m} \times 8\,\text{m} \\ &= 160\,\text{m}^2 \\ \text{Area of } F_2 &= s^2 \\ &= (7\,\text{m})^2 \\ &= 49\,\text{m}^2\end{aligned}$$

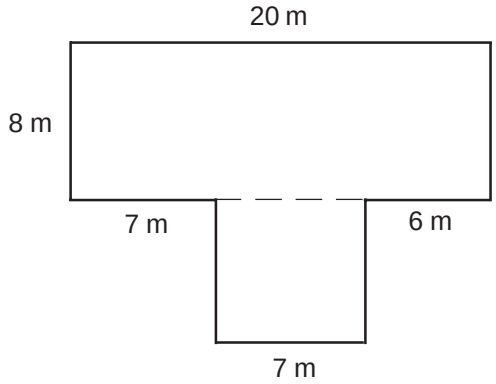
STEP 3 Add the areas of the two figures to get the area of the irregular planar figure.

Area of F_1 + Area of F_2 = 160 m^2 + 49 m^2 = 209 m^2

STEP 4 The farmer will not gain profit because the total area of his backyard is only 209 m^2.

Let's Try This

You can solve the problem in the preceding section using another mehtod. Try to figure out what it is. Do the following steps.



SOLUTION:

After identifying the given facts and what is asked for in the problem, do the following steps:

STEP 1 Figure out how you will divide the irregular planar figure so that you will have 3 regular planar figures, namely F_1, F_2 and F_3.

_____

STEP 2 What formula will you use to solve for the respective areas of F_1, F_2 and F_3?

_____

STEP 3 Solve.

STEP 4 Make your conclusion.

Compare your answers with those in the *Answer Key* on pages 39 and 40.

Let's See What You Have Learned

A. Identify each of the following figures and write the appropriate formula for finding its area.

1. 

Figure: _____

Formula: _____

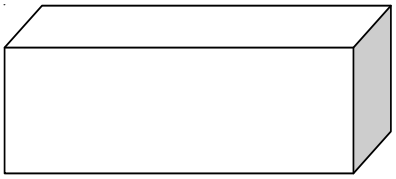
2. 

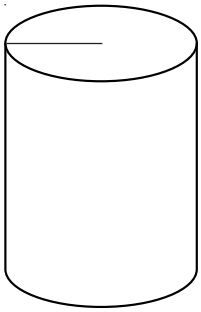
Figure: _____

Formula: _____

B. Solve the following problems.

1. A square room has an area of 36 m^2. A floor tile has a length of 16 in. and a width of 9 in. How many tiles are needed to cover the floor?

2. Look at the figure below:



What is the surface area of the tank if its radius is 5 ft. and its height is 20 ft.?

Compare your answers with those in the *Answer Key* on pages 40 and 41. Did you get a perfect score? If you did, that's very good. If you did not, that's okay. Just review the parts of the lesson you did not understand very well before you proceed to the next part of the module.

Let's Remember

- In solving for the area of a planar figure, the following formulas are used.
  - Area of a triangle = $\frac{b \times h}{2}$

    where b = base of the triangle; and

    h = height of the triangle.
  - Area of a square = s^2

    where s = side of the square
  - Area of a rectangle = $l \times w$

    where l = length of the longer side; and

    w = length of the shorter side.
  - Area of a rhombus = $\frac{d_1 \times d_2}{2}$

    where d_1 = first diagonal of the rhombus; and

    d_2 = second diagonal of the rhombus.
  - Area of a circle = πr^2

    where r = radius of the circle; and

    π = 3.14.
- When solving for the surface area of a solid, use the following formulas.
  - Surface area of a rectangular solid = $2[(w \times h) + (h \times l) + (l \times w)]$

    where w = width;

    h = height; and

    l = length.

— Surface area of a cylinder = $2\pi r^2 + 2\pi rh$

where $\pi = 3.14$

r = radius; and

h = height.

— Surface area of a cube = $6e^2$

where e = edge of the cube

♦ In solving for the area of an irregular planar figure, divide the figure into regular planar figures such as rectangles, squares or triangles. Solve for the area of each regular planar figure and add all the areas to get the total area of the irregular planar figure.

You have now reached the end of the module. Congratulations! Did you enjoy studying this module? Did you learn a lot from it? The following is a summary of its main points to help you remember them better.

Let's Sum Up

♦ Area is the number of square units equal to the measure of a surface.

♦ The standard unit of area in the metric system is the square meter.

♦ The following formulas are used in finding the area of planar figures.

— Area of a triangle = $\frac{b \times h}{2}$

where b = base of the triangle; and

h = height of the triangle.

— Area of a square = s^2

where s = side of the square

— Area of a rectangle = $l \times w$

where l = length of the longer side; and

w = length of the shorter side.

— Area of a rhombus = $\frac{d_1 \times d_2}{2}$

where d_1 = first diagonal of the rhombus; and

d_2 = second diagonal of the rhombus.

— Area of a circle = πr^2

where r = radius of the circle; and

$\pi = 3.14$

♦ When solving for the surface area of a solid, use the following formulas.

— Surface area of a rectangular solid = $2[(w \times h) + (h \times l) + (l \times w)]$

where w = width;

h = height; and

l = length.

— Surface area of a cylinder = $2\pi r^2 + 2\pi rh$

where $\pi = 3.14$;

r = radius; and

h = height.

— Surface area of a cube = $6\ e^2$

where e = edge of the cube

♦ In solving for the area of an irregular planar figure, divide the figure into regular planar figures. Get the area of each planar figure and add the areas to get the area of the irregular figure.

What Have You Learned?

A. Match each item in Column A with the appropriate unit(s) of area in Column B.

A		B	
_____ 1.	book	a.	mm^2
_____ 2.	floor area of a house	b.	$ft.^2$
_____ 3.	region	c.	ha
_____ 4.	paper	d.	cm^2
_____ 5.	country	e.	m^2
		f.	km^2
		g.	$in.^2$
		h.	dm^2

B. Identify each of the following figures and write the appropriate formula for finding its area.

1.

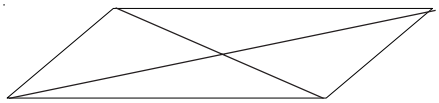


Figure: _____

Formula: _____

2.

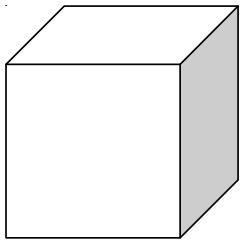


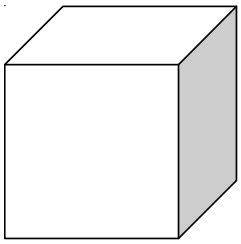
Figure: _____

Formula:_____

C. Solve the following problems.

1. A bathroom measures 2.5 m by 1.8 m. How many tiles are needed for the bathroom floor if each of the tiles to be used has an area of 1 dm^2?

2. Look at the figure below.



A man works for a company that makes objects out of clay. He was asked by his employer to make a clay box like the figure above. His employer said that the object should have an area of 6 ft.^{2}. What should be the measurement of each side of the figure?

Compare your answers with those in the *Answer Key* on pages 41 to 43. If you got a score of:

0–5 You should study the whole module again.

6–8 Good! Just review the parts of the module you did not understand very well.

9–10 Very good! You are now ready for the next module.

Answer Key

A. Let's See What You Already Know *(pages 2–4)*

A. 1. shoe box

Possible answers are **a, d, g** and **h** because of the small size of the object.

2. small tract of land

Possible answers are **b** and **e.** Land area is usually measured in square feet and square meters for small tracts of land.

3. beach

Possible answers are **c** and **f** because the areas of larger tracts of land are measured in larger units such as hectares and square kilometers.

4. small floor tile

Possible answers are **a, d, g** and **h.** Because of the small size of the object, its area can be measured in square millimeters, square centimeters, square inches and square decimeters.

5. bus

Possible answers are **b** and **e.** The area of large vehicles like buses is measured in square feet and square meters.

6. province

The possible answers are **c** and **f.** Provinces tend to be large thus their area is measured in hectares and square kilometers.

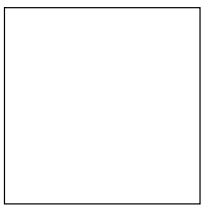
B. 1. 

Figure: square

Formula: $A = s^2$

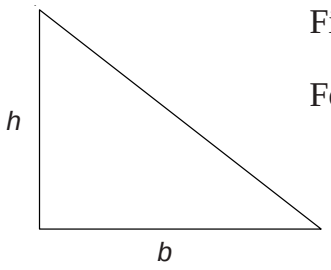
2. 

Figure: triangle

Formula: $A = \frac{(b \times h)}{2}$

C. 1. After identifying the given facts and what is asked for in the problem, do the following steps:

STEP 1 Convert 555 m^2 to square feet by:

$$1\ m^2 = 9\ ft.^2$$

STEP 2 Express the conversion factor as a ratio where the unit of measure to be cancelled out is the denominator.

$$\frac{9\ ft.}{1\ m^2}$$

STEP 3 Multiply 555 m^2 by the conversion factor in ratio form:

$$555\ \cancel{m^2} \times \frac{9\ ft.^2}{1\ \cancel{m^2}} = 4995\ ft.^2$$

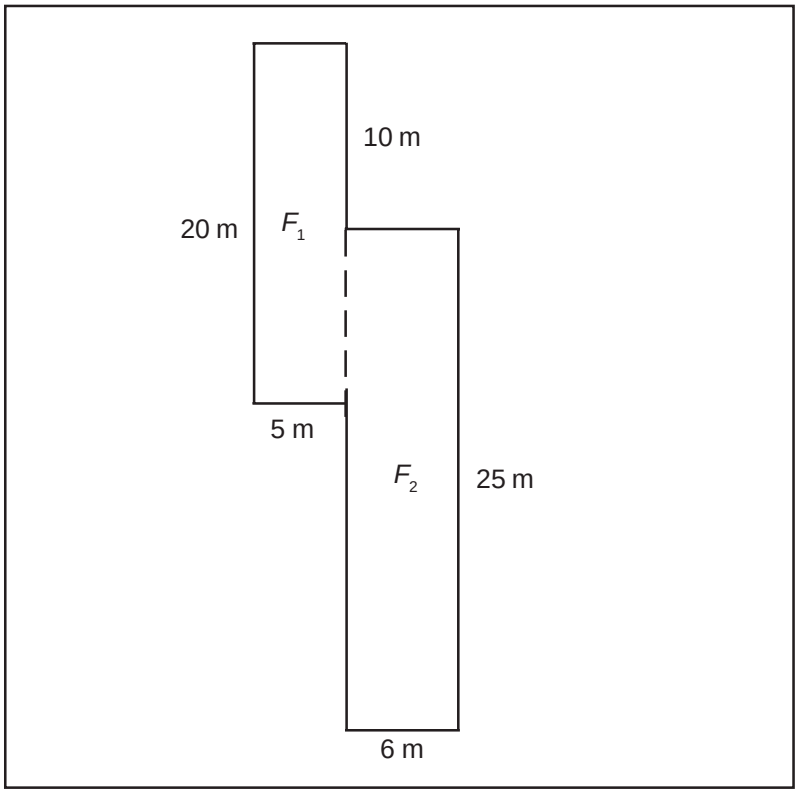
Multiply the total land area by the amount of tax to be paid per square foot.

$$4995\ \cancel{ft.^2} \times \frac{₱\ 2}{1\ \cancel{ft.^2}} = ₱\ 9990$$

STEP 4 The amount of real estate tax the businessman has to pay is ₱9990.00.

2. After identifying the given facts and what is asked for in the problem, do the following steps:

STEP 1 Divide the irregular planar figure into regular planar figures. The figure can be divided into two rectangles. The first rectangle is named F_1 and the second rectangle, F_2.



STEP 2 Solve for the area of each regular figure. F_1 and F_2 are both rectangles, so their area can be computed by multiplying the length by the width.

$$\begin{aligned}\text{Area of } F_1 &= 20 \text{ m} \times 5 \text{ m} \\ &= 100 \text{ m}^2 \\ \text{Area of } F_2 &= 25 \text{ m} \times 6 \text{ m} \\ &= 150 \text{ m}^2\end{aligned}$$

STEP 3 Add the areas of the two figures to get the area of the irregular planar figure.

$$\begin{aligned}\text{Area of } F_1 + \text{ Area of } F_2 &= 100 \text{ m}^2 + 150 \text{ m}^2 \\ &= 250 \text{ m}^2\end{aligned}$$

STEP 4 The businessman's fishpond will be profitable because its area measures more than 200 m^2.

B. Lesson 1

Let's Think About This (page 7)

1. Area is the number of square units equal in measure to a surface.

2. Answers will vary. The following is a sample answer.

   If we say the area of a rice field is 1400 square meters it means that it would take 1400 squares, each measuring 1 meter on a side, to cover the whole surface of the rice field.

Let's Try This (pages 10–11)

PROBLEM 1 **SOLUTION:**

After identifying the given facts and what is asked for in the problem, do the following steps:

STEP 1 Identify the conversion factor to be used.

$$1\,\text{in.}^2 = 6.4516\,\text{cm}^2$$

STEP 2 Express the conversion factor as a ratio.

$$\frac{6.4516\,\text{cm}^2}{1\,\text{in.}^2}$$

STEP 3 Convert the area of each bathroom tile to square centimeters.

$$48\,\cancel{\text{in.}^2} \times \frac{6.4516\,\text{cm}^2}{1\,\cancel{\text{in.}^2}} = 309.6768\,\text{cm}^2$$

Compute how many tiles are needed to cover the bathroom floor.

$$3096768\,\cancel{\text{cm}^2} \times \frac{1\,\text{tile}}{309.6768\,\cancel{\text{cm}^2}} = 1000\,\text{tiles}$$

STEP 4 It will take 1000 tiles to cover the bathroom floor.

PROBLEM 2 SOLUTION:

After identifying the given facts and what is asked for in the problem, do the following steps:

STEP 1 Identify the conversion factor to be used.

$$1\,\text{m}^2 = 9\,\text{ft.}^2$$

STEP 2 Express the conversion factor as a ratio.

$$\frac{1\,\text{m}^2}{9\,\text{ft.}^2}$$

STEP 3 Convert the unit of measurement.

$$450\,\cancel{\text{ft.}^2} \times \frac{1\,\text{m}^2}{9\,\cancel{\text{ft.}^2}} = 50\,\text{m}^2$$

STEP 4 Yes, the businessman can start his bakery because the store space available is more than 45 m^2.

Let's See What You Have Learned (pages 11–12)

A. 1. lighter

Possible answers are **a, d, g** and **h.** A lighter is very small hence its area is measured in square millimeters, square centimeters, square inches and square decimeters.

2. television set

Possible answers are **b** and **e.** A television needs to be measured in larger units, hence the appropriate units of area are square feet and square inches.

3. beach resort

Possible answers are **c** and **f.** A beach resort has a large ara, which is best measured in hectares and square kilometers.

4. matchbox

Possible answers are **a, d** and **g.** A matchbox is small and its area can be measured in square millimeters, square centimeters and square inches.

5. food tray

Possible answers are **a, d, g** and **h.** The area of a tray can be measured in square millimeters, square centimeters, square inches and square diameters.

6. farmland

Possible answers are **c** and **f.** The area of a farmland is expected to be large and is thus measured in hectares and square kilometers.

B. 1. **SOLUTION :**

STEP 1 Identify the conversion factor to be used.

$$1\,\text{ha} = 10000\,\text{m}^2$$

STEP 2 Express the conversion factor as a ratio.

$$\frac{1\,\text{ha}}{10000\,\text{m}^2}$$

STEP 3 Convert the unit of measurement.

$$40000\,\cancel{\text{m}^2} \times \frac{1\,\text{ha}}{10000\,\cancel{\text{m}^2}} = 4\,\text{ha}$$

Compute the share of each of the four brohters if the land is divided equally among them.

$$\frac{4\,\text{hectares}}{4\,\text{brothers}} = \frac{1\,\text{ha}}{1\,\text{brothers}}$$

STEP 4 The businessman cannot start his business. He needs at least 3 ha of land but his share of the land is only 1 ha.

2. **SOLUTION:**

STEP 1 Identify the conversion factor to be used.

$$1\,\text{m}^2 = 9\,\text{ft.}^2$$

STEP 2 Express the conversion factor as a ratio.

$$\frac{9\,\text{ft.}^2}{1\,\text{m}^2}$$

STEP 3 To get the total area needed to make curtains for all the windows, multiply the area of each window by the number of windows. Compute the total area of the 5 windows.

$$18\,\text{ft.}^2 \times 5 = 90\,\text{ft.}^2$$

Convert the unit of measurement from square meters to square feet.

$$10\,\text{m}^2 \times \frac{9\,\text{ft.}^2}{1\,\text{m}^2} = 90\,\text{ft.}^2$$

Compare the total area of the 5 windows and the area of the material for the curtains.

$$90\,\text{ft.}^2 = 90\,\text{ft.}^2$$

STEP 4 The material for the curtains of the 5 windows is not enough. There should be allowance for pleats.

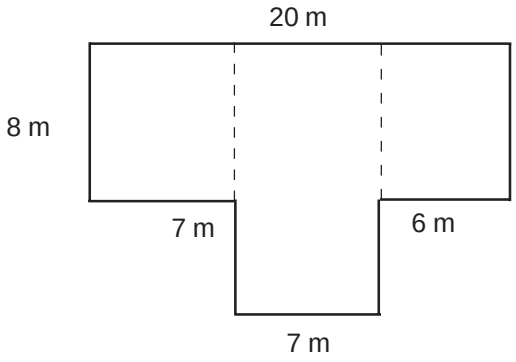
C. Lesson 2

Let's Think About This (page 16)

1. The land is square with each side measuring 9 meters long. The area of a square is computed by getting the square of its side. Therefore, the area of the lot = $(9\text{ m})^2 = 81\text{ m}^2$.

Let's Try This (pages 25–26)

STEP 1 Divide the irregular planar figure into three rectangles. The first figure is named F_1, the second figure, F_2; and the third figure, F_3.



STEP 2 Since all the 3 figures are rectangles, the formula to be used is:

$$A = l \times w$$

Solve for the area by substituting the given values in the formula:

$$A \text{ of } F_1 = 8\,\text{m} \times 7\,\text{m} = 56\,\text{m}^2$$
$$A \text{ of } F_2 = 15\,\text{m} \times 7\,\text{m} = 105\,\text{m}^2$$
$$A \text{ of } F_3 = 6\,\text{m} \times 8\,\text{m} = 48\,\text{m}^2$$

STEP 3 Add the areas of the 3 figures to get the total area of the irregular planar figure:

$$\begin{aligned}\text{Total area} &= A \text{ of } F_1 + A \text{ of } F_2 + A \text{ of } F_3 \\ &= 56\,\text{m}^2 + 105\,\text{m}^2 + 48\,\text{m}^2 \\ &= 209\,\text{m}^2\end{aligned}$$

STEP 4 The total area of the irregular planar figure is 209 m^2.

Let's See What You Have Learned (pages 26 –27)

A. 1.

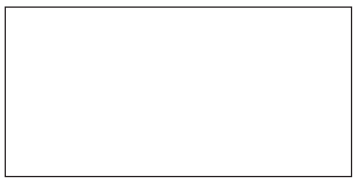


Figure : rectangle

Formula: $A = l \times w$

2.

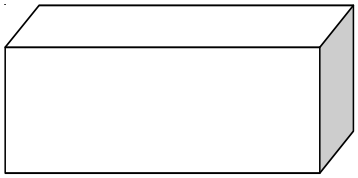


Figure: rectangular solid

Formula:

A = 2 [$(w \times h) + (h \times l) + (l \times w)$]

B. 1. **STEP 1** Compute the area of each floor tile by using the formula:

Area of a rectangle = $l \times w$

$$A = 16 \text{ in.} \times 9 \text{ in.} = 144 \text{ in.}^2$$

STEP 2 First, convert 36 m^2 to square feet because there's no direct conversion from square meters to square inches. Use the conversion factor:

$$\frac{9\,\text{ft}^2}{1\,\text{m}^2}$$

Thus we have:

$$36\,\cancel{\text{m}^2} \times \frac{9\,\text{ft.}^2}{1\,\cancel{\text{m}^2}} = 324\,\text{ft.}^2$$

Therefore, 36 m^2 = 324 $ft.^2$

STEP 3 Convert 324 ft.^{2} to square inches using the conversion factor
1 ft.^{2} = 144 in.^{2} expressed as a ratio:

$$\frac{144\,\text{in.}^2}{1\,\text{ft.}^2}$$

Thus we have:

$$324\,\text{ft.}^2 \times \frac{144\,\text{in.}^2}{1\,\text{ft.}^2} = 46656\,\text{in.}^2$$

The total area of the room to be covered with tiles is 46656 in.^{2}.

STEP 4 To get the number of floor tiles needed to cover the floor of the room, multiply the area of the room (46656 in.^{2}) by the ratio of one floor tile to its area (144 in.^{2}).

$$46{,}656\,\text{in}^2 \times \frac{1\,\text{floor tile}}{144\,\text{in}^2} = 324\,\text{floor tiles}$$

STEP 5 324 tiles are needed to cover the floor.

2. **STEP 1** Compute the surface area of the cylinder by using the formula:

$$SA = 2\pi r^2 + 2\pi rh$$

STEP 2 Substitute the given values in the formula:

$$\begin{aligned} SA &= 2\times 3.14\times(5\,\text{ft})^2 + (2\times 3.14\times 5\,\text{ft.}\times 20\,\text{ft.}) \\ &= 2\times 3.14\times 25\,\text{ft.}^2 + 628\,\text{ft.}^2 \\ &= 157\,\text{ft.}^2 + 628\,\text{ft.}^2 \\ &= 785\,\text{ft.}^2 \end{aligned}$$

D. What Have You Learned? *(pages 31–32)*

A. 1. book

Possible answers are **a, d, g** and **h.** The area of a book is best measured in square millimeters, square centimeters, square inches and square decimeters.

2. floor area of a house

Possible answers are **b** and **e.** The floor area of a house is usually measured in square feet and square meters.

3. region

   Possible answers are **c** and **f.** A region has a large area and that is best measured in hectares and square kilometers.

4. paper

   Possible answers are **a, d, g** and **h.** Paper has a small area that is usually measured in square millimeters, square centimeters, square inches and a square decimeters.

5. country

   Possible answers are **c** and **f.** The area of a country is very large and is thus measured in hectares and square kilometers.

B. 1.

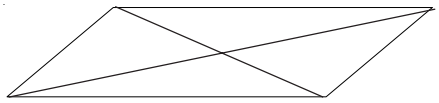


Figure: rhombus

Formula: $A = \frac{d_1 \times d_2}{2}$

2.

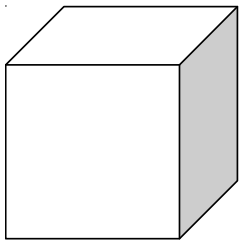


Figure : cube

Formula: $A = e^2$

C. **STEP 1** Since the bathroom is a rectangle, you will use the formula for finding the area of rectangle:

$$A = l \times w$$

STEP 2 Substitute the given values in the formula and compute.

$$A = 2.5\ \text{m} \times 1.8\,\text{m}$$
$$= 4.5\,\text{m}^2$$

STEP 3 Convert the unit of measurement.

Identify the conversion factor.

$$1\,\text{m}^2 = 100\ \text{dm}^2$$

Express the conversion factor as a ratio in such a way that the unit of measure to be cancelled out is in the denominator.

$$\frac{100\,\text{dm}^2}{1\,\text{m}^2}$$

Multiply 4.5 m^2 by $\frac{100\,\text{dm}^2}{1\,\text{m}^2}$.

$$4.5\,\cancel{\text{m}^2} \times \frac{100\,\text{dm}^2}{1\,\cancel{\text{m}^2}} = 450\,\text{dm}^2$$

STEP 4 Compute the total number of tiles needed to cover the bathroom floor.

$$450\,\cancel{\text{dm}^2} \times \frac{1\,\text{tile}}{1\,\cancel{\text{dm}^2}} = 450\,\text{tiles}$$

STEP 5 450 tiles are needed to cover the bathroom floor.

2. **STEP 1** Compute the unknown measurement of the side of the cube by using the formula:

$$SA = 6e^2$$

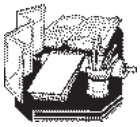
STEP 2 Substitute the given values in the formula.

$$6\ \text{ft.}^2 = 6e^2$$

STEP 3 Divide both sides of the equation by 6.

$$\frac{6\,\text{ft.}^2}{6} = \frac{6e^2}{6}$$
$$e^2 = 1\,\text{ft.}^2$$
$$\sqrt{e^2} = \sqrt{1\,\text{ft.}^2}$$
$$e = 1\,\text{ft.}$$

STEP 4 Each side of the cube measures 1 ft.



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Manura, David. (1995–2001) *Math 2. Org.* <www.sisweb.com/math/geometry/areasvols.htm.> June 30, 2001, date accessed.