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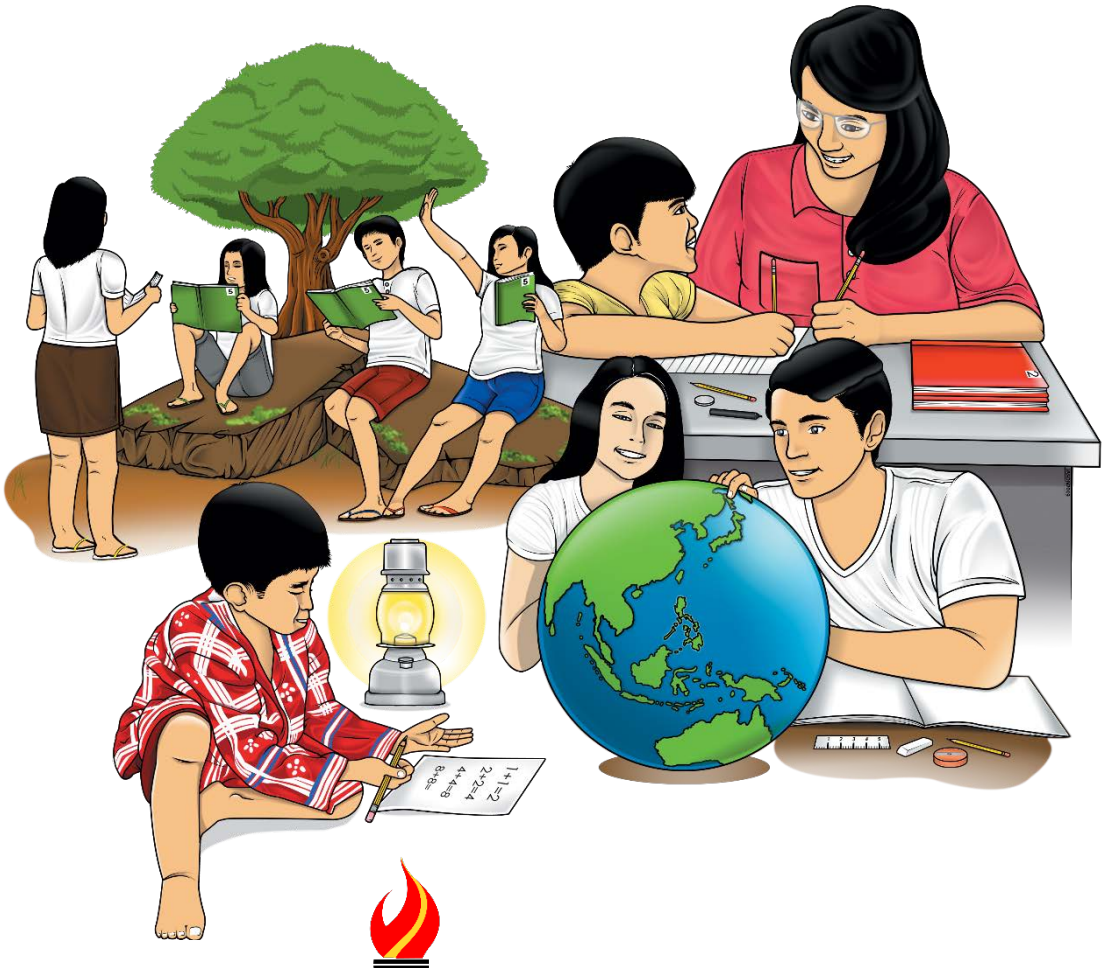
Mathematics

Quarter 4 – Module 3:
Solving Routine and Non-routine Problems Involving Areas of Plane Figures



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Secretary: Leonor Magtolis Briones
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Development Team of the Module

Writer : Nancy D. Fara-on
Editor : Elena D. Hubilla
Reviewer : Loyd H. Botor
Illustrator : Ireneo D. Dechavez
Layout Artist : Joan T. Briz
Management Team:
Gilbert T. Sadsad
Francisco B. Bulalacao Jr.
Grace U. Rabelas
Ma Leilani R. Lorico
Monserat D. Guemo
Florena M. Deuna

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Department of Education – Region V (Bicol)

Office Address: Regional Center Site, Rawis, Legazpi City 4500
Telefax: 0917-178-1288
E-mail Address: region5@deped.gov.ph

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Mathematics

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Solving Routine and Non-routine Problems Involving Areas of Plane Figures

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

In previous modules, we learned how to obtain the perimeter and area of plane figures. Now we will apply our knowledge and skills on finding the areas of plane figures to solve problems in real-world situations.

After going through this module, you are expected to solve routine and non-routine problems involving finding the areas of squares, rectangles, triangles, parallelograms, and trapezoids.

What I Know

A. Read the problem carefully, then answer the questions that follow. Choose the letter of your answer from the given choices inside the box.

A rose garden inside a park has the shape of a trapezoid. Its bases are 30 meters and 24 meters. The perpendicular distance between these bases is 16 meters. What is the area of the garden?

1. What is asked in the problem?
2. What facts are given?
3. What possible equation may help solve the problem?
4. How is the solution done?
5. What is the complete/final answer?

a. bases: 30 meters and 24 meters, height: 16 meters
b. 342 sq. m
c. A = $\frac{(b_1+b_2)\text{ x h}}{2}$
d. The perimeter of the garden
e. 432 sq. m
f. The area of the garden
g. Add the 2 bases, multiply the sum by its height, then divide the product by 2.

B. Analyze the problems, then solve.

A rectangular swimming pool measures 18 m by 9 m. A 2-meter-wide path around the pool is paved with concrete.

6. What is the area of the path?
7. What is the area of the swimming pool?

A rectangular grass lawn is 24 m long and 18 m wide. At each corner of the lawn are square flower boxes whose side is 3 m each.

8. What area of the lawn is covered by grass?
9. What is the total area of the four flower boxes?

10. Five small squares are put together to form a cross without overlap.

If a side of each square is 9 cm, what is the area of the cross?

Are you done answering?
If yes, time to check. Please go to page 15 for the ***Answer Key***.

CONGRATULATIONS! If you got a score of 9 or 10, you should not have any difficulty studying the lesson in this module.

If you got a score of 8 or below, you may need to study the lesson more carefully and do all the given activities.

What's In

Match each question card in column A with its corresponding answer in column B.

A	B
1. What is the formula for finding the area of a trapezoid?	a. 81 m^2
2. What is the formula for finding the area of a parallelogram?	b. $A = \frac{b \times h}{2}$
3. What is the area of a square whose side is 9 m long?	c. 120 cm^2
4. What is the formula for finding the area of a triangle?	d. $A = \frac{(b_1+b_2) \times h}{2}$
5. What is the area of the rectangle whose length (l) = 15 cm and width (w) = 8 cm?	e. A = b x h

Are you done answering?
If yes, time to check. Please go to page 15 for the ***Answer Key***.

What's New

Read and analyze the problem.

Carlos wants to cover their backyard with Bermuda grass to prevent soil erosion and preserve the topsoil. The backyard is in the shape of a parallelogram with a base of 11 meters and a height of 9 meters.

How many square meters of Bermuda grass are needed to cover the backyard?

How are we going to solve this problem?

What is It

The problem given is an example of a routine problem.

To solve it, we use the 4-step plan.

1. Understand the problem.

a. Know what facts are given.

A backyard in the shape of a parallelogram with the following dimensions: base = 11 meters; height = 9 meters.

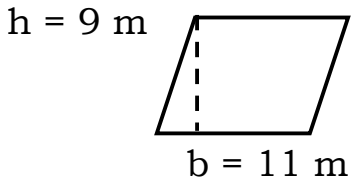
b. Know what is asked in the problem.

How many square meters of Bermuda grass is needed to cover the backyard?

2. Plan

What strategy can we use to solve the problem?

c. Draw a diagram to visualize the problem. (only if necessary)



Compute for the area of the backyard.

d. We use the formula:

Area = b x h

3. Solve to carry out the plan.

A = b x h
= 11 m x 9 m
A = 99 m^2

The backyard has an area of 99 m^2. So, Carlos needs 99 m^2 of Bermuda grass to cover the yard.

4. Check and Look back.

Ask yourself;

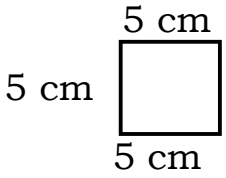
Did you use the correct formula?
Does the answer make sense?
Did you label the answer correctly?

If all your answers to these questions are yes, you have solved the problem correctly.

This time we are going to solve a non-routine problem.

> A rectangle is formed by three identical squares lying side by side. The perimeter of the square is 20 cm. What is the area of the rectangle?

- We can solve this problem by making an illustration.



The perimeter of the square is 20 cm. To find the measurement of each side (s), divide the perimeter by 4.

Perimeter = 4 x s

20 = 4 x s Divide both sides by 4

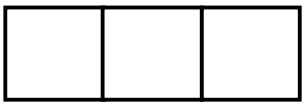
20 ÷ 4 = 4 ÷ 4 x s

5 = s

The side measures 5 cm.

- Let's put the three identical squares side by side.

Length: 5 cm + 5cm + 5cm = 15 cm



The dimensions of the rectangle formed is:

length = 15 cm; width = 5 cm

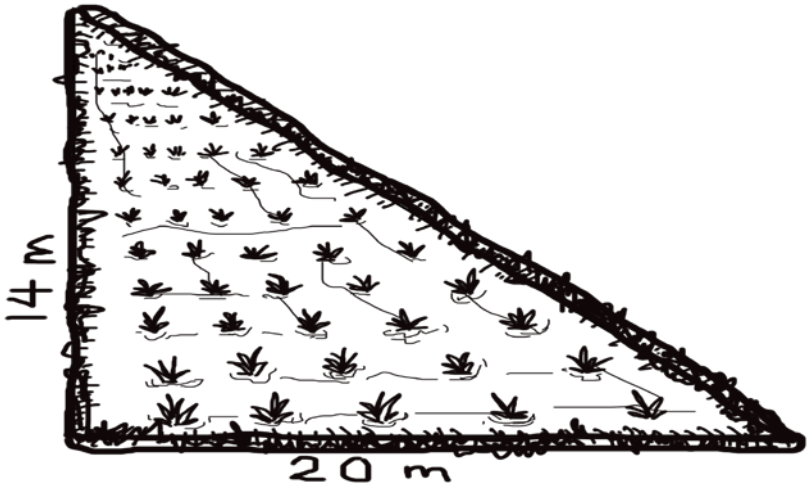
Then, find the area of the rectangle using the formula.

A = l x w
= 15 cm x 5 cm
= 75 cm^2

Therefore, the area of the rectangle is 75 cm^2.

Let us analyze another word problem.

A rice field is in the shape of a right triangle with a base of 20 m and a height of 14 m. What is its area?

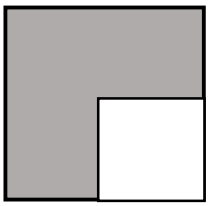


Steps	Questions	Answer
Understand	What is asked in the problem?	The area of the rice field.
	What are given?	b = 20 m , h = 14 m
Plan	What formula will be used?	$A = \frac{b \times h}{2}$
Solve	What is the solution?	$A = \frac{b \times h}{2}$ $= \frac{20\ m \times 14\ m}{2}$ $= \frac{280\ sq\ m}{2}$ $A = 140\ m^2$
Check your answer	What is the final/complete answer?	The area of the rice field is 140 m^2.

Now, let us solve another non-routine problem.

If the length of a side of the smaller square is 8 cm and that of the bigger square is 16 cm, what is the area of the shaded region shown?

16 cm



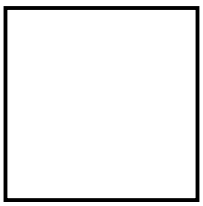
8 cm

To get the area of the shaded region;

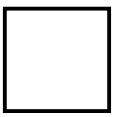
First, let's find the area of the two squares.

Area of the bigger square = s x s

= 16 cm x 16 cm

s = 16 cm  = 256 cm^2

Area of the smaller square = s x s

s = 8 cm  = 8 cm x 8 cm

= 64 cm^2

Then, subtract the area of the smaller square from the area of the bigger square.

Area of the shaded region = 256 cm^2 – 64 cm^2

= 192 cm^2

Therefore, the area of the shaded region is192 cm^2.

What's More

Solve the word problems and complete the statement.

1. Leilani and Elaine made a trapezoidal doormat. The bases measures 14 cm and 12 cm, respectively. If its height is 8 cm, what is its area?

a. The problem is asking for _____.
b. The given facts are _____
c. The formula to solve the problem is _____
d. The solution is _____
e. The complete answer is _____

2. A section of a stained-glass window has the shape of a parallelogram. Its base is 16 cm and its height is 14 cm. How much glass is needed to cover that section completely?

a. The problem is asking for _____.
b. The given facts are _____
c. The formula to solve the problem is _____
d. The solution is _____
e. The complete answer is _____

Illustrate/draw on a paper and solve.

3. The square is formed by three identical rectangles. The perimeter of each rectangle 32 cm. What is the area of the square?

Are you done answering?
If yes, time to check. Please go to page 15 for the ***Answer Key***.

What I Have Learned

Let us remember:

To solve routine word problems involving areas of plane figures, we can follow the 4-step plan:

1. Understand the problem.
   a. Know what is asked.
   b. Know what the given facts/data are.

2. Plan
   a. Draw or illustrate the diagram to visualize the problem, if necessary.
   b. Use the formula.

3. Solve
   a. Write the complete solution.
   b. Label your answer.

4. Check and Look back
   a. Review and check your answer.

Non-routine problems may be solved by drawing a picture or making an illustration, using a number line, making a table, or some other problem-solving strategies.

What I Can Do

Shapes make our lives meaningful. We are surrounded with objects which are shaped like squares, rectangles, triangles, parallelograms and trapezoids or a combination of these shapes.

Show which of the two figures in the situations below has a greater area.

a. A triangle with a base of 12 m and a height of 6 m
b. A trapezoid with bases of 12 m and 6 m, and a height of 4 m

Illustrate the figures, indicate the given dimensions and show your solution.

Are you done answering?
If yes, time to check. Please go to page 16 for the ***Answer Key***.

Assessment

Solve the following word problems. Choose the letter of the correct answer.

1. Nestor prepared a rectangular seedbed measuring 6 m long and 4 m wide. What is the area of the seedbed?
   a. 28 m^2 b. 24 m^2 c. 25 m^2 d. 30m^2

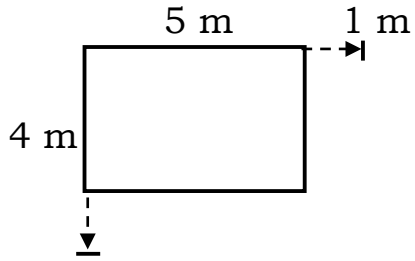
2. Rosemarie is making a table cloth for her square table. If one side of the table is 4 m long, what is the area of the top of the table?
   a. 16 m^2 b. 18 m^2 c. 15 m^2 d. 17 m^2

3. Aunt Susan placed a study table with a triangular top in her library. The top of the table has the following dimensions: its base is 60 cm and its height is 20 cm. What is the area of the top of the table?
   a. 650 cm^2 b. 600 cm^2 c. 700 cm^2 d. 610 cm^2

4. A decorative pillow is in the shape of a trapezoid. Its upper and lower bases measure 28 cm and 20 cm, respectively. Its height is 10 cm. What is the area of the front surface of the pillow?
   a. 220 cm^2 b. 230 cm^2 c. 240 cm^2 d. 250 cm^2

5. The playground is parallelogram in shape. It has a base of 10 m and a height of 17 m. What is its area?
   a. 190 m^2 b. 180 m^2 c. 175 m^2 d. 170 m^2

6. Mrs. Garcia has a flower garden 5 m long and 4 m wide. She wanted to widen it by adding 1 m to both its length and width.



Which is the correct equation to find the area of the bigger garden?

a. A = (5 m x 4 m) + 1 m
b. A = 5 m x 4 m x 1 m
c. A = (5 m + 1 m) + (4 m + 1 m)
d. A = (5 m + 1 m) x (4 m + 1 m)

7. What is the area of the bigger garden? (Please refer to problem #6).

a. 11 m^2 b. 20 m^2 c. 21 m^2 d. 30 m^2

For each of the following problems, draw the figure and indicate the given dimensions on a piece of paper. Then, solve the problem.

8. A rectangular grass lawn is 80 m long and 60 m wide. Four rectangular flower box each 15 m by 10 m are found within the lawn. What is the area covered by the grass?

9. Five identical squares are placed side by side to form a rectangle. The area of the rectangle is 45 cm^2. Squares are then removed from one end so that the resulting rectangle has a perimeter of 24 cm. What is the area of the new rectangle?

10. A rectangular mini park is 75 m long and 40 m wide. There is a concrete walk 3 m wide around it. Find the area of the concrete walk.

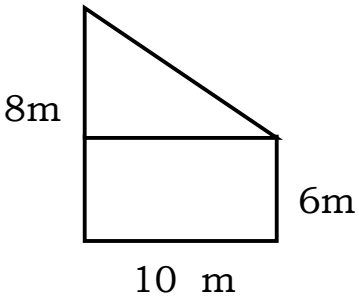
Are you done answering?
If yes, time to check. Please go to page 16-17 for the ***Answer Key***.

Got a score of 8 -10? EXCELLENT! You already understood the lesson. You are now ready for the next module.

If your score is below 8, kindly study again the lesson and the activities.

Additional Activities

1. A lemon orchard is shaped like the figure on the right. Find the area of the orchard.



2. Which of these two gardens has a larger area?

a) a trapezoid-shaped garden with parallel sides 34 m and 20 m long, and a 12-m perpendicular distance between these sides

b) a square garden that is 18 m on a side

Are you done answering?
If yes, time to check. Please go to page 17 for the ***Answer Key***.

Answer Key

What's More

1. a) The area of a trapezoidal door mat.
   b) bases: 14 cm and 12 cm , height = 8 cm

$$\text{c) } A = \frac{(b_1 + b_2)\text{x } h}{2}$$

$$\text{d) } A = \frac{(14\text{ cm} + 12\text{ cm})\text{x } 8\text{ cm}}{2}$$

$$= \frac{(26\text{ cm})\text{ x } 8\text{ cm}}{2}$$

$$= \frac{208\ cm^2}{2}$$

$$= 104\ \text{cm}^2$$

e) The area of the trapezoidal mat is $104\ \text{cm}^2$.

2. a) The area of the glass needed to cover the stained-glass window
   b) base = 16 cm, height = 14 cm
   c) A = b x h
   d) A = 16 cm x 14 cm
   $= 224\ \text{cm}^2$
   e) The area of the glass needed is $224\ \text{cm}^2$.

3.

A = s x s
= 12 cm x 12 cm
= $144\ \text{cm}^2$

The area of the square formed is $144\ \text{cm}^2$.

What's In

1. d
2. e
3. a
4. b
5. c

What I Know

1. f
2. a
3. c
4. g
5. e
6. 124 m^2
7. 162 m^2
8. 396 m^2
9. 36 m^2
10. 405 m^2

Assessment

1. B 2. A 3. B 4. C 5. D 6. D 7. D

8.

Area of grass rectangular lawn
A = l x w
= 80 x 60 m
= 4 800 m^2

Area of rectangular flower box.
A = l x w
= 15 m x 10 m
= 150 m^2

To get the total area of 4 rectangular flower boxes.
150 m^2 x 4 = 600 m^2

Area covered by grass = Area of rectangular grass lawn – area of 4 Rectangular flower boxes
= 4 800 m^2 – 600 m^2
= 4 200 m^2

What I Can Do

$A = \frac{b \times h}{2}$

$= \frac{12\ m \times 6\ m}{2}$

$= \frac{72\ m^2}{2}$

$= 36\ m^2$

$A = \frac{(b_1+b_2) \times h}{2}$

$= \frac{(6\ m + 12\ m) \times 4\ m}{2}$

$= \frac{(18\ m) \times 4\ m}{2}$

$= \frac{72\ m^2}{2}$

$= 36\ m^2$

The area of the triangle and the trapezoid are equal.

Additional Activitites

1. 100 m^2
2. The area of the square garden and the trapezoidal garden are equal.

9.

Five identical squares placed side by side formed a rectangle with an area of 45 cm^2.

To find the area of each square, we have to divide 45 cm^2 by 5.
45 $cm^2 \div 5 = 9$ cm^2.
The area of each square is 9 cm^2.
To find the measurement of one side, take the square root of the area of a square.

$s = \sqrt{9}$
$= 3$

s = 3 cm

The dimension of the rectangle formed:
l = 9 cm ; w = 3 cm
The area of the new rectangle:
A = l x w
= 9 cm x 3 cm
= 27 cm^2.

10.

(A and B)
Concrete walk: l = 81 m; w = 3 m
A = l x w
= 81 m x 3 m
= 243 m^2 x 2 = **486 m^2**.

(C and D) Concrete walk: l = 40 m; w = 3 m
A = l x w
= 40 m x 3 m
= 120 m^2 x 2 = 240 m^2

Area of the concrete walk = (A + B) + (C + D)
= 486 m^2 + 240 m^2
= 726 m^2

References

K to 12 Mathematics Curriculum Guide. 2016. Department of Education.

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For inquiries or feedback, please write or call:

Department of Education - Bureau of Learning Resources (DepEd-BLR)

Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph * blr.lrpd@deped.gov.ph