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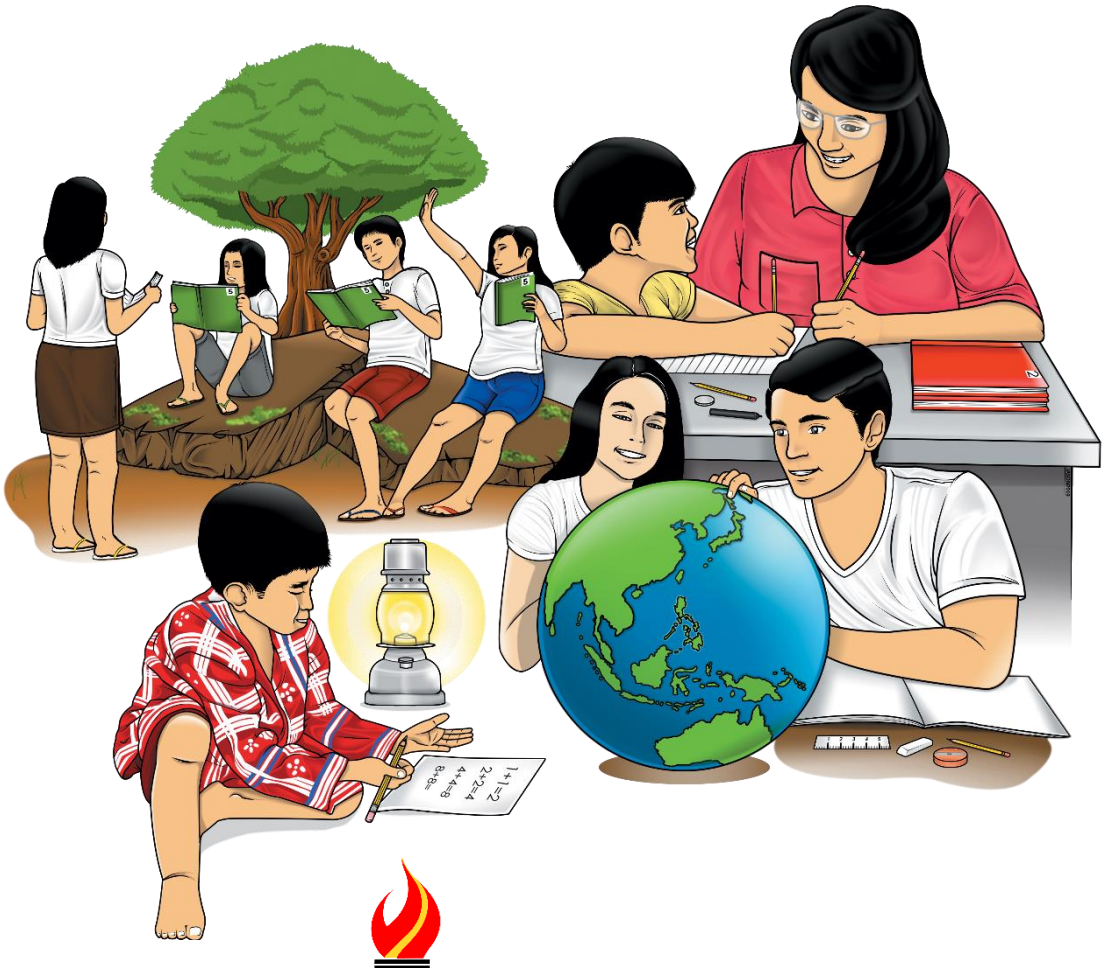
DEPARTMENT OF EDUCATION

Mathematics

Quarter 3 – Module 6:
Midline, Trapezoid and Kite



ALTERNATIVE DELIVERY MODE
ADM

Mathematics – Grade 9
Alternative Delivery Mode
Quarter 3 – Module 8: Midline, Trapezoid and Kite
First Edition, 2020

Published by the Department of Education
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Undersecretary: Diosdado M. San Antonio

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Printed in the Philippines by _____

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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.

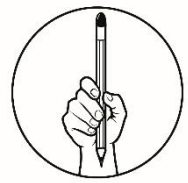
If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

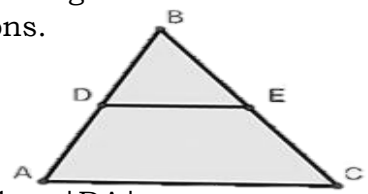
The learners will be able to:

- prove theorems on midlines, and
- solve problems involving problems(**M9GE – IIId – 1)**



What I Know

Direction: Let's see how much knowledge you have about this module. Answer each of the following items. Write the letter of the correct answer on the space after each equations.



Given: ΔABC, with D and E as midpoints of $\overline{AB}$ and $\overline{CB}$, respectively.

1. If |BD| = 6 cm, then |DA| = _____.
   a.) 24 cm b.) 12 cm c.) 6 cm d.) 3 cm

2. If |AD| = 6.5 cm, then |AB| = _____.
   a.) 18 cm b.) 13 cm c.) 7 cm d.) 3.25 cm

3. If |EC| = 7 cm, then |BC| = _____.
   a.) 14 cm b.) 18 cm c.) 21 cm d.) 28 cm

4. If |BC| = 26 cm, then |BE| = _____.
   a.) 13 cm b.) 9 cm c .) 7.5 cm d.) 6.5 cm

5. If |BE| = 13 cm and |BD| = 10 cm, then |AB|+|BC| = ____.
   a.) 16 cm b.) 26 cm c.) 36 cm d.) 46 cm

6. If |DE| = 12 cm, then |AC| = _____.
   a.) 36 cm b.) 24 cm c.) 18 cm d.) 12 cm

7. If |AD| = 7 cm, then |AB| = _____.
   a.) 7 cm b.) 8 cm c.) 10 cm d.) 14 cm

8. If |AC| = 42 cm, then |DE| = _____.
   a.) 12 cm b.) 28 cm c.) 17 cm d.) 21 cm

9. If |BC| = 36 cm, then |BE| = _____
   a.) 8 cm b.) 9 cm c.) 12 cm d.) 18 cm

10. If |BD| = 8 cm and |EC| = 9 cm, then |AB| + |BC| = _____.
    a.) 16 cm b.) 18 cm c.) 24 cm d.) 34 cm

Lesson 1

MIDLINE THEOREM

In the previous topics, you have learned about the properties of the different kinds of quadrilateral and how they can be applied in solving real-life problems. In this module, you will learn about the midline theorem. You will also learn the application of this theorem in finding the measure of the missing side in a triangle.

What's In

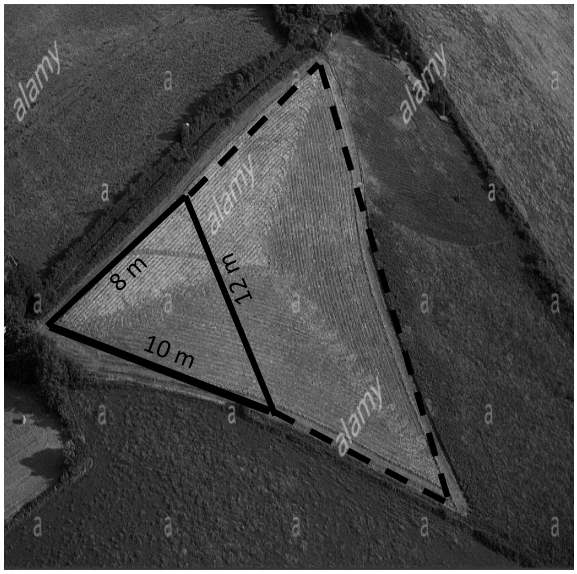
Let us have a recall on quadrilaterals. Tell whether the given statement is true or false.

1. Every rectangle is a square.
2. Every square is a rectangle.
3. Every square is a rhombus.
4. Every rhombus is a square.
5. The diagonals of a rhombus are perpendicular to each other.
6. Every parallelogram is a square
7. Every square is a parallelogram.
8. A rhombus is equiangular.
9. If the diagonals of a given parallelogram are perpendicular, then the parallelogram is a rectangle.
10. A square is an equiangular and equilateral parallelogram.

What's New

Aling Mids has a triangular farm in their province. The measures of the sides of the farm are 8, 10 and 12, all in meters. She was offered to buy the remaining open lot adjacent to her farm which extends to two sides of her farm and doubling the measures of these two sides. If she will buy the lot and keep a triangular farm, can you tell the new perimeter of her farm using the original sides?

Let us find it out.



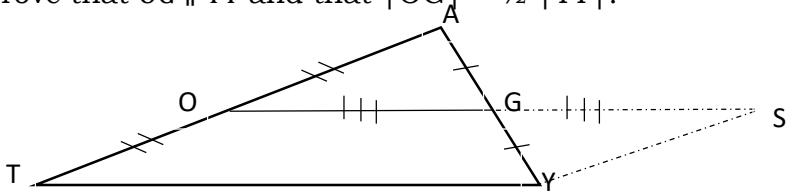
What is It

THE MIDLINE THEOREM

The segment whose endpoints are the midpoints of two sides of a triangle is parallel to and half as long as the third side.

Proof:

In ΔTAY, let O and G be the midpoints of $\overline{TA}$ and $\overline{AY}$, respectively. Let us prove that $\overline{OG} \parallel \overline{TY}$ and that $|OG| = \frac{1}{2} |TY|$.



Let S be a point on $\overleftrightarrow{OG}$ where $\overline{OG} \cong \overline{GS}$.

Given that O and G are midpoints , then

$\overline{TO} \cong \overline{OA}$

$\overline{AG} \cong \overline{GY}$.

By the Vertical Angle Theorem, we can say that

$\angle AGO \cong \angle SGY$

By SAS Postulate, we can have $\Delta AGO \cong \Delta YGS$, where

$\overline{OA} \cong \overline{SY}$ by CPCTC

Also, $\overline{TO} \cong \overline{SY}$ by Transitivity

And $\angle OAG \cong \angle SYG$ by CPCTC

Since a pair of alternate interior angles are formed which are congruent,

then $\overline{TO} \parallel \overline{SY}$

and thus, formed parallelogram TOSY.

In a parallelogram, the two pairs of opposite sides are congruent and parallel. Thus, we can say that $\overline{OS} \parallel \overline{TY}$ and $\overline{OS} \cong \overline{TY}$. Therefore, $\overline{OG} \parallel \overline{TY}$.

Note that G is the midpoint of $\overline{OS}$, therefore $|OG| = |GS|$. Note also that $|OS| = |TY|$. So,

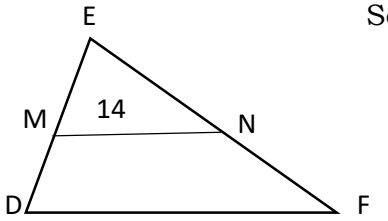
$$|OG| + |GS| = |OS|$$

$$|OG| + |OG| = |TY|$$

$$2|OG| = |TY|$$

Therefore, $|OG| = \frac{1}{2} |TY|$.

Example 1. Given M and N are midpoints of $\overline{DE}$ and $\overline{EF}$, respectively. If $|MN| = 14$ cm, find $|DF|$.



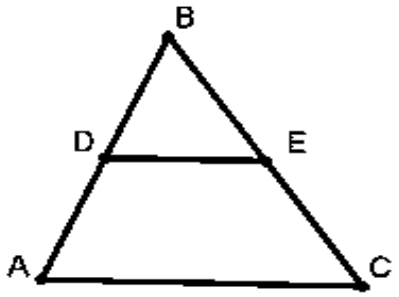
Solution:

$|DF| = 2|MN|$

$|DF| = 2(14)$

$|DF| = 28$ cm

Example 2. Refer to the figure below. Find |DE| if D and E are midpoints of $\overline{BA}$ and $\overline{BC}$, respectively and |AC| = 46 cm.



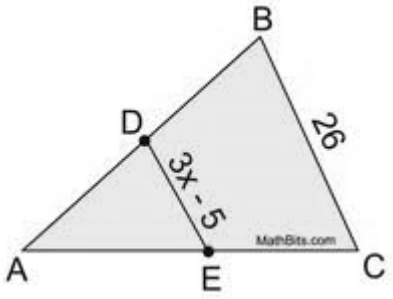
Solution:

$|AC| = 2|DE|$

$46 = 2|DE|$

$\frac{1}{2}(46) = |DE|$

Example 3. In the figure below, D and E are midpoints of $\overline{AB}$ and $\overline{AC}$, respectively. Find the value of x.



Solution:

$|BC| = 2|DE|$

$26 = 2(3x - 5)$

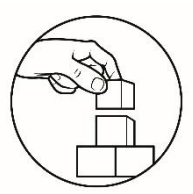
$26 = 6x - 10$

$26 + 10 = 6x$

$36 = 6x$

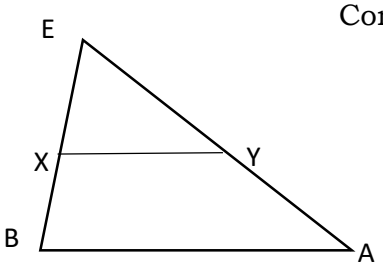
$\frac{36}{6} = x$

$6=x$ or $x=6$



What's More

1. In ΔBEA, X and Y are midpoints of $\overline{BE}$ and $\overline{EA}$, respectively.



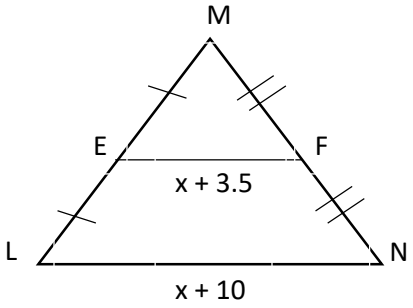
Complete the following statements:

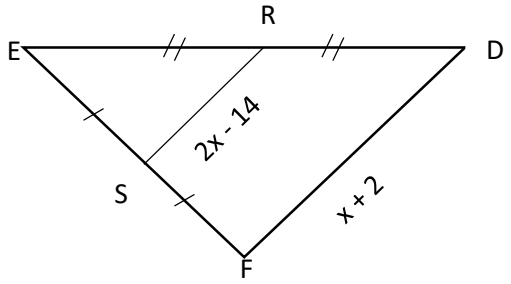
a) |BX| = _____.
b) |BA| = 2(_____).
c) |EA| = |EY| + _____.
d) If |BA| = 36 cm, then |XY|= _____.
e) If |EX| = 10 cm, then |BX|= _____.

2. Find the missing length as indicated.

1. Refer to ΔLMN a. find the value of x Refer to ΔEDF c. Find the value of x

b. Find |LN| d. Find SR

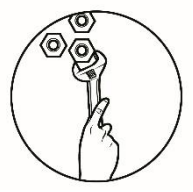




What I Have Learned

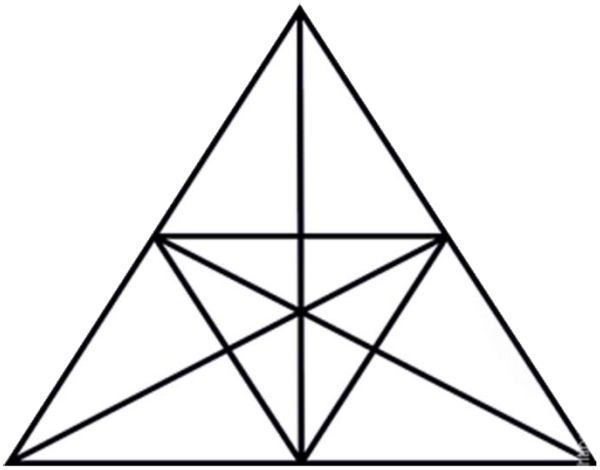
THE MIDLINE THEOREM

The segment whose endpoints are the midpoints of two sides of a triangle is parallel to and half as long as the third side.



What I Can Do

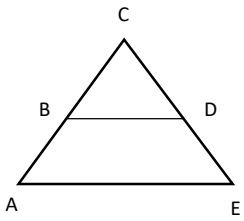
Direction: Count how many triangles are there in the given figure below. Write your answer beside the figure



Assessment

Direction: Read and answer each of the following questions below. Write the letter of the correct answer on your answer sheet.

Given: ΔACE, with B and D as midpoints of $\overline{CA}$ and $\overline{CE}$, respectively.



1. If |CD| = 19 cm, then ½ |CE| = _____.

   a.) 19 cm b.) 28.5 cm c.) 38 cm d.) 45 cm

2. If |BD| = 21 cm, then |BD| + |AE| = _____.

   a.) 84 cm b.) 63 cm c.) 42 cm d.) 21 cm

3. If |BD| = 2x – 1, |AE| = x + 4, then |BD| = _____.

   a.) 5 b.) 4 c.) 3 d.) 2

4. If |AE| = 32 cm, then ½ |BD| = _____

   a.) 32 cm b.) 16 cm c.) 12 cm d.) 8 cm

5. If |BC| = 2a – 1, |BA| = 4a – 17, then |BA| = _____.

   a.) 20 b.) 15 c.) 12 d.) 8

6. If |CA| = 56 cm, then ½ |BC| = _____.

   a.) 14 cm b.) 21 cm c.) 24 cm d.) 28 cm

7. IF |DC| = 2y + 14, |DE| = 5y – 16, then |DE| = _____.

   a.) 14 b.) 24 c.) 34 d.) 44

8. If |DE| = 13.8 cm, then |CE| = _____.

   a.) 55.2 cm b.) 27. 6 cm c.) 13.8 cm d.) 6.9 cm

9. If |BD| = 3b – 7, |AE| = 4b + 8, then |AE| = _____.

   a.) 22 b.) 32 c.) 42 d.) 52

10. If |BA| = 17 cm, and |DE| = 14 cm, then |CA| + |CE| = _____.

    a.) 62 cm b.) 52 cm c.) 34 cm d.) 28 cm

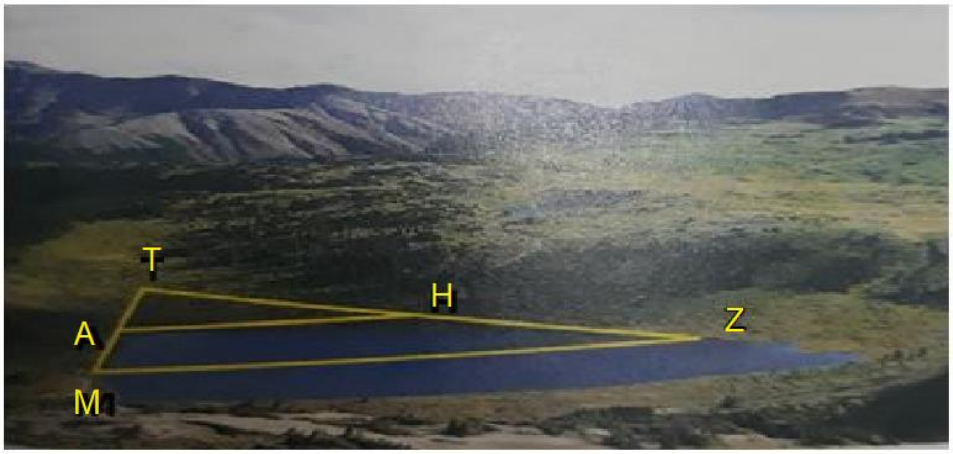
Additional Activities

Create your own real-life problem that will lead to the application of the Midline Theorem. Provide illustration and guide questions for the problem.

_____
_____
_____
_____
_____
_____

PROBLEM-BASED LEARNING WORKSHEET

The lake form a triangle.



Let's Analyze!

In ΔMTZ, A and H are midpoints of $\overline{\mathrm{MT}}$ and $\overline{\mathrm{TZ}}$, respectively.

1. If |AH| =12, then what is the value of |MZ|?
2. If |MZ|=14, then what is the value of |AH|?
3. If $|AT|$=18, then how long is $\overline{\mathrm{MA}}$?
4. If |MZ|= 16, |TH| = 5 and $|MA| = 6$ then what is the perimeter of ΔMTZ
5. If |MA|=2x+5 and |AT|=3x-1, then find|MT|?

Answer Key

What I Know

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

What's In

1. False
2. True
3. True
4. False
5. True
6 false
7. True
8. False
9. False
10. True

What's More

1.	2.
a. EX	a. 3
b. XY	b.1
c. YA	c.10
d. 18	d. 6
e. 10	

Assessment

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

Problem-Based Learning Worksheet

1. 24
2. 7
3. 18
4. 38
5. 34

References

To further explore the relationships of geometric figures using measurements, and if it possible to connect the internet, you may visit the following links:

http://www.slideshare.net/midline-theorem-mathematics-geometry
http://www.kutasoftware.com/midline
http://prezi.com/trvw8jp6c-pa/midline-theorem
http://scribd.com//presentation/midline-theorem
http://slideserve.com/real/midline-theorem-and-related-theorem
http://coursehero.com/files/43473483/3-5-midline-theorem-ppt

Mathematics 9 Learner's Material, Department of Education
Nivera, G. C and Lapinid, M. R (©2013). *Grade 9 Mathematics: Patterns and Practicalities.* Don Bosco Press, Inc.
Dawkin, P. (©2018). *Paul's Online Math Notes*. Retrieved from: http://tutorial.math.lamar.edu/Classes/Alg/SystemsTwoVrble.aspx#Sys_Two_Ex1_a
http://depedk12manuals.blogspot.com

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