7

Mathematics

Quarter 3 – Module 3:
Angles Formed by Parallel Lines Cut by a Transversal Line

SELF-LEARNING MODULE

Mathematics – Grade 7
Quarter 3 – Module 3: Angles Formed by Parallel Lines Cut by a Transversal Line
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Introductory Message

For the facilitator:

As a facilitator, you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning at home. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

As a learner, you must learn to become responsible of your own learning. Take time to read, understand, and perform the different activities in the module.

As you go through the different activities of this module be reminded of the following:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *Let Us Try* before moving on to the other activities.
3. Read the instructions carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are done.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone. We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!

Let Us Learn

Congratulations on making this far, in the previous lesson you have learned measures of angles. Now you will discover particular angles related to parallel lines cut by a transversal line. Good Luck!

Learning competency: The learner derives relationship among angles formed by parallel lines cut by a transversal using measurement and inductive reasoning. ***(M7GE-IIIc-1)***

Let Us Try

Directions: Read and analyze the following items and determine the letter of the correct answer from the given choices. Write your answer on a separate sheet of paper.

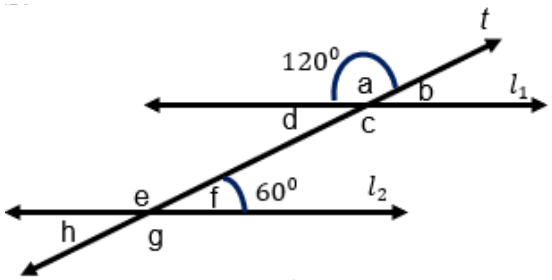


Figure 1

Using the figure above, answer the following:

1. Which angles are alternate exterior angles?
   a. $\angle a$ & $\angle f$ c. $\angle d$ & $\angle f$
   b. $\angle a$ & $\angle g$ d. $\angle d$ & $\angle c$
2. Which angles are alternate interior angles?
   a. $\angle d$ & $\angle g$ c. $\angle e$ & $\angle c$
   b. $\angle a$ & $\angle g$ d. $\angle f$ & $\angle b$
3. Which angles are corresponding angles?
   a. $\angle a$ & $\angle e$ c. $\angle d$ & $\angle e$
   b. $\angle a$ & $\angle h$ d. $\angle a$ & $\angle f$
4. Which of the following are interior angles on the same side of the transversal?
   a. $\angle d$ & $\angle e$ c. $\angle d$ & $\angle g$
   b. $\angle a$ & $\angle h$ d. $\angle b$ & $\angle g$

Complete each statement.

5. If two parallel lines are cut by a transversal, then alternate interior angles are _____.

6. If two parallel lines are cut by a transversal, then alternate exterior angles are _____.
7. If two parallel lines are cut by a transversal, then corresponding angles are _____.

8. If two parallel lines are cut by a transversal, then interior angles on the same side of the transversal are _____.

9. List all the angles whose degree measure is 60^0.

10. List all the angles whose degree measure is 120^0.

Let Us Study

Parallel Lines are lines in a plane which do not meet; that is, two straight lines (***l_1 and l_2 in Figure 2***) in a plane that do not intersect at any point. If parallel lines are cut by transversal, then eight angles and pairs of angles are formed.

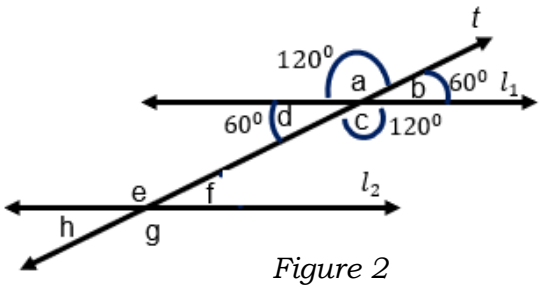


Figure 2

Transversal is a line (***t in Figure 2***) which intersects two coplanar lines at two different points.

Corresponding angles are pairs of non-adjacent interior angles and exterior angles on the same side of a transversal.

Refer to the figure 1 above, the following are corresponding angles:

$\angle a$ *and* $\angle e$ $\quad\quad$ $\angle b$ *and* $\angle f$

$\angle d$ *and* $\angle h$ $\quad\quad$ $\angle c$ *and* $\angle g$

Theorem: *If two parallel lines are cut by a transversal, then its corresponding angles are congruent.*

Example:

If $m\angle a = 120, then\ m\angle e = 120.$

If $m\angle c = 120, then\ m\angle g = 120.$

If $m\angle b = 60, then\ m\angle f = 60.$

If $m\angle d = 60, then\ m\angle h = 60$

Alternate interior angles are pairs of non-adjacent interior angles on opposite sides of a transversal.

Refer to the figure 1 above, the following are alternate interior angles:

$\angle d$ *and* $\angle f$ $\quad\quad$ $\angle c$ *and* $\angle e$

Theorem: *If two parallel lines are cut by a transversal, then the alternate interior angles are congruent.*

Example:

If $m\angle d = 60, then\ m\angle f = 60$

If $m\angle c = 120, then\ m\angle e = 120$

Alternate exterior angles are pairs of non-adjacent exterior angles on opposite sides of a transversal.

Refer to figure 1, the following are alternate exterior angles:
$\angle a \text{ and } \angle g$ $\angle b \text{ and } \angle h$

Theorem: *If two parallel lines are cut by a transversal, then the alternate exterior angles are congruent.*

Example:
If $m\angle a = 120, \text{then } m\angle g = 120.$
If $m\angle b = 60, \text{then } m\angle h = 60$

Same-side Interior Angles are interior angles on the same side of a transversal.

Refer to the figure 1 above, the following are same-side interior angles:
$\angle d \text{ and } \angle e$ $\angle c \text{ and } \angle f$

Theorem: *If two parallel lines are cut by a transversal, then the interior angles on the same side of the transversal are supplementary.*

Example:
1. In the figure, $m\angle d = 60.$ *Find the measure of* $\angle e.$
Since $m\angle d + m\angle e = 180,$
then $60 + m\angle e = 180$
$m\angle e = 180 - 60$

therefore, $m\angle e = 120.$

2. If $m\angle c = 120, \text{what is the measure of } \angle f?$
$m\angle c + m\angle f = 180$
$120 + m\angle f = 180$
$m\angle f = 180 - 120$

therefore, $m\angle f = 60.$

Same-side Exterior Angles are exterior angles on the same side of the transversal.

Refer to the figure 1 above, for the following examples:
$\angle a \text{ and } \angle h$ $\angle b \text{ and } \angle g$

Theorem: *If two parallel lines are cut by a transversal, then the exterior angles on the same side of the transversal are supplementary.*

$m\angle a + m\angle h = 180°$ $m\angle b + m\angle g = 180°$

Example:

1. In figure 2, $m\angle a = 120$. *Find the measure of* $\angle h$.

Since $m\angle a + m\angle h = 180$,

then $120 + m\angle h = 180$

$m\angle h = 180 - 120$

therefore, $m\angle h = 60$.

2. If $m\angle b = 60$, *what is the measure of* $\angle g$?

$m\angle b + m\angle g = 180$

$60 + m\angle g = 180$

$m\angle g = 180 - 60$

therefore, $m\angle g = 120$.

Let Us Practice

I- In the diagram, a‖b. Identify whether each pair of angles are corresponding angles, alternate interior, alternate exterior, same-side interior, same-side exterior.

1. ∠7 and ∠1
2. ∠2 and ∠6
3. ∠6 and ∠4
4. ∠2 and ∠8
5. ∠3 and ∠7
6. ∠4 and ∠5
7. ∠5 and ∠3
8. ∠8 and ∠4
9. ∠7 and ∠2
10. ∠1 and ∠5

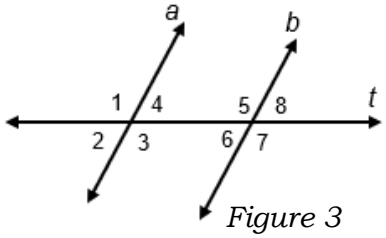


Figure 3

II- Tell whether each statement is **True** or **False.**

1. If two lines do not intersect, they are parallel.
2. Same-side interior angles are congruent.
3. Corresponding angles are congruent.
4. Alternate interior angles are supplementary.
5. Alternate exterior angles are congruent.

Let Us Practice More

Given the figure as marked and m∠7 = 55, find:

1. m∠8
2. m∠13
3. m∠10
4. m∠6
5. m∠11

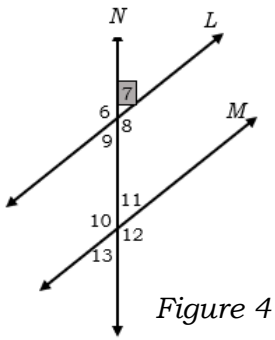
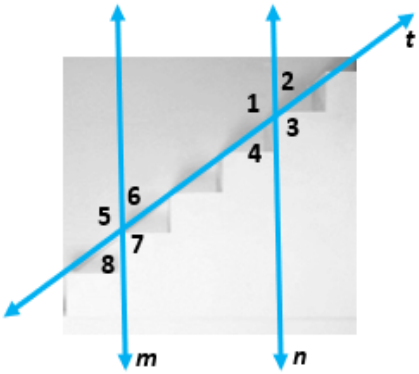


Figure 4

Let Us Remember

It would be convenient for us if we identify the different angles formed by two parallel lines cut by a transversal line. This will help us solve problems involving geometric figures. In summary, transversal is a line which intersects two coplanar lines at two different points. If a transversal line cuts two parallel lines the following relationships among angles are formed: corresponding angles, alternate-interior angles, alternate-exterior angles, interior angles on the same side of the transversal and exterior angles on the same side of the transversal.

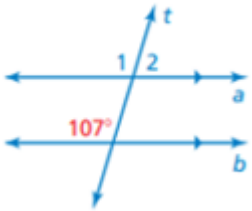
Let Us Assess



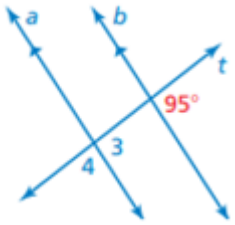
I- In items 1-4, use the given figure.

1. Which of the following are the parallel lines?
   a. *m* & *n* c. *n* & *t*
   b. *m* & *t* d. *none of the above*
2. Which of the following is the transversal line?
   a. *m* c. *t*
   b. *n* d. *none of the above*
3. How many angles are formed by the transversal line?
   a. 8 c. 6
   b. 4 d. 2
4. Which of the following pairs of angles are congruent?
   a. ∠6 & ∠2 ; ∠7 & ∠3 c. ∠1 & ∠6 ; ∠1 & ∠4
   b. ∠5 & ∠1 ; ∠5 & ∠8 d. ∠4 & ∠7 ; ∠4 & ∠3
5. Which of the following pairs of angles are supplementary?
   a. ∠8 & ∠2 ; ∠5 & ∠7 c. ∠5 & ∠2 ; ∠6 & ∠1
   b. ∠1 & ∠3 ; ∠7 & ∠1 d. ∠3 & ∠5 ; ∠4 & ∠8

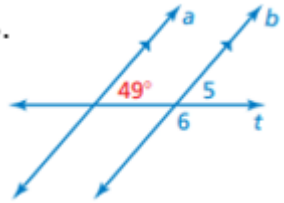
II- Use the figure to find the measures of the numbered angles.

6. 

   a. ∠1 = 107 & ∠2 = 73
   b. ∠1 = 73 & ∠2 = 107
   c. ∠1 = 180 & ∠2 = 90
   d. ∠1 = 90 & ∠2 = 180

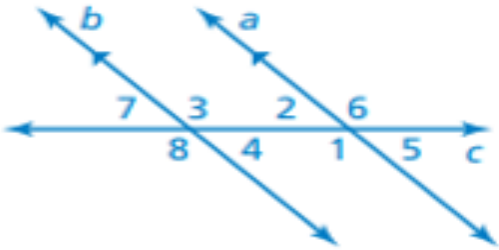
7. 

a. ∠3 = 105 & ∠4 = 95
b. ∠3 = 95 & ∠4 = 95
c. ∠3 = 85 & ∠4 = 95
d. ∠3 = 95 & ∠4 = 85

8. 

a. ∠5 = 49 & ∠6 = 131
b. ∠5 = 131 & ∠6 = 49
c. ∠5 = 49 & ∠6 = 49
d. ∠5 = 131 & ∠6 = 131

III- Complete the statement.



9. If the measure of ∠1 = 124^0, then the measure of ∠4 = _____.

a. 124
b. 56
c. 46
d. 44

10. If the measure of ∠2 = 48^0, then the measure of ∠3 = _____.

a. 48
b. 132
c. 84
d. 123

11. If the measure of ∠4 = 55^0, then the measure of ∠2 = _____.

a. 55
b. 125
c. 155
d. 135

12. If the measure of ∠6 = 120^0, then the measure of ∠8 = _____.

a. 120
b. 160
c. 60
d. 20

13. If the measure of ∠7 = 50.5^0, then the measure of ∠6 = _____.

a. 50.5
b. 29.5
c. 149.5
d. 129.5

14. If the measure of $\angle 3 = 118.7^0$, then the measure of $\angle 2$ = _____.

a. 117.7 c. 61.3

b. 63. 1 d. 118.7

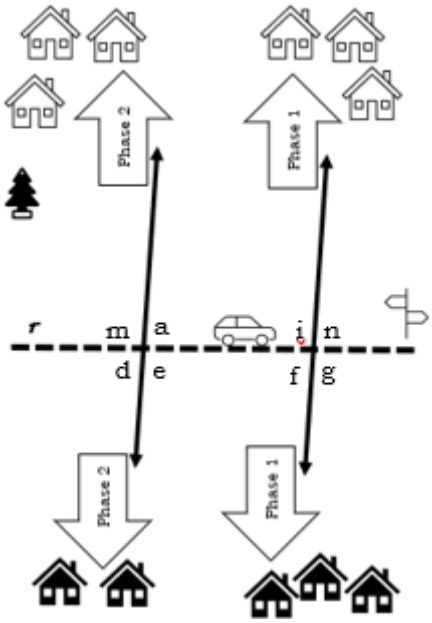
15. If the measure of $\angle 5 = 40^0$, then the measure of $\angle 7$ = _____.

a. 35 c. 120

b. 40 d. 130

Let Us Enhance

At the right is the map of DECA Homes Subdivision. Phase 1 and phase 2 are parallel. Main road ***r*** intersects the two phases 1 & 2. Phase 1 makes a 104° angle **(∠i)** with road ***r*** while Phase 2 makes a 76° angle **(∠d**) with road ***r***. Use the given description to complete the exercises.



1. What are the measures of the other angles that Phase 1 makes with main road ***r***?

2. What are the measures of the other angles that Phase 2 makes with main road ***r***?

Let Us Reflect

Answer this given question in a paragraph form.

OPEN-ENDED. Describe two real-life situations that use the concept of parallel lines.

Answer Key

Let us Assess

1. *a*
2. *c*
3. *a*
4. *a*
5. *c*
6. *a*
7. *d*
8. *a*
9. *b*
10. b
11. *a*
12. *a*
13. *d*
14. *c*
15. *b*

Let us Practice

I

1. *Alternate Exterior Angles*
2. *Corresponding Angles*
3. *Alternate Interior Angles*
4. *Alternate Exterior Angles*
5. *Corresponding Angles*
6. *Same Side Interior Angles*
7. *Alternate Interior Angles*
8. *Corresponding Angles*
9. *Same Side Exterior Angles*
10. *Corresponding Angles*

II

1. *True*
2. *False*
3. *True*
4. *False*
5. *True*

Let us More Practice

1. *125*
2. *55*
3. *125*
4. *125*
5. *55*

Let us Try

1. *b*
2. *c*
3. *a*
4. *a*
5. *Congruent*
6. *Congruent*
7. *Congruent*
8. *Supplementary*
9. *∠f, ∠h, ∠b & ∠d*
10. *∠a, ∠c, ∠e & ∠g*

Let Us Enhance

2.

Give: $m\angle i = 104\ and\ m\angle d = 76$

Phase 2 angles $\angle \boldsymbol{m}, \angle \boldsymbol{a}, \boldsymbol{and}\ \angle \boldsymbol{e}$

$\angle i \cong \angle m,$ *Corresponding Angle Congruent*
$\boldsymbol{m\angle m = 104}$

$m\angle i + m\angle a = 180$ *Same-side Interior Angle Supplementary*
$180 - m\angle i = m\angle a$

$180 - 104 = 76$
$\boldsymbol{m\angle a = 76}$

$\angle i \cong \angle e$ *Alternat Interior Angle Congruent*
$\boldsymbol{m\angle e = 104}$

Let Us Enhance

1.

Give: $m\angle i = 104\ and\ m\angle d = 76$

Phase 1 angles $\angle \boldsymbol{n}, \angle \boldsymbol{g}, \boldsymbol{and}\ \angle \boldsymbol{f}$

$\angle d \cong \angle n,$ *Alternate Exterior Angle Congruent*
$\boldsymbol{m\angle n = 76}$

$m\angle d + m\angle g = 180$ *Same-side Exterior Angle Supplementary*
$180 - m\angle d = m\angle g$

$180 - 76 = 104$
$\boldsymbol{m\angle g = 104}$

$\angle d \cong \angle f$ *Corresponding Angle Congruent*
$\boldsymbol{\angle f = 76}$

References

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