2018

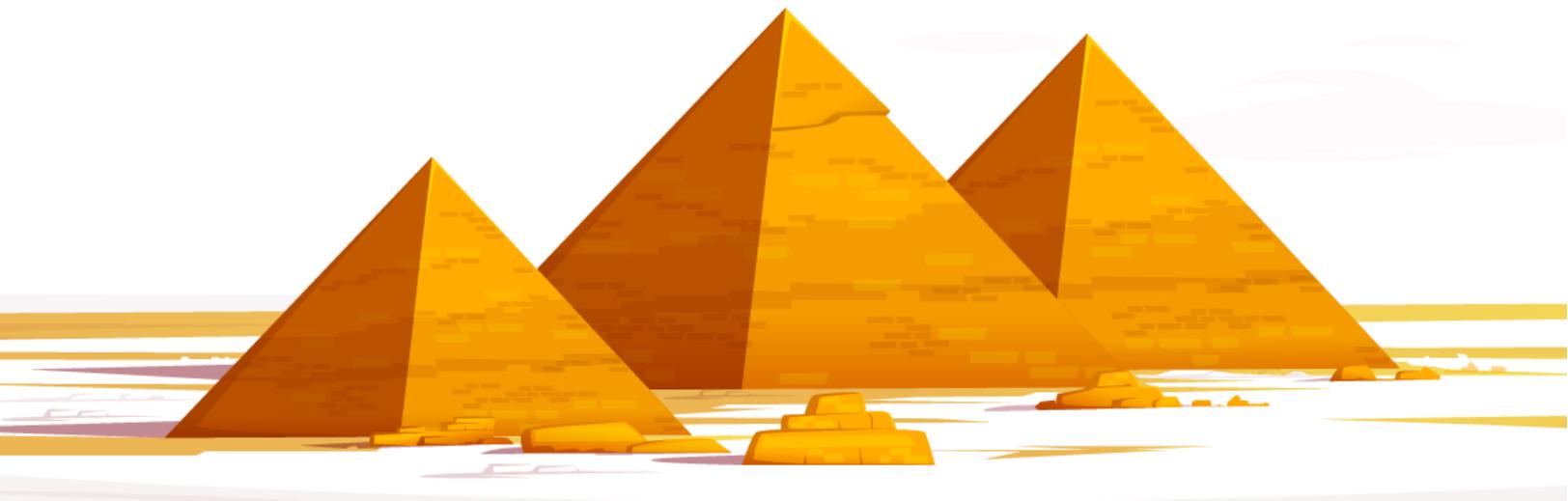# LEARNING MODULE

Geometry

NOTICE TO THE SCHOOLS

This learning module (LM) was developed by the Private Education Assistance Committee under the GASTPE Program of the Department of Education. The learning modules were written by the PEAC Junior High School (JHS) Trainers and were used as exemplars either as a sample for presentation or for workshop purposes in the JHS In-Service Training (INSET) program for teachers in private schools.

The LM is designed for online learning and can also be used for blended learning and remote learning modalities. The year indicated on the cover of this LM refers to the year when the LM was used as an exemplar in the JHS INSET and the year it was written or revised. For instance, 2017 means the LM was written in SY 2016-2017 and was used in the 2017 Summer JHS INSET. The quarter indicated on the cover refers to the quarter of the current curriculum guide at the time the LM was written. The most recently revised LMs were in 2018 and 2019.

The LM is also designed such that it encourages independent and self-regulated learning among the students and develops their 21st century skills. It is written in such a way that the teacher is communicating directly to the learner. Participants in the JHS INSET are trained how to unpack the standards and competencies from the K-12 curriculum guides to identify desired results and design standards-based assessment and instruction. Hence, the teachers are trained how to write their own standards-based learning plan.

The parts or stages of this LM include Explore, Firm Up, Deepen and Transfer. It is possible that some links or online resources in some parts of this LM may no longer be available, thus, teachers are urged to provide alternative learning resources or reading materials they deem fit for their students which are aligned with the standards and competencies. Teachers are encouraged to write their own standards-based learning plan or learning module with respect to attainment of their school's vision and mission.

The learning modules developed by PEAC are aligned with the K to 12 Basic Education Curriculum of the Department of Education. Public school teachers may also download and use the learning modules.

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MATHEMATICS 7

Module 3: Geometry

☑ **MODULE INTRODUCTION AND FOCUS QUESTION(S):**

Have you seen models of houses like the one shown below?

http://i299.photobucket.com/albums/mm311/arhitektor_dmoderna/contemporary_house_gifhq_762.jpg

http://www.dana-home.com/wp-content/uploads/2011/06/modern-house-design-3.jpg.jpg

Have you ever wondered how these houses were designed? How are the different geometric models reflected in the designs of these houses? How are the different geometric relations involving plane figures applied to come up with such designs? Find out the answers to these questions and determine the vast applications of the different geometric relations involving plane figures through this module.

☑ **MODULE LESSONS AND COVERAGE:**

In this module, you will examine these questions when you take the following lessons:

Lesson 1   Points, Lines, and Planes
              Subsets of a Line
              Angles and its Classification
Lesson 2   Angle Pairs, *Perpendicular* and Parallel Lines, Basic Construction
              (bisectors, parallel and perpendicular lines)
Lesson 3   Parallel Lines Cut by a Transversal
Lesson 4   Polygons and Circles

In these lessons, you will learn the following:

Lesson 1 – Represent a point, line and plane using concrete and pictorial models.
              Define, identify and name the subsets of a line.
              Illustrate, name, identify and define the different kinds of angles.
              Use a compass and straightedge to bisect line segments and angles
Lesson 2 – Derive relationships of geometric figures using measurements and by
              inductive reasoning; supplementary angles, complementary angles,
              congruent angles, vertical angles, adjacent angles, linear pairs,
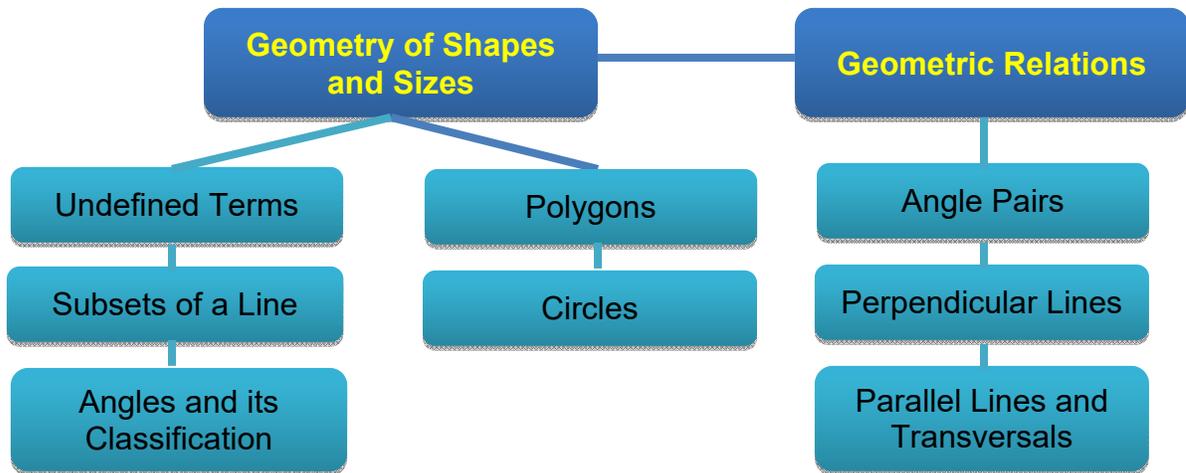   perpendicular lines, and parallel lines.
              Construct parallel and perpendicular lines.

Lesson 3 – Derive relationships among angles formed by parallel lines cut by a transversal using measurement and by inductive reasoning.

Lesson 4 – Illustrates polygons: (a) convexity; (b) angles; and (c) sides.
- Derives inductively the relationship of exterior and interior angles of a convex polygon.
- Illustrates a circle and the terms related to it: radius, diameter, chord, center, arc, central angle, and inscribed angle.
- Constructs triangles, squares, rectangles, regular pentagons, and regular hexagons.
- Solve problems involving sides and angles of polygon.

Here is a simple map of the above lessons you will cover:

```
          Geometry of Shapes                    Geometric Relations
             and Sizes
                 |                                       |
       +---------+---------+                             |
       |                   |                             |
  Undefined Terms       Polygons                    Angle Pairs
       |                   |                             |
  Subsets of a Line     Circles                  Perpendicular Lines
       |                                                 |
  Angles and its                              Parallel Lines and
  Classification                                  Transversals
```

To do well in this module, you need to remember and do the following:
1. *Take note of the geometric terms used*
2. *Always look for models that represent the terms*

PRE-ASSESSMENT:

Let's find out how much you already know about this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

MULTIPLE CHOICE: Read and understand each question carefully then select the letter corresponding to your answer.

1. The following pictures models a point **EXCEPT**

A.

B.

C.

D.

2. In reference to the figure below, which statement is NOT true?

A. $\overline{ML}$ and $\overline{LK}$ are opposite rays.

B. $\overline{NM}$ contains every point that lies in $\overline{NL}$.

C. $\overline{KL}$ is the same as $\overline{KN}$.

D. Point M is the common endpoint of

$\overline{ML}$ and $\overline{MN}$.

3. Which of the following angles has a measure greater than 90 but less than 180?
   A. Acute
   B. Obtuse
   C. Right
   D. Straight

4. What angle pair is depicted by the position of the hands of the clocks   below?
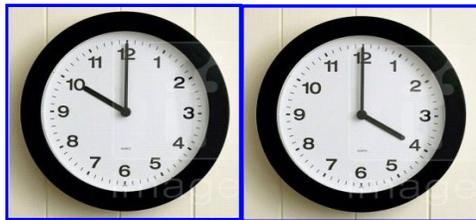
A. complementary angles
B. supplementary angles
C. vertical angles
D. congruent angles

5. In the figure, p and q are parallel lines and t is a transversal. Which of the following statements about $\angle 1$ and $\angle 2$ is true?

A. $\angle 1$ and $\angle 2$ are complementary.
B. $\angle 1$ and $\angle 2$ are adjacent angles.
C. $\angle 1$ and $\angle 2$ are congruent.*
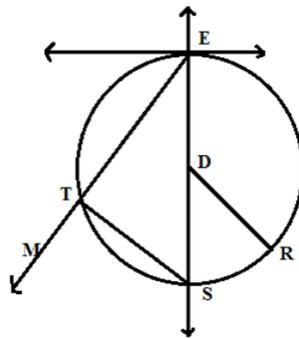D. $\angle 1$ and $\angle 2$ form a linear pair.
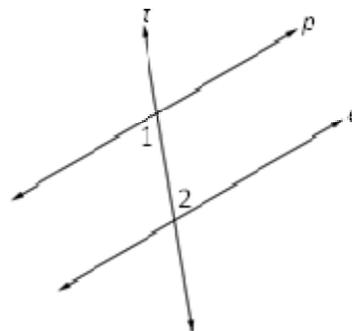
6. What is the relationship between the interior and exterior angles of polygons?
   A. They are congruent.
   B. They are complementary.
   C. They are supplementary. *
   D. They form vertical angles.
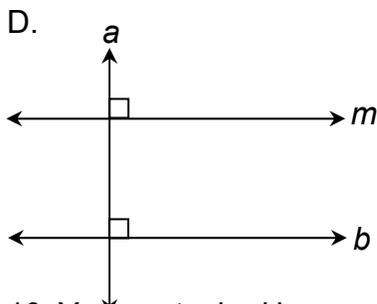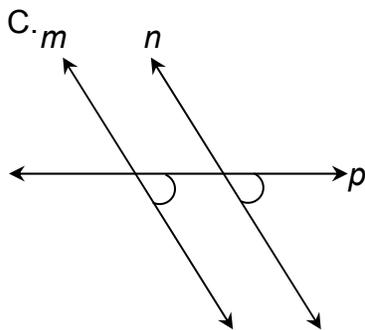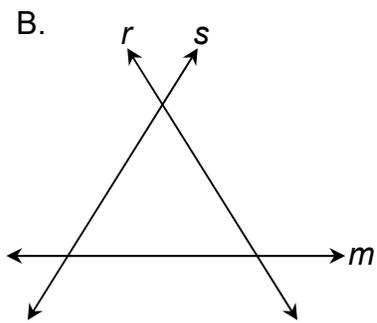
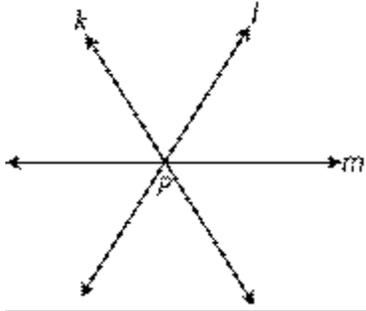7. Which of the following figures is <u>not</u> a polygon?
   A.

   B.

   C.
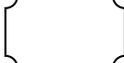
   D.

8. In the figure below, which is not a radius of the circle?

   A. $\overline{RD}$
   B. $\overline{SD}$
   C. $\overline{ED}$
   D. $\overline{TS}$

9. Which of the figures below shows that line *m* is a transversal?

A.

B.

C.

D.

10. You are tasked by your teacher to choose and bring a real-life object that would model both a segment and a ray. You have to explain it comprehensively to the class why you chose it. If these are the objects you that have seen in your house, which of these will you choose?

A. A rope
B. A meter stick

C. A growing plant

D. A twig of a tree

11. All of the following illustrate an acute angle EXCEPT
    A. A man reaching his hands to his toes.
    B. The angle formed by the two legs when a man is walking.
    C. The angle formed by the pair scissors when it is about to cut a material.
    D. A man stretching his back

12. How many sides does a polygon have if the sum of the measure of its interior angles is 1440?
A. 8
B. 10
C. 12
D. 14

13. How many sides does a regular polygon have if the measure of each interior angle is 90?
A. 3
B. 4
C. 5
D. 6

14. Below is a picture of a parking whose design is composed of parallel and perpendicular lines. Why are parking lots designed to be like this?

A. So that the parking lot's area will be organized.
B. There can be an easy flow of vehicles which are coming in and out of te parking area.
C. Vehicles are properly arranged.
D. All of the above.

15. The head of a school requested the Parents and Teachers Association to donate a new gate to minimize the security problems the school has been experiencing. He would like the gate to have perpendicular and parallel iron bars as braces to make it more strong and durable. In response to the school head's request, the association asked an architect to prepare a sketch plan and perspective drawing of the new gate to be presented to a big audience.

Which of the following is the best form of presentation the architect should use?
A. Printed copies of the plan and drawing in reduced size
B. Slide show presentation using projector
C. Poster presentation
D. Billboard-size print out of the plan and drawing

16. If you are asked to design a building, what should be the measure of the angle to be formed by the building and the ground in order for it to stand strong and straight?
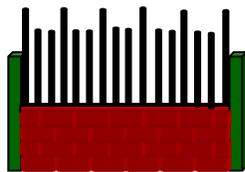   A. Less than 90^0
   B. Equal to 90^0
   C. More than 90 but less than 180^0
   D. Equal to 180^0

17. You are tasked to evaluate the new designs of a four-folds umbrella that can withstand strong winds and with ease of folding. One important part of the umbrella that you have to evaluate is its frame. What do you think are the criteria that you will consider in evaluating the frame of a four-folds umbrella.
   A. creativity, accuracy of measurements, stability of the frame
   B. creativity, accuracy of measurements, elegance of the design
   C. accuracy of measurements, elegance of the design, stability of the frame
   D. creativity, elegance of the design, stability of the frame

18. Suppose you are asked to present a design of a fence such that one standard it must have is the appropriate, flawless, and elegant illustration of perpendicular and parallel lines. Which of the following designs would you present?
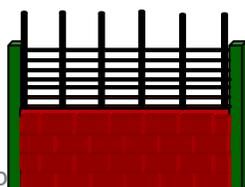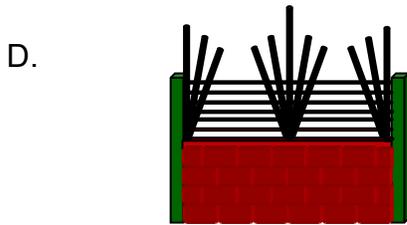
A.

B.

C.

     *

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DEPARTMENT OF EDUCATION

JHS INSET Learning Module Exemplar

D.

19. You are an engineer tasked to subdivide an agricultural land will be converted into a subdivision. Which of the following considerations will you choose in subdividing the blocks?
    A. The blocks should be parallel to each other.
    B. The blocks should be intersecting each other.
    C. The blocks should be perpendicular to each other.
    D. The blocks should close to each other.

20. You as an interior designer would like to introduce to a home owner who would like to tile his newly-built house a new design of floor tiles that would exceed the traditional designs. Which of the following set of standards will best assess your work?
    A. Accuracy of measurements, innovativeness, practicality
    B. Accuracy of measurements, innovativeness, neatness
    C. Accuracy of measurements, innovativeness, appropriateness
    D. Accuracy of measurements, innovativeness, authenticity

Lesson 1: Points, Lines and Planes

EXPLORE

Let's start the module by answering the problem below.

ACTIVITY 1.   Picture Analysis

Look at the plant closely.

Process Questions:

1. What geometric figures can you see that compose the plant?

2. How do these figures connect to each other to form the plant?

3. From another perspective, how does the plant come to existence? From what figure did it start? Describe the formation of the geometric figures as the plant grows.

4. Geometric figures exist in many objects around us, and from what you've observed, *how are geometric figures formed? How are they reflected / mirrored in some real-life objects/situations?*

ACTIVITY 2.   Anticipation/ Reaction Guide

Instruction: Respond to each statement twice: once before the lesson and again after the lesson.
Write **A** you if you agree with the statement
Write **B** you if you disagree with the statement

Response Before the Lesson	Statements	Response After Lesson
	a. Everything that we see is made up of the basic geometric figures: points, lines, and planes.	
	b. A line can be modeled by objects that have length and width.	
	c. A segment is a part of a line which has a definite length. Thus, it can be measured.	
	d. A ray is a part of the line that is extended without end. In the real-life life anything that grows, model a ray. But when the living thing stops growing, it models a segment.	
	e. Angles are used in the making of the different designs such as in furniture, and building.	
	f. Our everyday movement is defined by the different classification of angles.	

Click on SAVE if you have responded to the six statements in the first column.

End of EXPLORE:

You gave your initial answers to the questions and statements given above.

Let's find out how others would answer the above and compare their ideas to our own. As you compare, you will find out if your ideas are in line with the standard. You will also learn other concepts which will help you complete a required project found at the end. This project is about making an educational poster.

FIRM-UP

Your goal in this section is to learn and understand key concepts of the points, lines, planes, subsets of the line, and angles. You will also find real-world representations of each geometric term mentioned above.
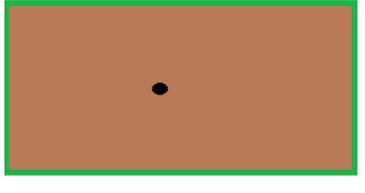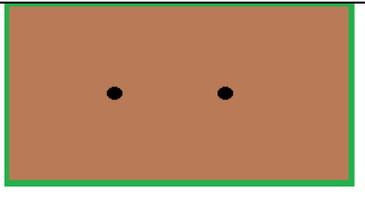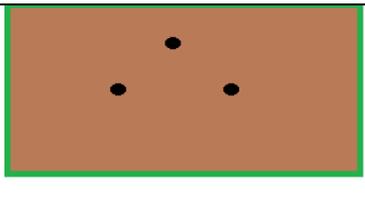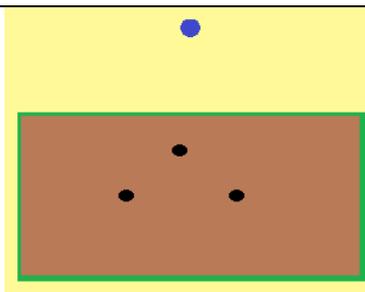
THE UNDEFINED TERMS IN GEOMETRY

ACTIVITY 3.   Investigating Points, Lines and Planes

INVESTIGATION
(Pair Work)

Materials: 2 Cork boards, Push pins, Yarn
Procedure:

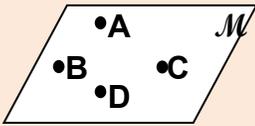|	
1. Tack one pushpin at the center of the corkboard. What geometric figure represents the head of the pushpin?	
2. Place another pushpin on the corkboard. Make sure that it is a little farther from the first pushpin. Using the yarn, connect the second push pin to the first push pin. What figure is formed?	
3. Place another pushpin on the corkboard. Make sure that the third pushpin will not lie along the first two points. Using the yarn again, connect the third push pin with the other two push pins. What figure is formed?	
4. Place one push pin on space. Using the yarn, connect the point into the three points on the first corkboard. What kind of figure is formed?	

Process Questions:

1. While connecting the points what have you observed? Were you able to create different figures?

2. The points, lines, and planes are called the **undefined terms** in Geometry. What do you think is the reason why they are called as such?

Verify your answers by reading the concepts below which contains the explanation of why points, lines, and planes are called the undefined terms, including how they are drawn, named, and described.
Examples of points, lines and planes are given, along with real-life objects that model each one of them.

The POINTS, LINES, and PLANES are the undefined terms in Geometry because they serve as basis in defining other terms in Geometry. Using them, other geometric figures are formed and defined.

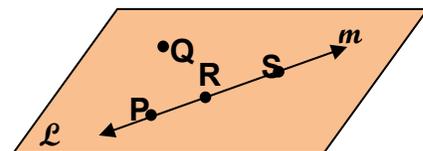|	POINT	LINE	PLANE
Model	A ●	ℓ ←•—————•→ A B	•A M •B •C •D
Drawn	as a dot	with an arrowhead at both ends	
Named By	a capital letter	Two letters representing two points on the line or a lower case script letter	a capital script letter of any three points that do not lie on the same line (noncollinear)
Words/symbols	Point A	$\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$, line l, line AB or line BA	Plane M Plane ABC Plane ABD Plane ACD Plane BCD Plane ABCD
Description	• It is the basic unit in geometry.	• It is a series of points that extends without end in	• It is a flat surface that extends

	It has no size (0-dimensional) • In real life it is not tangible; points are useful for identifying specific locations, but are not objects in themselves.	two directions (1-dimensional) • It is made up of infinite number of points. • The arrows show that the line extends without end in both directions.	without end in all directions. • It is a 2-dimensional figure.

Use the figure to name each of the following

a. A line containing point R.
The line can be named as **line m.**

Answer: There are three points on the line. Any two points can be used to name the line.
$\overleftrightarrow{PR}$ or $\overleftrightarrow{RP}$, $\overleftrightarrow{PS}$ or $\overleftrightarrow{SP}$, and $\overleftrightarrow{RS}$ or $\overleftrightarrow{SR}$

b. a plane containing point C

Answer: Any three points that do not lie on the same line name a plane..The letters can be reordered to create acceptable name for the plane.
Plane L, plane PRQ, plane PSR, plane RSQ, plane PQRS

Models of points, lines, and planes. Name the geometric term modelled by each object.

Guitar strings   **Knot in a rope**   **front page of the newspaper**

| A shadow | red cherry fruits | Chopsticks |

The knot in a rope and the red cherry fruits are models of a point because they can be seen as a dot from afar. The guitar strings and chopsticks are models of a line because they are straight and have length. A line, however, is longer, straighter, and thinner. The shadow and the front page of a newspaper model are examples of a plane because they are flat, and have length and width. A plane, however is broader, wider, and thinner.
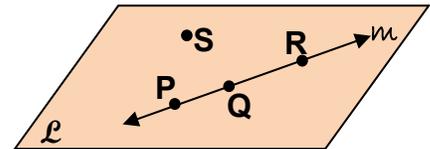
ACTIVITY 4. Test Yourself!

A. Identifying Points, Lines and Planes

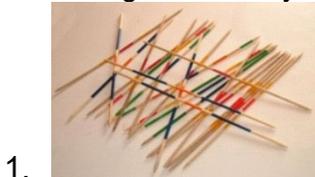1. Name two points on line m. List all three pairs of possible answers.

2. Give three names for the line. Write all possible
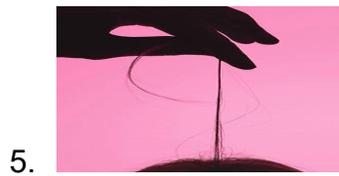

3. Give all possible names for the plane shown on

B. Indentifying Models of the Undefined Terms. Determine what undefined term is being modeled by each picture.

1.

2.

3.

4.

5.

6.

7.

8.

9.

Process Question:

1. How can you represent a point, a line, or a plane using real-life objects or
sit

*Click on **SUBMIT** if you have answered all the items before clicking the **Answer Key** to view the correct answers.*

ACTIVITY 5.   Identifying Models of Undefined Terms Found in Your Room

Look around your room. Identify and list 5 objects that would model each undefined term. Then look for a design (furniture, gadgets, personal belongings, etc) and identify the parts that models each of the undefined terms through labeling.

| POINTS	LINES	PLANES
Design		

Process Questions:

1. Did you find difficulty looking for examples of each undefined term? Why?

2. *How are geometric figures formed? How are they reflected / mirrored in some real-life objects/situations?*

3. Can you now see the connection of points, lines, and planes in forming other geometric figures? Why are points, lines and planes important in Geometry?

4. *How useful are geometric figures in solving problems related to design?*

*Click on **SUBMIT** if you have completed the table and have answered all the questions. Post your answers to the Process Questions and discuss with other students in the Discussion Forum.*

ACTIVITY 6.   Organize your thoughts!

Fill in the first row of boxes with a description of each undefined term. Fill in the second row with an explanation of how each is named using notations. Lastly, for the third row, give examples of real objects that model each of the undefined term.
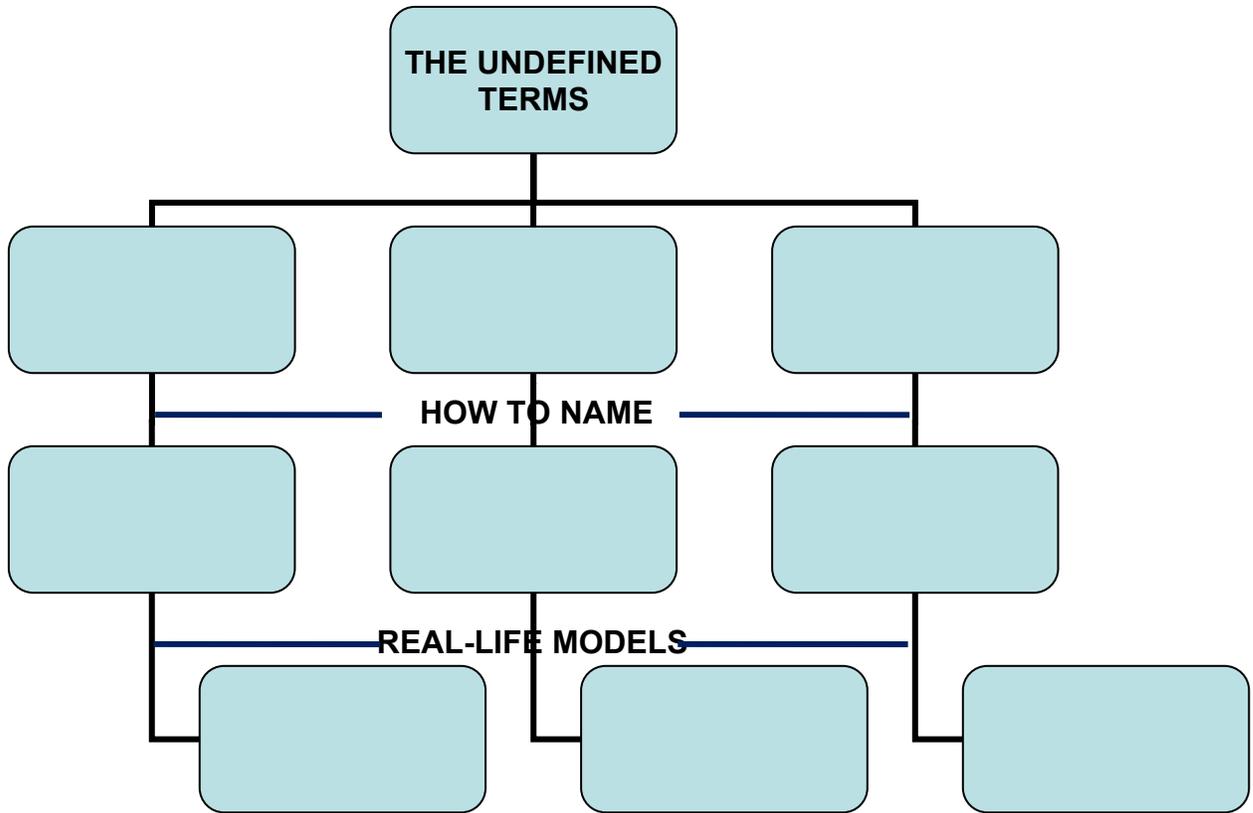
THE UNDEFINED TERMS

HOW TO NAME

REAL-LIFE MODELS

Skills Readiness Check: Reflect on the level of your performance for this lesson. Check the first column if you **need more practice** or you are now **ready to move on to the next activity**.

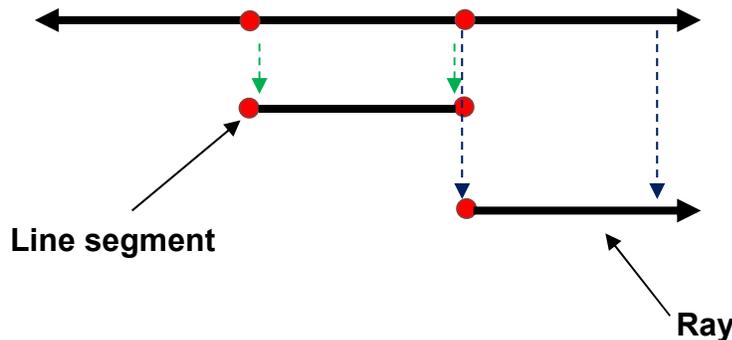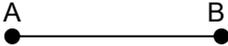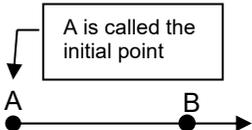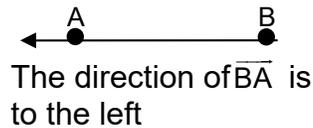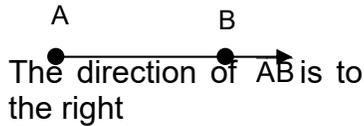| I Need more practice (if you incurred many mistakes)	I am ready to move on to the next activity (if you incurred 1 or two mistakes)
Review the concepts and retake the quizzes in Activity 4. Seek help from any knowledgeable person.	You may proceed to the next activity
Note: Your knowledge and skill on this part is needed in learning the next lesson. Do not proceed to the next part if you have not fully understood this part.	

THE SUBSETS OF A LINE

In the previous lesson, we have discussed the three undefined terms in which one of them is the line. A line has two subsets. Below is an illustration of how the subsets of a line are formed.

Every 2 points determine a line. If we take this part of the line with the two endpoints, a line segment is formed. And if we take one endpoint and all the points to the left or to the right of the given point, a ray is formed.

Line segment

Ray

Model	How to Name	Words/ Symbols	Definition
LINE SEGMENT A ●————————● B	Using two capital letters with the segment symbol on top of them.	$\overline{AB}$ or $\overline{BA}$	It does not extend without end. It has endpoints, in this case A and B. The segment contains all the points on the line between A and B.
RAY A is called the initial point A ●————● B →	Using two capital letters with the initial point as the first letter to be written.	$\overrightarrow{AB}$	It consists of one endpoint and all the points of the line on one side of the endpoint

SYMBOL ALERT! $\overrightarrow{AB}$ is not the same as $\overrightarrow{BA}$. Why?

A   B
●————●———→
The direction of $\overrightarrow{AB}$ is to the right

←————●————————●
A   B
The direction of $\overrightarrow{BA}$ is to the left

Always remember that in naming a ray the initial point should always be written first and the symbolic ray always has the arrowhead on the right regardless of the direction of the ray.
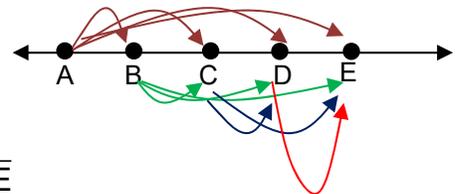
OPPOSITE RAYS

←——●———●———●——→
A   C   B

$\overrightarrow{CA}$ and $\overrightarrow{CB}$ are the two opposite rays

Are two collinear rays with the same endpoint.
They always form a line

Example

Refer to the figure to the right.

1. Name all the segments shown.
   Answer: $\overline{AB},\overline{AC},\overline{AD},\overline{AE}$, $\overline{BC},\overline{BD},\overline{BE}$, $\overline{CD},\overline{CE}$, $\overline{DE}$

2. Name $\overrightarrow{BD}$ in two other ways.
   Answer: $\overrightarrow{BC},\overrightarrow{BE}$

3. Name a pair of opposite rays with point C as endpoint.

   Answer: $\overrightarrow{CB}$ and $\overrightarrow{CD}$ or $\overrightarrow{CA}$ and $\overrightarrow{CD}$

You have just read the discussion regarding the subsets of a line. Now apply the concepts in the following activities.

ACTIVITY 7.   Test Yourself!

I. Use the words segment, ray, or opposite rays to answer the following questions.

1. Which will always form a line?   _____
2. Which has two endpoints?   _____
3. Which is extended in one direction without end?   _____
4. Which is extended in two directions?   _____

II. Use the figure on the right to answer items 5- 12.

5. Does $\overrightarrow{RQ}$ contain every point that lies in $\overrightarrow{RS}$?
   (Yes or No)

6. Does $\overrightarrow{RQ}$ contain every point that lies in $\overrightarrow{RP}$?
   (Yes or No)

7. What are $\overrightarrow{QR}$ and $\overrightarrow{QS}$ called?   _____
   (same rays or opposite rays)

8. What are $\overrightarrow{RP}$ and $\overrightarrow{RS}$ called?   _____
   (same rays or opposite rays)

III. Tell whether each statement is true or false.

9. $\overrightarrow{QR}$ and $\overrightarrow{RQ}$ are the same rays.   _____
10. $\overrightarrow{PS}$ and $\overrightarrow{PR}$ are the same rays.   _____
11. $\overline{PR}$ and $\overline{PS}$ are the same segments.   _____
12. The common point of $\overrightarrow{PS}$ and $\overrightarrow{QS}$ is point R.   _____

IV. Tell whether each object is a model of a segment or a ray. Explain.

13.   14.   15.

Cane   launched rocket   Logs

Process Question:
1. *Of the two subsets of a line, which one is measurable? Why?*
2. ***How can you represent a segment or a ray using real-life objects or situations?***

*Click on **SUBMIT** if you have answered all the items before clicking the **Answer Key**. Post your answers to the Process Questions in the Discussion Forum.*

Skills Readiness Check: Reflect on the level of your performance for this lesson. Check the first column if you **need more practice** or the second column if you are now **ready to move on to the next activity**.

I Need more practice (if you incurred many mistakes)	I am ready to move on to the next activity (if you incurred 1 or two mistakes)
Review the concepts and ask for more practice problems from your teacher.	You may proceed to the next activity

ACTIVITY 8.   Identifying Real-life Models of Segments and Rays

Instruction:
1. Make a collage of real-life objects that model
   a. segments
   b. rays
   c. both a segment and a ray

1.

2. Create a separate collage for each.

2.

3. Below the title is a short description for each collage.

3.

4. Suggested site is www.photovisi.com but you can also visit other sites for your collage**.**

Procedure:
1. Search for photos of objects or situations that would model segments and rays and save it in your computer.
2. Visit the site www.photovisi.com
3. Register for an account.

4. Click on **Start Creating** Button.
5. Select a template for your collage.
6. Click **+ Add Item to** download pictures from your computer. Just drag the pictures in to the template.
7. Click on **Add text** button to add title and description for each collage..
8. If you're finished with the collage, click on **Finish** button to save it.
9. Share your collage by clicking the **Email Collage** button then type the email address of your teacher and peers. Then, click **Share this Collage**.

Rubric

CRITERIA	EXCELLENT (4)	SATISFACTORY (3)	PROGRESSING (2)	DEVELOPING (1)	RATING
Number of Pictures (x3)	There are more than 8 pictures used to model segments and rays.	There are at least 5 and at most 8 pictures that are used to model segments and rays.	There are 3-4 pictures used to model segments and rays.	There are 1-2 pictures used to model segments and rays.	$\overline{}$ 15
Appropria-teness of the pictures (x 5)	All of the chosen pictures are correct and unique models segments and rays.	All of the chosen pictures are correct models for segments and rays.	One of the chosen pictures is not a correct model for segments and rays.	Most of the chosen pictures are not models for segments and rays.	$\overline{}$ 20
Visual Impact (x3)	Overall impact is memorable and effective.	Overall visual impact is effective.	Overall impact is limited.	Overall impact is weak.	$\overline{}$ 15
Total					$\overline{}$ 50

Process Question:

How can you represent a segment, ray or both using real-life objects or situations?
*Post your answer to this question on the Discussion Forum.*

SEGMENT BISECTORS

You have just learned how identify, and name the subsets of a line. You have also learned how to represent them using real-life models. In the next lesson, you will learn a new skill and that is to bisect a segment using a compass and a straightedge. But before moving to this lesson you need to earn first the concepts of congruent segments and midpoint.

Congruent Segments

Words: Two segments having the same length are congruent.
Symbol: $\cong$ is read as " is congruent to"
Model: $\overline{PQ} \cong \overline{RS}$
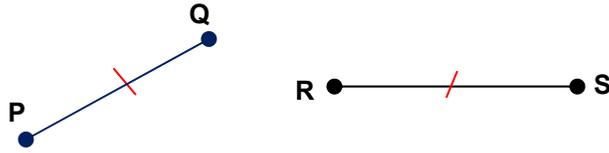
4. *Equal number of tick marks indicate that the segments are congruent.*

MIDPOINT OF A SEGMENT
1. Point M is the midpoint of a segment if and only if M is between S and T and $\overline{SM} \cong \overline{TM}$ which means that SM = TM.

S   M   T

---

http://www.youtube.com/watch?v=8PcE_pzA9eU. This video shows how to construct the midpoint of a segment. Take down notes in Ever Note.
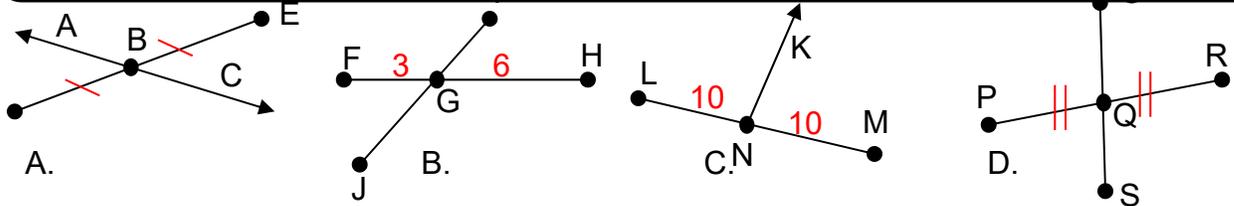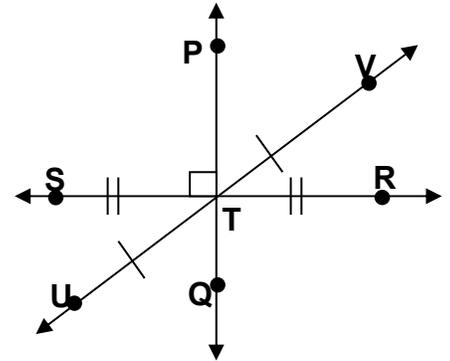
Process Questions:
1. How will you construct the midpoint of a segment?
2. What do you think is the reason why you need to know how to construct the midpoint of a segment?

Post your answers in the Discussion Forum.

SEGMENT BISECTOR
2. It is a segment, ray, or line that contains the midpoint of the segment.

A.   B.   C.   D.

Figures **A, C,** and **D** illustrate a **segment bisector**. In figure A, there is equivalent number of tick marks in $\overline{DB}$ and $\overline{EB}$, meaning $\overleftrightarrow{AC}$ bisected $\overline{DE}$ at midpoint B. In figure D, there is equivalent number of tick marks in $\overline{PQ}$ and $\overline{RQ}$, then $\overline{OS}$ bisected $\overline{PR}$ at midpoint Q. In figure C, $\overrightarrow{NK}$ bisected $\overline{LM}$ at point N because $\overline{LN}$ and $\overline{MN}$ have equal lengths of 10 units. And in figure **B,** $\overline{FG}$ and $\overline{HG}$ do not have the same length, that is why $\overline{IJ}$ is **not a bisector** of $\overline{FH}$.

PERPENDICULAR BISECTOR OF A SEGMENT
- It is a segment, ray, or line that is perpendicular to a segment at its midpoint.

Recall: Two lines are said to be perpendicular if they form 90^0 (right) angles.

√   15   18   **x**   √
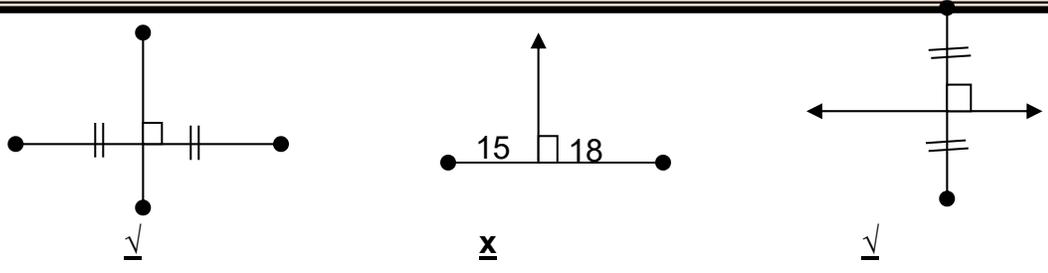
ACTIVITY 9.   Constructing the perpendicular bisector of a segment

Watch a video form YouTube Click the link
http://www.youtube.com/watch?v=RKk7EuLunQ8 . This video shows how to construct the perpendicular bisector of a segment. Make sure to take down notes.

Process Questions:
1. How will you construct the perpendicular bisector of a segment?
2. What do you think is the reason why you need to know how to construct it?

Post your answers in the Discussion Forum.

ACTIVITY 10.   Identifying the bisectors of a segment

I.   True or False. Write *true* if the statement is correct and *false* if it is wrong.

1. $\overline{ST} \cong \overline{TR}$ _____

2. $\overline{ST} \cong \overline{UT}$ _____

3. $\overline{PQ} \perp \overline{SR}$ _____

4. $\overline{PT} \perp \overline{TR}$ _____

5. $\dfrac{1}{2}\overline{UV} = \overline{UT}$ _____

6. T is the midpoint of $\overline{PQ}$. _____

7. T is the midpoint of $\overline{SR}$ and $\overline{UV}$. _____

8. $\overline{SR}$ is a segment bisector of $\overline{UV}$. _____

9. $\overline{PQ}$ is a perpendicular bisector of $\overline{UV}$. _____

10. $\overline{UV}$ is a perpendicular bisector of $\overline{PQ}$. _____

*Click on **SUBMIT** if you have answered all the items before clicking the **Answer Key**.*

Process Questions:
1. Can you easily identify the different bisectors of a segment?
2. If not, what do you think is the hindering factor to it?
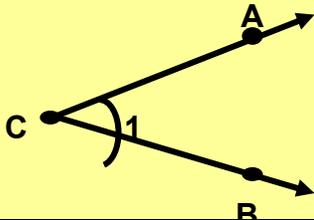
Post your answers in the Discussion Forum.

If you still find difficulty in identifying the segment bisectors, do not hesitate to ask assistance from a knowledgeable person, from your classmate, or from your teacher.
You may also go back to the concepts you have read in the previous pages or watch a tutorial video from YouTube. Just type the title of the video that you wish to watch. Then click Search button.

ACTIVITY 11.   Constructing the segment bisectors

In a short bond paper, copy the table below and draw the segments with your chosen lengths. Then draw the segment bisector indicated for each segment. Use a compass, pencil, and a straightedge or ruler.

Bisector	
Line	A •————————————————• B
Segment	C •————————————————• D
Ray	E •————————————————• F
Perpendicular Bisector	
Line	G •————————————————• H
Segment	I •————————————————• J
Ray	K •————————————————• L

Process Questions:
1. How did you find the activity?
2. Were you able to construct all segment bisectors correctly?
3. If not, what do you think is the hindering factor to it?

Pass your output to your teacher on your next face-to-face meeting. Post your answers in the Discussion Forum.

If you still find difficulty in constructing the segment bisectors, do not hesitate to ask assistance from a knowledgeable person, from your classmate, or from your teacher.
You may also go back to the videos you have watched previously.

ANGLES AND ITS CLASSIFICATION

In the previous lessons, you have learned how to identify, name, and represent using real-life models the undefined terms, and the subsets of a line. In the next lesson, you will also be taught how to identify, name, and represent using real-life models the angles and its classification

ANGLE

An angle is the union of two noncollinear rays that have a common endpoint called the vertex.

Figure	Vertex	Sides	Name

	C	$\overrightarrow{CA}$ and $\overrightarrow{CB}$	• Using three points and $\angle$ symbol. The middle point is always the vertex
			     $\angle ACB$ or $\angle BCA$
			 • Using the vertex point
			     $\angle C$ or $\angle 1$
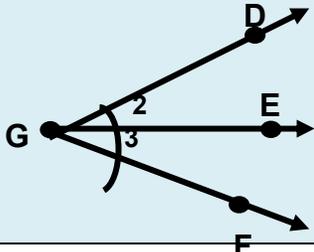
	G	$\overrightarrow{GD}$, $\overrightarrow{GE}$, and $\overrightarrow{GF}$	• If there are two or more angles at the vertex, then use three letters to name the angle.
			     $\angle DGE$ or $\angle 2$
			     $\angle DGF$
			     $\angle EGF$ or $\angle 3$

An angle separates a plane into three parts:
1. the **interior**
2. the **exterior**
3. the **angle itself**

In the figure shown at the right, *point B* and all other points in the green shaded region are in the interior of the angle.
Point A and all other points in the yellow shaded region are in the exterior of the angle.
Points Y,W, and *Z* are on the angle.
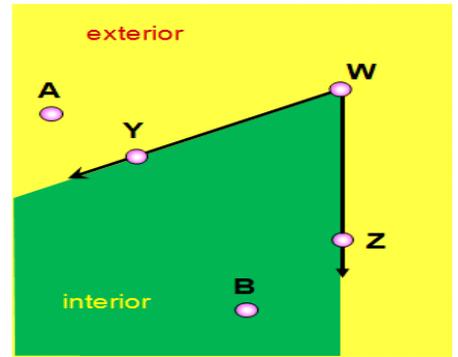
Example

1. Answer the following using the figure on the right.
   Name all angles having W as their vertex.
   Answer: ∠XWY , ∠YWZ , and ∠XWZ

2. What is the other name for ∠1 ?

   Answer: ∠XWY

3. Is there an angle that can be named ∠**W** ?
   Answer: Since there are three angles sharing a common vertex, then there will be no angle that can be named ∠**W** .The vertex can only be used to name an angle if we are referring to one angle only.
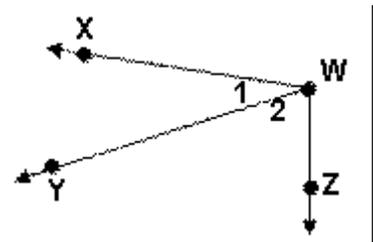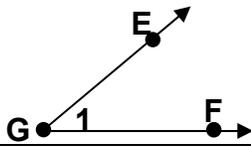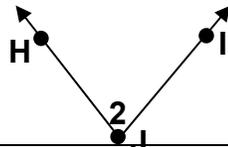
An additional material which is a PowerPoint Presentation will be given as a supplement. This presentation contains input and more examples. Click http://daviseric.files.wordpress.com/2011/08/glencoe-geo-1-4-angle-measure.ppt to open the file.

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DEPARTMENT OF EDUCATION

JHS INSET Learning Module Exemplar

ACTIVITY 12.   Test Yourself!

A. Identify the vertex and the sides of each angle.

Angle	Vertex	Sides
1.		
2.		
3. ∠POT		
4. ∠SAT		
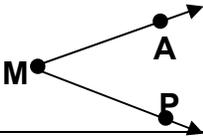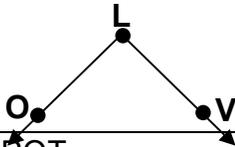
B. Name the following angles in four ways.

5..	∠_____	∠_____	∠_____	∠_____
6.	∠_____	∠_____	∠_____	∠_____

C. The figures below show a pattern of rays in the same plane that have a common endpoint. Draw the next figure in the given pattern.

7. Complete the table below.

No. of rays (n)	1	2	3	4	5	6	7	8	9
No. of angles formed									

8. Which of the following expressions should be used to get the number of angles formed given the number of rays?

A. $\dfrac{n(n-1)}{2}$　　　　B. $\dfrac{n(n-2)}{2}$　　　　C. $\dfrac{n(n-3)}{2}$

Click on SUBMIT before clicking the Answer Key.

Previously, you have learned the parts of an angle and how to name it. This time, you will classify them according to their measures; measure and classify an angle using a protractor. You will also look for some real-life objects that can represent each type of angle. Click http://www.bluffton.noacsc.org/powpak/data/edmistonm/files/M1,_M7,_G3,_G7_Angles.ppt to open a file which contains an input on how to classify an angle. Click also http://www.primaryresources.co.uk/maths/powerpoint/using_a_protractor.ppt to open a file which contains an input on how to measure an angle using a protractor.

ACTIVITY 13.   What is your angle?

In this activity you will visit interactive websites where you can measure angles using a protractor and classify angles according to their measures.

A. Measuring Angles. Click http://www.ezschool.com/Games/Math/Angles/Angles.html to open the site. Just drag and drop the protractor to the given angle then read the measure of each given angle. Your performance will be scored.

B. Classifying Angles.
Click http://www.sheppardsoftware.com/mathgames/geometry/shapeshoot/triangles_shoot.htm to open the site. Click on the first level. Shoot the angle indicated.

C. Take a five-item Interactive Quiz in classifying angles at http://www.glencoe.com/sec/math/studytools/cgi-bin/msgQuiz.php4?isbn=1-57039-850-X&chapter=8&lesson=1

Process Questions:

1. How did you find the activity?
2. In your own words, how will you read the measurement of an angle using a protractor; how will you classify angles?
3. How was your score in the five-item Interactive Quiz? Were you able to correctly answer all the items? If not, what will you do in order to make up with it?

Post your answers in the Discussion Forum. Make sure to discuss with your classmates.

Skills Readiness Check: Reflect on the level of your performance for this lesson. Check the first column if you **need more practice** or the second column if you are now **ready to move on to the next activity**.

I Need more practice (if most of your answers are incorrect)	I am ready to move on to the next activity (if you incur only few errors)
Review the concepts and retake the interactive quizzes. Seek help from any knowledgeable person.	You may proceed to the next activity

ACTIVITY 14.   Angles Around Us

A. Tell whether each picture illustrates an acute, right, or obtuse angle?
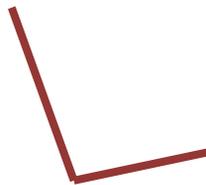
1.   2.   3.

B. Identifying models of right, acute, and obtuse angles.

Take pictures of items (furniture, gadgets, etc.) in your house that would model each angle type. Take at least two pictures for each.

Right Angle	Acute Angle	Obtuse Angle

Process Questions:

1. How useful are the different types of angles in the design or use of the models that you have chosen?

2. In your list, what particular type of angle has the most number of models found in your house? What do you think are the reasons this type of angle has the most number than the other angle types?

3. *How are angles reflected / mirrored in some real-life objects/situations?*

4. *How useful are the different angle types in solving problems related to design?*

ANGLE BISECTOR

Just as segments that have the same lengths are congruent, angles with the same measures are congruent.

In this part, we will discuss congruent angles and relate it to angle bisector. Do the investigation activity below to find out how a ray can be an angle bisector. Verify your answers by reading the definition of an angle bisector. Lastly, you will construct an angle bisector.

Words: Angles that have the same measure are congruent angles.
Arcs in the figure also indicate which angles are congruent.
Model:
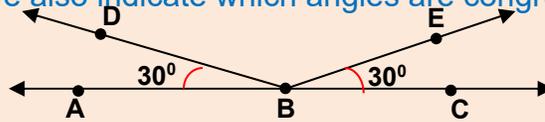
ACTIVITY 15.   Investigation Time

Investigating an Angle Bisector

Materials: paper, pencil, and ruler

Procedure:

1.   Draw ∠PQR on a paper.

2. Cut the angles following the rays.

3. Fold the paper through Q so that $\overrightarrow{QP}$ and $\overrightarrow{QR}$ are aligned together.

4. Open the paper and label a point on the crease in the interior of the angle as point S.
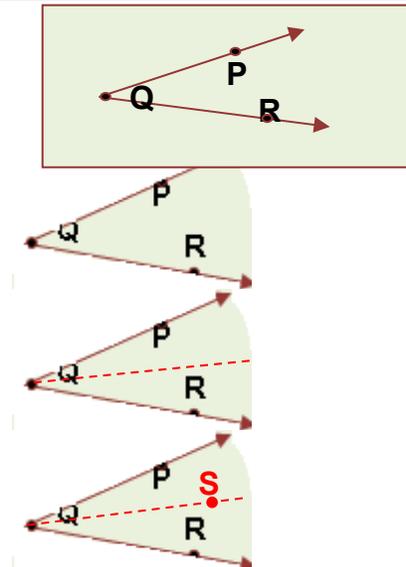
Answer the following:

a. What seems to be true about the measures of ∠PQS and ∠RQS ?

b. What does an angle bisector do to any angle?

*Post your answers to these questions in the **Discussion Forum**.*

ANGLE BISECTOR

The bisector of an angle is a ray with its endpoint at the vertex of the angle, extending into the interior of the angle. The bisector divides the angle into two congruent angles.

$\overrightarrow{QA}$ is the angle bisector of $\angle PQR$

$\angle 1 \cong \angle 2$ or $\angle PQA \cong \angle RQA$
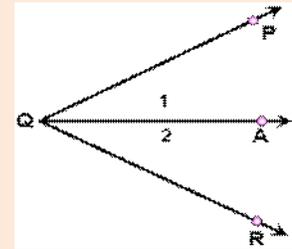
ACTIVITY 16.   How to construct an angle bisector

Watch a video from http://www.youtube.com/watch?v=2dhB6HHLBGM This video will teach you how to construct an angle bisector using a compass. Do not forget to take down notes.

Process Questions:
1. How will you construct the bisector of an angle?
2. What do you think is the reason why you need to know how to construct this?

Post your answers in the Discussion Forum and discuss with your classmates.

ACTIVITY 17.   Construct your own angle bisector

In a short bond paper, draw three angles (one acute, one right, and one obtuse angles) and draw its angle bisectors.

Process Questions:
1. Were you able to construct the bisector of each angle type? If not, what is the hindering factor to it?

If you find difficulty in constructing the bisector of each angle type, go back to Activity No. 17 and watch the tutorial video again. You may also ask assistance from any knowledgeable person.

Pass your output to your teacher on your next face-to-face meeting.

END OF FIRM-UP:

> In this section, the discussion was about how the points, lines, and planes are called the undefined terms in Geometry; the subsets of a line; and how angles are formed. Here,you learned how to name and represent terms mentioned above using models. Real-life models and situations were also identified to connect what you have learned to the real-world.
>
> Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision?
>
> Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

> Your goal in this section is to relate geometric figures to real-life problems or situations. Before proceeding to the next section, consider the following questions: **How are problems formed?** *How useful are the geometric in solving problems related to design?* Let us do the next activity to find out how.

ACTIVITY 18.   Song Analysis and Journal Writing

Click on the site http://www.youtube.com/watch?v=cxATuGITA4I to listen to a song. Refer to the lyrics below as you listen.

Tuldok
By Asin
Ang tuldok ay may salaysay at may kahulugan
Na dapat mapansin at maintindihan
Kahit sino ka man ay dapat malaman
Na dito sa mundo ikaw ay tuldok lang

Kahit na ang araw sa kalangitan
Siya ay tuldok lamang sa kalawakan
Lahat ng bagay ay tuldok ang pinanggalingan
At kung masdang mabuti, tuldok ang uuwian

Tingnan mong mabuti ang 'sang katauhan
Maraming nag-aaway, tuldok lang ang dahilan
Sa aking nakita, ako'y natawa lang
'Pagkat ang nangyayari'y malaking kahibangan

Kaya wala kang dapat na ipagmayabang
Na ikaw ay mautak at maraming alam
Dahil kung susuriin at ating iisipin
Katulad ng lahat, ikaw ay tuldok rin

Process Questions:
1. How is the point used in the song?

2. According to the song, what are some of the causes of problems in society?

3. What social issues are pointed out?

4. What events in your life can you relate to the song?

5. How will you relate your experiences (whether good or bad) to how the undefined terms form the other geometric figures?

6. What insights did you gain from the song?

ACTIVITY 19.   Revisiting Activity No.1. Picture Analysis.

1. Go back to your answers in Activity 1. Review your answers and make revisions to the items you want to revise. Then click on **SUBMIT.** Post your answer to the item 4 question "**how do you think geometric figures are formed?**" in the **Discussion Forum.**

ACTIVITY 20.   Revisiting Activity No. 2. A/R Guide

Go back to Activity No.2. Read again the statements and write your final response in the After Lesson column. Then click on **SUBMIT.**

ACTIVITY 21.   Quiz

A. Misconception Check.

1.

a. Ana was asked by her teacher to name all the angles used when dancing. She said that only acute and obtuse angles are used. Is she correct? Explain.

My Answer:

b. Bert said, "In order for the tall buildings to stand, it must form obtuse angles to the ground". Is he correct? Explain.

My Answer:

2. **Checking for Understanding**

1. What geometric figures were used in designing and constructing the modern kitchen?

2. What geometric figures were made to be congruent and what part of the design does it represent? Why?

1. What geometric figures were used in designing and constructing the living room?

	2. What geometric figures were made to be congruent and what part of the design does it represent? Why?
	a. What geometric figures were used in designing and constructing the bedroom?
	b. What geometric figures were made to be congruent and what part of the design does it represent? Why?

Conclusion:
How are geometric figures modelled/mirrored in some real-life objects/situations?
How useful are the different geometric figures in solving problems related to design?

ACTIVITY 22.   Writing a Synthesis Journal

Complete the table below.

Synthesis Journal			
Lesson	**What I did.**	**What I learned.**	**How I can use it**
Points, Lines, and Planes			
Segments and Rays			
Angles			

End of DEEPEN:

In this section, the discussion was about how the undefined terms, the subsets of a line, and angles are used in explaining situations and solving problems in the real world. What new realizations do you have about the topic? What new connections have you made for yourself?

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 23.   Bed Design

TASK

After renting a house for many years, your family will be moving into a newly owned house. The space is enough for the four family members. There are 2 bedrooms: one for your parents and one for you and your sibling. As the eldest child, you are given the task to sketch a design of a bed which would maximize the space of the room.

Do not forget to apply what you have learned in the *basic constructions* that you have learned in the previous activities.

Below is the Checbric to guide you in making your bed design.

	4 Excellent	3 Satisfactory	2 Developing	1 Beginning
1. The bed design maximizes the room space.				
2. The design is unique and innovative.				
3. Sketch contains evidence that the basic constructions were done to make sure that segments and angles are congruent.				

Process Questions:

1. How did you find the activity? Explain briefly what you have done in your bed design.

2. How does your knowledge of geometric relationships involving undefined terms (points, lines, and planes), segments, and angles help you in accomplishing your task?

3. ***How useful are geometric figures in solving problems related to design?***

Post your answers to the Process Questions in the Discussion Forum.

End of TRANSFER:

How did you find the performance task? How did the task help you see the real world use of angles?

LESSON 2:   ANGLE PAIRS, PERPENDICULAR AND PARALLEL LINES

EXPLORE
:

Let's start the lesson by answering the problem below.

ACTIVITY 1. Picture Analysis

Look at the interior design of the house. Observe how the furniture are designed and arranged.

Process Questions:

1. What kinds of angles are formed in the base of the center table? Can you see pairs of congruent/equal angles? How about straight angles?

2. How will you describe the horizontal lines in the design of the cabinet? Do they intersect each other? How about the vertical lines, do they intersect each other also? How do you call these lines?

3. What kind of angles are formed when the horizontal lines intersect vertical lines? Do you know how to call these lines?

4. What will happen to the center table if its design does not include the intersecting lines at the base part?

5. In the cabinet, can you still arrange the books placed on it the way it is arranged if its design does not include the types of lines shown? Why?

6. **How can you represent angle pairs, parallel and perpendicular lines using real-life models?**

7. **How useful are angle pairs, parallel and perpendicular lines in solving problems related to design?**

ACTIVITY 2.   A/R Guide

Instruction: Respond to each statement twice: once before the lesson and again after the lesson.
Write **A** you if you agree with the statement
Write **B** you if you disagree with the statement

Response Before the Lesson	Statements	Response After Lesson
	1. Complementary angles are the same as supplementary angles.	
	2. Complementary and supplementary angles can be adjacent or non-adjacent.	
	3. Supplementary angles can also be called linear pair of angles.	
	4. When two lines intersect only pairs of vertical angles are formed.	

	5. Angle pairs are useful in the making of infrastructure and furniture designs.	

End of EXPLORE:

> You gave your initial answers to the questions and statements given above.
>
> Let's find out how others would answer the above and compare their ideas to our own. As you compare, you will find out if your ideas are in line with the standard. You will also learn other concepts which will help you complete a required project found at the end. This project is about drawing the parts of house such as windows, doors, roofs using the angle pairs , perpendicular lines, and parallel lines .

FIRM-UP

> Your goal in this section is to learn and understand key concepts of the angle pairs, perpendicular lines and parallel lines. You will also find real-world representations of each geometric term mentioned above.

ADJACENT ANGLES

ADJACENT ANGLES
These are two angles that share a common side (ray) and a common vertex.

Examples

35°
55°

80° 45°

85° 20°

130° 50°

Non-Examples

100° 50°

35°
35°

55° 45°

ACTIVITY 3.   Side by side angles

Give the name of each pair of adjacent angles to complete the table below.

	No. of Pairs of Adjacent Angles	Name of Each pair of Adjacent Angles
	4	$\angle$ ____ and $\angle$ ____ $\angle$ ____ and $\angle$ ____ $\angle$ ____ and $\angle$ ____ $\angle$ ____ and $\angle$ ____
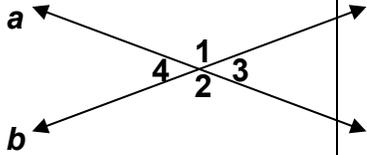
ACTIVITY 4.   Investigating Complementary and Supplementary Angles

INVESTIGATION

Observe the sum of the measures of each pair of angles below.

Adjacent Complementary Angles	Adjacent Supplement Angles (also known as the Linear Pair of Angles
Non-adjacent Complementary Angles	Non-adjacent Supplement Angles
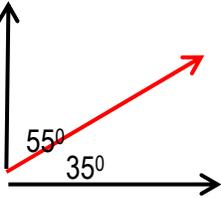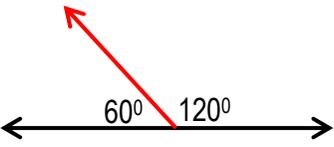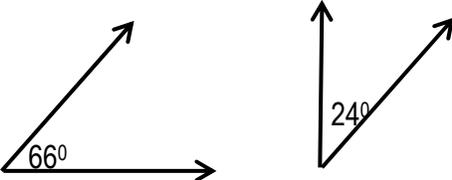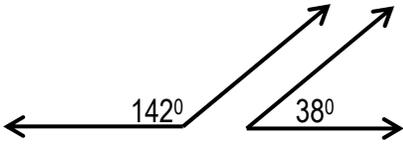
Process Questions:
1. What can you say about the sum of the measures of complementary angles?

2. What can you say about the sum of the measures of supplementary angles?

3. Why are adjacent supplementary angles also called linear pair of angles?

ACTIVITY 5. Supplementary angles in two intersecting lines

A. Give the name of each pair of adjacent supplementary angles or linear pair of angles to complete the table below.

	No. of Pairs of Adjacent Supplementary Angles or Linear Pair of Angles	Name of Each pair of Adjacent Angles
(figure with lines a and b intersecting, angles 1, 2, 3, 4)		$\angle$____ and $\angle$____
		$\angle$____ and $\angle$____
		$\angle$____ and $\angle$____
		$\angle$____ and $\angle$____
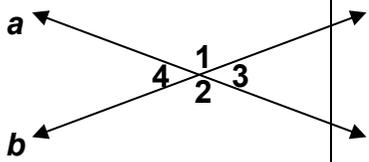
Conclusion: When two lines intersect there are_____pairs of adjacent supplementary angles or linear pair of angles formed.

B. Determine the measures of the angles by applying the concept of supplementary angles.
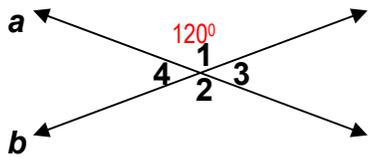
(figure with lines a and b intersecting, angle 1 = 120°, angles 2, 3, 4)	$m\angle 3 =$____ $m\angle 2 =$____ $m\angle 4 =$____

COMPLEMENTARY ANGLES

Click on this link
http://dolfanescobar.files.wordpress.com/2012/12/11math_g8_fl_06-01-c.ppt
to view a ppt about complementary and supplementary angles. Then read the
additional input and examples below.

Complementary Angles

Two angles whose sum of their measures is 90^0.

Adjacent Complementary Angles	
$\angle ABD$ and $\angle DBC$ are complementary angles because the sum of their measures is equal to 90^0. Notice that together they make a right angle. $m\angle ABD + m\angle DBC = 90$	
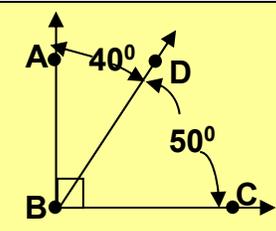
Non-adjacent Complementary Angles	
$\angle EFG$ and $\angle HIJ$ are complementary angles because $\quad$ 27° + 63° = 90°. $m\angle EFG + m\angle HIJ = 90$	
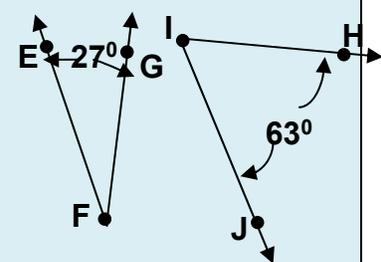
Examples:

1. What is the complement of each of the following angles?				
a. m$\angle$A = 12	b. m$\angle$B = 25	c. m$\angle$C = 45	d. m$\angle$D = 50	e. m$\angle$E = 84
comp. = 90 – 12 = 78	comp. = 90 – 25 = 65	comp. =90 – 45 = 45	comp. = 90 – 50 = 40	comp. = 90 – 84 = 6

2. The measure of an angle is three times the measure of its complement. Find the angles.

Let:	**Solution:**
x = the angle	a. Substitute equation 2 to equation 1
y= the complement of the angle	to get y
	x + y = 90
Given: x and y are complementary	3 y + y = 90
angles	4y = 90
	$\dfrac{4y}{4} = \dfrac{90}{4}$
Find: x , y	
Equations:	y = 22. 5
1. x+ y = 90 def. of comp.	b. solve for x
angles	x = 3y
2. x = 3y	= 3 (22.5)
	= 67.5
	Check: 67.25 is three times 22.5 which is its complement.
	∴ the angles are 22.5 and 67.5.

ACTIVITY 6.   Test Yourself!

I.   **Answer the following.**

1. If $\angle A$ and $\angle B$ are complementary, what is the sum of their measures?

2. If the measure of an angle is equal to the measure of its complement, what is the measure of the angle?

3. $\angle 1$ and $\angle 2$ are complementary angles. If m$\angle 1$ = 2m $\angle 2$, what is m$\angle 1$?
10.
4. The measure of an angle is five times the measure of its complement. Find the measure of each angle.
11.
5. The measure of the complement of the angle is 12 more than twice the measure of the angle. Find the measures of the angles.

II. Give the complement of each angle.

1. 36   2. 45   3. 67   4. 81   5. n

SUPPLEMENTARY ANGLES

Supplementary Angles

Two angles whose sum is 180^0.

Linear pair of Angles

Two angles form a linear pair if they are adjacent and the noncommon sides form a line.

Examples:

1. What is the supplement of each of the following angles?				
a. m∠A = 120 sup. = 180 – 120 = 60	b. m∠B = 70 sup. = 180 – 70 = 110	c. m∠C = 55 sup. =180 – 55 = 125	d. m∠D = 100 sup. = 180 – 100 = 80	e. m∠E = 90 sup. = 180 – 90 = 90

2. Find the value of x.	
Adjacent Supplementary Angles (Linear Pair)	**Non-adjacent Supplementary Angles**

<table>
<tr><td>

∠CJL and ∠CJG are supplementary angles.
m∠CJL +∠CJG = 180
x + 77 = 180
x = 180 – 77
<mark>x = 103</mark>

</td><td>

∠RQP ∠UTS are supplementary angles.

m∠RQP +∠UTS = 180
123 + x = 180
x = 180 – 123
<mark>x = 57</mark>

</td></tr>
</table>
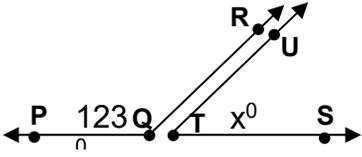
3. Solve the following problems.
   a. m∠J = (2x + 15) and m∠M = (6x – 35) . If ∠J and ∠M are supplementary angles, find x.

Given:	Solution:
∠J and ∠M are supplementary angles m∠J = (2x + 15) m∠M = (6x – 35) **Find**: x	∠J and ∠M are supplementary angles $\qquad$ m∠J+ m∠M = 180 (2x + 15) + (6x – 35) = 180 $\qquad$ 8x – 20 = 180 $\qquad$ 8x = 180 + 20 $\qquad \dfrac{8x}{8} = \dfrac{200}{8}$ $\qquad$ <mark>x = 25</mark> $\qquad$ <mark>∴ x = 25</mark>.

b. The measure of an angle is 10 more than thrice the measure of its supplement. Find the angles.

Let: x = angle
$\qquad$ y = supplement of the angle
Find: x , y
Equations/Solution:
$\quad$ a. **Solve for x**
Eq. 1: x + y = 180 $\qquad$ def. of supp. angles
$\qquad$ <mark>y = 180 – x</mark> $\,$ supplement of the angle
Eq. 2: (measure of the angle) (is) (10 more than thrice the measure of its supplement)

$\qquad\qquad\qquad$ x = 3y + 10
$\qquad\qquad\qquad$ x = 3 (180 – x)+ 10 $\qquad$ Substitute
$\qquad\qquad\qquad$ x = 540 – 3x + 10
$\qquad\qquad\quad$ x + 3x = 550 $\qquad\qquad\qquad$ Simplify

$$\frac{4x}{4} = \frac{550}{5}$$

$$x = 137.5$$

b. **Solve for y**

$y = 180 - x$

$= 180 - 137.5$

$= 42.5$

∴ The measure of the angle is 137.5 and the measure of its supplement is 42.5.

c. The supplement of an angle is four times greater than its complement, find $m \angle x$, its supplement and complement.

Let:

x = the angle

y = the complement of the angle

z = the supplement of the angle

Find:

x, y, z

Equations/Solution:

a.

Eq. 1: $x + y = 90$ def. of complementary angles

$y = 90 - x$ complement of x

Eq. 2: $x + z = 180$ def. of supplementary angles

$z = 90 - x$ supplement of x

Eq. 3: (the supplement of an angle) (is) (four times greater than its complement)

$$z = 4y$$
$$180 - x = 4(90 - x)$$
$$180 - x = 360 - 4x$$
$$-x + 4x = 360 - 180$$
$$\frac{3x}{3} = \frac{180}{3}$$
$$x = 60$$

b. solve for the:

complement of x	supplement of x	Check:
$y = 90 - x$	$y = 180 - x$	120 is four times greater than 30.
$= 90 - 60$	$= 180 - 60$	
$= 30$	$= 120$	

∴ The measure of the angle is 60, its supplement is 120, and its complement is 30.

ACTIVITY 7.   Test Yourself!

I.   Use the figure below to answer the following questions.
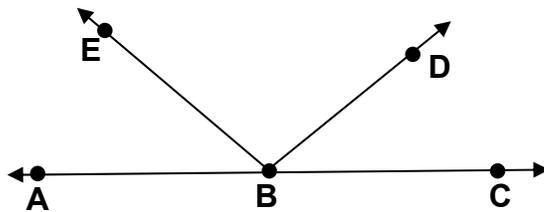
1. What is the angle that is supplementary to ∠ABD?

2. What is the angle that is supplementary to ∠CBE?

3. If m∠ABD = 160, what is m∠CBD?

4. If the measure of ∠ABD is twice the measure of ∠CBD, what is the measure of ∠CBD?

5. If m∠ABE = m∠CBD= 45, what kind of angle is ∠EBD?

II.   Solve the following problems.

1. ∠FGI and ∠HGI are linear pair of angles. If m∠FGI = 2x -20 and   m∠HGI = 3x – 25, find m∠FGI and m∠HGI.

2. The measure of the supplement of an angle is 30 less than twice the measure of the angle. Find the measure of each.

3. What is the measure of the supplement of an angle if twice the measure of its supplement is 30 more than five times the measure of its complement?

> Previously, you have learned the three angle pairs: adjacent angles, complementary angles, and supplementary angles. You have also learned that complementary and supplementary angles can be adjacent or non-adjacent. In the next lessons, you will learn about congruent angles and vertical angles.

CONGRUENT ANGLES and VERTICAL ANGLES

Words: Angles that have the same measure are congruent angles.
Arcs in the figure also indicate which angles are congruent.
Model:

D   E

30^0 30^0

A   B   C
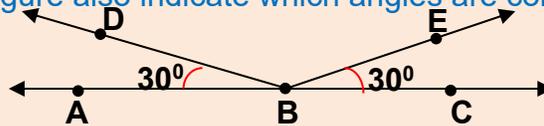
VERTICAL ANGLES

A pair of **non-adjacent angles** formed by the intersection of two straight lines.

m \ / 4 1 / 3 \ 2 *n*	• Lines m and n intersect forming $\angle 1$, $\angle 2$, $\angle 3$, and $\angle 4$ • 2 pairs of vertical angles are a. $\angle 1$ and $\angle 2$ b. $\angle 3$ and $\angle 4$

ACTIVITY 8.   Investigating Vertical Angles

INVESTIGATION

Procedure: Apply the concept of adjacent supplementary angles or linear pair of angles in getting the measures of the angles

130^0
5
8
6   7
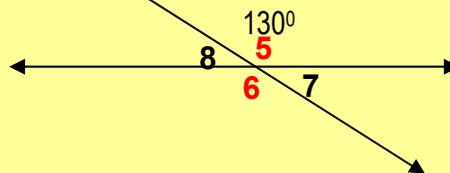
1. Determine the measure of each angle. Use **<, >,** or **=** to compare the measures of each pair of vertical angles.

   a. m$\angle 5$ = ☐   and m$\angle 6$ = ☐   , thus m$\angle 5$ ☐   m$\angle 6$

b. m∠7 =   and m∠8 =   , thus m∠7   m∠8

Conclusion: The measures of vertical angles are _____.

Examples:
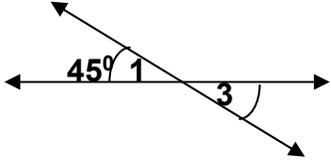
1. What is m∠3? 45⁰ 1 3	Given: ∠1 and ∠3 are vertical angles Solution: Applying the vertical angle theorem, m∠3 = 45.

2. Find the value of y and the measure of each angle.

(5y +   5
6 (2y + 15)⁰
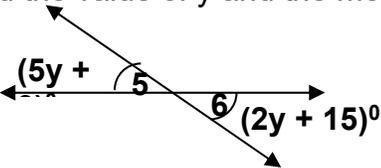
Given:
∠5 and ∠6 are vertical angles
m∠5 = (5y + 3
m∠6 = (2y + 15)

Solution:
 a. Solve for y
∠5 and ∠6 are vertical angles

    ∠5 ≅ ∠6
  m∠5 = m∠6   by vertical ∠
theorem
(5y + 3) = (2y + 15)   by substitution

 5y – 2y = 15 – 3
   $\frac{3y}{3} = \frac{12}{3}$
    y = 4

b. Solve for the measure of each angle

 m∠5 = m∠6

 (5y + 3) = (2y + 15)

 5(4) + 3 = 2(4) + 15

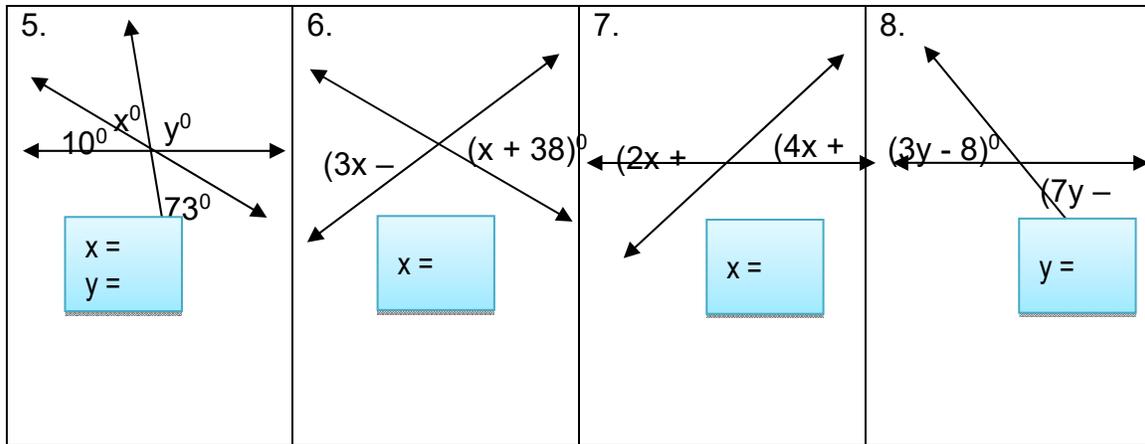 20 + 3 = 8 + 15

   23 = 23

 ∴ y = 4, m∠5 = m∠6 = 23.

3. Two angles are vertical angles. If one angle measures 24x + 16 and the other angle measures 18 x + 46, find the measure of each.

Let: $\angle 1$= the first angle
$\angle 2$= the second angle

Given:
$\angle 1$ and $\angle 2$ are vertical angles
$m \angle 1$= 24x + 16
$m \angle 2$= 18x + 46

Find: x , $m \angle 1$, $m \angle 2$

Solution:

a. **Solve for x**
$\angle 1$ and $\angle 2$ are vertical angles

$\angle 1 \cong \angle 2$ by vertical $\angle$

theorem

$m\angle 1 = m\angle 2$ def'n. of congruent

segments

24x + 16 = 18x + 46   by substitution

24x – 18x = 46 – 16

$\dfrac{6x}{6} = \dfrac{30}{6}$

x = 5

b. **Solve for the measure of each angle**

$m\angle 1 = m\angle 2$

24x + 16 = 18x + 46

24(5) + 16 = 18 (5) + 46

120 +16 = 90 + 46

136 = 136

$\therefore$ x= 5, $m\angle 1 = m\angle 2 = 136$.

ACTIVITY 9.   Test Yourself!

I. **Use the concepts of complementary, supplementary, and vertical angles to find the value of x and y.**

1.	2.	3.	4.
x^0 102^0 y^0	x^0 18^0 y^0	y^0 32^0 x^0	70^0 y^0 x^0 20^0
x = y =	x = y =	x = y =	x = y =

5.	6.	7.	8.
10^0 x^0 y^0 73^0 x = y =	$(3x -$ $(x + 38)^0$ x =	$(2x +$ $(4x +$ x =	$(3y - 8)^0$ $(7y -$ y =

Process Questions:

1. How did you score in the quiz?

2. Can you now say that you have a full knowledge of the different angle pairs?

Post your answers in the Discussion Forum.

ACTIVITY 10. Interactive Quiz on Angle Pairs

1. Before you take the quiz on angle pairs, answer first the preview test on the site http://www.thatquiz.org/tq/previewtest?J/N/F/Y/95161326825018 . This a 22-item test in which its answer key will be viewed at the bottom of the page.

12.

2. Click this link http://www.thatquiz.org/tq/practicetest?2y10d72y2av to take a 22-item test. Just click on the your chosen answer. Your score and incorrect answers will be viewed after the test.

Process Questions:

1. How did you score in every quiz?

2. Can you now say that you have a full knowledge of the different angle pairs?

Post your answers in the Discussion Forum.

To have a fuller grasp of the lesson about the angle pairs, click this link http://star.spsk12.net/math/8/AdjacentAngles.ppt to view a PowerPoint presentation containing an input and examples about the angle pairs. This will sum up everything that you have learned in this section.

Skills Readiness Check: Reflect on the level of your performance for this lesson. Check the first column if you **need more practice** or the second column if you are now **ready to move on to the next activity**.

I Need more practice (if most of your answers are incorrect)	I am ready to move on to the next activity (if you incur only few errors in the first three practice problems)
Review the concepts and retake the quizzes in Activities 9 and 10. Seek help from any knowledgeable person.	You may proceed to the next activity

ACTIVITY 11. Angle Pairs in the real-world

Materials: pen or pencil
Straight edge
copy of the pictures given in this activity

Directions: Given the set of pictures below, trace, mark (using numbers) and list down the pairs of angles, parallel lines, and perpendicular lines present in the design. Draw your answers on a sheet of paper, and submit to your teacher on your next meeting.
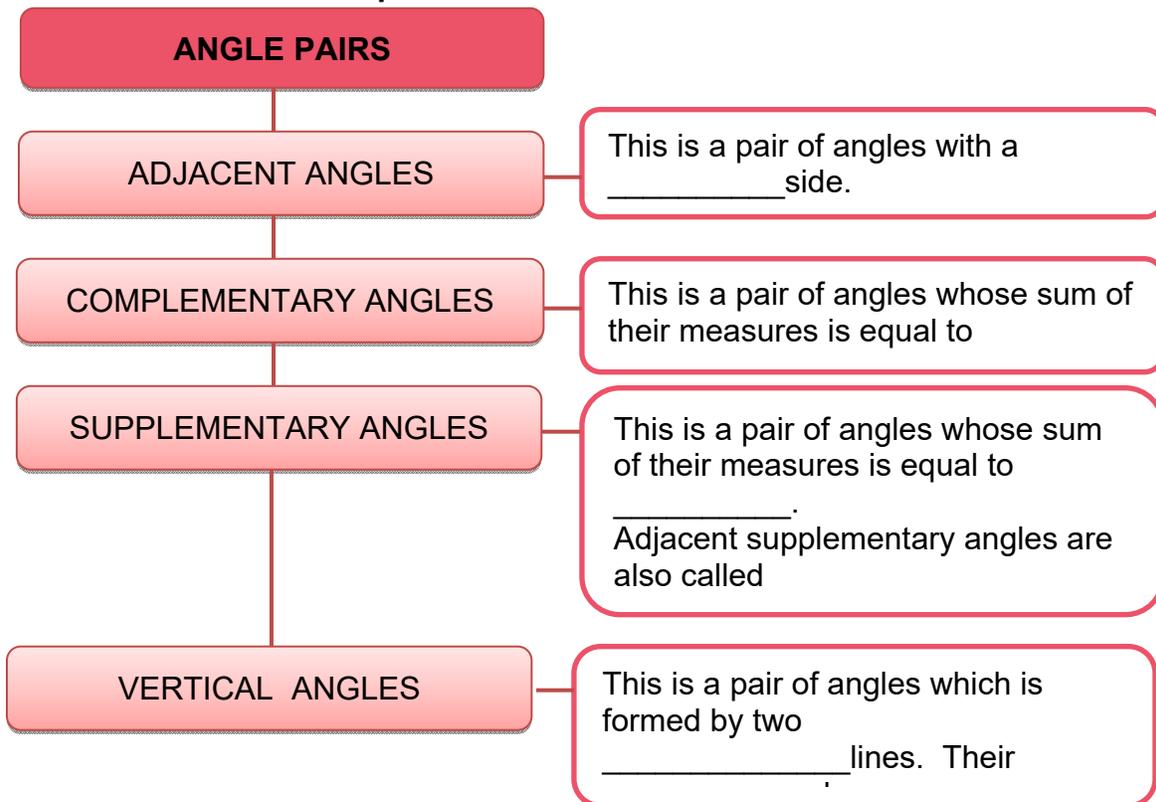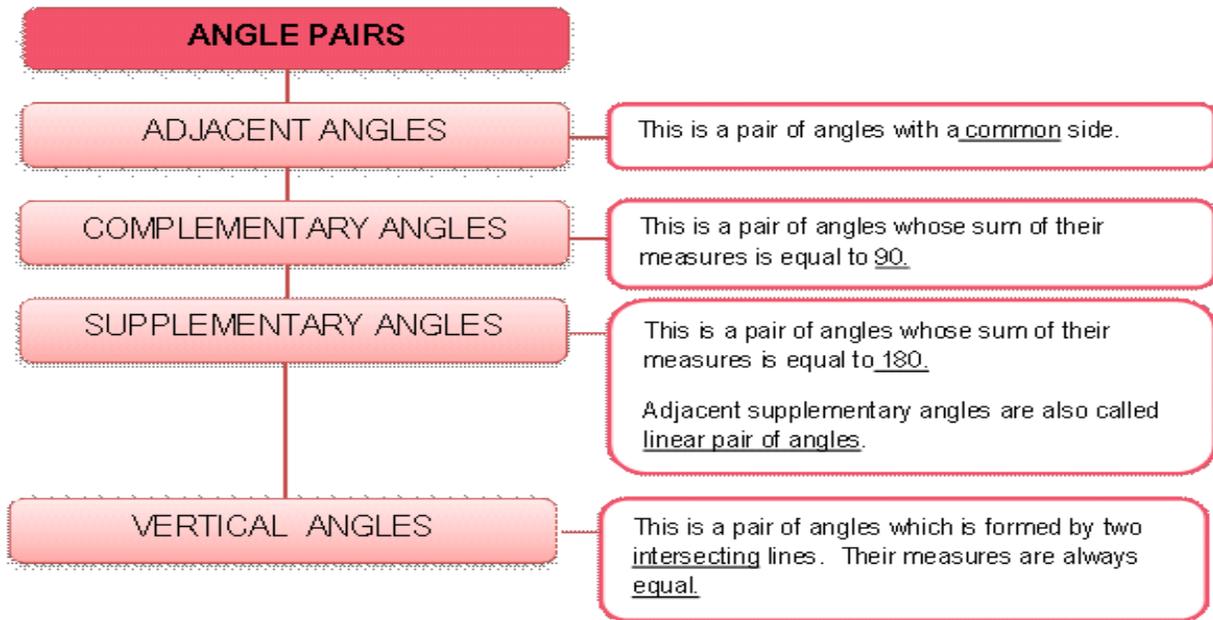
Process Question:

1. *How important are angle pairs, parallel and perpendicular lines in the design of the folding table and the design of the railings and doors of a house?*

2. *How useful are angle pairs, parallel and perpendicular lines in solving problems related to design?*

*Post your answer in the **Discussion Forum**.*

ACTIVITY 12.   Organize Your Thoughts.
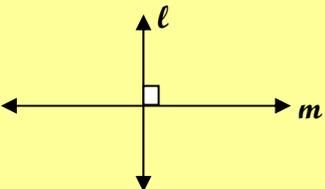
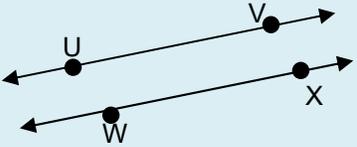**Fill in the blanks to complete the statement in each box.**

ANGLE PAIRS

ADJACENT ANGLES

This is a pair of angles with a _____side.

COMPLEMENTARY ANGLES

This is a pair of angles whose sum of their measures is equal to

SUPPLEMENTARY ANGLES

This is a pair of angles whose sum of their measures is equal to _____.
Adjacent supplementary angles are also called

VERTICAL ANGLES

This is a pair of angles which is formed by two _____lines. Their _____.

ANGLE PAIRS

ADJACENT ANGLES	This is a pair of angles with a common side.
COMPLEMENTARY ANGLES	This is a pair of angles whose sum of their measures is equal to 90.
SUPPLEMENTARY ANGLES	This is a pair of angles whose sum of their measures is equal to 180. Adjacent supplementary angles are also called linear pair of angles.
VERTICAL ANGLES	This is a pair of angles which is formed by two intersecting lines. Their measures are always equal.

In this lesson, we will be dealing with the two different kinds of lines.

PARALLEL AND PERPENDICULAR LINES

Perpendicular Lines - a special type of intersecting lines whose intersection forms 90^0 angles.	Line ℓ is perpendicular to line m. In symbols, $\ell \perp m$. $\overline{HG} \perp \overline{CG}$.
Parallel Lines – these are lines that do not intersect. The symbol for parallelism is //.	$\overline{UV}$ is parallel to $\overline{WX}$. In symbols, $\overline{UV}$ // $\overline{WX}$.

$\overline{DC} \parallel \overline{HG}$
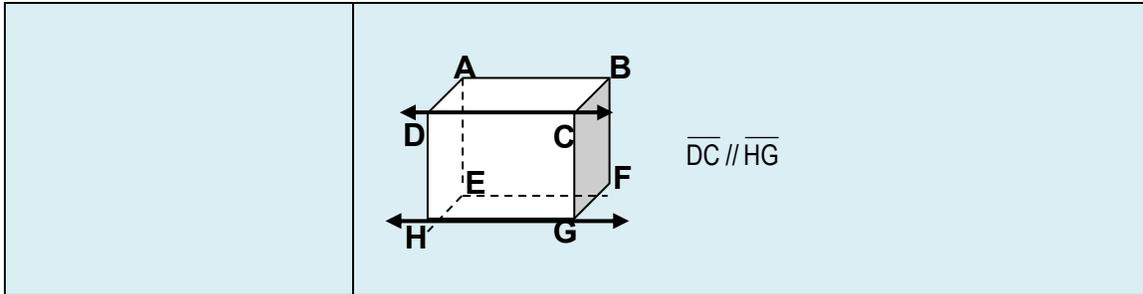
ACTIVITY 13.   Identifying Parallel and Perpendicular Lines
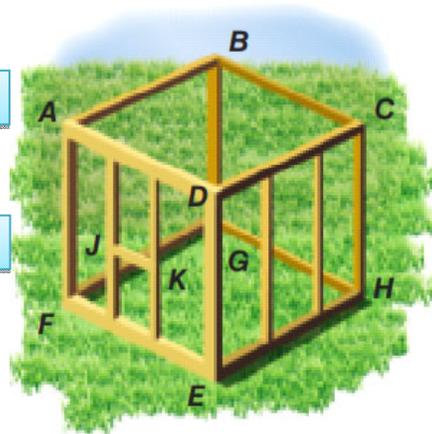
Use the picture to answer the following questions.

1. Name the four lines parallel to (line AD) $\overline{AD}$.

2. Name the four lines perpendicular to (line DE) $\overline{DE}$.

Process Questions:

1. **Can a stable box be made if you will not use parallel and perpendicular lines in its design? Why?**

2. **How useful are angle pairs, parallel and perpendicular lines in solving problems related to design?**

CONSTRUCTING PARALLEL and PERPENDICULAR LINES

ACTIVITY 14.   How to construct parallel and perpendicular lines

a. Watch a video from http://www.youtube.com/watch?v=im81vHIhZS8 to teach you how to construct parallel lines.

b. Watch a video from http://www.youtube.com/watch?v=I4dh2R6b1N0 to teach you how to construct perpendicular lines.

Process Questions:

3. How will you construct parallel and perpendicular lines?
4. What do you think is the reason why you need to know how to construct those lines?

Post your answers in the Discussion Forum.

ACTIVITY 15.   Construct your own parallel and perpendicular lines

Ina short bond paper, construct your own parallel and perpendicular lines following the videos you have just watched.

> If you find difficulty in constructing parallel and perpendicular lines, go back to Activity No. 13 and watch the tutorial videos again. You may also ask assistance from any knowledgeable person.

Pass your output to your teacher on your next face-to-face-meeting.

ACTIVITY 16.   Take a Pic!

Take at least one picture of the different types of design (objects, building structures, furniture, parts of a house, etc.) that would model the angle pairs, parallel lines and perpendicular lines. Create a title. Explain the importance of the presence of the mentioned terms above in the design.

Checkbric

	4 Excellent	3 Satisfactory	2 Developing	1 Beginning
3. The title is captivating.				
4. Picture/s taken really models of angle pairs, parallel lines and perpendicular lines..				
3. Pictures are taken within the locality and not from the internet				

Process Questions:

1. How useful are the different types of angle pairs, the parallel lines, and the perpendicular lines in the designs or use of the models that you have chosen?

2. *How are angle pairs, parallel lines and perpendicular lines reflected / mirrored in some real-life objects/situations?*

3. *How useful are angle pairs, parallel and perpendicular lines in solving problems related to design?*

Skills Check

Check the skills that you have already learned and mastered

I know how to identify and name the different angle pairs.	
I know how to solve algebraic problems involving angle pairs.	
I know how to solve real-life problems involving angle pairs.	
I know how to identify parallel lines and solve algebraic problems involving it.	
I know how to construct parallel and perpendicular lines.	
I know to solve real-life problems involving parallel and perpendicular lines.	

Do not proceed to the next part if not all the skills were not

![PEAC logo] ![DepED logo]
PRIVATE EDUCATION ASSISTANCE COMMITTEE
Trustee of the Fund for Assistance to Private Education
DEPARTMENT OF EDUCATION

JHS INSET Learning Module Exemplar

END OF FIRM-UP:

In this section, the discussion was about how the different angle pairs and congruent angles. We also learned parallel and perpendicular lines.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

Your goal in this section is to relate geometric figures to real-life problems or situations. Before proceeding to the next section, consider the following questions: **How can you represent each angle pair, parallel lines, and perpendicular lines using real-life models? How important are they in solving problems related to design?** Let us do the next activity to find out how.

ACTIVITY 17. Quiz

A. Misconception Check.

1. Bea and Beatriz were asked to solve the problem below. Each of them gave their answer. Who is correct? Explain.

"In order for ski jumpers to achieve the maximum distance on a jump, they need to make the angle between their body and their skis as small as possible. This allows them to get the proper extension over the tips of their skis.
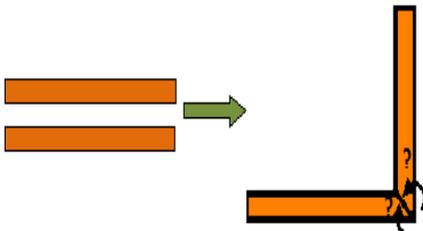
16.
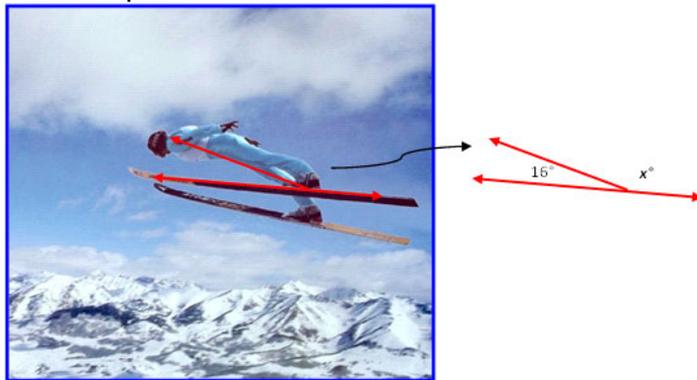
If a ski jumper's body is aligned so that the angle between the body and the front of the ski is 16°, what will be the angle that the tail of the skis forms with the body?"

Bea	Beatriz	My Answer:
74^0	164^0	

B. Test of Understanding
1. Angle Pairs in design

Solve the following problems by applying what you have learned on geometric relationships involving angle pairs.

.In the railings shown in the figure above, ∠3 measures 115°. Find the measures of the three other angles.	.The spokes of a ferris wheel (the bars that connect to the center pin of the Ferris wheel) form adjacent congruent angles. Suppose the picture at the right is the design of a ferris wheel to be built in an amusement park. Find the measure of the angle formed by the spokes.	Michaele is building a cold frame for his plants. He wants to cut two wood strips so that they'll fit together to make a right-angled corner. At what angle should he cut end of the strips if the angles are to be equal?

Process Questions:

a. What type of angle pairs are used to solve each problem?

b. What will happen to each design if the proper measurement of the angles are not considered?

c. How are the different angle pairs modelled/mirrored in some real-life objects/situations?

d. How useful are angle pairs, parallel and perpendicular lines in solving problems related to design?

2. **Parallel and Perpendicular Lines in design**

Examine each picture of structures below.

Process Questions:

    a. Can you see parallel and perpendicular lines in the body frame of each structure?

    b. Is each structure perpendicular to the ground?

    c. Which of the three structures is stable? Why?

    d. How are the parallel lines and perpendicular lines modelled/mirrored in some real-life objects/situations?

    e. How useful are angle pairs, parallel and perpendicular lines in solving problems related to design?

Process Questions:
    a. All types of angle pairs were used to solve all the problems.
    b. The design will not be that good and stable as it is if proper angle measurements were not considered.
    c. The different angle pairs are everywhere. It is modelled by the railings, the Ferris wheel, the frames of the window, etc.
    d. The knowledge of angle pairs help us ensure that the exact measurements of the different parts of the design. Thus, making it look good and stable.

Process Questions:
    a. Parallel and perpendicular lines are all seen in the body frame of each structure.
    b. The first two structures are not perpendicular to the ground. The third structure is the only structure which is perpendicular to the ground.

c. The third structure is stable than the first two structures. Perpendicularity of the building to the ground help the structure withstand disaster especially earthquake. When the first two structures will be shaken by an earthquake, it will easily collapse.

d. Parallel and perpendicular lines are seen in the different structures.

e. Parallel and perpendicular lines help us design stable and well-looking structural designs.

ACTIVITY 18.   Revisiting Activity No. 1: Picture Analysis

Go back to your answers in Activity 1. Review your answers and make revisions to the items you want to revise. Then click on **SUBMIT.** *Post your answer to items 6 and 7 question in the* ***Discussion Forum.***

ACTIVITY 19.   Revisiting Activity No. 2. A/R Guide

Go back to Activity No.2. Read again the statements and write your final response in the After Lesson column. Then click on **SUBMIT.**

ACTIVITY 20.   Writing a Synthesis Journal

Complete the table below.

Synthesis Journal			
Lesson	**What I did.**	**What I learned.**	**How I can use it**
Angle pairs			
Parallel Lines and Perpendicular Lines			

End of DEEPEN:

> In this section, the discussion was about how the angle pairs, parallel lines and perpendicular lines are used in explaining situations and solving problems in the real world. What new realizations do you have about the topic? What new connections have you made for yourself?

TRANSFER

> Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 21. Window and Grills Design

TASK

Make a sketch of a window and its grills design using the angle pairs, parallel lines ad perpendicular lines.
Do not forget to apply what you have learned in the *constructions* that you have learned in the previous activities.
Below is the Checkbric to guide you in making your bed design.

	4 Excellent	3 Satisfactory	2 Developing	1 Beginning
1. The design is unique and innovative.				
2. Sketch contains evidence that the basic constructions were done where segments are congruent, parallel or perpendicular.				

Process Questions:

a. How did you find the activity? Explain briefly what you have done in your design/sketch of the house.

b. How does your knowledge of geometric relationships involving parallel and perpendicular lines help you in accomplishing your task?

c. ***How useful are geometric figures in solving problems related to design?***

Post your answers to the Process Questions in the Discussion Forum.

End of TRANSFER:

How did you find the performance task? How did the task help you see the real world use of angles?

LESSON 3:   PARALLEL LINES AND TRANSVERSALS

EXPLORE

Let's start the lesson by answering the problem below.

ACTIVITY 1. Picture Analysis

Roller Coaster Ride

The framework of wooden roller coaster is composed of millions of feet of intersecting lumber that often form parallel lines and transversals. When parallel lines are intersected by a transversal, different angles are formed.

Process Questions:

1. What types of angles can be seen in the picture?

2. What angle pairs can you name? Are they all present?

3. *How useful are parallel lines and transversal in solving problems related to design?*

ACTIVITY 2.   A/R Guide

Instruction: Respond to each statement twice: once before the lesson and again after the lesson.
Write **A** you if you agree with the statement
Write **B** you if you disagree with the statement

Response Before the Lesson	Statements	Response After Lesson
	6. A transversal is a line that passes through one or more lines.	
	7. Lines that do not intersect are called parallel lines.	
	8. Angle pairs and relationships are formed when parallel lines are cut by a transversal.	
	9. Alternate interior angles, alternate exterior angles, same-side interior angles and corresponding angles formed by parallel lines cut by a transversal are congruent.	
	10. Parallel lines and transversal play an important role in the different engineering, architectural, and furniture designs.	

End of EXPLORE:

You gave your initial answers to the questions and statements given above.

Let's find out how others would answer the above and compare their ideas to our own. As you compare, you will find out if your ideas are in line with the standard. You will also learn other concepts which will help you complete a required project found at the end. This project is about making a sketch of your own dream house.

FIRM-UP

Your goal in this section is to learn and understand key concepts of the angle relationships formed by parallel lines cut by a transversal. You will also find real-world representations and solve problems related to it.

Angle Relationships Formed by Parallel Lines Cut by a Transversal

Transversal
A line (or segment) that intersects two or more coplanar lines (or segments) at distinct points.

Examples
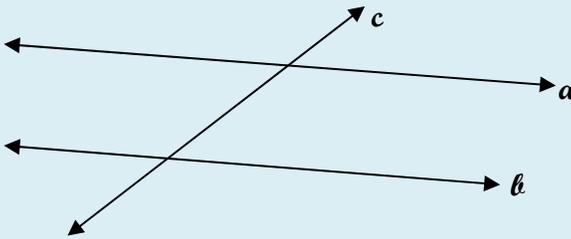
Line c is the transversal of lines a and b
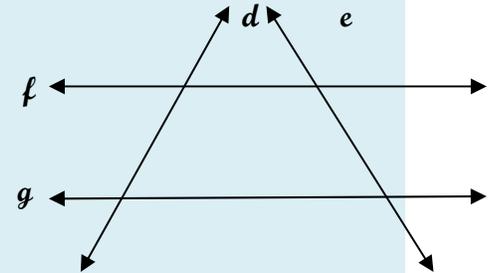
- Lines d and e are the transversals of lines f and g.
- Lines f and g are the transversals of lines d and e.

When two parallel lines are given in a figure, there are two main areas: the interior and the exterior.
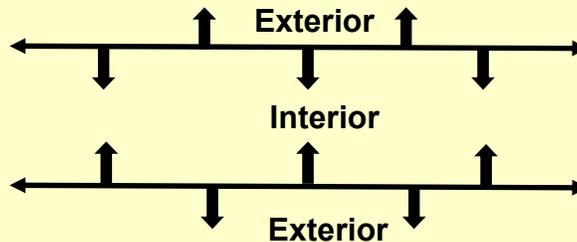
When two parallel lines are cut by a transversal (t), there are eight angles formed. There are also previously known pairs formed by this figure.
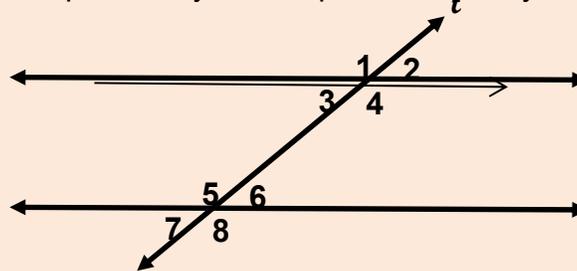
1. Vertical pairs: Pair of angles which are always congruent.

∠1 and ∠4   ∠2 and ∠3   ∠5 and ∠8   ∠6 and ∠7

2. Supplementary pairs (linear pair): The sum of the measures of the angles is 180^0.

∠1 and ∠2   ∠5 and ∠6   ∠2 and ∠4   ∠6 and ∠8
∠3 and ∠4   ∠7 and ∠8   ∠1 and ∠3   ∠5 and ∠7

ACTIVITY 3.   Investigating the Angle Relationships Formed by Parallel Lines Cut by a Transversal

INVESTIGATION

Figure 1. Original Intersecting Lines	Figure 2. Duplicate of Figure 1 but changing the names of the angles.	Figure 3. Combining Figue1 and 2.
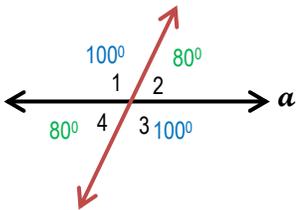
Notice that lines a and b are parallel and they are cut by the transversal line (red colored line)

Complete the table below. The first angle relationship is given as an example to follow on.

Definition Angle Relationships Formed	Name of the Angle Relationships formed based on figure 3	Combination of the Angles (both acute, both obtuse, acute and obtuse)	Relationships of the Angles in Terms of Measurement (congruent or supplementary)

Alternate interior angles are two angles in the interior of the parallel lines, and on opposite (alternate) sides of the transversal.	∠4 and ∠6	Both acute	They are congruent.
	∠3 and ∠5	Both obtuse	They are congruent.
Alternate exterior angles are two angles in the exterior of the parallel lines, and on opposite (alternate) sides of the transversal.	∠____ and ∠__		
	∠____ and ∠__		
Corresponding angles are two angles, one in the interior and one in the exterior that are on the same side of the transversal. Watch this video again from http://www.youtube.com/watch?v=im81vHlhZS8 to fully understand the corresponding angles formed by parallel lines cut by a transversal.	∠____ and ∠__		
	∠____ and ∠__		
	∠____ and ∠__		
	∠____ and ∠__		
Same-side interior angles are two interior angles lying on the same side of the transversal	∠____ and ∠__		
	∠____ and ∠__		

Conclusion:
When parallel lines are cut by a transversal, the angle relationships formed which are the alternate interior angles, alternate exterior angles, and corresponding angles are _____;   same   side   interior   angles   are
_____.

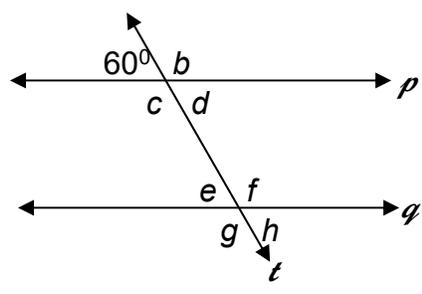Verify your answers in the investigation above by studying the concepts that follow.

ANGLE RELATIONSHIPS FORMED BY PARALLEL LINES CUT BY A TRANSVERSAL

Alternate interior angles are two angles in the interior of the parallel lines, and on opposite (alternate) sides of the transversal. Alternate interior angles are non-adjacent and congruent.	$\angle 4 \cong \angle 5 \qquad \angle 3 \cong \angle 6$
Alternate exterior angles are two angles in the exterior of the parallel lines, and on opposite (alternate) sides of the transversal. Alternate exterior angles are non-adjacent and congruent.	$\angle 2 \cong \angle 7 \qquad \angle 1 \cong \angle 8$
Corresponding angles are two angles, one in the interior and one in the exterior that are on the same side of the transversal. Corresponding angles are non-adjacent and congruent.	$\angle 1 \cong \angle 5 \qquad \angle 2 \cong \angle 6$ $\angle 3 \cong \angle 7 \qquad \angle 4 \cong \angle 8$
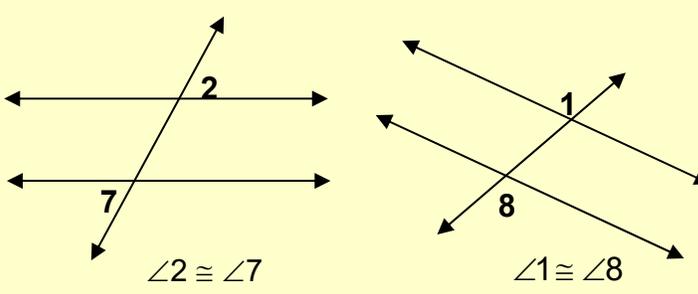
<table>
<tr>
<td>

Same-side interior angles are two interior angles lying on the same side of the transversal

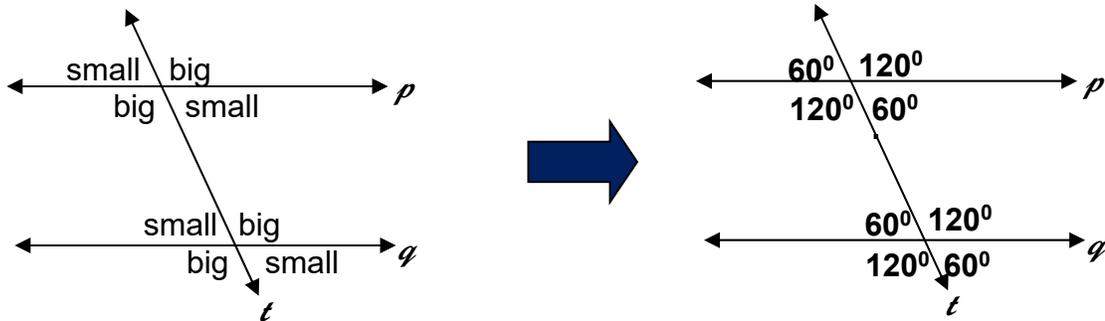Same-side interior angles are always supplementary.

</td>
<td>

$m\angle 3 + m\angle 5 = 180$ $m\angle 4 + m\angle 6 = 180$

</td>
</tr>
</table>
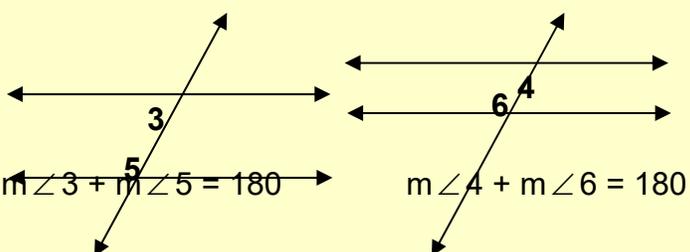
Example

1. Given the diagram below where p//q, determine the values of the angles *b, c, d, e, f, g* and *h*.

Solution:	
Step 1: *b* is a supplement of 60°. Therefore, *b* + 60° =180° *b* = 180° − 60° *b* = 120°	**Step 5**: *f* and *e* are supplementary angles. Therefore, *f* + 60° =180° *f* = 180° − 60 *f* = 120°
Step 2: *b* and *c* are vertical angles. Therefore, *c = b* = 120°	**Step 6**: *g* and *f* are vertical angles. Therefore, *g = f* = 120°
Step 3: *d* and 60° are vertical angles. Therefore, *d* = 60°	**Step 7**: *h* and *e* are vertical angles. Therefore, *h = e* = 60°
Step 4: *d* and *e* are alternate interior angles.	∴ *b* =120°, *c* = 120°, d = 60°, e = 60°, *f* = 120°, *g* = 120° and *h* = 60°

Therefore, $e = d = 60°$

From the above example, you may notice that either an angle is 60° or it is 120°. Actually, all the small angles are 60° and all the big angles are 120°. In general, the diagram will be as shown below. The small and big pair of angles are supplementary (i.e. small + big = 180°). Therefore, given any one angle you would be able to work out the values of all the other angles.

Click the link below to view more examples.
http://www.edmondschools.net/Portals/3/docs/Math/1%20VINCENT/PP%203.1.ppt

Example 2: Solve for x given that a//b.

$(5x)^0$

a

120^0

b

Solution:
Corresponding angles are congruent

$$\frac{5x}{5} = \frac{120}{5}$$

x = 24

∴ x = 24.

PARALLEL POSTULATE: Given a line and a point not on the line, there is only one line that is parallel to the line and passes through the point.
THEOREM 5-9: In a plane, if two lines are parallel to the same line, then they are parallel to each other.

Example: Solve for x.

55^0 ℓ

x A

45^0 m

Solution: by parallel postulate, we may draw a parallel line *n* to line *l* at point A . By theorem 5-9, line m is also parallel to line *n*

55^0 ℓ

45^0 A

55^0

45^0 m

By drawing line n, we have formed 2 pairs of alternate interior angles :55^0 and $\angle 1$, and 45^0 and $\angle 2$ .That is why m$\angle 1$= 55 and m$\angle 2$ = 45. So,

m$\angle x$ = m$\angle 1$+ m$\angle 2$
m$\angle x$ = 55 + 45
= 100
∴ x = 100.

ACTIVITY 4.   Skills Practice

A. Identifying Angle Relationship with the use of an Interactive Website

Click the link below to practice identifying the angle relationships formed by parallel lines cut by a transversal.
http://www.shodor.org/interactivate/activities/Angles/ . If you need a review doing the activity, click the **Learner** button. If you need help on how to answer the

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activity, click the **Help** button. Click **Check Answers** to determine your answers are correct or wrong. Click **Show Score** to view your score.

B. Interactive quiz

Take a 10-item quiz at http://www.thatquiz.org/tq-C/math/angles/ . Check **Parallel** on the left side. Determine the value of x. Your score will be given after taking the test and you will be given a chance to go back and correct your wrongly answered item.
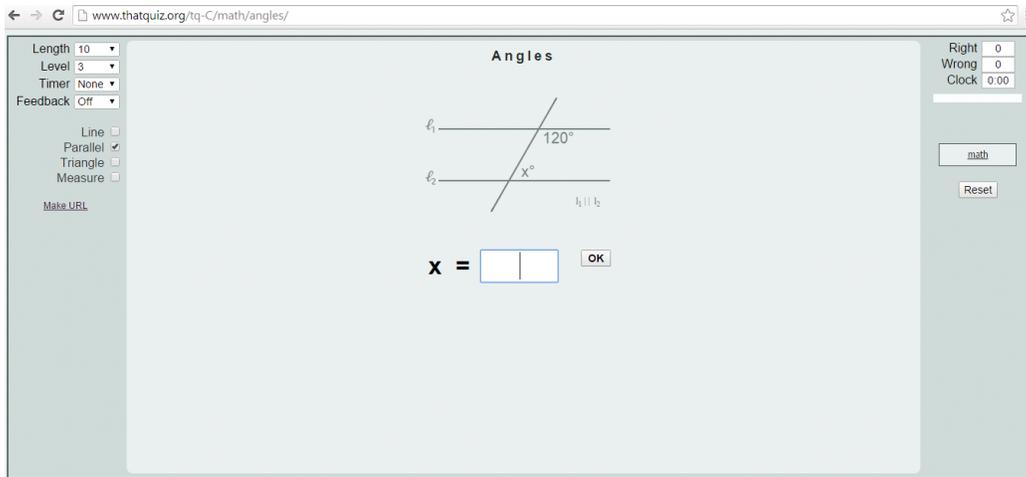
C. Written Practice

I. Classify the following pairs of angle as corresponding, alternate interior, alternate exterior ,same-side interior angles or vertical.

1. $\angle 1$ and $\angle 3$ _____

2. $\angle 4$ and $\angle 5$ _____

3. $\angle 2$ and $\angle 3$ _____

4. $\angle 6$ and $\angle 3$ _____

5. $\angle 7$ and $\angle 5$ _____

6. $\angle 1$ and $\angle 8$ _____

7. $\angle 2$ and $\angle 7$ _____

8. $\angle 2$ and $\angle 4$ _____

9. $\angle 6$ and $\angle 7$ _____
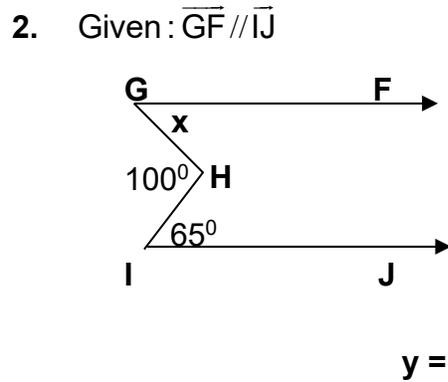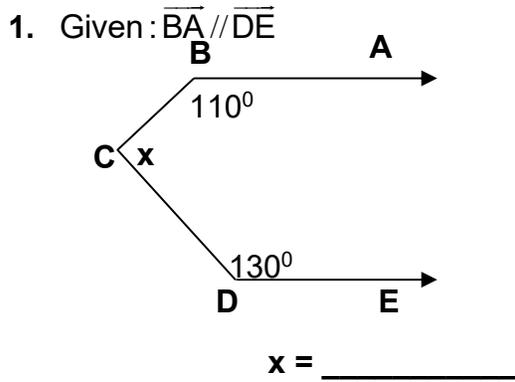
10. $\angle 1$ and $\angle 6$ _____
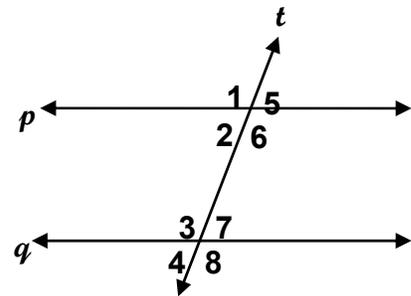
II. Given c // d. Find the measure of the indicated angle.

1. $m\angle 1$ 6. $m\angle 6$ 11. $m\angle$

=_____   =_____   11=_____

2. m∠2	7. m∠7	12. m∠
=_____	=_____	12=_____
3. m∠3	8. m∠8	13. m∠
=_____	=_____	13=_____
4. m∠4	9. m∠19	14. m∠
=_____	=_____	14=_____
5. m∠5	10. m∠10	
=_____	=_____	

III. Find x. Answer only.

1. Given: $\overrightarrow{BA} // \overrightarrow{DE}$

x = _____

2. Given: $\overrightarrow{GF} // \overrightarrow{IJ}$

y =

IV. Solve for x.

1. Given: a //b

$(x - 18)^0$

27^0

2. Given: e//f

$(4x - 10)^0$

$(2x + 26)^0$

Process Questions:
1. How was your scores?
2. Did the activities helped you master the skills in identifying the angle relationships formed by parallel lines cut by a transversal and solve algebraic problems related to it?

*Post your answers to these questions in the Discussion Forum and discuss with your classmates.*

Skills Readiness Check: Reflect on the level of your performance for this lesson. Check the first column if you **need more practice** or the second column if you are now **ready to move on to the next activity**.

| I Need more practice (if most of your answers in test C are incorrect)	I am ready to move on to the next activity (if you incur only few errors test C)
Review the concepts and Answer Test D. Seek help from any knowledgeable person.	You may proceed to the next activity

D.

I. Given c // d. Identify each pair of angles as *alternate interior*, *alternate exterior*, *same-side interior*, corresponding, or *vertical*.

1. ∠1 and ∠9   _____

2. ∠5 and ∠10   _____

3. ∠2 and ∠13   _____

4. ∠10 and ∠13   _____

5. ∠5 and ∠7   _____

6. ∠2 and ∠3   _____

7. ∠4 and ∠15   _____

8. ∠8 and ∠11   _____

9. ∠12 and ∠15   _____

10. ∠7 and ∠15   _____
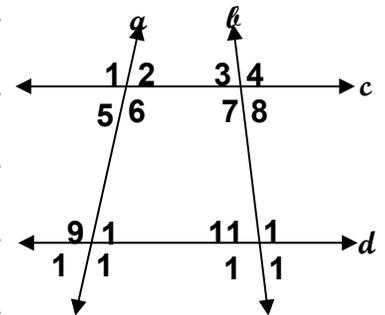
II. Solve for the values of x and y. Write your answer beside the variable.

11. 80 x/y

12. $120°$ x y

13. x y $115°$

14. $70°$ x $50°$ y

15. $114°$ $47°$ x y
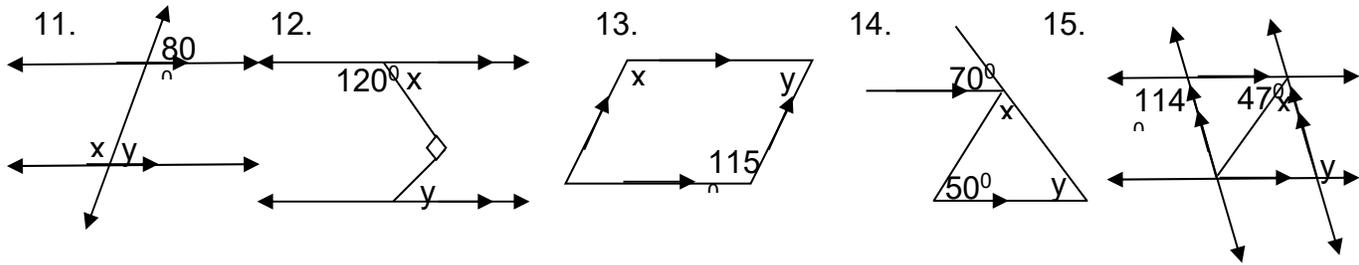
III.   Solve for the value of x.

16. Given: a //b	17. Given: c //d	18. Given: e //f
t *a* $(5x - 20)°$ *b* $(3x + 28)°$	*c* $(14x - 5)°$ *d* $13x°$	$126°$ $11x°$ $10x°$ *e* *f*

ACTIVITY 5.   Angles Formed by Lines and their Transversal

Trace all lines and their transversal in the picture below. Identify and label all pairs of alternate-interior angles, alternate-exterior angles, consecutive interior angles, and corresponding angles formed by these lines. Also, identify the lines and the transversal considered. Use numbers to name the angles formed and use small script letter for the name of the lines. Record your answers in the table provided.

Alternate-Interior Angles	Alternate-Exterior Angles	Consecutive Interior Angles	Corresponding Angles	Lines and Transversal considered

Process Questions:
1. Were you able to identify the angles formed by lines and their transversal?
2. If the design of the fence did not make use of parallel and perpendicular lines, what will happen to the fence in terms of appearance and stability?
3. ***Were you able to see how these geometric concepts model real-life objects?***

4. ***How useful are parallel lines and transversal in solving problems related to design?***

Pass your output to your teacher on your next face-to-face meeting. Post your answers to the Process Questions in the Discussion Forum.

ACTIVITY 6.   Application in the Real-World

1. Anthony is building a picnic table for his patio. He cut one of the legs at an angle of 40^0. At what angle should he cut the other end to ensure that the top of the table is parallel to the ground.


40

x =

2. Parallel drainage pipes are laid on each side of the Sinsuat Avenue Street. A pipe under the street connects the two pipes. The connector pipe makes 75^0 angle shown. What is the measure of the angle it makes with the pipe on the other side of the road?

Connector pipe

pipe

?

75°
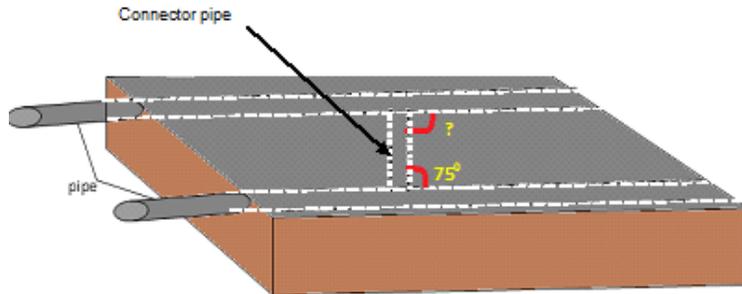
3. Brenda's residence is at the corner of Rizal Avenue and Luna Road. Bonifacio Street is parallel to Luna Road. Jacinto Street is parallel to Rizal Avenue. In going to church, she takes Jacinto Street. If she goes to school and takes Bonifacio Street, at what angle would she turn onto Rizal Avenue?

School

Church

Jacinto Street

104°

Bonifacio Street

Luna Road

Rizal Avenue

Brenda's Residence
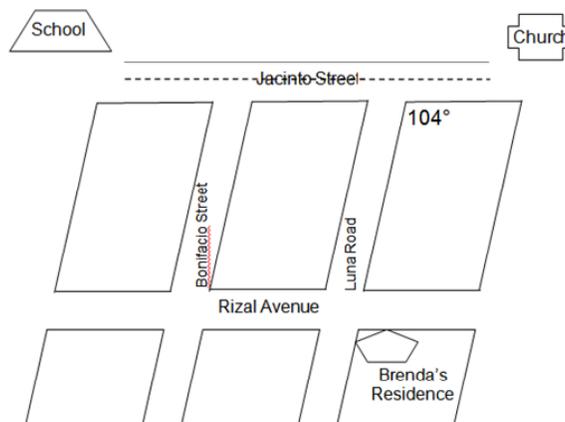
Process Questions:
1. *Were you able to see how these geometric concepts model real-life objects/situations?*

2. *How useful are parallel lines and transversal in solving problems related to design?*

You have just learned about the relationships between vertical angles and among angles formed by parallel lines cut by a transversal. Were you able to relate your previous knowledge and skills to the new lesson?

DEEPEN

Your goal in this section is to relate geometric figures to real-life problems or situations. Before proceeding to the next section, consider the following questions: **How can you represent each angle pair, parallel lines, and perpendicular lines using real-life models? How important are they in solving problems related to design?** Let us do the next activity to find out how.

ACTIVITY 7.   Test of Understanding

Answer the following problems below.

Expressway Design
The figure below shows a sketch of an expressway.
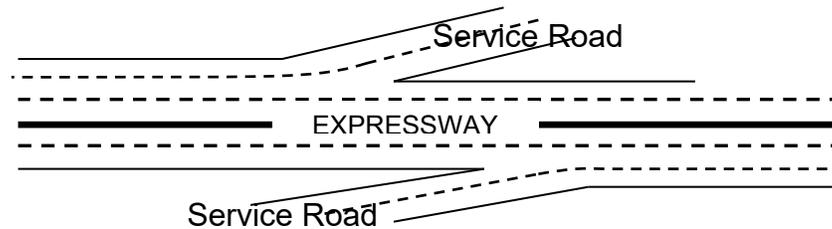
a. What part of the design models parallel lines and its transversals?

b. Explain why the expressway is designed the way as shown.

c. What do you think is the effect to the motorists if the service roads form 90-degree angle with the expressway?

Stair Design

A stairway is built to connect the first floor and the second floor of a house. Find $m\angle 1$.

60°
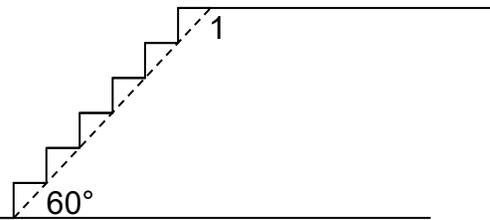
$m\angle 1 =$

a. What part of the design models parallel lines and its transversals?

b. Explain why the stair is designed the way as shown.

c. What do you think is the effect to the user of the stair if the angle formed by the stairs with is 90^0 instead of 60^0?

24. Building Design

Note: **Column**- an upright support of a structure

Beam- a horizontal structural support

a. What part of the design models parallel lines and its transversals?

b. Explain why the building is designed the way as shown.

c. Could you imagine how this structure is constructed without parallel lines? What would happen if the parallel lines in these structures are not properly executed?

Conclusion: How useful are parallel lines and transversal in solving problems related to design?

ACTIVITY 8. COMIC STRIP MAKING

Think of situation where you can apply the angle pairs, parallel lines, and perpendicular lines. Just imagine that your friend, mother, brother, or any person that can you think of needs your help in a particular situation/ problem and the solution to their problem is your knowledge on angle pairs, parallel lines, and perpendicular lines.. Suggested situations and objects can be found at home, furniture shops, and constructions sites. Make a comic script out of it. Go to www. toondoo.com. or any site where you can make your comic strips.

Procedure:
1. Go to http://www.toondoo.com.
2. Log in into your account.
3. After you have logged in, press the CREATE button on the upper right corner.
4. Choose a page layout for your comic.
5. Once chosen a page, choose any type of props, background, people, etc. on the tool bar on the left side of the screen b dragging it to the box.
6. If you want to change the expression or posture of the character, press the emotion or position button found on the bottom toolbar.
7. If you want to lay an object over another object, press BACK or FRONT button found on the bottom toolbar.
8. If you want to rotate your object, people, or background, press to ROTATE button on the bottom toolbar
9. If you have completed your comics, save it by clicking the Toondo icon on the left corner of the page and choose SAVE then type the title and description. Go down to SHARE OPTIONS and click share with friends then type the email address of your online teacher then click SAVE.

Rubric

CRITERIA	EXCELLENT (4)	SATISFACTORY (3)	PROGRESSING (2)	DEVELOPING (1)	RATING
Creativity (x2)	The story contains many creative and original details and/or description that contribute to the reader's comprehension and	The story contains a few creative details and/or description that contribute to the reader's comprehension and enjoyment of the story.	The story contains copied details and/or descriptions, and they distract from the story making it difficult to understand.	There is no evidence of creativity in the story. Story is incoherent.	$\overline{8}$

	enjoyment of the story.				
Dialogue/Text (x2)	There is an interesting and appropriate amount of dialogue and text to bring the characters to life and it is always clear which character is speaking. Grammar and usage are correct. Choice of words is correct and appropriate.	There is an appropriate amount of dialogue and text to bring the characters to life and it is always clear which character is speaking. Grammar and usage are correct. Choice of words is simple and correct	There is no appropriate dialogue or text but it is clear which character is speaking.	There is not enough dialogue or text and it is not clear which character is speaking.	$\overline{8}$
Illustration (x4)	Illustrations are detailed, presentable and relate to the text on the page.	Illustrations are presentable, and relate to the text on the page	Illustrations are limited and only some relate to the text on the page.	Illustrations do not relate to the text.	$\overline{16}$
Title (x1)	Title is catchy. It engages the reader to read the rest of the comic strip. It also tells what the topic will be.	Title is interesting and tells what the topic will be.	Title is interesting but does not relate to the topic.	Title is not interesting and does not relate to the topic.	$\overline{4}$
Originality (3)	Comic shows originality and	Comic shows originality in all parts. The content and	Comic shows an attempt at originality	Comic is a rehash of other people's	

	inventiveness in all parts. The content and ideas are presented in a unique and interesting way.	ideas are adequately presented.	~~and inventiveness~~ in some part of the presentation.	ideas and/or images and shows no attempt at original thought.	$\overline{15}$
Content and Accuracy (5)	All content throughout the presentation is accurate. There are no factual errors. Content shows connection of learned ideas from previous lessons.	All content throughout the presentation is accurate. There are no factual errors.	The content is generally accurate but one piece of information is inaccurate.	Content is confusing and contains more than one factual information.	$\overline{20}$
Total					$\overline{68}$

ACTIVITY 9.   Revisiting Activity No. 1: Picture Analysis

Go back to your answers in Activity 1. Review your answers and make revisions to the items you want to revise. Then c*lick on* **SUBMIT.**

ACTIVITY 10.   Revisiting Activity No. 2. A/R Guide

Go back to Activity No.2. Read again the statements and write your final response in the After Lesson column. Then c*lick on* **SUBMIT.**

ACTIVITY 11.   Writing a Synthesis Journal

Complete the table below.

Synthesis Journal			
Lesson	What I did.	What I learned.	How I can use it
Angle Relationships Formed by Parallel Lines Cut by a Transversal			

End of DEEPEN:

In this section, the discussion was about the angle relationships formed by parallel lines cut by a transversal and how they are used in the different real world situations specially on design.. What new realizations do you have about the topic? What new connections have you made for yourself?

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 12.   Design a House

TASK

Your newly- wed cousin wants to build a house. As the engineer of the family, he asked you to design a house for him. The design is only a simple drawing of the house. The design must be drawn accurately, creative, and supported with mathematical justification.

Rubric

CRITERIA	4 EXCELLENT	3 PROFICIENT	2 PROGRESSING	1 BEGINNING
ACCURACY OF THE DRAWING	Geometric figures used in the drawing are accurately	Geometric figures used in the drawing are	Some of the geometric figures used in the drawing are not	Most of the geometric figures used in the drawing are

	and neatly drawn.	accurately drawn.	accurately drawn.	not accurately drawn.
CREATIVITY OF THE DESIGN	The design shows originality and inventiveness. The design can be compared to a work a of professional designer.	The design shows originality and inventiveness. It is also appealing.	The design shows originality and inventiveness but is not appealing.	The design does not show originality and inventiveness. The design is copied from other designs.
CONTENT OF THE JUSTIFICATION	The drawing of the model house reveals student's exemplary understanding of the different geometric concepts of points, lines, planes, angle pairs, perpendicular and parallel lines. Geometric relationships involving these mathematics concepts are illustrated appropriately, flawlessly, and elegantly.	The drawing of the model house reveals adequate student's understanding of the different geometric concepts of points, lines, planes, angle pairs, perpendicular and parallel lines. Geometric relationships involving these mathematics concepts are illustrated appropriately.	The drawing of the model house reveals student's understanding of the different geometric concepts of points, lines, planes, angle pairs, perpendicular and parallel lines. Geometric relationships involving these mathematics concepts are illustrated but with some errors	The drawing of the model house barely reveals student's understanding of the different geometric concepts of points, lines, planes, angle pairs, perpendicular and parallel lines. Geometric relationships involving these mathematics concepts are fairly illustrated and with considerable errors

Process Question:

1. Were you able to make a drawing of a model house?

2. How did you illustrate the different geometric concepts?

3. How did you apply the different geometric relationships in doing the drawing of the model house?

4. What important things have you learned with the task done?

5. ***How useful are the different geometric in solving problems related to design?***

Post your answers to these questions in the discussion forum.

End of TRANSFER:

> How did you find the performance task? How did the task help you see the real world use of parallel lines and transversals, and the previous geometric terms and relationships you have learned?

LESSON 4: Polygons and Circles

EXPLORE :

Let's start the lesson by answering the problem below.

ACTIVITY 1. Picture Analysis

Look at the picture closely.

Process Questions:

1. What geometric figures can you see in the interior design of the living room?

2. What considerations are needed in order to perfectly draw these figures?

3. *How do polygons and circles help designers come up with their own design?*

ACTIVITY 2.   KWHL

Complete the first two columns of the chart below to elicit your prior knowledge about polygons.

What I know about polygons and circles	What I want to know about polygons and circles	How did I know it	What did I learn about polygons and circles
Polygons			
Circles			

End of EXPLORE:

You gave your initial answers to the questions and statements given above.

Let's find out how others would answer the above and compare their ideas to your own. As you compare ideas, you will find out if your ideas are in line with the standard. You will also learn other concepts which will help you complete a required project found at the end. This project is about making a sketch of your own dream house.

FIRM-UP

Your goal in this section is to learn and understand key concepts of the polygons and circles. You will also find real-world representations of each and solve problems related to it. Then keep on thinking about this question: **How does the knowledge of polygons and circles help us solve problems related to design?**

POLYGONS

POLYGON

A polygon is a closed figure which is the union of segments, such that:
1. These segments called their *sides* are noncollinear; and
2. Each segment or side intersects two other sides only at their endpoints, called their *vertices*.

Examples
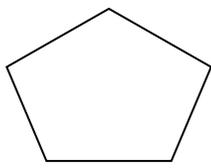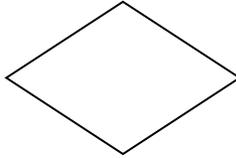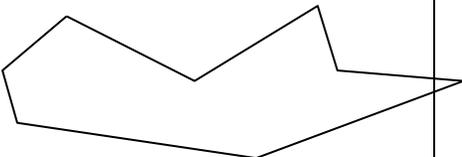
Non- examples

The figure is not a polygon, since it is not a closed figure.	The figure is not a polygon, since it is not made of line segments.	The figure is not a polygon, since not only two sides intersect in one vertex.

Important Terms to be Remembered

Side of a polygon- connects two consecutive vertices

Vertex – point where two sides meet.

Diagonal – is a segment joining two nonconsecutive vertices of a polygon

	Sides	Vertices	Diagonals
	$\overline{AB}$	A	$\overline{AC}$
	$\overline{BC}$	B	$\overline{BD}$
	$\overline{CD}$	C	
	$\overline{AD}$	D	
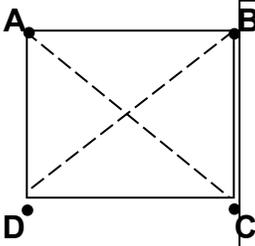
Convex and Concave Polygons

CONVEX and CONCAVE POLYGONS
   A figure is convex if every line segment drawn between any two points inside the figure lies entirely inside the figure.
   A figure that is not convex is called a concave figure.

Examples of CONVEX polygons	Examples of CONCAVE polygons
All lines drawn between any two points lie in the interior of the polygon.	All lines drawn between any two points do not lie entirely in the interior of the polygon.
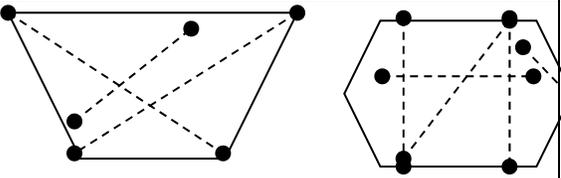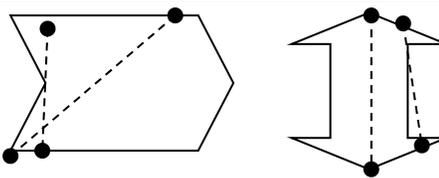
Types of Polygons

Polygons are named according to its number of sides. Click on this link to view the different names of the polygons
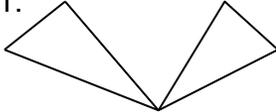http://www.regentsprep.org/Regents/math/geometry/GG3/Polygon.htm
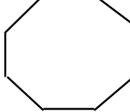
Regular Polygons

REGULAR POLYGONS
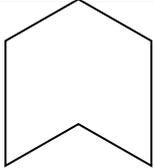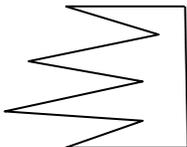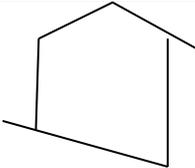
1. It is convex

2. All angles are congruent (equiangular)

3. All sides are congruent (equilateral)

Examples	Non-examples
SQUARE REGULAR HEXAGON	RECTANGLE

The polygons are
• Convex
• Equilateral
• Equiangular
 	
Since all of the properties of regular polygons are satisfied, then the polygons above are **regular**.
	• It is convex
	• Not equiangular
	• Equilateral
	
	    • It is convex
	    • Equiangular
	    • Not equilateral
	
	Since one of the properties of regular polygons is not satisfied, then the polygons above are **not regular.**

ACTIVITY 3.   **PolygoName It!**

I. Tell whether each figure is a polygon or not. If it is a polygon, give its name, and tell whether it is convex or concave.

1.

2.

3.

4.	5.	6.

II. Interactive Quiz

Take a 10-item quiz in naming polygons. Just click on this link http://www.newbedford.k12.ma.us/elementary/gomes/stjohn/Subjects/Math/Geo/Math%20Quiz/Polygons/Polygons%20-%20Online%20Quiz.html . Your score will be known every time you click on the correct answer.

Skills Check:
Reflect on the level of your performance for this lesson. Mark **x** to the column where you think your level of performance belongs.

Most of my answers were wrong.	I have incurred 1-3 mistakes.	I answered all the items correctly.
To do well in this part,		Move on to the next activity.
a. click on this link to for more explanations about polygons http://www.youtube.com/watch?v=DHKGYInh-N4 b. Ask your classmates and teacher for help by posting your questions in the Discussion Forum. c. Answer again ACTIVITY NO. 3. d. Click on the third column so you can proceed to the next activity.		

Click on *SAVE* if you are done in this part.

ACTIVITY 4. Parquet Tile Design
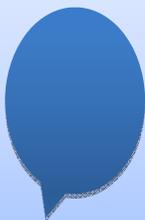
Look at the tile closely.

Process Questions:

1. What polygons can you see in the in the tile design? Are they convex or concave?

2. Can you also see regular polygons? If there is, kindly name it.

3. How are the different shapes applied to come up with such design?

You have just learned how to identify polygons from other plane figures, classify them as convex or concave, how to name them, and identify whether they are regular or not. In the next topic, we will find out why the sum of the interior angles of triangles is always 180^0. We will relate the sum of the interior angles of a triangle to the sum of the interior angles of other convex polygons. We will also find out the sum of the exterior angles of all convex polygons.

ACTIVITY 5.   Triangle-Angle-Sum Investigation

INVESTIGATION

1. Draw, label, and cut a triangle like the one shown far right below (or any kind of triangle). Cut the three angles and place them together as shown. What do you observe? What kind of angle is formed and what is the measure of the said angle?
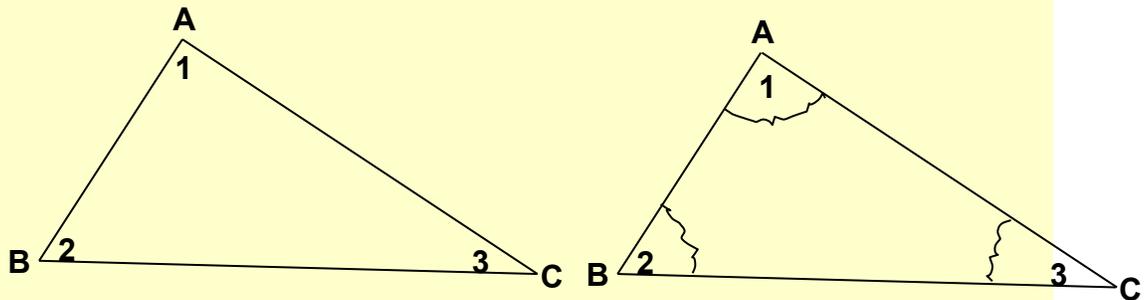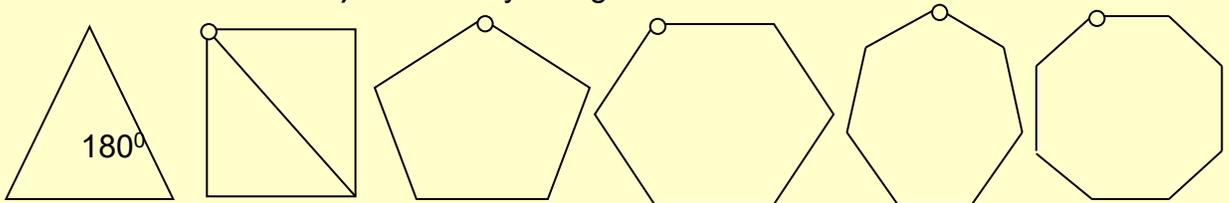

2. Make a conjecture about the sum of the interior angles of triangles.

ACTIVITY 6.   Investigation on the Sum of the Interior Angles of Polygons

INVESTIGATION

Recall: The sum of the measures of the interior angles of a triangle is 180.
1. Draw all diagonals that can be drawn in each polygon in one vertex only **(follow the chosen vertex)**. How many triangles are formed?

180^0

2. Complete the table below.

Convex Polygon	Number of Sides	Number of Triangles	Sum of the Measures of the Interior Angles
Triangle	3	1	1 (180) = 180
Quadrilateral	4	2	2 (180) = 360
Pentagon			
Hexagon			
Heptagon			
Octagon			

3. How do we get the number of triangles based on the number of sides? Can you see a pattern?

4. Make a formula in finding the sum of the measures of the interior angles of convex polygons.

The Sum of the Interior Angles of Polygons

Watch a video on http://www.youtube.com/watch?v=Y0q7IKfoABo. This contains an explanation on how to get the sum of the interior angles of polygons.

SUM OF THE INTERIOR ANGLES THEOREM

If a convex polygon has *n* sides and *S* is the sum of the interior angles, then $S_n = (n-2)\,180$.

COROLARIES

The number of sides of a convex polygon is $n = \dfrac{S_n}{180} + 2$

The sum (S) of the interior angles of a regular polygon with n sides is $S = (n-2)\,180$.

The measure of each interior angle (I_a) of regular polygon with n sides is $I_a = \dfrac{(n-2)180}{n}$.


Examples:

1. Find the sum of the interior angles of a decagon.	2. How many sides does a convex polygon have if the sum of the measures of its interior angles is 2,340?
Given: n = 10 Find: S Solution: $S = (n-2)180$ $S = (10-2)180$ $S = (8)180$ $S = 1\,440$ $\therefore$ the sum of the interior angles of a decagon is 1 440.	Given: S = 2, 340 Find: n Solution: $S = (n-2)180$ $n = \dfrac{S_n}{180} + 2$ $2,340 = (n-2)180$ $2,340 = 180n - 360$ **or** $= \dfrac{2,340}{180} + 2$ $2,340 + 360 = 180n$ $= 13 + 2$ $15 = n$ $= 15$ $\therefore$ the polygon has 15 sides.
3. Find the measure of each interior angle of a regular nonagon.	4. Find the number of sides of a regular polygon if each of its angles has a measure of 120.
Given: n = 9 **Find**: measure of each interior angle **Solution:** $I = \dfrac{(n-2)180}{n}$ $I = \dfrac{(9-2)180}{9}$ $I = \dfrac{(7)180}{9}$	**Given:** I = 120 **Find:** n **Solution:** $I = \dfrac{(n-2)180}{n}$ $120 = \dfrac{(n-2)180}{n}$ $120n = (n-2)180$ $120n = 180n - 360$

$I = \dfrac{1260}{9} = 140$ $\therefore$ the measure of each interior angles of a regular nonagon is 140.	$120n - 180n = -360$ $\dfrac{-60n}{-60} = \dfrac{-360}{-60}$ $n = 6$ $\therefore$ the polygon has 6 sides.

ACTIVITY 7.   Investigation on the Sum of the Exterior Angles of Polygons

INVESTIGATION

1. Determine the measures of the exterior angles of each convex polygon. Then, get the sum of the measures of the exterior angles of each.
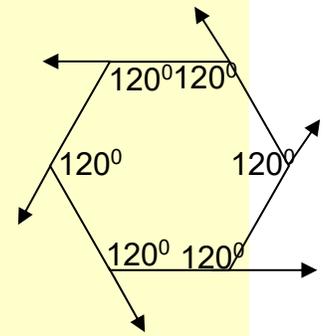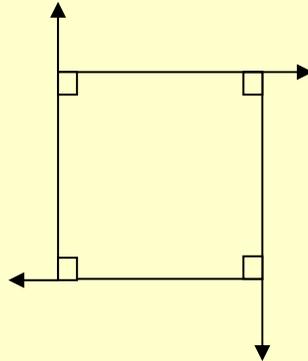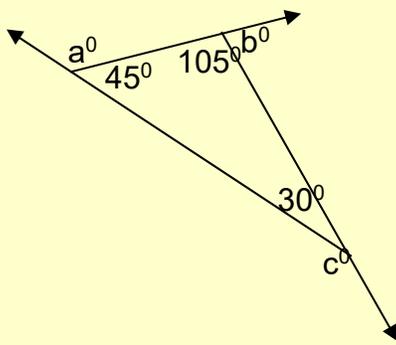
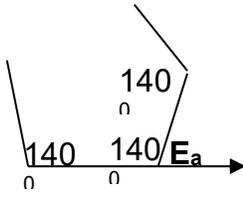2. Make a conjecture about the sum of the exterior angles of polygons.

The Sum of the Exterior Angles of Polygons

POLYGON EXTERIOR ANGLE-SUM THEOREM
   The sum of the measures of the exterior angles of a polygon, one at each vertex is 360.

COROLLARY

The measure of each exterior angle of a regular polygon with n sides is $\dfrac{360}{n}$.

Examples:

1. How many degrees are there in each exterior angle of a regular pentagon?	2. If each exterior angle of a regular polygon is 45, how many sides does a polygon have?
Given: n =5 **Find**: E_a = exterior angle **Solution:** $E_a = \dfrac{360}{n}$ $E_a = \dfrac{360}{5}$ <mark>$E_a = 72$</mark>	**Given**: E_a = 45 **Find:** n **Solution:** $E_a = \dfrac{360}{n}$ $45 = \dfrac{360}{n}$ $\dfrac{45n}{45} = \dfrac{360}{45}$ $n = 8$ <mark>∴ the polygon has 8 sides.</mark>
3. If each interior angle of a polygon is 140, how many sides does a polygon have?	4. Find the measure of each interior angle of a regular polygon with 10 sides.
Given: I_a = 140 **Find:** n **Solution:** **Recall:** $\begin{array}{c}140 \\ 140 \quad 140\;E_a\end{array}$ 140 + E_a = 180 linear pair of angles	**Given:** n= 10 **Find:** I_a **Solution:** Determine the the interior and measure of the exterior angle each exterior of any polygon are angle

$E_a = 180 - 140$		always
$E_a = 40$	$E_a = \dfrac{360}{n}$	supplementary:
Solve for n using $E_a = \dfrac{360}{n}$		$I_a + E_a = 180$
	$E_a = \dfrac{360}{10}$	$I_a + 36 = 180$
$40 = \dfrac{360}{n}$ $\quad \dfrac{40n}{40} = \dfrac{360}{40}$		$I_a = 180 - 36$
$n = 9$	$E_a = 36$	$I_a = 144$
∴the polygon has 9 sides.		∴ the measure of each interior angle is 144.

ACTIVITY 8.   Skills Practice

Solve the following. You may use a calculator.

I.   Find the sum of the interior angles of the following polygons.

1. 7-sided   2. 14-sided   3. 20 sided   4. 28-sided

II.   Solve for the measure of each interior angle of the following regular polygons.

1. 8-sided   2. 12-sided   3. 27- sided   4. 36-sided

III. Find the number of sides of each convex polygon given the sum of its interior angles.

1. 1 080   2. 1 260   3. 1 440   4. 2 520

IV. Find the number of sides of each regular polygon given the measure of each interior angle.

1. 135	2. 144	3. 150	4. 162

V. Find the measure of each exterior angle of the following polygons.

1. triangle	2. hexagon	3. heptagon	4. octagon

VI. Find the number of sides in each regular polygon given the measure of each exterior angle.

1. 20	2. 30	3. 36	4. 40

VII. Find the measure of each interior angle of the regular polygons using the given number of sides.

1. 12	2. 16	3. 18	4. 24

VIII. Solve the following problems.

1. The measures of the three angles of a quadrilateral are 85, 98, and 118, respectively. Find the measure of the fourth angle.

2. The measures of two angles of a quadrilateral are 100 and 120. If the other two angles are congruent, find the measure of each.

3. The measures of the four angles of a pentagon are 95, 110, 85, and 126, respectively. Find the measure of the fifth angle.

Skills Check:
Reflect on the level of your performance for this lesson. Mark **x** to the column where you think your level of performance belongs.

Most of my answers were wrong.	I have incurred 1-3 mistakes.	I answered all the items correctly.
To master the skill in solving problems involving the sum of the interior and exterior angles of polygons, do the following:		
a. Watch again the video given above. b. Go back to the examples given also. c. Post questions in the Discussion Forum so that your teacher and classmates can help you. d. Move on ACTIVITY 8. A set of review problems will be given before you take the 10-item quiz.		

ACTIVITY 9. Interactive Quiz for the Sum of the Interior and Exterior Angles of Polygons

a. http://www.thatquiz.org/tq/previewtest?M/W/A/F/28881208992771 . This test is only for practice. If you are ready to take another quiz click on Take This Quiz

b. Click on this link http://www.thatquiz.org/tq/practicetest?5wbtohx13m0 to take a 10-item quiz. The number of items that answered correctly and incorrectly will be viewed on the left part of the test.

Process Questions:
1. How did you find the activity?
2. Are you now confident in solving problems related to the sum of the interior and exterior angles of polygons?
3. How would your knowledge in this lesson help you in drawing figures with polygons?

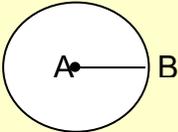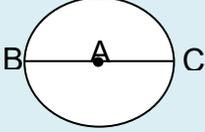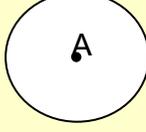*Post your answers in the Discussion Forum.*

You have just learned the relationship between the interior and exterior angles of polygons; how to get the sum of the measures of the interior angles of polygons using the sum of the measures of the interior angles of triangles; how the sum of the measures of exterior angles of polygons is equal to 360^0; and solve problems related to the interior and exterior angles of polygons.

In the next part, you will learn the key concepts of circles and its related terms. You will be asked to find model/s of each in the real-world.

Circle and the Terms Related to it

Circle
A circle is the set of all coplanar point at a given distance from a given point. The given distance is called the **radius** while the given point is called the **center** of the circle.
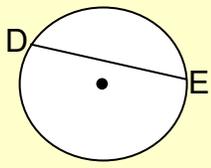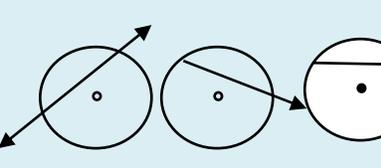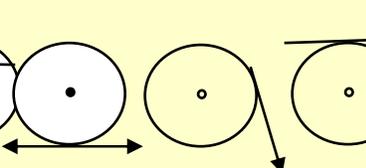
The Primary Parts

Radius	Diameter	Named by its center
The **radius** is the distance from the center of a circle to any point on the circle.	The **diameter** is a segment that has two points of the circle as endpoints with the center as the midpoint.	
$\overline{AB}$ is the radius	$\overline{BC}$ is the diameter	**circle A or ⊙A**

**Bicycle.** A bicycle wheel is model of a circle, and one spoke is a close physical model of a radius.
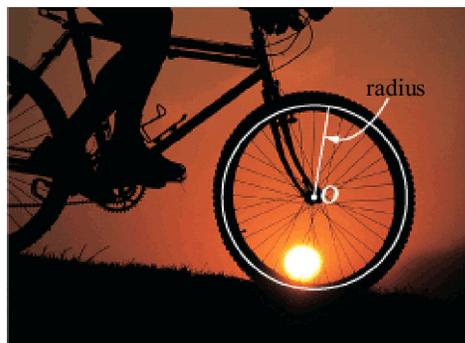
The Secondary Parts

Chord	Secant	Tangent
It is a segment that joins two points on the circle. The diameter is the longest chord.	It is any line, ray, or segment that contains a chord.	It is any line, ray, or segment that intersects the circle at exactly one point. The intersection is called the *point of tangency.*
  $\overline{DE}$ is a chord		

http://www.youtube.com/watch?v=-KC3AhyhefQ tutorial video on the circle and its parts.

Arcs and Angles of a Circle

A circle has a total measure of 360^0.

Arc

An arc of the circle is two points on the circle and continuous part of the circle between the two points.
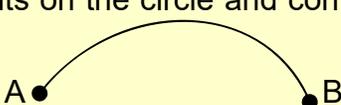
Semicircle
- Is an arc of a circle whose endpoints are the endpoints of a diameter
- Its measure is equal to 180.
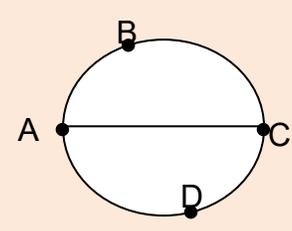
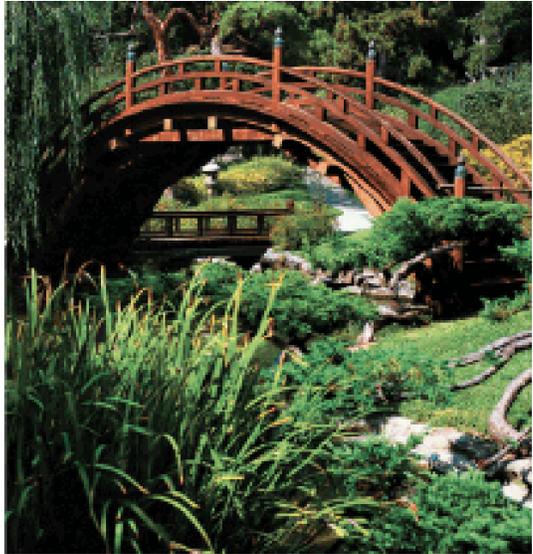$\overarc{ABC}$ and $\overarc{ADC}$ are the semicircles.

Minor Arc
- Is an arc of a circle that is smaller than a semicircle
- It measure is less than 180.

$\overparen{AB}$, $\overparen{BC}$, $\overparen{CD}$, and $\overparen{AD}$ are the minor arcs.

Major Arc
- Is an arc of a circle that is larger than a semicircle
- It measure is greater than 180.

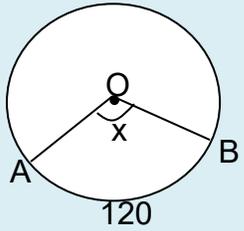$\overparen{ACD}$ and $\overparen{CAB}$ are the major arcs.

The major arc is used in the design of the bridge.

Central Angle

A central angle is an angle with its vertex at the center of the circle.

The formula is *Central angle = intercepted arc*

Example: Find the value of *x*

x = 120 since the measure of the central angle is equal to the measure of its intercepted arc.
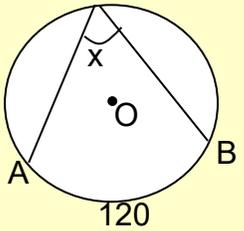
Inscribed Angle

An inscribed angle is an angle with its vertex on the circle.

The formula is
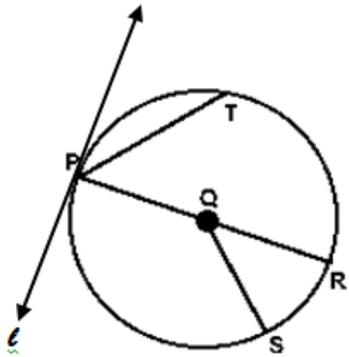
$$InscribedAngle = \frac{1}{2} xInterceptedArc$$

Example: Find the value of *x*

*Solution:* $x = \frac{1}{2}x120 = 60$

ACTIVITY 10. Skills Practice

I. Refer to the figure to the right to answer the following questions.

	1. Which is a chord, but not a diameter?
	2. What are the radii of the circle?
	3. What is the name of the circle?
	4. How do you call segment PR?
	5. What are the secants of the circle?
	6. What is the tangent line?
	7. What is the point of tangency of line I and line PR?

II. Determine whether each arc named is a minor arc, major arc, or a semicircle.
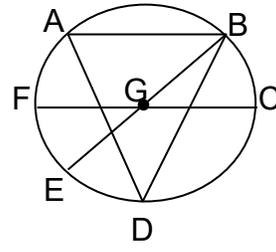
	1. $\overset{\frown}{ABC}$
	2. $\overset{\frown}{FBC}$
	3. $\overset{\frown}{AED}$
	4. $\overset{\frown}{CFD}$
	5. $\overset{\frown}{EDB}$
	6. arc intercepted by $\angle BGC$
	7. arc(s) determined by the endpoints of $\overline{FC}$
	8. arc(s) determined by the endpoints of $\overline{BE}$
	9. arc intercepted by $\angle CGE$
	10. arc intercepted by $\angle FGB$

III. Find the value of x.

1. 135^0	2. 160^0	3. 270^0
x =	x =	x =

ACTIVITY 11.   Interactive quiz for the Arcs and Angles of a Circle

a. Take the review problems at http://www.thatquiz.org/tq/previewtest?B/X/W/U/64931335349802.

c. Take the 22-item quiz at http://www.thatquiz.org/tq/practicetest?hx3ai2ow55hf. The number of items that answered correctly and incorrectly will be viewed on the left part of the test.

Skills Check:

Reflect on the level of your performance for this lesson. Mark **x** to the column where you think your level of performance belongs.

Most of my answers were wrong.	I have incurred 1-5 mistakes.	I answered all the items correctly.
To master the skill in solving problems involving circles and the terms related to it		
a. Go back to the examples and video given above. b. Post questions in the Discussion Forum so that your teacher and classmates can help you. c. Do ACTIVITY 9 and 10 again. d. Proceed to the next activity if you think you are already equipped with the skill expected from you in this part.		

Previously, you have learned many things about circles and the terms related to it. In the next lesson, you will learn how to construct regular polygons using a compass and a straightedge (ruler).

Constructing Polygons

Watch a video on http://www.youtube.com/watch?v=8ElsKQi3Ffs . This will show you how to construct regular polygons: equilateral triangle, square, pentagon, hexagon, heptagon, and octagon using compass and straight edge.

ACTIVITY 12.   Construct Your Own Polygon!

In a short bond paper, draw the following polygons:
  a. equilateral triangle
  b. square
  c. regular pentagon
  d. regular hexagon
  e. regular heptagon
  f. regular octagon

using straightedge, compass, and pencil. You may ask assistance from anybody who is knowledgeable of the activity.

Process Questions:
1. How did you find the activity? Were you able to construct the polygons correctly?
2. What difficulty have you encountered?
3. What do you think is the reason why you need to know how to construct polygons correctly?
4. What kind of tasks would require the correct knowledge of constructing polygons? Explain and give examples.

Pass your output to your teacher on your next face-to-face meeting. Post your answers to the Process Questions in the Discussion Forum.

END of FIRM-UP:

You have just learned about polygons, circles, and the terms related to them and use them in solving problems. You have learned also how to construct polygons correctly.

DEEPEN

Your goal in this section is to relate polygons and circles to real-life problems or situations. Before proceeding to the next section, consider the question:***How do polygons and circles help designers come up with their own design?***

Let us do the next activity to find out how.

ACTIVITY 13. Quiz

Choose the letter that corresponds to thecorrect answer.
1. Which of the following does not describe a polygon?
   A. It is a closed figure.
   B. It can be convex or concave
   C. It has at least three collinear sides.
   D. Every two noncollinear sides intersect at one vertex.

   1.

2. The following are the properties of a regular polygon **except**
   A. It is convex.
   B. It is concave.
   C. It is equilateral.
   D. It is equiangular.
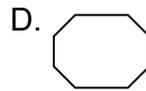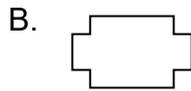
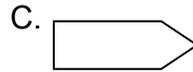   2.

3. Which of the following figures is not a polygon?
   A.   C.

   3.

B.   D.

4. Which of the following figures is a concave octagon?

A.   C.

B.   D.
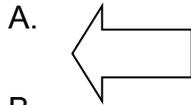
5. What is the sum of the interior angles of a triangle?

A. 60   C. 180

B. 90   D. 360

6. Which of the following equations is used to determine the sum of the interior angles of polygons?

A. $S = (n - 2) \ 180$

C. $S = \dfrac{n}{180} + 2$

B. $S = (n - 3) \ 180$

D. $S = \dfrac{180}{n} + 2$

7. Which of the following equations is used to determine number of sides of every convex polygon given the sum of the measures of its interior angles?

A. $n = \dfrac{S}{180} + 1$

C. $n = \dfrac{S}{180} + 3$

B. $n = \dfrac{S}{180} + 2$

D. $n = \dfrac{S}{180} + 4$

8. What is the sum of the interior angles of a pentagon?

A. 180   C. 540

B. 360   D. 720

9. What is the sum of the interior angles of a 17- gon?

A. 2 520   C. 3 060

B. 2 700   D. 3 600

10. How many sides does a convex polygon have if the sum of its interior angles is 2, 340?

A. 12   C. 14

B. 13   D. 15

11. What is the measure of each interior angle of a convex heptagon?
   A. 51.42   C. 180
   B. 128.57   D. 900

   11.

12. The measures of the three angles of a quadrilateral are 75,103, and 85. What is the measure of the fourth angle?
   A. 97   C. 263
   B. 107   D. 273

   12.

13. A heptagon has three pairs of congruent angles. The first pair measures 125 each, the second pair measures 150 each, and the third pair measures 130 each. What is the measure of the 7th angle?
   A. 30   C. 55
   B. 50   D. 90

   13.

14. The interior and exterior angles of any polygon are
   A. complementary   C. supplementary
   B. congruent   D. unequal

   14.

15. How many degrees are there in each exterior angle of a regular hexagon?
   A. 30   C. 60
   B. 45   D. 90

   15.

16. If the measure of the interior angle of a polygon is 67, what is the measure of its exterior angle?
   A. 67   C. 113
   B. 103   D. 123

   16.

17. How many sides does a regular polygon have if the measure of each interior angle is 120?
   A. 4   C. 9
   B. 6   D. 12

   17.

Refer to the figure to answer items 21-25.

18. What is $\overline{AB}$?
    A. chord   B. diameter
    C. radius   D. secant

18.

19. Which is a chord that is also a diameter?
    A. $\overline{AC}$ C. $\overline{CD}$
    C. $\overline{AG}$ D. $\overline{EF}$

19.

20. Which is **not** a chord?
    A. $\overline{AB}$ B. $\overline{AC}$
    C. $\overline{CD}$ D. $\overline{EF}$

20.

21. If the $m\overset{\frown}{AD} = 120$, what is the $m\angle ACD$?
    A. 30   C. 120
    B. 60   D. 150

21.

22. If the $m\overset{\frown}{GC} = 80$, what is the $m\angle GBC$?
    A. 40   C. 120
    B. 80   D. 160

22.

ACTIVITY 14.   Real- World Representations of Polygons and Circles: Checking for Understanding

Given are the different room designs. Analyse how the designers come up with each.
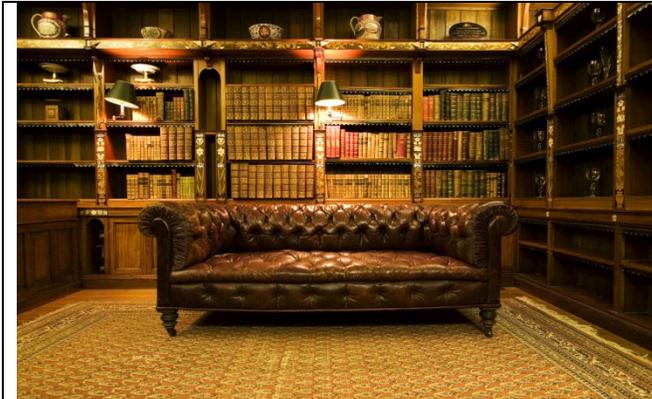
Process Questions:

1. What kind of plane figures are used in the design of the library? the living room? and the dining room?

2. What can you say about the aesthetic appearance of the ach design?

Conclusion: *How do polygons and circles help designers come up with their own design?*

Pass your output to your teacher on your next face-to-face meeting. Post your answer to the process question in the Discussion Forum.

ACTIVITY 15.   Data Analysis

Data Analysis. To learn how people really spend their time, a research firm studied the hour-by-hour activities of 3600 people. The participants were between 18 and 90 years old. Each participant was sent a 24-hour recording sheet every march for 3 years. The study found that people spend most of their time sleeping, working, and watching television. Some information of the study is shown below:

Recall: The measure of the whole circle is equal to 360^0.

Sleep – 31%	Work – 20%	Entertainment – 18%
Food – 9%	Other – 15%	Must Do – 7%

Direction: Using the data above, construct a circle (pie) graph and find the measure of each central angle and arc in the circle graph. Use short bond paper.
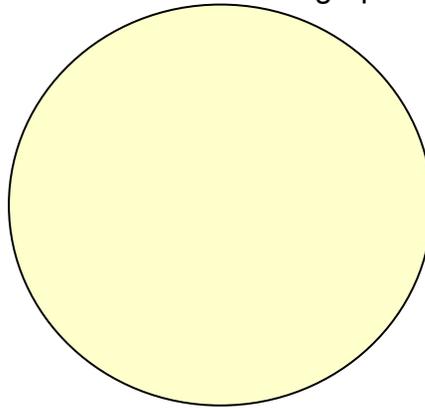
Process Questions:
1. How did you find the measure of the central angle in relation to the percentage given?
2. How do you determine the measure of the arc and central angle?
3. How are circles applied in the real-life?

Pass your output to your teacher on your next face-to-face meeting. Post your answers to the Process Questions in the Discussion Forum.

ACTIVITY 16.   Organize Your Thoughts!

Make a graphic organizer of the things you have learned in polygons and circles. Create your own graphic organizer at www.gliffy.com

ACTIVITY 17.   Revisiting Activity No. 1

Go back to Activity No.1 and revise your answers to the items you think you have incorrectly answered.
Click on SUBMIT.

ACTIVITY 18.   Revisiting Activity No. 2

Answer the last two columns of the KWHL Chart.

What I know about polygons and circles	What I want to know about polygons and circles	How did I know it	What did I learn about polygons and circles
Polygons			
Circles			

End of DEEPEN:

In this section, the discussion was about polygons and circles and how they are used in the different real world situations especially on design. What new realizations do you have about the topic? What new connections have you made for yourself?

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 19.   Living Room Design

TASK

You are newly architect of construction company thatbuilds condominium. You are tasked to make a design of the living room of each unit. The design must be creative, accurately drawn, and supported with mathematical justification.

Rubric

CRITERIA	4 EXEMPLARY	3 PROFICIENT	2 PROGRESSING	1 BEGINNING
ACCURACY OF THE DRAWING	Polygons and circles used in the drawing are accurately and neatly drawn.	Polygons and circles used in the drawing are accurately drawn.	Some of the polygons and circles used in the drawing are not accurately drawn.	Most of the polygons and circles used in the drawing are not accurately drawn.
CREATIVITY OF THE DESIGN	The design shows originality and inventiveness. The design can be compared to a work a of professional designer.	The design shows originality. It is also appealing.	The design shows originality but is not appealing.	The design does not show originality and inventiveness. The design is copied from other designs.
CONTENT OF THE JUSTIFICATION	The justification is clear and supported in detail by the various geometric relationships.	The justification is clear and supported in by the knowledge on polygons and circles.	The justification shows partial understanding of polygons and circles.	The justification is erroneous. The concepts of polygons and circles were not used to justify the project.

Process Question:
1. Were you able to make a drawing of a model house?

2. How did you illustrate the different geometric concepts?
3. How did you apply the different geometric relationships in doing the drawing of the model house?
4. What important things have you learned with the task done?
5. ***How do polygons and circles help designers come up with their own design?***

Present you output to your teacher on your next face-to-face meeting. Post your answers to these questionsin the discussion forum.

End of TRANSFER:

How did you find the performance task? How did the task help you see the real world use of polygons and circles, and the previous geometric terms and relationships you have learned?

POST-ASSESSMENT:

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next module. If your score is not at the expected level, you have to go back and take the module again.

1. The following are the acceptable names for the plane shown below EXCEPT
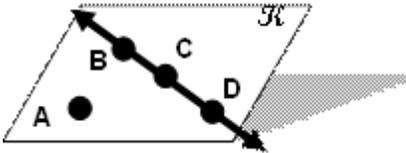
    A. plane ABC
    B. plane BCD
    C. plane ABCD
    D. plane **K**

2. The following pictures models a plane **EXCEPT**

A.

B.

C.

D.

3. Which of the following angles has a measure greater than 0^0 but less than 90^0?
A. acute
B. right
C. obtuse
D. straight

4. The following are the other names for $\overrightarrow{DB}$ **EXCEPT**

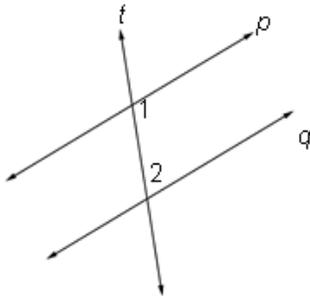A. $\overrightarrow{DC}$

B. $\overrightarrow{DB}$

C. $\overrightarrow{DA}$

D. $\overrightarrow{DF}$

5. What angle pair is illustrated in the picture below?

A. complementary angles

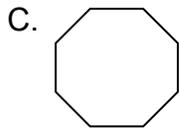B. linear pair of angles

C. supplementary angles

D. vertical angles

6. In the figure, *p* and *q* are parallel lines and *t* is a transversal. Which of the following statements about ∠1 and ∠2 is true?

A. ∠1 and ∠2 are congruent.

B. ∠1 and ∠2 are supplementary.

C. ∠1 and ∠2 are adjacent angles.

D. ∠1 and ∠2 form a linear pair.

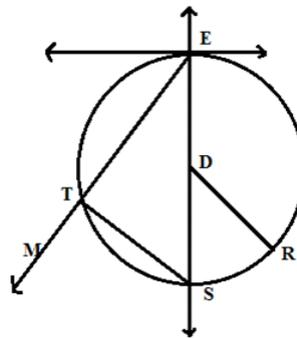7. Which of the following figures is a concave octagon?

A.

B.

C.

D.
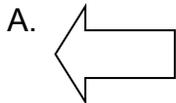
8. If the measure of the interior angle of a polygon is 67⁰, what is the measure of its exterior angle?

A. 67
B. 103
C. 113
D. 123

9. In the figure below, which is a diameter of the circle?

A. $\overline{ES}$
B. $\overline{ET}$
C. $\overline{ST}$
D. $\overline{RD}$

10. If you are asked to choose an object that would represent both a segment and a ray, which of the following will you choose?
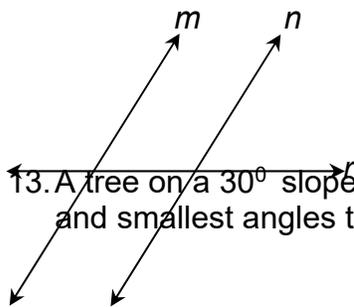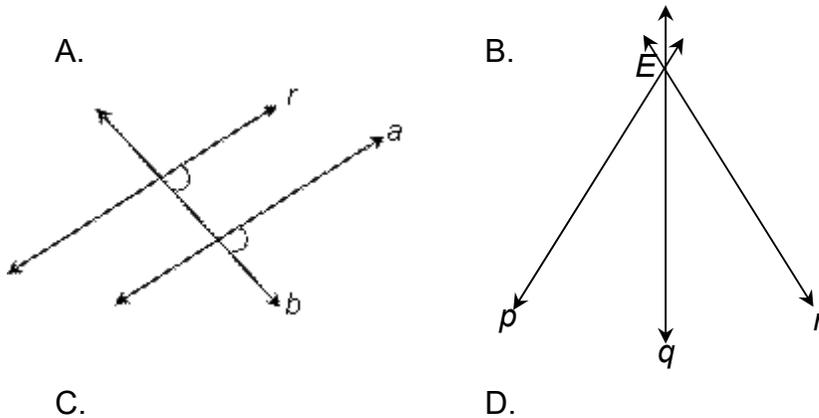
 A. stick
 B. Bottle of the wine
 C. A growing baby
 D. wire

11. All of the following illustrate a right angle EXCEPT
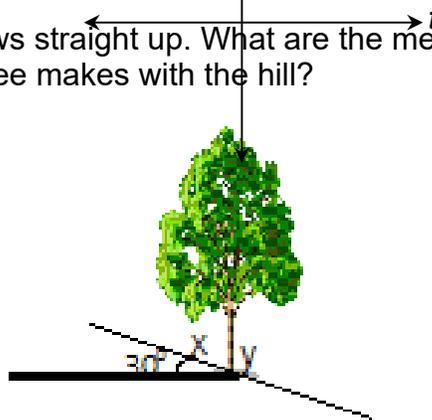   A. A man reaching his hands to his toes.
    B. A man standing straight to the ground
    C. Arms in lateral position

D. A building which is perpendicular to the ground.

12. Which of the figures below shows that line *r* is a transversal?

A.

B.

C.

D.

13. A tree on a 30⁰ slope grows straight up. What are the measures of the X greatest and smallest angles the tree makes with the hill?

A. x = 50, and y= 40
B. x = 60, and y= 30
C. x = 60, and y= 120
D. x = 70, and y= 110

14. How many sides does a regular polygon have if the measure of each interior angle is 140?
A. 6
B. 7
C. 9
D. 12

15. Below is a picture of a building whose design is composed of parallel and perpendicular lines. What is the reason why posts need to be parallel to each other and need to be perpendicular to the ground?

A. So that the building will stand straight and stable.
B. So that the building will easily be completed.
C. So that the building will look aesthetically good.
D. Both A and C.

16. If you are a design engineer tasked to design a high-rise building, what kind of lines will you draw to male sure that the building will stand straight and strong?
    A. Parallel lines only
    B. Perpendicular lines only
    C. Both paralle and perpendicular lines
    D. Skewlines only

17. If you are asked to create any design, which of the following considerations will you prioritize?
    A. Accurate construction/drawing of the geometric figures usedin the design.*
    B. Use of appropriate colors.
    C. Wise use of geometric figures.
    D. Wise use of angles.

18. You are tasked to recommend a design of balcony railings based on the following standards/criteria: simplicity, durability/stability, and appropriate use of angle pairs. Which of the following designs are you going to recommend?

A.
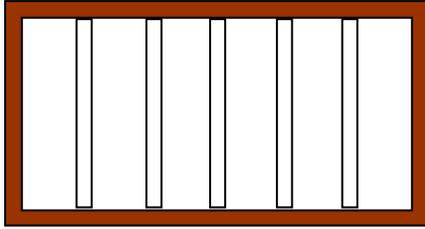
B.
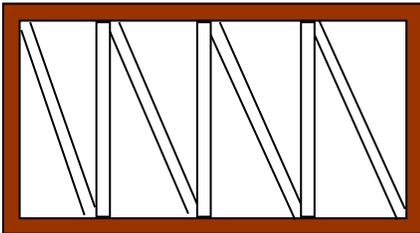
C.
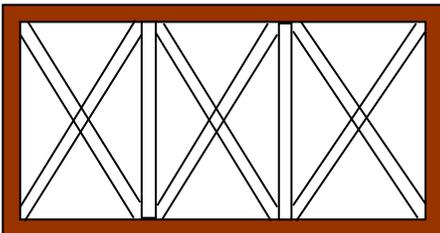
D.

.
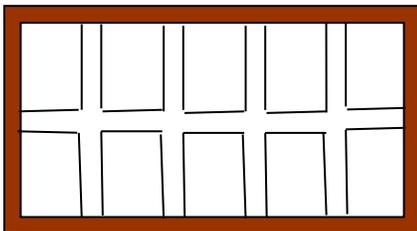
19. If you are a carpenter and you are asked to make the window of a house, what is the most important thing that you have ensure so that it will be very stable.
   A. All sides of the window must all be congruent and parallel to each other.
   B. All sides of the window must be congruent and perpendicular to each other.
   C. Each pair of opposite sides of the window must be congruent and parallel to each other.
   D. Each pair of opposite sides of the window must not be congruent and must be perpendicular to each other.

20. If you are a designer and asked to design a living room, which of the following standards will you consider first in order to ensure that it is perfectly done?
A. Accuracy of measurements
B. Innovativeness
C. Appropriateness
D. Authenticity

.

GLOSSARY OF TERMS USED:

Angle – is the union of two noncollinear rays that have a common endpoint called the vertex

Acute angle – an angle whose measure is less than 90^0

Adjacent angles – two angles sharing a common side

Alternate exterior angles – these are two angles in the exterior of the parallel lines, and on opposite (alternate) sides of the transversal.

Alternate interior angles – these are two angles in the interior of the parallel lines, and on opposite (alternate) sides of the transversal.

Central angle – an angle of a circle whose vertex is the center of the circle

Circle - a set of all points in a plane at a given distance from a given point

Chord – segment whose endpoints lie on the circle

Concave Polygon –occurs on ly when the lines pass through the interior of the polygon

Convex Polygon –occurs only when the lines containing the sides do not contain points in the polygon's interior

Complementary angles – these are two angles whose sum of their measures is 90.

Congruent angles – these are angles with equal measures.

Corresponding angles – these are two angles, one in the interior and one in the exterior that are on the same side of the transversal.

Diagonal – segment that joins two nonconsecutive vertices of the polygon

Diameter – chord that contains center of the circle

Inscribed Angle –an angle whose sides are chords of a circle and the vertex is a point on the circle.

Linear Pair - two adjacent angles supplementary angles

Obtuse angle – an angle whose measure is greater than 90^0 but less than 180^0

Parallel lines – these are two or more lines that do not intersect.

Perpendicular lines – these are two intersecting lines that form 90^0 angles.

Polygon – a plane figure formed by three or more segments such that each segment intersects exactly two others, one at each endpoint, and no two segments with common endpoint are collinear.

Protractor- is a tool that is used to measure angles

Ray - a part of the line that has one endpoint and is extended on one side of the line only

Right angle- an angle whose measure is exactly 90^0

Regular Polygon – both equilateral and equiangular polygon

Same-side interior angles – these are two interior angles lying on the same side of the transversal.

Secant – any line, ray, or segment that contains chord

Segment- a part of the line that has two endpoints

Supplementary angles – these are two angles whose sum of their measure is 180.

Triangle – polygon with three sides

Transversal – is line that passes through two or more coplanar lines at different points.

Undefined terms – these are the points, lines, and planes that serve as the basis in defining other terms in Geometry

Vertex – the common endpoint of two rays (sides) of an angle.

Vertical angles – these are two angles formed by the intersection of two lines and they are always congruent.

WEBSITE RESOURCES AND LINKS IN THIS LESSON

I. Books

1. Romero, Karl Friedrich. 2003. Geometry in the Real World. Salesiana Publishers Inc. Makati City, Philippines.
2. De Leon, N., Galangue, G., and Pascual, F. 2007. Worktext in Mathematics (Geometry). Innovative Educational Materials. Sta. Ana. Manila, Philippines.
3. Oronce, O., and Mendoza, M. 2007. E-math (Geometry). Rex Bookstore. Quezon City, Philippines.
4. Next Generation Math III: Geometry. 2011. Diwa Learning Systems. Makati City, Philippines.
5. Bass, L., Hall, R., et. al. 2001. Geometry: Tools for a Changing World. Prentice Hall. United States of America.
6. Serra, Michael. 2008. Discoverig Geometry: An Investigative Approach. United States of America.

II. Websites

Reference:

http://www.regentsprep.org/Regents/math/geometry/GG3/Polygon.htmRetrieved March 2, 2014. This link provides the different names of polygons.

YouTube

http://www.youtube.com/watch?v=cxATuGITA4IRetrieved January 20, 2014. This site provides the song entitled "Tuldok".

http://www.youtube.com/watch?v=8PcE_pzA9eU. Retrieved January 20, 2014. This video shows how to construct the midpoint of a segment.

http://www.youtube.com/watch?v=RKk7EuLunQ8. Retrieved January 20, 2014. This video shows how to construct the perpendicular bisector of a segment.
http://www.youtube.com/watch?v=im81vHIhZS8 . Retrieved January 20, 2014. This video shows how to construct parallel lines.
http://www.youtube.com/watch?v=I4dh2R6b1N0 . Retrieved January 20, 2014. This video shows how to construct perpendicular lines.
http://www.youtube.com/watch?v=DHKGYInh-N4Retrieved March 2, 2014. This is video about polygons.
http://www.youtube.com/watch?v=Y0q7IKfoABo. Retrieved March 2, 2014. This video contains an explanation on how to get the sum of the interior angles of polygons.
http://www.youtube.com/watch?v=-KC3AhyhefQ Retrieved March 2, 2014. This is a tutorial video on the circle and its parts.

http://www.youtube.com/watch?v=8ElsKQi3Ffs . Retrieved March 2, 2014. This video shows how to construct regular polygons: equilateral triangle, square, pentagon, hexagon, heptagon, and octagon using compass and straight edge.

PowerPoint presentation
http://www.primaryresources.co.uk/maths/powerpoint/using_a_protractor.pptRetrieved January 20, 2014. This link provides an input on how to measure an angle using a protractor.

http://daviseric.files.wordpress.com/2011/08/glencoe-geo-1-4-angle-measure.ppt Retrieved January 20, 2014.
This link provides a PowerPoint presentation which contains an input and examples about angles.

http://www.bluffton.noacsc.org/powpak/data/edmistonm/files/M1,_M7,_G3,_G7_Angles.pptRetrieved January 20, 2014.This link provides a PowerPoint presentation which contains an input on how to classify an angle.

http://dolfanescobar.files.wordpress.com/2012/12/11math_g8_fl_06-01-c.ppt Retrieved January 20, 2014. This link provides a PowerPoint presentation which contains an input about complementary and supplementary angles.
http://star.spsk12.net/math/8/AdjacentAngles.pptRetrieved January 20, 2014. This link provides a PowerPoint presentation which contains an input about angle pairs.

Click the link below to view more examples.
http://www.edmondschools.net/Portals/3/docs/Math/1%20VINCENT/PP%203.1.ptRetrieved January 21, 2014. This contains more examples for the angle relationships formed by parallel lines cut by transversal.

INTERACTIVE SITES
http://www.ezschool.com/Games/Math/Angles/Angles.html Retrieved January 20, 2014. This link allows the students to measure an angle using an protractor. The students will just drag and drop the protractor to the given angle then read the measure of each given angle.

http://www.sheppardsoftware.com/mathgames/geometry/shapeshoot/triangles_shoot.htm Retrieved January 20, 2014. This is an interactive website where students shoot the illustration of the type of angle being specified.

http://www.glencoe.com/sec/math/studytools/cgi-bin/msgQuiz.php4?isbn=1-57039-850-X&chapter=8&lesson=1Retrieved January 20, 2014. This is a five-item quiz about angles.
http://www.thatquiz.org/tq/previewtest?J/N/F/Y/95161326825018. Retrieved January 20, 2014. This a 22-item preview or practice test about angle pairs in which its answer key will be viewed at the bottom of the page.

http://www.thatquiz.org/tq/practicetest?2y10d72y2av Retrieved January 20, 2014. This a 22-item preview or practice test about angle pairs in which its answer key will be viewed after the test.

http://www.thatquiz.org/tq-C/math/angles/ . Retrieved January 21, 2014. This site provides a test where students solves problems involving angle relationship formed by parallel lines cut by a transversal.

http://www.shodor.org/interactivate/activities/Angles/ Retrieved January 21, 2014. This site provides an activity where students can practice identifying the angle relationship formed by parallel lines cut by a transversal

http://www.newbedford.k12.ma.us/elementary/gomes/stjohn/Subjects/Math/Geo/Math%20Quiz/Polygons/Polygons%20-%20Online%20Quiz.html . Retrieved March 2, 2014. This is a 10-item interactive quiz in naming polygons.

http://www.thatquiz.org/tq/previewtest?M/W/A/F/28881208992771 . Retrieved March 2, 2014. This is an interactive test only for practice on the sum of the interior and exterior angles of polygons.

http://www.thatquiz.org/tq/practicetest?5wbtohx13m0 . Retrieved March 2, 2014. This is a 10-item interactive quiz. The number of items that answered correctly and incorrectly will be viewed on the left part of the test.

http://www.thatquiz.org/tq/previewtest?B/X/W/U/64931335349802 . Retrieved March 2, 2014. This is a 22-item interactive review problems on the arcs and angles of a circle.
http://www.thatquiz.org/tq/practicetest?hx3ai2ow55hf . Retrieved March 2, 2014. This is a 22-item interactive quiz for the arcs and angles of a circle. The number of items that answered correctly and incorrectly will be viewed on the left part of the test.