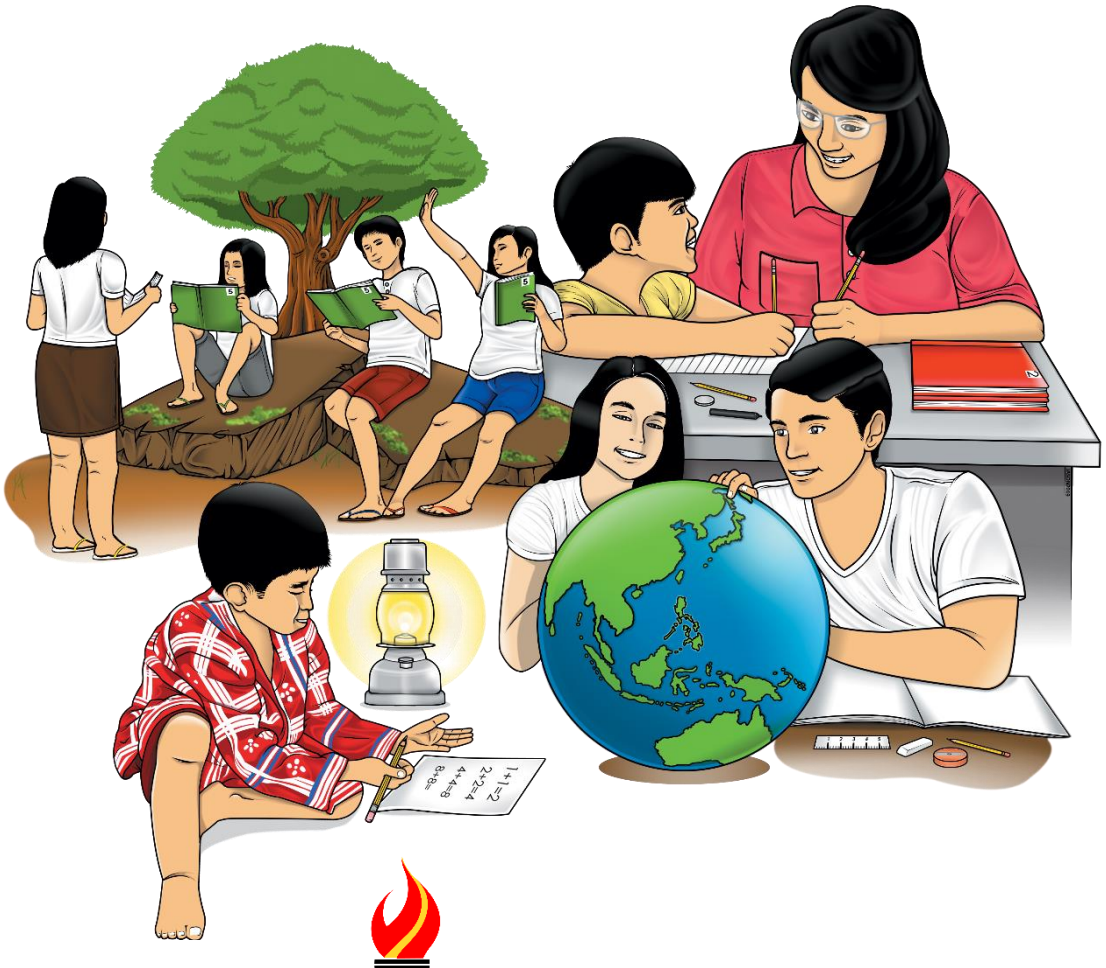
7

DepED
DEPARTMENT OF EDUCATION

Mathematics

Quarter 3 – Module 6:
Circles



ALTERNATIVE DELIVERY MODE
ADM

GOVERNMENT PROPERTY
NOT FOR SALE

Mathematics – Grade 7
Alternative Delivery Mode
Quarter 3 – Module 6: Circles
First Edition, 2020

Republic Act 8293, section 176 states that: No copyright shall subsist in any work of the Government of the Philippines. However, prior approval of the government agency or office wherein the work is created shall be necessary for exploitation of such work for profit. Such agency or office may, among other things, impose as a condition the payment of royalties.

Borrowed materials (i.e., songs, stories, poems, pictures, photos, brand names, trademarks, etc.) included in this module are owned by their respective copyright holders. Every effort has been exerted to locate and seek permission to use these materials from their respective copyright owners. The publisher and authors do not represent nor claim ownership over them.

Published by the Department of Education
Secretary: Leonor Magtolis Briones
Undersecretary: Diosdado M. San Antonio

Development Team of the Module

Writer:	Venus Jane E. Rosete
Editor:	Jacqueline C. Marcos
Reviewer:	Reynaldo C. Tagala
Layout Artist:	Maylene F. Grigana
Management Team:	Allan G. Farnazo
	Gilbert B. Barrera
	Arturo D. Tingson Jr.
	Peter Van C. Ang-ug
	Donna S. Panes
	Elizabeth G. Torres
	Judith B. Alba

Printed in the Philippines by: _____

Department of Education – SOCCSKSARGEN - Region XII

Office Address: Regional Center, Brgy. Carpenter Hill, City of Koronadal
Telefax: (083) 2288825/ (083)2281893
E-mail Address: region12@deped.gov.ph

7

Mathematics

Quarter 3 – Module 6:
Circles

DepED
DEPARTMENT OF EDUCATION

Introductory Message

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

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

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

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

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

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

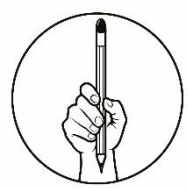
Thank you.

What I Need to Know

This module was designed and written with you in mind. It is here to help you learn about circles. This module may be used in many different learning situations. The language used recognizes your vocabulary. The lessons are arranged to follow the standard sequence of the course. But the order in which you study them can be rearranged to correspond with the textbook you are using.

After going through this module, you are expected to:

- Illustrate a circle and other terms related to it: radius, diameter chord, center, arc, chord, central angle and inscribed angle.



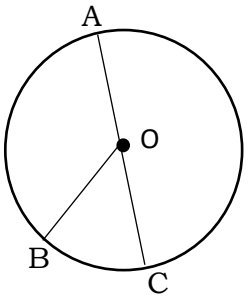
What I Know

Choose the letter of the best answer. Write your answer on a separate sheet of paper.

1. Which refers to a closed curve and whose points are all equidistant from a fixed point called the center?
   A. arc
   B. center
   C. circle
   D. semicircle

2. Which of the following is NOT true about circle?
   A. A circle has exactly one center.
   B. A radius is a chord of a circle.
   C. A chord is not a diameter.
   D. All radii of a circle are equal in measures.

For numbers 3-6, refer to the illustration on the right.



3. Which of the following is the name of the circle?
   A. ⊙A
   B. ⊙B
   C. ⊙C
   D. ⊙O

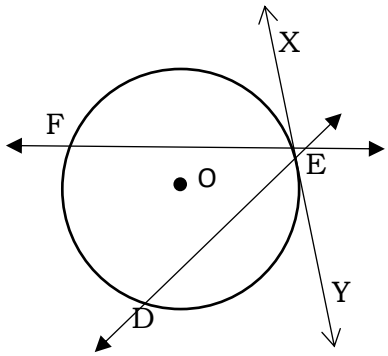
4. Which of the following is NOT a radius?
   A. $\overline{OA}$
   B. $\overline{OB}$
   C. $\overline{OC}$
   D. $\overline{AC}$

5. Which of the following is a semicircle?
   A. $\overset{\frown}{AB}$
   B. $\overset{\frown}{BC}$
   C. $\overset{\frown}{ABC}$
   D. $\overset{\frown}{ACB}$

6. Which of the following is a major arc?
   A. $\overset{\frown}{AB}$
   B. $\overset{\frown}{BC}$
   C. $\overset{\frown}{ABC}$
   D. $\overset{\frown}{ACB}$

7. What is an angle whose vertex is the center of the circle?
   A. central angle
   B. inscribed angle
   C. obtuse angle
   D. right angle

For numbers 8-10, refer to the illustration on the right.



8. What is the point of tangency in circle O?
   A. D
   B. E
   C. X
   D. Y

9. Which of the following is an inscribed angle?
   A. ∠ FED
   B. ∠ DEY
   C. ∠ FEX
   D. ∠ FEY

10. Which of the following is NOT a secant line?
   A. $\overleftrightarrow{EF}$
   B. $\overleftrightarrow{DE}$
   C. $\overleftrightarrow{XY}$
   D. none of the above

Lesson 1 Circles

In the previous lessons, you have learned about polygons, its convexity, angles and sides. In this module, you will learn about circles. Do you know that many practical problems in real-life situations can be solved using the concepts of circles?

Let us begin by studying circles and the other terms related to it such as radius, diameter chord, center, arc, chord, central angle and inscribed angle. Good luck!

What's In

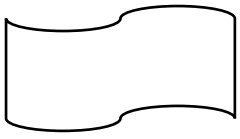
Before we will discuss circles, let us review the previous lessons about polygons by doing the activity below. Write your answer on a separate sheet of paper.

A. Complete the table below.

Polygon	**No. of Sides / Angles**	**Polygon**	**No. of Sides / Angles**
triangle	3	octagon	
quadrilateral			9
	5	decagon	
hexagon			11
	7	dodecagon	

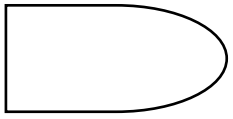
B. Tell whether the following is a polygon or not. If it is a polygon, classify whether it is convex or nonconvex. Write your answer on a separate sheet of paper.

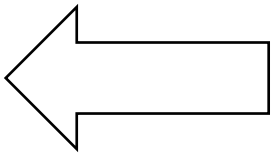
_____1.

_____2. 

_____3.

_____ 4.

_____ 5. 

_____6. 

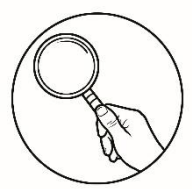
What's New

This time, we will be looking for 10 words in the grid that are related to circles. Encircle the words which may be written horizontally, vertically or diagonally.

M	D	I	A	M	E	T	E	R	M	M	S
I	E	N	H	E	R	A	P	A	I	A	E
N	U	S	T	C	H	O	R	D	S	J	M
O	R	C	I	A	X	T	E	I	T	O	I
R	D	R	E	M	N	Y	I	U	Z	R	C
A	S	I	R	A	N	G	L	S	H	A	I
R	A	B	C	X	A	W	E	T	W	R	R
C	N	E	M	A	K	L	S	N	I	C	C
U	S	D	I	V	F	B	P	E	T	E	L
C	E	N	T	R	A	L	A	N	G	L	E

Nice try! Check if you found all the 10 words below.

radius
diameter
chord
inscribed
central angle
minor arc
major arc
secant
tangent
semicircle

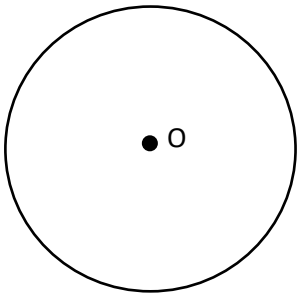


What is It

Let us familiarize ourselves with circles, its definitions and illustrations and the terms related to it.

A ***circle*** is a closed curve, all points of which are equidistant from a fixed point called the ***center.***

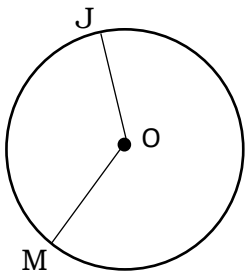
Circles are named by their centers using capital letters. The circle on the right is called circle O. In symbols, ⊙ O.



Lines related to circle:

1. A ***radius*** is a segment whose one endpoint is in the center of the circle and the other endpoint is any point on the circle.

   Examples:



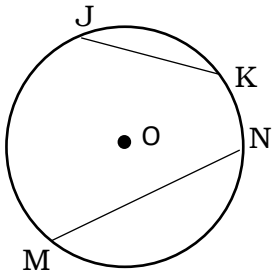
   $\overline{OJ}$ is a radius of circle O.

   $\overline{OM}$ is also a radius of circle O.

   All radii of a circle are equal in measures.

2. A ***chord*** is a segment whose endpoints are any of two different points in the circle.

   Examples:

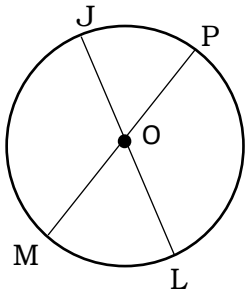


   $\overline{JK}$ is a chord of circle O.

   $\overline{MN}$ is also a chord of circle O.

3. A ***diameter*** is a chord which passes through the center of the circle. It passes through the center of a circle. It is twice the length of a radius.

Examples:



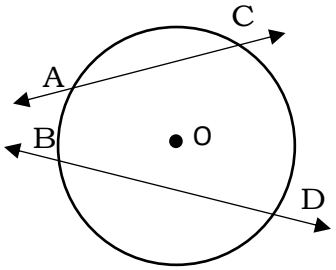
$\overline{JL}$ is a diameter of circle O.

$\overline{MP}$ is also a diameter of circle O.

All diameters of a circle have equal measures.

4. A ***secant*** is a line that contains a chord.

Examples:

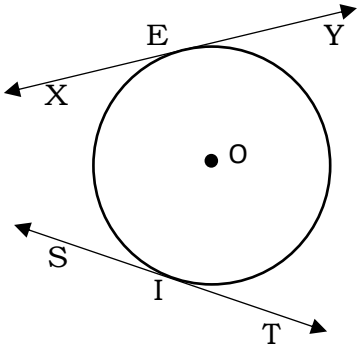


$\overleftrightarrow{AC}$ is a secant of circle O.

$\overleftrightarrow{BD}$ is also a secant of circle O.

5. A ***tangent*** is a line in the plane of a circle that intersects the circle at exactly one point. This point is called the *point of tangency*.

Example:

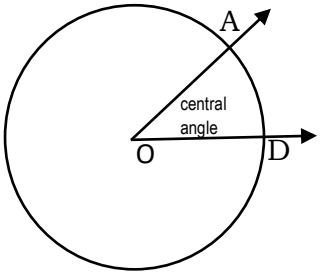


$\overleftrightarrow{XY}$ is a tangent of circle O whose point of tangency is at point E.

$\overleftrightarrow{ST}$ is also a tangent of $\odot O$ whose point of tangency is at point I.

Other basic terms related to circles are illustrated and defined as follows:

A ***central angle*** is an angle formed by two rays whose vertex is the center of the circle. Each ray intersects the circle at appoint, dividing it into arcs.

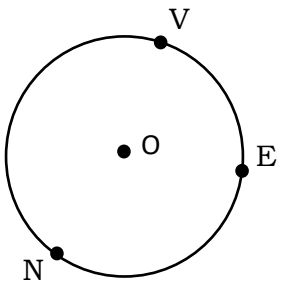


$\angle$ AOD is a central angle.

An ***arc*** is a part or a portion of a circle. The symbol for arc is $\overset{\frown}{\ }$. A semicircle is an arc with a measure equal to one-half the circumference of a circle. It is named using the two endpoints and another point in the arc.

Example:

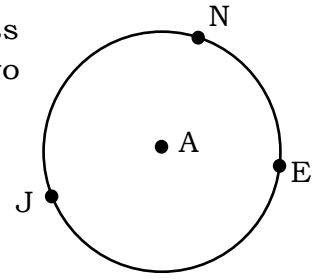
The curve from point V to point E is an arc. It is part of the circle O and is named as arc VE or $\overset{\frown}{VE}$. Other arcs of circle O are $\overset{\frown}{EN}$, $\overset{\frown}{EV}$, $\overset{\frown}{VEN}$, $\overset{\frown}{VNE}$ and $\overset{\frown}{EVN}$.



If m$\overset{\frown}{VEN}$ is one-half the circumference of $\odot$O, then it is a semicircle.

A ***minor arc*** is an arc of the circle that measures less than a semicircle. It is named usually by using the two endpoints of the arc.

Examples: $\overset{\frown}{JN}$, $\overset{\frown}{NE}$, and $\overset{\frown}{JE}$

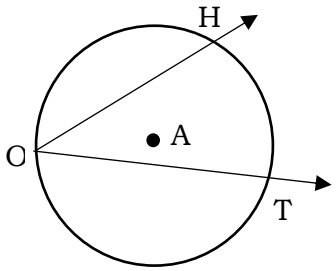


A ***major arc*** is an arc of the circle that measures greater than a semicircle. It is named by using two endpoints and another point on the arc.

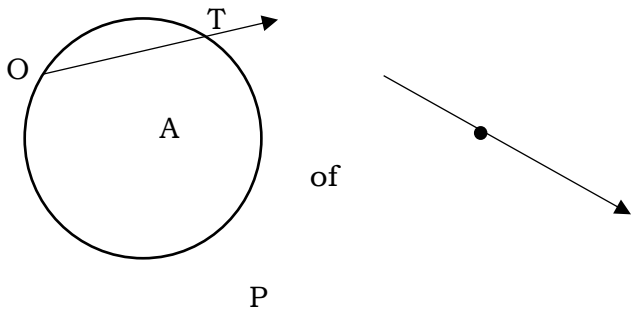
Examples: $\overset{\frown}{JEN}$, $\overset{\frown}{JNE}$, and $\overset{\frown}{EJN}$

An ***inscribed angle*** is an angle whose vertex lies on a circle and its two sides are chords a circle. The arc that lies in the interior of an inscribed angle and has endpoints on the angle is called the *intercepted arc*.

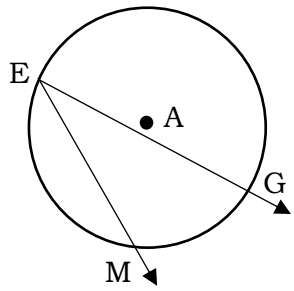
Examples:



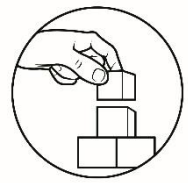
HOT is an ∠ inscribed angle and its intercepted arc is $\overset{\frown}{HT}$. The center of the circle is in the interior of the angle.



TOP is an inscribed ∠ angle and its $\overset{\frown}{TP}$ intercepted arc is TP. One side the angle is the diameter of the circle.



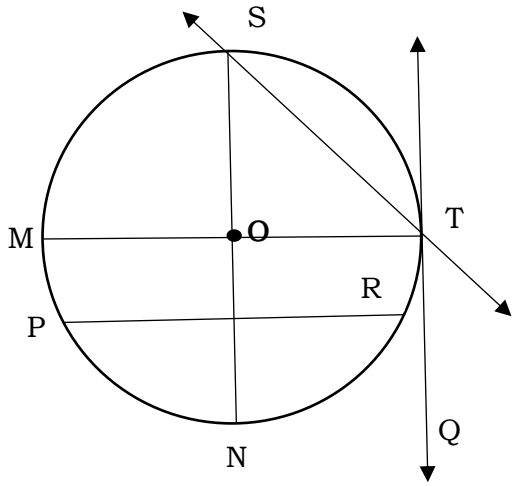
GEM is an ∠ inscribed angle and its intercepted arc is $\overset{\frown}{GM}$. The center of the circle is in the exterior of the angle.



What's More

Let us check your understanding about circles by answering the following set of problems.

A. Identify the parts of the circle. Write your answer on the space provided before each number.



_____1. O

_____ 2. $\overline{MT}$

_____ 3. $\overline{PR}$

_____ 4. $\overline{OM}$

_____ 5. $\overleftrightarrow{QT}$

_____ 6. $\angle TOS$

_____ 7. $\overleftrightarrow{ST}$

_____ 8. $\overset{\frown}{TSM}$

_____ 9. $\angle TSN$

_____ 10. $\overset{\frown}{PNR}$

B. Name each of the following. Refer to the circle below.

_____ 1. two radii

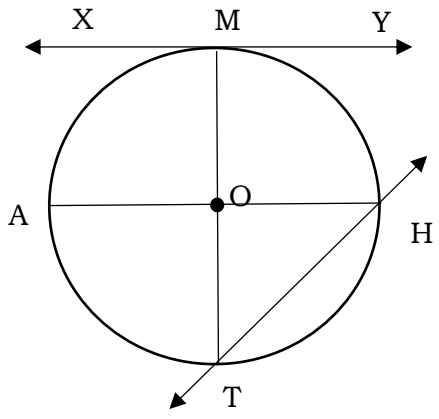
_____ 2. two diameters

_____ 3. a secant

_____ 4. a central angle

_____ 5. an inscribed angle

_____ 6. a tangent



What I Have Learned

Here is another activity that will let you apply what you have learned about circle. Choose the word/expressions from the box to fill in each blank to make a statement true. Write your answer on a separate sheet of paper.

radius	diameter	chord
Inscribed angle	central angle	minor arc
major arc	secant	tangent
semicircle	center	point of tangency

1. A circle is a closed curve, all points of which are equidistant from a fixed point called the _____.

2. A _____ is a segment one whose endpoint is in the center of the circle and the other endpoint is any point on the circle.

3. A _____ is a segment whose endpoints are any of two different points on the circle.

4. A _____ is a chord which passes through the center of the circle. It is twice the length of a radius.

5. A tangent is a line in the plane of a circle that intersects the circle at exactly one point. This point is called the _____.

6. A _____ is an arc with a measure equal to one-half the circumference of a circle.

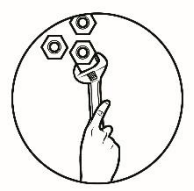
7. A _____ is an angle whose vertex is the center of the circle.

8. A _____ is an arc of the circle that measures less than a semicircle.

9. A _____ is an arc of the circle that measures greater than a semicircle.

10. An _____ is an angle whose vertex lies on a circle and its two sides are chords of a circle.

Nice work! Now you're up for the next challenge of this lesson.



What I Can Do

Apply what you have learned about circles and the terms related to it.

Direction: Draw your own circle inside the box and illustrate the following.

1. chord QR	6. minor arc BD
2. center A	7. radius AP
3. diameter DE	8. major arc BDS
4. radius AC	9. semicircle DBE
5. central angle PAC	10. tangent OB

Great work! You did a good job in applying what you have learned!

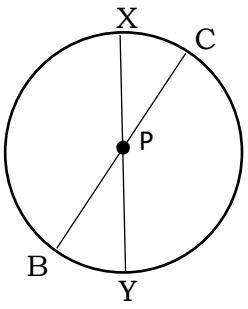
Assessment

Multiple Choice. Choose the letter with the correct answer. Write your answer on a separate sheet of paper.

1. A circle is a closed curve, all points of which are equidistant from a fixed point. What do you call this point?
   A. arc
   B. center
   C. circle
   D. semicircle

2. Which of the following is NOT a true statement about circle?
   A. A tangent passes through the center of a circle.
   B. A secant contains a chord.
   C. A tangent of a circle intersects a radius.
   D. A diameter divides the circle into two equal parts.

For numbers 3-6, refer to the illustration on the right.



3. Which of the following is the name of the circle?
   A. ⊙X
   B. ⊙Y
   C. ⊙B
   D. ⊙P

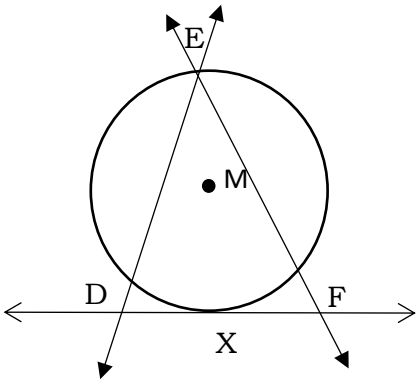
4. Which of the following is NOT a radius?
   A. $\overline{PX}$
   B. $\overline{PY}$
   C. $\overline{BC}$
   D. $\overline{PC}$

5. Which of the following is a semicircle?
   A. $\overset{\frown}{XC}$
   B. $\overset{\frown}{BY}$
   C. $\overset{\frown}{BXC}$
   D. $\overset{\frown}{XYB}$

6. Which of the following is a minor arc?
   A. $\overset{\frown}{XC}$
   B. $\overset{\frown}{XCY}$
   C. $\overset{\frown}{BXC}$
   D. $\overset{\frown}{XYB}$

7. What is an angle whose vertex lies on a circle and its two sides are chords of a circle?
   A. central angle
   B. inscribed angle
   C. obtuse angle
   D. right angle

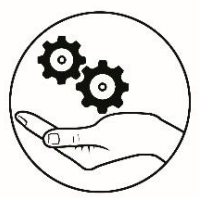
For numbers 8-10, refer to the illustration on the right.



8. What is the point of tangency in circle M?
   A. D
   B. E
   C. F
   D. X

9. Which of the following is an inscribed angle?
   A. $\angle$ DEF
   B. $\angle$ EDF
   C. $\angle$ DFE
   D. $\angle$ FDE

10. Which of the following is a tangent line?
   A. $\overleftrightarrow{DE}$
   B. $\overleftrightarrow{DF}$
   C. $\overleftrightarrow{EF}$
   D. all of the above



Additional Activities

Direction: On a separate sheet of paper, draw a circle with the corresponding measurement.

1. A circle P with a diameter of 3 cm

2. A circle M with a radius 5 cm

3. A circle X with a chord 1 cm

4. A circle O with 2 cm chord which is a part of secant XZ

5. A circle A with 3.5 cm radius AB and tangent line YZ whose point of tangency at B

Answer Key

What I Know

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

What's In

A.

Triangle – 3 sides
Quarilateral – 4 sides
Pentagon – 5 sides
Hexagon – 6 sides
Heptagon – 7 sides
Octagon – 8 sides
Nonagon – 9 sides
Decagon – 10 sides
Undecagon – 11 sides
Dodecagon – 12 sides

B.

1. polygon, convex
2. not polygon
3. polygon, nonconvex
4. polygon, convex
5. polygon, nonconvex

What's New

What's More

A. 1. center
2. diameter
3. chord
4. radius
5. tangent
6. central angle
7. secant
8. semicircle
9. inscribed angle
10. minor arc

B.

1. $\overline{OA}$, $\overline{OH}$, $\overline{OM}$, $\overline{OT}$
2. $\overline{MT}$, $\overline{AH}$
3. $\overleftrightarrow{HT}$
4. $\angle MOA$, $\angle MOH$, $\angle AOT$, $\angle HOT$
5. $\overset{\frown}{MTH}$
6. $\overleftrightarrow{XY}$

What I Have Learned

1. center
2. radius
3. chord
4. diameter
5. point of tangency
6. semicircle
7. central angle
8. minor arc
9. major arc
10. inscribed angle

What I Can Do

Assessment

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

References

1. Department of Education-Bureau of Learning Resources (DepEd-BLR) (2016) *Grade 10 Mathematics Learner's Module*. Lexicon Press Inc., Philippines

2. De Leon, Cecille M., et.al, *Integrated Mathematics Textbook for First Year*. JTW Corporation 2000.

For inquiries or feedback, please write or call:

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

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

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

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