

30 GEOMETRY AND MEASURES: CIRCLES

LEARNING OBJECTIVES

- Identify and apply circle definitions
- Know, prove and use the standard circle theorems
- Calculate arc lengths and angles and areas of circles

SPECIFICATION LINKS

- G9, G10, G17, G18

STARTER ACTIVITY

- **Parts of a circle; 5 minutes; page 192**
Full instructions are given on the activity sheet.

MAIN ACTIVITIES

- **Circle theorems; 25 minutes; page 193**
Explain to the student that they must be able to prove each circle theorem. Choose one of the circle theorems and model the proof, explaining that some proofs rely on assumption of another circle theorem.
Choose one circle theorem and ask the student to prove it, repeating as often as time allows.
- **Arc length and area of a sector; 15 minutes; page 194**
Ask the student to complete question 1, explaining that they must learn these formulae.
Model how to work out arc length and area of a sector given radius and angle. Draw out from the student how to work backwards to work out the angle given area/arc length. Work through questions 2 and 3.

PLENARY ACTIVITY

- **Picture it!; 5 minutes**
Sketch a diagram illustrating one of the circle theorems or a sector/arc length. Then ask the student to give you all the information they can about the diagram.

HOMEWORK ACTIVITY

- **Circle theorems; 60 minutes; page 195**
Full instructions are given on the activity sheet.

SUPPORT IDEA

Arc length and area of a sector Add the following additional step to the questions: 2. The area of a sector is 10 cm^2 . The angle in the sector is 60° . Work out the length of the arc.
3. A circle has radius 5 cm. The length of the arc of the circle is 10 cm. a) Work out the angle of the sector; b) Work out the area of the sector.

EXTENSION IDEA

- **Circle theorems** Tell the student that some proofs of the circle theorems assume other circle theorems.
Ask the student to design an order in which to prove the circle theorems, ensuring that any they use have already been proved.

PROGRESS AND OBSERVATIONS

STARTER ACTIVITY: PARTS OF A CIRCLE

TIMING: 5 MINS

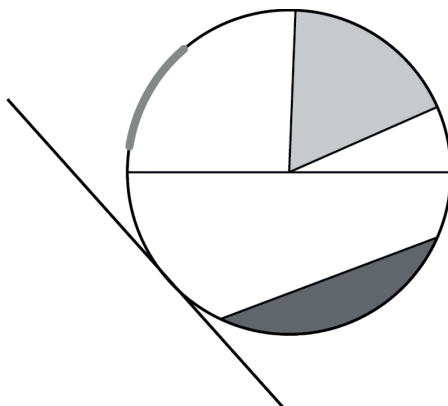
LEARNING OBJECTIVES

- Identify and apply circle definitions

EQUIPMENT

none

- Label the different parts of the circle using the vocabulary below.



radius

circumference

chord

diameter

tangent

arc

sector

segment

MAIN ACTIVITY: CIRCLE THEOREMS

TIMING: 25 MINS

LEARNING OBJECTIVES

- Know, prove and use the standard circle theorems

EQUIPMENT

- plain paper



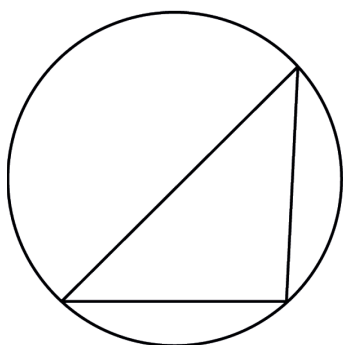
1. On a separate sheet of paper, draw diagrams to illustrate these facts.

- The angle between a tangent and a radius is 90° .
- The tangents from an external point are equal in length.

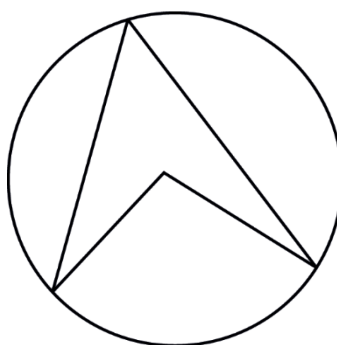


2. Match each of the following diagrams to a circle theorem below. Mark any angles on the diagrams to help to illustrate the theorem.

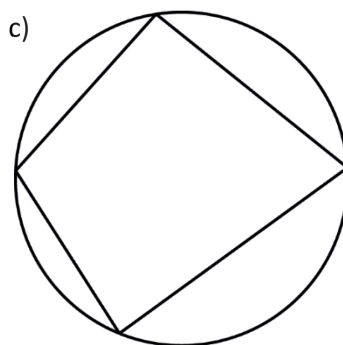
a)



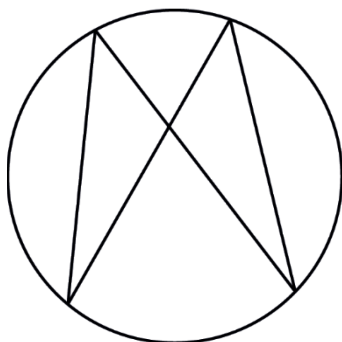
b)



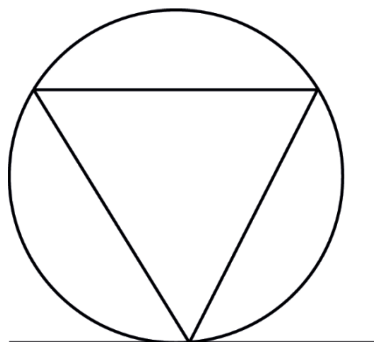
c)



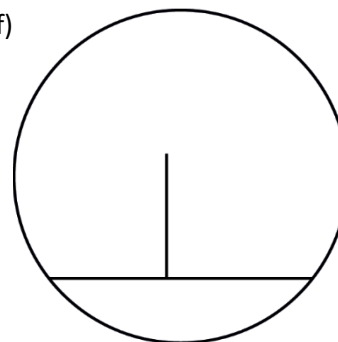
d)



e)



f)



A: The angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference.

B: The angle in a semicircle is a right angle.

C: The perpendicular from the centre of a circle to a chord bisects the chord.

D: Angles in the same segment are equal.

E: The angle between a chord and a tangent is equal to the angle in the alternate segment.

F: The opposite angles of a cyclic quadrilateral add up to 180° .

MAIN ACTIVITY: ARC LENGTH AND AREA OF A SECTOR

TIMING: 15 MINS

LEARNING OBJECTIVES

- Calculate arc length and angles and areas of circles

EQUIPMENT

- calculator

1. Write out these formulae. Remember that you need to remember them for your exam!

a) arc length =

b) area of a sector =

2. The area of a sector is 10 cm^2 . The angle in the sector is 60° .

Work out the length of the arc of the sector. Give your answer in centimetres to 1 decimal place.

.....

.....

3. A circle has radius 5 cm. The length of the arc of the circle is 10 cm. What is the area of the sector?

.....

.....

HOMEWORK ACTIVITY: CIRCLE THEOREMS

TIMING: 60 MINS

LEARNING OBJECTIVES

- Identify and apply circle definitions
- Know, prove and use the standard circle theorems

EQUIPMENT

- large sheet of paper/index cards/video recording device



1. You need to be able to identify, prove and use the circle theorems.
Create a revision tool to help you to learn the circle theorems.

You could choose to make a video, a poster, revision cards, a slideshow, a set of exam questions with model answers... It is up to you!

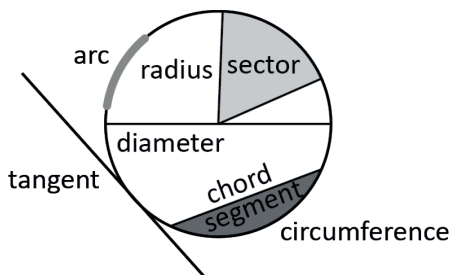
Make sure you include:

- **The six circle theorems**
 - The angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference.
 - The angle in a semicircle is a right angle.
 - The perpendicular from the centre of a circle to a chord bisects the chord.
 - Angles in the same segment are equal.
 - The angle between a chord and a tangent is equal to the angle in the alternate segment.
 - Opposite angles of a cyclic quadrilateral add up to 180° .
- **The key facts**
 - The angle between a tangent and a radius is 90° .
 - The tangents from an external point are equal in length.

30 ANSWERS

STARTER ACTIVITY: PARTS OF A CIRCLE

1.



MAIN ACTIVITY: CIRCLE THEOREMS

1. Check student's diagrams.

2. a) B b) A c) F d) D e) E f) C

MAIN ACTIVITY: ARC LENGTH AND AREA OF A SECTOR

1. a) arc length = $\frac{\theta}{180}\pi r$ b) area of sector = $\frac{\theta}{360}\pi r^2$

2. arc length = 4.6 cm

3. area of sector = 25 cm²

HOMEWORK ACTIVITY: CIRCLE THEOREMS

1. Check the student's work. Ask them some questions to check understanding.

GLOSSARY

Radius

A straight line that joins the centre of a circle to any point on the circumference

Diameter

A straight line that joins two points on the circumference of a circle and goes through the centre

Chord

A straight line joining any two points on the circumference of a circle

Circumference

The perimeter of a circle

Arc

Part of the circumference of a circle

Segment

Part of a circle that is bounded by an arc and a chord

Sector

Part of a circle bounded by two radii and an arc

Tangent (to a circle)

A straight line that is perpendicular to the radius at that point on the circumference