

## Lesson 9

## GCSE Mathematics Angles & Polygons

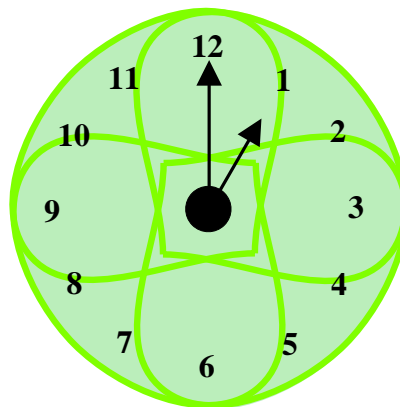
### 9.1 Clocks

An analogue clock is a source of classic angle problems.

The clock face is divided by the numbers from 1 to 12 into twelve equal parts.

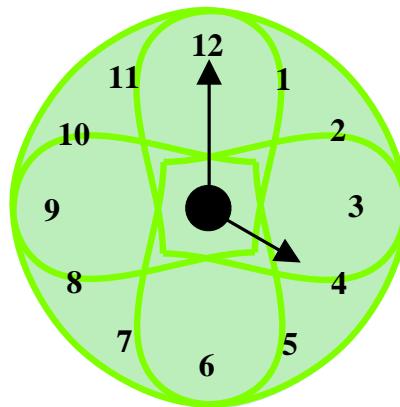
As  $\frac{360}{12} = 30^\circ$  the angle between the hour and minute hands of the clock at

1 O'clock is  $30^\circ$  as shown on the clock face below;



### Example

What is the obtuse angle between the hands of a clock at 4 O'clock ?



**Solution :** At 4 O'Clock the angle is  $4 \times 30 = 120^\circ$

Note : An acute angle,  $x$ , is such that  $0^\circ < x < 90^\circ$

A right angle,  $x$ , is such that  $x = 90^\circ$

An obtuse angle,  $x$ , is such that  $90^\circ < x < 180^\circ$

A straight angle,  $x$ , is such that  $x = 180^\circ$

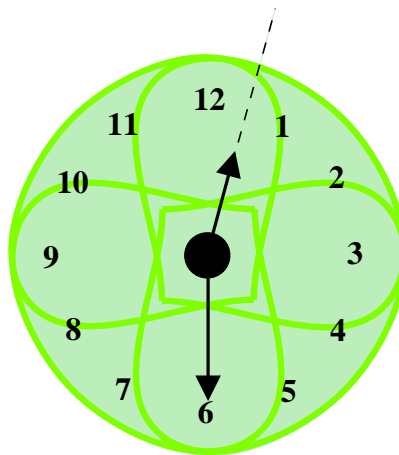
A reflex angle,  $x$ , is such that  $180^\circ < x < 360^\circ$

A full angle,  $x$ , is such that  $x = 360^\circ$

The challenge with clock angle problems comes from times that are not an integer O'Clock. That is, not 1. 2. 3, 4, ..., 12 O'Clock.

At “Half past 12” for example, the angle between the clock hands is not  $180^\circ$

This is because, although the minute hand is pointing straight down at the 6, the hour hand has crept half way between the 12 and the 1.



So the hour hand is half way through the  $30^\circ$  between the 12 and the 1.

As the angle between the 12 and the 1 is  $30^\circ$ , the hour hand has moved  $15^\circ$ .

So the angle between the two hands is  $15^\circ$  less than  $180^\circ$ .

In other words,  $165^\circ$

## 9.2 Exercise

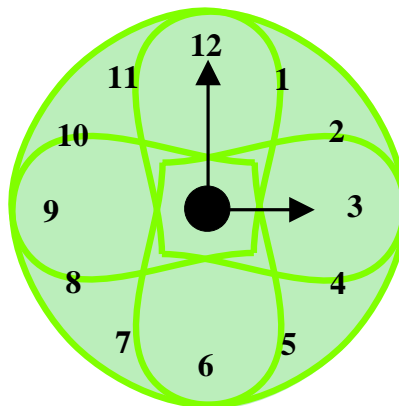
You may use a calculator

Marks Available : 40

### Question 1

What is the angle between the hands of a clock at 3 O'Clock ?

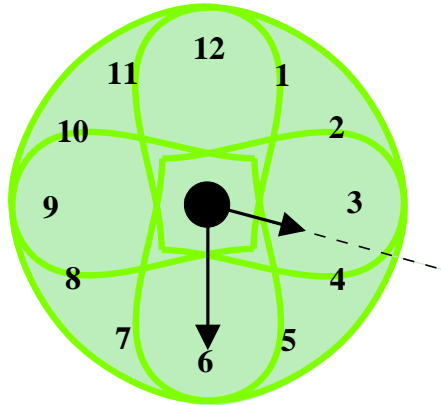
Show your working.



[ 2 marks ]

**Question 2**

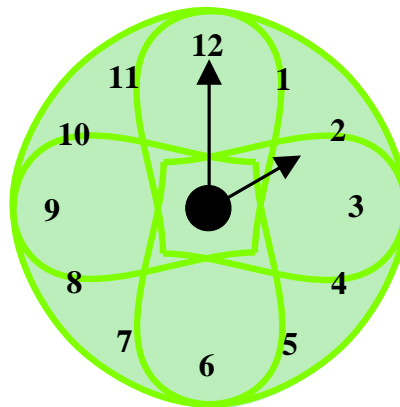
What is the acute angle between the hands of a clock at “Half past three” ?  
Show your working.



[ 3 marks ]

**Question 3**

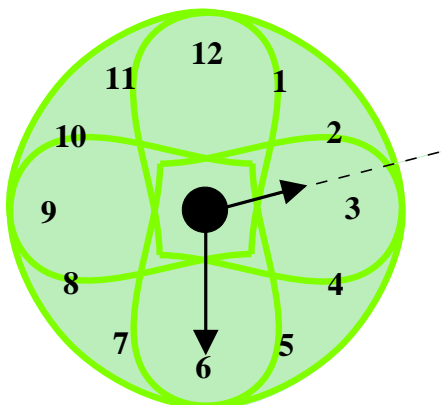
What is the acute angle between the hands of a clock at 2 O'Clock ?  
Show your working.



[ 2 mark ]

**Question 4**

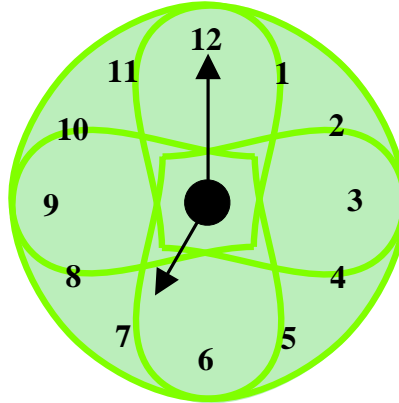
What is the obtuse angle between the hands of a clock at “Half past two” ?  
Show your working.



[ 3 marks ]

**Question 5**

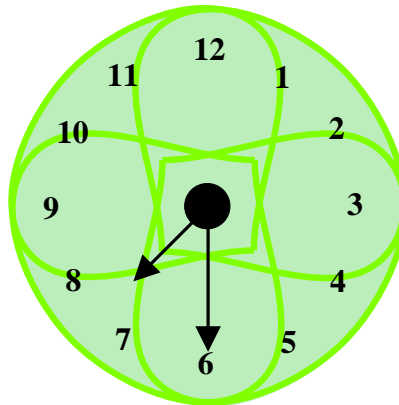
What is the obtuse angle between the hands of a clock at 7 O'Clock ?  
Show your working.



[ 2 mark ]

**Question 6**

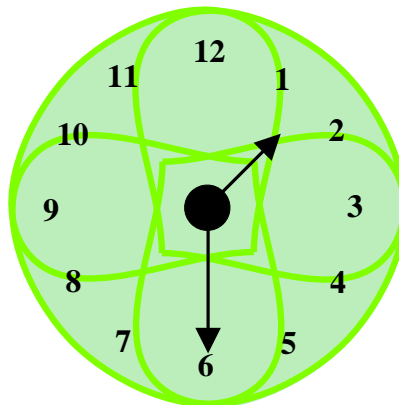
What is the acute angle between the hands of a clock at “Half past seven” ?  
Show your working.



[ 3 marks ]

**Question 7**

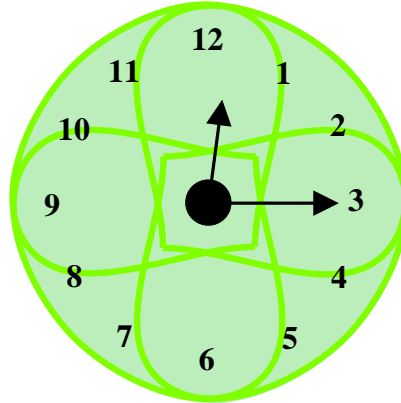
What is the obtuse angle between the hands of a clock at “Half past one” ?  
Show your working.



[ 3 marks ]

**Question 8**

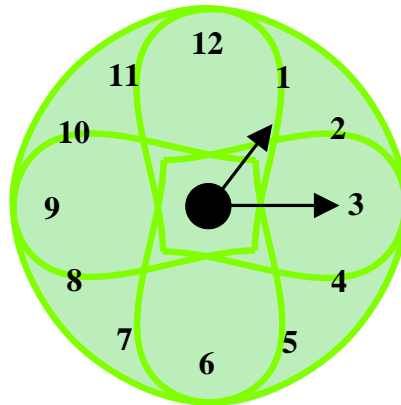
What is the acute angle between the hands of a clock at “Quarter past twelve” ?  
Show your working.



[ 4 marks ]

**Question 9**

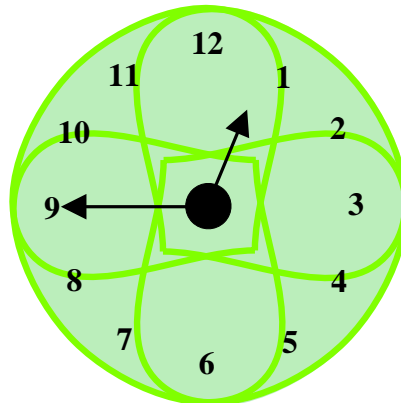
What is the acute angle between the hands of a clock at “Quarter past one” ?  
Show your working.



[ 4 marks ]

**Question 10**

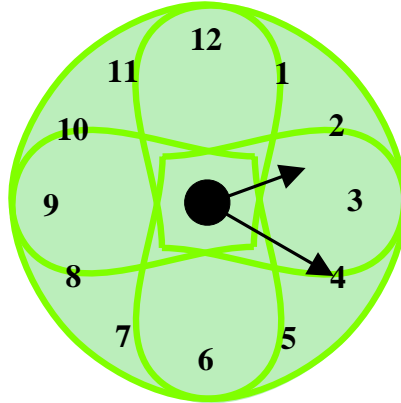
What is the obtuse angle between the hands of a clock at “Quarter to one” ?  
Show your working.



[ 4 marks ]

**Question 11**

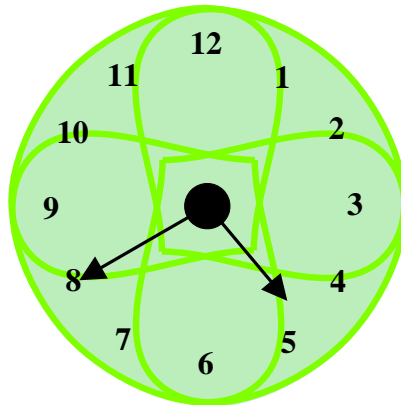
What is the acute angle between the hands of a clock at “Twenty past two” ?  
Show your working.



[ 5 marks ]

**Question 12**

What is the obtuse angle between the hands of a clock at “Twenty to five” ?  
Show your working.



[ 5 marks ]