



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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0607/52

October/November 2023

1 hour 10 minutes

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a graphic display calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly, including sketches, to gain full marks for correct methods.
- In this paper you will be awarded marks for providing full reasons, examples and steps in your working to communicate your mathematics clearly and precisely.

- The total mark for this paper is 36.
- The number of marks for each question or part question is shown in brackets [].

This document has **8** pages. Any blank pages are indicated.

Answer **all** the questions.

INVESTIGATION

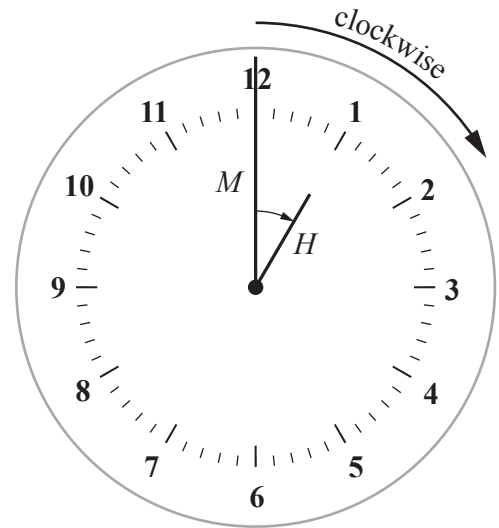
CLOCK HANDS

This investigation looks at the angle between the hands of a clock at different times of day.

You should **not** measure angles from the clock diagrams.

In this investigation:

- the hour hand is labelled H
- the minute hand is labelled M
- the hands of the clock rotate clockwise in the direction shown
- the *clockwise angle* between the two hands is shown on the clock.



1 (a) The clock shows the time 1.00 am.

(i) Write down the mathematical name for the type of angle shown.

..... [1]

(ii) Explain why hand H rotates through 360° in 12 hours.

..... [1]

(iii) Write down the calculation to show that the clockwise angle from hand M to hand H is 30° .

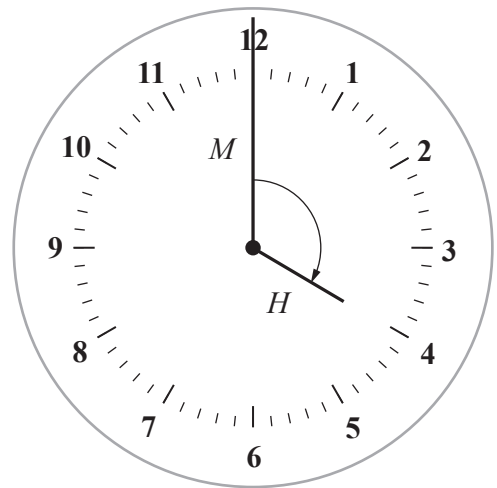
[1]

(iv) Write down a calculation to show that the **anticlockwise** angle from hand M to hand H is 330° .

[1]

(b) This clock shows the time 4.00 am.

- (i) Work out the clockwise angle from hand M to hand H .



..... [2]

- (ii) Work out the anticlockwise angle from hand M to hand H .

..... [2]

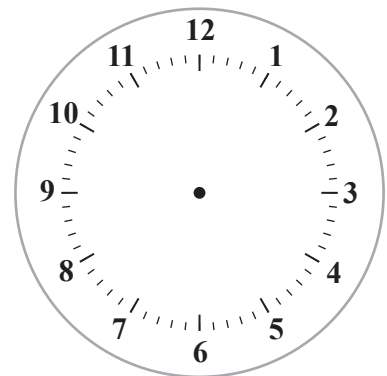
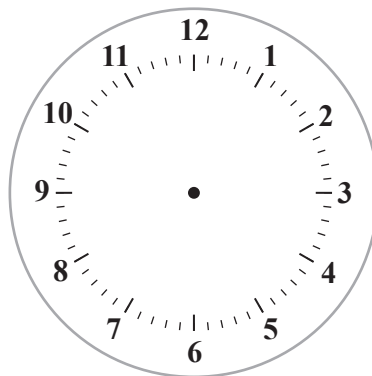
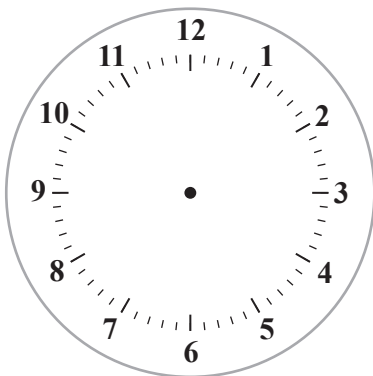
(c) Write down the clockwise angle from hand M to hand H at 6.00 am.

..... [1]

(d) Complete the table using **part (b)** and **part (c)**.

You may use the clock diagrams and patterns to help you.

	Hour shown by hand H (x)	Angle between hand H and hand M in degrees	
		Clockwise angle	Anticlockwise angle
	1	30	330
	2		
	3		
part (b)	4		
	5		
part (c)	6		



[4]

(e) Find an expression for the clockwise angle at hour x .

..... [1]

(f) Write down the rule for continuing the sequence in the **anticlockwise angle** column.

..... [1]

(g) Find an expression for the anticlockwise angle at hour x .

..... [1]

- 2 (a) In one hour, hand H rotates clockwise from one number to the next number.
For example, from 1.00 am to 2.00 am hand H rotates from 1 to 2.

Show that hand H rotates 0.5° in one minute.

[1]

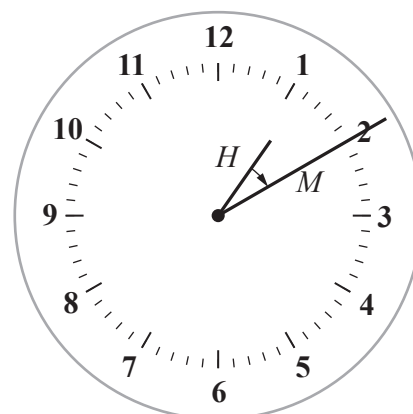
- (b) In one hour, hand M rotates through a full circle.

Show that hand M rotates 6° in one minute.

[1]

- 3 (a) This clock shows the time 1.10 am.

- (i) Use **Question 2(a)** to find the angle that hand H has rotated in the 10 minutes since 1.00 am.



..... [2]

- (ii) Use **Question 2(b)** to find the angle that hand M has rotated in the 10 minutes since 1.00 am.

..... [2]

- (iii) Show that the clockwise angle from hand H to hand M at 1.10 am is 25° .

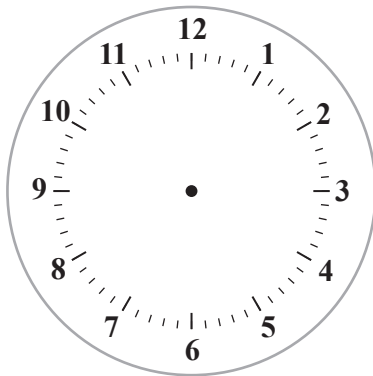
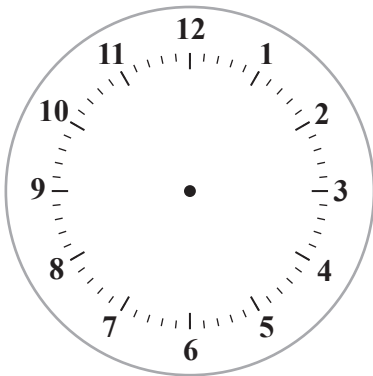
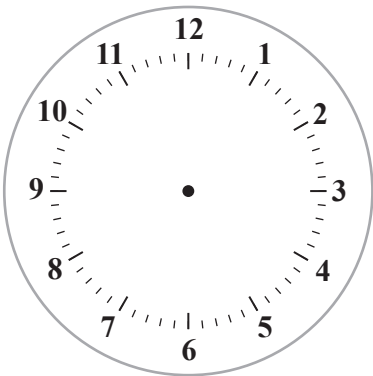
[1]

(b) Complete the table using your results from **part (a)(i)** and **part (a)(ii)**.

You may use the clock diagrams and patterns to help you.

part (a)(i)
part (a)(ii)

Number of minutes since 1.00 am (<i>m</i>)	Angle rotated since 1.00 am in degrees		Clockwise angle between the hands in degrees
	Hand <i>H</i> angle	Hand <i>M</i> angle	
6			
7	3.5	42	8.5
8			
9			
10			25



[6]

(c) Find an expression, in terms of *m*, for the clockwise angle between the hands.

..... [2]

- (d) Find how many minutes and seconds after 1.00 am the clockwise angle is 270° .
Give your answer correct to the nearest second.

..... minutes seconds [5]

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