

Mathematics A
PAPER 1H
Higher Tier
(Calculator)

Total Marks

Thursday 16 May 2024 – Morning

Time: 2 hours

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Ruler, protractor, pair of compasses, writing and drawing equipment, calculator. Tracing paper may be used.

YOU WILL BE GIVEN

A separate Formulae Booklet

A separate Diagram Booklet

You may be provided with a model for Question 8. It is not accurate.

INSTRUCTIONS

Answer ALL questions.

Without sufficient working, correct answers may be awarded no marks.

Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – there may be more space than you need.

Calculators may be used.

You must NOT write anything in the Formulae Booklet.

Anything you write on the formulae pages will gain NO credit.

INFORMATION

The total mark for this paper is 100.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

There may be spare copies of some diagrams.

ADVICE

Read each question carefully before you start to answer it.

Check your answers if you have time at the end.

Answer ALL TWENTY FIVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. (a) Look at the list of numbers below.

The numbers are the first four terms of an arithmetic sequence.

1 4 7 10

Find an expression, in terms of n , for the n th term of this sequence.

(2 marks)

1. continued.

(b) The n th term of a different arithmetic sequence is $5n + 17$

Find the 12th term of this sequence.

(1 mark)

(Total for Question 1 is 3 marks)

2. **450** students were asked how they travelled to school on Monday.

Each student walked or travelled by bus or travelled by car or travelled by bicycle.

Each student used just one method of travel.

One of these students is chosen at random.

The table below shows information about the probability of each method of travel.

Method of travel	Probability
walk	0.20
bus	x
car	$2x$
bicycle	0.26

Work out how many of the 450 students travelled by car.

(4 marks)

Answer space continues on the next page.

2. continued.

(Total for Question 2 is 4 marks)

- 3. Find the highest common factor (HCF) of 72 and 108**
Show your working clearly.

(Total for Question 3 is 2 marks)

4. Ava records the number of kilometres she drives each month.

In April, Ava drove **943** kilometres.

This is **15%** more than the number of kilometres she drove in March.

Work out the number of kilometres Ava drove in March.

_____ kilometres

(Total for Question 4 is 3 marks)

Turn over

5. Look at the diagram for Question 5 in the separate Diagram Booklet.

The diagram is NOT accurately drawn.

In the diagram:

ABCDE is a regular pentagon.

Angle **AEF** = 96°

Work out the size of the obtuse angle **FED**

Show your working clearly.

(4 marks)

Answer space continues on the next page.

5. continued.

FED = _____ °

(Total for Question 5 is 4 marks)

6. (a) Expand and simplify the following expression.

$$(m + 5)(m - 8)$$

(2 marks)

(continued on the next page)

6. continued.

(b) Solve the equation given below.

$$3n - 4 = \frac{5n + 6}{3}$$

Show clear algebraic working.

(3 marks)

$n =$ _____

(Total for Question 6 is 5 marks)

Turn over

7. Look at the information given below.

$$\mathcal{E} = \{23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34\}$$

$$A = \{\text{even numbers}\}$$

$$B = \{23, 29, 31\}$$

$$C = \{\text{multiples of } 3\}$$

(a) List the members of the set

(i) $B \cup C$

(1 mark)

(continued on the next page)

7. (a) continued.

$$\mathcal{E} = \{23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34\}$$

$$A = \{\text{even numbers}\}$$

$$B = \{23, 29, 31\}$$

$$C = \{\text{multiples of 3}\}$$

List the members of the set

(ii) $A' \cap C$

(1 mark)

(continued on the next page)

7. continued.

$$\mathcal{E} = \{23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34\}$$

$$A = \{\text{even numbers}\}$$

$$B = \{23, 29, 31\}$$

$$C = \{\text{multiples of } 3\}$$

(b) Is it true that $B \cap C = \emptyset$?

Tick (✓) one of the boxes below.

Yes

☐

No

☐

Give a reason for your answer.

(1 mark)

because _____

(continued on the next page)

Turn over

7. continued.

$$\mathcal{E} = \{23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34\}$$

$$A = \{\text{even numbers}\}$$

$$B = \{23, 29, 31\}$$

$$C = \{\text{multiples of } 3\}$$

(c) The set **D** has 4 members and is such that

$$D \cap (A \cup C) = \emptyset$$

List the members of set **D**

(2 marks)

(Total for Question 7 is 5 marks)

8. Look at the diagram for Question 8 in the separate Diagram Booklet.

The diagram is NOT accurately drawn.

You may be given a model.

A cylinder is placed on a table.

The height of the cylinder is 21 cm

The volume of the cylinder is 1575 cm³

The force exerted by the cylinder on the table is 84 newtons.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the pressure on the table due to the cylinder.

(3 marks)

Answer space continues on the next page.

8. continued.

_____ newtons/cm²

(Total for Question 8 is 3 marks)

9. The table below gives the amount of rice produced by each of two countries in 2020

Country	Amount of rice (tonnes)
Indonesia	3.5×10^7
Argentina	8.2×10^5

- (a) Write 3.5×10^7 as an ordinary number.
(1 mark)

(continued on the next page)

9. continued.

(b) In 2020, Japan produced 6 780 000 more tonnes of rice than Argentina.

Work out the amount of rice Japan produced in 2020

Give your answer in standard form.

(2 marks)

_____ tonnes

(Total for Question 9 is 3 marks)

Turn over

10. (a) Simplify the expression $(2p)^0$ where $p > 0$
(1 mark)

- (b) Find the value of n , when:

$$y^9 \times y^{-3} = y^n$$

(1 mark)

$n =$ _____

(continued on the next page)

10. continued.

(c) Simplify fully the expression given below.

$$(5t^4v^2)^3$$

(2 marks)

(Total for Question 10 is 4 marks)

11. Look at the diagram for Question 11 in the separate Diagram Booklet.

The diagram is NOT accurately drawn.

The diagram shows a roof support.

**The roof support is made from four lengths of wood,
AB, AC, BC and MC**

In the diagram:

$AC = BC = 9 \text{ m}$

$AB = 12 \text{ m}$

angle $AMC = 90^\circ$

**Lewis is going to buy lengths of wood to make the
roof support.**

The wood costs 21.50 euros per metre.

**Each length of wood he buys has to be a whole number
of metres.**

Work out the total cost of the wood Lewis needs to buy.

Show your working clearly.

(4 marks)

Answer space continues on the next page.

Turn over

11. continued.

_____ euros

(Total for Question 11 is 4 marks)

12. (a) Factorise fully the expression given below.

$$6y^2 - 5y - 4$$

(2 marks)

(continued on the next page)

12. continued.

(b) Express the expression below as a single fraction in its simplest form.

$$\frac{2y + 1}{4y} + \frac{7 - 5y}{3y}$$

(3 marks)

Answer space continues on the next page.

12. (b) continued.

(Total for Question 12 is 5 marks)

13. Look at the diagram for Question 13 in the separate Diagram Booklet.

**The diagram is an incomplete probability tree diagram.
Harman has two bags of beads.**

In bag A, there are 3 white beads and 7 black beads.

In bag B, there are 5 white beads and 4 black beads.

**Harman takes at random a bead from bag A and a
bead from bag B**

**(a) Complete the probability tree diagram.
(2 marks)**

(continued on the next page)

13. continued.

- (b) Work out the probability that Harman takes two beads of the same colour.
(3 marks)**

(Total for Question 13 is 5 marks)

14. The combined savings of Abel and Bahira are 15 435 dinars.

The savings of Bahira are 45% more than the savings of Abel.

The savings of Bahira are $\frac{3}{2}$ times the savings of Chanda.

Work out the savings of Chanda.

(5 marks)

Answer space continues on the next page.

14. continued.

_____ dinars

(Total for Question 14 is 5 marks)

15. The function f is defined as

$$f : x \mapsto \frac{3x + 1}{x - 2}$$

- (a) State the value of x that cannot be included in any domain of the function f
(1 mark)

(continued on the next page)

15. continued.

(b) Express the inverse function f^{-1} in the form $f^{-1}(x) = \dots$

(3 marks)

$$f^{-1}(x) = \underline{\hspace{10cm}}$$

(Total for Question 15 is 4 marks)

Turn over

16. There are **20** sweets in a box.

15 of the sweets are red

5 of the sweets are yellow

Fred takes at random **3** sweets from the box.

Work out the probability that Fred takes at least one sweet of each colour from the box.

(4 marks)

Answer space continues on the next page.

16. continued.

(Total for Question 16 is 4 marks)

Turn over

17. Show that the expression $\frac{1 + \sqrt{5}}{3 - \sqrt{5}}$ can be written in the form $a + \sqrt{b}$ where a and b are integers.

Show each stage of your working clearly.

(3 marks)

Answer space continues on the next page.

17. continued.

(Total for Question 17 is 3 marks)

18. A curve **C** has equation $y = x^3 - 40x + 1$

Find the coordinates of both the points on **C** at which the gradient is 8

(5 marks)

Answer space continues on the next page.

18. continued.

(_____ , _____)

(_____ , _____)

(Total for Question 18 is 5 marks)

19. Look at the diagram for Question 19 in the separate Diagram Booklet.

The diagram is NOT accurately drawn.

The diagram shows a quadrilateral, ABCD.

In the diagram:

$$\mathbf{AB = 15.2 \text{ m}}$$

$$\mathbf{BC = 12.8 \text{ m}}$$

$$\mathbf{AD = 13.4 \text{ m}}$$

$$\mathbf{\text{Angle BCD} = 62^\circ}$$

$$\mathbf{\text{Angle BDC} = 40^\circ}$$

$$\mathbf{\text{Angle BAD} = x^\circ}$$

Work out the value of X

Give your answer correct to 3 significant figures.

(5 marks)

Answer space continues on the next page.

19. continued.

x = _____

(Total for Question 19 is 5 marks)

20. Look at the diagram for Question 20 in the separate Diagram Booklet.

The diagram is NOT accurately drawn.

The diagram shows a sector $OABC$ of a circle centre O

In the diagram:

Angle $AOC = 60^\circ$

The area of the shaded segment ABC is 38 cm^2

Work out the perimeter of the shaded segment ABC

Give your answer correct to one decimal place.

(4 marks)

Answer space continues on the next page.

20. continued.

_____ cm

(Total for Question 20 is 4 marks)

21. A curve has equation $y = f(x)$

There is one minimum point on this curve.

The coordinates of this minimum point are $(5, -4)$

Write down the coordinates of the minimum point on the curve with equation:

(i) $y = f(x + 7)$

(1 mark)

(_____ , _____)

(ii) $y = f(x) - 6$

(1 mark)

(_____ , _____)

(Total for Question 21 is 2 marks)

Turn over

22. Look at the diagram for Question 22 in the separate Diagram Booklet.

The diagram is an incomplete histogram.

The incomplete histogram shows some information about the distances, in kilometres, that 100 adults ran last week.

All of the adults ran at least 5 kilometres.

None of the adults ran more than 55 kilometres.

15 adults ran between 15 kilometres and 20 kilometres.

Complete the histogram.

(3 marks)

Answer space continues on the next page.

22. continued.

(Total for Question 22 is 3 marks)

23. Look at the diagram for Question 23 in the separate Diagram Booklet.

The diagram is NOT accurately drawn.

A solid shape is made by removing a hemisphere from a cone as shown by the shaded area in the diagram.

The diagram shows that:

The radius of the hemisphere is $2x$ cm

The radius of the base of the cone is $5x$ cm

The vertical height of the cone is $6x$ cm

The volume of the solid shape is $6948\pi \text{ cm}^3$

Work out the TOTAL surface area of the solid hemisphere that has been removed from the cone.

Give your answer correct to the nearest integer.

(5 marks)

Answer space continues on the next 2 pages.

23. continued.

23. continued.

_____ cm^2

(Total for Question 23 is 5 marks)

24. A polygon has n sides, where $n > 5$

The interior angles of the polygon form an arithmetic sequence.

The smallest angle of the polygon is 84°

The common difference of the sequence is 4°

Work out the sum of the interior angles of the polygon.

Show clear algebraic working.

(6 marks)

Answer space continues on the next 2 pages.

24. continued.

24. continued.

o

(Total for Question 24 is 6 marks)

Turn over

25. $f(x) = 17 - 3x^2 + 12x$

Write $f(x)$ in the form $a - b(x - c)^2$ where a , b and c are constants.

(4 marks)

Answer space continues on the next page.

25. continued.

$$f(x) = \underline{\hspace{10cm}}$$

(Total for Question 25 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

END OF PAPER
