

Mathematics A
PAPER 1HR
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

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.

You may be given models for Question 6 and Question 22.

They are not accurate.

Turn over

ADVICE

**Read each question carefully before you start to answer it.
Check your answers if you have time at the end.**

Answer ALL TWENTY THREE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. Six cards are shown below.

Five of the cards have a number written on them.

16	15	3	2	9	
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Work out the number that should be written on the last card so that the mean of the six numbers will be 11
(3 marks)

Answer space continues on the next page.

1. continued.

(Total for Question 1 is 3 marks)

2. Look at the diagram for Question 2 in the separate Diagram Booklet. The diagram shows a biased spinner.

The table below gives information about the probability that, when the spinner is spun once, it will land on each number.

Number	1	2	3	4	5
Probability	2x	0.27	0.04	x	0.12

Alexis is going to spin the spinner 400 times.

Work out an estimate for the number of times the spinner will land on an odd number.

(4 marks)

Answer space continues on the next page.

2. continued.

(Total for Question 2 is 4 marks)

3. Norberto sells white loaves of bread and brown loaves of bread.

He sells a total of **200** loaves such that

the number of white loaves sold : the number of brown loaves sold = **3 : 2**

Norberto sells the white loaves for **£1.50** each.

He sells the brown loaves for **£1.75** each.

40% of the price of a white loaf is profit.

60% of the price of a brown loaf is profit.

Work out Norberto's total profit when he sells all **200** loaves.

(5 marks)

Answer space continues on the next page.

3. continued.

£ _____

(Total for Question 3 is 5 marks)

4. Show that $2\frac{1}{3} \div 5\frac{1}{4} = \frac{4}{9}$

(Total for Question 4 is 3 marks)

5. Slavomir invests **5200** euros in a savings account for 4 years.

He gets **2·5%** per year compound interest.

Work out how much money Slavomir will have in the savings account at the end of 4 years.

Give your answer correct to the nearest euro.

_____ euros

(Total for Question 5 is 3 marks)

6. Look at the diagram for Question 6 in the separate Diagram Booklet. The diagram is NOT accurately drawn. The diagram shows a solid wooden cylinder. You may also be given a model.

The cylinder has radius 8 cm and height h cm.

The volume of the cylinder is 1208 cm^3

- (a) Work out the value of h

Give your answer correct to the nearest whole number.

(2 marks)

$h =$ _____

(continued on the next page)

6. continued.

(b) The density of the wood is 1.25 g/cm^3

Work out the mass of the cylinder.

Give your answer in kilograms.

(2 marks)

_____ kilograms

(Total for Question 6 is 4 marks)

7. (a) Simplify $g^9 \div g^2$
(1 mark)
-

- (b) Expand $5k^2(k^3 + 4)$
(2 marks)
-

(continued on the next page)

7. continued.

- (c) (i) Factorise $x^2 - 2x - 63$
(2 marks)

-
- (ii) Hence, solve $x^2 - 2x - 63 = 0$
(1 mark)
-

(continued on the next page)

Turn over

7. continued.

(d) Solve the inequality $7 - 2y < 3y - 12$

(3 marks)

(Total for Question 7 is 9 marks)

8. Look at the diagram for Question 8 in the separate Diagram Booklet. The diagram is NOT accurately drawn. The diagram shows a trapezium, **ABCD**

In the diagram:

DAB and **ADC** are right angles.

AD = 15 cm

DC = 14 cm

The area of the trapezium is **360 cm^2**

Work out the perimeter of the trapezium.

(6 marks)

Answer space continues on the next page.

8. continued.

_____ cm

(Total for Question 8 is 6 marks)

9. Look at the diagram for Question 9 in the separate Diagram Booklet. The diagram shows a coordinate grid. Line **L** is drawn on the grid.

Find an equation for **L**

Give your answer in the form $y = mx + c$

(Total for Question 9 is 3 marks)

10. Here are the numbers of goals scored by a hockey team in its 11 games this season.

0 1 2 2 3 4 4 6 7 9 11

Work out the interquartile range of the numbers of goals.

(Total for Question 10 is 2 marks)

11. (a) $A = 2^5 \times 5 \times 7^2$
 $B = 2^3 \times 5^3 \times 7^4$

Write down the highest common factor (HCF) of
5A and **2B**

Give your answer as a product of prime factors.

(2 marks)

(continued on the next page)

11. continued.

(b) $A = 2^5 \times 5 \times 7^2$

$$B = 2^3 \times 5^3 \times 7^4$$

Work out the value of $(AB)^2$

Give your answer as a product of prime factors.

(2 marks)

(Total for Question 11 is 4 marks)

12. Solve the simultaneous equations

$$4x + 3y = 9.6$$

$$6x + 5y = 16.8$$

Show clear algebraic working.

$x =$ _____

$y =$ _____

(Total for Question 12 is 4 marks)

13. Look at the diagram for Question 13 in the separate Diagram Booklet. The diagram is NOT accurately drawn.

The diagram shows points **A**, **B**, **C** and **D** on a circle, centre **O**

Angle **BCD** = 128°

Work out the size of angle **OBD**

Give a reason for each stage of your working.

(5 marks)

Answer space continues on the next page.

13. continued.

angle OBD = _____°

(Total for Question 13 is 5 marks)

14. (a) Expand and simplify $(3y + 1)(2 - y)(4 + y)$
(3 marks)

(continued on the next page)

14. continued.

(b) Simplify fully $\left(\frac{a^3c}{a^9c^5} \right)^{-\frac{1}{2}}$

(3 marks)

(Total for Question 14 is 6 marks)

Turn over

15. Look at the diagram for Question 15 in the separate Diagram Booklet. The diagram is NOT accurately drawn. The diagram shows isosceles triangle **EFG**

In the diagram:

$$EF = GF$$

$$\text{Angle } EFG = 130^\circ$$

The area of triangle **EFG** is 74 cm^2

Work out the length of **EF**

Give your answer correct to 3 significant figures.

_____ cm

(Total for Question 15 is 3 marks)

Turn over

16. The table below gives information about the heights, in metres, of the trees in a park.

Height (h metres)	Frequency
$0 < h \leq 5$	15
$5 < h \leq 10$	20
$10 < h \leq 20$	15
$20 < h \leq 30$	10

On the grid provided for Question 16 in the separate Diagram Booklet, draw a histogram for this information.

(Total for Question 16 is 3 marks)

17. (a) $\left(\sqrt[4]{k^{12}}\right)^5 = k^n$

Find the value of n

(1 mark)

$n =$ _____

(continued on the next page)

17. continued.

- (b) Express $\frac{7}{2 - \sqrt{3}}$ in the form $\sqrt{c} + d$ where c and d are integers.

Show your working clearly.
(3 marks)

(Total for Question 17 is 4 marks)

Turn over

18. Look at the diagram for Question 18 in the separate Diagram Booklet. The diagram is NOT accurately drawn. The diagram shows two similar vases, **A** and **B**

The height of vase **A** is 30 cm

The height of vase **B** is 12 cm

Given that

$$\begin{aligned} &\text{surface area of vase } \mathbf{A} - \text{surface area of vase } \mathbf{B} \\ &= 178.5\text{cm}^2 \end{aligned}$$

find the surface area of vase **A**

(4 marks)

Answer space continues on the next page.

18. continued.

_____ cm^2

(Total for Question 18 is 4 marks)

19. A curve **C** has equation $y = x^3 - 8x^2 - 12x + 5$

Curve **C** has exactly two stationary points, one at point **A** and one at point **B** such that

x coordinate of point **A** > **x** coordinate of point **B**

Find the coordinates of point **A**

Show clear algebraic working.

(5 marks)

Answer space continues on the next page.

19. continued.

(_____ , _____)

(Total for Question 19 is 5 marks)

20. (a) Express $2x^2 - 11x + 9$ in the form $a(x - b)^2 - c$ where a , b and c are numbers to be found.
(3 marks)

(continued on the next page)

20. continued.

(b) The curve **C** has equation

$$y = 2(x - 3)^2 - 11(x - 3) + 9$$

The point **P** is the minimum point on **C**

Find the coordinates of **P**

(2 marks)

(_____ , _____)

(Total for Question 20 is 5 marks)

Turn over

21. There are 25 counters in a bag such that

6 counters are blue

x counters are orange, where $x > 9$

the rest of the counters are pink

Maalam takes at random two of the counters from the bag.

The probability that Maalam takes one orange counter and one pink counter is $\frac{22}{75}$

Calculate the probability that Maalam takes 2 pink counters from the bag.

Show clear algebraic working.

(5 marks)

Answer space continues on the next page.

21. continued.

(Total for Question 21 is 5 marks)

Turn over

22. Look at the diagram for Question 22 in the separate Diagram Booklet. The diagram is NOT accurately drawn. The diagram shows a cuboid **ABCDEFGH** with horizontal base **ADEH**. You may also be given a model.

In the diagram:

$$\mathbf{AB = 8\text{ cm}}$$

$$\mathbf{AD = 12\text{ cm}}$$

$$\mathbf{DE = 20\text{ cm}}$$

M is the midpoint of the base **ADEH** and **P** is the midpoint of the edge **CF**

Work out the size of angle **BMP**

Give your answer correct to one decimal place.

(6 marks)

Answer space continues on the next 2 pages.

22. continued.

22. continued.

o

(Total for Question 22 is 6 marks)

23. Here are the first three terms of an arithmetic sequence.

$$(4y - 14) , (y + 2) , (7y - 9)$$

Find, as an integer, the sum of the first 40 terms of the sequence.

Show clear algebraic working.

(4 marks)

Answer space continues on the next page.

23. continued.

(Total for Question 23 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

END OF PAPER
