

Mathematics A  
PAPER 2H  
Higher Tier  
(Calculator)

Total Marks
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Monday 3 June 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 Diagram Booklet**

**A separate Formulae 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.**

**Turn over**

**ADVICE**

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

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**Answer ALL TWENTY FIVE questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

- 1. Look at the list of eight numbers and letters below.**

**They are written in order of size,**

**r      6      7      8      t      16      w      w**

**where r, t and w are integers.**

**The median of the eight numbers is 10**

**The mode of the eight numbers is 18**

**The range of the eight numbers is 13**

**Work out the value of r, the value of t and the value of w**

**(3 marks)**

**Answer space continues on the next page.**

**Turn over**

1. continued.

$r =$  \_\_\_\_\_

$t =$  \_\_\_\_\_

$w =$  \_\_\_\_\_

(Total for Question 1 is 3 marks)

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Turn over

2. (a) Look at the diagram for Question 2 in the separate Diagram Booklet. The diagram shows a grid.

On the grid, draw the straight line with equation

(i)  $y = 2$

(ii)  $x = 6$

(iii)  $y = x + 1$

Label each line with its equation.

(3 marks)

- (b) Label, with the letter **R**, the region that satisfies all three of the inequalities

$$y \geq 2 \qquad x \leq 6 \qquad y \leq x + 1$$

(1 mark)

(Total for Question 2 is 4 marks)

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3. A plane takes 9 hours 36 minutes to fly from New Delhi to Perth.

The plane flies at an average speed of 820 km/h.

Work out the total distance the plane flies.

\_\_\_\_\_ km

(Total for Question 3 is 3 marks)

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4. Show that  $2\frac{4}{7} \times 3\frac{1}{9} = 8$

(Total for Question 4 is 3 marks)

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5. Look at the diagram for Question 5 in the separate Diagram Booklet. The diagram is NOT accurately drawn.

The diagram shows triangle **ABC**

In triangle **ABC**:

$$AC = 6.5 \text{ cm}$$

$$BC = x \text{ cm}$$

$$\text{Angle } BAC = 34^\circ$$

Angle **ABC** is a right angle.

Work out the value of **x**

Give your answer correct to one decimal place.

$$x = \underline{\hspace{2cm}}$$

(Total for Question 5 is 3 marks)

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6. Change a speed of  $W$  metres per second to a speed in kilometres per hour.

Give your answer in terms of  $W$  in its simplest form.

\_\_\_\_\_ kilometres per hour

(Total for Question 6 is 3 marks)

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7. Look at the diagram for Question 7 in the separate Diagram Booklet. The diagram is NOT accurately drawn.

The diagram shows a 6-sided shape, **ABCDEF**.

In the diagram:

$$AF = 21 \text{ cm}$$

$$CD = 15 \text{ cm}$$

$$AB = FE = 13 \text{ cm}$$

The perpendicular height of the shape is  $h$  cm

**CD** is parallel to **AF**

The area of the shape is  $390 \text{ cm}^2$

Work out the value of  $h$ .

(4 marks)

Answer space continues on the next page.

7. continued.

$h =$  \_\_\_\_\_

(Total for Question 7 is 4 marks)

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8. Ishir plants **600** bulbs in a garden.

He plants tulip bulbs, crocus bulbs and daffodil bulbs so that:

number of tulip bulbs : number of crocus bulbs :

number of daffodil bulbs = **9 : 4 : 2**

**45%** of the tulip bulbs are for yellow flowers.

$\frac{5}{8}$  of the crocus bulbs are for yellow flowers.

All of the daffodil bulbs are for yellow flowers.

Work out the number of bulbs that are for yellow flowers.

(5 marks)

Answer space continues on the next page.

8. continued.

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(Total for Question 8 is 5 marks)

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9. Giovanni invests **4500** koruna in a savings account for **4** years.

He gets **2.4%** per year compound interest.

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

Give your answer correct to the nearest koruna.

\_\_\_\_\_ koruna

(Total for Question 9 is 3 marks)

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Turn over

10. Solve the simultaneous equations shown below.

$$6x + 4y = 1$$

$$3x + 5y = 8$$

Show clear algebraic working.

$$x = \underline{\hspace{4cm}}$$

$$y = \underline{\hspace{4cm}}$$

(Total for Question 10 is 3 marks)

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- 11 (i) Factorise the expression below.

$$x^2 + 9x - 22$$

(2 marks)

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- (ii) Hence, solve the following equation

$$x^2 + 9x - 22 = 0$$

(1 mark)

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(Total for Question 11 is 3 marks)

**12 Ali uses a fitness tracker to count the number of steps he walks each day for 7 days.**

**For the first 4 days, his mean number of steps is 11 800**

**For the next 3 days, his mean number of steps is 13 207**

**Work out his mean number of steps for the 7 days.**

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**(Total for Question 12 is 3 marks)**

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**Turn over**

13. The table gives information about the distances, in km, that 70 teachers travel to school.

Distance (d km)	Frequency
$0 < d \leq 10$	5
$10 < d \leq 20$	5
$20 < d \leq 30$	10
$30 < d \leq 40$	25
$40 < d \leq 50$	20
$50 < d \leq 60$	5

- (a) Complete the cumulative frequency table.

(1 mark)

Distance (d km)	Cumulative frequency
$0 < d \leq 10$	
$0 < d \leq 20$	
$0 < d \leq 30$	
$0 < d \leq 40$	
$0 < d \leq 50$	
$0 < d \leq 60$	

**13. continued.**

**(b) On the grid provided for Question 13 (b) in the separate Diagram Booklet, draw a cumulative frequency graph for your table.**

**(2 marks)**

**(c) Use your graph to find an estimate for the interquartile range of the distances.**

**(2 marks)**

\_\_\_\_\_ km

**(continued on the next page)**

**13. continued.**

- (d) Use your graph to find an estimate for the number of teachers who travel more than 45 km.**

**(2 marks)**

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**(Total for Question 13 is 7 marks)**

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14. (a) Show that the expression  $3y(2y + 5)(y + 7)$  can be written in the form  $ay^3 + by^2 + cy$  where **a**, **b** and **c** are integers.  
(3 marks)

(continued on the next page)

14. continued.

(b) Solve the equation given below.

$$\frac{2y + 3}{5} + \frac{6y - 5}{4} = \frac{163}{100}$$

Show clear algebraic working.

(4 marks)

$y =$  \_\_\_\_\_

(Total for Question 14 is 7 marks)

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Turn over

15. (a) Make  $r$  the subject of the following equation

$$p = \sqrt{\frac{7r + 5}{11 + 2r}}$$

(4 marks)

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(continued on the next page)

Turn over



15. continued.

(b) Solve the inequality shown below.

$$3y^2 + 4y - 32 > 0$$

Show your working clearly.

(3 marks)

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(Total for Question 15 is 7 marks)

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Turn over

- 16. 60 art students were asked if they would like to attend workshops for knitting (K), for photography (P) or for embroidery (E)**

**Of these students**

- 9 chose knitting, photography and embroidery**
- 17 chose knitting and photography**
- 16 chose photography and embroidery**
- 20 chose knitting and embroidery**
- 28 chose photography**
- 39 chose embroidery**
- 2 chose none of the workshops**

- (a) Using the information given above, complete the Venn diagram provided for Question 16 (a) in the separate Diagram Booklet, to show the numbers of students in each subset.**

**(3 marks)**

**(continued on the next page)**

16. continued.

(b) One of the students is chosen at random.

Given that this student chose photography,  
find the probability that this student also  
chose knitting.

(2 marks)

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(c) Find  $n(P \cap K')$

(1 mark)

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(continued on the next page)

16. continued.

(d) Find  $n([P \cup E] \cap K)$

(1 mark)

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(Total for Question 16 is 7 marks)

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17.  $Q$  is directly proportional to the square root of  $d$

$$Q = 4.5 \text{ when } d = 324$$

Find a formula for  $Q$  in terms of  $d$

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(Total for Question 17 is 3 marks)

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18. The straight line **P** has equation  $5y + 2x = 7$

Find the gradient of a straight line that is  
perpendicular to **P**

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(Total for Question 18 is 2 marks)

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19. Given that:

$$Y = \frac{m}{2p - 3r}$$

and that:

$m = 8$  correct to the nearest whole number

$p = 6.62$  correct to 2 decimal places

$r = 1.2$  correct to 1 decimal place,

work out the lower bound for the value of  $Y$ .

Give your answer correct to 3 decimal places.

Show your working clearly.

(3 marks)

Answer space continues on the next page.

**19. continued.**

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**(Total for Question 19 is 3 marks)**

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20. Given that:

$$k = x - y \quad \text{and} \quad x = \frac{1}{4y}$$

express  $\frac{5k}{x + 2}$  in the form  $\frac{a - by^2}{c + dy}$

where  $a$ ,  $b$ ,  $c$  and  $d$  are integers.

(3 marks)

Answer space continues on the next page.

20. continued.

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**(Total for Question 20 is 3 marks)**

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**21. Look at the diagram for Question 21 in the separate Diagram Booklet. The diagram is NOT accurately drawn.**

**The diagram shows a square,  $ABCD$  and a circle.**

**The sides of the square are tangents to the circle.**

**The total area of the shaded regions is  $80 \text{ cm}^2$**

**Work out the length of  $AC$**

**Give your answer correct to 3 significant figures.**

**(5 marks)**

**Answer space continues on the next 2 pages.**

21. continued.

21. continued.

\_\_\_\_\_ cm

(Total for Question 21 is 5 marks)

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**22. The straight line  $L$  has equation,  $x + y = 5$**

**The curve  $C$  has equation,  $2x^2 + 3y^2 = 210$**

**Find the coordinates of the points where  
 $L$  and  $C$  intersect.**

**Show clear algebraic working.**

**(5 marks)**

**Answer space continues on the next page.**

**22. continued.**

( \_\_\_\_\_ , \_\_\_\_\_ ) ( \_\_\_\_\_ , \_\_\_\_\_ )

**(Total for Question 22 is 5 marks)**

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23. Simplify the expression given below.

$$\frac{30 \times 25^{2x+7}}{\sqrt{180} \times (\sqrt{5})^{4x+9}}$$

Give your answer in the form  $5^W$  where W is an expression in terms of X

Show each stage of your working clearly.

(3 marks)

Answer space continues on the next page.



**23. continued.**

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**(Total for Question 23 is 3 marks)**

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24. Look at the diagram for Question 24 in the separate Diagram Booklet. The diagram is NOT accurately drawn.

The diagram shows a quadrilateral **OACB**.

In the diagram:



$$\mathbf{OA} = 4\mathbf{a}$$



$$\mathbf{OB} = 3\mathbf{b}$$



$$\mathbf{BC} = 2\mathbf{a} + \mathbf{b}$$

(continued on the next page)

24. continued.

(a) Find  $\vec{AC}$  in terms of  $a$  and  $b$

Give your answer in its simplest form.

(2 marks)

$\vec{AC} =$  \_\_\_\_\_

(continued on the next page)

Turn over

24. continued.

(b) The point **P** lies on **AC** such that **AP : PC = 3 : 2**

The point **Q** is such that **OPQ** and **BCQ** are straight lines.

Using a vector method, find  $\overrightarrow{OQ}$  in terms of **a** and **b**

Give your answer in its simplest form.

Show your working clearly.

(4 marks)

Answer space continues on the next page.

24. (b) continued.

$$\overrightarrow{OQ} = \underline{\hspace{10cm}}$$

(Total for Question 24 is 6 marks)

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25. Look at the diagram for Question 25 in the separate Diagram Booklet. The diagram shows a sketch of the graph of  $y = 2\sin(x + 60)^\circ$

- (i) Find the coordinates of the point **A**.  
(1 mark)

( \_\_\_\_\_ , \_\_\_\_\_ )

- (ii) Find the coordinates of the point **B**.  
(1 mark)

( \_\_\_\_\_ , \_\_\_\_\_ )

(Total for Question 25 is 2 marks)

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**TOTAL FOR PAPER IS 100 MARKS**  
**END OF PAPER**

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