Total Marks

Mathematics A

PAPER 2H
Higher Tier
(Calculator)

Friday 10 November 2023 – Morning

Time: 2 hours

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

Surname	
Other names	
Centre Number	
Candidate Number	

Q73469A

Pearson

YOU MUST HAVE

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

YOU WILL BE GIVEN

Diagram Booklet
Formulae Pages

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 on the separate diagrams – there may be more space than you need.

CALCULATORS MAY BE USED.

You must NOT write anything on the Formulae Pages.

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.

You may be provided with three models for Question 23 They are NOT accurate.

You may be provided with a cutout shape for Question 3(a)
It is accurate.

There may be spare copies of some diagrams in case you need them.

ADVICE

Read each question carefully before you start to answer it.

Check your answers if you have time at the end.

Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. **Look at the table for Question 1 in the Diagram Booklet.**

   It shows information about the lengths, in minutes, of 50 telephone calls.

   (a) **Write down the modal class.**

   (1 mark)

   _____

(continued on the next page)

1. continued.

    (b) **Work out an estimate for the total length, in minutes, of these telephone calls.**

    (3 marks)

    _____ minutes

(Total for Question 1 is 4 marks)

Turn over

2. **Look at the diagram for Question 2 in the**

    Diagram Booklet.

    It is NOT accurately drawn.

    It shows triangle ABC and triangle ECD

    ACD and EBC are straight lines.

    AB = 10 cm

    AC = 8 cm

    EB = 5 cm

    CD = 14 cm

    ED = w cm

    Angle ECD is a right angle.

    Work out the value of w

    Give your answer correct to one decimal place.

    (4 marks)

    Answer space continues on the next two pages.

Turn over

2. **continued.**

2. **continued.**

w = _____

(Total for Question 2 is 4 marks)

3. **(a)** Look at the diagram for Question 3(a) in the Diagram Booklet.

It shows shape **T** on a grid.

Reflect shape **T** in the line **y = x**

A cutout shape may be available if you wish to use it.

(2 marks)

(b) Look at the diagram for Question 3(b) in the Diagram Booklet.

It shows triangle **A** and triangle **B** on a grid.

Describe fully the single transformation that maps triangle **A** onto triangle **B**

(3 marks)

_____

_____

_____

(Total for Question 3 is 5 marks)

Turn over

4.   (a)   Solve

$$\frac{2t + 5}{6} = 2t - 5$$

Show clear algebraic working.

(3 marks)

t = _____

(continued on the next page)

4. continued.

(b) Simplify

$$p^{15} \div p^3$$

(1 mark)

_____

(c) Simplify fully

$$(2m^3q^5)^4$$

(2 marks)

_____

(continued on the next page)

Turn over

4. **continued.**

(d) Given that

$$\frac{y^5 \times y^n}{y^7} = y^{12}$$

work out the value of **n**

(2 marks)

n = _____

(Total for Question 4 is 8 marks)

5. Avril bakes a cake.

   She uses flour, butter and sugar such that

   weight of flour : weight of butter = **6 : 5**

   weight of butter : weight of sugar = **3 : 2**

   Avril uses **120** grams of sugar.

   Work out the weight of flour Avril uses.

   (3 marks)

   Answer space continues on the next page.

5.   **continued.**

_____ **grams**

(Total for Question 5 is 3 marks)

6. **Show that**

$$3\frac{3}{7} \div 2\frac{2}{3} = 1\frac{2}{7}$$

(3 marks)

Answer space continues on the next page.

6. **continued.**

(Total for Question 6 is 3 marks)

7.   Hermione buys a boat for $26 800

The value of the boat depreciates by 8% each year.

Work out the value of the boat at the end of 3 years.

Give your answer correct to the nearest dollar.

$_____

(Total for Question 7 is 3 marks)

8.   The mean number of goals scored by a hockey team

in **8** matches is **6**

The team plays **2** more matches and scores

k goals in each match.

The mean number of goals scored by the hockey

team in the **10** matches is **7**

Work out the value of **k**

(3 marks)

Answer space continues on the next page.

8. **continued.**

k = _____

(Total for Question 8 is 3 marks)

Turn over

9. A straight line passes through the points with coordinates $(0, -3)$ and $(2, 0)$

Find an equation of the line.

_____

(Total for Question 9 is 2 marks)

Turn over

10. Look at the diagram for Question 10 in the
Diagram Booklet.

It is NOT accurately drawn.

It shows a hexagon **ABCDEF**

AB = 25 cm

BC = (y + 2) cm

CD = 8 cm

EF = 7 cm

AF = (y + 6) cm

All the marked angles are right angles.

The area of hexagon **ABCDEF** is **258 cm^2**

Work out the value of **y**

(5 marks)

Answer space continues on the next page.

10. continued.

y = _____

(Total for Question 10 is 5 marks)

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

It shows an incomplete probability tree diagram.

Sid has **2** boxes of crayons, box **X** and box **Y**

5 of the **16** crayons in box **X** are red.

7 of the **20** crayons in box **Y** are red.

Sid takes at random one crayon from box **X** and one crayon from box **Y**

(a) Complete the probability tree diagram in the Diagram Booklet.

There are five spaces to fill.

(2 marks)

(b) Work out the probability that Sid takes two crayons that are red or two crayons that are not red.

(3 marks)

Answer space continues on the next page.

Turn over

11. (b) continued.

(Total for Question 11 is 5 marks)

Turn over

12. (a) Calculate the value of **x** when

$$2^7 \times 4^5 = 4^x$$

(2 marks)

x = _____

(continued on the next page)

12. continued.

(b) Simplify fully

$$\left(125p^6y^{24}\right)^{\frac{2}{3}}$$

(2 marks)

_____

(Total for Question 12 is 4 marks)

Turn over

13. Robert asked **11** people how many meetings they attended last week.

Here are the results in numerical order.

1   2   4   6   6   8
11   12   13   14   17

Find the interquartile range of the number of meetings.

(2 marks)

Answer space continues on the next page.

13. continued.

(Total for Question 13 is 2 marks)

Turn over

14. Look at the diagram for Question 14 in the

  Diagram Booklet.

  It is the graph of the equation $2y + x = 1$ drawn on

  a grid.

  By drawing another straight line on the grid, solve

  the simultaneous equations

  $y - x - 2 = 0$

  $2y + x = 1$

  x = _____

  y = _____

(Total for Question 14 is 3 marks)

Turn over

15. (a) Use algebra to show that $0.3\dot{7}\dot{2} = \dfrac{41}{110}$

(2 marks)

Answer space continues on the next page.

15. (a) continued.

(continued on the next page)

15. continued.

  (b) Express

$$\frac{\sqrt{125} + \sqrt{80}}{\sqrt{3}}$$

in the form $\sqrt{n}$ where n is an integer.

Show your working clearly.

(3 marks)

Answer space continues on the next page.

15. (b) continued.

_____

(Total for Question 15 is 5 marks)

16. **Expand and simplify**

$$(2y + 3)(y - 5)(y + 4)$$

_____

(Total for Question 16 is 3 marks)

Turn over

17. $P = t(m + y)$

t = 8·3 correct to **2** significant figures

m = 2 correct to **1** significant figure

y = 15 correct to the nearest **5**

Work out the upper bound for the value of P

Show your working clearly.

(3 marks)

Answer space continues on the next page.

17. continued.

(Total for Question 17 is 3 marks)

18. A particle is moving along a straight line that passes through the fixed point **O**

    The displacement, **s** metres, of the particle from **O** at time **t** seconds is given by

    $$s = 2t^3 - 5t^2 + 6t - 5$$

    Find the value of **t** when the acceleration of the particle is **5 m/s^2**

    (4 marks)

    Answer space continues on the next two pages.

18. **continued.**

18. continued.

t = _____

(Total for Question 18 is 4 marks)

Turn over

19. The functions **f** and **g** are such that

$$f : x \longmapsto 5x + 7$$

$$g : x \longmapsto \frac{5}{2x - 9}$$

(a) State which value of **x** cannot be included in any domain of **g**

(1 mark)

_____

(b) Find **fg(4)**

(2 marks)

_____

(continued on the next page)

Turn over

19. **continued.**

The function h is such that

$$h : x \mapsto 3x^2 - 12x + 8 \quad \text{where} \quad x > 2$$

(c) Express the inverse function h^{-1} in the form

$$h^{-1} : x \mapsto \ldots$$

(4 marks)

Answer space continues on the next page.

Turn over

19. (c)   continued.

$$h^{-1} : x \mapsto \underline{\hspace{4cm}}$$

(Total for Question 19 is 7 marks)

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

It is NOT accurately drawn.

It shows equilateral triangle **ABC** with sides of
length **10 cm**

A circle is drawn inside the triangle.

D, **E** and **F** are points on the circle.

ADB, **BEC** and **CFA** are tangents to the circle.

Calculate the total area of the regions shown
shaded in the diagram.

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

(4 marks)

Answer space continues on the next page.

20. **continued.**

_____ **cm^2**

(Total for Question 20 is 4 marks)

Turn over

21. **The line with equation**

$x + 2y = 5$ intersects the curve with equation

$x^2 + 3y^2 = 13$ at the points **A** and **B**

Find the coordinates of A and the coordinates of B

Show clear algebraic working.

(5 marks)

Answer space continues on the next two pages.

21. **continued.**

21. **continued.**

(_____ , _____)

(_____ , _____)

(Total for Question 21 is 5 marks)

Turn over

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

It shows a quadrilateral OACB

$$\overrightarrow{OA} = 3\underline{a}$$

$$\overrightarrow{OB} = 4\underline{b}$$

$$\overrightarrow{BC} = 2\underline{a} - 2\underline{b}$$

(a) (i) **Find the vector $\overrightarrow{OC}$ in terms of $\underline{a}$ and $\underline{b}$**

Simplify your answer.

(1 mark)

$$\overrightarrow{OC} = \underline{\hspace{4cm}}$$

(continued on the next page)

Turn over

22. (a) continued.

(ii) **Find the vector $\overrightarrow{AB}$ in terms of $\underline{a}$ and $\underline{b}$**

(1 mark)

$\overrightarrow{AB}$ = _____

(continued on the next page)

22. continued.

The point **P** lies on **AB** and on **OC**

(b) Using a vector method, find the ratio **AP** : **PB**

Show your working clearly.

(3 marks)

Answer space continues on the next two pages.

22. (b) continued.

22. (b) continued.

_____

(Total for Question 22 is 5 marks)

Turn over

23. Look at Diagram 1 and Diagram 2 for Question 23 in the Diagram Booklet.

You may be provided with three models.

They are NOT accurate.

They show a frustum of a cone.

Diagram 1 shows a 3D view of the frustum.

Diagram 2 shows a 2D view of the frustum.

The frustum is made by removing a small cone from a similar large cone, as shown by the diagrams and the models.

The height of the large cone is **15 cm**

The radius of the base of the large cone is **6 cm**

The radius of the base of the small cone is **x cm**

(continued on the next page)

Turn over

23. continued.

Given that the volume of the frustum is

$$\frac{4212}{25} \, \pi \, \text{cm}^3$$

work out the value of **x**

Show clear algebraic working.

(5 marks)

Answer space continues on the next two pages.

23. continued.

23. continued.

x = _____

(Total for Question 23 is 5 marks)

24. Solve

$$\frac{45y^3 - 80y}{3y^2 + y - 4} \times \left(\frac{1}{3y - 4} + \frac{1}{y} \right) = \frac{4(y + 2)}{5y - 8}$$

Show clear algebraic working.

(5 marks)

Answer space continues on the next two pages.

Turn over

24. **continued.**

24. continued.

x = _____

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

END OF PAPER