

Mathematics
PAPER 2 (Calculator)
Higher Tier

Total Marks

Monday 3 June 2024 – Morning

Time: 1 hour 30 minutes

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, Formulae Booklet (enclosed). Tracing paper may be used.

YOU WILL BE GIVEN

A separate Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

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.

You must show all your working.

Diagrams are NOT accurately drawn, unless otherwise indicated.

(continued on the next page)

Turn over

INSTRUCTIONS continued.

Calculators may be used.

If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

INFORMATION

The total mark for this paper is 80

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 17.

ADVICE

Read each question carefully before you start to answer it.

Try to answer every question.

Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. Look at the diagram for Question 1 in the separate Diagram Booklet.

The diagram is NOT accurately drawn.

The diagram shows a right-angled triangle labelled **ABC**.

In the diagram:

$$AB = 10 \text{ cm}$$

$$AC = 19 \text{ cm}$$

Work out the length of **CB**.

Give your answer correct to

3 significant figures.

(2 marks)

Answer space continues on the next page.

1. continued.

_____ **cm**

(Total for Question 1 is 2 marks)

Turn over

- 2. (a) Write 90 as a product of its prime factors.
(2 marks)**

Answer space continues on the next page.

2. (a) continued.

(continued on the next page)

Turn over

2. continued.

(b) When

$$T = 2^2 \times 3$$

$$U = 2 \times 3^2$$

**write down the lowest common
multiple (LCM) of T and U.**

(1 mark)

(Total for Question 2 is 3 marks)

Turn over

3. The number of hours, H , that some machines take to make 5000 bottles is given by

$$H = \frac{72}{n} \quad \text{where } n \text{ is the number of machines.}$$

On Monday, 6 machines made 5000 bottles.

On Tuesday, 9 machines made 5000 bottles.

The machines took more time to make the bottles on Monday than on Tuesday.

How much more time?

(2 marks)

Answer space continues on the next 2 pages.

Turn over

3. continued.

3. continued.

_____ hours

(Total for Question 3 is 2 marks)

4. There are only red discs, blue discs and yellow discs in a bag.

There are **24** yellow discs in the bag.

Mel is going to take at random a disc from the bag.

The probability that the disc will be yellow is **0.16**

the number of red discs : the number of blue discs = **5 : 4**

Work out the number of red discs in the bag.

(4 marks)

Answer space continues on the next 2 pages.

4. continued.

4. continued.

(Total for Question 4 is 4 marks)

Turn over

5. (a) Complete the table below of values
for $y = x^2 - x$
(2 marks)

x	−2	−1	0	1	2	3
y	6		0		2	

- (b) Look at the diagram for
Question 5 (b) in the separate
Diagram Booklet.

The diagram shows a grid.

On the grid, draw the graph of
 $y = x^2 - x$ for values of x from
−2 to 3

(2 marks)

(continued on the next page)

5. continued.

(c) Use your graph to find estimates for the solutions of the equation

$$\mathbf{x^2 - x = 4}$$

(2 marks)

(Total for Question 5 is 6 marks)

Turn over

6. Andy, Luke and Tina share some sweets in the ratio 1 : 6 : 14

Tina gives $\frac{3}{7}$ of her sweets to Andy.

Tina then gives $12\frac{1}{2}\%$ of the rest of her sweets to Luke.

Tina says,

“Now all three of us have the same number of sweets.”

Is Tina correct?

You must show how you get your answer.
(4 marks)

Answer space continues on the next 2 pages.

6. continued.

6. continued.

(Total for Question 6 is 4 marks)

Turn over

- 7. Look at the diagram for Question 7 in the separate Diagram Booklet.**

The diagram is NOT accurately drawn.

The diagram shows a quadrilateral labelled ABCD.

In the diagram:

All angles are measured in degrees.

$$\text{Angle } ABC = 4y + 8$$

$$\text{Angle } BCD = 3y - 3$$

$$\text{Angle } CDA = 2y + 15$$

$$\text{Angle } DAB = 4y + 15$$

Show that ABCD is a trapezium.

(4 marks)

Answer space continues on the next 2 pages.

7. continued.

7. continued.

(Total for Question 7 is 4 marks)

Turn over

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

The diagram is NOT accurately drawn.

The diagram shows a playground in the shape of a right-angled triangle labelled PQR.

Dan makes a scale drawing of the playground.

He uses a scale of 1 cm represents 5 m

The area of the playground on the scale drawing is 28 cm^2

The real length of PQ is 40 m

Work out the real length of RQ.

(3 marks)

Answer space continues on the next 2 pages.

Turn over

8. continued.

8. continued.

_____ m

(Total for Question 8 is 3 marks)

Turn over

**9. A number N is rounded to
2 significant figures.**

The result is 7.3

**(a) Write down the least possible value
of N .**

(1 mark)

(continued on the next page)

9. continued.

(b) Leila says,

“The value of N cannot be greater than 7.349 because 7.350 would round up to 7.4 ”

Is Leila correct?

You must give a reason for your answer.

(1 mark)

Answer space continues on the next page.

Turn over

9. (b) continued.

(Total for Question 9 is 2 marks)

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

The diagram is NOT accurately drawn.

The diagram shows two right-angled triangles labelled PQR and STU.

In the diagram:

All lengths are measured in centimetres.

In triangle PQR:

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

$$\mathbf{RQ = (7 - 2y) \text{ cm}}$$

Angle RPQ is marked a

In triangle STU:

$$\mathbf{SU = (1 + y) \text{ cm}}$$

$$\mathbf{UT = 4 \text{ cm}}$$

Angle STU is marked b

Given that

$$\mathbf{\sin a = \tan b}$$

work out the value of y .

(3 marks)

Answer space continues on the next 2 pages.

Turn over

10. continued.

10. continued.

$y =$ _____

(Total for Question 10 is 3 marks)

11. Look at the frequency table for Question 11 in the separate Diagram Booklet. It gives information about the weights of 60 parcels.

(a) Complete the cumulative frequency table below.

(1 mark)

Weight (w kg)	Cumulative frequency
$0 < w \leq 2$	
$0 < w \leq 4$	
$0 < w \leq 6$	
$0 < w \leq 8$	
$0 < w \leq 10$	

(continued on the next page)

Turn over

11. continued.

(b) Look at the grid for Question 11 (b) in the separate Diagram Booklet.

On the grid, draw a cumulative frequency graph for your table.

(2 marks)

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

(2 marks)

_____ kg

(continued on the next page)

Turn over

11. continued.

- (d) Use your graph to find an estimate
for the number of these parcels with
a weight greater than 7 kg
(2 marks)**

(Total for Question 11 is 7 marks)

12. (a) f is inversely proportional to d^2

$$f = 3.5 \text{ when } d = 8$$

Find an equation for f in terms of d .
(2 marks)

(continued on the next page)

Turn over

12. continued.

**(b) Find the positive value of d
when $f = 10$**

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

(2 marks)

$d =$ _____

(Total for Question 12 is 4 marks)

Turn over

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

The diagram shows a coordinate grid.

On the grid, shade the region R that satisfies all the following inequalities.

$$x \leq 2$$

$$y \geq -3$$

$$y \leq 2x + 1$$

$$3x + 2y \leq 6$$

Label the region R.

(Total for Question 13 is 3 marks)

Turn over

14. Look at the diagram for Question 14 (a) in the separate Diagram Booklet.

The diagram is a graph.

The graph shows the velocity of a car, in metres per second, t seconds after it starts to slow down.

- (a) Calculate an estimate for the acceleration of the car when $t = 5$**
You must show all your working.
(3 marks)

Answer space continues on the next page.

14. (a) continued.

_____ m/s^2

(continued on the next page)

14. continued.

**(b) Look at the diagram for
Question 14 (b) in the separate
Diagram Booklet.**

**It shows the same graph as in part (a).
Work out an estimate for the distance
the car travels in the first 6 seconds
after it starts to slow down.**

Use 3 strips of equal width.

(3 marks)

Answer space continues on the next page.

14. (b) continued.

_____ m

(Total for Question 14 is 6 marks)

Turn over

**15. Given that p is a prime number,
rationalise the denominator of $\frac{1}{\sqrt{p} + 1}$**

Give your answer in its simplest form.

(Total for Question 15 is 2 marks)

Turn over

16. Solve $(4y - 3)(y + 5) < 0$
(2 marks)

Answer space continues on the next page.

16. continued.

(Total for Question 16 is 2 marks)

Turn over

17. Look at the diagrams for Question 17 in the separate Diagram Booklet.

The diagrams are NOT accurately drawn.

The diagrams show three similar solid cylinders made from the same material.

The cylinders are labelled cylinder L, cylinder M and cylinder P. You may also be given three models.

Cylinder L has a mass of 64 g

Cylinder M has a mass of 125 g

Cylinder M has a total surface area of 144 cm^2

Cylinder P has a total surface area of 16 cm^2

(continued on the next page)

17. continued.

Work out

**height of
cylinder L : height of
cylinder M : height of
cylinder P**

(4 marks)

Answer space continues on the next 2 pages.

Turn over

17. continued.

17. continued.

(Total for Question 17 is 4 marks)

Turn over

18. There are only 4 red counters, 3 yellow counters and 1 green counter in a bag.

Tony takes at random three counters from the bag.

Work out the probability that there are now more yellow counters than red counters in the bag.

**You must show all your working.
(5 marks)**

Answer space continues on the next 3 pages.

18. continued.

18. continued.

18. continued.

(Total for Question 18 is 5 marks)

Turn over

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

The diagram is NOT accurate.

The diagram shows a quadrilateral labelled OACB.

In the diagram:

M is the midpoint of OA.

N is the point on BC such that

$$\mathbf{BN : NC = 4 : 5}$$

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

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

$$\overrightarrow{AC} = k\mathbf{b} \text{ where } k \text{ is a positive integer.}$$

(a) Express \overrightarrow{MN} in terms of k , \mathbf{a} and \mathbf{b} .

Give your answer in its simplest form.

(4 marks)

Answer space continues on the next 2 pages.

Turn over

19. (a) continued.

19. (a) continued.

(continued on the next page)

Turn over

19. continued.

(b) Is MN parallel to OB?

Give a reason for your answer.

(1 mark)

(Total for Question 19 is 5 marks)

20. The curve **C** has equation

$$y = 2x^2 - 12x + 7$$

Find the coordinates of the turning point on **C**.

(3 marks)

Answer space continues on the next page.

20. continued.

(_____ , _____)

(Total for Question 20 is 3 marks)

Turn over

21. Look at the grid for Question 21 in the separate Diagram Booklet.

The graph of $y = g(x)$ is shown on the grid.

**On the grid, draw the graph of
 $y = g(-x) + 2$**

(Total for Question 21 is 2 marks)

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

The diagram is NOT accurately drawn.

In the diagram:

A and B are points on a circle, centre O.

MAP and NBP are tangents to the circle.

Prove that $AP = BP$

(4 marks)

Answer space continues on the next 2 pages.

22. continued.

22. continued.

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

END OF PAPER
