

Paper Reference 1MA1/3H
Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Total Marks

Mathematics
PAPER 3 (Calculator)
Higher Tier

Wednesday 14 June 2023 – 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, compasses, writing and drawing equipment, calculator, Formulae Sheet (enclosed).
Tracing paper may be used.**

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

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

You must SHOW ALL YOUR WORKING.

Diagrams are NOT accurately drawn, unless otherwise indicated.

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 in case you need them.

**You may be provided with two models for Question 18
and also a formula model for Question 18
They are NOT accurate.**

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. (a) Simplify
 $(m^2)^3$
(1 mark)
-

- (b) Simplify
 $y^5 \times y^8$
(1 mark)
-

(continued on the next page)

Turn over

1. continued.

(c) Expand

$$4p(p^2 + 3p)$$

(2 marks)

(Total for Question 1 is 4 marks)

Turn over

2. Jonny wants to know how much coffee he will need for 800 people at a meeting.

Each person who drinks coffee will drink 2 cups of coffee.

10·6 grams of coffee is needed for each cup of coffee.

Jonny assumes 68% of the people will drink coffee.

- (a) Using this assumption, work out the amount of coffee Jonny needs.

Give your answer correct to the nearest gram.

(4 marks)

Answer space continues on the next page.

2. (a) continued.

_____ grams

(continued on the next page)

Turn over

2. continued.

Jonny's assumption is wrong.

72% of the people will drink coffee.

(b) How does this affect your answer to part (a)?

(1 mark)

(Total for Question 2 is 5 marks)

3. Look at the diagram for Question 3 in the Diagram Booklet.

It shows triangle **AGF** and two straight lines **ACF** and **ADG**

BCD and **EFG** are parallel lines.

Angle **CDG** = 110°

Angle **EFC** = 125°

Show that triangle **ACD** is isosceles.

Give a reason for each stage of your working.

(5 marks)

Answer space continues on the next page.

3. continued.

(Total for Question 3 is 5 marks)

Turn over

4. It takes 14 hours for 5 identical pumps to fill a water tank.

How many hours would it take 4 of these pumps to fill another water tank of the same size?

_____ hours

(Total for Question 4 is 2 marks)

5. **A** and **B** are numbers such that

$$A = 2^2 \times 3^4 \times 7$$

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

- (a) Find the highest common factor (HCF) of
A and **B**
(1 mark)

(continued on the next page)

Turn over

5. continued.

Remember:

$$A = 2^2 \times 3^4 \times 7$$

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

(b) Find the lowest common multiple (LCM) of
A and B

(2 marks)

Answer space continues on the next page.

5. (b) continued.

(Total for Question 5 is 3 marks)

6. Lava flows from a volcano at a constant rate of $11.9 \text{ m}^3/\text{s}$

How many days does it take for $67\,205\,600 \text{ m}^3$ of lava to flow from the volcano?

Give your answer correct to the nearest day.

(3 marks)

Answer space continues on the next page.

6. continued.

_____ days

(Total for Question 6 is 3 marks)

7. Look at the diagram for Question 7 in the Diagram Booklet.

It shows the graph of

$$y = x^2 - 2x - 2$$

- (a) Write down the coordinates of the turning point on the graph of

$$y = x^2 - 2x - 2$$

(1 mark)

(_____ , _____)

(continued on the next page)

7. continued.

(b) Write down an estimate for one of the roots of

$$\mathbf{x^2 - 2x - 2 = 0}$$

(1 mark)

(Total for Question 7 is 2 marks)

Turn over

8. A solid cuboid is made of metal.

The metal has a density of 9 g/cm^3

The volume of the cuboid is 72 cm^3

Work out the mass of the cuboid.

_____ grams

(Total for Question 8 is 2 marks)

9. Some people were asked if they wanted a new television.

70% of the people said yes.

80% of the people who said yes wanted a television with a large screen.

What percentage of the people asked said they wanted a television with a large screen?

(2 marks)

Answer space continues on the next page.

9. continued.

_____ %

(Total for Question 9 is 2 marks)

Turn over

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

It shows a triangle **ABD**

C is a point on **BD**

AB = 6.8 cm

Angle **ABC = 41°**

Angle **ADC = 55°**

Angle **ACB** and **ACD** are right angles.

Work out the length of **DC**

Give your answer correct to **1** decimal place.

(3 marks)

Answer space continues on the next two pages.

10. continued.

10. continued.

_____ cm

(Total for Question 10 is 3 marks)

11. The table below shows some information about the heights of a group of adults.

least height	170 cm
greatest height	185 cm
median	177.5 cm
lower quartile	175 cm
upper quartile	180 cm

- (a) Look at the diagram for Question 11(a) in the Diagram Booklet.

It shows a grid.

On the grid, draw a box plot for the information in the table.

(3 marks)

(continued on the next page)

11. continued.

**Look at the diagram for Question 11(b) in the
Diagram Booklet.**

**It is a box plot showing the distribution of the
heights of a group of teenagers.**

**(b) Compare the distribution of the heights of the
adults with the distribution of the heights of the
teenagers.**

(2 marks)

(Total for Question 11 is 5 marks)

Turn over

12. Show that

$(x - 1)(x + 3)(x - 5)$ can be written in the form
 $ax^3 + bx^2 + cx + d$

where a , b , c and d are integers.

(3 marks)

Answer space continues on the next page.

12. continued.

(Total for Question 12 is 3 marks)

Turn over

13. An expression for the n th term of the sequence of triangular numbers is

$$\frac{n(n + 1)}{2}$$

Prove that the sum of any two consecutive triangular numbers is a square number.

(3 marks)

Answer space continues on the next page.

13. continued.

(Total for Question 13 is 3 marks)

14. Look at the diagram for Question 14 in the Diagram Booklet.

OAB is a triangle.

OBC is a sector of a circle, centre **O**

$$BA = 9 \text{ cm}$$

$$AO = 6 \text{ cm}$$

$$\text{Angle } BAO = 35^\circ$$

$$\text{Angle } BOC = 80^\circ$$

Calculate the area of **OBC**

Give your answer correct to 3 significant figures.

(4 marks)

Answer space continues on the next two pages.

14. continued.

Turn over

14. continued.

_____ cm^2

(Total for Question 14 is 4 marks)

15. (a) Factorise
 $x^2 - y^2$
(1 mark)

(continued on the next page)

15. continued.

(b) Show that

$2^{40} - 1$ is the product of two consecutive odd numbers.

(2 marks)

(Total for Question 15 is 3 marks)

Turn over

16. Look at the diagram for Question 16 in the Diagram Booklet.

It shows triangle **T and triangle **U** on a grid.**

Describe fully the single transformation that maps triangle **T onto triangle **U****

(Total for Question 16 is 2 marks)

17. Look at the diagram for Question 17 in the Diagram Booklet.

It shows a distance–time graph.

(a) Find an estimate of the gradient of the graph at time 2.5 seconds.

You must show how you get your answer.

(3 marks)

(continued on the next page)

Turn over

17. continued.

(b) What does the gradient of the graph represent?
(1 mark)

(Total for Question 17 is 4 marks)

- 18. Look at Diagram 1, Diagram 2 and the formula for Question 18 in the Diagram Booklet.**

You may be provided with two models for this question and an additional formula model.

They show a cone and a frustum.

A solid frustum is made by removing a small cone from a large cone as shown by Diagram 1 and the models.

Diagram 2 is a simplified 2D diagram of the frustum.

The slant height of the small cone is 6 cm

The slant height of the large cone is 10 cm

The radius of the base of the large cone is 3 cm

Calculate the total surface area of the frustum.

Give your answer correct to 3 significant figures.

(5 marks)

Answer space continues on the next two pages.

18. continued.

18. continued.

_____ cm²

(Total for Question 18 is 5 marks)

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

It shows a graph.

Sana needs to draw the graph of

$$y = 3^x \text{ for } 0 \leq x \leq 2$$

She draws the graph shown on the grid in the Diagram Booklet.

Write down one thing Sana has done wrong.

(Total for Question 19 is 1 mark)

20. Prove algebraically that $0.\dot{1}\dot{2}\dot{3}$ can be written as

$$\frac{61}{495}$$

(3 marks)

Answer space continues on the next page.

20. continued.

(Total for Question 20 is 3 marks)

21. Solve

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

(4 marks)

Answer space continues on the next two pages.

21. continued.

Turn over

21. continued.

(Total for Question 21 is 4 marks)

Turn over

22. Given that the vector

$a \begin{pmatrix} 2 \\ 6 \end{pmatrix} + b \begin{pmatrix} 8 \\ 2 \end{pmatrix}$ is parallel to the vector

$$\begin{pmatrix} 13 \\ 6 \end{pmatrix}$$

find an expression for **b** in terms of **a**

(3 marks)

Answer space continues on the next page.

22. continued.

(Total for Question 22 is 3 marks)

23. A circle has equation
 $x^2 + y^2 = 25$

The point **P** with coordinates $(-3, 4)$ lies on the circle.

Alex says that the tangent to the circle at **P** crosses the **X**-axis at the point $(-8, 0)$

Is Alex correct?

You must show how you get your answer.

(4 marks)

Answer space continues on the next two pages.

23. continued.

Turn over

23. continued.

(Total for Question 23 is 4 marks)

Turn over

24. There is a total of y counters in a box.

There are X pink counters and 5 blue counters in the box.

The rest of the counters are green.

$$x : y = 1 : 3$$

Freda takes at random two counters from the box.

Find, in terms of X , an expression for the probability that Freda takes two counters of the same colour.

Give your answer as a fraction in the form

$$\frac{ax^2 + bx + c}{dx^2 + ex}$$

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

(5 marks)

Answer space continues on the next two pages.

24. continued.

Turn over

24. continued.

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

END OF PAPER
