

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

Total Marks
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Mathematics  
PAPER 3  
(Calculator)  
Higher Tier

Time: 1 hour 30 minutes plus your additional time allowance

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. 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  $\pi$  button, take the value of  $\pi$  to be  $3.142$  unless the question instructs otherwise.**

**Turn over**

## **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.**

## **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 Diagram Booklet.

It is a scatter graph which shows information about the volume of traffic and the carbon monoxide level at a point on a road each day for 22 days.

One point is an outlier.

- (a) Write down the coordinates of this point.

(1 mark)

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

(continued on the next page)

Turn over

**1. continued.**

**For another day, 370 cars pass the point on the road.**

**(b) Estimate the carbon monoxide level for this day.**

**(2 marks)**

\_\_\_\_\_ **mg/m<sup>3</sup>**

**(continued on the next page)**

**Turn over**

**1. continued.**

**Alfie says,**

**“Because there is an outlier, there is no correlation.”**

**(c) Is Alfie correct?**

**You must give a reason for your answer.**

**(1 mark)**

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**(Total for Question 1 is 4 marks)**

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**Turn over**



**2. Natalie makes potato cakes in a restaurant.**

**She mixes potato, cheese and onion so that**

**weight of potato : weight of  
cheese : weight of onion = 9 : 2 : 1**

**Natalie needs to make 6000 grams of potato cakes.**

**Cheese costs £2.25 for 175 grams.**

**(continued on the next page)**

**2. continued.**

**Work out the cost of the cheese  
needed to make 6000 grams of  
potato cakes.**

**(4 marks)**

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

**2. continued.**

**Turn over**

**2. continued.**

£ \_\_\_\_\_

**(Total for Question 2 is 4 marks)**

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**Turn over**

**3. (a) Write**

**$4.5 \times 10^5$  as an ordinary  
number.**

**(1 mark)**

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**(continued on the next page)**

**Turn over**

**3. continued.**

**(b) Write  $0.007$  in standard form.**

**(1 mark)**

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**(continued on the next page)**

**Turn over**

**3. continued.**

**(c) Work out**

$$4 \cdot 2 \times 10^3 + 5 \cdot 3 \times 10^2$$

**Give your answer in standard form.**

**(2 marks)**

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**(Total for Question 3 is 4 marks)**

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**Turn over**

**4. A water tank is empty.**

**Anil needs to fill the tank with  
2400 litres of water.**

**Company A supplies water at a rate  
of 8 litres in 1 minute 40 seconds.**

**Company B supplies water at a rate  
of 2·2 gallons per minute.**

**1 gallon = 4·54 litres**

**Company A would take more time to  
fill the tank than Company B would  
take to fill the tank.**

**(continued on the next page)**

**Turn over**



**4. continued.**

**How much more time?**

**Give your answer in minutes correct to the nearest minute.**

**(4 marks)**

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

**Turn over**

4. continued.

**4. continued.**

\_\_\_\_\_ **minutes**

**(Total for Question 4 is 4 marks)**

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**Turn over**

5. The first four terms of a Fibonacci sequence are

$n$              $2n$              $3n$              $5n$

The sum of the first five terms of this sequence is 228

Work out the value of  $n$

(3 marks)

Answer space continues on the next two pages.

**5. continued.**

**Turn over**

**5. continued.**

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**(Total for Question 5 is 3 marks)**

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**Turn over**

**6. Look at the table for Question 6 in the Diagram Booklet.**

**In a bag there are only red counters, blue counters, green counters and pink counters.**

**A counter is going to be taken at random from the bag.**

**The table in the Diagram Booklet shows the probabilities of taking a red counter or a blue counter.**

**(continued on the next page)**

**6. continued.**

**The probability of taking a green counter is  $0.2$  more than the probability of taking a pink counter.**

**(a) Complete the table in the Diagram Booklet.**

**There are two spaces to fill.**

**(2 marks)**

**(continued on the next page)**

**Turn over**



**6. continued.**

**There are 18 blue counters in the bag.**

**(b) Work out the total number of counters in the bag.**

**(2 marks)**

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

**6. continued.**

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**(Total for Question 6 is 4 marks)**

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**Turn over**

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

**It shows a sector  $OPQR$  of a circle, centre  $O$  and radius  $8\text{ cm}$**

**$OP = OR = 8\text{ cm}$**

**The marked angle is a right angle.**

**$OPR$  is a triangle.**

**Work out the area of the shaded segment  $PQR$**

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

**(4 marks)**

**Answer space is on the next two pages.**

**Turn over**

**7. continued.**

**Turn over**

**7. continued.**

\_\_\_\_\_ **cm<sup>2</sup>**

**(Total for Question 7 is 4 marks)**

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**Turn over**

8. (a) Look at the diagram for Question 8(a) in the Diagram Booklet.

Using the axes in the Diagram Booklet, sketch a graph to represent the statement

**$y$  is directly proportional to  $x$**

**(1 mark)**

**(continued on the next page)**

**8. continued.**

**(b) Look at the diagram for  
Question 8(b) in the  
Diagram Booklet.**

**Using the axes in the  
Diagram Booklet, sketch a graph  
to represent the statement**

**$y$  is inversely proportional to  $x$**

**(1 mark)**

**(Total for Question 8 is 2 marks)**

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**9. On Monday, 12 people took 5 hours to clean a number of cars.**

**On Tuesday, 15 people cleaned the same number of cars.**

**Assuming that all the people worked at the same rate,**

**(a) work out how many hours the 15 people took to clean the cars.**

**(2 marks)**

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



9. (a) continued.

\_\_\_\_\_ hours

(continued on the next page)

Turn over

**9. continued.**

**The assumption is wrong.**

**(b) How might this affect the time  
taken for the 15 people to clean  
the cars?**

**(1 mark)**

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**(Total for Question 9 is 3 marks)**

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**Turn over**

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

**The diagram shows two right-angled triangles  $ACB$  and  $DEB$**

**Triangle  $DEB$  is smaller than triangle  $ACB$**

**Both the marked angles are right angles.**

$$\mathbf{AD = 9\text{ cm}}$$

$$\mathbf{DE = 2\text{ cm}}$$

$$\mathbf{DB = 6\text{ cm}}$$

**(continued on the next page)**

**Turn over**

**10. continued.**

**Calculate the length of CB**

**Give your answer correct to  
2 decimal places.**

**(4 marks)**

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

**Turn over**

**10. continued.**

\_\_\_\_\_ **cm**

**(Total for Question 10 is 4 marks)**

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**Turn over**

- 11. Freya writes down the value of  $x$ , correct to 1 decimal place.**

**She writes  $x = 6.4$**

**Complete the error interval for  $x$   
(2 marks)**

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

**11. continued.**

$$\underline{\hspace{2cm}} \leq x < \underline{\hspace{2cm}}$$

**(Total for Question 11 is 2 marks)**

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**Turn over**

12.  $(mx^6)^{\frac{1}{n}} = 7x^3$

**Work out the value of  $m$  and the value of  $n$**   
**(2 marks)**

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



**12. continued.**

**m = \_\_\_\_\_**

**n = \_\_\_\_\_**

**(Total for Question 12 is 2 marks)**

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**Turn over**

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

**It shows a pattern made from four identical rectangles within a set of axes.**

**The sides of the rectangles are parallel to the axes.**

**Point A has coordinates (3, 4)**

**Point B has coordinates (11, 20)**

**Point C is marked on the diagram in the Diagram Booklet.**

**(continued on the next page)**

**13. continued.**

**Work out the coordinates of C**

**You must show all your working.**

**(5 marks)**

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

**Turn over**

**13. continued.**

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

**(Total for Question 13 is 5 marks)**

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**Turn over**

14. Olivia and Jessica have in total half as many sweets as Fran and Gary have in total.

Fran and Gary share their sweets in the ratio  $2:3$

Olivia and Jessica share their sweets in the ratio  $9:1$

Fran got  $W$  sweets.

Gary got  $X$  sweets.

Olivia got  $y$  sweets.

Jessica got  $Z$  sweets.

Find, in its simplest form,  $W:X:y:Z$   
(4 marks)

Answer space is on the next two pages.

Turn over

**14. continued.**

**Turn over**

**14. continued.**

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**(Total for Question 14 is 4 marks)**

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**Turn over**

**15. Look at the diagram for Question 15 in the Diagram Booklet.**

**It shows a graph which gives the volume of water, in litres, in a container at time  $t$  seconds after the water started to flow out of the container.**

**Using the graph, work out an estimate for the rate at which the water is flowing out of the container when  $t = 12$**

**You must show your working.**

**(3 marks)**

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



**15. continued.**

\_\_\_\_\_ litres per second

**(Total for Question 15 is 3 marks)**

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**Turn over**

16. The curve **C** has equation

$$y = x^2 + 3x - 3$$

The line **L** has equation

$$y - 5x + 4 = 0$$

Show, algebraically, that **C** and **L**  
have exactly one point in common.

(4 marks)

Answer space continues on the next  
three pages.

**16. continued.**

**Turn over**

16. continued.

Turn over

**16. continued.**

**(Total for Question 16 is 4 marks)**

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**Turn over**

- 17.  $x$  is directly proportional to the square of  $y$**   
 **$y$  is directly proportional to the cube of  $z$**

**$z = 2$  when  $x = 32$**

**Find a formula for  $x$  in terms of  $z$**   
**(4 marks)**

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

17. continued.

Turn over

**17. continued.**

**Turn over**



**17. continued.**

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**(Total for Question 17 is 4 marks)**

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**Turn over**

**18. Look at the diagram for Question 18 in the Diagram Booklet.**

**It shows a trapezium  $OABC$**

**A straight line inside the trapezium joins point  $O$  and point  $B$**

$$\vec{OA} = a$$

$$\vec{AB} = b$$

$$\vec{OC} = 3b$$

**$D$  is the point on  $OB$  such that**

$$\mathbf{OD:DB = 2:3}$$

**$E$  is the point on  $BC$  such that**

$$\mathbf{BE:EC = 1:4}$$

**(continued on the next page)**

**Turn over**

**18. continued.**

**Work out the vector  $\overrightarrow{DE}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$**

**Give your answer in its simplest form.**

**(4 marks)**

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

**18. continued.**

**Turn over**

**18. continued.**

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**(Total for Question 18 is 4 marks)**

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**Turn over**

**19. At the start of year  $n$ , the number of animals in a population is  $P_n$**

**At the start of the following year, the number of animals in the population is  $P_{n+1}$  where**

$$P_{n+1} = kP_n$$

**At the start of 2017 the number of animals in the population was 4000**

**At the start of 2019 the number of animals in the population was 3610**

**(continued on the next page)**

**19. continued.**

**Find the value of the constant  $k$   
(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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**Turn over**



**20. Pat throws a fair coin  $n$  times.**

**Find an expression, in terms of  $n$ , for the probability that Pat gets at least 1 head and at least 1 tail.**

**(2 marks)**

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

**20. continued.**

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**(Total for Question 20 is 2 marks)**

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**Turn over**

**21. Look at the diagram for Question 21 in the Diagram Booklet.**

**It is a speed–time graph showing the speed, in metres per second, of an object  $t$  seconds after it started to move from rest.**

- (a) Using 3 trapeziums of equal width, work out an estimate for the area under the graph between  $t = 1$  and  $t = 4$  (3 marks)**

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

**21. (a) continued.**

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**(continued on the next page)**

**Turn over**

**21. continued.**

**(b) What does this area represent?**

**(1 mark)**

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**(Total for Question 21 is 4 marks)**

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**22. Show that**

$$\frac{6y^3}{(9y^2 - 144)} \div \frac{2y^4}{3(y - 4)}$$

**can be written in the form**

$$\frac{1}{y(y + r)} \text{ where } r \text{ is an integer.}$$

**(3 marks)**

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

**22. continued.**

**Turn over**

**22. continued.**

**(Total for Question 22 is 3 marks)**

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**Turn over**



**23. Look at the diagram for Question 23 in the Diagram Booklet.**

**It shows triangle ABC**

**D is the point on BC such that  
angle BAD = angle DAC =  $x^\circ$**

**Prove that  $\frac{AB}{BD} = \frac{AC}{DC}$   
(4 marks)**

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

**23. continued.**

**Turn over**

**23. continued.**

**(Total for Question 23 is 4 marks)**

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**TOTAL FOR PAPER IS 80 MARKS**

**END OF PAPER**

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