

Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				
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Examiner Comments	

Total Marks

# MATHEMATICS

## AS PAPER 2

# CM

Bronze Set A (AQA Version)

Time allowed: 1 hour and 30 minutes

### Instructions to candidates:

- In the boxes above, write your centre number, candidate number, your surname, other names and signature.
- Answer ALL of the questions.
- You must write your answer for each question in the spaces provided.
- You may use a calculator.

### Information to candidates:

- Full marks may only be obtained for answers to ALL of the questions.
- The marks for individual questions and parts of the questions are shown in square brackets.
- There are 17 questions in this question paper. The total mark for this paper is 75.

### Advice to candidates:

- You should ensure your answers to parts of the question are clearly labelled.
- You should show sufficient working to make your workings clear to the Examiner.
- Answers without working may not gain full credit.

AS/M/P2

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1 0 3 3 1 2 2 1 8 0 0 0 5



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**Section A**

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Answer **all** questions in the spaces provided.

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1 Simplify  $\sqrt{6} + \sqrt{54}$ .

Circle your answer.

[1 mark]

$2\sqrt{15}$

$4\sqrt{6}$

18

$3\sqrt{6}$

2 Which of the following expressions is equivalent to  $\sin(x - 90^\circ)$ ?

Tick **one** box.

[1 mark]

$\cos x$

$-\cos x$

$-\sin x$

$\sin(-x)$



- 3 Given that  $2^{x+y} = 8^{3x+1}$ , express  $y$  in terms of  $x$ .

Tick **one** box.

[1 mark]

$y = 8x + 3$

$y = 8x + 1$

$y = 2x + 1$

$y = 2x + 3$

- 4 Solve the simultaneous equations

$$x^2 + 4y^2 = 1$$

$$2y = x + 1$$

[4 marks]

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Turn over ►



5 The function  $f$  is defined such that

$$f(x) = 3x^3 + ax^2 - x - 2$$

5 (a) Given that  $(x + 1)$  is a factor of  $f(x)$ , find the value of the constant  $a$ .

**[2 marks]**

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5 (b) Solve the equation  $f(x) = 0$ .

**[3 marks]**

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**5 (b)** In the space below, sketch the curve with equation  $y = f(x)$ .

On your sketch, show clearly the coordinates of any points where the curve crosses or meets intersects the coordinate axes.

**[3 marks]**

Turn over ►



1 0 3 3 1 2 2 1 8 0 0 0 5

- 6** The price of a car,  $P$  pounds, at time  $t$  years after being released is modelled by the equation

$$P = 14500e^{-0.37t} + 1500$$

- 6 (a)** Show that the initial price of the car is £16000

[1 mark]

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- 6 (b)** Find the time taken for the car to drop to 50% of its initial value.

[4 marks]

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**6 (c)** Write down the limiting value for the price of the car.

**[1 mark]**

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Turn over ►



1 0 3 3 1 2 2 1 8 0 0 0 5

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**7** The circle  $C$  has the equation  $x^2 + 2x - y^2 + 3y = 4 - 2y^2$ .

**7 (a)** Express the equation of the circle  $C$  in the form

$$(x - a)^2 + (y - b)^2 = k$$

where  $a$ ,  $b$  and  $k$  are constants to be found.

[2 marks]

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**7 (b)** Hence, write down the coordinates of the centre of the circle  $C$ .

[1 mark]

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**7 (c)** Verify that the point  $P(0, 1)$  lies on the circle  $C$ .

[1 mark]

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7 (d) Find the equation of the normal to  $C$  at  $P$ .

[3 marks]

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7 (e) The normal to  $C$  at  $P$  intersects the circle again at the point  $Q$ .  
Write down the exact distance between  $P$  and  $Q$ .

[1 mark]

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Turn over ►



**8 (i)**

$$y = 2x^2 - 4x - x^2\sqrt{x}, \quad x > 0$$

**8 (i) (a)** Find  $\frac{dy}{dx}$ .**[3 marks]**

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**8 (i) (b)** Find the value of  $k$  such that

$$\frac{d^2y}{dx^2} + k\sqrt{x} = 4$$

**[3 marks]**

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**8 (ii)** The curve  $C$  has the equation  $y = 3x^3 - 2x^2$ .

Find the equation of the normal to  $C$  at  $x = -1$ .

Give your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers.

**[5 marks]**

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Turn over ►



9

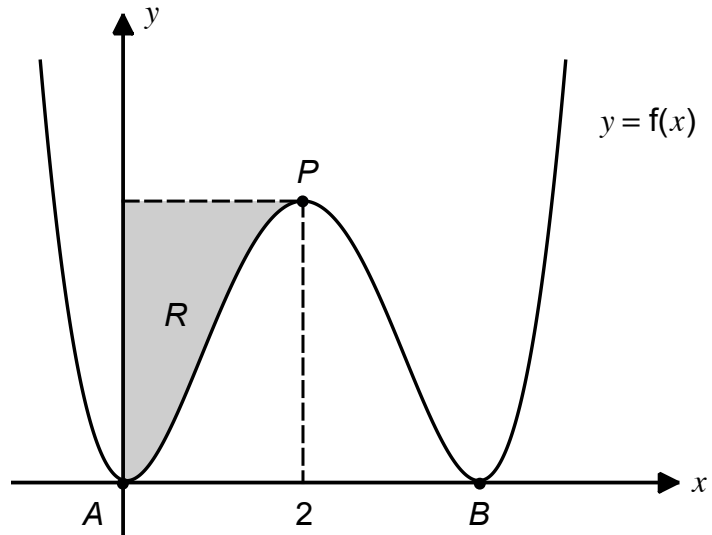


Figure 1

Figure 1 shows a sketch of the curve  $C$  with equation  $y = f(x)$ , where

$$f(x) = \frac{1}{4}x^2(4-x)^2$$

The curve  $C$  crosses the  $x$ -axis at the points  $A$  and  $B$ .

9 (a) Write down the coordinates of points  $A$  and  $B$ .

[1 mark]

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9 (b) Expand and simplify  $f(x)$ .

[1 mark]

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**9 (b)** The curve  $C$  has three stationary points.

The point  $P$  is a maximum point on  $C$ .

Use calculus to show that the curve has a stationary point at  $x = 2$ .

[2 marks]

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**9 (b) (ii)** Use further calculus to justify that the stationary point at  $x = 2$  is the point  $P$ .

[3 marks]

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QUESTION 10 IS CONTINUED ON  
THE NEXT PAGE

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**Section B**

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Answer **all** questions in the spaces provided.

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- 10** A student is given the task of obtaining answers to a questionnaire.  
He stands at the school gate one morning and asks the first 10 people he sees.  
What type of sampling method has the student used?

Tick **one** box.

[1 mark]

simple random

stratified

opportunity

census

Turn over ►



1 0 3 3 1 2 2 1 8 0 0 0 5

- 11 A sample of the large data set is used to collect data about different car models. The data from the sample is processed to produce the chart in Figure 2 below.

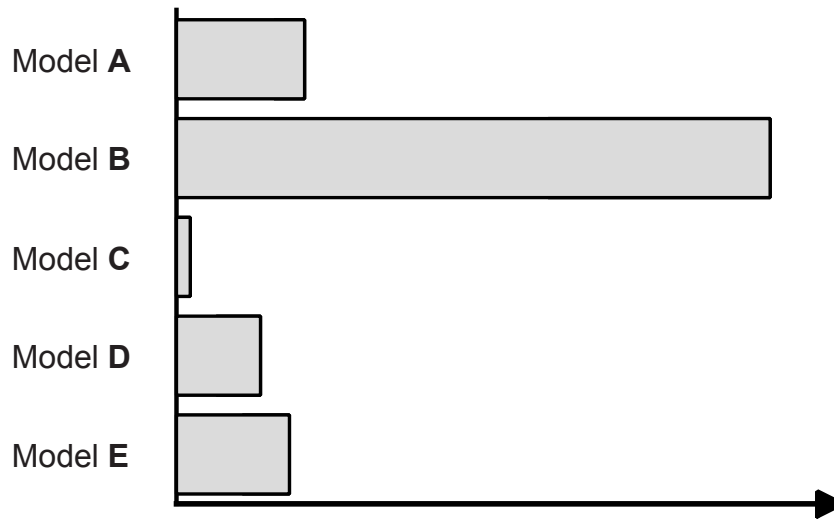


Figure 2

Use your knowledge of the large data set, identify the name of the model **B**.

Tick **one** box.

[1 mark]

BMW

Ford

Vauxhall

Toyota

Volkswagen





- 12 The table below summarises some data obtained about a variable  $x$ .

$x$	Frequency
0–2	11
2–4	25
4–6	17

Use interpolation to find an estimate for the median of these data.

[3 marks]

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Turn over ►



1 0 3 3 1 2 2 1 8 0 0 0 5

**13** Heidi is completing an investigation.

For her investigation, she requires information about the average mass of vehicles in the UK.

To obtain this data, she takes a sample of 60 cars from the large data set and for each car, she notes down corresponding mass  $m$  on the spreadsheet.

The summary statistics below summarise her data.

$$\sum m = 80\,789 \quad \sum m^2 = 113\,666\,365$$

**13 (a)** Use the summary statistics to find the mean and standard deviation of  $m$ .

**[3 marks]**

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**13 (b)** Using part (a) and your knowledge of the large data set, find the mean mass of a vehicle in the UK.

**[2 marks]**

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**13 (c)** With reference to the large data set, explain **one** limitation of your answer to **(b)**.

**[1 mark]**

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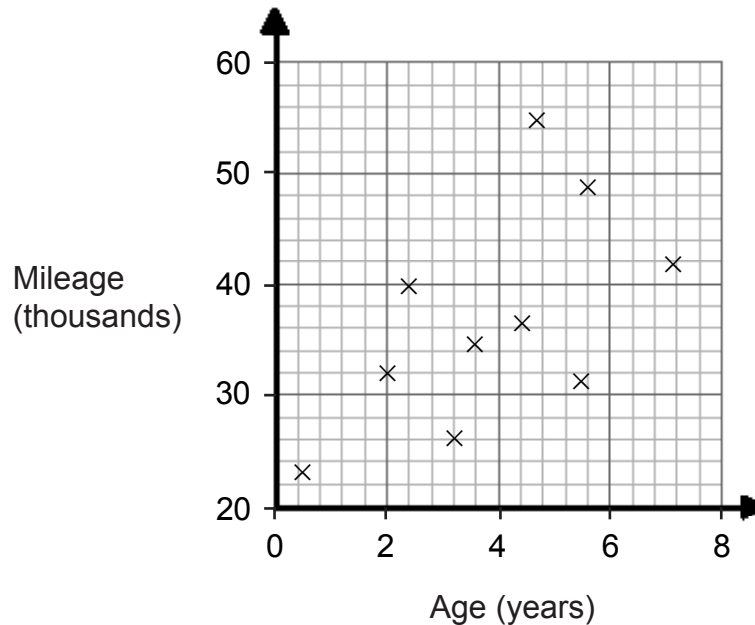
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1 0 3 3 1 2 2 1 8 0 0 0 5

- 14 Karan collects data on the relationship between the age of a car,  $A$  years, and its mileage ( $M$  thousands).

He uses his data to draw the following scatter graph.



**Figure 2**

Karan calculates the product moment correlation coefficient for his data.

Which of the following values is most likely to be the product moment correlation coefficient for Karan's data?

−1.56      −0.32      0      0.09      0.58      0.99

Explain your answer.

**[1 mark]**

Most likely value \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



15

In a communications centre, it is suggested that in 3% of calls, customers are accidentally disconnected from the call. A manager holds a team meeting in an attempt to reduce the number of customers that are accidentally disconnected from calls. The manager thinks her meeting was effective and there will be reduction in the number of disconnected calls. After the meeting, the manager monitors 200 calls and finds that 4 calls are disconnected accidentally.

Using a 10% level of significance, test the manager's claim.

State your hypotheses clearly.

**[5 marks]**

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**Turn over ►**



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**16** The amount of money,  $M$  pounds, raised by individuals in a fundraising competition is recorded. The recorded data is summarised in a grouped frequency table and then represented on a histogram.

**16 (a)** Justify the use of the histogram to represent these data.

[1 mark]

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**16 (b)** Write down the underlying feature associated with each of the bars of a histogram.

[1 mark]

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One of the classes in the grouped frequency table is  $100 \leq M < 120$  and its associated frequency is 40. The bar representing this class on the histogram has a height of 4 cm and width of 2 cm. Another class in the grouped frequency table is  $50 \leq M < 80$  and its associated frequency is 80.

**16 (c)** Find the width and height of the bar representing the class  $50 \leq M < 80$ .

[3 marks]

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**16 (d)** The mean amount of money raised per individual was £102.

Given that the total area under the histogram is  $52 \text{ cm}^2$ , estimate the total amount of money fundraised by all the people in the competition.

**[3 marks]**

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17 The random variable  $X$  has the probability distribution

$$P(X = x) = \begin{cases} \frac{x^2 + 1}{k} & x = -1, 0, 1, 2 \\ 0 & \text{otherwise} \end{cases}$$

where  $k$  is a constant.

The random variable  $Y = 2X - 1$ .

Find  $P(-3 < Y \leq 2)$ .

[4 marks]

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END OF QUESTIONS

