



Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

AS

MATHEMATICS

Paper 2

7356/2

Thursday 23 May 2024 Afternoon

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]



J U N 2 4 7 3 5 6 2 0 1

MATERIALS

- **You must have the AQA Formulae for A-level Mathematics booklet.**
- **You should have a graphical or scientific calculator that meets the requirements of the specification.**

INSTRUCTIONS

- **Use black ink or black ball-point pen. Pencil should only be used for drawing.**
- **Answer ALL questions.**
- **You must answer each question in the space provided.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Do NOT write on blank pages.**



- **Show all necessary working; otherwise marks for method may be lost.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**

INFORMATION

- **The marks for questions are shown in brackets.**
- **The maximum mark for this paper is 80.**

ADVICE

- **Unless stated otherwise, you may quote formulae, without proof, from the booklet.**
- **You do not necessarily need to use all the space provided.**

DO NOT TURN OVER UNTIL TOLD TO DO SO



SECTION A

Answer ALL questions in the spaces provided.

1 Line L has equation

$$5y = 4x + 6$$

Find the gradient of a line parallel to line L

Circle your answer. [1 mark]

$$-\frac{5}{4}$$

$$-\frac{4}{5}$$

$$\frac{4}{5}$$

$$\frac{5}{4}$$



2 One of the equations below is true for all values of x

Identify the correct equation.

Tick (✓) ONE box. [1 mark]

$$\cos^2 x = -1 - \sin^2 x$$

$$\cos^2 x = -1 + \sin^2 x$$

$$\cos^2 x = 1 - \sin^2 x$$

$$\cos^2 x = 1 + \sin^2 x$$

[Turn over]



3 It is given that

$$3 \log_a x = \log_a 72 - 2 \log_a 3$$

Solve the equation to find the value of x

Fully justify your answer.
[4 marks]



4 Curve C has equation $y = 8 \sin x$

4 (a) Curve C is transformed onto curve C_1 by a

translation of vector $\begin{bmatrix} 0 \\ 4 \end{bmatrix}$

Find the equation of C_1
[1 mark]



4 (b) Curve C is transformed onto curve C_2 by a stretch of scale factor 4 in the y direction.

Find the equation of C_2
[1 mark]

[Turn over]



4 (c) Curve C is transformed onto curve C_3 by a stretch of scale factor 2 in the x direction.

Find the equation of C_3
[1 mark]



BLANK PAGE

[Turn over]



5 A student suggests that for any positive integer n the value of the expression

$$4n^2 + 3$$

is always a prime number.

Prove that the student's statement is false by finding a counter example.

Fully justify your answer.
[3 marks]



[Turn over]



[Turn over]



6 (b) The constant term in the expansion is 729

The coefficient of x in the expansion is negative.

6 (b) (i) Verify that $n = 6$ [1 mark]

6 (b) (ii) Find the value of a [3 marks]



[Turn over]



[Turn over]



8 Prove that the graph of the curve with equation

$$y = x^3 + 15x - \frac{18}{x}$$

has no stationary points.
[5 marks]





BLANK PAGE

[Turn over]



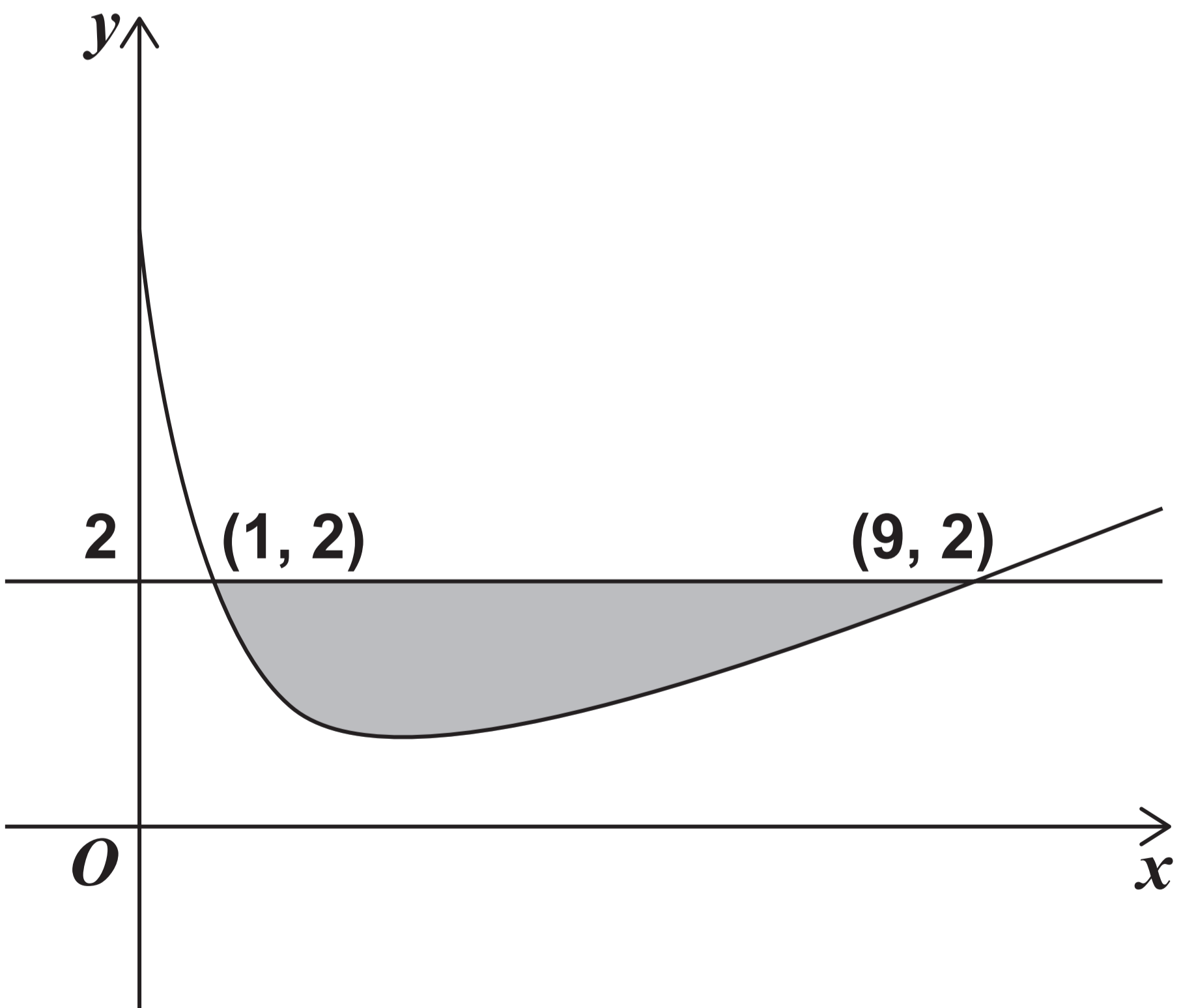
9

A curve has equation

$$y = x - a\sqrt{x} + b$$

where a and b are constants.

The curve intersects the line $y = 2$ at points with coordinates $(1, 2)$ and $(9, 2)$, as shown in the diagram below.





- 9 (b) On the diagram, on page 26, the region enclosed between the curve and the line $y = 2$ is shaded.

Show that the area of this shaded region is $\frac{16}{3}$

Fully justify your answer.
[6 marks]

[Turn over]





[Turn over]



10

A singer has a social media account with a number of followers. The singer releases a new song and the number of followers grows exponentially.

The number of followers, F , may be modelled by the formula

$$F = ae^{kt}$$

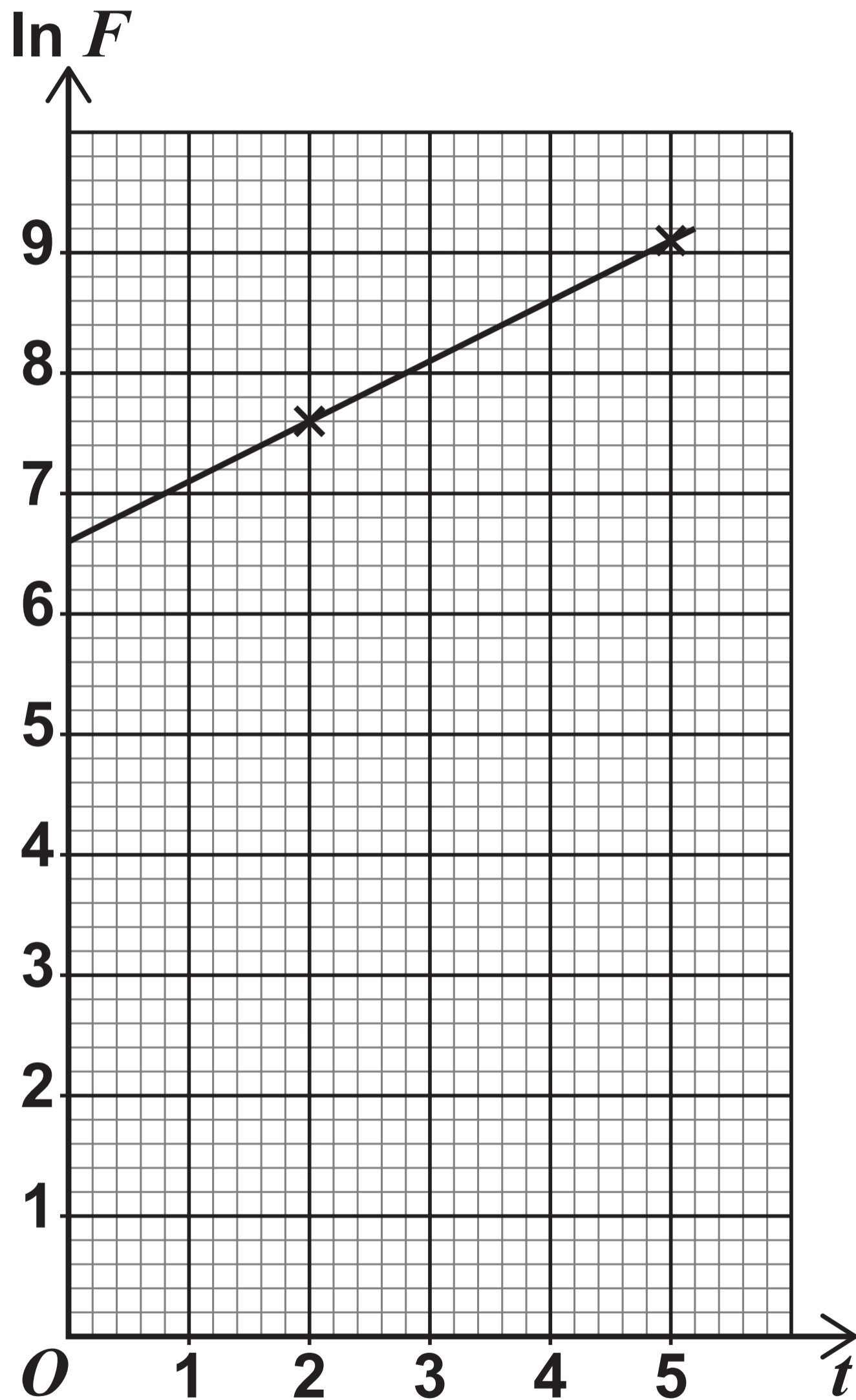
where t is the number of days since the song was released and a and k are constants.

- Two days after the song is released the account has 2050 followers.
- Five days after the song is released the account has 9200 followers.

On the graph, on the opposite page, $\ln F$ has been plotted against t for these two pieces of data.



A line has been drawn passing through these two data points.



[Turn over]



10 (a) (ii) Using the graph, on page 33, estimate the value of the constant a and the value of the constant k [4 marks]

[Turn over]





10 (b) (i) Show that $\frac{dF}{dt} = kF$

[2 marks]

[Turn over]



10 (b) (ii) Using the model, estimate the RATE at which the number of followers is increasing 5 days after the song is released. [2 marks]



10 (c) The singer claims that 30 days after the song is released, the account will have more than a billion followers.

**Comment on the singer's claim.
[1 mark]**

END OF SECTION A

[Turn over for Section B]



SECTION B

Answer ALL questions in the spaces provided.

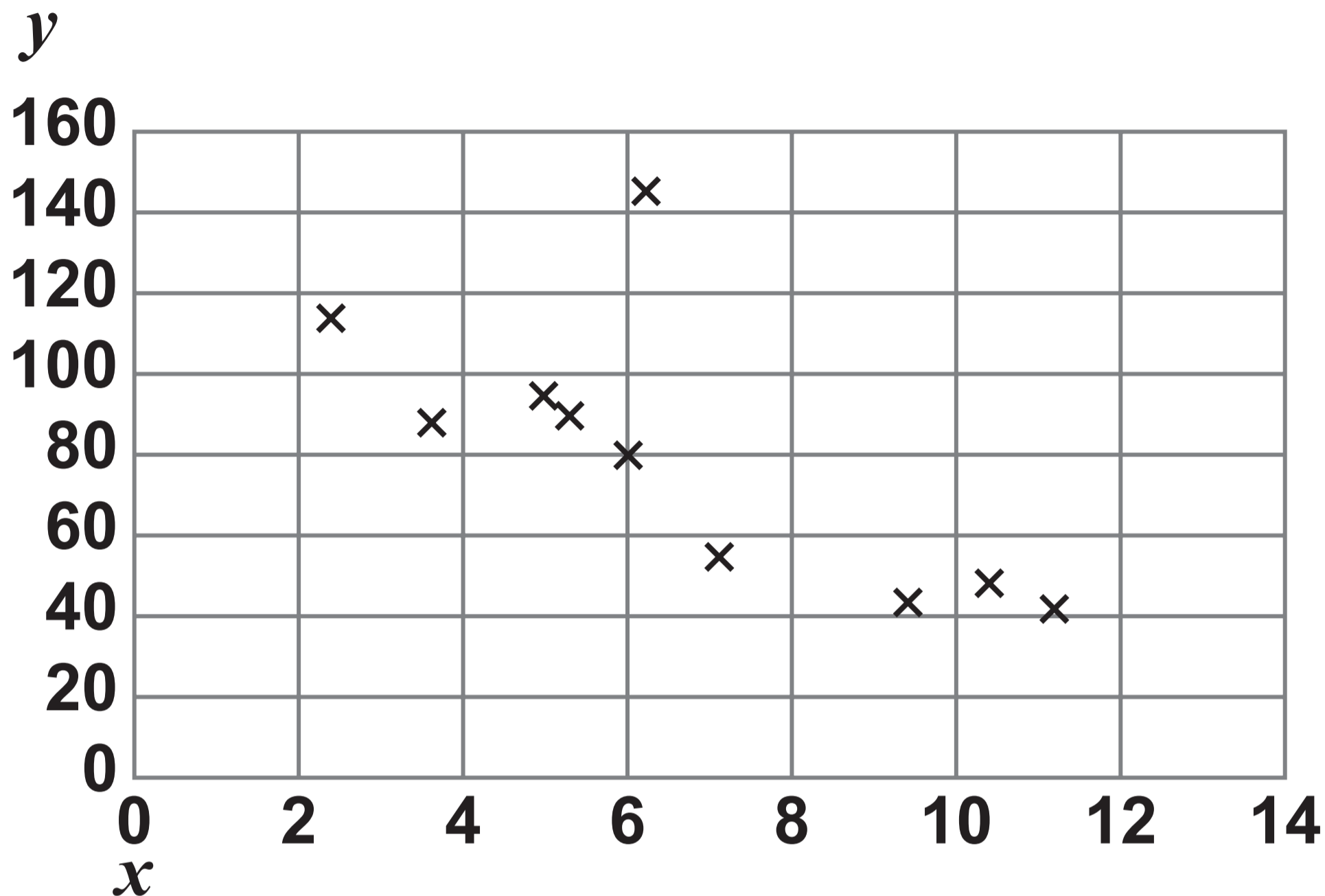
- 11 The table below shows the daily salt intake, x grams, and the daily Vitamin C intake, y milligrams, for a group of 10 adults.

ADULT	A	B	C	D	E
x	5.3	6.2	3.6	10.4	2.4
y	90	145	88	48	114

ADULT	F	G	H	I	J
x	9.4	6	5	7.1	11.2
y	44	80	95	55	41



A scatter diagram of the data is shown below.



One of the adults is an outlier.
Identify the letter of the adult
that is the outlier.

Circle your answer below.
[1 mark]

A

B

E

J

[Turn over]



12 Which **ONE** of the following is **NOT** a measure of spread?

Circle your answer. [1 mark]

median

range

standard deviation

variance



BLANK PAGE

[Turn over]



13 The headteacher of a school wishes to collect the opinions of the students on a new timetable structure.

To do this, a random sample of size 50, stratified by year group, will be selected.

The school has a total of 720 students.

The number of students in each of the year groups at this school is shown below.

YEAR GROUP	10	11	12	13
NUMBER OF STUDENTS	200	240	150	130



13 (a) Find the number of students from each year group that should be selected in the stratified random sample.
[3 marks]

[Turn over]





**13 (b) State ONE advantage of using a stratified random sample.
[1 mark]**

[Turn over]



14 The discrete random variables X and Y can be modelled by the distributions

$$X \sim B(40, p)$$

$$Y \sim B(25, 0.6)$$

It is given that the mean of X is equal to the variance of Y

14 (a) Find the value of p [3 marks]



[Turn over]



14 (b) Find $P(Y = 17)$ [1 mark]



BLANK PAGE

[Turn over]



- 15** The number of flowers which grow on a certain type of plant can be modelled by the discrete random variable X

The probability distribution of X is given in the table below.

x	0	1	2	3	4	5 or more
$P(X = x)$	0.03	0.15	0.22	0.31	0.09	p

- 15 (a)** Find the value of p [2 marks]



[Turn over]



15 (b) Two plants of this type are randomly selected from a large batch received from a local garden centre.

Find the probability that the two plants will produce a TOTAL of three flowers. [3 marks]

[Turn over]



15 (c) (i) State ONE assumption necessary for the calculation in part (b) to be valid. [1 mark]



15 (c) (ii) Comment on whether, in reality, this assumption is likely to be valid. [1 mark]

[Turn over]



16

An investigation into the hydrocarbon emissions, X g/km, from cars in the Large Data Set was carried out.

The results are summarised below.

$$\sum x = 128.657$$

$$\sum x^2 = 8.701\ 707$$

$$n = 2405$$

where n is the total number of cars which had a measured hydrocarbon emission in the Large Data Set.



16 (a) (i) Find the mean of X [1 mark]

[Turn over]

16 (a) (ii) Find the standard deviation of X
[2 marks]



BLANK PAGE

[Turn over]



16 (b) (i) The Large Data Set is a sample taken from the entire UK Department for Transport Stock Vehicle Database.

It is claimed that the values in part (a)(i) and part (a)(ii) obtained from the Large Data Set should be reliable estimates for the mean and standard deviation of the hydrocarbon emissions for the entire UK Department for Transport Stock Vehicle Database.

State, with a reason, whether this claim is likely to be correct. [1 mark]

16 (b) (ii) State ONE type of emission where MORE THAN 80% of the data is known for cars in the entire UK Department for Transport Stock Vehicle Database. [1 mark]

[Turn over]



17

The proportion of vegans in a city is thought to be 8%

The owner of an organic food café in this city believes that the proportion of their customers who are vegan is greater than 8%

To test this belief, a random sample of 50 customers at the café were interviewed and it was found that 7 of them were vegan.

Investigate, at the 5% level, whether this sample supports the owner's belief. [5 marks]



END OF QUESTIONS



Additional page, if required. Write the question numbers in the left-hand margin.



Additional page, if required. Write the question numbers in the left-hand margin.



BLANK PAGE

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
TOTAL	

Copyright information

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from www.aqa.org.uk.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2024 AQA and its licensors. All rights reserved.

G/LM/Jun24/7356/2/G4004/E3



7 0



2 4 6 A 7 3 5 6 / 2