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EDEXCEL GCSE (9-1) MATHS: QUESTIONS BY TOPIC

Sequences (A3)

GCSE (9-1) Mathematics (1MA1) · Higher tier

26 questions · 93 marks · Mark schemes included

Past papers June 2017 - June 2025 · 2 sub-topics

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HOW TO USE THIS BOOKLET

Questions are grouped by sub-topic and run from the lowest to the highest mark tariff, then oldest paper first.

Click any row below to jump straight to that sub-topic or question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme; < QUESTION brings you back.

A gold bar in the left margin marks exactly where the question sits on the original page.

Diagrams, graphs, grids and tables are printed exactly as they appear in the original papers.

Each question is filed under its main topic; longer questions may also test skills from other topics.

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QUESTIONS

26 questions · 93 marks · 2 sub-topics

SUB-TOPIC A3a

LINEAR SEQUENCES & NTH TERM

Sub-topic A3a · 8 questions · 24 marks · lowest tariff first



20 Here are the first five terms of a sequence.

−1 0 3 8 15

Find an expression, in terms of n , for the n th term of this sequence.

(Total for Question 20 is 2 marks)

21 When a biased coin is thrown 4 times, the probability of getting 4 heads is $\frac{16}{81}$

Work out the probability of getting 4 tails when the coin is thrown 4 times.

(Total for Question 21 is 2 marks)



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1** The first five terms of an arithmetic sequence are

1 4 7 10 13

Write down an expression, in terms of n , for the n th term of this sequence.

(Total for Question 1 is 2 marks)

- 2** Show that

$$2\frac{1}{3} \times 3\frac{3}{4} = 8\frac{3}{4}$$

(Total for Question 2 is 3 marks)



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

..... cm
(2)

Alan also grew plants of the same type inside.
The interquartile range of the heights of these plants is 30 cm.

(d) Give one comparison between the distribution of the heights of the plants grown inside with the distribution of the heights of the plants grown outside.

.....
.....
.....
.....
(1)

(Total for Question 13 is 6 marks)

14 Here are the first six terms of a quadratic sequence.

5 11 21 35 53 75

Find an expression, in terms of n , for the n th term of this sequence.

.....
(Total for Question 14 is 2 marks)

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1** Here are the first four terms of an arithmetic sequence.

1 5 9 13

Find an expression, in terms of n , for the n th term of this sequence.

.....
(Total for Question 1 is 2 marks)



16 Here are the first five terms of a quadratic sequence.

10 21 38 61 90

Find an expression, in terms of n , for the n th term of this sequence.

.....
(Total for Question 16 is 3 marks)

17 Write down the coordinates of the turning point on the graph of $y = (x + 12)^2 - 7$

(....., ...)

(Total for Question 17 is 1 mark)



- 14 Show that $\frac{x^2 - x - 6}{2x^2 - 5x - 3}$ can be written in the form $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

(Total for Question 14 is 3 marks)

- 15 Here are the first four terms of a quadratic sequence.

3 9 17 27

Find an expression, in terms of n , for the n th term of this sequence.

(Total for Question 15 is 3 marks)



3 Here are the first five terms of an arithmetic sequence.

7 13 19 25 31

(a) Find an expression, in terms of n , for the n th term of this sequence.

.....
(2)

The n th term of a different sequence is $8 - 6n$

(b) Is -58 a term of this sequence?

You must show how you get your answer.

(2)

(Total for Question 3 is 4 marks)



15 Here are the first five terms of a quadratic sequence.

3 20 47 84 131

(a) Find an expression, in terms of n , for the n th term of this sequence.

.....
(3)

The terms of a different sequence are given by the rule $u_{n+1} = ku_n + k$ where k is a constant.

Given that $u_1 = 9$ and $u_2 = 4$

(b) find the value of u_4

$u_4 =$
(3)

(Total for Question 15 is 6 marks)



SUB-TOPIC A3b

QUADRATIC, GEOMETRIC & OTHER SEQUENCES

Sub-topic A3b · 18 questions · 69 marks · lowest tariff first



- 13 The number of animals in a population at the start of year t is P_t
The number of animals at the start of year 1 is 400

Given that

$$P_{t+1} = 1.01P_t$$

work out the number of animals at the start of year 3

(Total for Question 13 is 2 marks)

- 14 y is inversely proportional to x^3

$$y = 44 \text{ when } x = a$$

Show that $y = 5.5$ when $x = 2a$

(Total for Question 14 is 3 marks)



22 Here are the first five terms of a sequence.

4 11 22 37 56

Find an expression, in terms of n , for the n th term of this sequence.

(Total for Question 22 is 3 marks)



- 15 The graph of the curve C with equation $y = f(x)$ is transformed to give the graph of the curve S with equation $y = f(-x) - 3$

The point on C with coordinates (7, 2) is mapped to the point Q on S.

Find the coordinates of Q .

(....., ...)

(Total for Question 15 is 2 marks)

- 16 Here are the first six terms of a quadratic sequence.

-1 5 15 29 47 69

Find an expression, in terms of n , for the n th term of this sequence.

(Total for Question 16 is 3 marks)



6 The n th term of a sequence is $2n^2 - 1$

The n th term of a different sequence is $40 - n^2$

Show that there is only one number that is in both of these sequences.

(Total for Question 6 is 3 marks)

7 Work out $(3.42 \times 10^{-7}) \div (7.5 \times 10^{-6})$
Give your answer in standard form.

(Total for Question 7 is 2 marks)



- 5 The first four terms of a Fibonacci sequence are

$$a \quad 2a \quad 3a \quad 5a$$

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

Work out the value of a .

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



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

Find the value of the constant k .

(Total for Question 19 is 3 marks)

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.

(Total for Question 20 is 2 marks)



12 The number of insects in a population at the start of the year n is P_n

The number of insects in the population at the start of year $(n + 1)$ is P_{n+1} where

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

Given that k has a constant value of 1.13

- (a) find out how many years it takes for the number of insects in the population to double.
You must show how you get your answer.

.....
(2)

The value of k actually increases year on year from its value of 1.13 in year 1

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

.....
.....
.....
(1)

.....
(Total for Question 12 is 3 marks)



- 17 A ball is thrown upwards and reaches a maximum height.
The ball then falls and bounces repeatedly.

After the n th bounce, the ball reaches a height of h_n

After the next bounce, the ball reaches a height given by $h_{n+1} = 0.55h_n$

After the 1st bounce, the ball reaches a height of 8 metres.

What height does the ball reach after the 4th bounce?

..... metres

(Total for Question 17 is 3 marks)



- 18 At the start of year n , the population of deer in a park is D_n
At the start of the following year, the population of the deer is D_{n+1}

$$D_{n+1} = K D_n \quad \text{where } K \text{ is a constant.}$$

At the start of 2019, the population of the deer was 2000

At the start of 2020, the population of the deer was 2400

Show that, at the start of 2022, the population of the deer was greater than 3000

(Total for Question 18 is 3 marks)



- 22 The number of rabbits on a farm at the end of month n is P_n
The number of rabbits at the end of the next month is given by $P_{n+1} = 1.2P_n - 50$

At the end of March there are 200 rabbits on the farm.

- (a) Work out how many rabbits there will be on the farm at the end of June.

.....
(3)

- (b) Considering your results in part (a), suggest what will happen to the number of rabbits on the farm after a long time.

.....
.....
(1)

(Total for Question 22 is 4 marks)



19 A hot air balloon is descending.

The height of the balloon n minutes after it starts to descend is h_n metres.

The height of the balloon $(n+1)$ minutes after it starts to descend, h_{n+1} metres, is given by

$$h_{n+1} = K \times h_n + 20 \quad \text{where } K \text{ is a constant.}$$

The balloon starts to descend from a height of 1200 metres at 09 15

At 09 16 the height of the balloon is 1040 metres.

Work out the height of the balloon at 09 18

..... m

(Total for Question 19 is 4 marks)



20 The profit made by a shop increases each year.

The profit made by the shop in year n is $\text{£}P_n$

Given that the profit made by the shop in the next year is $\text{£}P_{n+1}$ then

$$P_{n+1} = aP_n + 800 \text{ where } a \text{ is a constant.}$$

The table shows the profit made by the shop in 2018 and in 2019

Year	2018	2019
Profit	£24 000	£29 600

Work out the profit predicted to be made by the shop in 2021

£.....

(Total for Question 20 is 4 marks)



16 At the start of year n the population of a species is P_n

At the start of the following year the population of the species is given by

$$P_{n+1} = kP_n \text{ where } k \text{ is a positive constant.}$$

The population of the species at the start of year 1 is 8 million.

The population of the species at the start of year 2 is 6 million.

(a) Work out the population of the species at the start of year 3

..... million
(3)

At the start of year 5 the value of k is increased by 0.3 to a new constant value.

Louise thinks that from the start of year 5 the population of the species would increase year on year.

(b) Is Louise correct?

You must give a reason for your answer.

(1)

(Total for Question 16 is 4 marks)



- 22 The 2nd term of a geometric sequence is $3 + 2\sqrt{2}$
The 3rd term of the sequence is $13 + 9\sqrt{2}$

Find the value of the common ratio of the sequence.

Give your answer in the form $a + \sqrt{b}$ where a and b are integers.

You must show all your working.

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS



23 S is a geometric sequence.

- (a) Given that $(\sqrt{x} - 1)$, 1 and $(\sqrt{x} + 1)$ are the first three terms of S, find the value of x .
You must show all your working.

.....
(3)

- (b) Show that the 5th term of S is $7 + 5\sqrt{2}$

(2)

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



23 Here are the first five terms of a geometric sequence.

$$\sqrt{5} \quad 10 \quad 20\sqrt{5} \quad 200 \quad 400\sqrt{5}$$

(a) Work out the next term of the sequence.

.....
(2)

The 4th term of a different geometric sequence is $\frac{5\sqrt{2}}{4}$

The 6th term of this sequence is $\frac{5\sqrt{2}}{8}$

Given that the terms of this sequence are all positive,

(b) work out the first term of this sequence.
You must show all your working.

.....
(3)

(Total for Question 23 is 5 marks)



16 The n th term of a sequence is given by $an^2 + bn$ where a and b are integers.

The 2nd term of the sequence is -2

The 4th term of the sequence is 12

(a) Find the 6th term of the sequence.

.....
(4)

Here are the first five terms of a different quadratic sequence.

0 2 6 12 20

(b) Find an expression, in terms of n , for the n th term of this sequence.

.....
(2)

(Total for Question 16 is 6 marks)



20 $x - 4$, $x + 2$ and $3x + 1$ are three consecutive terms of an arithmetic sequence.

(a) Find the value of x .

$x = \dots\dots\dots$
(2)

$y - 4$, $y + 2$ and $3y + 1$ are three consecutive terms of a geometric sequence.

(b) Find the possible values of y .

$\dots\dots\dots$
(5)

(Total for Question 20 is 7 marks)



MARK SCHEMES

official mark schemes, in the same order as the questions



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	3.4	M1	for drawing a suitable tangent at $t = 6$	Use of change in y over change in x Answers of $\frac{10}{6}$ oe scores no marks
		M1	for a full method to find the gradient of the tangent at $t=6$, eg $20 \div 5.8$	
		A1	answer in the range 3.05 to 3.7	
20	$n^2 - 2n$	M1	for correct deduction from differences, eg 2nd difference of 2 implies $1n^2$ or gives a quadratic expression which includes the term $1n^2$ or states 1,4,9,16,25 and deduces 2,4,6,8,10	
		A1	oe	
21	$\frac{1}{81}$	M1	for finding the probability of heads eg $\sqrt[4]{\frac{16}{81}}$ ($= \frac{2}{3}$)	Seeing a probability of $\frac{2}{3}$ or $\frac{1}{3}$ is enough for this mark
		A1	or for finding the probability of tails $1 - \sqrt[4]{\frac{16}{81}}$ ($= \frac{1}{3}$) oe	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	$3n - 2$	B2 (B1)	for $3n - 2$ oe for $3n + k$ where $k \neq -2$ or is absent unambiguously shown)	Accept a different variable, eg. $3x - 2$ $n = 3n - 2$ gets B1 only $n + 3$ gets NO marks
2	Shown	M1 M1 C1	for conversion to improper fractions eg. $\frac{7}{3}$ or $\frac{15}{4}$ (dep) for method to multiply fractions, eg. $\frac{7 \times 15}{3 \times 4} (= \frac{105}{12})$ or $\frac{28 \times 45}{12 \times 12} (= \frac{1260}{144})$ oe for complete working showing each stage as far as $\frac{35}{4}$ or $8\frac{9}{12}$	Need not be shown with operators
3	B C D A	B2 (B1)	cao for two or three correct)	
4	A & D	B1	cao	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
13 (a)	$\frac{6}{80}$	M1	for correct method using the graph at 90 cm, eg $80 - 74 (= 6)$	Accept $80 - 75 (= 5)$
		A1	for $\frac{6}{80}$ oe, accept $\frac{5}{80}$ oe	Accept any equivalent fraction, decimal (0.075) or percentage (7.5%)
(b)	60	B1	for answer in the range 58.5 – 61.5	
(c)	35	M1	for $UQ = 75$ or $LQ = 40$	Allow UQ in range 74 to 76 Allow LQ in range 39 to 41 Value(s) may be seen on graph
		A1	for answers in the range 34 to 36 or ft acceptable readings from the graph	
(d)	Comparison made	C1	(ft) for a correct comparison of the IQRs eg the heights of the plants grown outside are more varied or the IQR of the plants grown outside is 35 cm but the IQR of the plants grown inside is only 30 cm.	The comparison must include some context (eg refers to heights or cm) Ignore any additional information provided there is no contradiction. Figures need not be seen but if given they must be correct.
14	$2n^2 + 3$	M1	for a correct start to a method to find the n th term eg constant 2nd differences of 4 and the term $2n^2$ or states $an^2 + bn + c$ (where bn may be missing) and $2a = 4$ or gives the sequence 2, 8, 18, ...	Need to see constant second difference found and $2n^2$ Condone use of different variable throughout
		A1	oe	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	$4n - 3$	B2	for $4n - 3$ oe	Accept a different variable eg $4x - 3$ Accept $u_n = 4n - 3$, $T = 4n - 3$ etc
		(B1	for $4n + k$ where $k \neq -3$ or is absent unambiguously shown)	$n = 4n - 3$ or $4n^{\text{th}} - 3$ gets B1 only

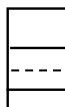


Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	$3n^2 + 2n + 5$	M1	for a correct start to a method to find the n th term, eg equal 2nd differences imply a term in n^2	Need to see constant second difference found and n^2
		M1	for working with $3n^2$, eg $3n^2$ and sequence 7, 9, 11, ...	$3n^2 + 2n$ implies M2
		A1	for $3n^2 + 2n + 5$	
17	$-12, -7$	B1	cao	
18	160π	P1	for process to find curved surface area of cone, eg $\pi \times 10 \times 25 (= 250\pi) (= 785\dots)$	
		P1	for process to find the radius or diameter of the smaller cone eg $10 \times \frac{15}{25} (= 6)$ or $20 \times \frac{15}{25} (= 12)$ oe OR uses area scale factor, eg " 250π " $\times \left(\frac{15}{25}\right)^2 (= 90\pi)$	15 comes from $25 - 10$ $\frac{15}{25}$ may be seen as 0.6
		P1	for a complete process, eg " 250π " $- \pi \times "6" \times 15 (= 785\dots - 282\dots)$ or answer in range 502 to 503	
		A1	for 160π	Award 0 marks for an answer of 160π or an answer in range 502 to 503 with no supportive working. If 160π seen but answer in range 502 to 503 given on answer line isw and award full marks



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$n^2 + 3n - 1$	M1 M1 A1	for a correct start to a method to find the n th term, eg constant 2nd differences and n^2 OR states $2a = 2$ or $3a + b = 6$ for working with n^2 , eg n^2 and sequence 2, 5, 8, ... OR states $2a = 2$ and $3a + b = 6$ for $n^2 + 3n - 1$	Need to see constant second difference found and n^2 Condone use of different variable throughout $a = 1$ or $b = 3$ implies M1 $n^2 + 3n$ implies M2 $a = 1$ and $b = 3$ implies M2
16 (a)	Bar of height 2.4 cm (fd = 1.2) drawn for interval 40 – 60 hours	M1 A1	for using area to represent frequency, eg 11.2 (cm ²) represents 28 (students) or for showing correct scale on fd axis, 2 cm = 1 unit or correct process to find the height of bar, eg $\frac{28}{10}$ (= 2.8) or $\frac{24}{20}$ (= 1.2)	May use any unit of area. Can be implied by frequency of 32 or 36.
(b)	120	M1 A1	ft their histogram for method to find total frequency, eg (1.6 × 20) + (3.6 × 10) + 28 + 24 oe or for method to find total area under the histogram, eg (4 × 3.2) + (2 × 7.2) + (2 × 5.6) + (4 × 2.4) (= 48) oe for 120 ft	Can ignore scale if bar is correct Condone 1 error in reading fd values or measurements.



Paper: 1MA1/2H					
Question	Answer	Mark	Mark scheme	Additional guidance	
1	(a)	(2, 1)	B1	cao	Accept negative correlation Ignore any comment about strength Any numbers used in the description must be within tolerance
	(b)	Description	C1	correct description, eg as the amount of rainfall decreases the number of hours of sunshine increases	
	(c)	3 to 4	M1 A1	for a suitable line of best fit drawn, or for a point marked at (x, 7), or a horizontal line drawn from 7 across to (x, 7) where x is in the range 2.5 to 4 answer in the range 3 to 4	
2	Elevation	B2	fully correct side elevation 5 high and 3 wide		
		(B1)	for a rectangle 5 high and 3 wide or correct side elevation in the wrong orientation)		
3	(a)	$6n + 1$	B2 (B1)	2, -4, -10, -16, -22, -28, -34, -40, -46, -52 May stop at -58 or ring if sequence continues	
	(b)	Shown with supportive working	M1		for $8 - 6n = -58$ or $8 - 6 \times 11$ ($= -58$) or starts to list terms of the sequence, with at least 3 correct or any other valid method.
			A1		shown with working or an explanation , eg Yes and 11 or 2, -4, -10, -16, ..., -52, -58

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	$5n^2 + 2n - 4$	M1	for a correct start to a method to find the n th term, eg constant 2nd differences and n^2 OR states $2a = 10$ or $3a + b = 17$	Need to see constant 2nd difference found and n^2 Condone use of a different variable throughout $a = 5$ or $b = 2$ implies M1 $5n^2 + 2n$ implies M2 $5n^2$ is implied by 5, 20, 45, ... $a = 5$ and $b = 2$ implies M2 Condone $+ - 4$
		M1	for working with $5n^2$, eg $5n^2$, and sequence $-2, 0, 2, \dots$ OR states $2a = 10$ and $3a + b = 17$	
		A1	for $5n^2 + 2n - 4$ oe	
	1.2	M1	for substituting values, eg $4 = k \times 9 + k$ or $4 = k(9 + 1)$ or $(k = 0.4)$	
		M1	for $(u_3 =) "0.4" \times 4 + "0.4" (= 2)$	
		A1	for 1.2 oe	
16	Histogram completed	M1	for method to use area to find at least one other frequency (not 11), eg $10 \times 1.5 (= 15)$ or $20 \times 0.3 (= 6)$	Condone one error in reading FD Ft one error from reading FD
		M1	for method to find unknown frequencies, eg $(60 - 11 - "15" - "6") \div 2 (= 14)$	
		M1	ft for method to find an unknown frequency density, eg $"14" \div 5 (= 2.8)$ or $"14" \div 10 (= 1.4)$ or one correct bar drawn	
		C1	cao	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	73.6	P1	for correct initial use of Pythagoras eg $5^2 + 5^2 (=50)$ or a trigonometric ratio in the form $\frac{5+2}{0.5AC} = \sin 45$ oe	do not accept $\sqrt{20} \div 2$
		P1	for finding the length of half of the diagonal eg $\sqrt{50} \div 2 (= 3.5...)$ or $0.5AC = \frac{5+2}{\sin 45} (=3.5...)$ oe	
		P1	for process to use tan eg $\tan TAC = (12 \div "3.5..") (=3.3..)$ or complete alternative method arriving at an equation with the subject as $\sin TAC$ or $\cos TAC$	
		A1	for an answer in the range 73.58 to 74.1	
13	408	M1	for $1.01 \times 400 (= 404)$ or 408.04 or 412.08	412(.08) on the answer line M1A0 1.01×400 may be seen as part of a calculation
		A1	cao	
14	Evidence of solution	M1	for constructing an equation eg $y \propto \frac{1}{x^2}$ or eg $y = \frac{k}{x^2}$ oe	Must show all steps clearly
		M1	for substituting in the values a and 44 into $y = \frac{k}{x^2}$	
		C1	for a complete method to use the equation, the value of k and $x = 2a$ to show $y=5.5$ eg $(2a)^2y = 44a^3$ and $y = 44a^3 \div 8a^3=5.5$	



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
20 (a)		-0.4 to -0.2 and 3.2 to 3.4	M1 A1	for $(y =) x + 4$ for answers in the range -0.4 to -0.2 and 3.2 to 3.4
(b)		1.6 to 2.5	M1 M1 A1	for drawing a tangent to the curve at $x = 2$ for method to find gradient of their tangent for answer in the range 1.6 to 2.5
21		8600	P1 P1 P1 A1	for process to find the length of the rectangle, e.g. $24 \times 4 (= 96)$ for process to find the perpendicular height of an equilateral triangle of side (24×2) cm, e.g. $48\sin 60 (= 41.5(69..))$ or $\sqrt{48^2 - 24^2} (= 24\sqrt{3}$ oe) for complete process to find the width of rectangle, e.g. " $41.5(69..)$ " + 24 + 24 (= 89.5(69..)) for answer in the range 8592 to 8602
22		$2n^2 + n + 1$	M1 M1 A1	for a correct start to a method to find n th term, eg. equal 2nd differences imply a term in n^2 or sight of $an^2 + bn + c$ for a method leading to $2n^2$ and either n or 1 for $2n^2 + n + 1$ oe
23		$y = \frac{-3}{\sqrt{7}}x + \frac{8}{\sqrt{7}}$	M1 M1 A1	for method to find gradient of OP, eg. $\frac{\sqrt{7}}{2} \div \frac{3}{2} (= \frac{\sqrt{7}}{3}$ or 0.88 ...) oe (dep) for method to find gradient of tangent, m , eg. $\frac{\frac{\sqrt{7}}{2}}{\frac{3}{2}} \times m = -1$ ($m = \frac{-3}{\sqrt{7}}$ or -1.13..)) for $y - \frac{\sqrt{7}}{2} = \frac{-3}{\sqrt{7}}(x - \frac{3}{2})$ or $y = \frac{-3\sqrt{7}}{7}x + \frac{8\sqrt{7}}{7}$ oe or $y - 1.32.. = -1.13..(x - 1.5)$



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$(-7, -1)$	M1 A1	for a method which shows understanding of the type of transformation eg reflection in the y axis or translation $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$ or “(0 units right and) 3 units down” or for x coordinate as -7 or y coordinate as -1 for $(-7, -1)$	“Reflection” or “Translation” alone is insufficient. Note that the -7 or the -1 may appear in the working space, not necessarily in the final answer.
16	$2n^2 - 3$	M1 M1 A1	begins to work with 2 nd differences identifies $2n^2$ as part of the expression eg gives the sequence 2, 8, 18, 32, ... or gives a quadratic expression which includes the term $2n^2$ oe	$\begin{matrix} 6 & 10 & 14 & 18 & 22 \\ 4 & 4 & 4 & 4 \end{matrix}$ A quadratic expression of the form $2n^2 + bn + c$ can be awarded the first 2 marks
17	B, A, D, C	B2 (B1	for all correct for two or three correct)	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
4 (i)	238	P1 A1	for working with proportion eg $\frac{17}{50} \times 700$ oe cao	
(ii)	statement	C1	for statement Acceptable Sample is representative (otherwise answer wrong) Random sample (otherwise answer will be different) The 50 people are from the 700 (otherwise not accurate) 17 out of every 50 want a sports bag (otherwise answer will be different / wrong) There is no bias That the other 650 will want the same gifts as the 50 Not acceptable There would be more than 17 people who want the sports bag I rounded my answer 17 out of 50 want a sports bag A repeat of the calculation done in (i) Most of the people would want a sports bag References as what might change in the future (eg a change in membership) That all 700 people wanted a type of gift rather than no gift (otherwise would have changed my answer)	
5 (a)	F	B1	cao	
(b)	D	B1	cao	
6	Shown (supported)	M1 M1 A1	for method to find at least two terms, eg $2 \times 4^2 - 1 (= 31)$ and $40 - 3^2 (= 31)$ for generating at least three correct terms of each sequence for generating at least the terms 1, 7, 17, 31, 49 of the first sequence and at least the terms 39, 36, 31, 24, 15, 4 of the second sequence	1 7 17 31 49 71 97 127 161 199 39 36 31 24 15 4 -9

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
5	12	P1	for a process to find the fifth term, eg $3a + 5a (= 8a)$	[8a] allow use of what is clearly indicated as the missing term $\frac{228}{19}$ or $\frac{228}{1+2+3+5+8}$ scores P1 P1 $\frac{228}{1+2+3+5+[8]}$ scores P0P1
		P1	for setting up the equation eg $a + 2a + 3a + 5a + [8a] = 228$	
		A1	cao	
6	(a)	P1	for $1 - 0.05 - 0.15 (= 0.8)$	Award this mark for any two probabilities that sum to 0.8
		A1	oe	
	(b)	M1	$18 \div 0.15$ oe or $6 + 18 + a + b$ where $a + b = 96$	
		A1	cao	
7	18.3	P1	for finding the area of the triangle eg $0.5 \times 8 \times 8 (= 32)$	Accept rounded or truncated figures If the answer is given within the range but then rounded incorrectly award full marks.
		P1	for finding the area of the circle $\pi \times 8 \times 8 (= 201.06..)$	
		P1	for finding the area of the sector eg $\frac{1}{4} \times \pi \times 8^2$ or "201.06.." $\div 4 (= 50.26...)$	
		A1	for an answer in the range 18.2 to 18.3	
8	(a)	C1	Sketch	Accept freehand provided intention is clear
	(b)	C1	Sketch	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	$\frac{2}{5}\mathbf{a} + \mathbf{b}$	P1 for relationship involving D eg $\overrightarrow{OD} = \frac{2}{5}\overrightarrow{OB}$ or $\overrightarrow{DB} = \frac{3}{5}\overrightarrow{OB}$ or for relationship involving E eg $\overrightarrow{BE} = \frac{1}{5}\overrightarrow{BC}$ or $\overrightarrow{EC} = \frac{4}{5}\overrightarrow{BC}$ P1 for relationship involving D in terms of $\mathbf{a}$ and $\mathbf{b}$ eg $\overrightarrow{OD} = \frac{2}{5}(\mathbf{a} + \mathbf{b})$ or $\overrightarrow{DB} = \frac{3}{5}(\mathbf{a} + \mathbf{b})$ or for relationship involving E in terms of $\mathbf{a}$ and $\mathbf{b}$ eg $\overrightarrow{BE} = \frac{1}{5}(-\mathbf{b} - \mathbf{a} + 3\mathbf{b})$ oe or $\overrightarrow{EC} = \frac{4}{5}(-\mathbf{b} - \mathbf{a} + 3\mathbf{b})$ oe or $\overrightarrow{BC} = 2\mathbf{b} - \mathbf{a}$ oe or $\overrightarrow{CB} = \mathbf{a} - 2\mathbf{b}$ oe P1 (dep P2) for expression for $\overrightarrow{DE}$ in terms of $\mathbf{a}$ and $\mathbf{b}$ eg $\overrightarrow{DE} = \frac{3}{5}(\mathbf{a} + \mathbf{b}) + \frac{1}{5}(-\mathbf{b} - \mathbf{a} + 3\mathbf{b})$ A1 for $\frac{2}{5}\mathbf{a} + (1)\mathbf{b}$ or $\frac{1}{5}(2\mathbf{a} + 5\mathbf{b})$		
19	0.95	P1 for initial use of the formula eg $3610 = kP_n$ or $P_{n+1} = 4000k$ or for $P_{n+2} = k^2P_n$ or for $3610 = k^2 \times 4000$ P1 for a complete method to find k eg $\sqrt{\frac{3610}{4000}}$ or ± 0.95 A1 oe	Accept n or any integer replacement for n This may be seen in steps	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
10	17500	P1 P1 A1	for a process to find the value at the end of year 1, eg $10914.75 \div 0.81 (= 13475)$ or $10914.75 \div 0.77 (= 14175)$ or for finding the combined multiplier, eg $0.77 \times 0.81 (= 0.6237)$ for a complete process to find the initial value, eg “ $13475 \div 0.77$ ” or “ $14175 \div 0.81$ ” or $10914.75 \div “0.6237”$ cao	
11	Box plot	B3 (B2) (B1	for fully correct box plot for box plot showing a box and at least 3 correctly plotted values from 24, 42, 54, 64, 96) for correctly identifying one of the LQ (42) Median (54) or UQ (64) from the CF graph)	Box can be of any height. Accept ends that are marked (eg line, cross, dot) or defined by the end of the whiskers if clear May be implied by one of these correct on the box plot
12 (a)	6	M1 A1	for an attempt to evaluate 1.13^n for at least one value of n (with $n > 1$) 6 years coming from finding n such that $1.13^n > 2$	1.13, 1.27..., 1.44..., 1.63..., 1.84..., 2.08... May be used with a value Values rounded or truncated to 2dp or better
(b)	Explanation	C1	for explanation Acceptable examples it will decrease the number of years will go down we can't tell (as we don't know how much it is increasing by) it will be an overestimate Not acceptable examples it will increase it will be an underestimate	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	-6	B1	cao	
(b)	4	M1	for $g(1) = 5 - 3 \times 1 (= 2)$ and a clear intention to find $f(2)$ or for $\frac{12}{5-3 \times 1 + 1}$ or for stating fg, eg $\frac{12}{5-3x+1}$ oe	For reference $f(x) = \frac{12}{x+1}$ and $g(x) = 5 - 3x$
(c)	$\frac{1}{3}$	A1	cao	Accept $\frac{4}{1}$
		M1	for g^{-1} as $\frac{5-x}{3}$ oe or for $5 - 3x = 4$ or $g(\frac{1}{3}) = 5 - 1 = 4$	Could be shown in the form of a flowchart, which must show correct inverse operations. Allow g^{-1} and g to be in terms of y ie accept $\frac{5-y}{3}$ and $5 - 3y = 4$
		A1	for $\frac{1}{3}$ oe eg 0.33(3...)	
17	1.331	M1	for method to find height after 2nd bounce, eg $0.55 \times 8 (= 4.4)$	
		M1	for method to find height after 3rd bounce, eg $0.55 \times "4.4" (= 2.4(2))$ or for method to find height after 4th bounce, eg $0.55^3 \times 8$ or for method to find height after 5th bounce, eg $0.55^4 \times 8 (= 0.73(205))$	Award this mark for $0.55^n \times 8$ where $n > 1$
		A1	for 1.331, accept 1.33, 1.3 oe mixed number	If a correct answer is shown and then incorrectly rounded award full marks



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	Shown	M1 M1 C1	for beginning to find K eg $2400 = K \times 2000$ or $K = 1.2$ oe For a correct method to find the value for 2021 or 2022, eg $2400 \times "1.2" (= 2880)$ or $2400 \times ("1.2")^2 (= 3456)$ or $2000 \times ("1.2")^2 (= 2880)$ or $2000 \times ("1.2")^3 (= 3456)$ OR method to find rate leading to 3000 in 2022, eg $\sqrt[3]{\frac{3000}{2000}} (= 1.144...)$ for comparative figures eg 3456 (and 3000) OR $3000 \div 2880 = 1.041... \text{ and } 1.2$ OR 1.144... and 1.2	M marks can be awarded in either order $1.2^2 = 1.44$ 3000 need not be restated to award this mark If comparison made with 2023 or beyond do not award C1
19	17	P1 P1 P1 A1	for a process to use trigonometry to find BG eg $\frac{BG}{15} = \tan 27$ or 7.64(28...) for a process to find to find EG eg $\frac{15}{EG} = \cos 52$ or 24.3(64...) for a process to use trigonometry to find angle GEB eg $\tan GEB = \frac{"7.64..."}{"24.36..."}$ for an answer in the range 17 to 17.6	Other methods are possible for all P marks but only award the mark at the point of an equation with the correct length or angle as the only unknown



Paper: 1MA1/2H						
Question	Answer	Mark	Mark scheme	Additional guidance		
22 (a)	163 or 164	P1	uses formula eg $1.2 \times 200 - 50 (= 190)$			
		P1	for complete process, eg May: $1.2 \times "190" - 50 (= 178)$ and June: $1.2 \times "178" - 50 (= 163.6)$			
		A1	for 163 or 164			
	(b)	Statement	C1		(dep P1) ft statement, eg there won't be any rabbits, fewer rabbits, decrease	
23 (a)	Shown	C1	for a method to find the area of half of the parallelogram or of the whole parallelogram, eg $\frac{1}{2}(2x - 1)(10 - x) \sin 150$ or $\frac{1}{2}(2x - 1)(10 - x) \times \frac{1}{2}$ oe or $(2x - 1)(10 - x) \sin 150$ or $(2x - 1)(10 - x) \times \frac{1}{2}$ oe			
		C1	for a correct expansion of the whole area eg $\frac{1}{2}(20x - 10 - 2x^2 + x)$ or $\frac{1}{2}(-2x^2 + 21x - 10)$ or $-x^2 + 10.5x - 5$			
		C1	complete chain of reasoning with fully correct algebra dealing with the inequality eg $x^2 - 10.5x + 5 < -15$ or $x^2 - 10.5x + 20 < 0$ or $2x^2 - 21x + 10 < -30$ which lead to $2x^2 - 21x + 40 < 0$			
	(b)	$2.5 < x < 8$	M1		for factorising, $(2x - 5)(x - 8)$	Could use the formula
			A1		for critical values, 2.5, 8	
			A1		for any statement that x is greater than 2.5 and x is less than 8	Need not be given as an inequality statement



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	788.4	P1 P1 P1 A1	for substituting values, eg $1040 = K \times 1200 + 20$ for process to find K , eg $(1040 - 20) \div 1200$ oe ($= 0.85$) for complete process, eg 09 17: “0.85” $\times$ $1040 + 20$ ($= 904$); 09 18: “0.85” $\times$ “904” $+ 20$ for 788.4 or 788 or 789	
20 (a)	Shown	M1 M1 C1	for $\frac{n}{n+8}$ or starts to work with ratios, eg 3:7 forms equation and clears fractions, eg $10n = 7n + 56$ or $10n + 3(n+8) = 10(n+8)$ or equates $\frac{3}{10} = \frac{8}{x}$ or $\frac{3}{10} = \frac{8}{n+8}$ or continues to work with ratios, eg 3:7 = 24:56 gives the total sweets eg $\frac{80}{3}$ oe or number of red sweets $n = \frac{56}{3}$ oe or gives number of red as $\frac{56}{3}$ OR award 3 marks for a complete written argument, eg, $P(y) = \frac{3}{10}$ and there are 8 yellows. This cannot work as 3 is not a factor of 8 (and $\frac{3}{10}$ is in its simplest form)	Does not have to restate the $\frac{7}{10}$; giving a different probability will suffice



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	$\frac{-11x+2}{x^2-4}$	M1	for writing at least one of the 3 terms with a denominator of $(x^2 - 4)$ or $(x - 2)(x + 2)$ eg. $\frac{3x(x-2)}{x^2-4}$ oe or $\frac{(x+2)(2x+1)}{x^2-4}$ oe or $\frac{x^2-4}{x^2-4}$	Students may work with a denominator of $(x - 2)(x + 2)$ for the first 3 marks
		M1	for $\frac{3x(x-2)}{x^2-4} - \frac{(x+2)(2x+1)}{x^2-4} - \frac{x^2-4}{x^2-4}$ oe or for $\frac{x^2-11x-2}{x^2-4} (-1)$ or for $\frac{[x^2-11x-2]}{x^2-4} - \frac{x^2-4}{x^2-4}$	$[x^2 - 11x - 2]$ denotes their expansion of $3x(x - 2) - (x + 2)(2x + 1)$ May be simplified
		M1	for a numerator of $3x^2 - 6x - 2x^2 - 5x - 2 - x^2 + 4$	Accept $a = -11$ and $b = 2$
		A1	for $\frac{-11x+2}{x^2-4}$	
20	44 384	P1	for process to find a , eg. $29\,600 = 24\,000a + 800$ or $(a =) 1.2$ oe	
		P1	for $(P_{2020} \Rightarrow) "1.2" \times 29\,600 + 800 (= 36\,320)$	
		P1	for $(P_{2021} \Rightarrow) "1.2" \times "36\,320" + 800$	
		A1	cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	4.5	P1	for initial use of formula, eg $6 = 8k$	If figures are given as part of the answer they must be correct, but can allow ft
		P1	for a full process to find P_3 eg $\frac{6}{8} \times 6$	
		A1	oe	
(b)	Explanation	C1	for explanation Acceptable examples Yes, the population will increase as k is over 1 She is correct because $1.05 > 1$ Yes, each year the population will increase by 5% Yes, because $0.75 + 0.3 = 1.05$ Yes, a 0.3 increase is greater than the current 0.25 decrease Not acceptable examples Yes, the population will increase each year Yes, because there is an increase in k No because 0.3 is less than 0.75	
17 (a)	$(2x + 1)(3x - 4)$	M1	for $(2x \pm 1)(3x \pm 4)$ oe or for brackets which when expanded give 2 out of 3 terms correct	
		A1	cao	
(b)	$-\frac{1}{2} < x < \frac{4}{3}$	M1	for two critical values with at least one correct, $-\frac{1}{2}$ or $\frac{4}{3}$ or ft their critical values from (a)	
		A1	for $-\frac{1}{2} < x < \frac{4}{3}$ oe eg $x < \frac{4}{3}, x > -\frac{1}{2}$	

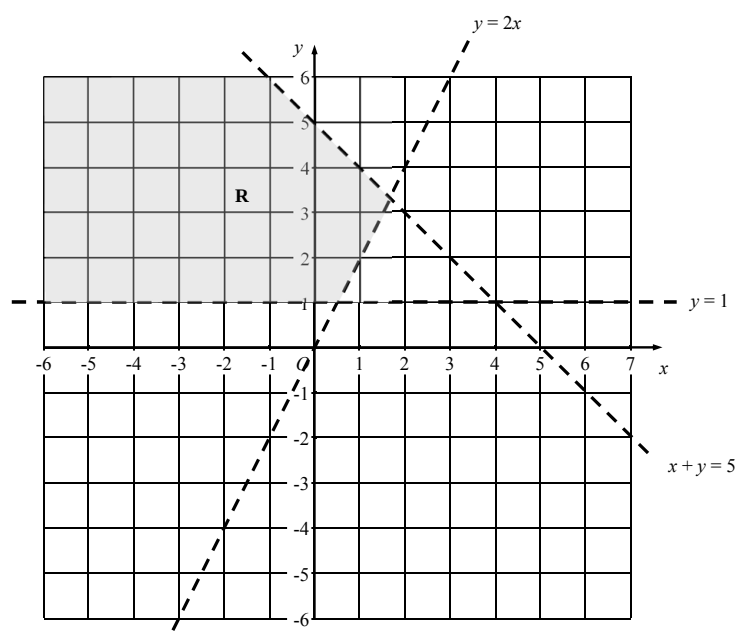


Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
22	$3 + \sqrt{2}$	P1	for start of process to find the common ratio, eg writes $\frac{13+9\sqrt{2}}{3+2\sqrt{2}}$	Award P1 for process to rationalise the denominator of $\frac{3+2\sqrt{2}}{13+9\sqrt{2}}$
		P1	for process to rationalise the denominator, eg $\frac{13+9\sqrt{2}}{3+2\sqrt{2}} \times \frac{3-2\sqrt{2}}{3-2\sqrt{2}}$	
		P1	(dep P2) for expanding terms, condone one error in expansion of numerator or denominator, eg $\frac{39+27\sqrt{2}-18\sqrt{2}\sqrt{2}-26\sqrt{2}}{9+6\sqrt{2}-6\sqrt{2}-4\sqrt{2}\sqrt{2}}$ or $\frac{39+27\sqrt{2}-26\sqrt{2}-36}{9-8}$ oe	
		A1	cao	A correct answer with no supportive working gets 0 marks.



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
23 (a)		2	M1	for start to express the common ratio algebraically, eg $1/(\sqrt{x} - 1)$ or $(\sqrt{x} + 1)/1$ or $\sqrt{x} + 1 = k \times 1$ or $1 = k \times (\sqrt{x} - 1)$
			M1	for setting up an appropriate equation in x , eg $1/(\sqrt{x} - 1) = (\sqrt{x} + 1)/1$
			C1	for convincing argument to show $x = 2$
		Shown	M1	for expressing the relationship between the common ratio, one of the first three terms of the sequence and the fifth term, eg $5^{\text{th}} \text{ term} = 3^{\text{rd}} \text{ term} \times (\text{common ratio})^2$
			C1	for a complete explanation to include eg, $(\sqrt{2} + 1)(\sqrt{2} + 1)^2 = 7 + 5\sqrt{2}$
(b)				

Q14



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
23 (a)	4000	P1	for process to identify the common ratio, eg $400\sqrt{5} \div 200 (= 2\sqrt{5})$ or $200 \div 400\sqrt{5} (= \frac{1}{2\sqrt{5}})$ or for a process to find the next term of the sequence, eg $200 \times (200 \div 10)$	May use any 2 consecutive terms
		A1	cao	
		P1	for process to find the ratio of the 4th and 6th terms, eg $\frac{5\sqrt{2}}{8} \div \frac{5\sqrt{2}}{4} (= \frac{1}{2})$ or $\frac{5\sqrt{2}}{4} \div \frac{5\sqrt{2}}{8} (= 2)$ or for finding that the 2nd term is $\frac{5\sqrt{2}}{2}$	
		P1	for complete process to find 1st term, eg $\frac{5\sqrt{2}}{4} \div \left(\frac{1}{\sqrt{2}}\right)^3$	
24 (b)	1 : $\sqrt{8}$	A1	cao	Award 0 marks for a correct answer with no supportive working
		P1	for process to equate the two volumes, $\frac{4}{3}\pi r^3 = \frac{1}{3}\pi r^2 h$	
		A1	cao	
		P1	for process to equate surface areas, eg $4\pi r^2 = \pi r^2 + \pi r l$	
24 (a)	1 : 4	P1	for process to substitute $l = \sqrt{h^2 + r^2}$, eg $4\pi r^2 = \pi r^2 + \pi r \sqrt{h^2 + r^2}$	Can be implied by $3r = l$
		P1	for process to isolate term in r^2 after substituting for l , eg $8r^2 = h^2$	
		A1	for 1 : $\sqrt{8}$	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	42	P1	for process to find an equation in a and b , eg $a \times 2^2 + b \times 2 = -2$ ($4a + 2b = -2$) or $a \times 4^2 + b \times 4 = 12$ ($16a + 4b = 12$)	Allow one arithmetic error in elimination, eg $16a + 8b = -8$ and $16a + 4b = 12$ leading to $4b = 20$ but no subtraction sign seen
		P1	for process to find a pair of simultaneous equations and eliminate one unknown, eg $16a + 8b = -8$ and $16a + 4b = 12$ and subtraction or $16a + 4b = 12$ and $8a + 4b = -4$ and subtraction	
		A1	for $a = 2$ and $b = -5$	
		A1	cao	
(b)	$n^2 - n$	M1	for correct method, eg n^2 seen as a term	
		A1	for $n^2 - n$ oe	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	1610	B1	for 5.875×10^8 or 5.885×10^8 or 3.55×10^5 or 3.65×10^5 or the digits 5875 or 5885 or 355 or 365	Accept 5.8849 for 5.885 Accept 3.649 for 3.65
		M1	for method to find lower bound, $\frac{[LB]}{[UB]}$ eg $(5.875 \times 10^8) \div (3.65 \times 10^5)$ oe	$5.875 \times 10^8 \leq [LB] < 5.88 \times 10^8$ $3.6 \times 10^5 < [UB] \leq 3.65 \times 10^5$
		A1	for answer in range 1609 – 1610 from correct working	If an answer is shown in the range in working and then incorrectly rounded award full marks
20 (a)	3.5	P1	for process to find the common difference between the first and second and the common difference between the third and second term eg $(3x + 1) - (x + 2) (= 2x - 1)$ and $(x + 2) - (x - 4) (= 6)$ or for process to write a correct equation in x , eg $(3x + 1) - (x + 2) = (x + 2) - (x - 4)$ or $2x - 1 = 6$ oe	r can be any letter apart from y The quadratic does not have to equal 0, ie accept $2y^2 - 15y = 8$
		A1	for 3.5 oe eg $\frac{7}{2}$	
	-0.5, 8	P1	for process to write a correct equation in terms of the common ratio and y eg $r(y - 4) = y + 2$ or $r(y + 2) = 3y + 1$	
		P1	for process to write a correct equation in y eg $\frac{3y+1}{y+2} = \frac{y+2}{y-4}$ oe	
		P1	for process to write a correct equation without fractions eg $(3y + 1)(y - 4) = (y + 2)(y + 2)$ oe	
		P1	for process of writing a correct simplified equation eg $2y^2 - 15y - 8 (= 0)$	
		A1	cao	
(b)				

