



GuideMyGrades

— YOUR GOALS. OUR EXPERTISE. —

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

Algebraic Manipulation (A1)

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

79 questions · 299 marks · Mark schemes included

Past papers June 2017 - June 2025 · 6 sub-topics

 guidemygrades.com

 [@Guidemygrades](https://www.instagram.com/Guidemygrades)

 [@Guidemygrades](https://twitter.com/Guidemygrades)

 [@Guidemygrades](https://www.youtube.com/Guidemygrades)

 info@guidemygrades.com

 Piccadilly Business Centre, Unit C, Aldow Enterprise Park
Blackett Street, Manchester, M12 6AE

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.

QUESTION	SOURCE	MARKS	PAGE
A1a NOTATION, SIMPLIFYING & SUBSTITUTION		4 Qs · 15 marks	4
1. Q4	GCSE Paper 1H June 2017	3	5
2. Q9	GCSE Paper 3H November 2024	3	6
3. Q10	GCSE Paper 2H November 2020	4	7
4. Q1	GCSE Paper 3H November 2020	5	8
A1b EXPANDING & FACTORISING		21 Qs · 80 marks	9
5. Q10	GCSE Paper 3H November 2022	1	10
6. Q2	GCSE Paper 3H June 2018	2	11
7. Q10	GCSE Paper 1H June 2017	3	12
8. Q10	GCSE Paper 1H November 2018	3	13
9. Q15	GCSE Paper 2H November 2019	3	14
10. Q14	GCSE Paper 1H November 2021	3	15
11. Q12	GCSE Paper 2H November 2021	3	16
12. Q15	GCSE Paper 3H June 2023	3	17
13. Q9	GCSE Paper 2H November 2023	3	18
14. Q14	GCSE Paper 1H June 2024	3	19
15. Q13	GCSE Paper 2H June 2025	3	20
16. Q15	GCSE Paper 1H June 2018	4	21
17. Q1	GCSE Paper 3H November 2019	4	22
18. Q1	GCSE Paper 3H June 2023	4	23
19. Q1	GCSE Paper 2H June 2022	5	24
20. Q14	GCSE Paper 3H June 2022	5	25
21. Q14	GCSE Paper 3H November 2022	5	26
22. Q11	GCSE Paper 1H November 2024	5	27
23. Q18	GCSE Paper 3H June 2019	6	28
24. Q1	GCSE Paper 2H November 2023	6	29
25. Q15	GCSE Paper 3H June 2024	6	30
A1c FORMULAE & REARRANGING		13 Qs · 41 marks	31
26. Q12	GCSE Paper 1H November 2019	1	32
27. Q10	GCSE Paper 2H November 2019	2	33
28. Q1	GCSE Paper 3H November 2022	2	34
29. Q14	GCSE Paper 1H November 2017	3	35
30. Q15	GCSE Paper 2H June 2019	3	36
31. Q10	GCSE Paper 3H November 2023	3	37
32. Q2	GCSE Paper 3H June 2025	3	38



QUESTION	SOURCE	MARKS	PAGE
33. Q2	GCSE Paper 1H November 2018	4	39
34. Q17	GCSE Paper 1H November 2020	4	40
35. Q11	GCSE Paper 1H November 2021	4	41
36. Q2	GCSE Paper 3H June 2022	4	42
37. Q17	GCSE Paper 1H June 2023	4	43
38. Q15	GCSE Paper 3H November 2024	4	44
A1d ALGEBRAIC FRACTIONS & IDENTITIES		16 Qs · 62 marks	45
39. Q17	GCSE Paper 1H June 2018	3	46
40. Q13	GCSE Paper 1H November 2019	3	47
41. Q15	GCSE Paper 1H November 2021	3	48
42. Q22	GCSE Paper 3H November 2021	3	49
43. Q22	GCSE Paper 3H November 2022	3	50
44. Q14	GCSE Paper 2H June 2023	3	51
45. Q12	GCSE Paper 3H June 2023	3	52
46. Q17	GCSE Paper 2H November 2024	3	53
47. Q19	GCSE Paper 2H June 2017	4	54
48. Q13	GCSE Paper 2H June 2019	4	55
49. Q22	GCSE Paper 3H November 2019	4	56
50. Q19	GCSE Paper 3H June 2022	4	57
51. Q20	GCSE Paper 2H November 2023	4	58
52. Q14	GCSE Paper 3H June 2017	6	59
53. Q12	GCSE Paper 2H November 2018	6	60
54. Q12	GCSE Paper 3H November 2020	6	61
A1e ALGEBRAIC PROOF & REASONING		10 Qs · 31 marks	62
55. Q17	GCSE Paper 1H November 2017	2	63
56. Q13	GCSE Paper 1H June 2019	2	64
57. Q15	GCSE Paper 3H November 2018	3	65
58. Q15	GCSE Paper 3H November 2019	3	66
59. Q13	GCSE Paper 3H June 2023	3	67
60. Q20	GCSE Paper 3H June 2023	3	68
61. Q10	GCSE Paper 1H June 2025	3	69
62. Q16	GCSE Paper 1H June 2017	4	70
63. Q12	GCSE Paper 1H June 2018	4	71
64. Q16	GCSE Paper 1H November 2022	4	72
A1f FUNCTIONS (COMPOSITE & INVERSE)		15 Qs · 70 marks	73
65. Q11	GCSE Paper 2H June 2018	3	74
66. Q22	GCSE Paper 2H November 2022	3	75
67. Q19	GCSE Paper 1H November 2018	4	76
68. Q10	GCSE Paper 3H November 2018	4	77
69. Q19	GCSE Paper 2H June 2022	4	78
70. Q19	GCSE Paper 2H November 2023	4	79



QUESTION	SOURCE	MARKS	PAGE
71. Q18	GCSE Paper 1H November 2024	4	80
72. Q22	GCSE Paper 2H November 2017	5	81
73. Q19	GCSE Paper 1H November 2020	5	82
74. Q20	GCSE Paper 1H June 2023	5	83
75. Q16	GCSE Paper 3H June 2024	5	84
76. Q17	GCSE Paper 1H June 2025	5	85
77. Q18	GCSE Paper 1H November 2019	6	86
78. Q21	GCSE Paper 1H November 2021	6	87
79. Q21	GCSE Paper 1H June 2019	7	88



QUESTIONS

79 questions · 299 marks · 6 sub-topics

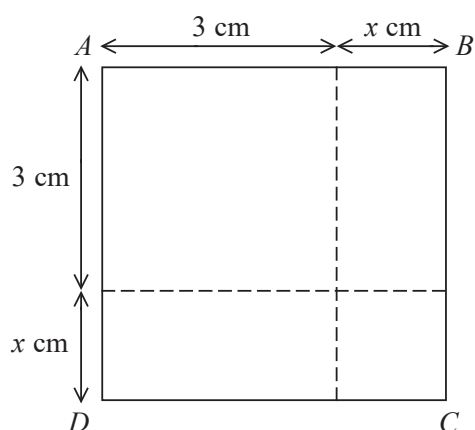
SUB-TOPIC A1a

NOTATION, SIMPLIFYING & SUBSTITUTION

Sub-topic A1a · 4 questions · 15 marks · lowest tariff first



4



The area of square $ABCD$ is 10 cm^2 .

Show that $x^2 + 6x = 1$

(Total for Question 4 is 3 marks)

9 (a) Simplify fully $2x^3y^5 \times 7x^2y$

.....
(2)

(b) Simplify $(m^2)^{-3}$

.....
(1)

(Total for Question 9 is 3 marks)

10 In a sale, the normal prices are reduced by 15%
Amina buys a dress in the sale for £46.75

Work out the normal price of the dress.

£.....

(Total for Question 10 is 2 marks)

10 (a) Simplify $\left(\frac{1}{m^2}\right)^0$

.....
(1)

(b) Simplify $\frac{8(x-4)}{(x-4)^2}$

.....
(1)

(c) Simplify $(3n^4w^2)^3$

.....
(2)

(Total for Question 10 is 4 marks)

11 Jack is in a restaurant.

There are 5 starters, 8 main courses and some desserts on the menu.

Jack is going to choose one starter, one main course and one dessert.

He says there are 240 ways that he can choose his starter, his main course and his dessert.

Could Jack be correct?

You must show how you get your answer.

(Total for Question 11 is 2 marks)



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify $n^3 \times n^5$

.....
(1)

(b) Simplify $\frac{c^3d^4}{c^2d}$

.....
(2)

(c) Solve $\frac{5x}{2} > 7$

.....
(2)

(Total for Question 1 is 5 marks)



SUB-TOPIC A1b

EXPANDING & FACTORISING

Sub-topic A1b · 21 questions · 80 marks · lowest tariff first



- 10 Peter has to subtract $(x^2 - 2x - 4)$ from $(x^2 + 3x + 5)$

Here is his working

$$\begin{aligned}(x^2 + 3x + 5) - (x^2 - 2x - 4) \\= x^2 + 3x + 5 - x^2 - 2x - 4 \\= x + 1\end{aligned}$$

Explain what is wrong with Peter's working.

.....

.....

.....

(Total for Question 10 is 1 mark)

- 11 x and y are integers such that

$$\begin{aligned}3 < x < 8 \\4 < y < 10 \\ \text{and } x + y = 14\end{aligned}$$

Find all the possible values of x .

.....

(Total for Question 11 is 2 marks)

- 12 Martin used his calculator to work out the value of a number P .
He wrote down the first two digits of the answer on his calculator.

He wrote down 1.2

Complete the error interval for P .

$$\dots \leq P < \dots$$

(Total for Question 12 is 2 marks)



Kristina is 11 years old.
Her best time to run 100 metres is 12 seconds.

The point representing this information would be an outlier on the scatter diagram.

(b) Explain why.

(1)

Debbie is 15 years old.

Debbie says,

“The scatter diagram shows I should take less than 12 seconds to run 100 metres.”

(c) Comment on what Debbie says.

(1)

(Total for Question 1 is 3 marks)

2 Expand and simplify $5(p + 3) - 2(1 - 2p)$

(Total for Question 2 is 2 marks)



9 Jules buys a washing machine.

20% VAT is added to the price of the washing machine.

Jules then has to pay a total of £600

What is the price of the washing machine with **no** VAT added?

£.....

(Total for Question 9 is 2 marks)

10 Show that $(x + 1)(x + 2)(x + 3)$ can be written in the form $ax^3 + bx^2 + cx + d$ where a , b , c and d are positive integers.

(Total for Question 10 is 3 marks)



- (b) Compare the distribution of the delays on Monday with the distribution of the delays on Tuesday.

.....

.....

.....

.....

(2)

Mary says,

“The longest delay on Tuesday was 33 minutes.

This means that there must be some delays of between 25 minutes and 30 minutes.”

- (c) Is Mary right?

You must give a reason for your answer.

.....

.....

(1)

(Total for Question 9 is 6 marks)

10 (a) Simplify $\frac{x-1}{5(x-1)^2}$

(1)

(b) Factorise fully $50 - 2y^2$

(2)

(Total for Question 10 is 3 marks)



14 Sadia is going to buy a new car.

For the car, she can choose one body colour, one roof colour and one wheel type.

She can choose from

19 different body colours

25 different wheel types

The total number of ways Sadia can choose the body colour and the roof colour and the wheel type is 3325

Work out the number of different roof colours that Sadia can choose from.

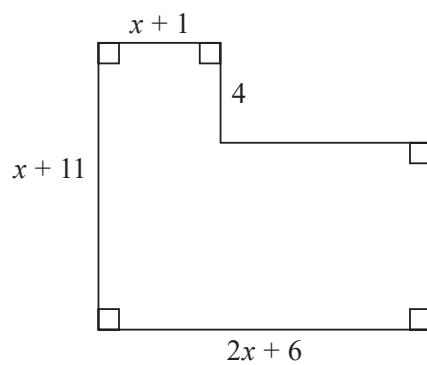
(Total for Question 14 is 2 marks)

15 Expand and simplify $(3x + 2)(2x + 1)(x - 5)$

(Total for Question 15 is 3 marks)



14 Here is a shape with all its measurements in centimetres.



The area of the shape is $A \text{ cm}^2$

Show that $A = 2x^2 + 24x + 46$

(Total for Question 14 is 3 marks)

12 Expand and simplify $(x - 2)(3x + 2)(2x + 3)$

(Total for Question 12 is 3 marks)

13 In a school there are 16 teachers and 220 students.
Of these students 120 are girls and 100 are boys.

One teacher, one girl and one boy are going to be chosen to represent the school.

Work out the number of different ways there are to choose one teacher, one girl and one boy.

(Total for Question 13 is 2 marks)



15 (a) Factorise $a^2 - b^2$

.....
(1)

(b) Show that $2^{40} - 1$ is the product of two consecutive odd numbers.

(2)

(Total for Question 15 is 3 marks)



- 8 A number x is written correct to 2 significant figures.

The result is 1.9

Complete the error interval for x .

..... $\leq x <$

(Total for Question 8 is 2 marks)

- 9 Expand and simplify $(x + 7)(x - 2)(x + 3)$

.....

(Total for Question 9 is 3 marks)



14 Expand and simplify $(3x - 1)(2x + 3)(x - 5)$

.....
(Total for Question 14 is 3 marks)



13 Show that $(2x + 3)(x - 1)(x + 2)$ can be written in the form

$ax^3 + bx^2 + cx + d$ where a , b , c and d are integers.

(Total for Question 13 is 3 marks)



15 (a) Factorise $a^2 - b^2$

.....
(1)

(b) Hence, or otherwise, simplify fully $(x^2 + 4)^2 - (x^2 - 2)^2$

.....
(3)

(Total for Question 15 is 4 marks)

16 There are only red counters, blue counters and purple counters in a bag.

The ratio of the number of red counters to the number of blue counters is 3 : 17

Sam takes at random a counter from the bag.

The probability that the counter is purple is 0.2

Work out the probability that Sam takes a red counter.

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



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1** (a) Expand and simplify $(x + 5)(x - 9)$

.....
(2)

- (b) Factorise fully $9x^2 + 6x$

.....
(2)

(Total for Question 1 is 4 marks)

- 2** (a) Use your calculator to work out $\frac{29^2 - 4.6}{\sqrt{35 - 1.9^3}}$

Write down all the figures on your calculator display.

.....
(2)

- (b) Write your answer to part (a) correct to 4 significant figures.

.....
(1)

(Total for Question 2 is 3 marks)



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)

(b) Simplify $x^5 \times x^8$

.....
(1)

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

.....
(2)

(Total for Question 1 is 4 marks)



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify $(x^3)^5$

.....
(1)

(b) Expand and simplify $4(x + 3) + 7(4 - 2x)$

.....
(2)

(c) Factorise fully $15x^3 + 3x^2y$

.....
(2)

(Total for Question 1 is 5 marks)



14 (a) Factorise fully $4p^2 - 36$

.....
(2)

(b) Show that $(m + 4)(2m - 5)(3m + 1)$ can be written in the form $am^3 + bm^2 + cm + d$ where a , b , c and d are integers.

(3)

(Total for Question 14 is 5 marks)



14 (a) Simplify fully $(3x^5y^6)^4$

.....
(2)

(b) Expand and simplify $(x + 2)(x - 3)(x + 4)$

.....
(3)

.....
(Total for Question 14 is 5 marks)

- 18 (a) Show that $(2x + 1)(x + 3)(3x + 7)$ can be written in the form $ax^3 + bx^2 + cx + d$ where a , b , c and d are integers.

(b) Solve $(1 - x)^2 < \frac{9}{25}$

(3)

.....
(3)

(Total for Question 18 is 6 marks)



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1** (a) Expand and simplify $3(2y - 5) + 7(y + 2)$

.....
(2)

- (b) Factorise fully $6x^2 + 15x$

.....
(2)

- (c) Make g the subject of the formula $f = 3g + 11$

.....
(2)

(Total for Question 1 is 6 marks)



15 (a) Simplify fully $\frac{(a-3)^2}{5(a-3)}$

(1)

(b) Factorise $3k^2 + 11k - 4$

(2)

(c) Simplify fully $\frac{4-x^2}{x^2+3x} \div \frac{x+2}{x+3}$

(3)

(Total for Question 15 is 6 marks)



SUB-TOPIC A1c

FORMULAE & REARRANGING

Sub-topic A1c · 13 questions · 41 marks · lowest tariff first



- 11 There are p counters in a bag.
12 of the counters are yellow.

Shafiq takes at random 30 counters from the bag.
5 of these 30 counters are yellow.

Work out an estimate for the value of p .

(Total for Question 11 is 2 marks)

12 $T = \frac{q}{2} + 5$

Here is Spencer's method to make q the subject of the formula.

$$2 \times T = q + 5$$

$$q = 2T - 5$$

What mistake did Spencer make in the first line of his method?

(Total for Question 12 is 1 mark)



10 Make k the subject of the formula $y = \sqrt{2m - k}$

(Total for Question 10 is 2 marks)



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1** Make a the subject of the formula $p = 3a - 9$

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

- 2** Rob has been asked to divide 120 in the ratio 3:5

Here is his working.

$$120 \div 3 = 40 \qquad 120 \div 5 = 24$$

Rob's working is not correct.

Describe what Rob has done wrong.

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



14 The ratio $(y + x):(y - x)$ is equivalent to $k:1$

Show that $y = \frac{x(k + 1)}{k - 1}$

(Total for Question 14 is 3 marks)

15 $x = 0.4\dot{3}\dot{6}$

Prove algebraically that x can be written as $\frac{24}{55}$

(Total for Question 15 is 3 marks)



- (b) Work out an estimate for the distance the car travels in the first 20 seconds of its journey.
Use 4 strips of equal width.

.....m

(3)

(Total for Question 14 is 7 marks)

- 15 Make m the subject of the formula $f = \frac{3m + 4}{m - 1}$

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



- 10 Make m the subject of $k = p + \frac{2m}{5}$

(Total for Question 10 is 3 marks)

- 11 The floor plan of a house is drawn using a scale of 1 : 50
On the plan, a room in the house has a floor area of 48 cm^2

Work out the real area of the floor of this room.
Give your answer in m^2

..... m^2

(Total for Question 11 is 3 marks)



- 2 Ben is trying to make m the subject of $p = \frac{m}{3} + 5$

Here is his working.

$$p - 5 = \frac{m}{3}$$

$$3 \times p - 5 = m$$

$$m = 3p - 5$$

Ben's answer is wrong.

- (a) What mistake has Ben made?

.....

.....

.....

(1)

- (b) Factorise fully $2x^3y + 4xy^2$

.....

(2)

(Total for Question 2 is 3 marks)



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out the value of $\frac{3^7 \times 3^{-2}}{3^3}$

(Total for Question 1 is 2 marks)

2 $v^2 = u^2 + 2as$

$u = 12 \quad a = -3 \quad s = 18$

(a) Work out a value of v .

(2)

(b) Make s the subject of $v^2 = u^2 + 2as$

(2)

(Total for Question 2 is 4 marks)



17 Make f the subject of the formula $d = \frac{3(1-f)}{f-4}$

(Total for Question 17 is 4 marks)

18 x is proportional to $\sqrt{y}$ where $y > 0$

y is increased by 44%

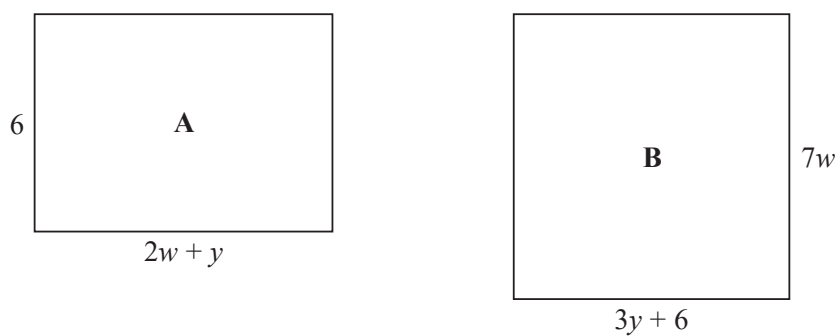
Work out the percentage increase in x .

.....%

(Total for Question 18 is 3 marks)



11 The diagram shows two rectangles, **A** and **B**.



All measurements are in centimetres.

The area of rectangle **A** is equal to the area of rectangle **B**.

Find an expression for y in terms of w .

(Total for Question 11 is 4 marks)



2 $T = 4m^2 - 11$

(a) Work out the value of T when $m = -3$

$$T = \dots\dots\dots$$

(2)

(b) Make p the subject of the formula $d = 3p + 4$

$$\dots\dots\dots$$

(2)

(Total for Question 2 is 4 marks)



17 Make x the subject of the formula $y = \frac{4(2x - 7)}{5x + 3}$

(Total for Question 17 is 4 marks)

18 7 kg of carrots and 5 kg of tomatoes cost a total of 480p

cost of 1 kg of carrots : cost of 1 kg of tomatoes = 5 : 9

Work out the cost of 1 kg of carrots and the cost of 1 kg of tomatoes.

carrots p

tomatoes p

(Total for Question 18 is 4 marks)



14 Prove algebraically that $0.4\dot{6}\dot{2}$ can be written as $\frac{229}{495}$

(Total for Question 14 is 3 marks)

15 Make p the subject of the formula $t = \frac{2(2p - 3)}{5 - 2p}$

(Total for Question 15 is 4 marks)



SUB-TOPIC A1d

ALGEBRAIC FRACTIONS & IDENTITIES

Sub-topic A1d · 16 questions · 62 marks · lowest tariff first



17 Simplify fully $\frac{3x^2 - 8x - 3}{2x^2 - 6x}$

(Total for Question 17 is 3 marks)



13 (a) Write $\frac{5}{x+1} + \frac{2}{3x}$ as a single fraction in its simplest form.

.....
(2)

(b) Factorise $(x+y)^2 + 3(x+y)$

.....
(1)

(Total for Question 13 is 3 marks)

15 Show that $\frac{4x+3}{2x} + \frac{3}{5}$ can be written in the form $\frac{ax+b}{cx}$ where a , b and c are integers.

(Total for Question 15 is 3 marks)



22 Show that $\frac{6x^3}{(9x^2 - 144)} \div \frac{2x^4}{3(x - 4)}$ can be written in the form $\frac{1}{x(x + r)}$ where r is an integer.

(Total for Question 22 is 3 marks)



22 $\frac{2x+3}{x-5} + \frac{x-4}{x+5} - 3$ can be written in the form $\frac{ax+b}{x^2-25}$ where a and b are integers.

Work out the value of a and the value of b .
You must show all your working.

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

(Total for Question 22 is 3 marks)



- 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)



- 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.

(Total for Question 12 is 3 marks)

- 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.

(Total for Question 13 is 3 marks)



17 Show that $\frac{6x - y}{10xy} + \frac{1}{2x} - \frac{2y - 7x}{5xy}$ simplifies to $\frac{k}{y}$ where k is an integer.

(Total for Question 17 is 3 marks)



19 $2 - \frac{x+2}{x-3} - \frac{x-6}{x+3}$ can be written as a single fraction in the form $\frac{ax+b}{x^2-9}$

where a and b are integers.

Work out the value of a and the value of b .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

(Total for Question 19 is 4 marks)



13 Show that $6 + \left[(x + 5) \div \frac{x^2 + 3x - 10}{x - 1} \right]$ simplifies to $\frac{ax - b}{cx - d}$ where a , b , c and d are integers.

(Total for Question 13 is 4 marks)



22 Show that $\frac{7x-14}{x^2+4x-12} \div \frac{x-6}{x^3-36x}$ simplifies to ax where a is an integer.

(Total for Question 22 is 4 marks)



19 Show that $\frac{3x}{x+2} - \frac{2x+1}{x-2} - 1$ can be written in the form $\frac{ax+b}{x^2-4}$
where a and b are integers.

(Total for Question 19 is 4 marks)



20 Write

$\frac{14}{3x-21} + \left[(x+4) \div \frac{2x^2-6x-56}{2x+3} \right]$ in the form $\frac{ax+b}{cx+d}$ where a, b, c and d are integers.

(Total for Question 20 is 4 marks)



14 (a) Simplify $\frac{x^2 - 16}{2x^2 - 5x - 12}$

.....
(3)

(b) Make v the subject of the formula $w = \frac{15(t - 2v)}{v}$

.....
(3)

.....
(Total for Question 14 is 6 marks)



12 (a) Write $\frac{4x^2 - 9}{6x + 9} \times \frac{2x}{x^2 - 3x}$ in the form $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

(b) Express $\frac{3}{x+1} + \frac{1}{x-2} - \frac{4}{x}$ as a single fraction in its simplest form.

(3)

(3)

(Total for Question 12 is 6 marks)



12 (a) Express $\frac{x}{x+2} + \frac{2x}{x-4}$ as a single fraction in its simplest form.

.....
(3)

(b) Expand and simplify $(x-3)(2x+3)(4x+5)$

.....
(3)

(Total for Question 12 is 6 marks)



SUB-TOPIC A1e

ALGEBRAIC PROOF & REASONING

Sub-topic A1e · 10 questions · 31 marks · lowest tariff first



16 y is directly proportional to $\sqrt[3]{x}$

$$y = 1\frac{1}{6} \text{ when } x = 8$$

Find the value of y when $x = 64$

(Total for Question 16 is 3 marks)

17 n is an integer.

Prove algebraically that the sum of $\frac{1}{2}n(n+1)$ and $\frac{1}{2}(n+1)(n+2)$ is always a square number.

(Total for Question 17 is 2 marks)



13 Given that n can be any integer such that $n > 1$, prove that $n^2 - n$ is never an odd number.

(Total for Question 13 is 2 marks)

14 Find the exact value of $\tan 30^\circ \times \sin 60^\circ$
Give your answer in its simplest form.

(Total for Question 14 is 2 marks)



15 Prove algebraically that the difference between the squares of any two consecutive odd numbers is always a multiple of 8

(Total for Question 15 is 3 marks)



- 15** Prove algebraically that the sum of the squares of any two consecutive even numbers is always a multiple of 4

(Total for Question 15 is 3 marks)

- 16** y is inversely proportional to the square of x .

$y = 8$ when $x = 2.5$

Find the negative value of x when $y = \frac{8}{9}$

(Total for Question 16 is 3 marks)



- 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.

(Total for Question 12 is 3 marks)

- 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.

(Total for Question 13 is 3 marks)



20 Prove algebraically that $0.1\dot{2}\dot{3}$ can be written as $\frac{61}{495}$

(Total for Question 20 is 3 marks)



10 Prove that the difference in the squares of two consecutive even numbers is always a multiple of 4

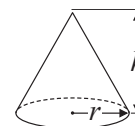
(Total for Question 10 is 3 marks)



- 15 A cone has a volume of 98 cm^3 .
The radius of the cone is 5.13 cm .

(a) Work out an estimate for the height of the cone.

$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$



.....cm

(3)

John uses a calculator to work out the height of the cone to 2 decimal places.

- (b) Will your estimate be more than John's answer or less than John's answer?
Give reasons for your answer.

.....

.....

.....

(1)

(Total for Question 15 is 4 marks)

- 16 n is an integer greater than 1

Prove algebraically that $n^2 - 2 - (n - 2)^2$ is always an even number.

(Total for Question 16 is 4 marks)

12 Prove that the square of an odd number is always 1 more than a multiple of 4

(Total for Question 12 is 4 marks)

13 $\sqrt{5}(\sqrt{8} + \sqrt{18})$ can be written in the form $a\sqrt{10}$ where a is an integer.

Find the value of a .

$a = \dots\dots\dots$

(Total for Question 13 is 3 marks)



16 (a) Prove that

$$(2m + 1)^2 - (2n - 1)^2 = 4(m + n)(m - n + 1)$$

(3)

Sophia says that the result in part (a) shows that the difference of the squares of any two odd numbers must be a multiple of 4

(b) Is Sophia correct?

You must give reasons for your answer.

(1)

(Total for Question 16 is 4 marks)



SUB-TOPIC A1f

FUNCTIONS (COMPOSITE & INVERSE)

Sub-topic A1f · 15 questions · 70 marks · lowest tariff first



11 f and g are functions such that

$$f(x) = \frac{2}{x^2} \quad \text{and} \quad g(x) = 4x^3$$

(a) Find $f(-5)$

.....
(1)

(b) Find $fg(1)$

.....
(2)

.....
(Total for Question 11 is 3 marks)

22 $f(x) = \sqrt[3]{x}$
 $g(x) = 2x + 3$

$h(x) = fg(x)$

Find $h^{-1}(x)$

$h^{-1}(x) = \dots\dots\dots$

(Total for Question 22 is 3 marks)

19 For all values of x

$$f(x) = (x + 1)^2 \quad \text{and} \quad g(x) = 2(x - 1)$$

(a) Show that $gf(x) = 2x(x + 2)$

(2)

(b) Find $g^{-1}(7)$

(2)

(Total for Question 19 is 4 marks)



10 $f(x) = 4\sin x^\circ$

(a) Find $f(23)$

Give your answer correct to 3 significant figures.

.....
(1)

$g(x) = 2x - 3$

(b) Find $fg(34)$

Give your answer correct to 3 significant figures.

.....
(2)

$h(x) = (x + 4)^2$

Ivan needs to solve the following equation $h(x) = 25$

He writes

$$(x + 4)^2 = 25$$

$$x + 4 = 5$$

$$x = 1$$

This is not fully correct.

(c) Explain why.

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

(Total for Question 10 is 4 marks)



19 The functions g and h are such that

$$g(x) = \sqrt[3]{2x - 5} \qquad h(x) = \frac{1}{x}$$

(a) Find $g(16)$

.....
(1)

(b) Find $hg^{-1}(x)$

Give your answer in terms of x in its simplest form.

$hg^{-1}(x) = \dots\dots\dots$
(3)

(Total for Question 19 is 4 marks)

19 The functions f and g are such that

$$f(x) = (2x + 3)^2 \quad \text{and} \quad g(x) = 2x - 1$$

(a) Find $gf(-3)$

.....
(2)

(b) Find $g^{-1}(x)$

$$g^{-1}(x) = \text{.....}$$

(2)

(Total for Question 19 is 4 marks)

18 $f(x) = \frac{5x - 3}{4}$

(a) Find $f^{-1}(x)$

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

For all values of x

$$g(x) = (x - 1)^2 \text{ and } h(x) = 1 - 2x$$

(b) Work out the value of $gh(5)$

$$gh(5) = \dots\dots\dots (2)$$

(Total for Question 18 is 4 marks)



22 The functions f and g are such that

$$f(x) = 5x + 3 \quad g(x) = ax + b \quad \text{where } a \text{ and } b \text{ are constants.}$$

$$g(3) = 20 \quad \text{and} \quad f^{-1}(33) = g(1)$$

Find the value of a and the value of b .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

(Total for Question 22 is 5 marks)



19 f and g are functions such that

$$f(x) = \frac{12}{\sqrt{x}} \quad \text{and} \quad g(x) = 3(2x + 1)$$

(a) Find $g(5)$

.....
(1)

(b) Find $gf(9)$

.....
(2)

(c) Find $g^{-1}(6)$

.....
(2)

.....
(Total for Question 19 is 5 marks)



20 For $x \geq 0$, the functions f and g are such that

$$f(x) = 3x + 4 \qquad g(x) = \frac{\sqrt{x} + 2}{5}$$

(a) Find $g^{-1}(x)$

$$g^{-1}(x) = \dots\dots\dots (2)$$

(b) Solve $gf(x) = 3$

$$x = \dots\dots\dots (3)$$

(Total for Question 20 is 5 marks)



16 The functions f and g are given by

$$f(x) = \frac{12}{x+1} \quad \text{and} \quad g(x) = 5 - 3x$$

(a) Find $f(-3)$

.....
(1)

(b) Find $fg(1)$

.....
(2)

(c) Find $g^{-1}(4)$

.....
(2)

(Total for Question 16 is 5 marks)



17 $g(x) = 1 - 3x$ $h(x) = 2x^2 - 1$

Show that $3gh(x) + hg(x) = 0$ has just one solution for x .

(Total for Question 17 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



18 The function f is given by

$$f(x) = 2x^3 - 4$$

(a) Show that $f^{-1}(50) = 3$

(2)

The functions g and h are given by

$$g(x) = x + 2 \quad \text{and} \quad h(x) = x^2$$

(b) Find the values of x for which

$$hg(x) = 3x^2 + x - 1$$

(4)

(Total for Question 18 is 6 marks)



21 The functions f and g are such that

$$f(x) = 3x^2 + 1 \quad \text{for } x > 0 \quad \text{and} \quad g(x) = \frac{4}{x^2} \quad \text{for } x > 0$$

(a) Work out $gf(1)$

.....
(2)

The function h is such that $h = (fg)^{-1}$

(b) Find $h(x)$

.....
(4)

.....
(Total for Question 21 is 6 marks)



21 The functions f and g are such that

$$f(x) = 3x - 1 \quad \text{and} \quad g(x) = x^2 + 4$$

(a) Find $f^{-1}(x)$

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

Given that $fg(x) = 2gf(x)$,

(b) show that $15x^2 - 12x - 1 = 0$

(5)

(Total for Question 21 is 7 marks)



MARK SCHEMES

official mark schemes, in the same order as the questions



Paper: 1MA1/1H																																					
Question	Working	Answer	Mark	Notes																																	
1	(a)	10,19	B1	cao																																	
	(b)	positive	C1	positive (correlation)																																	
	(c)	12 to 13	M1	for an appropriate line of best fit drawn, or a point marked at (x, 16.4) or a horizontal line drawn from 16.4 across to (x, 16.4) where x is in the range 12 to 13																																	
			A1	hours given in the range 12 to 13																																	
	(d)	explanation	C1	(yes) e.g. as the majority of points for high temperature appear when there are more hours of sunshine (positive correlation)																																	
2		$2 \times 2 \times 2 \times 7$	M1	for complete method to find prime factors; could be shown on a complete factor tree with no more than 1 arithmetic error																																	
			A1	accept $2^3 \times 7$																																	
3	21840 1638 23478 <table><tr><td></td><td>5</td><td>4</td><td>6</td></tr><tr><td>2</td><td><table><tr><td>2</td><td>0</td></tr><tr><td>1</td><td>5</td></tr></table></td><td><table><tr><td>1</td><td>6</td></tr><tr><td>1</td><td>2</td></tr></table></td><td><table><tr><td>2</td><td>4</td></tr><tr><td>1</td><td>8</td></tr></table></td><td>4</td></tr></table> <table><tr><td></td><td>500</td><td>40</td><td>6</td></tr><tr><td>40</td><td>20000</td><td>1600</td><td>240</td></tr><tr><td>3</td><td>1500</td><td>120</td><td>18</td></tr></table> $20000 + 1600 + 240 + 1500 + 120 + 18 = 23478$		5	4	6	2	<table><tr><td>2</td><td>0</td></tr><tr><td>1</td><td>5</td></tr></table>	2	0	1	5	<table><tr><td>1</td><td>6</td></tr><tr><td>1</td><td>2</td></tr></table>	1	6	1	2	<table><tr><td>2</td><td>4</td></tr><tr><td>1</td><td>8</td></tr></table>	2	4	1	8	4		500	40	6	40	20000	1600	240	3	1500	120	18	234.78	M1	for complete method with relative place value correct including addition of all the appropriate elements of the calculation e.g. two lines of 1 st method, internal numbers of grids, or complete structure shown of partitioning methods
	5	4	6																																		
2	<table><tr><td>2</td><td>0</td></tr><tr><td>1</td><td>5</td></tr></table>	2	0	1	5	<table><tr><td>1</td><td>6</td></tr><tr><td>1</td><td>2</td></tr></table>	1	6	1	2	<table><tr><td>2</td><td>4</td></tr><tr><td>1</td><td>8</td></tr></table>	2	4	1	8	4																					
2	0																																				
1	5																																				
1	6																																				
1	2																																				
2	4																																				
1	8																																				
	500	40	6																																		
40	20000	1600	240																																		
3	1500	120	18																																		
			A1	for digits 23478																																	
			A1	(ft dep M1) for correct placement of the decimal point into their final answer																																	
4		$x^2 + 6x = 1$	M1	writes the area using algebraic terms e.g. $(x + 3) \times (x + 3)$ or at least two correct area expressions which may be written on the diagram or x given as $\sqrt{10} - 3$																																	
			M1	expands and includes the given 10 e.g. $x^2 + 3x + 3x + 9 = 10$; condone one error in the four terms when expanding or $10 - 3\sqrt{10} - 3\sqrt{10} + 9 + 6\sqrt{10} - 18 (=1)$ condone 1 error in the 6 terms																																	
			A1	rearranges to give the given equation or shows surd expression simplifies to 1																																	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	Comparison	B1	for correctly identifying the median of (School) A as 57	If median for school B is stated in the comparison it must be correct
		C1	(ft, dep on value for the median being stated) for making a correct comparison of <u>median</u> eg 'the median of (School) A is higher than the median of (School) B'	
		B1	for correctly identifying the range of (School) A as 49	
		C1	(ft, dep on value for the range being stated) for making a correct comparison of <u>range</u> eg 'the range of (School) A is higher than the range of (School) B'	
7	10.2 and 10.3	B1	for 10.2 in the correct place	Accept 10.29 or 10.299(99...)
		B1	for 10.3 in the correct place	
8	14.3	M1	for a correct statement for AB using trigonometry, eg $\tan 62 = \frac{AB}{7.6}$ or $(AB =) 7.6 \times \tan 62$	If an answer is given in the range in working and then rounded incorrectly award full marks
		A1	answer in the range 14.28 to 14.3	
9	(a) $14x^5y^6$	B2	cao	Where a , x^b , y^c can be made up of two products Condone inclusion of multiplication signs for B1
	(b) m^{-6}	(B1)	for correct simplification of two terms ax^5y^6 or $14x^b y^6$ or $14x^5 y^c$ where $a \neq 14$, $b \neq 5$, $c \neq 6$	
		B1	for m^{-6} or $\frac{1}{m^6}$	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
10 (a)	1	B1	cao	
	(b) $\frac{8}{x-4}$	B1	cao	
	(c) $27n^{12}w^6$	B2 (B1)	cao for two of $27, n^{12}, w^6$ in a product	
11	Yes (supported)	P1	for process to find number of combinations, eg 5×8 oe (= 40) or for $240 \div 5$ (= 48) or $240 \div 8$ (= 30) or for $240 \div 5 \div 8$ (= 6) or $5 \times 8 \times x = 240$	
		C1	Yes and 6	
12 (a)	-0.09	M1	for suitable method to find gradient, eg $27 \div 300$	Any readings from the graph must be reasonable. Condone missing negative for M1 Can fit explanation linked to incorrect gradient in part (a)
		A1	for answer in the range -0.1 to -0.08 oe	
		C1	for explanation Acceptable examples volume of petrol used each km litres/km Rate of fuel consumption For every 9 litres you can travel 100km Not acceptable examples volume $\div$ distance volume of petrol used per distance km/litre as distance increases volume decreases	



Paper: IMA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	(a)	B1	cao	
	(b)	M1	for partial simplification, eg c or d^3	May be seen as simplification in original fraction
		A1	for cd^3	Accept c^1d^3
	(c)	M1	for $5x > 14$ or $5x = 14$ or critical value, $\frac{14}{5}$ oe	Must see carried out correctly, ie at least $5x > 7 \times 2$ not just intention seen. Allow other signs for this mark.
		A1	$x > \frac{14}{5}$ or $x > 2\frac{4}{5}$ or $x > 2.8$	
2	2 hours 45 minutes	P1	for $30 \div 24 (= 1.25)$ or $12 \div 8 (= 1.5)$	May be written in hours and/or minutes
		P1	for finding the sum of their two times eg “1.25” + “1.5” (= 2.75) or 165 (minutes)	or 3 h 15 min or 2 h 75 min
		A1	cao	
3	9.35, 9.45	B1	for 9.35 in the correct position	
		B1	for 9.45 in the correct position	Accept 9.449 oe or 9.4499...oe

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9	(a)	B1	cao	If the answer (for 2 marks) is seen in working and then rounded or truncated, award full marks.
	(b)	M1	for 10.5472×10^3 oe or 1.6×10^8 oe or 2.575×10^{-1} oe or for 6.592×10^n where $n \neq 5$ or for 6.59×10^5 or for 6.6×10^5 or for 659200 oe	
		A1	cao	
10	Explanation	C1	for full explanation indicating the problem with the negative signs Acceptable examples He should have $+2x + 4$ on the second line He should have done -4 and $-2x$ $3x - -2x = 5x$, not $1x$ Two minuses make a plus which he didn't account for Not acceptable examples He has not expanded the brackets Peter has to factorise first He did not collect the terms He didn't include the x^2	
11	5, 6, 7	M1	for identification of possible values of x (4,5,6,7) or of y (5,6,7,8,9)	Could be shown on a number line or using a Venn diagram This mark can be awarded for an answer of 4, 5, 6, 7 Answers may be given in any order.
		A1	cao	
12	1.2, 1.3	B1	for 1.2 in the correct position	Accept $1.2\dot{9}$ or 1.299... must be 9 recurring.
		B1	for 1.3 in the correct position	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	negative	B1	cao	Ignore any description of a relationship and any reference to strength of correlation
(b)	Explanation	C1	for a correct explanation, eg "not in line with the trend of the other points" "does not fit in with the correlation" "is far away from the other points or line of best fit"	
(c)	Comment	C1	for an explanation eg "point would be outside of the range of the scatter diagram"	
2	$9p + 13$	M1 A1	for method to expand one bracket, eg $5 \times p + 5 \times 3 (= 5p + 15)$ or $2 \times 1 - 2 \times 2p (= 2 - 4p)$ or $-2 \times 1 - 2 \times -2p (= -2 + 4p)$ cao	If an attempt is made to multiply by -2 in the second brackets then it must be done consistently.
3	Triangle of area 18	M1 A1	for a complete method to find area of trapezium eg $\frac{1}{2}(2 + 7) \times 4 (= 18)$ OR for a triangle drawn of area 36 OR for a triangle that would give an area ft their area of trapezium for a triangle drawn of area 18 eg base = 6, height = 6 or base = 9, height = 4	The value for the area of the trapezium must be clear for the ft to be checked. Accept use of dimensions that are not whole numbers as long as the intention is clear

Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
5		70.5	P1 P1 P1 P1 A1	starts process of Pythagoras e.g. $5^2 + 12^2$ complete process for Pythagoras e.g. $\sqrt{5^2 + 12^2}$ or $\sqrt{25 + 144}$ or $\sqrt{169}$ (=13) (dep P1 for Pythagoras) process of adding all the lengths e.g. $5 + 5 + 12 + 12 + "13"$ (=47) (indep) process of multiplying at least 2 lengths by 1.5 cao SC: any evidence of working with Pythagoras award the P1 or P2
6		comparison	M1 A1	starts to manipulate expression e.g. $3y = 9x - 6$ or $3y = 9x - 5$ gives equation(s) which can be used to show that the gradients of the two lines are the same e.g. $y = 3x - 5/3$
7		72	P1 P1 A1	for showing the process of 30×60 (=1800) or 20×54 (=1080) (dep P1) for showing the complete process e.g. (" 1800 " – " 1080 ") $\div 10$ concluding the answer is 72 (and not 66)
8 (a) (b)		0.00000797 6.3×10^7	B1 M1 A1	cao for partial calculation involving powers of 10 e.g. $0.63 \times 10^{5-3}$ or 6.3×10^n where $n \neq 7$ or for $n \times 10^8$ or for 63000000 cao
9		500	M1 A1	recognition of 1.2 or 120% oe eg $600 \div 1.2$ oe $x \times 1.2 = 600$ oe or $120\% = 600$ cao
10		$x^3 + 6x^2 + 11x + 6$	M1 M1 A1	for method to find the product of any two linear expressions (3 correct terms) e.g. $x^2 + x + 2x + 2$ or $x^2 + 2x + 3x + 6$ or $x^2 + x + 3x + 3$ for method of multiplying out remaining products, half of which are correct (ft their first product) e.g. $x^3 + x^2 + 2x^2 + 3x^2 + 2x + 3x + 6x + 6$ cao



Paper: 1MA1/1H					
Question	Answer	Mark	Mark scheme		Additional guidance
9	(a)	box plot drawn	B1	ends of whiskers at 0 and 42 with a box	The 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.
			B1	median at 10 inside a box	Has to be inside a box; whiskers not required
			B1	for ends of box at 4 and 20	An independent mark that can be awarded for just a box; do not need whiskers for this mark.
	(b)	Comparison	C1	for a correct comparison of medians, eg. the median delay time on Mon was greater than the median delay time on Tues. or ft (a)	Simply quoting values for median, range and IQR is insufficient, they must be compared
			C1	for a correct comparison of a measure of spread, eg. the interquartile range (range) of delay times on Mon was greater than the interquartile range (range) of delay times on Tues. or ft (a) For the award of both marks at least one of the comparisons must be in context	Comparisons can relate to the median, and then either the range or the IQR.
	(c)	statement	C1	‘No’ with statement explaining that there might not be any delays between 25 minutes and 30 minutes as in the upper 25% (12 trains) the delays may all be between 17 and 25 or 30 and 33	The ‘No’ may be implied from their wording, and could be written next to the “?” The statement must mention (or imply) values above the UQ of 17
10	(a)	$\frac{1}{5(x-1)}$	B1	for $\frac{1}{5(x-1)}$ or $\frac{1}{5x-5}$	
	(b)	$2(5+y)(5-y)$	M1	for partial factorisation, eg $2(25 - y^2)$ oe or $(10 + 2y)(5 - y)$ oe or $(5+ y)(10 - 2y)$ oe	
			A1	or $-2(y^2 - 25)$ oe for $2(5+y)(5-y)$ or $-2(5+y)(y-5)$	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	2.2	P1	works out interest for one year, eg $3550 \times 0.026 (= 92.3(0))$ or $3550 \times 1.026 (= 3642.3(0))$	If an answer in the range is seen in working and then incorrectly rounded award full marks
		P1	for compound interest calculation, eg $3550 \times 1.026^2 (= 3736.9\dots)$ or for an answer given as 0.0219... or 1.0219...	
		A1	answer in range 2.19 to 2.2	
14	7	M1	method to find number of combinations, eg 19×25 oe ($= 475$) or for $3325 \div 19 (= 175)$ or $3325 \div 25 (= 133)$	
		A1	cao	
15	$6x^3 - 23x^2 - 33x - 10$	M1	for method to find the product of any two linear expressions (3 out of no more than 4 terms correct with correct signs or 4 correct terms ignoring signs)	Note that, for example, $6x^2 + 7x$ or $7x + 2$ are regarded as three terms in the expansion of $(3x + 2)(2x + 1)$ First product must be quadratic but need not be simplified or may be simplified incorrectly
		M1	for method of multiplying out remaining products, half of which are correct (ft their first product)	
		A1	cao	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	$6x^3 + x^2 - 20x - 12$	M1 M1 A1	for method to find the product of any two linear expressions (3 out of no more than 4 terms correct with correct signs or 4 correct terms ignoring signs), eg. $6x^2 + 9x + 4x + 6$ or $3x^2 + 2x - 6x - 4$ or $2x^2 + 3x - 4x - 6$ for method of multiplying out remaining products, half of which are correct (ft their first product), eg. $6x^3 + 13x^2 - 12x^2 + 6x - 26x - 12$ cao	Note that, for example, $6x^2 + 13x$ or $13x + 6$ are regarded as three terms in the expansion of $(x - 2)(3x + 2)$ First product must be quadratic but need not be simplified or may be simplified incorrectly.
13	192 000	M1 A1	for $16 \times 120 \times 100$ oe cao	
14	25 with reasons	M1 M1 C2 (C1)	for method to find angle BCD eg $180 \div (3 + 1) (= 45)$ or $BAD = 180 \div (3 + 1) \times 3 (= 135)$ for method to find angle BDA eg $180 - 20 - (180 - "45") (= 25)$ or method to find angle SBD eg $SBD = BCD (= 45)$ for finding $SBA (= 25)$ and both reasons given, eg <u>Opposite angles</u> of a <u>cyclic quadrilateral</u> add up to 180 for angle $SBD = 45$ because <u>alternate segment</u> theorem (dep M1) for one reason given <u>Opposite angles</u> of a <u>cyclic quadrilateral</u> add up to 180 for angle $SBD = 45$ because <u>alternate segment</u> theorem)	Could be shown on the diagram or in working Do not award if it ambiguous as to which angle is being found Underlined words need to be shown; reasons need to be linked to their method

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	$(a - b)(a + b)$	B1	for $(a - b)(a + b)$ oe	
(b)	Relationship shown	M1	for factorising the expression, eg $(2^{20} - 1)(2^{20} + 1)$ or for $(2^{40} \div) (2^{20})^2$	Note that 1048575 and 1048577 earns 2 marks as an alternative approach
		C1	for explanation, eg 2^{20} is even so $2^{20} - 1$ and $2^{20} + 1$ are odd (leading to conclusion)	
16	Triangle at (6, -2) (4, 4) (8, 4)	M1	for the correct shape in the correct orientation in the wrong position or for two correct points	
		A1	cao	
17 (a)	16.5 to 19.5	M1	for tangent drawn at $t = 2.5$	The tangent must be seen to award any marks
		M1	dep (M1) for a complete method to find the gradient from tangent eg $(48 - 0) \div (4 - 1.4) (= 18.4...)$	
		A1	for answer in the range 16.5 to 19.5 or ft acceptable tangent	
(b)	Description	C1	eg speed or velocity	Award 0 marks for a correct answer (in the range) with no (or incorrect) supportive working "speed" may be expressed in a different way, eg distance per unit time (at that point) Award if extra information is given provided not contradictory.



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	65	P1	for a full process to find the volume of the container, eg $\pi \times 15^2 \times 43$ (= 30 394.9...)	These steps may be completed in a different order Accept 9675π
		P1	for a process to convert between cm^3 and litres, eg "30 394.9..." $\div 1000$ (= 30.39...) or [volume] $\div 1000$ or 0.47×1000 (= 470)	Accept 9.675π or $\frac{387}{40}\pi$
		P1	for a process to find the time taken, eg [volume] $\div 0.47$ or [volume] $\div$ "470"	[volume] can be any value they believe to be the volume that might have been incorrectly converted (or not at all)
		A1	answer in the range 64.6 to 65	If an answer is given in the range in working and then rounded incorrectly award full marks.
8	$1.85 \leq x < 1.95$	B1	for 1.85 in correct position	Accept 1.949 or 1.9499(...)
		B1	for 1.95 in correct position	
9	$x^3 + 8x^2 + x - 42$	M1	for a method to find the product of two linear expression (3 out of 4 terms correct or 4 correct terms ignoring signs), eg $x^2 - 2x + 7x - 14$ or $x^2 + 3x - 2x - 6$ or $x^2 + 3x + 7x + 21$	Note that (eg) $5x - 14$ in expansion of $(x + 7)(x - 2)$ is to be regarded as 3 correct terms.
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product), eg $x^3 + 3x^2 - 2x^2 + 7x^2 - 6x + 21x - 14x - 42$	First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		A1	cao	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
13 (a)	Histogram drawn	B3	for fully correct histogram with axes scaled and labelled	Relative heights 2, 3.5, 4.4, 2, 0.8
		(B2)	for 4 correct bars or for frequency ÷ class width for all 5 frequencies and 2 correct bars of different widths)	
		(B1)	for 2 correct bars of different widths or for frequency ÷ class width for at least 3 frequencies)	
		M1	for a method to find number of people in interval eg $\frac{1}{2} \times 70 + 22 + \frac{1}{3} \times 30 (= 67)$ or $150 - 20 - 8 - \frac{1}{2} \times 70 - \frac{2}{3} \times 30 (= 67)$ or $10 \times [3.5] + 5 \times [4.4] + 5 \times [2]$ ft their histogram	
(b)	$\frac{67}{150}$	A1	for $\frac{67}{150}$ or ft their histogram	Where [3.5], [4.4] and [2] are the heights of the bars of their histogram
14	$6x^3 - 23x^2 - 38x + 15$	M1	for method to find the product of any two linear expressions (3 out of 4 terms correct or 4 correct terms ignoring signs) eg $6x^2 + 9x - 2x - 3$ or $3x^2 - 15x - x + 5$ or $2x^2 - 10x + 3x - 15$	Note that, for example, $7x - 3$ in expansion of $(3x - 1)(2x + 3)$ is regarded as 3 correct terms Do not award this mark for eg $6x^2 + 9x - 2x - 3 + 3x^2 - 15x - x + 5$ First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $6x^3 + 7x^2 - 30x^2 - 35x - 3x + 15$ or $6x^3 + 9x^2 - 32x^2 - 48x + 10x + 15$ or $6x^3 - 2x^2 - 21x^2 - 45x + 7x + 15$	
		A1	cao	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	Shown	M1	for a method to find the product of any two linear expressions (3 out of 4 terms correct or 4 terms ignoring signs) eg $2x^2 - 2x + 3x - 3$ ($= 2x^2 + x - 3$) or $x^2 - x + 2x - 2$ ($= x^2 + x - 2$) or $2x^2 + 4x + 3x + 6$ ($= 2x^2 + 7x + 6$)	Note that, for example, $2x^2 + x$ in the expansion of $(2x + 3)(x - 1)$ is regarded as 3 correct terms
		M1	(dep on M1) for a complete method to obtain all terms, half of which are correct (ft their first product) eg $2x^3 - 2x^2 + 3x^2 + 4x^2 - 3x - 4x + 6x - 6$ or $2x^3 - 2x^2 + 4x^2 - 4x + 3x^2 - 3x + 6x - 6$ or $2x^3 + 4x^2 + 3x^2 + 6x - 2x^2 - 4x - 3x - 6$ or $2x^3 + 4x^2 + x^2 - 3x + 2x - 6$ or $2x^3 + 2x^2 + 3x^2 - 4x + 3x - 6$ or $2x^3 - 2x^2 + 7x^2 - 7x + 6x - 6$	First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		C1	for $2x^3 + 5x^2 - x - 6$ from correct working	Accept $a = 2, b = 5, c = -1, d = -6$ Condone $-1x$
14	27720	P1	for 15×14 ($= 210$) or 12×11 ($= 132$) or 15×12 ($= 180$)	If values given as probabilities can award P marks only
		P1	for a complete method eg $15 \times 14 \times 12 \times 11$	If a correct product seen and divided (by 2 or 4 or 24) award P marks
		A1	cao	
			SCB1 for an answer of 342 if P0 awarded	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	$(a - b)(a + b)$	B1	cao	Accept reversed brackets
(b)	$12(x^2 + 1)$	M1	for using ' a ' = $x^2 + 4$ and ' b ' = $x^2 - 2$ OR multiplying out both brackets, at least one fully correct	Correct 4 terms if not simplified or 3 terms if simplified
		M1	(dep) for a correct expression for (' a ' + ' b ')('' a ' - ' b '') with no additional brackets, simplified or unsimplified eg $(x^2 + 4 + x^2 - 2)(x^2 + 4 - x^2 + 2)$ or $(2x^2 + 2) \times 6$ OR ft for a correct expression without brackets, simplified or unsimplified eg $x^4 + 8x^2 + 16 - x^4 + 4x^2 - 4$	
		A1	for $12(x^2 + 1)$ or $12x^2 + 12$ oe	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	$x^2 - 4x - 45$	M1	for 3 of 4 terms correct or 4 terms correct ignoring signs	3 terms correct can be implied, eg $x^2 - 4x + c$
		A1	cao	
(b)	$3x(3x + 2)$	B2	for $3x(3x + 2)$	
		(B1	for $3(3x^2 + 2x)$ or $x(9x + 6)$ or $3x(ax + b)$ where a and b are integers or $(3x + 2)$ as a factor)	
2 (a)	157.668(255)	M1	for 836.4 or 5.304(809139) or 28.141 or a truncated or rounded version of 157.668255 to no less than 3 sf	Answer must be given to at least 3 decimal places rounded or truncated Accept a clear indication of the decimal point. Check first 3 decimal places only
		A1	for 157.668(255)	
(b)	157.7	B1	ft from part (a) provided answer to (a) has at least 5 sf	
3	35 to 42	M1	for drawing a suitable line of best fit or for a line from $x = 34$ or for a point marked on the grid at $(34, y)$, y in the range 33 to 44	Line at $x = 34$ does not have to be full length of grid but should be in or reach the data set. Acceptable values for the data set are $y = 33$ to $y = 44$
		A1	answer in the range 35 to 42	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	m^6	B1	cao	
(b)	x^{13}	B1	cao	
(c)	$4p^3 + 12p^2$	B2	for $4p^3 + 12p^2$	
		(B1	for expanding the bracket to get $p^3 + 3p^2$ or $4p^3$ or $12p^2$)	
2 (a)	11533	P1	for working with 68%, eg 800×0.68 (= 544 people) oe or “16960” $\times$ 0.68 oe	Percentage calculation could be done at any stage
		P1	for a correct process, other than that of finding a %, eg “544” $\times$ 2 (= 1088) or 10.6×2 (= 21.2) or 800×2 (= 1600) or “544” $\times$ 10.6 (= 5766.4) or 800×10.6 (= 8480)	
		P1	for full process to find amount of coffee required eg “1088” $\times$ 10.6 or “544” $\times$ “21.2” or “5766.4” $\times$ 2 (= 11532.8) or for an answer of 11532	
		A1	for answer in the range 11532.5 to 11533	An answer within the range shown in working but incorrectly rounded gets full marks.
(b)	Statement	C1	for a correct statement Acceptable examples the amount will be more he will need more coffee it is an underestimate my answer in part (a) means there would not be enough for everyone he will need 12211(.2) needs 678(.4) more Not acceptable examples amount will decrease amount of coffee will change	If figures are given as part of the answer they must be correct, but can allow ft.

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	x^{15}	B1	cao	
		M1	for method to expand one bracket, or collect like terms eg $4 \times x + 4 \times 3 (= 4x + 12)$ or $7 \times 4 - 7 \times 2x (= 28 - 14x)$ or $4 \times x - 7 \times 2x (= 4x - 14x)$ and $4 \times 3 + 7 \times 4 (= 12 + 28)$	
		A1	oe	
(b)	$40 - 10x$	M1	for method to expand one bracket, or collect like terms eg $4 \times x + 4 \times 3 (= 4x + 12)$ or $7 \times 4 - 7 \times 2x (= 28 - 14x)$ or $4 \times x - 7 \times 2x (= 4x - 14x)$ and $4 \times 3 + 7 \times 4 (= 12 + 28)$	Where $a \geq 1$ and $b \geq 1$
		A1	oe	
		M1	for $3(5x^3 + x^2y)$ or $x(15x^2 + 3xy)$ or $3x(5x^2 + xy)$ or $x^2(15x + 3y)$ or $3x^2(ax + by)$	
(c)	$3x^2(5x + y)$	A1	cao	
2	translation $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$	B1	for translation	Award no marks if more than one transformation is given
		B1	for vector $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$	Do not accept as a coordinate $(-5, 6)$
3	89.5 and 90.5	B1	for 89.5 in the correct position	Accept 90.49 or 90.499(...)
		B1	for 90.5 in the correct position	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	$\begin{pmatrix} -1 \\ 4 \end{pmatrix}$	M1 M1 A1	for $3\begin{pmatrix} 2 \\ -3 \end{pmatrix} - 2\mathbf{b} = \begin{pmatrix} 8 \\ -17 \end{pmatrix}$ oe or for $\begin{pmatrix} 6 \\ -9 \end{pmatrix}$ for $2\mathbf{b} = \begin{pmatrix} 3 \times 2 - 8 \\ 3 \times -3 - -17 \end{pmatrix} (= \begin{pmatrix} -2 \\ 8 \end{pmatrix})$ oe or $-2\mathbf{b} = \begin{pmatrix} 8 - 3 \times 2 \\ -17 - 3 \times -3 \end{pmatrix} (= \begin{pmatrix} 2 \\ -8 \end{pmatrix})$ oe or for one element correct, -1 or 4 cao (if M0 scored, SC B1 for $\begin{pmatrix} 1 \\ -4 \end{pmatrix}$)	Must see “ $2\mathbf{b} = \dots$ ” or “ $-2\mathbf{b} = \dots$ ” to award 2 marks One correct element scores 2 marks
14	(a) $4(p-3)(p+3)$ (b) $6m^3 + 11m^2 - 57m - 20$	M1 A1 M1 M1 A1	for $4(p^2 - 9)$ or partial factorisation which includes the product of 2 linear factors eg. $(4p - 12)(p + 3)$ or $(p - 3)(4p + 12)$ or $(2p - 6)(2p + 6)$ or $2(2p - 6)(p + 3)$ or $2(2p + 6)(p - 3)$ or $2(p - 3)2(p + 3)$ for $4(p - 3)(p + 3)$ for a method to find the product of two linear expressions, 3 correct terms out of 4 terms, eg. $6m^2 + 2m - 15m - 5 = 6m^2 - 13m - 5$ or $2m^2 + 8m - 5m - 20 = 2m^2 + 3m - 20$ or $3m^2 + 12m + m + 4 = 3m^2 + 13m + 4$ for a complete method to obtain all terms, at least half of which are correct (ft their first product), eg. $6m^3 + 2m^2 - 15m^2 + 24m^2 + 8m - 60m - 5m - 20$ for $6m^3 + 11m^2 - 57m - 20$	Note that, for example, $3m - 20$ is regarded as three terms in the expansion of $(m + 4)(2m - 5)$ First product must be a 3 or 4 term quadratic but need not be simplified or may be incorrect. Accept $a = 6$, $b = 11$, $c = -57$, $d = -20$

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	Statements	C1 C1	Makes reference to the fact that the label on the horizontal axis is missing Makes reference to the fact that the graph has not been plotted at the top end of the class intervals, eg has plotted at midpoints	
14	(a) $81x^{20}y^{24}$ (b) $x^3+3x^2-10x-24$	B2 (B1 M1 M1 A1)	cao for two of $81, x^{20}, y^{24}$) for method to find the product of any two linear expressions (3 out of 4 terms correct or 4 correct terms ignoring signs), eg $x^2 + 2x - 3x - 6$ or $x^2 + 2x + 4x + 8$ or $x^2 + 4x - 3x - 12$ for a complete method to find all terms, at least half of which are correct (ft their first product), eg $x^3 + 4x^2 + 2x^2 - 3x^2 + 8x - 6x - 12x - 24$ cao	Note that, for example $-x - 6$ in expansion of $(x + 2)(x - 3)$ is regarded as 3 correct terms. First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
15	Shown	M1 C1	for one correct product eg $7 \times 5 (= 35)$ or $13 \times 5 (= 65)$ or $7 \times 13 \times 5 (= 455)$ for showing three correct products added eg $35 + 65 + 455$	Ignore additional products There is no need to show the three products sum to 555



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
11 (a)	Explanation	C1	for explanation Acceptable examples the sum must be 5 and the product must be 6 she had the sum and the product the wrong way round it should be the other way around a and b must be multiplied together to make 6 Not acceptable examples the answer should be $(x + 3)(x + 2)$ the product of a and b is not 5	
(b)	$2(m - 1)(m + 1)$	M1	for a correct partial factorisation, eg $2(m^2 - 1)$ or $(2m - 2)(m + 1)$ or $(m - 1)(2m + 2)$	
		A1	cao	
(c)	$(a + b)(x - y)$	M1	for a correct partial factorisation, eg $x(a + b) - y(a + b)$ or $x(a + b) + y(-a - b)$ or $a(x - y) + b(x - y)$	
		A1	for $(a + b)(x - y)$ oe	
12	64 : 25	P1	for start of process to find ratio of lengths of A to B , eg $\sqrt[3]{64} (= 4)$ or $\sqrt[3]{125} (= 5)$ or 4 : 5	
		P1	for $\sqrt[3]{125} \div 2 (= 2.5)$ or $(\sqrt[3]{64})^2 (= 16)$	
		P1	for process to find ratio of areas of A to C , eg " 4^2 " : " 2.5^2 " ($= 16 : 6.25$)	
		A1	for 64 : 25 oe in form $a : b$ where a and b are integers	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
18 (a)	$6x^3 + 35x^2 + 58x + 21$	M1	for a method to find the product of two linear expressions, 3 correct terms out of 4 terms e.g. $2x^2 + x + 6x + 3$ or $3x^2 + 7x + 9x + 21$ or $6x^2 + 14x + 3x + 7$	Note that, for example, $7x + 3$ is regarded as three terms in the expansion of $(2x + 1)(x + 3)$
		M1	for a complete method to obtain all terms, at least half of which are correct (ft their first product) e.g. $6x^3 + 32x^2 + 42x + 3x^2 + 16x + 21$	First product must be a 3 or 4 term quadratic but need not be simplified or may be simplified incorrectly
		A1	cao	Accept $a = 6, b = 35, c = 58, d = 21$
	$\frac{2}{5} < x < 1\frac{3}{5}$	M1	for first step of finding the square root of both sides eg $1 - x < \pm \frac{3}{5}$ OR for writing in the form $ax^2 + bx + c (< 0)$ eg $x^2 - 2x + \frac{16}{25} (< 0)$ or $25x^2 - 50x + 16 (< 0)$	Condone use of an “=” sign; accept one square root (eg $\frac{3}{5}$) only shown.
		M1	for showing critical values $\frac{2}{5}$ (= 0.4) and $1\frac{3}{5}$ (= 1.6) oe	Critical values can be stated, or shown in an expression (which may have incorrect inequality symbols)
		A1	for $\frac{2}{5} < x < 1\frac{3}{5}$ oe	Could be written as two separate expressions eg $x > \frac{2}{5}$ and $x < 1\frac{3}{5}$ oe

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	$13y - 1$	M1	for method to expand one bracket or collect like terms, eg $3 \times 2y - 3 \times 5$ ($= 6y - 15$) or $7 \times y + 7 \times 2$ ($= 7y + 14$) or $3 \times 2y + 7 \times y$ ($= 6y + 7y$) or $3 \times -5 + 7 \times 2$ ($= -15 + 14$)	May be implied by $13y$ or -1
		A1	oe	
		B2	oe	
		(B1	for $3(2x^2 + 5x)$ or $x(6x + 15)$ or $3x(ax + b)$)	
		M1	for correct first step to rearrange, eg $f - 11 = 3g + 11 - 11$ or $f - 11 = 3g$ or $\frac{f}{3} = \frac{3g}{3} + \frac{11}{3}$ or $-3g = 11 - f$ or answer ambiguously shown, eg $g = f - 11 \div 3$ or given as $\frac{f - 11}{3}$	
2	35	A1	oe	May be seen in different equivalent forms
		P1	for process to find income and outgoings, eg $7.5(0) \times 54$ ($= 405$) and $100 + 120 + 80$ ($= 300$)	
		P1	For process to find the profit, eg “405” – “300” ($= 105$) or “405” $\div$ “300” ($= 1.35$) or “405” $\div$ “300” $\times 100$ ($= 135$)	
		P1	for a full process to find percentage profit, eg (“105” $\div$ “300”) $\times 100$ or (“1.35” – 1) $\times 100$ or “135” – 100	
		A1	cao	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	$\frac{a-3}{5}$	B1	for $\frac{a-3}{5}$ oe	
(b)	$(3k-1)(k+4)$	M1	for $(3k \pm 1)(k \pm 4)$ oe or for brackets which when expanded give 2 out of 3 terms correct	Accept $3k(k+4) - (k+4)$ Accept $k(3k-1) + 4(3k-1)$
		A1	cao	Accept $(1-3k)(-k-4)$
(c)	$\frac{2-x}{x}$	M1	for factorisation eg $(4-x^2 \Rightarrow) (2-x)(2+x)$ and $(x^2+3x \Rightarrow) x(x+3)$ or for inversion and multiplication (condone incorrect factorising) eg $\frac{4-x^2}{x^2+3x} \times \frac{x+3}{x+2}$ oe	
		M1	for factorisation of both quadratics and inversion and multiplication, eg $\frac{(2-x)(2+x)}{x(x+3)} \times \frac{x+3}{x+2}$ allow sign errors in one bracket	
		A1	for $\frac{2-x}{x}$ or $\frac{2}{x} - 1$	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	72	M1 A1	for $\frac{5}{30} = \frac{12}{p}$ oe, eg $\frac{12}{p} \times 30 = 5$ or $12 \div \frac{5}{30}$ or $5 : 30 = 12 : p$ or 1 in 6 ($30 \div 5$) counters are yellow, so $12 \times "6"$ or using equivalent ratios to $5 : 30$, eg. $2 : 12$ and $10 : 60$ and adding to give $2 + 10 : 12 + 60$ cao	
12	Mistake identified	C1	for a correct mistake identified Acceptable examples all three terms should be multiplied by 2 and not just two of them the 5 should be multiplied by 2 it should be $2 \times T = q + 2 \times 5$ should subtract 5 first (before multiplying by 2) Not acceptable examples Should remove the 5 first $2 \times T$ should be $2T$ should have got rid of the denominator	Accept answers showing a correct first step
13 (a)	$\frac{17x+2}{3x(x+1)}$	M1 A1	for a correct common denominator with at least one correct numerator eg. $\frac{5 \times 3x}{3x(x+1)} + \frac{2(x+1)}{3x(x+1)}$ for a single simplified fraction, eg. $\frac{17x+2}{3x(x+1)}$ or equivalent eg. $\frac{17x+2}{3x^2+3x}$	$\frac{15x+2(x+1)}{3x(x+1)}$ gets M1 only
(b)	$(x+y)(x+y+3)$	B1	cao	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
10	$k = 2m - y^2$	M1 A1	correct first step of showing an intention to square both sides with no algebraic ambiguity in any resulting statements, eg $y^2 = 2m - k$ for $k = 2m - y^2$	
11	(a) Explanation (b) Comparison	C1 C1	eg 'No' the median is 57 (ft) a correct comparison of medians eg the median weight for Megan was greater than the median weight for Amy a correct comparison of a measure of spread eg the interquartile range of weights for Megan was greater than the interquartile range of weights for Amy For the award of both marks at least one of the comparisons must be in the context of the question	Simply quoting values for median, range and IQR is insufficient, they must be compared Median Range IQR Megan 57 49 26 Amy 42 47 16 Figures given must be correct. Comparisons can relate to the range or the IQR
12	32.1	P1 P1 P1 A1	starts process, eg $\sin 40 = \frac{DB}{8.6}$ oe or for $8.6 \times \sin 40 (=5.52797\dots)$ complete process to find ED , eg $(8.6 \times \sin 40) \div 2 (=2.76\dots)$ process to find angle EAD , eg $\tan^{-1}\left(\frac{2.76\dots}{4.4}\right)$ or $\tan^{-1}("0.628\dots")$ answer in range 32.09 to 32.2	Accept values rounded or truncated to 2 dp. If an answer in the range is seen in working and then incorrectly rounded award full marks



Paper: 1MA1/3H																								
Question	Answer	Mark	Mark scheme	Additional guidance																				
1	$a = \frac{p+9}{3}$	M1 A1	for correct first step to rearrange, eg $p + 9 = 3a - 9 + 9$ or $\frac{p}{3} = \frac{3a-9}{3}$ oe or answer ambiguously shown eg $a = p + 9 \div 3$ or answer given as $\frac{p+9}{3}$ oe oe	May be seen in different equivalent forms but must be carried out, not just intention seen.																				
2	Description	C1	Identifies a mistake in the working Acceptable examples Rob should divide by 8 He should have added the 3 and 5 first He divided 120 by 3 and 5 instead of 8 He did not do it as $120 \times \frac{3}{8}$ and $120 \times \frac{5}{8}$ He did not add the two ratios first Not acceptable examples He has done it in two parts but he should do it in one The answer should be 45 : 75 They do not add up to 120 He is supposed to add his numbers 40 + 24 does not equal 120																					
3	22	P1 P1 A1	for process to find total German eg $200 - 104 - 70 (= 26)$ for complete process to find boys choosing Spanish eg $90 - (60 + ("26" - 18))$ cao	for process to find girls choosing French, eg $104 - 60 (= 44)$ or girls total, eg $200 - 90 (= 110)$ for complete process to find boys choosing Spanish eg $70 - ("110" - "44" - 18)$ <table border="1"><tr><td></td><td>F</td><td>S</td><td>G</td><td>total</td></tr><tr><td>girls</td><td>44</td><td>48</td><td>18</td><td>110</td></tr><tr><td>boys</td><td>60</td><td>22</td><td>8</td><td>90</td></tr><tr><td>total</td><td>104</td><td>70</td><td>26</td><td>200</td></tr></table>		F	S	G	total	girls	44	48	18	110	boys	60	22	8	90	total	104	70	26	200
	F	S	G	total																				
girls	44	48	18	110																				
boys	60	22	8	90																				
total	104	70	26	200																				

Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
14	$ky - y = x + kx$ $y(k-1) = x(1+k)$	$y = \frac{x(k+1)}{k-1}$	M1 M1 A1	$y + x = k(y - x)$ or $\frac{y+x}{y-x} = k$ oe For isolating x and y on opposite sides eg $ky - y = x + kx$ Completing correct algebraic reasoning to reach conclusion
15		Proof to reach $\frac{24}{55}$	M1 M1 A1	for $100x = 43.636\ldots (43.\dot{6}\dot{3})$ or $10x = 4.3636\ldots (4.\dot{3}\dot{6})$ and $1000x = 436.36\ldots (436.\dot{3}\dot{6})$ (dep) for finding difference that would lead to a terminating decimal for completing algebra to reach $\frac{24}{55}$
16		$\frac{7}{3}$	M1 M1 A1	for $y = k\sqrt[3]{x}$ oe or $\frac{7}{6} = \sqrt[3]{8}k$ oe for $k = \frac{7}{6 \times \sqrt[3]{8}}$ oe for $\frac{7}{3}$ oe
17		Completes proof	M1 C1	Expands both expressions eg $\frac{1}{2}(n^2 + n + n^2 + n + 2n + 2)$ or $n^2 + n$ and $n^2 + n + 2n + 2$ or factorises $\frac{1}{2}(n+1)(n+n+2)$ Completes proof with explanation and reference to $(n+1)^2$

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$m = \frac{f+4}{f-3}$	M1	for multiplying both sides by $m-1$, eg. $f(m-1) = 3m+4$	Condone missing brackets for this mark only
		M1	(dep) for a method to rearrange the formula to isolate terms in m in a correct equation, eg. $fm - 3m = f + 4$ or $-fm + 3m = -f - 4$	
		A1	for $m = \frac{f+4}{f-3}$ or eg $m = \frac{-f-4}{-f+3}$	
16	$y = -\frac{3}{4}x - \frac{11}{4}$	M1	for identifying gradient of $\frac{4}{3}$	Ignore constant term
		M1	for beginning a method to find the gradient of the perpendicular line eg $\frac{4}{3} \times m = -1$ or identifies gradient of perpendicular line as $-\frac{3}{4}$	Can fit providing gradient is clearly stated
		A1	for $y = -\frac{3}{4}x - \frac{11}{4}$ or any equivalent equation	$4y + 3x = -11$ $y + 5 = -\frac{3}{4}(x-3)$



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9	$y = -2x + 3$	M1 M1 A1	for a correct method to find the gradient of the line, eg $\frac{-1-3}{2-0}$ ($= -2$) or uses 3 as the intercept in $y = mx + c$, eg $y = mx + 3$ oe, $y = 1.5x + 3$ for $y = [-2]x + c$, $c \neq 0$ or for (L $\Rightarrow$) $3 - 2x$ or uses their gradient and a point on the line, eg $y - -1 = [-2](x - 2)$ for $y = -2x + 3$ oe	 [−2] must be identifiable as their gradient Any correct equation gets 3 marks
10	$m = \frac{5(k-p)}{2}$	M1 M1 A1	for a correct first step, eg $k - p = \frac{2m}{5}$ or $5k = 5p + 2m$ or $\frac{k}{2} = \frac{p}{2} + \frac{m}{5}$ for a correct statement isolating $2m$, $-2m$, $\frac{m}{5}$ or $-\frac{m}{5}$ eg $5(k - p) = 2m$ or $5k - 5p = 2m$ or $\frac{m}{5} = \frac{k}{2} - \frac{p}{2}$ for $m = \frac{5(k-p)}{2}$ oe	Steps must be carried out not just intention seen Accept statements with m on the right hand side, eg $\frac{5(k-p)}{2} = m$

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
2 (a)	Mistake identified	C1	for identifying the mistake Acceptable examples $p - 5$ should be multiplied by 3 $(-)5$ should be multiplied by 3 All of left side / everything should be multiplied by 3 He failed to multiply the 5 as well He should have / didn't put brackets around the $p - 5$ (The $3p - 5$) should be $3p - 15$ (The $- 5$) should be $- 15$ / (the 5) should be 15 (The answer should be) $m = 3p - 15$ / $m = 3(p - 5)$ He only times the p by 3 Not acceptable examples The first line should be $3p = m + 5$ He should have multiplied everything Ben didn't divide $p - 5$ by 3 He failed to multiply the $p - 5$ He failed to multiply the $(-)5$ He only times the p He should have multiplied by 3 first He only multiplied one side by 3 He needs to get rid of the fraction Should have used brackets Just circling the $3 \times p - 5$ and / or the $m = 3p - 5$ Needs to multiply the 5 by -3 He should have done $p - 5 \times 3$	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
(b)	$2xy(x^2 + 2y)$	B2 (B1)	for $2xy(x^2 + 2y)$ oe eg $2(x^2 + 2y)xy$ for $2x(x^2y + 2y^2)$ or $2y(x^3 + 2xy)$ or $xy(2x^2 + 4y)$ or for correctly identifying the HCF in the factorisation of the form $2xy(ax^2 \pm \dots)$ or $2xy(\dots \pm by)$ where a and b are integers or $(x^2 + 2y)$ as a factor eg $2x(x^2 + 2y)$	... can be numerical or algebraic but not equal to 0 or absent



Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	9	M1 A1	for a correct first step, using the laws of indices to simplify eg. 3^2 or $3^{7+ -2}$ or 3^{7-3} or 3^{-2-3} OR for using exact values, eg. $2187 \times \frac{1}{9}$ (= 243) or $2187 \div 27$ (= 81) or $\frac{1}{27 \times 9}$ (= $\frac{1}{243}$) cao	
2	(a) 6 or -6	M1 A1	for $12^2 + 2 \times -3 \times 18$ (= 36) for 6 or -6, accept ± 6	Terms may be partially evaluated. Only one value is required for full marks
	(b) $s = \frac{v^2 - u^2}{2a}$	M1 A1	for subtracting u^2 from both sides or dividing all terms by $2a$ as the first step $s = \frac{v^2 - u^2}{2a}$ oe	Must see this step carried out, not just the intention shown

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	$f = \frac{4d+3}{d+3}$	M1 M1 M1 A1	for clearing the fraction eg $d(f-4) = 3(1-f)$ or $df-4d = 3-3f$ (dep M1) for isolating f terms in a correct equation eg $df+3f = 3+4d$ (dep on two terms in f) for factorising eg $f(d+3) = 3+4d$ oe	Condone error in expansion of RHS for this mark
18	20	P1 P1 A1	for a statement of proportionality eg $x = k\sqrt{y}$ or 1.44 oe for using $\sqrt{1.44}$ as multiplier eg $(x_2 \Rightarrow) k\sqrt{1.44}y$ or 1.2 oe cao	Must be written in the form of an equation with a constant term, accept $x \propto k\sqrt{y}$

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	$\frac{30w}{6-21w}$	P1 <		

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	7.5	M1 A1	for correct use of Pythagoras, eg. $8.5^2 - 4^2 (= 56.25)$ or $4^2 + x^2 = 8.5^2$ for 7.5 or $7\frac{1}{2}$ or $\frac{15}{2}$	Must have values substituted Trigonometry may be used but M1 only awarded when complete method shown.
2 (a)	25	M1 A1	for $(T =) 4 \times (-3)^2 - 11$ or $4 \times (-3)^2 = 36$ cao	Can accept missing brackets.
(b)	$p = \frac{d-4}{3}$ oe	M1 A1	for a correct first step, eg. $d - 4 = 3p$ or $\frac{d}{3} = p + \frac{4}{3}$ or for $\frac{d-4}{3}$ as answer for $p = \frac{d-4}{3}$ oe	May be in unsimplified form, eg $d - 4 = 3p + 4 - 4$
3	1.5	P1 P1 P1 P1 A1	for process to develop 3 algebraic expressions, eg. (R =) n , (S =) $2n$, (T =) $2n - 6$, oe, at least two must be correct. or for selecting 3 values satisfying the given criteria, eg. (R =) 10, (S =) 20, (T =) 14 for process to sum 3 algebraic expressions and equating to 54, eg. $n + "2n" + "2n - 6" = 54$ or for finding the correct sum of their values eg. $"10" + "20" + "14" = 44$ for start of process to solve the correct linear equation, eg. $5n = 54 + 6$ ($n = 12$) or for 12, 24, 18 for $"12" : 2 \times "12" - 6$ oe eg 12 : 18 oe or 18 : 12 linked to T, R for 1.5 or $\frac{3}{2}$ or $1\frac{1}{2}$	Accept 1 : 1.5 etc as answer

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	$10\sqrt{2}$	P1	for process to find total surface area of sphere, eg $75\pi \div 3 \times 8 (= 200\pi)$ or $75 \div 3 \times 8 (= 200)$ or for setting up an equation, eg $\frac{3}{8} \times 4\pi r^2 = 75\pi$ or $\frac{3}{8} \times 4r^2 = 75$	Could work without π for the three P marks
		P1	for process to find r^2 , eg $(r^2 =) \frac{200\pi}{4\pi}$ oe or $(r^2 =) \frac{75\pi}{4\pi} \times \frac{8}{3}$ oe or $r^2 = "50"$	
		P1	for process to find radius, eg $(r =) \sqrt{\frac{200\pi}{4\pi}}$ oe or $\sqrt{"50"}$ or $5\sqrt{2}$ or for $(2r =) \sqrt{"200"}$	
		A1	cao	
17	$x = \frac{3y+28}{8-5y}$	M1	for clearing the fraction eg $y(5x+3) = 4(2x-7)$ or $5xy+3y = 8x-28$	Condone error in expansion of RHS for this mark
		M1	(dep M1) for isolating x terms in a correct equation eg $3y+28 = 8x-5xy$	
		M1	(dep on two terms in x) for factorising eg eg $x(8-5y) = 3y+28$	
		A1	for $x = \frac{3y+28}{8-5y}$ oe eg $x = \frac{-3y-28}{5y-8}$	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
14	Shown	M1 M1 C1	for start to find multiples of x with the same recurring pattern eg for ($10x \Rightarrow$) 4.626262... or ($100x \Rightarrow$) 46.262626... or ($1000x \Rightarrow$) 462.626262... (dep on M1) for a correct subtraction that would lead to a terminating decimal, eg ($1000x - 10x = 462.6262... - 4.6262... (= 458)$) or ($100x - x = 46.2626 ... - 0.4626... (= 45.8)$) for correct working leading to the correct answer	Any recurring notation acceptable throughout. Proofs with terminating decimals (at least 5 figures) score M1M1C0
15	$p = \frac{5t+6}{4+2t}$	M1 M1 M1 A1	for clearing the fraction eg $t(5-2p) = 2(2p-3)$ or $5t - 2pt = 4p - 6$ (dep M1) for isolating p terms in a correct equation eg $4p + 2pt = 5t + 6$ (dep on two terms in p of the form ap + bpt) for factorising eg $p(4+2t) = 5t + 6$ for $p = \frac{5t+6}{4+2t}$ or $p = \frac{5t+6}{2(2+t)}$ oe eg $p = \frac{-6-5t}{-4-2t}$	Condone error in expansion of RHS for this mark a and b are non zero integers

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	0.12	P1 P1 A1	for process to start eg $(1 - 0.2) \div (3 + 17)$ (= 0.04) or $(3 + 17) \div (1 - 0.2)$ oe (= 25) or $(100 - 20) \div (3 + 17)$ (= 4) or 3×4 (= 12) and 17×4 (= 68) full process to find the required probability eg $3 \times "0.04"$ or $\frac{3}{20} \times (1 - 0.2)$ oe or $3 \div "25"$ or $3 \times "4" \div 100$ oe	Just $1 - 0.2 = 0.8$ is not sufficient for P1 May be seen in a ratio 0.12 using incorrect probability notation gets P2
17	$\frac{3x+1}{2x}$	M1 A1 A1	for $(3x+1)(x-3)$ or $2x(x-3)$ for $(3x+1)(x-3)$ and $2x(x-3)$ $\frac{3x+1}{2x}$ oe	Accept $(2x+0)$ for the first two marks but not for the final answer
18	Graph drawn	C2 (C1)	for graph translated by -2 in the y direction for a graph translated in the y direction OR for a correct graph through four of the five key points)	Key points: $(-180, -2)$, $(-90, -3)$, $(0, -2)$, $(90, -1)$, $(180, -2)$

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$\frac{26x+15}{10x}$	M1 M1 A1	for method to write at least one of the fractions with a suitable denominator, eg $\frac{4x+3}{2x} \times \frac{5}{5} (= \frac{20x+15}{10x})$ or $\frac{3}{5} \times \frac{2x}{2x} (= \frac{6x}{10x})$ for method to combine the fractions, eg $\frac{5(4x+3)}{5 \times 2x} + \frac{3 \times 2x}{5 \times 2x}$ or $\frac{5(4x+3)+3 \times 2x}{5 \times 2x}$ or $\frac{20x+15}{10x} + \frac{6x}{10x}$ for correct algebra leading to $\frac{26x+15}{10x}$ oe in form $\frac{ax+b}{cx}$	
16	$\frac{180}{336}$	P1 P1 P1 A1	for $\frac{3}{7}$ or $\frac{4}{7}$ or $\frac{5}{7}$ as probability for second counter for one correct product eg $\frac{3}{8} \times \frac{5}{7} \times \frac{4}{6} (= \frac{60}{336})$ or $\frac{5}{8} \times \frac{3}{7} \times \frac{4}{6} (= \frac{60}{336})$ or $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} (= \frac{60}{336})$ for a complete process eg $\frac{3}{8} \times \frac{5}{7} \times \frac{4}{6} + \frac{5}{8} \times \frac{3}{7} \times \frac{4}{6} + \frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}$ oe, eg $\frac{15}{28}$ SC B1 for answer of $\frac{225}{512}$ (replacement)	May be seen in a calculation or on a diagram Accept equivalent fractions, decimals (0.53... or 0.54) or percentages (53% or 54%)



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	$1 - \left(\frac{1}{2}\right)^n - \left(\frac{1}{2}\right)^n$	M1 A1	for $\left(\frac{1}{2}\right)^n$ oe oe eg $1 - \left(\frac{1}{2}\right)^{n-1}$	
21 (a)	19.1	M1 M1 A1	for a method to find an estimate for the area of at least 1 trapezium under the curve eg $0.5 \times 1 \times (4 + 6)$ or $0.5 \times 1 \times (6 + 7.2)$ or $0.5 \times 1 \times (7.2 + 7.8)$ for a complete method eg $0.5 \times 1 \times (4 + 6) + 0.5 \times 1 \times (6 + 7.2) + 0.5 \times 1 \times (7.2 + 7.8)$ or $0.5 \{(4 + 7.8) + 2(6 + 7.2)\}$ cao	Allow a maximum of 2 errors in y values used Ignore any reference to units
(b)	Statement	C1	eg distance (travelled)	If units are given they must be correct
22	$\frac{1}{x(x+4)}$	M1 M1 A1	inverting the fraction and multiplying eg $\frac{6x^3}{(9x^2-144)} \times \frac{3(x-4)}{2x^4}$ for factorising $9x^2 - 144$, eg $(3x - 12)(3x + 12)$ cao	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
21	$(7, -196)$ supported	P1 P1 A1	for process as far as $4(x^2 - 14x)$ or $(2x - 14)^2 + c$ or for $(x - 7)^2 - 49$ for full process to complete the square eg $4((x - 7)^2 - 49)$ or $(2x - 14)^2 - 196$ for conclusion from correct use of completing the square	c may be 0
22	$a = 4$ $b = 110$	M1 M1 A1	for writing at least one of the 3 terms with a denominator of $(x^2 - 25)$ or $(x - 5)(x + 5)$ eg. $\frac{(2x+3)(x+5)}{x^2-25}$ oe or $\frac{(x-4)(x-5)}{x^2-25}$ oe or $\frac{3(x^2-25)}{x^2-25}$ oe for $\frac{(2x+3)(x+5)}{x^2-25} + \frac{(x-4)(x-5)}{x^2-25} - \frac{3(x^2-25)}{x^2-25}$ oe or for $\frac{3x^2+4x+35}{x^2-25} (-3)$ or for $\frac{[3x^2+4x+35]}{x^2-25} - \frac{3(x^2-25)}{x^2-25}$ oe for $a = 4$ and $b = 110$	Students may work with a denominator of $(x - 5)(x + 5)$ for the award of the first 2 marks.
23	(a) Sketch (b) $y = -g(x)$	B1 B1	for appropriate sketch which crosses the x axis at $(-3, 0)$, $(-1, 0)$, $(0, 0)$ and passes through $(-2, 2)$ with end points in the correct square oe	Allow some tolerance on the points and in drawing the curve if the intention is clear Accept $-y = g(x)$



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	58.5	P1 P1 P1 A1	for start of process to find angle BCA , eg $\frac{18}{\sin 70} = \frac{15}{\sin BCA}$ or $\frac{\sin 70}{18} = \frac{\sin BCA}{15}$ for rearrangement, eg $(\sin BCA =) \frac{15 \sin 70}{18}$ ($= 0.783\dots$) oe or $BCA = 51.5\dots$ for complete process to find angle BAC , eg $180 - 70 - \sin^{-1}\left(\frac{15 \sin 70}{18}\right)$ for answer in the range 58.4 to 58.5	Angle BCA must be correctly identified to gain marks $\sin 70 = 0.939\dots$ $\sin 70 \div 18 = 0.052\dots$ $18 \div \sin 70 = 19.1\dots$ If an answer is given in the range in working and then rounded incorrectly award full marks.
14	$\frac{x+2}{2x+1}$	M1 M1 A1	for correctly factorising one expression, eg $(x-3)(x+2)$ or $(x-3)(2x+1)$ for factorising both expressions, eg $(x-3)(x+2)$ and $(x-3)(2x+1)$ oe or $a=1, b=2, c=2, d=1$	eg $\frac{2+x}{1+2x}, \frac{-x-2}{-2x-1}$

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	Shown	M1	for a method to find the product of two linear expressions (3 out of 4 terms correct or 4 correct terms ignoring signs) eg $x^2 + 3x - x - 3$ or $x^2 + 3x - 5x - 15$ or $x^2 - 5x - x + 5$	Note that (eg) $2x - 3$ in expansion of $(x - 1)(x + 3)$ is to be regarded as 3 correct terms. First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $x^3 - 5x^2 - 10x + 2x^2 - 3x + 15$	
		A1	for $x^3 - 3x^2 - 13x + 15$ shown, accept $x^3 + -3x^2 + -13x + 15$	
13	Proof	M1	for giving a general term for a consecutive triangular number eg $\frac{(n+1)(n+2)}{2}$ or $\frac{(n-1)n}{2}$	
		M1	for $\frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$ or $\frac{(n-1)n}{2} + \frac{n(n+1)}{2}$ oe	
		C1	for completing the proof to show a square number, eg $(n + 1)^2$ or n^2	
14	19.9	P1	for substituting into the cosine rule to find OB , eg $(OB)^2 = 9^2 + 6^2 - 2 \times 9 \times 6 \times \cos 35$	May be implied by $OB = 5.34...$ Values may be rounded or truncated. If a correct answer within the range is shown in working but incorrectly rounded award full marks.
		P1	for using correct order of operations eg $81 + 36 - 88.46...$ (= 28.5...)	
		P1	for process to find the area of the sector, eg $\frac{80}{360} \times \pi \times "5.34..."^2$	
		A1	for answer in the range 19.8 to 20	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	shown	M1	for use of a common denominator for 2 correct fractions, eg 2 of $\frac{6x-y}{10xy}$ or $\frac{5y}{10xy}$ or $\frac{2(2y-7x)}{10xy}$ oe	If seen in steps all arithmetic must be correct
		M1	for a correct method to write as single fraction, eg $\frac{6x-y}{10xy} + \frac{5y}{10xy} - \frac{4y-14x}{10xy}$ or $\frac{6x-y}{10xy} + \frac{5y}{10xy} - \frac{(4y-14x)}{10xy}$ or $\frac{6x-y+5y-4y+14x}{10xy}$ or $\frac{20x}{10xy}$ oe	
		C1	for correct working leading to $\frac{2}{y}$	



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
17		66.5	B1 P1 P1 P1 A1	for recognising an angle of 60 at AOB for a process to find the area of the sector, e.g. $\frac{60}{360} \times \pi \times 11^2$ (= 63.3.. or $\frac{121\pi}{6}$) for a process to find the area of the triangle, e.g. $\frac{1}{2} \times 7^2 \times \sin "60"$ (=21.2.. or $\frac{49\sqrt{3}}{4}$) for a process to find the required percentage, eg. $\frac{"63.3.."-"21.2.."}{"63.3.."} \times 100$ for answer in the range 66.5 to 66.6
18		1.45	P1 P1 A1 P1 A2	for converting to a common base with at least one correct conversion, eg. $(16 \Rightarrow) 2^4$ or $(8 \Rightarrow) 2^3$ (dep) for correct use of index laws to derive an equation, eg. $4 \times \frac{1}{5} + x = 3 \times \frac{3}{4}$ oe for 1.45 oe (accept $2^{1.45}$) OR for a process to find the value of 2^x , eg. $8^{\frac{3}{4}} \div 16^{\frac{1}{5}} = 2.73...$ for 1.45 oe (accept $2^{1.45}$)
19		$a = 4, b = -42$	M1 M1 M1 A1	for at least two terms from $2(x-3)(x+3)$, $(x+2)(x+3)$, $(x-6)(x-3)$ (dep) for the correct expansion of at least two expressions, irrespective of signs, eg. $2x^2 - 18$, $x^2 + 2x + 3x + 6$, $x^2 - 6x - 3x + 18$ oe for $2x^2 - 18 - x^2 - 5x - 6 - x^2 + 9x - 18$ for $a = 4, b = -42$ (accept $4x - 42$)



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	$\frac{7x-13}{x-2}$	B1	for factorising eg $(x+5)(x-2)$	
		M1	for a method to divide $(x+5)$ by the algebraic fraction eg $(x+5) \times \frac{(x-1)}{x^2+3x-10}$	Condone incorrect factorising
		M1	for finding 2 fractions with a common denominator or a single fraction eg $\frac{6(x-2)}{x-2} + \frac{(x-1)}{x-2}$ or $\frac{6(x-2)+(x-1)}{x-2}$ or $\frac{6(x^2+3x-10)}{x^2+3x-10} + \frac{(x+5)(x-1)}{x^2+3x-10}$ or $\frac{6(x^2+3x-10)+(x+5)(x-1)}{x^2+3x-10}$	Condone incorrect factorising
		A1	$\frac{7x-13}{x-2}$	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
22	7x	M1	multiplication by reciprocal, eg $\frac{7(x-2)}{(x-2)(x+6)} \times \frac{x(x+6)(x-6)}{x-6}$	Independent mark, may be awarded at any point
		M1	for factorising the numerator or denominator of the 1 st fraction, eg $\frac{7(x-2)}{(x-2)(x+6)}$ or $\frac{7(x-2)}{x^2+4x-12}$ or $\frac{7x-14}{(x-2)(x+6)}$	
		M1	for factorising the denominator of the second fraction, eg $\frac{x-6}{x(x+6)(x-6)}$ ($= \frac{1}{x(x+6)}$)	
		A1	completing the algebra to reach 7x	
23	264	P1	correct substitution into the volume formula, eg $56.8 = \frac{1}{3} \times \pi \times r^2 \times 3.6$	AOB does not need to be the subject of the equation
		P1	completes process to find base radius or the value of r^2 , eg $r = \sqrt{\frac{56.8 \times 3}{\pi \times 3.6}}$ ($= 3.88158\dots$) or $r^2 = \frac{56.8}{1.2\pi}$ ($= 15.066$)	
		P1	Uses Pythagoras to find the sloping length, eg $\sqrt{3.88^2 + 3.6^2}$ ($= 5.29\dots$)	
		P1	process to find an equation in AOB, eg $\pi \times 3.88 \times 5.29 = \frac{AOB}{360} \times \pi \times 5.29^2$ or $\frac{AOB}{360} \times \pi \times 2 \times 5.29 = 2 \times \pi \times 3.88$ or $\frac{AOB}{360} \times 5.29 = 3.88$	
		A1	answer in the range 263.9 to 264.1	



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: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	$\frac{6x+37}{6x-42}$	P1	for factorising to get the numerator, eg $(x+4)(2x-14)$ or $2(x+4)(x-7)$ or $(2x+8)(x-7)$	P marks can be awarded in any order
		P1	For process to work with the division by $\frac{2x^2-6x-56}{2x+3}$ eg multiplies by $\frac{2x+3}{2x^2-6x-56}$	
		P1	for two correct fractions with a common denominator, eg $\frac{28}{6(x-7)}$ and $\frac{6x+9}{6(x-7)}$ oe or $\frac{28+6x+9}{6(x-7)}$ oe	
		A1	oe or $a=6, b=37, c=6, d=-42$	
21	98	P1	for (total number of gold =) $6x-3$	
		P1	for forming an equation, eg $\frac{x}{6x-3} = \frac{2}{11}$	
		P1	(dep on P2) for correct substitution of their value into all expressions, eg $7 \times "6" - 11 + "6" + 5 \times "6" - 3 (= 64)$	
		A1	98	



Paper 1MA1: 3H				
Question	Working	Answer	Mark	Notes
10		6 (%)	P1 P1 A1	for y^5 oe or $8029.35 \div 6000$ for a process to find $1+x$ e.g. $\sqrt[5]{(8029.35 \div 6000)}$ or 1.06 or 1.0599.. 5.99 to 6
11		No (supported)	P1 C1	Process to find number of rose trees e.g. $215 \div 17 (=12.647\dots)$ or show number of choices with 12 and 13 eg $17 \times 12 = 204$ and $17 \times 13 = 221$ No with interpretation that 12.6.. is not a whole number or a whole number of plants must be bought or number of plants would have to be between 12 and 13 which is not possible
12		3 : 4 : 11	P1 P1 A1	Makes a start e.g. by using multipliers e.g. $1 + 5 = 6$ and $7 + 11 = 18$ and $6 \times 3 = 18$ or $AB:BD = 3:15$ or $x=3y$ (appropriate x and y shown) or $\frac{1}{6} = \frac{3}{18}$ Complete process to find ratios e.g. $(7 + 11) \div (1 + 5) = 3$ and $1 \times "3" : 7 - ("3" \times 1) : 11$ oe
13		$y \geq -2, y \geq x$ and $y \leq 0.5x + 1$	M1 M1 M1 A1	$y = -2$ indicated; accept any inequality for " $\geq$ " $y = x$ oe indicated; accept any inequality for " $\geq$ " $y = 0.5x + 1$ oe indicated; accept any inequality for " $\geq$ " $y \geq -2, y \geq x$ and $y \leq 0.5x + 1$
14 (a)		$\frac{x+4}{2x+3}$	M1 M1 A1	Factorising the denominator $(2x \pm 3)(x \pm 4)$ or $2(x \pm 1\frac{1}{2})(x \pm 4)$ Factorising the numerator $(x - 4)(x + 4)$ oe
(b)		$v = \frac{15t}{w+30}$	M1 M1 A1	A correct step towards solution e.g. expanding brackets to get $15t - 30v$ or multiply both sides by v For a method to rearrange the formula to isolate terms in v eg $vw + 30v = 15t$ oe



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	1335	M1	for one correct procedure eg $9 \times 15 (=135)$ or $15 \times 8 (=120)$ or $9 \times 15 \times 8 (=1080)$	Ignore additional products.
		M1	for all three correct products eg “135”, “120”, “1080” or 9×15 , 15×8 , $9 \times 15 \times 8$ oe	Only these three products must be identified. There is no need to indicate summing at this stage.
		C1	for showing the three correct products added eg $135 + 120 + 1080$	There is no need to show the three products sum to 1335
12	(a)	M1	factorises numerator of $4x^2 - 9$ eg $(2x - 3)(2x + 3)$ oe	$\frac{2x(2x-3)(2x+3)}{3x(2x+3)(x-3)}$
		M1	factorises denominator eg $x(x-3)$ or $3(2x+3)$ or for $3x(2x^2 - 3x - 9)$	
		A1	cancels to give $\frac{4x-6}{3x-9}$	
	(b)	M1	method to use a common denominator eg $x(x+1)(x-2)$ by multiplying terms	Method must involve finding equivalents for all three separate terms; may be done in several stages.
		M1	deduce numerator eg $3x(x-2) + x(x+1) - 4(x+1)(x-2)$	Equivalents must be algebraically equivalent and must have involved full simplification.
		A1	oe	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
12 (a)	$\frac{3x^2}{(x-4)(x+2)}$	M1	for method to identify a common denominator, eg $(x-4)(x+2)$	Accept $\frac{2x(x+2)}{(x-4)(x+2)} + \frac{x(x-4)}{(x-4)(x+2)}$
		M1	for method to combine the fractions, eg $\frac{2x(x+2) + x(x-4)}{(x-4)(x+2)}$	
		A1	for $\frac{3x^2}{(x-4)(x+2)}$ or $\frac{3x^2}{x^2-2x-8}$	
	$8x^3 - 2x^2 - 51x - 45$	M1	for method to find the product of two linear expressions, eg 3 correct terms out of 4 terms or 4 terms ignoring signs	Note that, for example, $-3x - 9$ in expansion of $(x-3)(2x+3)$ is to be regarded as 3 correct terms. First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $8x^3 - 12x^2 - 15x + 10x^2 - 36x - 45$	
		A1	cao.	
13 (a)	region identified	M1	for 2 of lines $x=2$, $y=x+3$, $2x+3y=6$ correctly drawn	Accept use of full or broken lines for all marks Award for clear intention, shading not needed. Award for clear intention, shading not needed.
		M1	for all 3 lines $x=2$, $y=x+3$, $2x+3y=6$ correctly drawn	
		M1	for region which satisfies at least 2 of the inequalities $x \leq 2$, $y \leq x+3$, $2x+3y \geq 6$	
		A1	for correct region identified	
	no supported with reason	B1	for no and reason, eg (2, 4) does satisfy $x+y \leq 6$ or (2, 4) lies on the boundary of the region satisfying the equality sign.	

Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	$\frac{4}{9}$	P1	for process to find link between volume of Q and volume of P or between volume of R and volume of Q, eg ratio 1.5 : 1 or $Q = 1.5P$ or $P = \frac{2}{3}Q$ or two values in the ratio 1 : 1.5 such as 100 and 150	$1.5^2 (= \frac{9}{4})$ is enough for this mark, award P1P1 Accept $P = \frac{4}{9}R$
		P1	for process to find link between volume of R and volume of P eg 1.5 ² : 1 or two values in the ratio 1 : 2.25 such as 100 and 225	
		A1	for $\frac{4}{9}$ or fraction eg $\frac{100}{225}$	
13	Proof shown	C2 (C1	for complete argument, eg $n(n-1)$ is the product of two consecutive integers and must be even as either n or $n-1$ must be even or gives correct reasoning for n odd and n even n odd: odd $\times$ odd = odd and odd $-$ odd = even n even: even $\times$ even = even and even $-$ even = even or n odd: $(2n+1)^2 - (2n+1) = 4n^2 + 2n = 2(2n^2 + n)$ n even: $(2n)^2 - (2n) = 4n^2 - 2n = 2(2n^2 - n)$ for factorising, eg $n(n-1)$ OR gives correct reasoning for n odd or n even OR gives a partial explanation using n odd and n even, eg odd ² $-$ odd = even and even ² $-$ even = even)	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	proof	C1	for writing an expression for an odd number, eg $2n + 1$ or $2n - 1$ (assuming n is any integer) or states n is even and eg $(n + 1)$ or $(n + 3)$ as odd numbers	Expansion of $(2n - 1)^2 - (2n + 1)^2$ oe is acceptable
		C1	for a correct expression of the form $(2n + 1)^2 - (2n - 1)^2$ expanded eg $4n^2 + 12n + 9 - (4n^2 + 4n + 1)$ or $4n^2 + 4n + 1 - (4n^2 - 4n + 1)$ or $(2n + 1 + 2n - 1)(2n + 1 - (2n - 1))$ or when n is even and eg $(n^2 + 6n + 9) - (n^2 + 2n + 1) (=4n + 8)$	
		C1	for a correct simplified expression as a multiple of 8 eg $8n + 8$ or $8n$ or when n is even and eg $4n + 8$ and full explanation as to why $4(n+2)$ is always a multiple of 8	
16	39.9	P1	for finding the length of the minor or major arc eg $\frac{220}{360}\pi \times 12 (= 23(.03834..))$	Allow appropriate rounding if calculation seen in parts
		P1	for substituting into the sine or cosine rule to find OD eg $14 \div \sin 140 = OD \div \sin 24$ or $(OD^2 =) 6^2 + 14^2 - 2 \times 6 \times 14 \times \cos 24 (=78.5...)$	Must involve OD in the relationship but may be implied
		P1	for a complete process to find the length OD eg $14 \div \sin 140 \times \sin 24 (=8.8(58778..))$	
		P1	for a complete process to find the perimeter eg $"23(.03834..)" + 14 + "8.8(58778..)" - 6$	May be seen in multiple calculations
		A1	for an answer in the range 39.8 to 40	If an answer in the range is seen in working and then incorrectly rounded award full marks.



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	Proof	M1	for correct expressions for two consecutive even numbers eg $2n$ and $2n+2$	$(2n)^2 + (2n+2)^2$ $= 4n^2 + 4n^2 + 8n + 4$ $= 8n^2 + 8n + 4 = 4(2n^2 + 2n + 1)$
		M1	(dep M1) for expanding both expressions with at least one expansion fully correct eg $4n^2$ and $4n^2 + 4n + 4n + 4$ or for factorising both terms and intention to square correctly eg $(2n)^2$ and $2^2(n+1)^2$	Or $(2n)^2 + (2n+2)^2$ $= 4n^2 + 4n^2 + 8n + 4$ $= 8n^2 + 8n + 4 = 4(2n^2 + 2n + 1)$
		A1	complete proof	Or $(2n)^2 + (2n+2)^2$ $= 4(n)^2 + 4(n+1)^2$ $= 4(n^2 + (n+1)^2)$
16	-7.5	M1	for stating a correct relationship, eg $y = \frac{k}{x^2}$ or $8 = \frac{k}{2.5^2}$	Accept $y \propto \frac{k}{x^2}$ where k may be 1
		A1	for $k = 50$, could be seen in an equation	
		A1	-7.5 oe	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	Proof	M1	for $(10x =) 1.2323\dots$ or $(100x =) 12.323\dots$ or $(1000x =) 123.23\dots$	Any recurring notation acceptable throughout. Proofs with terminating decimals (at least 5 figures) score M1M1C0
		M1	(dep M1) for a method using two recurring decimals that leads to a terminating decimal difference, using correct multiples of x eg $(1000x - 10x =) 123.23\dots - 1.23\dots (= 122)$ or $\frac{122}{990}$ or $(100x - x =) 12.323\dots - 0.123\dots (= 12.2)$ or $\frac{12.2}{99}$	
		C1	for completing algebra to $\frac{61}{495}$	
21	-2 and $-\frac{3}{2}$	M1	for writing a correct equation without fractions eg $(2 - 2x) + 3(x + 4) = (2 - 2x)(x + 4)$ oe	
		M1	for simplifying to a correct equation in the form $ax^2 + bx + c (= 0)$, eg $2x^2 + 7x + 6 (= 0)$	
		M1	for method to solve a correct quadratic equation, eg $(2x + 3)(x + 2) (= 0)$ or correct substitution into the formula or for correctly completing the square	
		A1	for -2 and $-\frac{3}{2}$ oe	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
10	Proof	M1	for writing expressions for two consecutive even numbers, eg $2n$ and $2n + 2$ or $2n - 2$ and $2n$ or $2n + 2$ and $2n + 4$ oe (assuming n is any integer)	For both M marks accept use of linear expressions with a difference of 2, eg n and $n + 2$ or $n + 1$ and $n + 3$
		M1	(dep M1) for correctly expanding the squares of both expressions, eg $(2n + 2)^2 = 4n^2 + 4n + 4n + 4$ and $(2n)^2 = 4n^2$ or $(2n)^2 = 4n^2$ and $(2n - 2)^2 = 4n^2 - 4n - 4n + 4$ or $(2n + 4)^2 = 4n^2 + 8n + 8n + 16$ and $(2n + 2)^2 = 4n^2 + 4n + 4n + 4$ or for a correct expression using the difference of two squares eg $(2n + 2 + 2n)(2n + 2 - 2n)$ oe or $(2n + 2n - 2)(2n - (2n - 2))$ oe	Expressions need not be simplified for this mark
		C1	for a complete proof without any errors leading to eg $4(2n + 1)$ or $4(2n - 1)$ or to a statement that eg $8n + 4$ is a multiple of 4 because $8n$ and 4 are both multiples of 4	$4n^2 + 8n + 4 - 4n^2 = 8n + 4$ $4n^2 - (4n^2 - 8n + 4) = 8n - 4$ Accept eg $(2n)^2 - (2n + 2)^2$ $= 4n^2 - (4n^2 + 4n + 4n + 4)$ $= -8n - 4$ $= 4(-2n - 1)$ A proof using eg n and $n + 2$ must include a statement that n is even for the C mark to be awarded and a proof using eg $n + 1$ and $n + 3$ must include a statement that n is odd

Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
14		$\frac{1}{3}$	P1	process to solve the problem e.g. $\frac{3}{10} \times \frac{4}{9} (= \frac{12}{90} = \frac{2}{15})$ OR finds the number of white circles for their chosen number OR for 9 : 21 (or a multiple of 9 : 21)
			P1	second step of the process e.g. $\frac{7}{10} \times \frac{2}{7} (= \frac{14}{70} = \frac{2}{10} = \frac{1}{5})$ OR finds the number of black circles for their chosen number OR for a multiple of 2 : 5 where the ratio parts sum to "21"
			P1	for complete process e.g. " $\frac{2}{15}$ " + " $\frac{1}{5}$ " ($= \frac{4}{30} + \frac{6}{30}$) OR finds the total number of circles for their chosen number OR for 3 ratios that could be used to solve the problem eg 9 : 21 with 4 : 5 with 6 : 15
			A1	for $\frac{1}{3}$ oe
15 (a)		3.5 to 4.5	M1	substitution into formula $\frac{1}{3}\pi r^2 h$ of chosen values for r and V (accept $r = 5.13$ and $V = 98$) and starts rearrangement e.g. multiplies by 3, divides by π or divides by r^2 (both sides)
			M1	uses estimates in calculation e.g. $\frac{3 \times 100}{3 \times 25}$ (or in rearranged formula) or $\frac{12}{\pi}$
			A1	arrives at a single value from estimate in the range 3.5 to 4.5
(b)		more	C1	ft e.g. more since number in numerator goes up; numbers in denominator go down.
16		$2(2n-3)$	C1	correct expansion of brackets to give at least 3 terms from $n^2-2n-2n+4$
		even	C1	arrives at n^2-2-n^2+4n-4 oe
			C1	reduces to $2(2n-3)$ or $4n-6$
			C1	for conclusion e.g. $2(2n-3)$ always even, $4n-6$ is always even since both are even numbers, they are multiples of 2.



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	Statement supported by algebra	B1	writing a general expression for an odd number eg $2n+1$	Could be $2n-1$, $2n+3$, etc
		M1	(dep) for expanding ("odd number") ² with at least 3 out of 4 correct terms	Note that $4n^2 + 4n + 2$ or $2n^2 + 4n + 1$ in expansion of $(2n+1)^2$ is to be regarded as 3 correct terms
		A1	for correct simplified expansion, eg $4n^2 + 4n + 1$	
		C1	(dep A1) for a concluding statement eg $4(n^2 + n) + 1$ (is one more than a multiple of 4)	
13	5	M1	for $\sqrt{40}$ or $\sqrt{90}$ OR $2\sqrt{2}$ or $3\sqrt{2}$	Answer of $5\sqrt{10}$ from correct working gets M2 A0
		M1	for $2\sqrt{10}$ or $3\sqrt{10}$ or $\sqrt{4} \times \sqrt{10}$ or $\sqrt{9} \times \sqrt{10}$ or $\sqrt{4 \times 10}$ or $\sqrt{9 \times 10}$ OR $2\sqrt{2} + 3\sqrt{2}$	
		A1	cao	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	Proof	M1	for expansion of $(2m+1)^2$ or $(2n-1)^2$, all 4 terms correct with or without signs (and no additional terms) or 3 out of 4 terms correct with signs, eg $4m^2 + 2m + 2m + 1$ or $4n^2 - 2n - 2n + 1$ or for correct expansion of $4(m+n)(m-n+1)$ or $(m+n)(m-n+1)$ eg $4m^2 - 4mn + 4m + 4mn - 4n^2 + 4n$ oe or $m^2 - mn + m + mn - n^2 + n$ oe or for $[2m+1+2n-1][(2m+1)-(2n-1)]$	Note that, for example, $4m+1$ is regarded as 3 terms in the expansion of $(2m+1)^2$
		M1	for correct expression after expansion for $(2m+1)^2 - (2n-1)^2$ eg $(4m^2 + 4m + 1) - (4n^2 - 4n + 1)$ or $4m^2 + 4m + 1 - 4n^2 + 4n - 1$ oe (= $4m^2 + 4m - 4n^2 + 4n$) or for $[2m+1+2n-1][2m+1-2n+1]$	
		C1	for a complete proof without any errors, eg uses difference of two squares to show that LHS = RHS or expands both sides and shows that LHS = RHS or expands and simplifies LHS and factorises convincingly to get RHS	Must see correct expression $4m^2 - 4n^2 + 4m + 4n$ $= 4[(m^2 - n^2) + (m + n)]$ $= 4[(m+n)(m-n) + (m+n)]$ $= 4(m+n)(m-n+1)$
(b)	Yes (supported)	C1	for yes with explanation, eg $2m+1$ and $2n-1$ are odd numbers (for any positive integer value of m, n) and the right-hand side is a multiple of 4	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
10 (a)	Diagram	B1	for correct vector drawn including arrow	May be drawn anywhere on the grid. Condone missing label Accept consistent incorrect notation for M1
	$\begin{pmatrix} 3 \\ -4 \end{pmatrix}$	M1	for $\mathbf{a} + 2\mathbf{b}$ drawn with resultant vector or for writing $\mathbf{a}$ and $\mathbf{b}$ as column vectors and attempt to add $\mathbf{a} + 2\mathbf{b}$, eg $\begin{pmatrix} 1 \\ 2 \end{pmatrix} + 2 \times \begin{pmatrix} 1 \\ -3 \end{pmatrix}$ or $\begin{pmatrix} 1+2 \\ c \end{pmatrix}$ or $\begin{pmatrix} d \\ 2+-6 \end{pmatrix}$ or $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$	
		A1	cao	
11 (a)	$\frac{2}{25}$	B1	accept 0.08	All powers and products must be evaluated
	$\frac{1}{8}$	M1	$fg(x) = \frac{2}{(4x^3)^2}$ oe or $g(1) = 4$ or $\frac{2}{(4 \times 1^3)^2}$ oe	
		A1	oe	
12	BDAC	B2	all correct	
		(B1	for at least 2 correct)	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	56	P1	for a correct process to find AF , eg $\sqrt{13^2 - 9^2}$ ($= 9.38\dots$) or $2\sqrt{22}$ or $\sqrt{88}$	Decimal values truncated or rounded to 3 sf or more If a correct answer within the range is shown in working but incorrectly rounded award full marks
		P1	for a correct process to find FH , eg $\frac{9}{\cos(49)}$ ($= 13.7\dots$)	
		P1	for a correct trig statement involving FAH , eg $\tan(FAH) = \frac{13.7\dots}{9.38\dots}$	
		A1	answer in the range 55.6 to 56	
21 (a)	1.06	M1	for tangent drawn at $t=17.5$	No tangent drawn at $t=17.5$ scores zero marks Use of change in y over change in x Working may be seen on the diagram Answer of $\frac{10.5}{17.5}$ oe scores no marks Accept answers in the form a/b where a and b are integers
		M1	for a complete method to find the gradient, eg tangent drawn at $t = 17.5$, and $18.5 \div 17.5$	
		A1	answer in the range 0.9 to 1.2	
		C1	suitable explanation, eg the rate of change of volume	
(b)	Explanation			If units are given they must be correct.
22	$\frac{x^3 - 3}{2}$	M1	for $(h(x)) = \sqrt[3]{2x + 3}$	$[h(x)]$ must be their composite function and cannot be either $\sqrt[3]{x}$ or $2x + 3$
		M1	for a correct first step to find the inverse of $[h(x)]$	
		A1	oe	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
18 (a)	sketch	B1	for appropriate sketch which crosses the x axis at (2,0) and (4,0), minimum point at (3,-1) and end points at (1,3) and (5,3)	Allow some tolerance on the points if the intention is clear.
(b)	$y = g(-x)$	B1	cao	
19 (a)	shown	C1	for first step, eg $2((x+1)^2 - 1)$ or $2(x^2 + 2x + 1 - 1)$ oe	It is insufficient to state $gf(x) = 2x(x+2)$ without showing the first step, and the following sequence of algebraic steps leading to it. Could be shown in the form of a flowchart, which must show inverse operations.
		C1	for fully correct chain of reasoning	
(b)	4.5	M1	process to find inverse of g , eg $g^{-1}(x) = \frac{1}{2}x + 1$ or for $2(x-1) = 7$	
		A1	for 4.5 oe	



Paper: 1MA1/3H					
Question	Answer	Mark	Mark scheme	Additional guidance	
10	(a)	1.56	B1	1.56 to 1.563	If an answer in the range is seen in working and then incorrectly rounded award full marks.
	(b)	3.63	M1	for a complete method to find fg(34) eg 4 sin 65(=3.625..) or fg(x) eg 4 sin (2x–3)	
			A1	for answer in the range 3.6 to 3.63	
	(c)	Statement	C1	for statement eg positive and negative square root required. Acceptable examples The other answer is –9 The quadratic should have 2 solutions. Not acceptable examples He has not expanded the brackets. He needed to (x+4) twice as there is a squared sign. (x+4)² is 16 not 25. Didn't expand the bracket.	
11	Graph drawn	C2	for fully correct sketch between 0° and 360°		
		(C1	for a graph with clear asymptotes at 90° and 270° only or the correct graph translated along the x-axis must have a period of 180)		

Paper: 1MA1/2H						
Question		Answer	Mark	Mark scheme	Additional guidance	
19	(a)	3	B1	cao		$[g^{-1}(x)]$ must be their inverse function and cannot be $\sqrt[3]{2x-5}$
	(b)	$\frac{2}{x^3+5}$	M1	for finding $(g^{-1}(x)) = \frac{x^3+5}{2}$ oe		
			M1	for $(hg^{-1}(x)) = \frac{1}{[g^{-1}(x)]}$ oe		
			A1	Accept $\left(\frac{x^3+5}{2}\right)^{-1}$		
20		98	M1	for $BAD = 132 \div 2 (= 66)$	Angles may be seen on diagram	
		M1	eg $BCD = 180 - "66" (= 114)$ or $ABE = 180 - "66" - 16 (= 98)$	M2 for reflex $BOD = 360 - 132 (= 228)$ and $BCD = "228" \div 2 (= 114)$		
		A1	for finding $CDE = 98$			
		C1	(dep on at least M2) for one circle theorem relevant to their method eg The <u>angle</u> at the <u>centre</u> of a circle is <u>twice</u> the <u>angle</u> at the <u>circumference</u> or <u>Opposite angles</u> of a <u>cyclic quadrilateral</u> add up to 180			
Underlined words need to be shown; reasons need to be linked to their method.						

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	Proof	B1 B1 B1 A1	for $\overrightarrow{EH} = -\mathbf{b} + \mathbf{a}$ or $\overrightarrow{HE} = -\mathbf{a} + \mathbf{b}$ or $\overrightarrow{HG} = \mathbf{a} + \mathbf{c}$ or $\overrightarrow{GH} = -\mathbf{c} - \mathbf{a}$ for $\overrightarrow{BC} = -2\mathbf{b} + 2\mathbf{a} + 2\mathbf{c}$ or $\overrightarrow{CB} = 2\mathbf{b} - 2\mathbf{a} - 2\mathbf{c}$ for $\overrightarrow{EF} = \mathbf{b} + \frac{1}{2}(-2\mathbf{b} + 2\mathbf{a} + 2\mathbf{c}) (= \mathbf{a} + \mathbf{c})$ or $\overrightarrow{FE} = \frac{1}{2}(2\mathbf{b} - 2\mathbf{a} - 2\mathbf{c}) - \mathbf{b} (= -\mathbf{a} - \mathbf{c})$ or $\overrightarrow{FG} = \frac{1}{2}(-2\mathbf{b} + 2\mathbf{a} + 2\mathbf{c}) - \mathbf{c} (= -\mathbf{b} + \mathbf{a})$ or $\overrightarrow{GF} = \mathbf{c} + \frac{1}{2}(2\mathbf{b} - 2\mathbf{a} - 2\mathbf{c}) (= -\mathbf{a} + \mathbf{b})$ for completing proof, $\overrightarrow{EH} = \overrightarrow{FG}$ or $\overrightarrow{HG} = \overrightarrow{EF}$ (so $EFGH$ is a parallelogram)	
19 (a)	17	M1 A1	For $(gf(x)) = 2(2x + 3)^2 - 1$ or $(gf(x)) = 8x^2 + 24x + 17$ or $2(2 \times (-3) + 3)^2 - 1$ cao	Substitution may be seen in 2 steps
(b)	$\frac{x+1}{2}$	M1 A1	for a suitable first step, eg adds 1 to both sides, eg $y + 1 = 2x$ or $x + 1 = 2y$ or $g(x) + 1 = 2x$ or $x = \frac{y+1}{2}$ oe	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	100	M1	for angle $BAC = 40$	
		M1	for angle OAC or angle $OCA = 10$ or angle OAB or angle $OBA = 30$	angle $AOB = 120$ gets M1M1
		M1	for angle $ACB = (180 - 30 - 30) \div 2 (= 60)$ or angle $ OCD = 90$ or angle $OCB = 50$	Award M3C0 for answer of 100 with no correct appropriate circle theorem
		C1	for angle $ACD = 100$ and one correct appropriate circle theorem from <u>alternate segment</u> theorem <u>angle at the centre</u> is <u>twice</u> the <u>angle at the circumference</u> the <u>tangent</u> to a circle is perpendicular to the <u>radius</u>	Underlined words need to be shown Reason needs to be linked to their method, which can be implied from correctly identified angles (stated or written on the diagram)
18 (a)	$\frac{4x+3}{5}$	M1	for first step to change the subject of $y = \frac{5x-3}{4}$ or $x = \frac{5y-3}{4}$ eg $4y = 5x - 3$ or $4x = 5y - 3$	Answer of $\frac{4y+3}{5}$ gets M1A0
(b)	100	A1	oe	
		M1	for $h(5) = 1 - 2 \times 5 (= -9)$ and a clear intention to find $g(" - 9")$ or for $((1 - 2 \times 5) - 1)^2$ or for stating $gh(x)$, eg $(1 - 2x - 1)^2$ oe	
		A1	cao	



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
21 (a)		$\frac{1}{55}$	M1	for $\frac{4}{12} \times \frac{3}{11} \times \frac{2}{10}$
			A1	for $\frac{1}{55}$ oe
(b)		Conclusion (supported)	C1	starts correct argument, eg by calculating a relevant probability, eg $\frac{5}{15} \times \frac{4}{14} \times \frac{3}{13}$
			C1	statement of “more likely” from eg comparison of probabilities, ft answer to (a) eg $\frac{1}{55}$ (= 0.018...) and $\frac{2}{91}$ (= 0.021...or 0.022)
22		7, -1	P1	for strategy to use $g(3) = 20$, e.g. $3a + b = 20$
			P1	for $g(1) = a + b$
			P1	for a process to find inverse of f. e.g. $f^{-1}(x) = \frac{x-3}{5}$ or $f^{-1}(33) = 6$
			P1	for using $f^{-1}(33) = g(1)$ to find an equation e.g. $\frac{33-3}{5} = a + b$
			A1	for $a = 7, b = -1$

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
19 (a)	33	B1	cao	
(b)	27	M1	for $f(9) = 12 \div \sqrt{9}$ (=4) and a clear intention to find $g(“4”)$ or for $3 \times (2 \times \frac{12}{\sqrt{9}} + 1)$ or for stating gf eg $3(2 \times \frac{12}{\sqrt{x}} + 1)$ oe	
(c)	$\frac{1}{2}$	A1	cao	
		M1	for g^{-1} as $\frac{x-3}{6}$ oe or for starting to solve $3(2x+1) = 6$	Accept $\frac{y-3}{6}$
		A1	for $\frac{1}{2}$ oe	
20	$1 + \frac{\sqrt{5}}{5}$	P1	for writing $\sqrt{180}$ as $6\sqrt{5}$	
		P1	for process to rationalising the denominator eg $\frac{\sqrt{180} - 2\sqrt{5}}{5\sqrt{5} - 5} \times \frac{5\sqrt{5} + 5}{5\sqrt{5} + 5}$ or $\frac{4\sqrt{5}}{5\sqrt{5} - 5} \times \frac{5\sqrt{5} + 5}{5\sqrt{5} + 5}$ oe	This process mark can be awarded whenever this is seen, which might be later in the process.
		P1	(dep on previous P1) for expanding terms eg $\frac{5\sqrt{5}\sqrt{180} + 5\sqrt{180} - 50 - 10\sqrt{5}}{125 - 25}$ or $\frac{100 + 20\sqrt{5}}{100}$ oe	
		A1	for $1 + \frac{\sqrt{5}}{5}$	Accept written as $a = 1, b = 5$



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	7	P1 A1	for process to use product rule to find number of desserts, eg $5 \times 12 \times \text{desserts} = 420$ or $420 \div (5 \times 12)$ oe cao	
20 (a)	$(5x - 2)^2$	M1 A1	for a first step to change the subject of $y = \frac{\sqrt{x} + 2}{5}$ or $x = \frac{\sqrt{y} + 2}{5}$, eg $5y = \sqrt{x} + 2$ or $5x = \sqrt{y} + 2$ oe	
(b)	55	M1 M1 A1	for method to find $gf(x)$, eg $\frac{\sqrt{3x+4} + 2}{5}$ or method to find $g^{-1}(3)$, eg $(5 \times 3 - 2)^2 (= 169)$ for method to solve as far as 2 steps away, eg $(5 \times 3 - 2)^2 = 3x + 4$ or $3x + 4 = "169"$ or for a complete method, eg $("169" - 4) \div 3$ cao	

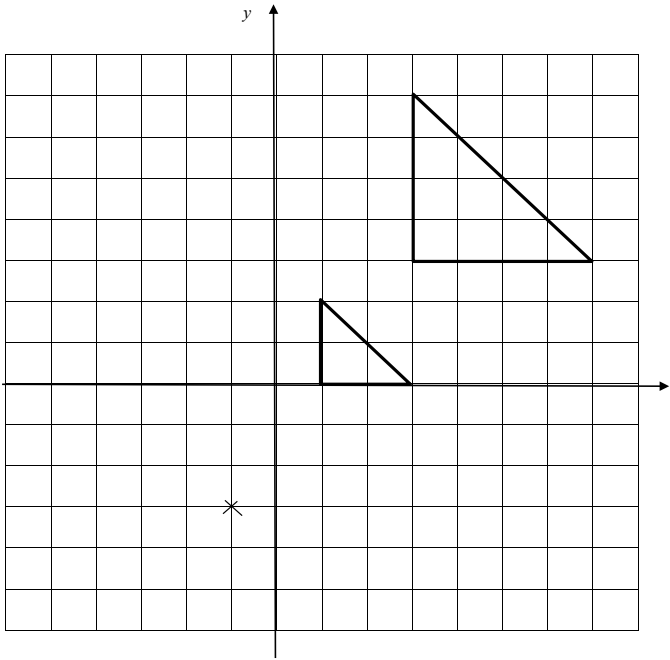


Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	-6	B1	cao	
(b)	4	M1	for $g(1) = 5 - 3 \times 1 (= 2)$ and a clear intention to find $f(2)$ or for $\frac{12}{5-3 \times 1 + 1}$ or for stating fg, eg $\frac{12}{5-3x+1}$ oe	For reference $f(x) = \frac{12}{x+1}$ and $g(x) = 5 - 3x$
(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: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	Shown	M1	for method to finding $gh(x)$, eg $gh(x) = 1 - 3(2x^2 - 1)$	$= 1 - 6x^2 + 3$ $= 4 - 6x^2$
		M1	for method to find $hg(x)$, eg $hg(x) = 2(1 - 3x)^2 - 1$	$= 2(1 - 3x - 3x + 9x^2) - 1$ $= 2 - 12x + 18x^2 - 1$ $= 1 - 12x + 18x^2$
		M1	(dep M2) for method to find $3gh(x) + hg(x)$ eg $3(1 - 3(2x^2 - 1)) + 2(1 - 3x)^2 - 1 (= 0)$	Expressions for $gh(x)$ and $hg(x)$ may have been incorrectly expanded and simplified
		M1	for expanding all brackets as far as at least $3 - 18x^2 + 9 + 2 - 12x + 18x^2 - 1 (= 0)$	Need not be fully simplified but must be correct
		C1	for reducing to a linear equation eg $13 - 12x = 0$ and stating that this gives just one solution or stating $x = \frac{13}{12}$ oe	



Question 9(b)



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
18 (a)	Shown	C1	for $f^{-1}(x) = \sqrt[3]{\frac{x+4}{2}}$ OR for $2x^3 - 4 = 50$ OR for substituting $x = 3$ to find $f(3)$	
(b)	$x = -1$ and $x = 2.5$	C1	for substituting $x = 50$ to show the result giving $f^{-1}(50) = 3$ OR solving for x to give $x = 3$ OR for showing that $f(3) = 50$	
		P1	for $hg(x) = (x + 2)^2$	
		P1	(dep) for start to a process to derive a quadratic equation eg. $x^2 + 4x + 4 = 3x^2 + x - 1$	$(x + 2)^2$ must be correctly expanded
		P1	for a process to solve the quadratic equation $2x^2 - 3x - 5 = 0$ eg $(2x - 5)(x + 1) (= 0)$ or $\frac{-3 \pm \sqrt{(-3)^2 - 4 \times 2 \times -5}}{2 \times 2}$ or $2\left[\left(x - \frac{3}{4}\right)^2 - \frac{9}{16} - \frac{5}{2}\right] (= 0)$	
		A1	for $x = -1$ and $x = 2.5$	2.5 or $2\frac{1}{2}$ or $\frac{5}{2}$ acceptable
19	$\frac{3}{4}$ oe	P1	for a first step to converting to a common base with one correct conversion, eg. $9^{-\frac{1}{2}} = 3^{-1}$ or $\frac{1}{3}$ or $27^{\frac{1}{4}} = 3^{\frac{3}{4}}$ oe	$9^{-\frac{1}{2}} = 3^{-1}$ (or $\frac{1}{3}$) oe or $27^{\frac{1}{4}} = 3^{\frac{3}{4}}$ oe seen alone gets the P1
		P1	(dep) for $3^{-1} = 3^{\frac{3}{4}} \div 3^{x+1}$ oe	
		A1	cao	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
21 (a)	$\frac{1}{4}$	M1	for $f(1) = 3 \times 1^2 + 1 (= 4)$ and a clear intention to find $g(“4”)$	
			or for $\frac{4}{(3 \times 1^2 + 1)^2}$	
			or for stating $gf(x)$, eg $\frac{4}{(3x^2 + 1)^2}$ oe	
		A1	oe	
(b)	$\sqrt[4]{\frac{48}{x-1}}$	M1	for finding $fg(x)$, eg $3 \times \left(\frac{4}{x^2}\right)^2 + 1$ or $\frac{48}{x^4} + 1$	
		M1	for start of method to find the inverse of $fg(x)$, eg $y - 1 = 3 \times \left(\frac{4}{x^2}\right)^2$ or $y - 1 = \frac{48}{x^4}$	
			or $x - 1 = \frac{48}{y^4}$ or $x - 1 = 3 \times \left(\frac{4}{y^2}\right)^2$	
		M1	for $y^4 = \frac{48}{x-1}$ or $x^4 = \frac{48}{y-1}$ or for a final answer of $\sqrt[4]{\frac{48}{y-1}}$	
		A1	oe	
22	(3, 36)	P1	for factorising -3 from the expression, eg $-3(x^2 - 6x - 3)$ or $-3(x^2 - 6x) + 9$	ft from their factorising if only one error An answer only and no working is 0 marks
		P1	for starting the process to complete the square, eg $(x - 3)^2 - 9$	
		P1	for completing the process of completing the square, eg $-3[(x - 3)^2 - 12]$ or $-3(x - 3)^2 + 36$	
		A1	cao	

Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	$h = \frac{120}{\sqrt{t}}$	P1	for setting up a proportional relationship between h and p , eg $h \propto \frac{1}{p}$ or $h = \frac{k}{p}$ OR a proportional relationship between p and t , eg $p \propto \sqrt{t}$ or $p = K\sqrt{t}$	Condone the use of ' $\propto$ ' instead of '=' for the first two P marks Relationship may be implied by substitution
		P1	for process to substitute at least 2 values, eg $10 = \frac{k}{6}$ ($k = 60$) or $6 = K\sqrt{144}$ ($K = 0.5$)	
		P1	for full process leading to $h = \frac{60}{p}$ or $p = 0.5\sqrt{t}$ or $h = \frac{120}{\sqrt{t}}$	Both constants must come from a correct process
		A1	$h = \frac{120}{\sqrt{t}}$ or $h = \frac{120\sqrt{t}}{t}$ or $h = \frac{60}{0.5\sqrt{t}}$	Formula for h in terms of t Does not need to be in simplest form
21	(a)	M1	first step to change the subject of $y = 3x - 1$ or $x = 3y - 1$, eg $y + 1 = 3x$	
		A1	oe	
	(b)	M1	for method to find $fg(x)$, eg $fg(x) = 3(x^2 + 4) - 1$	
		M1	for method to find $gf(x)$, eg $gf(x) = (3x - 1)^2 + 4$	
		M1	(dep on previous two M marks) for setting up equation, eg $3(x^2 + 4) - 1 = 2[(3x - 1)^2 + 4]$	
		M1	(dep 2nd M1) for correct expansion of $(3x - 1)^2$ eg $9x^2 - 3x - 3x + 1$	
		C1	for $15x^2 - 12x - 1 = 0$ from correct working	

