

Write your name here

Surname

Other names

Pearson Edexcel
Level 1 / Level 2
GCSE (9–1)

Centre Number

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Candidate Number

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Mathematics

Paper 3 (Calculator)

Higher Tier

Mr Coren' Predicted Paper 'we haven't seen this stuff yet'!

Time: 1 hour 30 minutes

Paper Reference

1MA1/3H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.



Information

- The total mark for this section is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on time.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

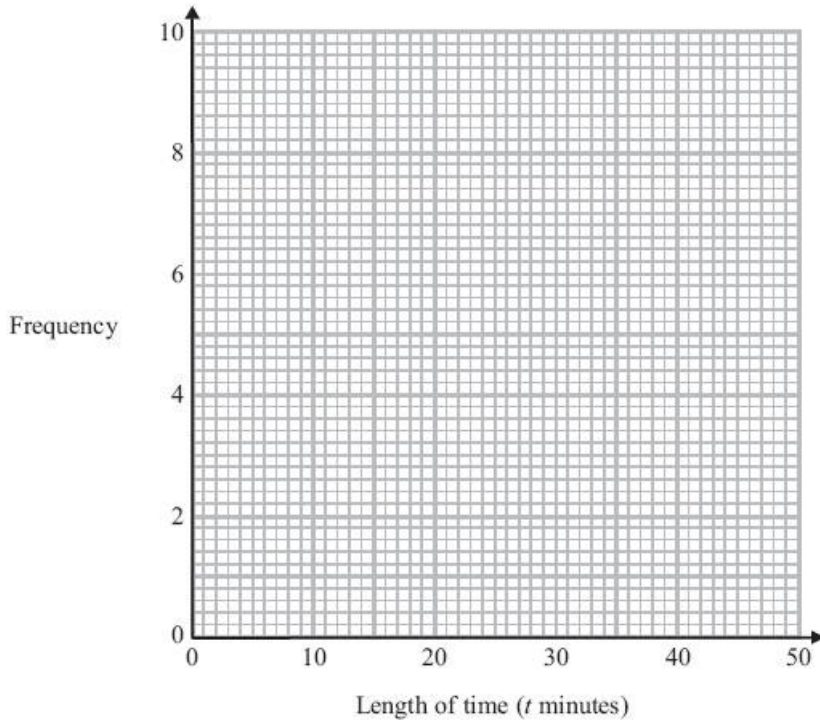
Q1.

Helen went on 35 flights in a hot air balloon last year.

The table gives some information about the length of time, t minutes, of each flight.

Length of time (t minutes)	Frequency
$0 < t \leq 10$	6
$10 < t \leq 20$	9
$20 < t \leq 30$	8
$30 < t \leq 40$	7
$40 < t \leq 50$	5

On the grid below, draw a frequency polygon for this information.



(Total for Question is 2 marks)

Q2.

(a) Expand and simplify $3(x + 4) + 2(5x - 1)$

..... (2)

(b) Expand and simplify $(2x + 1)(x - 4)$

..... (2)

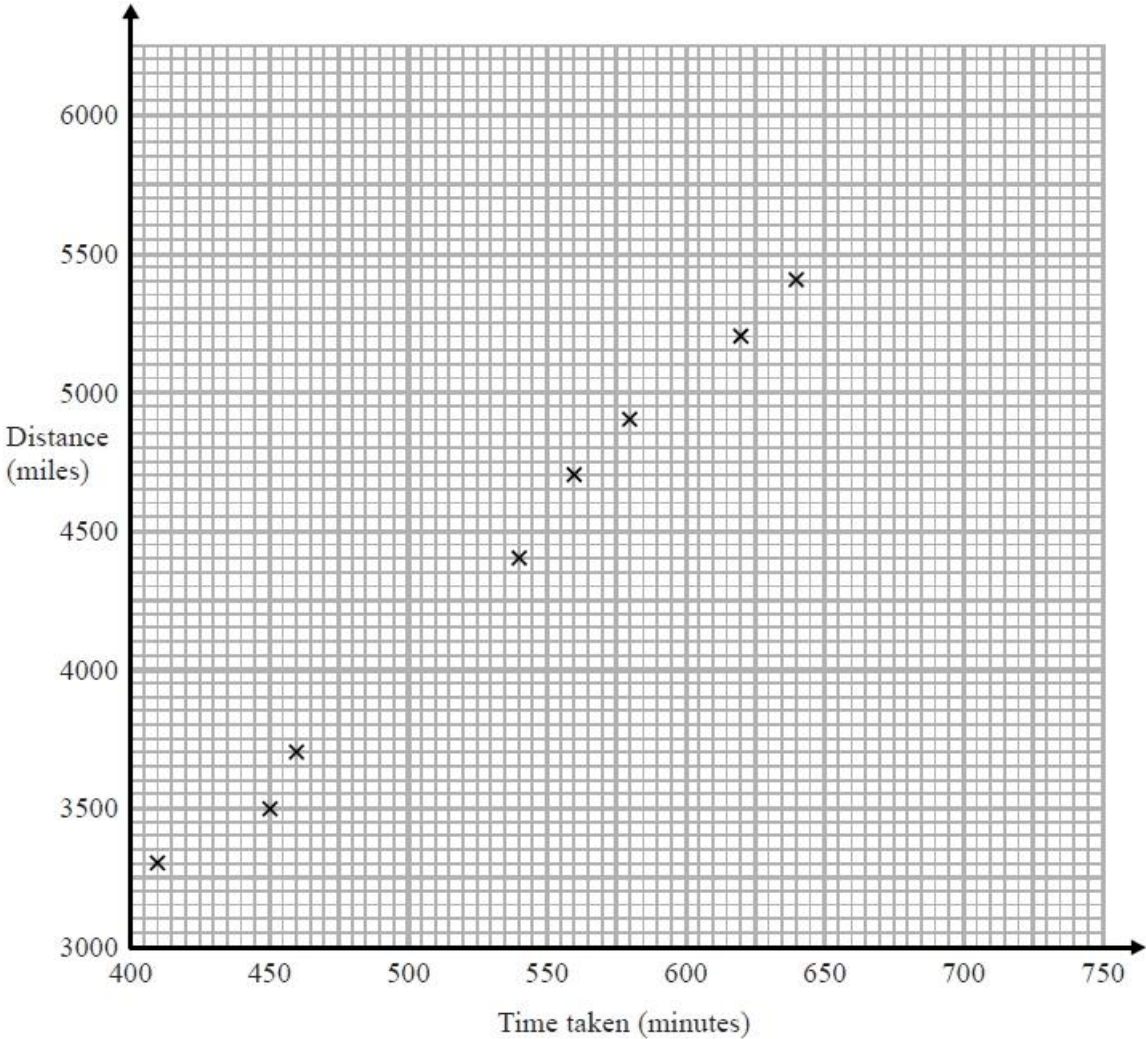
(c) Factorise completely $6y^2 - 9xy$

..... (2)

(Total for Question is 6 marks)

Q3. Oliver records the distance from London to each of eight cities in the USA.
 He also records the time taken to fly from London to each of these cities.

The scatter graph shows this information.



Chicago is a city in the USA.
 Chicago is 4000 miles from London.

(a) (i) By drawing a line of best fit, find an estimate for the time taken to fly from London to Chicago.

..... minutes (2)

(ii) Why is your answer to part (i) only an estimate?

.....

(1)

(b) (i) Calculate the gradient of your line of best fit.

..... (2)

(ii) Give an interpretation of the gradient of your line of best fit.

.....

(1)

(Total for question = 6 marks)

Q4. Make x the subject of $4x - 3 = 2(x + y)$

$x = \dots\dots\dots$

(Total for Question is 6 marks)

Q5. Factorise $x^2 + 3x - 4$

$\dots\dots\dots$

(Total for question is 2 marks)

Q6. Solve, by factorising, the equation $8x^2 - 30x - 27 = 0$

$\dots\dots\dots$

(Total for Question is 3 marks)

Q7. Steph's weight in kilograms is $2x + 9$
Kyle's weight in kilograms is $4x - 7$

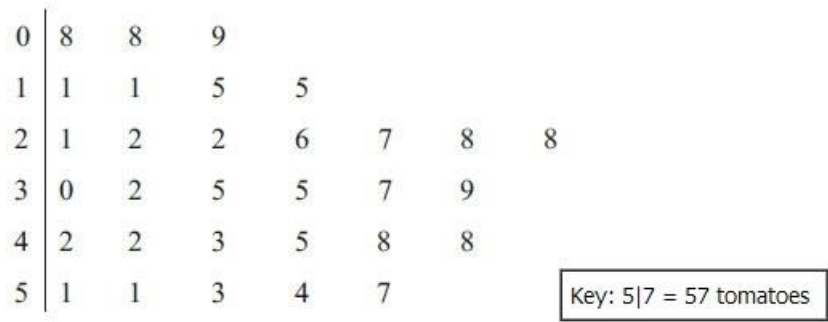
Write down an expression, in terms of x , for the mean of their weights.

$\dots\dots\dots$ kilograms

(Total for question = 2 marks)

Q8.

The stem and leaf diagram gives information about the numbers of tomatoes on 31 tomato plants.



(a) Work out the median.

..... (1)

(b) Work out the interquartile range.

..... (2)

(Total for Question is 3 marks)

Q9. Here are the first four terms of an arithmetic sequence.

3 10 17 24

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

..... (2)

(b) Is 150 a term of this sequence?

You must explain how you get your answer.

.....
.....
.....
.....
.....

(2)

(Total for Question is 4 marks)

Q10. Here are the first five terms of a sequence.

4 11 22 37 56

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

.....
(Total for question = 3 marks)

Q11. The table shows some information about the prices of 64 secondhand cars that are for sale.

Price (£ x)	Frequency		
$0 < x \leq 2000$	8		
$2000 < x \leq 4000$	14		
$4000 < x \leq 6000$	28		
$6000 < x \leq 8000$	10		
$8000 < x \leq 10\,000$	4		

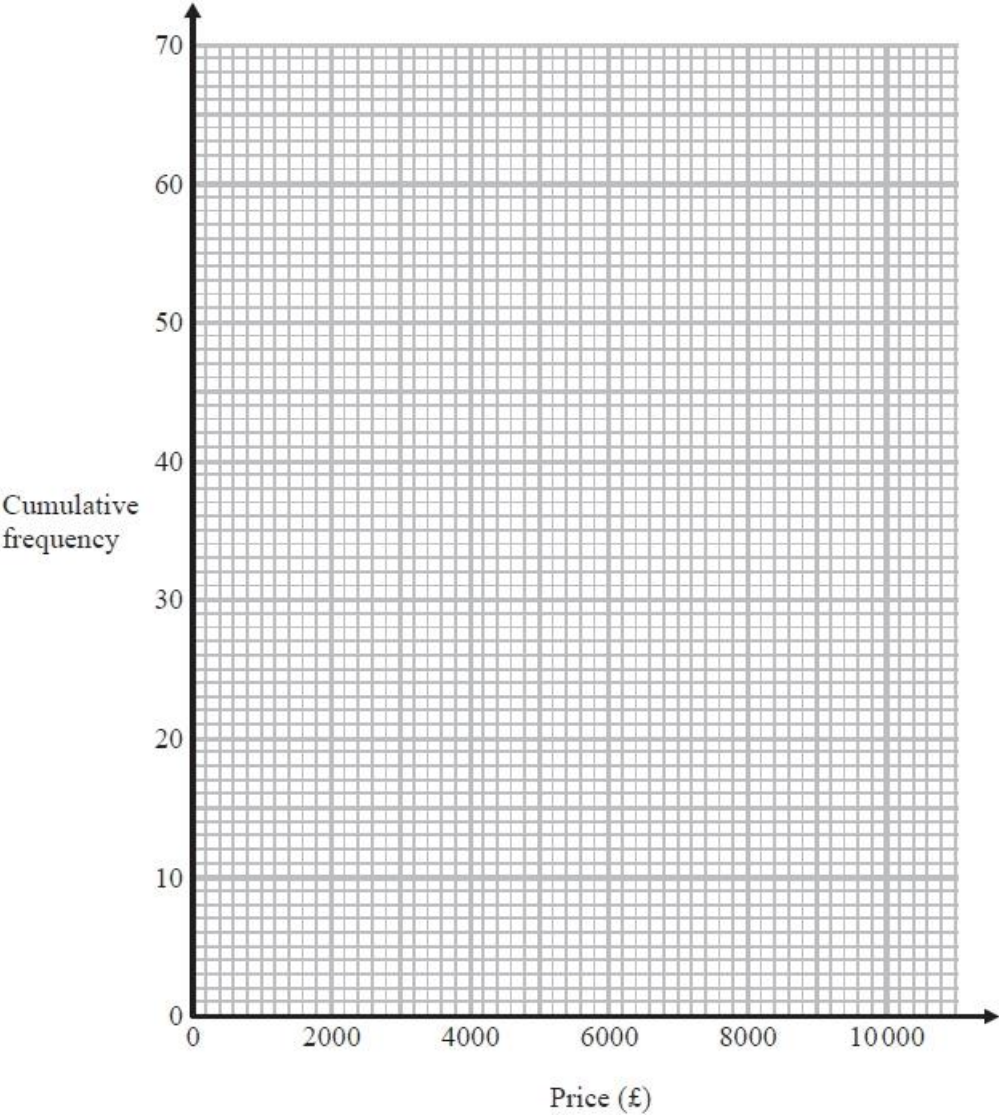
(a) Calculate an estimate for the mean price.

£ (4)

(b) Complete the cumulative frequency table.

Price (£ x)	Cumulative frequency
$0 < x \leq 2000$	
$0 < x \leq 4000$	
$0 < x \leq 6000$	
$0 < x \leq 8000$	
$0 < x \leq 10\,000$	

(c) On the grid, draw a cumulative frequency graph for your table.



(2)

(d) Find an estimate for the interquartile range.

£ (2)

(Total for question = 9 marks)

Q12. Here are the first six terms of a Fibonacci sequence.

1 1 2 3 5 8

The rule to continue a Fibonacci sequence is,
the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

.....
(1)

The first three terms of a different Fibonacci sequence are

$$a \quad b \quad a + b$$

(b) Show that the 6th term of this sequence is $3a + 5b$

(2)

Given that the 3rd term is 7 and the 6th term is 29,

(c) find the value of a and the value of b .

.....(3)

(Total for question = 6 marks)

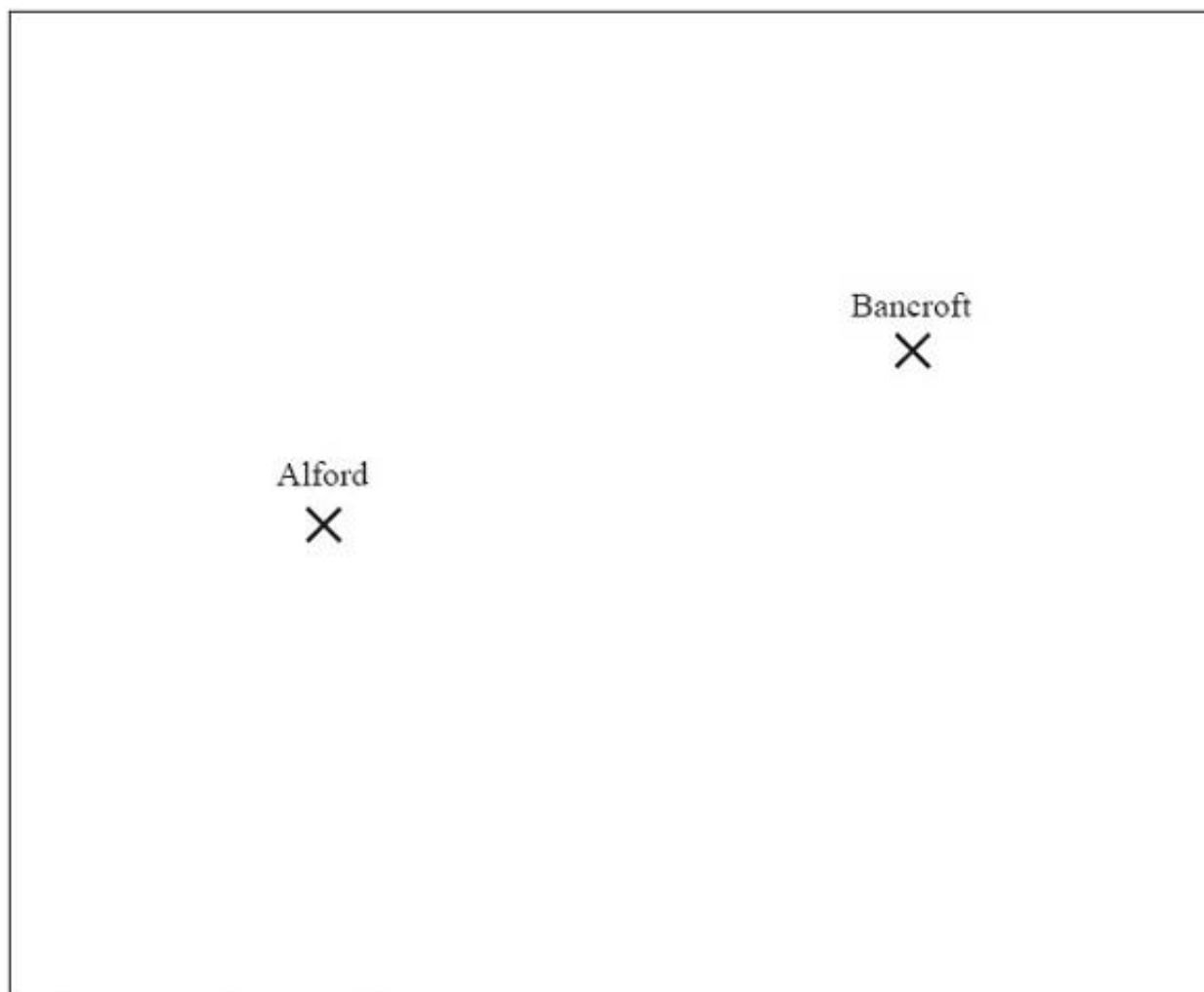
Q13.



Use ruler and compasses to **construct** the perpendicular bisector of the line AB .
You must show all your construction lines.

(Total for question = 2 marks)

Q14. The map shows the positions of two schools, Alford and Bancroft.



Scale 1 cm represents 1 km

A new school is going to be built.

The new school will be less than 5 kilometres from Alford.

It will be nearer to Bancroft than to Alford.

Shade the region on the map where the new school can be built.

(Total for Question is 3 marks)

Q15. Martin and Janet are in an orienteering race.

Martin runs from checkpoint *A* to checkpoint *B*, on a bearing of 065°

Janet is going to run from checkpoint *B* to checkpoint *A*.

Work out the bearing of *A* from *B*.

.....^o

(Total for question = 2 marks)

Q16.

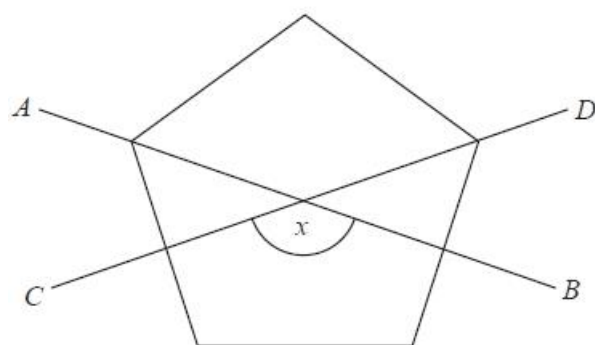


Diagram NOT
accurately drawn

The diagram shows a regular pentagon.
 AB and CD are two of the lines of symmetry of the pentagon.

Work out the size of the angle marked x .
You must show all your working.

.....°

(Total for question = 4 marks)

Q17.

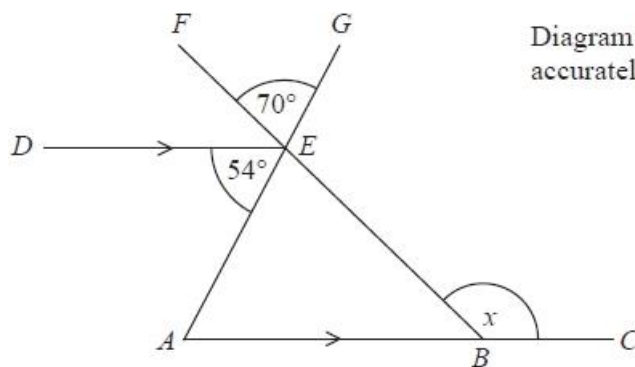


Diagram NOT
accurately drawn

ABC and DE are parallel lines. AEG and BEF are straight lines.

Angle $AED = 54^\circ$ Angle $FEG = 70^\circ$

Work out the size of the angle marked x . Give a reason for each stage of your working.

(Total for question = 4 marks)

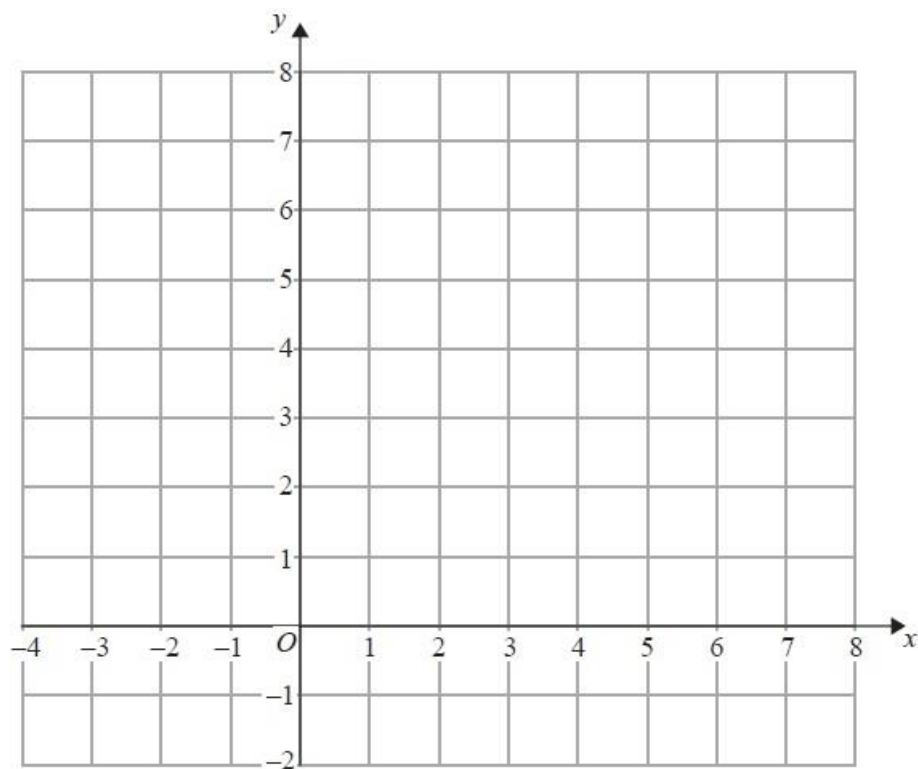
Q18. On the grid below, show by shading, the region defined by the inequalities

$$x + y < 6$$

$$x > -1$$

$$y > 2$$

Mark this region with the letter R.



(Total for Question is 4 marks)

Q19.

The function f is such that

$$f(x) = 4x - 1$$

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

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

The function g is such that

$$g(x) = kx^2 \text{ where } k \text{ is a constant.}$$

Given that $fg(2) = 12$

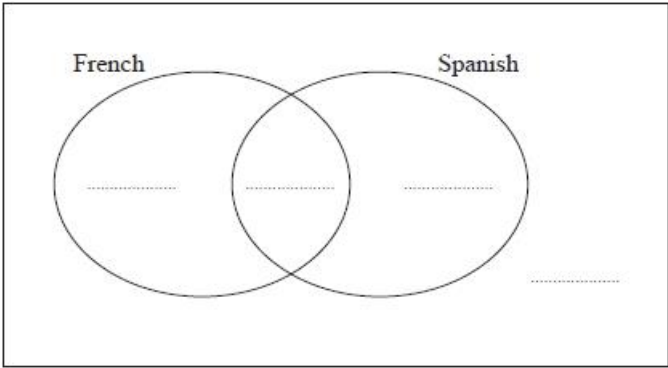
(b) work out the value of k

$$k = \dots\dots\dots (2)$$

(Total for question = 4 marks)

Q20. There are 60 students at a college. 20 students study both French and Spanish.
 13 students study French but not Spanish. A total of 43 students study Spanish.

(a) Complete the Venn diagram for this information.



(3)

One of the students at the college is to be selected at random.

(b) Write down the probability that this student studies neither French nor Spanish.

..... (1)

(Total for question = 4 marks)

Q21. Show that $(3x - 1)(x + 5)(4x - 3) = 12x^3 + 47x^2 - 62x + 15$ for all values of x .

(Total for question is 3 marks)

Q22. Solve $2x^2 + 4x - 5 = 0$ Give your solutions correct to 2 decimal places.

.....
 (Total for question = 3 marks)

Q23.

(a) Show that the equation $x^3 - 3x^2 + 3 = 0$ has a solution between $x = 2$ and $x = 3$

(2)

(b) Show that the equation $x^3 - 3x^2 + 3 = 0$ can be rearranged to give $x = \sqrt[3]{3x^2 - 3}$

(1)

(c) Starting with $x_0 = 2$, use the iteration formula $x_{n+1} = \sqrt[3]{3x_n^2 - 3}$ to find the value of x_2
Give your answer correct to 3 decimal places.

(3)

(Total for question = 6 marks)

Q24. Solve the simultaneous equations $x^2 + y^2 = 9$
 $x + y = 2$

Give your answers correct to 2 decimal places.

$x = \dots\dots\dots y = \dots\dots\dots$
or $x = \dots\dots\dots y = \dots\dots\dots$

(Total for Question is 6 marks)

Q25. Paper clips are sold in small boxes and in large boxes.
 There is a total of 1115 paper clips in 4 small boxes and 5 large boxes.
 There is a total of 530 paper clips in 3 small boxes and 2 large boxes.
 Work out the number of paper clips in each small box and in each large box.

(Total for Question is 5 marks)

Q26.

$OACB$ is a parallelogram.

M is the midpoint of AC .

C is the midpoint of the straight line BCX .

$$\vec{OA} = \mathbf{a} \quad \vec{OB} = \mathbf{b}$$

Prove that OMX is a straight line.

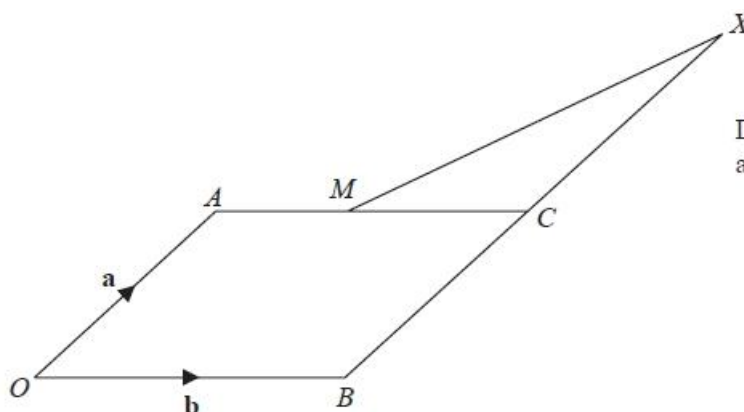


Diagram **NOT**
accurately drawn

(Total for Question is 4 marks)

Q27.

(a) Simplify fully $\frac{3-x}{3x^2-5x-12}$

..... (2)

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

..... (3)

(Total for question = 5 marks)

Q28. $ABCD$ is a quadrilateral.

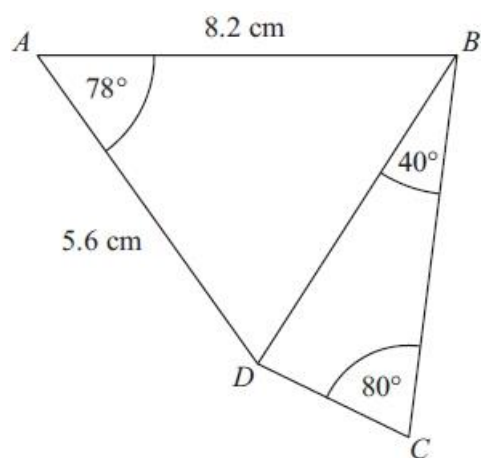


Diagram **NOT** accurately drawn

Work out the length of DC .
Give your answer correct to 3 significant figures.

..... cm

(Total for Question is 6 marks)

Q29.

In triangle ABC ,
 $AC = 6 \text{ cm}$
Angle $ACB = 120^\circ$
Angle $ABC = 25^\circ$

Work out the area of triangle ABC .
Give your answer correct to 1 decimal place.
You must show all your working.

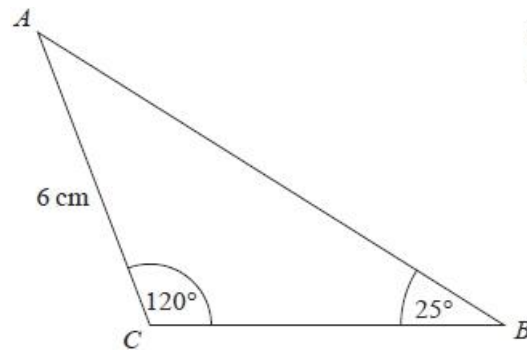


Diagram **NOT**
accurately drawn

..... cm^2

(Total for question = 4 marks)

Q30 Prove algebraically that the recurring decimal $0.1\overline{78}$ can be written as the fraction $\frac{59}{330}$

(Total for question = 3 marks)

Q31. Jeff is choosing a shrub and a rose tree for his garden.
At the garden centre there are 17 different types of shrubs and some rose trees.

Jeff says,

"There are 215 different ways to choose one shrub and one rose tree."

Could Jeff be correct? You must show how you get your answer.

(Total for question = 2 marks)

Examiner's Report

Q1. A variety of diagrams were seen. Some candidates insist on joining the first to last points forming an enclosed shape. This may come from their interpretation of the word polygon in this question. Centres should ensure candidates are aware this is not correct when drawing a frequency polygon. Another common error is to plot the heights at the end of the intervals. If candidates did this consistently they were awarded one mark. Some candidates draw the histogram first and then add the frequency polygon, this is an acceptable method and full marks can be awarded.

Q2. Success in all three parts of this question was very variable.

The most common error in part (a) was to fail to expand both brackets correctly. Of those who did expand correctly many seemed unable to simplify, with 12 and -2 being combined incorrectly to give -10 .

In part (b), candidates who knew how to find the product of two linear expressions frequently made arithmetic errors when simplifying, with $-8x + x$ often being simplified to $9x$ or $-9x$ rather than the correct $-7x$. Another common error was to give -3 as the product of 1 and -4 , adding rather than multiplying the numbers.

In part (c), some candidates failed to factorise fully but did gain 1 mark for a correct partially factorised answer. A significant proportion of incorrect answers occurred when candidates tried to factorise into two brackets.

Q3. No Examiner's Report available for this question

Q4. Candidates who did not initially multiply out the brackets correctly ran into problems soon after. Many errors resulted from poor rearrangement and $2y - 3$ was frequently seen.

Q5. No Examiner's Report available for this question

Q6. Factorisation of a quadratic function with non-unitary coefficient of x^2 was poor. Many chose to employ the formula to solve the given equation. Any mistake in the use of the formula, which was more often than not, resulted in no marks. A fully correct solution by this method gained just one of the three available marks. Many did make good attempts at factorising but then failed to complete the solution. A common incorrect attempt at factorisation was $(4x-9)(2x+3)$.

Q7. Most students realised they had to add the given expressions with many scoring 1 mark for $2x + 9 + 4x - 7$ and many of these going on to divide by 2. A few students reached the correct answer but then carried on trying to 'simplify' more such as $(2x + 9 + 4x - 7) \div 2 = (6x - 2) \div 2$ or $3x - 1$. However, there were many students who just formed the equation $2x + 9 = 4x - 7$ or tried to write a product such as $(2x + 9)(4x - 7)$ scoring no marks.

Q8. Part (a) was well answered although some candidates failed to interpret the diagram correctly and gave 2 rather than 32 as the median.

In part (b) 49 was a common incorrect answer from those candidates who worked out the range rather than, as requested, the interquartile range. Others attempted to work out the interquartile range by halving the range. Some candidates worked out that the lower and upper quartiles would come from the 7.75th and 23.25th (or 8th and 24th) values but then went onto subtract 7.75 from 23.25 rather than use the values of the variable associated with them.

Q9. In part (a) most candidates recognised that the coefficient of n was 7, but failed to identify the correct number term, with $+3$ or -3 as the most common incorrect term used. Some weaker candidates gave n^{+7} as their answer. In part (b) quite a few wrote out the full sequence or demonstrated that the 22nd term worked, which was quite adequate. An algebraic approach using $7n - 4 = 150$ usually worked well. Some described the method they would use such as "adding on 7s" which received some credit. Vague responses included those that made some reference to dividing 150 by 7 or using 150 in some other way.

Q10. This question was very well answered by a great many students of all levels of ability, gaining at least one mark for realising that the sequence was a quadratic sequence. Having found the second differences of '4', many gave $4n^2$ as the first part of their n th term. Having found a correct first term of $2n^2$, many students continued to employ a differencing approach. Others successfully arrived at a correct solution from solving simultaneous equations. Where students were not successful it was common to see $4n$, $2n$ or n instead of $2n^2$; thus many 2 term linear expressions.

Q11. Many fully correct answers were seen. The usual misconception of dividing by 5 was seen in part (a), along with a more unusual error of using 2000 for each 'midpoint'.

Part (b) was well answered, with the only real error seen being a silly mistake for example 4 instead of 64 as the final entry,

In part (c) a few scatter graphs were drawn and several students plotted the midpoints. Almost all joined their points with smooth curves although line segments are acceptable.

For part (d) many correct answers were seen and follow through was allowed for all marks in this part of the question and the scale was used well. The most common errors seen were to use 70 instead of 64 as the total frequency or find the median instead of the interquartile range.

Q12. No Examiner's Report available for this question

Q13. There were many correct lines drawn. Some presented an incomplete construction by using only one pair of construction arcs with a measured point on the line.

Q14. This question was not answered well at all. Very few candidates understood the need or were able to construct a perpendicular bisector. Most candidates did however gain one mark for a correct arc drawn of radius 5 cm, with centre the point at Alford. The most common error was to draw an intersecting arc, centre Bancroft, of radius either 3.75 cm ($\frac{1}{2}$ of AB) or 5 cm and then shade the common area between the arcs.

Q15. On the whole this question was not well answered. Examiners were able to give some credit to those students who clearly conveyed that they understood which angle was required in this question – this was often through using a clear sketch diagram with the appropriate angle marked. Surprisingly, many of the students who correctly identified the angle made an arithmetic mistake in its calculation. A common incorrect approach was to subtract 65° from 360° .

Q16. The mark for a correct interior angle of the pentagon was often the only mark achieved by many students; other angles were sometimes incorrectly labelled 108° . As usual, many gave 72° as the interior angle. Although many correctly used the properties of the lines of symmetry, which did gain credit, few correctly completed the solution to find the angle x . Some students gave 72° as the angle between the two lines of symmetry given.

Q17. The greater number of students gained at least one mark in this question for identifying a correct angle, usually angle $FED = 56^\circ$ or angle $AEB = 70^\circ$. Many progressed to correctly find the angle x . Full marks were not as common as many students still fail to give acceptable forms for their reasoning. Confusion between alternate and corresponding angles and/or a failure to write "**vertically** opposite angles are equal", were the major causes for the loss of the loss of communication marks. Centres need to make it clear to students that 'alternative' angles does not gain credit when used instead of alternate angles.

Q18. A fully correct solution was not the norm in this question. A great many candidates were unable to draw the three lines correctly; $x = -1$ and $y = 2$ were often drawn as $y = -1$ and $x = 2$ and often $x + y = 5$ or $x = 6$ and $y = 6$ were drawn instead of $x + y = 6$. Shading, whether 'in' or 'out', was generally well done but credit was dependent upon at least two correct lines.

Q19/20/21. No Examiner's Report available for this question

Q22. This question was well attempted by the more able students who quickly identified that it required the use of the formula. These students usually worked carefully and accurately to score full marks. Of the many students who were not successful, most either attempted to factorise the quadratic expression or they attempted other fruitless algebraic manipulation. Attempts using trial and improvement were also often seen but these were invariably unsuccessful.

Q23. No Examiner's Report available for this question

Q24. Those that understood the method usually applied it and gained marks, but for many haphazard or trial and improvement methods resulted in zero marks.

Too many candidates attempted to create a second equation in order to use the elimination method of solving simultaneous equations and it was not uncommon to see $x+y=2$ squared to give $x^2 + y^2=4$.

Expansions of $(2-x)^2$ was also sometimes done poorly, leaving incorrect quadratic equations for solution.

Sketch graphs always failed to deliver the accurate required for the solutions.

Q25.

The students that translated the given information into a pair of simultaneous equations usually went on to score well, often full marks. Those students attempting trial and improvement/error methods usually failed to gain any credit. A small number of students wrote down the two initial equations but then did nothing with them. There were many responses using a ratio method, often initially dividing through by 9, which also failed to gain any credit.

Q26.

Many students who were comfortable working with vectors generally scored at least 3 marks on this question. For the award of the final mark a full and complete proof was required. This question was often left blank many students.

Q27.

A correct answer in part (a) was rare, with the great majority of students, who did make a good start, failing to deal with either negative signs or the fraction; $\frac{1}{3x+4}$ and $3x + 4$ were common incorrect answers seen. It is clear many fail to appreciate that $(x - 3)$ is the same as $-(3 - x)$.

Part (b) was answered considerably better with many gaining two marks for correct fractions with a correct common denominator. Some students having found the correct answer then tried to simplify it further and lost the final mark through algebraic errors. Some students lost the final accuracy mark by not dealing with the two negative signs correctly in the numerator.

Q28.

There were some who did not understand the topic and associated this question with Pythagoras and right-angled trigonometry. The majority deduced Cosine rule was needed and correctly substituted in their values. In many cases the order of operations in Cosine Rule was flawed, resulting in an incorrect length for DB. Many then went on to use Sine Rule, with greater success and sound method shown resulted in additional marks.

Q29.

About half of the students understood how to start this problem and were able to score some marks in this question. Almost all the attempts used the approach that linked the sine rule and sine formula for finding the area of a triangle rather than dropping the exterior perpendicular from A or the interior perpendicular from C. Those students that managed to start the question then went on to solve the problem and score all four marks.

Q30.

Some students could recall the need to consider multiplying the recurring decimal by powers of ten but not many could use a correct combination to eliminate the recurring nature of the decimal. A small number of students gave a clear, accurate and complete solution to score full marks.

Q31.

This question targeted a new area of the specification and it was pleasing to see the majority of students scored at least one mark on this question.

Many students obtained one mark for $215 \div 17 = 12.647..$ and some went on to correctly indicate that it is not possible to have 0.647.. of a rose tree or that the answer was not an integer when an integer would be required. An alternative method seen was to show $12 \times 17 (= 204)$ and $13 \times 17 (= 221)$ and an explanation that there could not be a number of trees between 12 and 13.

The main errors seen in this question, were to show a correct calculation with no interpretation scoring one mark, or to show $17 \times 17 = 289$, which has no meaning in this question or to give a vague reason e.g. '215 can't be divided by 17' the latter two do not score any marks.

Mark Scheme

Q1.

	Working	Answer	Mark	Notes
		Points plotted at (5, 6), (15, 9), (25, 8), (35, 7), (45, 5) and joined with line segments	2	B2 for correct plotting of 5 points and joining with line segments (B1 for points plotted correctly at midpoints of intervals OR joining points with line segments at the correct heights <u>and</u> consistent within the class interval (including end values) OR correct frequency polygon with one point incorrect OR correct frequency polygon with first and last points joined) NB Ignore any histogram drawn and any part of frequency polygon outside range of first and last points plotted

Q2.

	Working	Answer	Mark	Notes
(a)	$3x + 12 + 10x - 2$	$13x + 10$	2	M1 for correct method to expand one bracket eg $3 \times x + 3 \times 4$ or $3x + 12$ or $2 \times 5x - 2 \times 1$ or $10x - 2$ A1 for $13x + 10$
(b)	$2x^2 - 8x + x - 4$	$2x^2 - 7x - 4$	2	M1 for all 4 terms (and no additional terms) correct ignoring signs or 3 out of no more than four terms correct A1 for $2x^2 - 7x - 4$
(c)		$3y(2y - 3x)$	2	B2 for $3y(2y - 3x)$ (B1 for $3(2y^2 - 3xy)$ or $y(6y - 9x)$ or $3y(2y + 3x)$ or $3y(2y - ax)$ where a is any positive integer except 3 or $3y(by - 3x)$ where b is any positive integer except 2)

Q3.

Question	Working	Answer	Mark	Notes
(a)(i)		480 – 500	B1 B1	for line of best that can be used to estimate time of flight for 480 – 500 or ft lobf
(a)(ii)		reason	C1	for reason, e.g. lobf can vary, data is only a sample, scale cannot be read exactly
(b)(i)		9.4 – 9.8	M1 A1	for method to find gradient, e.g. triangle drawn with “change in distance ÷ change in time” for 9.4 – 9.8 or ft lobf
(b)(ii)		speed	C1	for speed (in miles per minute) oe

Q4.

	Working	Answer	Mark	Notes
	$4x - 3 = 2x + 2y$ $2x - 3 = 2y$ $2x = 2y + 3$ $x = y + 1.5$	$x = y + 1.5$	3	M1 for attempt to expand brackets eg $2x + 2y$ or divide through by 2 (each term). M1 for attempt to get x on one side of equation. A1 for $(x =) y + 1.5$, $2y + 3/2$, oe

Q5.

Paper 1MA1: 3H			
Question	Working	Answer	Notes
		$(x - 1)(x + 4)$	M1 $(x \pm 1)(x \pm 4)$ A1 $(x - 1)(x + 4)$ oe

Q6.

PAPER: 5MB3H 01				
Question	Working	Answer	Mark	Notes
		4.5, -0.75 oe	3	M2 for $(2x - 9)(4x + 3)$ oe (M1 for $(2x \pm 9)(4x \pm 3)$) oe A1 for 4.5, -0.75 oe [SC: B1 for 4.5 and -0.75 oe, found by any other method]

Q7.

PAPER: 5MB1H 01				
Question	Working	Answer	Mark	Notes
		$\frac{2x + 9 + 4x - 7}{2}$	2	M1 for $2x + 9 + 4x - 7$ oe A1 for $\frac{2x + 9 + 4x - 7}{2}$ oe

Q8.

Question	Working	Answer	Mark	Notes
(a)	$8 \times 1000 = 8000$ $14 \times 3000 = 42000$ $28 \times 5000 = 140000$ $10 \times 7000 = 70000$ $4 \times 9000 = 36000$ $296000 \div 64$	4625	4	M1 for finding at least 4 products fx consistently within interval (including end points) M1 (dep) for use of at least 4 correct midpoints M1 (dep on first M1) for $\Sigma fx \div 64$ A1 cao
(b)		8,22,50,60,64	1	B1 all 5 correct
(c)		Cumulative frequency graph	2	M1 for at least 4 of '5 points' plotted consistently within each interval, and joined by curve or line segments providing no gradient is negative. A1 for correct cumulative frequency graph
(d)		2500 - 3000	2	M1 dep on cf graph for readings at $cf = 16$ or 16.25 and $cf = 48$ or 48.75 A1 ft from cf graph

Q9.

Question	Working	Answer	Mark	Notes
(a)		32	1	B1 cao
(b)	LQ = 21 UQ king = 45	24	2	M1 for 45 or 21 or 43.5 or 19.5 or 7.75 th or 8 th or 23.25 th or 24 th (al of the above may be seen in working space or indicated on S&L) or Clear attempt to find UQ and LQ from list of values or in stem and leaf diagram A1 cao

Q10.

PAPER: 1MA0_2H				
Question	Working	Answer	Mark	Notes
(a)		$7n - 4$	2	B2 for $7n - 4$ (B1 for $7n + d$ where d is an integer)
(b)		explanation	2	M1 for ' $7n - 4$ ' = 150 or any other valid method, eg. counting on 7s (to get 150) A1 for a complete explanation eg. the 22nd term is 150 or $n = 22$ from solution of equation or a clear demonstration based on 22 or complete sequence

Q11.

Question	Working	Answer	Mark	Notes
		$2n^2 + n + 1$	M1 M1 A1	for a correct start to a method to find n th term, eg. equal 2nd differences imply a term in n^2 or sight of $an^2 + bn + c$ for a method leading to $2n^2$ and either n or 1 for $2n^2 + n + 1$ oe

Q12.

Paper 1MA1: 3H			
Question	Working	Answer	Notes
(a)	8, 13, 21,	34	B1 cao
(b)	$a, b, a + b, a + 2b, 2a + 3b$	Shown	M1 Method to show by adding pairs of successive terms $a + 2b, 2a + 3b$ shown C1
(c)	$3a + 5b = 29$ $a + b = 7$ $3a + 3b = 21$ $b = 4, a = 3$	$a = 3$ $b = 4$	P1 Process to set up two equations P1 Process to solve equations A1

Q13.

5MB3H_01 November 2015				
Question	Working	Answer	Mark	Notes
		bisector	2	M1 for an appropriate pair of arcs or correct line drawn without construction arcs A1 for perpendicular bisector of AB drawn with a pair of construction arcs

Q14.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
		Correct region shaded	3	B1 for perpendicular bisector within guidelines B1 for arc of circle, centre A, within guidelines B1 ft for a correct region shaded or otherwise indicated from their perpendicular bisector of AB and their arc drawn, centre A

Q15.

PAPER: 1MA0_2H				
Question	Working	Answer	Mark	Notes
		245	2	M1 for method to identify the angle required, including on a diagram A1 cao

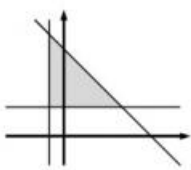
Q16.

Question	Working	Answer	Mark	Notes
		144	4	<p>M1 for method to find the interior angle of a regular pentagon, eg. $180 \times (5 - 2) \div 5 (= 108)$ oe M1 (indep) for using a line of symmetry to find an angle, eg. "interior angle" $\div 2$ (half an interior angle) or 90 between line and side M1 (dep on M2) for complete method to find angle x, eg. $90 + "54"$ or $"108" \times 5 - "108" \times 2 - 90 \times 2$ A1 for 144 supported by working</p> <p>OR</p> <p>M1 for considering all 5 lines of symmetry or angle vertically opposite x with angle bisector drawn M1 for $360 \div 10 (= 36)$ or $360 \div 5 (= 72)$ M1 for $(360 \div 10) \times 4$ or $(360 \div 5) \times 2$ A1 for 144 supported by working</p> <p>OR</p> <p>M1 for method to find the exterior angle of a regular pentagon (72°), eg. $360 \div 5 (= 72)$ oe M1 (indep) for using a line of symmetry to find an angle, eg. "interior angle" $\div 2$ (half an interior angle) or 90 between line and side M1 (dep on M2) for complete method to find angle x, eg. $180 - 2(180 - 90 - 72)$ A1 for 144 supported by working</p>

Q17.

Question	Working	Answer	Mark	Notes
		124° with reasons	4	<p>M1 for a method to find any angle, eg. angle $DEF = 180 - 70 - 54 (= 56)$ or angle $AEB = 70$ or angle $EAB = 54$ or angle $GEB = 180 - 70 (= 110)$ A1 for $x = 124$ NB: angles may be just shown on the diagram</p> <p>C2 for full reasons, appropriate to their given method, with no additional reasons (C1 for one appropriate reason relating to parallel lines)</p> <p>Possible reasons: corresponding angles are equal; alternate angles are equal; co-interior angles (allied) add up to 180 angles on a straight line add up to 180; angles in a triangle add up to 180; vertically opposite angles are equal; the exterior angle of a triangle is equal to the sum of the interior opposite angles; angles at a point add up to 360;</p>

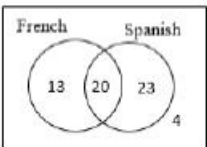
Q18.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
		Region identified	4	<p>B1 for $x + y = 6$ or $x = -1$ or $y = 2$ drawn B1 for $x + y = 6$ and $x = -1$ and $y = 2$ drawn M1 for consistent shading (in or out) for any two of the lines $x + y = 6$, $x = -1$, $y = 2$ A1 lines drawn, and correct region identified by either shading in, or shading out; the letter R is not required, but necessary if no shading.</p> <p>Note: Lines may be solid or dotted/dashed etc</p>

Q19.

Paper 1MA1: 3H			
Question	Working	Answer	Notes
(a)		$\frac{x+1}{4}$	<p>M1 start to method eg. $y = 4x - 1$ or $x = \frac{y+1}{4}$</p> <p>A1 oe</p>
(b)		$\frac{13}{16}$	<p>P1 for start to process eg. $f(4k) = 16k - 1$ or $g(2) = \frac{12+1}{4}$</p> <p>A1</p>

Q20.

Question	Working	Answer	Mark	Notes
(a)		Correct diagram	3	<p>B1 13 and 20 in correct positions M1 $43 - 20 (= 23)$ or $60 - 43 - 13 (= 4)$ A1 correct diagram</p>
(b)		$\frac{4}{60}$	1	<p>B1 $\frac{4}{60}$ oe or ft Venn diagram for $\frac{4}{60}$</p>

Q21.

Paper 1MA1: 2H			
Question	Working	Answer	Notes
		Fully correct algebra to show given result	<p>M1 for method to find the product of any two linear expressions; eg. 3 correct terms or 4 terms ignoring signs M1 for method of 6 products, 4 of which are correct (ft their first product) A1 for fully accurate working to give the required result</p>

Q22.

Question	Working	Answer	Mark	Notes
(a)		Shown	M1 A1	for method to establish at least one root in (2, 3), e.g. $f(x) = x^3 - 3x^2 + 3$, $f(2) (= -1)$, $f(3) (= 3)$ oe for supportive explanation e.g. "since there is a change in sign there must be at least one root in $2 < x < 3$ (as f is continuous)" oe
(b)		Shown	C1	for at least $x^3 = 3x^2 - 3$ and no incorrect steps.
(c)		2.153	M1 A1 A1	for $x_1 = \sqrt[3]{3 \times 2^2 - 3}$ for $x_1 = 2.080(\dots)$ for $x_2 = 2.153(\dots)$

Q23.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
		-2.87, 0.87	3	M1 for substitution into formula; allow sign errors in b and c M1 for reduction to $\frac{-4 - \sqrt{56}}{4}$ or $\frac{-4 + \sqrt{56}}{4}$ A1 for 0.87 to 0.88 and -2.87 to -2.88 OR M1 for $(x+1)^2$ M1 for reduction to $\sqrt{\frac{7}{2}} - 1$ or $-\sqrt{\frac{7}{2}} - 1$ A1 for 0.87 to 0.88 and -2.87 to -2.88

Q24.

	Working	Answer	Mark	Notes
		$x = 2.87, y = -0.87$ and $x = -0.87, y = 2.87$	6	M1 for $x^2 + (2-x)^2 = 9$ M1 for $4 - 4x + x^2$ A1 for $2x^2 - 4x - 5 = 0$ oe 3 term simplified quadratic M1 for a correct method to solve their quadratic Eg $x = \frac{4 \pm \sqrt{(16 - 4 \times 2 \times -5)}}{4}$ A1 for $x = 2.87, y = -0.87$ or better A1 for $x = -0.87, y = 2.87$ or better Award marks for equivalent algebraic expressions. Apply the same scheme as above for y first.

Q25.

Paper: 5MB3H_01				
Question	Working	Answer	Mark	Notes
*	<p>Example:</p> $4a+5b=1115$ $3a+2b=530$ $12a+15b=3345$ $\underline{12a+8b=760}$ $7b=1225$ $b=175$ $a=(1115-5 \times 175) \div 4 (=60)$ <p>OR</p> $8a+10b=2230$ $\underline{15a+10b=2650}$ $7a=420$ $a=60$ $b=(1115-4 \times 60) \div 5 (=175)$	<p>Small = 60 Large = 175</p>	5	<p>M1 for two correct equations expressed in terms of two variables M1 (dep) for correct process to eliminate either variable (condone one arithmetic error) A1 for 60 or 175 M1 (dep) for correct substitution of their found variable or M1 (indep) for correct process to eliminate the other variable (condone one arithmetic error) C1 (dep on M3) for a statement giving small = 60 and large = 175</p>

Q26.

Paper: 5MB3H_01				
Question	Working	Answer	Mark	Notes
		proof	4	<p>B1 for $\overrightarrow{AM} = 0.5\mathbf{b}$ or $\overrightarrow{MC} = 0.5\mathbf{b}$ or $\overrightarrow{BC} = \mathbf{a}$ or $\overrightarrow{CX} = \mathbf{a}$ or $\overrightarrow{BX} = 2\mathbf{a}$ Note: This could be shown on the diagram or in a correct vector expression M1 for a correct relevant vector expression for \overrightarrow{OM} or \overrightarrow{MX} or \overrightarrow{OX} eg $\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM}$ or $\overrightarrow{OX} = \mathbf{b} + 2\mathbf{a}$ A1 for any two from $(\overrightarrow{OM}) = \mathbf{a} + 0.5\mathbf{b}$, $(\overrightarrow{MX}) = \mathbf{a} + 0.5\mathbf{b}$ and $(\overrightarrow{OX}) = \mathbf{b} + 2\mathbf{a}$ B1 for a fully correct proof, eg. "$\overrightarrow{OX} = 2\overrightarrow{OM}$ so the vectors are parallel and have a common point O" OR (geometric proof) M1 for $\angle OAM = \angle MCX$ or $OA = CX$ and $AM = CM$ A1 for $\angle OAM = \angle MCX$ with reason (alternate angles) and $OA = CX$ and $AM = CM$ B1 for $\triangle OAM \equiv \triangle XCM$ with reason, eg SAS B1 for correct proof, eg $\angle AMO = \angle CMX$ with reason (vertically opposite angles)</p>

Q27.

Question	Working	Answer	Mark	Notes
(a)		$\frac{-1}{3x+4}$	2	<p>M1 for $(3x+4)(x+3)$ or $(-3x+4)(-x+3)$ A1 for $\frac{-1}{3x+4}$, accept $\frac{1}{-3x-4}$</p>
(b)		$\frac{2x}{x^2-1}$	3	<p>M1 for common denominator $(x-1)(x+1)$ or x^2-1 M1 for $\frac{x(x+1)}{(x-1)(x+1)} - \frac{x(x-1)}{(x-1)(x+1)}$ oe or $\frac{x(x+1)-x(x-1)}{(x-1)(x+1)}$ oe (NB: The denominator must be $(x-1)(x+1)$ or x^2-1 or another suitable common denominator) A1 for $\frac{2x}{(x-1)(x+1)}$ or $\frac{2x}{x^2-1}$</p>

Q28.

Question	Working	Answer	Mark	Notes
	$DB^2 = 5.6^2 + 8.2^2 - 2 \times 5.6 \times 8.2 \cos 78$ $DB^2 = 79.505\dots$ $DB = 8.9165795\dots$ $\frac{8.9165\dots}{\sin 80} = \frac{DC}{\sin 40}$ $DC = \frac{8.9165\dots \times \sin 40}{\sin 80}$ $= 8.9165\dots \times 0.6572\dots$ $= 5.8198$	5.82	6	M1 Cosine rule: $DB^2 = 5.6^2 + 8.2^2 - 2 \times 5.6 \times 8.2 \times \cos 78$ M1 $\sqrt{79.505\dots}$ (=8.9165795...) A1 for DB = 8.90 to 8.92 M1 $\frac{8.9165\dots}{\sin 80} = \frac{DC}{\sin 40}$ M1 $\frac{8.9165\dots \times \sin 40}{\sin 80}$ (=5.8198) A1 for answer 5.80 to 5.83 If working in RAD or GRAD award method marks only. RAD: DB=13.318..., DC=-9.98.. GRAD: DB=8.2152..., DC=5.0773...

Q29.

Question	Working	Answer	Mark	Notes
		21.2	4	M1 for correct use of sine rule to find AB or BC , eg $\frac{6}{\sin 25} = \frac{AB}{\sin 120}$ or $\frac{6}{\sin 25} = \frac{BC}{\sin(180-120-25)}$ M1 for $(AB =) \frac{6}{\sin 25} \times \sin 120$ (= 12.2(951...)) or $(BC =) \frac{6}{\sin 25} \times \sin 35$ (= 8.1(431...)) M1(dep M2) for method to find area, eg $0.5 \times 6 \times "AB" \sin 35$ or $0.5 \times 6 \times "BC" \sin 120$ A1 for answer in the range 21.1 – 21.2 OR (with perpendicular from A meeting BC extended at a point X) M1 for method to find AX M1 for method to find BX M1(dep M2) for $0.5 \times "AX" \times "BC"$ A1 for answer in the range 21.1 – 21.2

Q30.

PAPER: 5MB3H 01				
Question	Working	Answer	Mark	Notes
		$\frac{59}{330}$	3	M1 for $100x = 17.87878787\dots$ or $1000x = 178.7878787\dots$ and $10x = 1.7878787$ M1 (dep) for subtraction, $100x - x$ or $1000x - 10x$ or $\frac{17.7}{99}$ or $\frac{177}{990}$ seen A1 working leading to given fraction

Q31.

Question	Working	Answer	Mark	Notes
		No (supported)	P1 C1	Process to find number of rose trees e.g. $215 \div 17$ (=12.647...) 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