Questions

Q1.

Simplify $\frac{x+1}{2} + \frac{x+3}{3}$

. . . .

(Total for Question is 3 marks)

Q2.

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 = 3 marks)

Q3.

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

(Total for question = 3 marks)

Q4.

Solve $\dfrac{1}{2x-1} + \dfrac{3}{x-1} = 1$

Give your answer in the form $\dfrac{p \pm \sqrt{q}}{2}$ where *p* and *q* are integers.

....

(Total for question = 4 marks)

Q5.

Show that $\dfrac{3x}{x+2} - \dfrac{2x+1}{x-2} - 1$ can be written in the form $\dfrac{ax+b}{x^2-4}$

where *a* and *b* are integers.

(Total for question = 4 marks)

Q6.

(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 = 3 marks)

Q7.

Prove algebraically that the recurring decimal $0.3\dot{1}\dot{8}$ can be written as $\frac{7}{22}$

(Total for question = 2 marks)

Q8.

Express the recurring decimal $0.2\dot{8}\dot{1}$ as a fraction in its simplest form.

. . . .

(Total for Question is 3 marks)

Q9.

Prove that the recurring decimal $0.4\dot{3}$ has the value $\frac{13}{30}$

(Total for question = 2 marks)

Q10.

Write $0.6\dot{2}\dot{4}$ as a fraction in its simplest form.

....

(Total for question = 3 marks)

Q11.

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

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

(Total for question = 3 marks)

Q12.

Using algebra, prove that $0.1\dot{3}\dot{6} \times 0.\dot{2}$ is equal in value to

$\frac{1}{33}$

(Total for question = 3 marks)

Q13.

Prove algebraically that $0.7\dot{3}$ can be written as $\frac{11}{15}$

(Total for question = 2 marks)

Q14.

(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 = 6 marks)

Q15.

(a) Factorise $x^2 + 5x + 4$

. . . .

(2)

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

. . . .

(2)

(c) Write as a single fraction $\frac{1}{2x} + \frac{1}{5x} - \frac{1}{3x}$

. . . .

(2)

(Total for Question is 6 marks)

Q16.

There are four types of cards in a game.

Each card has a black circle or a white circle or a black triangle or a white triangle.

number of cards with a black shape : number of cards with a white shape = 3 : 5

number of cards with a circle : number of cards with a triangle = 2 : 7

Express the total number of cards with a black shape as a fraction of the total number of cards with a triangle.

....

(Total for question = 3 marks)

Q17.

There are 60 people in a choir.
Half of the people in the choir are women.

The number of women in the choir is 3 times the number of men in the choir.
The rest of the people in the choir are children.

the number of children in the choir : the number of men in the choir = n : 1

Work out the value of n.
You must show how you get your answer.

n = ...

(Total for question = 4 marks)

Q18.

A shop sells packs of black pens, packs of red pens and packs of green pens.

There are

2 pens in each pack of black pens
5 pens in each pack of red pens
6 pens in each pack of green pens

On Monday,

$$\frac{\text{number of packs}}{\text{of black pens sold}} : \frac{\text{number of packs}}{\text{of red pens sold}} : \frac{\text{number of packs}}{\text{of green pens sold}} = 7:3:4$$

A total of 212 pens were sold.

Work out the number of green pens sold.

....

(Total for question = 4 marks)

Q19.

There are two drama groups in a school.

In one group there are 36 boys and 48 girls.

In the other group, $\frac{3}{7}$ of the students are boys and the rest of the students are girls.

Ann says,

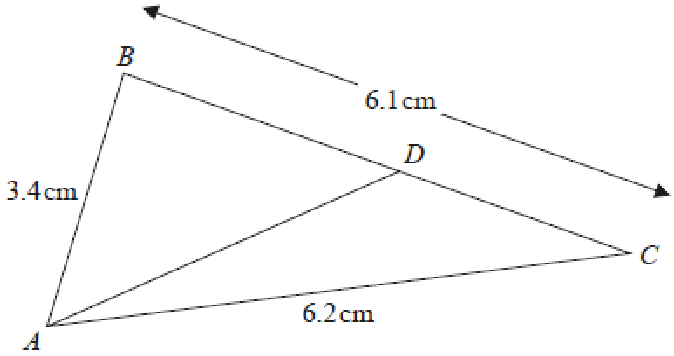
"The ratio of the number of boys to the number of girls is the same for both groups."

Is Ann correct?
You must show how you get your answer.

(Total for question = 3 marks)

Q20.

The diagram shows triangle *ABC*.



AB = 3.4 cm AC = 6.2 cm BC = 6.1 cm

D is the point on BC such that

$$\text{size of angle } DAC = \frac{2}{5} \times \text{ size of angle } BCA$$

Calculate the length DC.
Give your answer correct to 3 significant figures.
You must show all your working.

.... cm

(Total for question = 5 marks)

Q21.

Given that $\frac{a}{b} = \frac{2}{5}$ and $\frac{b}{c} = \frac{3}{4}$

find $a : b : c$

....

(Total for question = 3 marks)

Q22.

(a) Solve $\frac{9+x}{7} = 11 - x$

x = ...

(3)

(b) Simplify $\frac{4(y+3)^3}{(y+3)^2}$

....

(1)

(Total for question = 4 marks)

Q23.

(a) Factorise $3(x - y)^2 - 2(x - y)$

....

(2)

(b) Show that $\frac{1}{2x^2 + x - 15} \div \frac{1}{3x^2 + 9x}$ simplifies to $\frac{ax}{bx + c}$ where a, b and c are integers.

(3)

(Total for question = 5 marks)

Q24.

$x = 0.0\dot{4}\dot{5}$

Prove algebraically that x can be written as $\frac{1}{22}$

(Total for question = 3 marks)

Q25.

(a) Simplify $\frac{4(x+5)}{x^2+2x-15}$

. . . .

(Total for Question is 2 marks)

Q26.

(a) Simplify fully $\frac{x^2+3x-4}{2x^2-5x+3}$

. . . .

(3)

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

....

(3)

(Total for Question is 6 marks)

Q27.

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

....

(3)

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

....

(3)

(Total for question = 6 marks)

Q28.

Write

$$4 - \left[(x + 3) \div \frac{x^2 + 5x + 6}{x - 2}\right]$$

as a single fraction in its simplest form.
You must show your working.

....

(Total for question is 4 marks)

Examiner's Report

Q1.

It was obvious that many candidates had been taught to cross multiply without understanding that they were still dealing with a fraction and so a common error was to multiply both fractions by 6 and so clear the fractions giving an answer of 5*x*+ 9. Incorrect attempts to add the fractions were common – multiplying the numerators and adding the denominators was a fairly common mistake; the most common incorrect answers were $\frac{(2x+4)}{5}$ or $\frac{(x^2+4)}{6}$. Candidates who attempted this incorrect method gained no marks. It was disappointing to see a number of candidates get the correct two equivalent fractions and then fail to expand the brackets in their numerators correctly. Others failed at the final stage. Having reached the correct answer of $\frac{5x+9}{6}$ they then attempted to simplify this further inappropriately, sometimes to 5*x*+ 1.5 and thus failed to gain the final accuracy mark. Some candidates did not see this as an expression but tried to turn it into an equation to solve for *x*.

Q2.

Most of the students who used 10*x* as a common denominator went on to score full marks. Exceptions to this were those who made errors in expanding brackets, for example 5(4*x* + 3) = 20*x* + 3, and those who wrote $\frac{3}{5}$ as $\frac{6}{10x}$. Some students wrote only one of the fractions with a suitable denominator, often this was $(\frac{20x+15}{10x})$ and gained the first mark only. Many students did not know how to tackle this question.

Q3.

There were some excellent clear and concise answers to this question leading to the correct answer $\frac{1}{x(x+4)}$. Many students were able to show that to divide the algebraic fractions, inverting the second fraction and multiplying it by the first fraction was needed. Fewer students realised the need to factorise the denominator of the first fraction and much fruitless algebra was seen with students frequently multiplying out expressions.

Q4.

Relatively few students could demonstrate the necessary skills of algebraic manipulation to solve the equation and give the answer in the required form. Many students were able to correctly write the two fractions with a common denominator and gain the first mark but a significant number were then unable to carry the algebraic solution any further. Those that did reduce the equation to a 3 term quadratic often made errors when rearranging and did not get the second mark. Substitution into the quadratic equation formula was generally done well but some students attempted to use completing the square and this was done less well due to not dealing with the coefficient of 2 correctly. Some students who did not get a correct quadratic equation were still able to gain the third mark for dealing correctly with their 3 term quadratic equation. The final step to write $\frac{10 \pm \sqrt{60}}{4}$ in the required form proved difficult with $\frac{5 \pm \sqrt{30}}{2}$ a common incorrect answer.

Q5.

Fully correct answers to this question were seen infrequently. However, a significant proportion of students taking this paper were able to score at least one mark for using a correct common denominator and writing at least one of the three terms with that common denominator, usually the first fraction as $\frac{3x(x-2)}{x^2-4}$. Only the best students were able to work accurately in order to gain more credit for their responses. The question discriminated well between high ability students aiming to get one of the two top grades. For many students, this question proved to be the most challenging question on the paper. In particular mistakes were often made with signs when the fraction $\frac{(x+2)(2x+1)}{x^2-4}$ was subtracted from the fraction $\frac{3x(x-2)}{x^2-4}$ or in writing $-(x^2 - 4)$ as $-x^2 - 4$.

Q6.

Any marks gained in this question were usually in part (a), only a very small number of students gained the mark in part (b).

In part (a), many students correctly found the common denominator of $3x(x + 1)$ or equivalent. Unfortunately, numerators of 5 and 2 were often retained gaining no credit. A numerator $5 \times 3x + 2(x + 1)$ was often not or incorrectly simplified resulting expressions of $15x + 2x + 2$(or 1). It was also disappointing to see so many students having found the correct simplified expression then try to simply further. In algebraic questions, such subsequent incorrect working can never be ignored, and the final accuracy mark is lost.

In part (b), the modal approach was to expand the brackets rendering the resulting expression near impossible to factorise.

Q7. No Examiner's Report available for this question

Q8.

Candidates who were able to recognise that the given recurring decimal was 0.28181… rather than 0.281281… gained a generous first method mark. In order to gain the second method mark a full correct method had to be seen. Unfortunately, many attempted the subtraction of 281.8181… and 0.28181… which is an incorrect method. Some got as far as $^{27.9}/_{99}$ or $^{279}/_{99}$ but were then unable to finish their solution correctly to arrive at the correct answer of $^{31}/_{110}$. There were many incorrect guesses of $^{281}/_{10000}$ and $^{281}/_{999}$ seen.

Q9. No Examiner's Report available for this question

Q10. No Examiner's Report available for this question

Q11.

Another familiar question from the legacy specification and one where we would expect to see more correct algebra. Most students understood the need to find multiples of x, unfortunately these were either often wrong, or the wrong multiples were found. For example finding $1000x$ but not $10x$. There were though a good number of students that were able to follow the algebra through to the correct fraction.

Q12.

There were a variety of acceptable approaches to the solving of this question but full marks demanded an algebraic approach at some point. Most students were able to at least begin to convert each of the given recurring decimals to a fraction and thus gain credit.

A popular incorrect approach however was to let say x be equal to the given product followed by, for example, $10x = 1.3636... \times 2.222...$ This gained no marks.

Q13.

About a quarter of students provided a clear proof in answer to this question. Sometimes the lack of any indication that values used were recurring decimals spoiled a student's working. Examiners accepted a dot above a 3 (eg $73.\dot{3}$) or dots at the end of a number (eg 73.3...) to signify a recurring decimal. Terminating decimals such as 73.33 were not accepted as part of a proof. A small number of students resorted to a purely numerical approach dividing 11 by 15 to show this gave $0.7\dot{3}$. This approach could not, of course, be given any credit and students are advised to follow the request to "prove algebraically" in similar questions set in the future.

Q14.

Students usually scored well in this question requiring the addition of two algebraic fractions in part (a) and the expansion of a product of three linear expressions in part (b). The question was a good discriminator at the level set and tested skills and confidence in the area of algebraic manipulation and simplification.

About a half of students taking this paper scored at least two of the three marks available in part (a). They were able to decide on a common denominator and combine the fractions with accuracy. However, a large number of students then went on to make errors in simplifying their expressions. It was common to see a correct answer of $\frac{3x^2}{x^2-2x-8}$ spoiled by incorrect cancelling leading to an incorrect final answer. Examples of incorrect final answers seen quite frequently are $\frac{2x^2}{-2x-8}$, $\frac{3}{-2x-8}$ and $\frac{x}{-5}$. Another commonly seen error occurred when students obtained a correct result of the form $\frac{3x^2}{(x+2)(x-4)}$ only to make the decision to multiply out the brackets but then to do this incorrectly. Students should be advised that it is generally acceptable to leave the denominator in factorized form.

More students scored full marks in part (b) than in part (a) of this question. Errors in part (b) were usually restricted to incorrect terms rather than a flawed strategy although some students omitted terms from their expansion. Most students earned at least two of the available marks. Less able students sometimes either stopped after multiplying two linear expressions together or lacked a clear strategy and tried to multiply all three brackets together at once.

Q15.

Part (a) was usually answered correctly, probably because of the absence of minus signs, though some candidates did consider by including (x- 1).

In part (b) weaknesses in algebra became clear, with many failed attempts to multiply out the brackets. Errors included 6$x$instead of $6x^2$, misplaced minus signs, and 6 or 4 as the number term. A significant number lost the final mark due to an inability to simplify their four terms.

Part (c) was designed as a discriminator for those working towards grade A, and indeed it was only the more able who were able to show any understanding of what was needed. The *x*in the denominator caused problems for candidates who knew how to manipulate fractions. A number of candidates added all three fractions, which was unfortunate. Overall few made progress with this question.

Q16.

Many students made a successful start by showing the fractions $\frac{3}{8}$ and $\frac{7}{9}$ and gained the first mark. However, a very common incorrect next step was to multiply the two fractions and give an answer of $\frac{21}{72}$. Some students did divide $\frac{3}{8}$ by $\frac{7}{9}$ to get $\frac{27}{56}$ and scored full marks. A more common route to the correct answer was for students to recognise the significance of 72 and write $\frac{3}{8}=\frac{27}{72}$ and $\frac{7}{9}=\frac{56}{72}$ or use the ratios 3 : 5 and 2 : 7 to get 27 : 45 and 16 : 56. Some students could not then make the final step to $\frac{27}{56}$. The final mark was lost if the answer was given as a ratio and not as a fraction.

Q17.

Only a few students failed to determine that there were 10 men and 20 children in the choir. The correct value for *n* (2) or a correct ratio of 2:1 was often seen but many misread the question thinking that *n* was the number of children and an answer of 20 was a common error. An answer of 2:1 was awarded full marks. It was common to see students do 60/3 =20 and give 20 as the number of men and then 10 as the number of children meaning their answer of 2 but came from incorrect working and so could not be credited.

Q18.

This question was not well answered.

Many students were able to obtain one mark for calculating the number of each colour pen but then failed to progress any further with anything creditworthy. A common incorrect method seen was to add together 7, 3 and 4 and to divide 212 by the sum of the parts as they would to divide into a given ratio. It was common to see 212 ÷14 and then an answer of 60. Some students did put 24 as an answer but did not always support this with working and all the three figures of 14,15 and 24 were required for the first mark. Again, a good number of arithmetic errors were seen in this question.

Q19.

This question was not well answered with only a few understanding what was being asked in the question. Many did not realise that they had to find the ratio of boys to girls for each of the two drama groups. A common approach was to find $\frac{3}{7}$ and in some cases $\frac{4}{7}$ of 84 (36 + 48) concluding that there were 36 boys and 48 girls also in the second group and therefore Ann must be correct. This was not enough to get full marks without ratios (or fractions) being considered. Very few wrote $\frac{3}{7} \div \frac{4}{7}$ for the second group, 3 : 7 frequently appearing. Those that did usually went on to gain full marks.

A common error when considering fractions was to express the boys in group one as $\frac{36}{48}$ rather than $\frac{36}{84}$.

Those students who set up two columns and worked separately on the two groups had the greater chance of success.

Q20.

Many students found this question challenging and the modal score is zero. There were many blank responses.

Those who could use the cosine rule generally obtained the first two marks, however there was often confusion over the identity of angle BCA. Of those that correctly found angle BCA very few were able to apply the sine rule accurately and gain full marks for this question. A small number of students lost the final accuracy mark due to rounding earlier in their solution.

The most common errors seen involved using the trigonometry ratios for right-angled triangles.

Q21.

Many students gained the first mark for writing $\frac{3}{4}$ as $\frac{15}{20}$ or for writing the ratios 2 : 5 and 3 : 4. To make further progress students had to realise that they needed to make the value of *b* the same in each fraction or in each ratio. Unfortunately,

those writing $\frac{3}{4}$ as $\frac{15}{20}$ often wrote $\frac{2}{5} = \frac{8}{20}$ instead of writing $\frac{2}{5} = \frac{6}{15}$ and those who started with the ratios 2 : 5 and 3 : 4 often failed to link the two ratios correctly. The students that did show a correct process for the second mark usually went on to give the correct answer.

Q22.

Over a third of the students gained full marks for this question. Those that were successful usually carried out the same series of steps, multiplying by 7 for their first step rather than the use of fractions and then isolating x.

For those that were not fully successful the most common incorrect response was to only multiply one of 11 or $-x$ by 7. Another common error was to also multiply $9 + x$ by 7 as well as $11 - x$.

Part (b) was correctly answered by approximately half of the cohort. Incorrect answers were usually seen when students tried to multiply out the brackets or cancel terms within the brackets without considering the powers of 3 and 2.

Q23. No Examiner's Report available for this question

Q24.

Most students were able to score one mark for showing an understanding of the recurring decimal notation. Many were then able to find two appropriate decimals to subtract in order to write x as a fraction. Some students, having seen the solutions to this type of questions before, guessed at answers such as 45/99 and failed to gain any credit. A number of students attempted to work 'backwards' and divide 1 by 22. This method was not acceptable as an algebraic approach was required by the question.

Q25.

About one in six candidates scored full marks for their solution to this question with examiners awarding one mark to candidates who realised the need to express the denominator of the fraction as a product of factors and making a good attempt to do this. A good proportion of candidates began by expanding the numerator rather than factorising the denominator so, even if they did go on to factorise the denominator, they did not always identify the common factor.

Q26.

In both parts of this question there was clear evidence of incorrect cancelling. This was also seen at the conclusion of a solution, often following the correct answer, in which case the candidate could not be awarded the final accuracy mark. In part (a) the numerator was correctly factorised more often than the denominator. Those that factorised both correctly generally went onto gain full marks. Except for those candidates who spoilt a correct answer by incorrect cancelling, most of those who found the correct common denominator in part (b) went on to score full marks. The exception to this were those candidates who wrote down the common denominator incorrectly straight away as x^2 - 2 without showing (x- 2)(x+ 2) and others who made errors in expanding brackets, particularly where this involved negative numbers. A significant number of students calculated the numerator correctly, but failed to give a denominator at all.

Q27.

It was pleasing to see a good number of correct answers to part (a) and part (b) almost in the same proportion.

Part (a) was generally well attempted with the vast majority of students gaining at least one mark, normally for the factorisation of the two squares component. The factorisation of the other quadratic caused a problem, with many failing to obtain the correct solution often with incorrect signs seen. Some errors were also seen in the cancellation of the terms in the fraction. Also, some further incorrect simplifications were seen. A common misconception still being seen is for students to just cross out part terms e.g. x^2 in this fraction. Obviously this issue should continue to be addressed by centres as it is an incorrect step.

In part (b) a larger proportion of students gained the first mark than did in part (a) of this question. This mark was usually for clearing the v or expanding the brackets. The subsequent rearrangement of the equation caused more problems for the students. Several were able to rearrange the equation to the form $vw + 30v = 15t$ only then to state that $31v = 15t/w$, showing a lack of understanding of simplifying expressions.

Some students struggled to read their own writing and often missed off a digit or letter for no apparent reason.

Q28. No Examiner's Report available for this question

Mark Scheme

Q1.

Question		Working	Answer	Mark	Notes
		$\frac{3(x+1)}{6}+\frac{2(x+3)}{6}=\frac{3x+3+2x+6}{6}$	$\frac{5x+9}{6}$	3	M1 Use of common denominator of 6 (**or** any other multiple of 6) and at least one numerator correct Eg. $\frac{3(x+1)}{6}$ or $\frac{2(x+3)}{6}$ M1 $\frac{3(x+1)}{6}+\frac{2(x+3)}{6}$ oe A1 cao

Q2.

Question	Answer	Mark	Mark scheme
	$\frac{26x+15}{10x}$	M1	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** $\frac{3}{5}\times\frac{2x}{2x}\ (=\frac{6x}{10x})$
		M1	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** $\frac{20x+15}{10x}+\frac{6x}{10x}$
		A1	for correct algebra leading to $\frac{26x+15}{10x}$ oe in form $\frac{ax+b}{cx}$

Q3.

Question	Answer	Mark	Mark scheme	Additional guidance
	$\dfrac{1}{x(x+4)}$	M1	inverting the fraction and multiplying eg $\frac{6x^8}{(9x^2-144)} \times \frac{3(x-4)}{2x^4}$	
		M1	for factorising $9x^2 - 144$, eg $(3x - 12)(3x + 12)$	
		A1	cao	

Q4.

Question	Answer	Mark	Mark scheme	Additional guidance
	$\dfrac{5 \pm \sqrt{15}}{2}$	M1	for using a common denominator eg $\dfrac{x-1}{(2x-1)(x-1)} + \dfrac{3(2x-1)}{(2x-1)(x-1)}$ $(= 1)$ **or** $(x - 1) + 3(2x - 1) = (2x - 1)(x - 1)$	
		M1	for expanding and rearranging to get $2x^2 - 10x + 5$ $(= 0)$	Note we don't need to see "= 0"; just the LHS is sufficient Accept other forms of the 3 term quadratic, eg $2x^2 - 10x = -5$
		M1	(dep M1) ft for a method to solve their 3 term quadratic equation eg $\dfrac{10 \pm \sqrt{(-10)^2 - 4 \times 2 \times 5}}{2 \times 2}$ or $\dfrac{10 \pm \sqrt{60}}{4}$ **or** $2\left[\left(x - \dfrac{5}{2}\right)^2 - \left(\dfrac{5}{2}\right)^2\right] + 5 = 0$ oe	Correct use of formula or completing the square
		A1	cao	

Q5.

Question	Answer	Mark	Mark scheme	Additional guidance
	$\frac{-11x+2}{x^2-4}$	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 $3x(x-2)-(x+2)(2x+1)$
		M1	for a numerator of $3x^2-6x-2x^2-5x-2-x^2+4$	May be simplified
		A1	for $\frac{-11x+2}{x^2-4}$	Accept $a=-11$ and $b=2$

Q6.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	$\frac{17x+2}{3x(x+1)}$	M1	for a correct common denominator with at least one correct numerator eg. $\frac{5\times 3x}{3x(x+1)} + \frac{2(x+1)}{3x(x+1)}$	
		A1	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	

Q7.

Question	Working	Answer	Notes
		proof leading to $\frac{7}{22}$	M1 for finding two correct recurring decimals that when subtracted would result in a terminating decimal or integer with intention to subtract eg $x = 0.31818...$, $100x = 31.81818...$ A1 fully correct proof

Q8.

Question		Working	Answer	Mark	Notes
		eg. $x = 0.28181...$ $100x = 28.181...$ $99x = 27.9$	$^{31}/_{110}$	3	M1 for 0.28181(...) **or** 0.2 + 0.08181(...) **or** evidence of correct recurring decimal eg. 281.81(...) M1 for two correct recurring decimals that, when subtracted, would result in a terminating decimal, and attempting the subtraction eg. $100x = 28.1818...$, $x = 0.28181...$ and subtracting eg. $1000x = 281.8181...$, $10x = 2.8181...$ and subtracting **OR** $^{27.9}/_{99}$ or $^{279}/_{990}$ oe A1 cao

Q9.

Question	Working	Answer	Mark	Notes
		Proof	M1 A1	for a fully complete method as far as finding two correct decimals that, when subtracted, give a terminating decimal (or integer) and showing intention to subtract, e.g. $9x = 3.9$ correct working to conclusion

Q10.

Question		Working	Answer	Mark	Notes
			$\frac{103}{165}$	3	M1 for method to find 2 multiples of 0.624 that can be used to eliminate the decimals M1 for complete method A1 cao

Q11.

Question	Working	Answer	Mark	Notes
		Proof to reach $\frac{24}{55}$	M1	for $100x = 43.636\ldots\ (43.\dot{6}\dot{3})$ **or** $10x = 4.3636\ldots\ (4.\dot{3}\dot{6})$ and $1000x = 436.36\ldots.(436.\dot{3}\dot{6})$
			M1	(dep) for finding difference that would lead to a terminating decimal
			A1	for completing algebra to reach $\frac{24}{55}$

Q12.

Question	Working	Answer	Mark	Notes
			M1	for the start of a method to convert 0.22.. to a fraction, eg$10y = 2.22..$ or $(y=)\frac{2}{9}$
			M1	for the start of a method to convert 0.13636... to a fraction, $10x = 1.3636..$ or $100x = 13.6363\ldots$ or $1000x = 136.3636..$ or $(x=)\_\frac{13.5}{99}$ or $(x=)\frac{135}{990}$
			C1	for correct arithmetic and concluding the proof
				OR
			M1	for $0.1\dot{3}\dot{6} \times 0.\dot{2} = 0.\dot{0}\dot{3}\ (= z)$
			M1	for complete method to find two appropriate recurring decimals the difference of which is a rational number, eg. $100z = 3.0303\ldots,(z=)\ 0.0303\ldots$ or $\frac{3}{99}$
			C1	for correct arithmetic and concluding the proof

Q13.

Question	Answer	Mark	Mark scheme	Additional guidance
	Proof	M1	for $10x = 7.333\ldots$ ($7.\dot{3}$) and for finding difference that would lead to a terminating decimal	$100x$ and $1000x$, etc could also be used
		A1	for completing algebra to reach $\frac{11}{15}$	

Q14.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	$\dfrac{3x^2}{(x-4)(x+2)}$	M1	for method to identify a common denominator, eg $(x - 4)(x + 2)$	
		M1	for method to combine the fractions, eg $\dfrac{2x(x+2)+x(x-4)}{(x-4)(x+2)}$	Accept $\frac{2x(x+2)}{(x-4)(x+2)} + \frac{x(x-4)}{(x-4)(x+2)}$
		A1	for $\dfrac{3x^2}{(x-4)(x+2)}$ or $\dfrac{3x^2}{x^2-2x-8}$	
(b)	$8x^3 - 2x^2 - 51x - 45$	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.
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $8x^3 - 12x^2 - 15x + 10x^2 - 36x - 45$	First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		A1	cao.	

Q15.

Question		Working	Answer	Mark	Notes
	(a)		$(x+1)(x+4)$	2	B2 for $(x+1)(x+4)$ (B1 for $(x+a)(x+b)$ with one factor correct or $(x-1)(x-4)$ or $x(x+4)+1(x+4)$ or $x(x+1)+4(x+1)$)
	(b)	$3x(2x+5)-1(2x+5)$ $6x2+15x-2x-5$	$6x^2+13x-5$	2	B2 for fully correct (B1 for 3 out of not more than 4 terms including signs or 4 terms correct ignoring signs)
	(c)	$\frac{15}{30x}+\frac{6}{30x}-\frac{10}{30x}$	$\frac{11}{30x}$	2	M1 for attempt to use a correct common denominator with at least 2 correct equivalent fractions A1 for $\frac{11}{30x}$ oe

Q16.

Question	Answer	Mark	Mark scheme	Additional guidance
	$\frac{27}{56}$	P1	for $\frac{3}{8}$ **and** $\frac{7}{9}$ **OR** uses a total of 72 cards and shows a process to find the number of cards with a black shape **or** the number of cards with a triangle, eg $72 \div 8 \times 3$ (=27) **or** $72 \div 9 \times 7$ (=56)	72 or any multiple of 72 Could be seen in a ratio, eg 27 : 45 or 16 : 56
		P1	for process shown to divide fractions $\frac{3}{8} \div \frac{7}{9}$ **or** $\frac{3}{8} \times \frac{9}{7}$ **OR** for $\frac{3}{8} \times \frac{9}{9}$ $(=\frac{27}{72})$ **and** $\frac{7}{9} \times \frac{8}{8}$ $(=\frac{56}{72})$ **OR** uses a total of 72 cards and shows a process to find the number of cards with a black shape **and** the number of cards with a triangle, eg $72 \div 8 \times 3$ (=27) **and** $72 \div 9 \times 7$ (=56)	Accept the division shown as $\frac{\frac{3}{8}}{\frac{7}{9}}$ Could be seen in ratios, eg 27 : 45 and 16 : 56
		A1	for $\frac{27}{56}$ or any other equivalent fraction	Answer of 27 : 56 gets P2A0

Q17.

Question	Answer	Mark	Mark scheme	Additional guidance
	2	P1	for a process to find the number of men, eg. (60 ÷ 2) ÷ 3 (= 10)	
	(supported)	P1	for a process to find the number of children, eg. 60 – "30" – "10" (= 20)	60 ÷ 3 = 20 scores no marks
		P1	for a start of a process to find the value of *n*, eg. ("20" : "10") ÷ 5 or 20 : 10 = 10 : 5 or "20" ÷ "10"	Any ratio must come from correct processes to find the number of children and the number of men
		A1	for 2 with supportive working	Award 0 marks for 2 with no correct supportive working Award full marks for 2 : 1 given as a final answer from correct supportive working

Q18.

Question	Answer	Mark	Mark scheme	Additional guidance
	96	P1	for process to find the ratio of the number of pens of each colour sold, eg 2 × 7 : 5 × 3 : 6 × 4 (= 14 : 15 : 24)	Does not have to be seen as a ratio but all three needed
		P1	for process to find the proportion of green pens sold, eg $\frac{212}{"14"+"15"+"24"}$ or $\frac{"24"}{"14"+"15"+"24"}$	
		P1	for a complete process to find the number of green pens sold, eg $\frac{212}{"14"+"15"+"24"} \times$ "24" or $\frac{"24"}{"14"+"15"+"24"} \times 212$	P3 can be implied by the values 56, 60 and 96
		A1	cao	

Q19.

Question	Answer	Mark	Mark scheme	Additional guidance
	Yes, supported by correct working	P1	for 36 : 48 oe **OR** $\frac{36}{84}$ oe **or** $\frac{48}{84}$ oe	Relating to drama group 1
		P1	for $\frac{4}{7}$ **or** 3 : 4 oe (for group 2) **OR** $(\frac{36}{84} = \frac{3}{7})$ **or** $(\frac{48}{84} = \frac{4}{7})$ **or** 84 × 3 ÷ 7 (= 36 boys) **or** 84 × 4 ÷ 7 (= 48 girls) **or** N × 3 ÷ 7 and N × 4 ÷ 7	Relating to drama group 2 N can be any number (other than 84) of students in the 2nd group
		A1	for Yes with both ratios 3 : 4 oe or for a correct pair of fractions and stating they are equivalent.	Both equivalent forms of the ratios (fractions) must be the same "Yes" may be implied from working

Q20.

Question	Answer	Mark	Mark scheme	Additional guidance
	1.95	P1	for correct substitution into the cosine rule, eg $3.4^2 = 6.1^2 + 6.2^2 - 2 \times 6.1 \times 6.2 \times \cos BCA$	Can be any angle within triangle ABC
		P1	for a full process to find BCA eg (cos BCA =) $\frac{6.1^2 + 6.2^2 - 3.4^2}{2 \times 6.1 \times 6.2}$ **or** (BCA =) 32(.08046913…)	P2 can be awarded for BCA = 32(.08046913…)
		P1	correct substitution into the sine rule, eg $\frac{DC}{\sin(\text{"32.08..."} \times \frac{2}{5})} = \frac{6.2}{\sin(180 - \text{"32.08..."} - (\text{"32.08..."} \times \frac{2}{5}))}$	
		P1	for complete process to find DC eg (DC =) $\frac{6.2 \times \sin\text{"12.832"}}{\sin\text{"135.088"}}$	
		A1	Answer in the range 1.94 to 1.951	Must not come from incorrect processing

Q21.

Question	Answer	Mark	Mark scheme	Additional guidance
	6 : 15 : 20	P1	chooses a multiplier to equate the two fractions in terms of b eg $\frac{2}{5}\times\frac{3}{3}$ $(=\frac{6}{15})$ **or** $\frac{3}{4}\times\frac{5}{5}$ $(=\frac{15}{20})$ **or** lists equivalent fractions to $\frac{2}{5}$ up to at least $\frac{6}{15}$, eg. $\frac{2}{5}$, $\frac{4}{10}$, $\frac{6}{15}$, ... **or** lists equivalent fractions to $\frac{3}{4}$ up to at least $\frac{15}{20}$, eg. $\frac{3}{4}$, $\frac{6}{8}$, $\frac{9}{12}$, $\frac{12}{16}$, $\frac{15}{20}$, ... **or** $(a : b =)$ 2 : 5 **and** $(b : c =)$ 3 : 4 **or** for 6 : 15 or 15 : 20 seen	
		P1	puts into related terms ready for ratio eg $\frac{2}{5}\times\frac{3}{3}=\frac{6}{15}$ **and** $\frac{3}{4}\times\frac{5}{5}=\frac{15}{20}$ **or** for $(a : b =)$ 6 : 15 **and** $(b : c =)$ 15 : 20 **or** lists equivalent ratios up to a common element for b, eg $a : b$ = 2 : 5, 4 : 10, 6 : <u>15</u> **and** $b : c$ = 3 : 4, 6 : 8, 9 : 12, 12 : 16, <u>15</u> : 20	Need not be written in ratio form
		A1	for 6 : 15 : 20 oe	Accept equivalent ratios Accept a =6, b = 15 and c = 20

Q22.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	8.5	M1	for multiplying both sides by 7 as a first step eg $9 + x = 7(11 - x)$ **or** dividing each term on the left hand side by 7 eg $\frac{9}{7}+\frac{x}{7} = 11 - x$	× 7 written near the equation is not enough for this mark
		M1	(dep M1) for method to isolate the x terms on one side	
		A1	oe	
(b)	$4(y + 3)$	B1	$4(y + 3)$ **or** $4y + 12$	

Q23.

Question	Working	Answer	Mark	Notes
(a)		$(x-y)(3x-3y-2)$	M1 A1	identify $x-y$ as a common factor , e.g. $(x-y)(\ldots\ldots..)$ oe
(b)		$\dfrac{3x}{2x-5}$	M1 M1 A1	factorise $2x^2+x-15$ [$=(2x-5)(x+3)$] or $3x^2+9x$ [$=3x(x+3)$] $\dfrac{1}{(2x-5)(x+3)}\times\dfrac{3x(x+3)}{1}$ cao

Q24.

PAPER: 1MA0_1H				
Question	Working	Answer	Mark	Notes
		Proof	3	M1 for ($x=$) 0.04545(...) or $1000x = 45.4545(\ldots)$, accept $1000x = 45.\dot{4}\dot{5}$ or $100x = 4.54545(\ldots)$, accept $100x = 4.\dot{5}\dot{4}$ or $10x = 0.4545(\ldots)$,accept $10x = 0.\dot{4}\dot{5}$ M1 for finding the difference between two correct, relevant recurring decimals for which the answer is a terminating decimal A1 (dep on M2) for completing the proof by subtracting and cancelling to give a correct fraction eg $\dfrac{45}{990}=\dfrac{1}{22}$ or $\dfrac{4.5}{99}=\dfrac{1}{22}$

Q25.

		Working	Answer	Mark	Notes
		$\dfrac{4(x+5)}{(x+5)(x-3)}$	$^4/_{x-3}$	2	M1 for $(x \pm 5)(x\pm3)$ A1 for $^4/_{x-3}$

Q26.

Question		Working	Answer	Mark	Notes
	(a)	$\frac{(x+4)(x-1)}{(2x-3)(x-1)}$	$\frac{x+4}{2x-3}$	3	M1 for $(x + 4)(x - 1)$ M1 for $(2x - 3)(x - 1)$ A1 cao
	(b)	$\frac{4(x-2)}{(x+2)(x-2)}+\frac{3(x+2)}{(x+2)(x-2)}$	$\frac{7x-2}{(x+2)(x-2)}$	3	M1 for denominator $(x + 2)(x - 2)$ oe **or** $x^2 - 4$ M1 for $\frac{4(x-2)}{(x+2)(x-2)}$ oe **or** $\frac{3(x+2)}{(x+2)(x-2)}$ oe (NB. The denominator must be $(x + 2)(x - 2)$ **or** $x^2 - 4$ **or** another suitable common denominator) A1 for $\frac{7x-2}{(x+2)(x-2)}$ **or** $\frac{7x-2}{x^2-4}$ SC: If no marks awarded then award B1 for $\frac{4(x-2)}{x^2-2}+\frac{3(x+2)}{x^2-2}$ oe

Q27.

Question	Working	Answer	Mark	Notes
(a)		$\frac{x+4}{2x+3}$	M1	Factorising the denominator $(2x \pm 3)(x \pm 4)$ or $2\left(x \pm 1\frac{1}{2}\right)(x \pm 4)$
			M1	Factorising the numerator $(x - 4)(x + 4)$
			A1	oe
(b)		$v = \frac{15t}{w+30}$	M1	A correct step towards solution e.g. expanding brackets to get $15t - 30v$ or multiply both sides by v
			M1	For a method to rearrange the formula to isolate terms in v eg $vw + 30v = 15t$
			A1	oe

Q28.

Paper 1MA1:3H			
Question	**Working**	**Answer**	**Notes**
		$\frac{3x+10}{x+2}$	B1 for factorising to get $(x+3)(x+2)$ M1 for dealing with the division of $(x+3)$ by $\frac{x^2+5x+6}{x-2}$ M1 for two correct fractions with a common denominator or a correct single fraction A1 $\frac{3x+10}{x+2}$