Q1. Simplify fully $\dfrac{x+3}{4}+\dfrac{x-5}{3}$

....

(Total 3 marks)

Q2. Simplify $\dfrac{x^2+2x+1}{x^2+3x+2}$

....

(Total 3 marks)

Q3. Simplify fully $\dfrac{2x^2 + 3x + 1}{x^2 - 3x - 4}$.

....

(Total 3 marks)

Q4. Write as a single fraction in its simplest form

$$\frac{2x}{x-1} - \frac{7x-3}{x^2-1}$$

....

(Total 4 marks)

Q5. Simplify fully $\dfrac{x^2 - 2x - 15}{x^2 - 4x - 21}$

....

(Total 3 marks)

Q6. Simplify fully $\dfrac{x+3}{4} + \dfrac{x-5}{3}$

(Total 3 marks)

Q7. Simplify fully $\frac{x^2 + x - 6}{x^2 - 7x + 10}$

....

(Total 3 marks)

Q8. Simplify fully $\frac{x^2 - 8x + 15}{2x^2 - 7x - 15}$

....

(Total 3 marks)

Q9. Simplify $\dfrac{3x^2 - 16x - 35}{9x^2 - 25}$

....

(Total 3 marks)

M1.

Working	Answer	Mark	Additional Guidance
$\frac{x+3}{4}+\frac{x-5}{3}$ $=\frac{3(x+3)+4(x-5)}{12}$ $=\frac{3x+9+4x-20}{12}$ $=\frac{7x-11}{12}$	$\frac{7x-11}{12}$	3	**M1** for adding with a common denominator of 12 and at least one equivalent fraction correct **M1** for $\frac{3(x+3)+4(x-5)}{12}$ or $\frac{3x+9+4x-20}{12}$ **A1** for $\frac{7x-11}{12}$
			Total for Question: 3 marks

M2.

Working	Answer	Mark	Additional Guidance
$\frac{\cancel{(x+1)}(x+1)}{\cancel{(x+1)}(x+2)}$	$\frac{x+1}{x+2}$	3	**M1** for $(x \pm 1)(x \pm 1)$ **M1** for $(x \pm 1)(x \pm 2)$ **A1** for $\frac{\cancel{(x+1)}(x+1)}{\cancel{(x+1)}(x+2)}$
			Total for Question: 3 marks

M3.

Working	Answer	Mark	Additional Guidance
$\frac{(x+1)(2x+1)}{(x+1)(x-4)} =$	$\frac{(2x+1)}{(x-4)}$	3	**B3** for $\frac{(2x+1)}{(x-4)}$ (**B1** for $(x + 1)(2x + 1)$ and/or **B1** for $(x + 1)(x - 4)$)
			Total for Question: 3 marks

M4.

Working	Answer	Mark	Additional Guidance
$\frac{2x}{x-1} - \frac{7x-3}{x^2-1}$ $= \frac{2x(x+1)}{x^2-1} - \frac{7x-3}{x^2-1}$ $= \frac{2x^2+2x-7x+3}{x^2-1}$ $= \frac{2x^2-5x+3}{x^2-1}$ $= \frac{(2x-3)(x-1)}{(x+1)(x-1)}$ $= \frac{2x-3}{x+1}$ **Alternative method** $\frac{2x}{x-1} - \frac{7x-3}{x^2-1}$ $= \frac{2x(x^2-1)}{(x-1)(x^2-1)} - \frac{(7x-3)(x-1)}{(x-1)(x^2-1)}$ $= \frac{2x(x^2-1)-(7x-3)(x-1)}{(x-1)(x^2-1)}$	$\frac{2x-3}{x+1}$	4	**B1** for $x^2 - 1 = (x + 1)(x - 1)$ **M1** for correct process to obtain any common denominator **M1** for correct expansion and simplification of numerator **A1** cao **Alternative method** **M1** for correct process to obtain any common denominator **B1** for $2x^3 - 2x - 7x^2 + 7 + 3x - 3$

$= \frac{2x^3 - 2x - 7x^2 + 7 + 3x - 3}{(x-1)(x^2-1)}$ $= \frac{2x^3 - 7x^2 + 8x - 3}{(x-1)(x^2-1)}$ $= \frac{(2x-3)(x-1)^2}{(x+1)(x-1)^2}$ $= \frac{2x-3}{x+1}$			**M1** (dep on first M1) for correct expansion and simplification of numerator **A1** cao
			Total for Question: 4 marks

M5.

Working	Answer	Mark	Additional Guidance
$\frac{x^2 - 2x - 15}{x^2 - 4x - 21} = \frac{(x-5)(x+3)}{(x-7)(x+3)}$	$\frac{x-5}{x-7}$	3	**M1** attempt to factorise numerator (at least one bracket correct) or $(x \pm 5)(x \pm 3)$ **M1** attempt to factorise denominator (at least one bracket correct) or $(x \pm 7)(x \pm 3)$ **A1** oe
			Total for Question: 3 marks

M6.

Working	Answer	Mark	Additional Guidance
$\frac{x+3}{4}+\frac{x-5}{3}$ $=\frac{3(x+3)+(x-5)}{12}$	$\frac{7x-11}{12}$	3	**M1** resolution of denominator to 12 **M1** expansion and simplification of brackets **A1** cao
			Total for Question: 3 marks

M7.

Working	Answer	Mark	Additional Guidance
$\frac{\cancel{(x-2)}(x+3)}{\cancel{(x-2)}(x-5)}$	$\frac{(x+3)}{(x-5)}$	3	**B3** for $\frac{(x+3)}{(x-5)}$ (otherwise award **B1** for $(x-2)(x+3)$ and / or **B1** for $(x-2)(x-5)$, which may not appear in the context of a fraction)
			Total for Question: 3 marks

M8.

Working	Answer	Mark	Additional Guidance
$\frac{(x-3)\cancel{(x-5)}}{(2x+3)\cancel{(x-5)}}$	$\frac{(x-3)}{(2x+3)}$	3	**B1** for $(x-3)(x-5)$or $x(x-5)$-$3(x-5)$ **M1** for $(2x \pm 3)(x \pm 5)$ or $2x(x+5) \pm 3(x+5)$ or $2x(x-5) \pm 3(x-5)$

			A1 for $\frac{(x-3)}{(2x+3)}$ cao as final answer
			Total for Question: 3 marks

M9.

Working	Answer	Mark	Additional Guidance
$\frac{(3x+5)(x-7)}{(3x-5)(3x+5)}$	$\frac{x-7}{(3x-5)}$	3	**B1** $(3x+5)(x-7)$ **B1** $(3x-5)(3x+5)$

Total for Question: 3 marks

E1. Many candidates demonstrated little understanding of how to combine the fractions in this question. A significant proportion could identify that a common denominator of 12 was appropriate but often they could offer little more of worth. It was not uncommon to see 7 as the common denominator. The answer $\frac{2x-2}{7}$ was often seen. Unfortunately, of those candidates who did successfully identify a correct strategy, many made careless errors in multiplying out brackets and some removed the denominator completely from their final answers. About one in five candidates scored full marks for their answers.

E2. This question was very poorly answered with only about 5% of candidates obtaining the correct answer. Only about 10% of candidates attempted to factorise either the quadratic expression on the top or bottom of the fraction and they were mostly incorrect. The modal incorrect answer was for candidates who mistakenly cancelled the x^2 and then subtracted $2x + 1$ from $3x + 2$ to give a final answer of $x + 1$.

E3. About one in seven candidates gained all 3 marks in this question.

Only the better candidates realised the need to factorise the two quadratic expressions before any attempt at simplification is made.

Of those who did realise this but were unable to complete the question successfully, some were credited for being able to factorise at least one expression correctly, usually the one which appeared in the denominator. Many candidates attempted to “cancel” individual terms which appeared in both the numerator and denominator without factorising.

##

It was very rare indeed for a candidate to spot that the $x^2 – 1$ denominator could be factorised (*x*

+ 1)(x – 1). Instead many began to use (x + 1)(x^2 – 1) as the common denominator. Whilst a single mark was awarded for this correct process, candidates rarely scored further marks due to difficulties with signs and the lengthy expansion. When using the x^2 – 1 denominator, candidates were very rarely successful subtracting (7x – 3)(x – 1)x in the numerator as the -3 term was incorrectly dealt with.

##

Just over two thirds of the candidates did not understand that factorising was required and so could not make any inroads into the simplification. Many of these candidates attempted to simplify by ‘cancelling’ the terms in x^2 and/or the terms in x. 32% of the candidates were able to make a valid attempt at factorising both expressions but 9% of these either made sign errors in their factorisation or failed to simplify by cancelling the common factor thereby losing the final mark.

E7. About a fifth of the candidates were able to score full marks on this question. A significant number of candidates reached the expression $\frac{(x+3)(x-2)}{(x-2)(x-5)}$ but then did not go on to simply this further, and some, having obtained the correct answer $\frac{x+3}{x-5}$, went on to incorrectly simplify this to –3/5. The most popular incorrect approach was to start by cancelling the x^2 terms from the expression.

E8. A challenging question for all but the most able candiates. Many did not appreciate the need to factorize the numerator and denominator and tried to cancel individual terms. More students gained marks from factorizing the numerator than the denominator, here a non - unitary x^2 coefficient was beyond the reach of all but the best. Pleasingly, the vast majority of those who reached the final answer did not try to cancel again. There were a surprising number of attempts to use the quadratic equation formula here.