1 (a)	Factorising numerator as $(5x + 4)(2x + 3)$		3	M1
	Factorising denominator as $(2x + 3)(2x - 3)$			M1
		5x + 4		A1
		$\overline{2x-3}$		
(b)	$(8^{5y} =) 2^{15y}$ or $(4^n =) 2^{2n}$ or 2^{5y+2}		4	M1
	$2^{5y+2} = 2^{15y-2n}$ oe			M1 e.g. $2^{2n} = 2^{15y - 5y - 2}$
	5y + 2 = 15y - 2n oe			M1 Correct equation using the powers
		n = 5y - 1		A1 Dep on M2 (accept $5y - 1$)
				Total 7 marks

2	$\frac{4(2x-3)-3(2x-5)}{(2x-5)(2x-3)} \text{ or } \frac{8x-12-6x+15}{(2x-5)(2x-3)} \text{ oe}$		4	Ml	Writing 1st fraction as a fraction over a common denominator (can be 2 separate fractions)
	x(3-2x)(3+2x) or $(3x-1)(2x-5)$			M1	Complete factorisation of numerator or denominator of 2nd fraction
	$\frac{2x+3}{(2x-5)(2x-3)} \times \frac{(3x-1)(2x-5)}{x(3-2x)(3+2x)}$			M1	may be partially simplified
		$\frac{3x-1}{x(2x-3)(3-2x)}$		A1	e.g. $\frac{3x-1}{x(2x-3)(3-2x)}$ or $\frac{1-3x}{x(2x-3)^2}$ or
					$\frac{3x-1}{x(12x-9-4x^2)} \text{ or }$ $\frac{3x-1}{(12x^2-9x-4x^3)} \text{ oe }$ isw for incorrect denominator
					expansion Total 4 marks
					Total 4 marks

3	$[x=]$ $\frac{5}{9\left(\frac{5}{5a-2}\right)+5}$ oe or $y=\frac{5}{9x}-\frac{5}{9}$ oe		4	M1	A correct substitution for y or writing y in terms of x
	$[x =] \frac{5(5a-2)}{45+5(5a-2)} \text{ oe or } (5-5x)(5a-2) = 45x \text{ oe}$ $\text{or } 9x = \frac{5(45a-18)}{35+25a} \text{ oe}$			M1	Multiplying each term in the numerator and denominator by $(5a-2)$ to eliminate the fraction in the denominator or equating y 's and getting rid of fractions as far as shown on left or single fraction in terms of a
	$[x =]$ $\frac{25a - 10}{35 + 25a}$ oe or $[x =]$ $\frac{5(5a - 2)}{5(7 + 5a)}$			M1	A correct fraction not in simplest form with all brackets expanded or numerator and denominator factorised with the same common factor taken out
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$x = \frac{5a - 2}{7 + 5a}$		A1	Correctly simplified $x = \text{needed for the answer, or } x = \text{previously seen in working with correct simplified expression}$ Do not isw if students have tried to do some incorrect cancelling eg $x = \frac{5a-2}{7+5a} = \frac{-2}{7}$ gets M3A0
					Total 4 marks

4 b	E.g. $\frac{3(2x+1)+4(x-2)}{3(2x+1)+3(x-2)}$ or	3	M1	for expressing both fractions correctly with a common denominator.
	$\frac{3(2x+1)}{12} + \frac{4(x-2)}{12}$			Allow as two separate fractions.
	E.g. $\frac{6x + 3 + 4x - 8}{12}$		M1	for removing brackets correctly in a correct single fraction
		$\frac{10x-5}{12}$	Al	accept $\frac{5(2x-1)}{12}$
5	5 3	5 M1	Facto	rising $x^2 + 2x$ in correct expression on LHS

5	5 3 (2)		5	M1	Factorising $x^2 + 2x$ in correct expression on LHS
	$\frac{5}{x+2} + \frac{3}{x(x+2)}$ (= 2)				or for writing the two fractions over a common
	or $\frac{5x}{x^2 + 2x} + \frac{3}{x^2 + 2x}$ (= 2)				denominator.
	5x+3 2 or $5x+3$ 2			M1	Correct simplified single fraction = 2
	$\frac{5x+3}{x(x+2)} = 2$ or $\frac{5x+3}{x^2+2x} = 2$				or correct equation with no fractions.
	or $5x + 3 = 2x(x + 2)$ oe				
	or $5x + 3 = 2x^2 + 4x$ oe				
	$2x^2 - x - 3 = 0$			M1	Correct 3 term quadratic
	(2x-3)(x+1) (=0)			M1ft	independent
	or $\frac{1\pm\sqrt{(-1)^2-4\times2\times(-3)}}{2\times2}$				For solving <i>their</i> 3 term quadratic equation
	or				using any correct method. If factorising, allow brackets which expanded
	or $\left(x - \frac{1}{4}\right)^2 - \frac{1}{16} - \frac{3}{2} = 0$ oe				give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as eg
					$\frac{1 \pm \sqrt{1 + 24}}{4}$ or eg $\left(x - \frac{1}{4}\right)^2 = \frac{25}{16}$ oe
		1.5 and -1		A1	oe dep on M3
					Total 5 marks

Alternativ	e Mark Scheme for question 5 (obtaining a cubic)				
5	$\frac{5(x^2+2x)+3(x+2)}{(x^2+2x)(x+2)} $ (=2) oe		5	M1	Correct fraction over a common denominator (may be 2 separate fractions)
	eg $5(x^2+2x)+3(x+2) = 2(x^2+2x)(x+2)$ oe			M1	Correct equation with no fractions.
•	$2x^3 + 3x^2 - 5x - 6 (=0)$			M1	Correct cubic
	(x+1)(2x-3)(x+2) (= 0)			M1	For product of 3 correct linear factors.
		1.5 and -1		A1	oe dep on M3 Do not award A mark if extra solution (-2) given.
•					Total 5 marks

6 (a)	$\frac{4(x+1)-3(x-2)}{(x-2)(x+1)}$ or $\frac{4(x+1)}{(x-2)(x+1)} - \frac{3(x-2)}{(x-2)(x+1)}$		3	M1	for expressing both fractions correctly with a common denominator.
	$\frac{4x+4-3x+6}{(x-2)(x+1)} \text{ or } \frac{4x+4-3x+6}{x^2-x-2}$			M1	for removing brackets in a single fraction with a correct denominator. Allow denominator to be expanded. Allow one error in the expansion of the numerator.
		$\frac{x+10}{(x-2)(x+1)}$		Al	accept $\frac{x+10}{x^2-x-2}$ oe

eg $36a - 28 - 15a + 35 = 20 \times 4.55$ or $21a = 84$ oe M1 Expanding brackets and multiply denominator with no more than a sign error A1 dep on M1 (b) $p^2 = \frac{ac + 8}{3 + c}$ $3p^2 + cp^2 = ac + 8$ $cp^2 - ac = 8 - 3p^2$ or $3p^2 - 8 = ac - cp^2$ M1 for removing square root M1 for multiplying by denominator a expanding in a correct equation M1ft for gathering terms in c on one si other terms the other side fit their equation dep on 2 terms in and two other terms	7 (a)	eg $20 \times \frac{9a-7}{5} - 20 \times \frac{3a-7}{4} = 20 \times 4.55 (= 91)$ or eg $4(9a-7) - 5(3a-7) = 20 \times 4.55$ or eg $\frac{4(9a-7)}{20} - \frac{5(3a-7)}{20} (= 4.55)$ or eg $\frac{4(9a-7) - 5(3a-7)}{20} (= 4.55)$		3	M1	For clear intention to multiply all terms by 20 (or 4×5) or a multiple of 20 oe or to express LHS as two fractions over 20 (or 4×5) or a multiple of 20 oe or as a single fraction with a denominator of 20 (or 4×5) or a multiple of 20 oe if expanded numerator, allow one error
(b) $p^2 = \frac{ac + 8}{3 + c}$ $3p^2 + cp^2 = ac + 8$ $cp^2 - ac = 8 - 3p^2 \text{ or } 3p^2 - 8 = ac - cp^2$ M1 for multiplying by denominator a expanding in a correct equation M1ft for gathering terms in c on one si other terms the other side fit their equation dep on 2 terms in and two other terms		eg $36a - 28 - 15a + 35 = 20 \times 4.55$ or		-	M1	Expanding brackets and multiplying by denominator with no more than one sign error
$3p^{2} + cp^{2} = ac + 8$ $cp^{2} - ac = 8 - 3p^{2} \text{ or } 3p^{2} - 8 = ac - cp^{2}$ M1 for multiplying by denominator a expanding in a correct equation M1ft for gathering terms in c on one si other terms the other side fit their equation dep on 2 terms in and two other terms			4		A1	. 0
$3p^2 + cp^2 = ac + 8$ $cp^2 - ac = 8 - 3p^2 \text{ or } 3p^2 - 8 = ac - cp^2$ $M1 \text{ for multiplying by denominator a expanding in a correct equation}$ $M1 \text{ for gathering terms in } c \text{ on one si other terms the other side fit their equation dep on 2 terms in and two other terms}$	(b)	$p^2 = \frac{ac + 8}{3 + c}$		4	M1	for removing square root
$cp^2 - ac = 8 - 3p^2 \text{ or } 3p^2 - 8 = ac - cp^2$ M1ft for gathering terms in c on one si other terms the other side fit their equation dep on 2 terms in and two other terms		$3p^2 + cp^2 = ac + 8$			M1	for multiplying by denominator and expanding in a correct equation
$8-3p^2$ A1 $3p^2-8$		$cp^2 - ac = 8 - 3p^2$ or $3p^2 - 8 = ac - cp^2$			M1ft	for gathering terms in c on one side and other terms the other side ft their equation dep on 2 terms in c
$c = \frac{c}{p^2 - a} \qquad \text{or } c = \frac{c}{a - p^2}$			$c = \frac{8 - 3p^2}{p^2 - a}$	-	A1	or $c = \frac{3p^2 - 8}{a - p^2}$
Total 7						Total 7 marks

8	$\frac{(5x-8)(5x+8)}{(5x+2)(x-3)} \times \frac{(x-5)(x-3)}{5x+8} \text{ or eg } \frac{(5x-8)(x-5)}{(5x+2)} (-(x-7))$		4	M2	For factorising at least 2 of the quadratics correctly – could be implied by 2 factors cancelled correctly (M1 For factorising at least 1 of the 3 quadratics correctly)
	$\frac{(5x-8)(x-5)-(x-7)(5x+2)}{5x+2} \text{ oe or}$ $\frac{5x^2-25x-8x+40-(5x^2-35x+2x-14)}{5x+2} \text{ oe or}$ $\frac{(25x^2-64)(x^2-8x+15)-(x-7)(5x^2-13x-6)(5x+8)}{(5x^2-13x-6)(5x+8)} \text{ oe or}$ $\frac{(5x-8)(x^2-8x+15)-(x-7)(5x+2)(x-3)}{(5x+2)(x-3)} \text{ oe or}$ $\frac{(25x^2-64)(x-5)-(x-7)(5x+2)(5x+8)}{(5x+2)(5x+8)} \text{ oe}$			M1	(indep (ft if M2 awarded)) For writing the fractions over a common denominator with or without brackets removed – need not be in simplest form Could be written as 2 separate fractions over a common denominator
		54		A1	dep on M3
		5x+2			
					Total 4 marks

9	$ \begin{array}{l} \text{eg } \frac{20}{x^2 - 36} - \frac{2(x+6)}{x^2 - 36} \text{ oe or } \frac{20}{(x-6)(x+6)} - \frac{2(x+6)}{(x-6)(x+6)} \text{ oe} \\ \text{or } \\ \frac{20(x-6)}{(x^2 - 36)(x-6)} - \frac{2(x+6)(x-6)}{(x^2 - 36)(x-6)} \text{ or } \\ \frac{20 - 2(x+6)}{(x^2 - 36)(4-x)} \text{ oe} \end{array} $		3	M1	for writing the first two fractions with a common denominator (may be a single denominator) or multiplying both fractions by $\frac{1}{4-x}$ and writing over a common denominator
	eg $\frac{8-2x}{x^2-36} \times \frac{1}{4-x}$ or $\frac{8-2x}{(x-6)(x+6)} \times \frac{1}{4-x}$ or $\frac{20x-2x^2-48}{(x^2-36)(x-6)} \times \frac{1}{4-x}$ oe $\frac{8-2x}{(x^2-36)(4-x)}$ oe			M1	for simplifying first 2 fractions to a single fraction and expanding and simplifying numerator – must be correct, and showing intention to multiply by $\frac{1}{4-x}$ or expanding the numerator of the full solution and writing as a single fraction
		$\frac{2}{x^2 - 36}$		A1	oe eg $\frac{2}{(x-6)(x+6)}$
					Total 3 marks

10	eg $\frac{(4x+3)(x-5)}{2x-1} \times \frac{(2x-1)(x-3)}{(x+5)(x-5)}$ or eg $\frac{(4x+3)(x-3)}{x+5} (+(29-4x))$		4	M2	for factorising at least 2 of the quadratics correctly – could be implied by 2 factors cancelled correctly
					(M1 for factorising at least 1 of the 3 quadratics correctly)
	eg $\frac{(4x+3)(x-3)+(29-4x)(x+5)}{x+5}$ oe or eg $\frac{4x^2-9x-9+145+9x-4x^2}{x+5}$ oe			M1	for writing the correct fractions over a common denominator of $(x + 5)$ with or without brackets removed – need not be in simplest form. Could be written as 2 separate fractions.
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{136}{x+5}$		A1	
					Total 4 marks