Question		Answer	Marks	AO	Guidance
6	(a)	$\frac{5-35x}{(2+x)(1-2x)^2} = \frac{A}{2+x} + \frac{B}{1-2x} + \frac{C}{(1-2x)^2}$	B1*	1.1	Correct form of partial fractions. **See Appendix** for alternative using $\frac{5-35x}{(2+x)(1-2x)^2} = \frac{A}{2+x} + \frac{B}{1-2x} + \frac{Cx+D}{(1-2x)^2}$. Can be implied by $5-35x \equiv A(1-2x)^2 + B(1-2x)(2+x) + C(2+x)$.
		$5-35x \equiv A(1-2x)^2 + B(1-2x)(2+x) + C(2+x)$	M1dep*	1.1	Removal of fractions **and** substitution of a value of x to find one of A, B or C (or other complete method to find one of A, B or C e.g. compare coefficients).
		$A=3, B=6, C=-5$	A1 A1	1.1 1.1	For any one value of A, B or C correct. www – fully correct with **either** $\frac{A}{2+x} + \frac{B}{1-2x} + \frac{C}{(1-2x)^2}$ **and** $A=3, B=6, C=-5$ stated **or** $\frac{3}{2+x} + \frac{6}{1-2x} - \frac{5}{(1-2x)^2}$ seen. **If B0 then** either **SC B1** for $\frac{5-35x}{(2+x)(1-2x)^2} = \frac{A}{2+x} + \frac{B}{(1-2x)^2}$. or **SC B1** for $\frac{5-35x}{(2+x)(1-2x)^2} = \frac{A}{2+x} + \frac{Bx+C}{(1-2x)^2}$ and then **B1** for $A=3, B=-12$ and $C=1$.
			[4]		

Question		Answer	Marks	AO	Guidance
6	(b)	$\frac{3}{2+x}+\frac{6}{1-2x}-\frac{5}{(1-2x)^2}$ $=3(2+x)^{-1}+6(1-2x)^{-1}-5(1-2x)^{-2}$	B1FT	2.1	**See Appendix for those candidates not using part (a).** Re-write their partial fractions from part **(a)** in the correct form for expansion – their partial fractions must contain at least two terms with a term in $(2+x)^{-1}$ and a term in $(1-2x)^{-2}$.
		$(2+x)^{-1}=\frac{1}{2}\left(1+\frac{1}{2}x\right)^{-1}$	B1	3.1a	Correctly re-write $(2+x)^{-1}$ as $\frac{1}{2}\left(1+\frac{1}{2}x\right)^{-1}$ or $2^{-1}\left(1+\frac{1}{2}x\right)^{-1}$ - can be implied by a correct expansion of this term.
		$=\frac{3}{2}\left(1-\frac{1}{2}x+...\right)+6(1+2x+...)-5(1+4x+...)$	M1	1.1	Expand any one of $(2+x)^{-1},(1-2x)^{-1}$ or $(1-2x)^{-2}$ correctly up to the term in x (ignore coefficients and higher order terms).
		$=\frac{5}{2}-\frac{35}{4}x+...$	A1	1.1	cao www but ignore higher order terms even if incorrect.
		Alternative Method $=3(2+x)^{-1}+(1-12x)(1-2x)^{-2}$	B1FT		From $\frac{3}{2+x}+\frac{1-12x}{(1-2x)^2}$ (if correct). Re-write their partial fractions in the correct form for expansion – follow through their $\frac{A}{2+x}+\frac{Bx+C}{(1-2x)^2}$.
		$(2+x)^{-1}=\frac{1}{2}\left(1+\frac{1}{2}x\right)^{-1}$	B1		Correctly re-write $(2+x)^{-1}$ as $\frac{1}{2}\left(1+\frac{1}{2}x\right)^{-1}$ - can be implied by a correct expansion of this term.
		$=\frac{3}{2}\left(1-\frac{1}{2}x+...\right)+(1-12x)(1+4x+...)$	M1		Expand any one of $(2+x)^{-1}$ or $(1-2x)^{-2}$ correctly up to the term in x (ignore coefficients and higher order terms).
		$=\frac{5}{2}-\frac{35}{4}x+...$	A1		cao www but ignore higher order terms even if incorrect.
			[4]		

Question		Answer	Marks	AO	Guidance
6	(c)	$\frac{5}{2}-\frac{35}{4}x=\frac{11}{5}-\frac{1}{3}x$	M1	3.1a	Sets their two-term linear expression from part **(b)** equal to $\frac{11}{5}-\frac{1}{3}x$. If no linear equation seen, then awrt 0.036 implies this mark provided a correct expansion seen in part **(b)**. No linear equation seen and an answer of 0.031(1092…) is **M0** (implies BC).
		$x=0.036$	A1	1.1	cao accept awrt 0.036 (0.035643…) or $\frac{18}{505}$.
			[2]		
6	(d)	The expansion in part **(b)** is only valid for $\lvert x\rvert<0.5$ but the x-coordinate of B (from the diagram) is greater than 0.5	B1	2.3	Must include the correct validity of the expansion and an indication that the x-coordinate of B is not within this interval. For the interval accept $-0.5<x<0.5$ but not $-0.5<\lvert x\rvert<0.5$ or $\lvert x\rvert\leq 0.5$. Allow arguments of the form 'the expansion is only valid for values of x up to 0.5 and the x-coordinate of B is greater than this'. Allow a similar correct argument based on $\lvert x\rvert<2$ (e.g. the expansion is not valid for values of x greater than 2). Any incorrect additional statement(s) is **B0** (e.g. 'the radius of convergence for the expansion is 2' or 'the expansion is only valid for $\lvert x\rvert<2$').
			[1]		

Alternative method for 6(a).

Answer	Mark	Guidance
$\frac{5-35x}{(2+x)(1-2x)^2} = \frac{A}{2+x} + \frac{B}{1-2x} + \frac{Cx+D}{(1-2x)^2}$	**B1***	
$5-35x = A(1-2x)^2 + B(2+x)(1-2x) + (Cx+D)(2+x)$	**M1dep***	Removal of fractions **and** substitution of a value of x to find one of A, B, C or D (or other complete method to find one of A, B, C or D e.g. compare coefficients).
$A=3, B=6, C=0, D=-5$	**A1** **A1**	**A1** for any one of A, B or D correct. www – fully correct with **either** $\frac{A}{2+x} + \frac{B}{1-2x} + \frac{Cx+D}{(1-2x)^2}$ **and** $A=3, B=6, C=0, D=-5$ stated **or** $\frac{3}{2+x} + \frac{6}{1-2x} - \frac{5}{(1-2x)^2}$ seen.

Alternative response for 6(b) – not using part (a) – max 3 marks.

Answer	Mark	Guidance
$(5-35x)(2+x)^{-1}(1-2x)^{-2}$	**B1**	
$(2+x)^{-1} = \frac{1}{2}\left(1+\frac{1}{2}x\right)^{-1}$	**B1**	Correctly re-write $(2+x)^{-1}$ as $\frac{1}{2}\left(1+\frac{1}{2}x\right)^{-1}$ - can be implied by a correct expansion of this term.
$= (5-35x)\times\frac{1}{2}\left(1-\frac{1}{2}x+...\right)\times(1+4x+...)$	**M1**	Expand any one of $(2+x)^{-1}$ or $(1-2x)^{-2}$ correctly up to the term in x (ignore coefficients and higher order terms).
$= \frac{5}{2} - \frac{35}{4}x + ...$	**A0**	**Max. 3 marks as not using part (a) as requested.**