Question Number	Scheme	Marks
1 (a)	$\dfrac{5x+10}{(1-x)(2+3x)} \equiv \dfrac{A}{1-x}+\dfrac{B}{2+3x} \Rightarrow$ Value for A or B	**M1**
	One correct value, either $A=3$ or $B=4$	**A1**
	Correct PF form $\dfrac{3}{1-x}+\dfrac{4}{2+3x}$	**A1**
		(3)
(b)(i)	$\dfrac{A}{1-x}=A(1-x)^{-1}=A\left(1+x+x^2+...\right)$	**B1**
	$\left\{\dfrac{B}{2}\right\}\left(1+\dfrac{3x}{2}\right)^{-1}=\left\{\dfrac{B}{2}\right\}\left(1+(-1)\dfrac{3x}{2}+\dfrac{(-1)(-2)}{2}\left(\dfrac{3x}{2}\right)^2+...\right);=\dfrac{B}{2}\left(1-\dfrac{3x}{2}+\dfrac{9x^2}{4}+...\right)$	**M1; A1**
	$f(x)= \quad 3\times\left(1+x+x^2+...\right)+ \quad \dfrac{4}{2}\left(1-\dfrac{3x}{2}+\dfrac{9x^2}{4}+...\right)$	**M1**
	$=5+\dfrac{15}{2}x^2+...$	**A1**
		(5)
(b)(ii)	$\left\|x\right\|<\dfrac{2}{3}$	**B1**
		(1)
		(9 marks)
(b)(i) Alt 1	$(1-x)^{-1}=1+x+x^2+...$	**B1**
	$\left\{\dfrac{1}{2}\right\}\left(1+\dfrac{3x}{2}\right)^{-1}=\left\{\dfrac{1}{2}\right\}\left(1+(-1)\dfrac{3x}{2}+\dfrac{(-1)(-2)}{2}\left(\dfrac{3x}{2}\right)^2+...\right);=\dfrac{1}{2}\left(1-\dfrac{3x}{2}+\dfrac{9}{4}x^2+...\right)$	**M1; A1**
	$\dfrac{5x+10}{(1-x)(2+3x)}=(5x+10)\left(1+x+x^2+...\right)\times\dfrac{1}{2}\left(1-\dfrac{3x}{2}+\dfrac{9x^2}{4}+...\right)=5+...x+...x^2$	**M1**
	$=5+\dfrac{15}{2}x^2+...$	**A1**
		(5)
(b)(i) Alt 2	$\dfrac{5x+10}{(1-x)(2+3x)}=(5x+10)\left(2+\left(x-3x^2\right)\right)^{-1}=\dfrac{1}{2}(5x+10)\left(1+\dfrac{1}{2}\left(x-3x^2\right)\right)^{-1}$	**B1**
	$\left(1+p(x)\right)^{-1}=\left(1\pm p(x)+\dfrac{(-1)(-2)}{2}\left(p(x)\right)^2+...\right);\ \dfrac{1}{2}\left(1-\dfrac{1}{2}\left(x-3x^2\right)+\dfrac{1}{4}\left(x-3x^2\right)^2+...\right)$	**M1; A1**
	$(10+5x)\left(\dfrac{1}{2}-\dfrac{1}{4}x+\dfrac{3}{4}x^2+\dfrac{1}{8}x^2+...\right)=5-\dfrac{5}{2}x+\dfrac{35}{4}x^2+\dfrac{5}{2}x-\dfrac{5}{4}x^2+...$	**M1**

	$=5+\frac{15}{2}x^2+...$	**A1**
		(5)

Notes:

a)

M1: Attempts at correct PF. Correct form identified (may be implicit) and achieves a value for at least one of the constants.

A1: One correct value or term.

A1: Correct PF form $\frac{3}{1-x}+\frac{4}{2+3x}$. This may be awarded if seen in (b) but the correct final form (not just values) must be seen somewhere in the question. Accept at $3(1-x)^{-1}+4(2+3x)^{-1}$

(b)(i)

B1: $\frac{A}{1-x}=A(1-x)^{-1}=A\left(1+x+x^2+...\right)$ which may be unsimplified. Allow with their *A* or with *A* = 1.

M1: Attempts to expand $\frac{1}{2+3x}=(2+3x)^{-1}$ binomially either by taking out the factor 2 first, or directly. Look for $(1+kx)^{-1}=...\left(1\pm kx+\frac{(-1)(-2)}{2}(kx)^2+...\right)$ where $k\neq 1$ following an attempt at taking out a factor 2, or $\frac{1}{2+3x}=(2+3x)^{-1}=\left(2^{-1}\pm 2^{-2}kx+\frac{(-1)(-2)}{2}2^{-3}(kx)^2+\right)$ by direct expansion. Allow missing brackets on kx^2 in either case.

A1: $\frac{B}{2+3x}=\frac{B}{2}\left(1+\frac{3x}{2}\right)^{-1}=\frac{B}{2}\left(1-\frac{3x}{2}+\frac{9}{4}x^2+\right)$ oe with their *B* from (a) or with *B* = 1

M1: Uses their coefficients and attempts to add both series.

A1cao: $5+\frac{15}{2}x^2+...$ Condone additional higher order terms. Terms may be either order.

(b)(ii)

B1: $|x|<\frac{2}{3}$ or exact equivalent. This must be clearly identified as the answer. B0 if both ranges are given with no choice of which is correct. (But B1 if formal set notation with $\cap$ used.)

(b)(i) Alt 1:

B1: $(1-x)^{-1}=1+x+x^2+...$ which may be unsimplified.

M1: Same as main scheme.

A1: Correct expansion (see main scheme, *B* = 1 allowed).

M1: Attempts to expand all three brackets, achieving the correct constant term at least.

A1cso: $5+\frac{15}{2}x^2+...$ Condone additional higher order terms. Terms may be either order.

(b)(i) Alt 2

B1: Writes f(*x*) as $(5x+10)\left(2+\left(x-3x^2\right)\right)^{-1}$ or with the 2 extracted, with the $\left(x-3x^2\right)$ clear.

M1: Attempts the binomial expansion on $\left(1+p(x)\right)^{-1}$ or $\left(2+p(x)\right)^{-1}$ for $p(x)$ of form $ax+bx^2$.

Same conditions as for main scheme.

A1: Correct expansion. For direct expansion $\left(\frac{1}{2}-\frac{1}{4}\left(x-3x^2\right)+\frac{1}{8}\left(x-3x^2\right)^2+...\right)$

M1: Expands the brackets achieving at least the correct constant term.

A1cao: $5+\frac{15}{2}x^2+...$ Condone additional higher order terms. Terms may be either order.

Question Number	Scheme	Marks
2 (a)	E.g. $x=\frac{t-1}{2t+1}\Rightarrow t=\frac{x+1}{1-2x}$ or $y=\frac{6}{2t+1}\Rightarrow t=\frac{6-y}{2y}$	**M1**
	E.g. $y=\frac{6}{2t+1}\Rightarrow y=\frac{6}{2\times\left(\frac{x+1}{1-2x}\right)+1}$ or $t=\frac{6-y}{2y}\Rightarrow x=\frac{\frac{6-y}{2y}-1}{2\times\frac{6-y}{2y}+1}$	**A1**
	E.g. $y=\frac{6}{2\times\left(\frac{x+1}{1-2x}\right)+1}\Rightarrow y=\frac{6\left(1-2x\right)}{2\times\left(x+1\right)+1\left(1-2x\right)}=ax+b$	**dM1**
	E.g. $y=\frac{6\left(1-2x\right)}{3}, y=2\left(1-2x\right)$ oe so linear *	**A1***
		(4)
(b)	$y=2\left(1-2x\right)$ and $y=x+12\Rightarrow 2\left(1-2x\right)=x+12\Rightarrow x=...$	**M1**
	$x=-2$	**A1cao**
		(2)
Alt (b)	$\frac{6}{2t+1}=\frac{t-1}{2t+1}+12\Rightarrow t=\left(-\frac{1}{5}\right)$	**M1**
	$x=\frac{-\frac{1}{5}-1}{2\times-\frac{1}{5}+1}=-2$	**A1**
		(2)
		(6 marks)

Notes:

(a) Do not recover marks for part (a) from part (b) if there is an attempt at part (a). If there is no labelling mark as a whole.

M1: For an attempt to get t in terms of x or y **or** x and y $\frac{x}{y}=\frac{t-1}{6}\Rightarrow t=\frac{6x+y}{y}$ or full method to eliminate t from the equations.

A1: Forms a correct equation linking x and y only. Other forms are possible using t in terms of x and y in either equation for x or y etc.

dM1: Depends on first M. Attempts to simplify the fraction reaching a linear form in x and y. Allow if there are slips but an unsimplified equation of form $ax + by = c$ must be achieved.

A1: Achieves $y=2\left(1-2x\right)$ o.e. (and isw after a correct linear equation) and states linear or hence on line etc. There must be a reference to linearity in some form (similarly for the Alts).

(b)

M1: Solves their "$y=2\left(1-2x\right)$" (may not be linear) with $y=x+12$, E.g. $2\left(1-2x\right)=x+12\Rightarrow x=...$