Question Number	Answer	Mark
1 (a)	$\frac{2+11x}{(1+x)(2+5x)} \equiv \frac{A}{1+x}+\frac{B}{2+5x} \Rightarrow$ Values for A and B	M1
	One correct value, either $A=3$ or $B=-4$	A1
	Correct PF form $\frac{3}{1+x}-\frac{4}{2+5x}$	A1
		(3)
(b)	$\frac{'3'}{1+x} = '3'\left(1+x\right)^{-1} = '3'\left(1-x+x^2+...\right)$	B1
	$\frac{'4'}{2+5x} = \frac{'4'}{2}\left(1+\frac{5x}{2}\right)^{-1} = \frac{'4'}{2}\left(1+(-1)\frac{5x}{2}+\frac{(-1)(-2)}{2}\left(\frac{5x}{2}\right)^2+\right)$	M1, A1
	$f(x) = '3'\times\left(1-x+x^2+...\right)-\frac{'4'}{2}\left(1-\frac{5x}{2}+\frac{25x^2}{4}+...\right)$	dM1
	$=1+2x-\frac{19}{2}x^2+...$	A1
		(5)
(c)	Valid $\left\|x\right\|<\frac{2}{5}$ o.e	B1
		(1)
		(9 marks)

(a)

M1: Attempts correct PF. What is seen in the scheme is acceptable. There is no need to see any working. Just look for the correct PF form followed by values for A and B

A1: One correct value for A or B or one correct term

A1: Correct PF form $\frac{3}{1+x}-\frac{4}{2+5x}$ oe. such as $\frac{3}{1+x}+\frac{-4}{2+5x}$

. The correct values for A and B are insufficient but you can award if the correct expression is seen in (b)

(b)

B1: $\frac{'3'}{1+x} = '3'\left(1+x\right)^{-1} = '3'\left(1-x+x^2+...\right)$ correct and simplified which may be implied by a multiplied-out bracket. Ignore any additional terms in x^3 etc, follow through on their '3'

M1: Attempts $\frac{1}{2+5x} = \left(2+5x\right)^{-1} = ...$

Look for $\left(...\left(1+kx\right)^{-1}\right)=...\left(1+(-1)kx+\frac{(-1)(-2)}{2}\left(kx\right)^{2}+\right)$ with or without the bracket on the second term. Look for correct powers of x with correct binomial coefficients and the value of k ($k\neq 1$) used consistently.

Also allow $\left(2+5x\right)^{-1}=2^{-1}+\left(-1\right)2^{-2}\left(5x\right)^{1}+\frac{\left(-1\right)\left(-2\right)}{2!}2^{-3}\left(5x\right)^{2}+...$ condoning missing brackets

A1: $\frac{'4'}{2+5x}=\pm\frac{'4'}{2}\left(1+\frac{5x}{2}\right)^{-1}=\pm\frac{'4'}{2}\left(1+(-1)\frac{5x}{2}+\frac{(-1)(-2)}{2}\left(\frac{5x}{2}\right)^{2}+\right)$ which is OK left unsimplified.

Follow through on their '4'. FYI the fully simplified form is $\frac{'4'}{2}\left(1-\frac{5x}{2}+\frac{25}{4}x^{2}+\right)$

dM1: Uses their coefficients and attempts to correctly combine the two series.

Look for $'3'\left(1\pm x\pm x^{2}+...\right)\pm\frac{'4'}{2}\left(1\pm\alpha x\pm\beta x^{2}+\right)=a+bx+cx^{2}+$

but condone $'3'\left(1\pm x\pm x^{2}+...\right)\pm 2\times'4'\left(1\pm\alpha x\pm\beta x^{2}+\right)=a+bx+cx^{2}$

To score this mark

- the previous method mark must have been awarded
- there must be some evidence of an attempt to expand both brackets and collect like terms, seen or implied in at least two out of the three cases. Condone the series being added instead of subtracted

A1: $1+2x-\frac{19}{2}x^{2}+...$ or equivalent including $1+\left(2x\right)+\left(-\frac{19}{2}x^{2}\right)+...$

Condone additional terms even if incorrect. Condone terms being given as a list $1,2x,-9.5x^{2}$

If they reach the correct answer and then multiply by 2 it is A0. We do not isw this error.

(c)

B1: $\left|x\right|<\frac{2}{5}$ ONLY or exact equivalent such as $-\frac{2}{5}<x<\frac{2}{5}$ or $x\in\left(-\frac{2}{5},\frac{2}{5}\right)$

Condone $\left|x\right|\leqslant\frac{2}{5}$ o.e. If they give $\left|x\right|\leqslant 1$ as well (without discounting it) it will be B0

Question Number	Scheme	Marks
2 (a)	States that $\begin{pmatrix}4\\-3\\10\end{pmatrix}$ is not a scalar multiple of $\begin{pmatrix}2\\-1\\5\end{pmatrix}$	B1 **(1)**
(b)	Assume that there exists a λ and a μ such that $\begin{pmatrix}-2\\5\\3\end{pmatrix}+\lambda\begin{pmatrix}2\\-1\\5\end{pmatrix}=\begin{pmatrix}6\\12\\-5\end{pmatrix}+\mu\begin{pmatrix}4\\-3\\10\end{pmatrix}$	B1
	Attempts to solve two of the equations and find either λ or μ .	M1
	Correct values for either λ or μ for the appropriate equation E.g. (1) and (2) $-2+2\lambda=6+4\mu \quad 5-1\lambda=12-3\mu \quad \Rightarrow \lambda=26$ or $\mu=11$	A1
	E.g Uses $\lambda=26, \mu=11$ in equation (3) LHS = $3+5\lambda=133$ RHS = $-5+10\mu=105$	dM1
	$133 \neq 105$, so lines don't intersect	A1 **(5)** **(6 marks)**

(a)

B1: Explains that $\begin{pmatrix}4\\-3\\10\end{pmatrix}$ is not a (scalar) multiple of $\begin{pmatrix}2\\-1\\5\end{pmatrix}$. E.g States that $\begin{pmatrix}4\\-3\\10\end{pmatrix}\neq k\begin{pmatrix}2\\-1\\5\end{pmatrix}$

Allow attempts via use of ratios such as $4=\underline{\underline{2}}\times 2$, $10=\underline{\underline{2}}\times 5$ but $-3=\underline{\underline{3}}\times -1$ so cannot be parallel.

Condone for this mark a statement that 'the direction vectors are not multiples of each other'

(b)

B1: Sets up the contradiction

There must be some words and a reference to what it would mean for the equations

E.g.I Assume that l_1 and l_2 intersect so

$-2+2\lambda=6+4\mu$, $5-1\lambda=12-3\mu$ and $3+5\lambda=-5+10\mu$

E.g.II Assume the lines meet so

$-2+2\lambda=6+4\mu$, $5-1\lambda=12-3\mu$ and $3+5\lambda=-5+10\mu$

The equations may appear some way after the assumption

Note that B0, M1, A1, dM1, A1 is possible

Standard/usual method:

M1: Attempts to solve two of the equations to find the value of λ OR μ

E.g. (1) and (2) $-2+2\lambda=6+4\mu \quad 5-1\lambda=12-3\mu \quad \Rightarrow \lambda=...$or $\mu=...$

E.g. (2) and (3) $3+5\lambda=-5+10\mu \quad 5-\lambda=12-3\mu \quad \Rightarrow \lambda=...,$or $\mu=...$