1. Express $x + \dfrac{1}{1-x} + \dfrac{2}{1+x}$ as a single fraction, simplifying your answer.

[3]

2.
   i. Express $\dfrac{2}{3-x} + \dfrac{3}{1+x}$ as a single fraction in its simplest form.

   [2]

   ii. Hence express $\left(\dfrac{2}{3-x} + \dfrac{3}{1+x} \right) \times \dfrac{x^2 + 8x - 33}{121 - x^2}$ as a single fraction in its lowest terms.

   [3]

END OF QUESTION paper

Mark scheme

Question			Answer/Indicative content	Marks	Part marks and guidance	
1			$x(1 - x^2) + (1 + x) + 2(1 - x)$ oe	M1	condone one sign error	if M0B0, SC1 for any pair of terms correctly combined into a single fraction, may be unsimplified
			$1 - x^2$ oe	B1	any correct denominator common to all three fractions	
					must be fully simplified; mark the final answer	
			$\dfrac{3 - x^3}{1 - x^2}$ oe cao	A1	**Examiner's Comments** Most candidates were able to identify the correct common denominator and write down the correct numerator in expanded form. Whilst many went on to earn the third mark, algebraic slips were quite common, $3 - x^2$ and $3 - x - x^2$ were commonly seen in the final answer. A surprisingly high number of candidates achieved the correct answer and then went on to "simplify" the result with incorrect cancelling out, thus losing the last mark.	eg $\dfrac{x(3 - x^3)}{x(1 - x^2)}$ oe may score a maximum of M1B1A0
		Total		**3**		
2	i		$\dfrac{2(1 + x) + 3(3 - x)}{(3 - x)(1 + x)}$	B1	or $\dfrac{2(1 + x)}{(3 - x)(1 + x)} + \dfrac{3(3 - x)}{(3 - x)(1 + x)}$ numerator must be simplified **B2** if unsupported	allow recovery from omission of brackets; brackets may be expanded in numerator
	i		$\dfrac{11 - x}{(3 - x)(1 + x)}$ oe isw	B1	**Examiner's Comments** This proved accessible to nearly all candidates, with most scoring full marks. A few slipped up with arithmetic and lost the accuracy mark, but zero marks was very rare.	denominator may be in expanded form at either stage eg $3 + 2x - x^2$

	ii	$\dfrac{(x+11)(x-3)}{(11+x)(11-x)}$ or $\dfrac{(x+11)(x-3)}{(121-x^2)}$	M1*	allow $(x-11)(x+3)$ for numerator and / or $(x-11)(x+11)$ in denominator or $\dfrac{2}{(3-x)} \times$ their $\dfrac{(x+11)(x-3)}{(11+x)(11-x)}$ $+ \dfrac{3}{(1+x)} \times$ their $\dfrac{(x+11)(x-3)}{(11+x)(11-x)}$	Polynomials
	ii	their $\dfrac{11-x}{(3-x)(1+x)} \times$ their $\dfrac{(x+11)(x-3)}{(11+x)(11-x)}$	M1*dep	<u>Examiner's Comments</u> A minority of candidates ignored the request for lowest terms and simply multiplied everything out. This approach didn't score. Most correctly factorised the numerator, however, and usually successfully cancelled out at least one pair of terms. Surprisingly, only a minority successfully reached the final answer.	with at least one pair of their terms correctly cancelled out, allow if RH fraction only partially factorised
	ii	$\dfrac{-1}{(1+x)}$ oe cao	A1		
		Total	**5**		