Rational Functions and Polynomial Division MS (From Legacy OCR C4)

Q1 (Jun 2005, Q1)

(Quotient =) $x^2 + 2x + 2$	B1	For correct leading term x^2 in quotient
	M1	For evidence of division/identity process
	A1	For correct quotient
(Remainder =) $0x - 3$	A1 **4**	For correct remainder. The '$0x$' need not be written but must be clearly derived. **4**
Allow without working		

Q2 (Jan 2006, Q1)

Attempt to factorise numerator and denominator	M1		
num = $xx(x-3)$ or denom = $(x-3)(x+3)$	A1		Not num = $x(x^2-3x)$
Final answer = $\frac{x^2}{x+3}$ [Not $\frac{xx}{x+3}$]	A1	3	Do not ignore further cancellation.

Q3 (Jun 2009, Q1)

Long Division For leading term $3x^2$ in quotient	B1	
Suff evid of div process (ax^2, mult back, attempt sub)	M1	
(Quotient) = $3x^2 - 4x - 5$	A1	
(Remainder) = $-x + 2$	A1	
Identity $3x^4 - x^3 - 3x^2 - 14x - 8 = Q(x^2 + x + 2) + R$	*M1	
$Q = ax^2 + bx + c, R = dx + e$ & attempt ≥ 3 ops.	dep*M1	If $a = 3$,this $\Rightarrow$ 1 operation
$a = 3, b = -4, c = -5$	A1	dep*M1; $Q = ax^2 + bx + c$
$d = -1, e = 2$	A1	

Inspection Use 'Identity' method; if $R = e$, check cf(x) correct before awarding 2nd M1

4

Q4 (Jun 2007, Q7)

(i) Leading term in quotient = $2x$	B1		
Suff evidence of division or identity process	M1		
Quotient = $2x + 3$	A1		Stated or in relevant position in division
Remainder = x	A1	4	Accept $\frac{x}{x^2+4}$ as remainder
(ii) their quotient + $\frac{\text{their remainder}}{x^2+4}$	√B1	1	$2x + 3 + \frac{x}{x^2+4}$

Q5 (Jan 2008, Q3)

Method 1 (Long division)			
Clear correct division method at beginning	M1		x^2 in quot, mult back & attempt subtraction [At subtraction stage, cf $(x^4) = 0$]
Correct method up to & including x term in quot	M1		[At subtraction stage, cf $(x^3) = 0$]
Method 2 (Identity)			
Writing $(x^2 + 2x - 1)(x^2 + bx + 2) + cx + 7$	M1		Probably equated to $x^4 - 2x^3 - 7x^2 + 7x + a$
Attempt to compare cfs of x^3 or x^2 or x or const	M1		
Then:			
$b = -4$	A1		
$c = -1$	A1		
$a = 5$	A1	5	

Q6 (Jun 2008, Q1)

(a)	$2x^2 - 7x - 4 = (2x+1)(x-4)$ or $3x^2 + x - 2 = (3x-2)(x+1)$	**B1**	
	$\dfrac{2x+1}{3x-2}$ as final answer; this answer only	**B1**	Do not ISW
		2	

Q7 (Jun 2009, Q1)

Long Division For leading term $3x^2$ in quotient	B1	
Suff evid of div process (ax^2, mult back, attempt sub)	M1	
(Quotient) = $3x^2 - 4x - 5$	A1	
(Remainder) = $-x + 2$	A1	
Identity $3x^4 - x^3 - 3x^2 - 14x - 8 = Q(x^2 + x + 2) + R$	*M1	
$Q = ax^2 + bx + c, R = dx + e$ & attempt ≥ 3 ops.	dep*M1	If $a = 3$,this $\Rightarrow$ 1 operation
$a = 3, b = -4, c = -5$	A1	dep*M1; $Q = ax^2 + bx + c$
$d = -1, e = 2$	A1	
Inspection Use 'Identity' method; if $R = e$, check cf(x) correct before awarding 2nd M1		
	4	

Q8 (Jun 2014, Q1)

$x(1-x^2)+(1+x)+2(1-x)$ 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	
$\frac{3-x^3}{1-x^2}$ oe cao	A1 [3]	must be fully simplified; mark the final answer	eg $\frac{x(3-x^3)}{x(1-x^2)}$ oe may score a maximum of M1B1A0

Q9 (Jun 2015, Q1)

(i)		$\frac{2(1+x)+3(3-x)}{(3-x)(1+x)}$	**B1**	or $\frac{2(1+x)}{(3-x)(1+x)}+\frac{3(3-x)}{(3-x)(1+x)}$
		$\frac{11-x}{(3-x)(1+x)}$ oe isw	**B1** **[2]**	numerator must be simplified **B2** if unsupported
(ii)		$\frac{(x+11)(x-3)}{(11+x)(11-x)}$ or $\frac{(x+11)(x-3)}{(121-x^2)}$	**M1***	allow $(x-11)(x+3)$ for numerator and / or $(x-11)(x+11)$ in denominator
		their $\frac{11-x}{(3-x)(1+x)}\times$ their $\frac{(x+11)(x-3)}{(11+x)(11-x)}$	**M1*dep**	or $\frac{2}{(3-x)}\times$ their $\frac{(x+11)(x-3)}{(11+x)(11-x)}$ $+\frac{3}{(1+x)}\times$ their $\frac{(x+11)(x-3)}{(11+x)(11-x)}$
		$\frac{-1}{(1+x)}$ oe cao	**A1** **[3]**	