

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

Q1 (Jun 2005, Q1)

(Quotient =) $x^2 + 2x + 2$	B1 M1	For correct leading term x^2 in quotient For evidence of division/identity process
(Remainder =) $0x - 3$	A1 A1 4	For correct quotient 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)

<u>Long Division</u>	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
<u>Identity</u>	$3x^4 - x^3 - 3x^2 - 14x - 8 = Q(x^2 + x + 2) + R$	*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
<u>Inspection</u>	Use 'Identity' method; if $R = e$, check cf(x) correct before awarding 2 nd M1	

4

Q4 (Jun 2007, Q7)

(i) Leading term in quotient = $2x$	B1	
<u>Suff evidence</u> 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 + $\frac{\text{their remainder}}{x^2 + 4}$	$\sqrt{B1}$	1 $2x + 3 + \frac{x}{x^2 + 4}$

Q5 (Jan 2008, Q3)

<u>Method 1 (Long division)</u>		
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 $(x^3) = 0$]
<u>Method 2 (Identity)</u>		
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**
- $\frac{2x+1}{3x-2}$ 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 **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	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
	[3]		

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		
		[2]	
(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]	