Partial Fractions Exam Questions MS (From Legacy OCR C4)

Q1 (Jun 2005, Q8) [Modified]

(i) $3x+4 \equiv A(2+x)^2+B(2+x)(1+x)+C(1+x)$	M1	Accept ≡ or =
$A = 1$	A/B1	If identity used, award 'A' mark, if
$C = 2$	A/B1	cover-up rule used, award 'B' mark.
$A+B=0$ or $4A+3B+C=3$ or $4A+2B+C=4$	A1	Any correct eqn for B from identity
$B = -1$	A1 5	
	B1	

Q2 (Jan 2006, Q7) [Modified]

(i) $A=3$	B1	For correct value stated
$C=1$	B1	For correct value stated
$11+8x \equiv A(1+x)^2+B(2-x)(1+x)+C(2-x)$	M1	AEF; any suitable identity
e.g. $A-B=0, 2A+B-C=8, A+2B+2C=11$	A1	For any correct (f.t.) equation involving B
$B=3$	A1 5	

Q3 (Jun 2007, Q1) [Modified]

(i) Correct format $\dfrac{A}{x+2}+\dfrac{B}{x-3}$	M1	s.o.i. in answer
$A=1$ and $B=2$	A1 2	for both

Q4 (Jan 2008, Q1)

(i) Correct format $\dfrac{A}{x+1}+\dfrac{B}{x+2}$	M1	stated or implied by answer
$-\dfrac{1}{x+1}$ or $A=-1$	A1	
$+\dfrac{2}{x+2}$ or $B=2$	A1 3	

Q5 (Jun 2010, Q3)

$\dfrac{A}{x-1}+\dfrac{B}{(x-1)^2}+\dfrac{C}{x-2}$	M1	For correct format
$A(x-1)(x-2)+B(x-2)+C(x-1)^2 \equiv x^2$	M1	
$A=-3$	A1	
$B=-1$	A1	(B1 if cover-up rule used)
$C=4$	A1	(B1 if cover-up rule used)

Q6 (Jun 2013, Q1)

$\frac{(x-7)(x-2)}{(x+2)(x-1)^2} \equiv \frac{A}{x+2} + \frac{B}{(x-1)} + \frac{C}{(x-1)^2}$ [If no partial fractions seen anywhere, B0]	B1	<u>**SC**</u> $\frac{(x-7)(x-2)}{(x+2)(x-1)^2} \equiv \frac{A}{x+2} + \frac{Bx+C}{(x-1)^2}$ [If no partial fractions seen anywhere, B0]
$(x-7)(x-2) \equiv A(x-1)^2 + B(x+2)(x-1) + C(x+2)$ [Allow careless minor error but not algebraic method error] or any equiv identity such as $\frac{(x-7)(x-2)}{(x-1)^2} \equiv A + \frac{B(x+2)}{(x-1)} + \frac{C(x+2)}{(x-1)^2}$ (or even the identity on the 1st line), in which values of x are substituted (or cfs compared)	M1	$(x-7)(x-2) \equiv A(x-1)^2 + (Bx+C)(x+2)$ [Allow careless minor error but not algebraic method error] or any equivalent identity (as in previous column) (or even the identity on the 1st line), in which values of x are substituted (or cfs compared)
$A=4, B=-3, C=2$ or $\frac{4}{x+2} - \frac{3}{x-1} + \frac{2}{(x-1)^2}$ ISW The 3 @ A1 are dep on the used identity being correct. <u>Cover-up:</u> A=4,C=2 score B1,B1; $B=-3$ needs M1, then A1	A1,1,1 **[5]**	$A=4,\ B=-3, C=5$ or $\frac{4}{x+2} + \frac{-3x+5}{(x-1)^2}$

Q7, (Edexcel 6666, Jan 2013, Q3)

$\frac{9x^2+20x-10}{(x+2)(3x-1)} \equiv 3 + \frac{5x-4}{(x+2)(3x-1)}$	their constant term = 3	B1
So, $\frac{5x-4}{(x+2)(3x-1)} \equiv \frac{B}{(x+2)} + \frac{C}{(3x-1)}$ $5x-4 \equiv B(3x-1) + C(x+2)$	Forming a correct identity.	B1
Either x: $5 = 3B + C$, constant: $-4 = -B + 2C$ or $x = -2 \Rightarrow -10-4 = -7B \Rightarrow -14 = -7B \Rightarrow B = 2$	Attempts to find the value of either one of their B or their C from their identity.	M1
$x = \frac{1}{3} \Rightarrow \frac{5}{3} - 4 = \frac{7}{3}C \Rightarrow -\frac{7}{3} = \frac{7}{3}C \Rightarrow C = -1$	Correct values for their B and their C, which are found using $5x-4 \equiv B(3x-1) + C(x+2)$	A1
So, $\frac{9x^2+20x-10}{(x+2)(3x-1)} \equiv 3 + \frac{2}{(x+2)} - \frac{1}{(3x-1)}$		**[4]**

Q8, (Edexcel IAL, C34, Jun 2016, Q4)

(a)	$$\begin{array}{r} x^2+5 \\ x^2+x-12\overline{)x^4+x^3-7x^2+8x-48} \\ \underline{x^4+x^3-12x^2} \\ 5x^2+8x-48 \\ \underline{5x^2+5x-60} \\ 3x+12 \end{array}$$ M1: Divides $x^4+x^3-7x^2+8x-48$ by x^2+x-12 to get a quadratic quotient and a remainder of the form $\alpha x+\beta$ where α and β are not both zero A1: Correct quotient and remainder	M1A1
	$\frac{x^4+x^3-7x^2+8x-48}{x^2+x-12} \equiv x^2+5+\frac{3(x+4) \text{ or } 3x+12}{(x+4)(x-3)}$ Writes their answer as $\frac{x^4+x^3-7x^2+8x-48}{x^2+x-12} \equiv \text{Their Quotient} + \frac{\text{Their Remainder}}{(x+4)(x-3)}$	M1
	$\equiv x^2+5+\frac{3}{(x-3)}$ or states $A=5$, $B=3$	A1
		(4)

(b)	$g'(x)=2x-\frac{3}{(x-3)^2}$	M1: $x^2+A+\frac{B}{x-3} \to 2x \pm \frac{B}{(x-3)^2}$ A1: $x^2+A+\frac{B}{x-3} \to 2x-\frac{B}{(x-3)^2}$ Follow through their B or the letter B or a made up B.	M1A1ft
	Special Case: If they write g(x) as $x^2+5+\frac{3x+12}{(x-3)}$ and correctly attempt to differentiate as $2x$ + the quotient rule on $\frac{3x+12}{(x-3)}$ then the M mark is available but **not** the A1ft. It must be the correct quotient rule and the numerator must be a linear expression.		
	$g'(4)=2\times 4-\frac{3}{(4-3)^2}(=5)$	Substitutes $x=4$ into their derivative	M1
	Uses $m=g'(4)=(5)$ with $(4, g(4))=(4, 24)$ to form eqn of tangent		
	$y-24=5(x-4)$	Correct method of finding an equation of the tangent. The gradient must be $g'(4)$ and the point must be an attempt on $(4, g(4))$	M1
	$y=5x+4$	Cso. This mark may be withheld for an incorrect "A" earlier or any incorrect work leading to a correct gradient.	A1
			(5)

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Q9, (Edexcel IAL, C34, Jun 2017, Q5)

(a)	$$\begin{array}{r} x^2+5 \\ x^2+x-12\overline{)x^4+x^3-7x^2+8x-48} \\ \underline{x^4+x^3-12x^2} \\ 5x^2+8x-48 \\ \underline{5x^2+5x-60} \\ 3x+12 \end{array}$$ M1: Divides $x^4+x^3-7x^2+8x-48$ by x^2+x-12 to get a quadratic quotient and a remainder of the form $\alpha x+\beta$ where α and β are not both zero A1: Correct quotient and remainder	M1A1
	$\frac{x^4+x^3-7x^2+8x-48}{x^2+x-12} \equiv x^2+5+\frac{3(x+4) \text{ or } 3x+12}{(x+4)(x-3)}$ Writes their answer as $\frac{x^4+x^3-7x^2+8x-48}{x^2+x-12} \equiv \text{Their Quotient} + \frac{\text{Their Remainder}}{(x+4)(x-3)}$	M1
	$\equiv x^2+5+\frac{3}{(x-3)}$ or states $A=5$, $B=3$	A1
		(4)

(b)	$g'(x)=2x-\frac{3}{(x-3)^2}$	M1: $x^2+A+\frac{B}{x-3} \to 2x \pm \frac{B}{(x-3)^2}$ A1: $x^2+A+\frac{B}{x-3} \to 2x - \frac{B}{(x-3)^2}$ Follow through their B or the letter B or a made up B.	M1A1ft
	Special Case: If they write g(x) as $x^2+5+\frac{3x+12}{(x-3)}$ and correctly attempt to differentiate as $2x$ + the quotient rule on $\frac{3x+12}{(x-3)}$ then the M mark is available but **not** the A1ft. It must be the correct quotient rule and the numerator must be a linear expression.		
	$g'(4)=2\times4-\frac{3}{(4-3)^2}(=5)$	Substitutes $x=4$ into their derivative	M1
	Uses $m=g'(4)=(5)$ with $(4, g(4))=(4,24)$ to form eqn of tangent		
	$y-24=5(x-4)$	Correct method of finding an equation of the tangent. The gradient must be $g'(4)$ and the point must be an attempt on $(4, g(4))$	M1
	$y=5x+4$	Cso. This mark may be withheld for an incorrect "A" earlier or any incorrect work leading to a correct gradient.	A1
			(5)
			(9 marks)