Binomial Expansion Exam Questions MS (from OCR 4722)

Q1, (Jan 2011, Q1)

(i)	$(1 + 2x)^7 = 1 + 14x + 84x^2$	**B1**		Obtain $1 + 14x$
		M1		Attempt third term
		A1	**3**	Obtain $84x^2$
(ii)	$(2 - 5x)(1 + 14x + 84x^2)$ coeff of $x^2 = -70 + 168$ $= 98$	**M1**		Attempt at least one relevant product
		A1ft		Obtain two correct unsimplified terms (not necessarily summed) – either coefficients or still with powers of x involved
		A1	**3**	Obtain 98
			6	

Q2, (Jan 2010, Q3)

(i)	$(2 - x)^7 = 128 - 448x + 672x^2 - 560x^3$	M1		Attempt (at least) two relevant terms – product of binomial coeff, 2 and x (or expansion attempt that considers all 7 brackets)
		A1		Obtain $128 - 448x$
		A1		Obtain $672x^2$
		A1	4	Obtain $-560x^3$
(ii)	$-560 \times (1/4)^3 = -35/4$	M1		Attempt to use coeff of x^3 from **(i)**, with clear intention to cube $1/4$
		A1	2	Obtain $-35/4$ (w^6), (allow $35/4$ from $+560x^3$ in **(i)**)
			6	

Q3, (Jun 2010, Q3)

3 (i)	$(1 + \frac{1}{2}x)^{10} = 1 + 5x + 11.25x^2 + 15x^3$	**B1**		Obtain $1 + 5x$
		M1		Attempt at least the third (or fourth) term of the binomial expansion, including coeffs
		A1		Obtain $11.25x^2$
		A1		Obtain $15x^3$
			4	
(ii)	coeff of $x^3 = (3 \times 15) + (4 \times 11.25) + (2 \times 5)$ $= 100$	**M1**		Attempt at least one relevant term, with or without powers of x
		A1 ft		Obtain correct (unsimplified) terms (not necessarily summed) – either coefficients or still with powers of x involved
		A1	**3**	Obtain 100

Q4 (Jan 2009, Q7)

(i)	$6k^2a^2 = 24$	M1*		Obtain at least two of 6, k^2, a^2
	$k^2a^2 = 4$	M1dep*		Equate $6k^ma^n$ to 24
	$ak = 2$ **A.G.**	A1	**3**	Show $ak = 2$ convincingly – no errors allowed
(ii)	$4k^3a = 128$	B1		State or imply coeff of x is $4k^3a$
	$4k^3\left(\frac{2}{k}\right) = 128$	M1		Equate to 128 and attempt to eliminate a or k
	$k^2 = 16$	A1		Obtain $k = 4$
	$k = 4$, $a = \frac{1}{2}$	A1	**4**	Obtain $a = ½$
				SR B1 for $k = \pm 4$, $a = \pm\frac{1}{2}$
(iii)	$4 \times 4 \times \left(\frac{1}{2}\right)^3 = 2$	M1		Attempt $4 \times k \times a^3$, following their a and k (allow if still in terms of a, k)
		A1	**2**	Obtain 2 (allow $2x^3$)

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Q5, (Jan 2013, Q4)

(i)		$(2 + x)^5 = 32 + 80x + 80x^2 + 40x^3 + 10x^4 + x^5$	M1*	Attempt expansion resulting in at least 5 terms – products of powers of 2 and x
			M1d*	Attempt to use correct binomial coefficients
			A1	Obtain at least 4 correct simplified terms
			A1	Obtain a fully correct expansion
(ii)		$80\,(3y + y^2)^2 + 40\,(3y + y^2)^3$ coeff of $y^3 = (80 \times 6) + (40 \times 27)$ $= 1560$	M1	Attempt to use $x = 3y + y^2$
			A1	Obtain $480(y^3)$ or $1080(y^3)$
			A1	Obtain 1560 (or $1560y^3$)
		OR $(1 + y)^5(2 + y)^5$ $= (1 + 5y + 10y^2 + 10y^3 \ldots) \times (32 + 80y + 80y^2 + 40y^3 \ldots)$ coeff of $y^3 = 320 + 800 + 400 + 40$		
		OR $((2 + 3y) + y^2)^5$ $= (2 + 3y)^5 + 5(2 + 3y)^4 y^2$ $= \ldots 10 \times 4 \times 27y^3 \ldots + 5 \times 4 \times 8 \times 3y \times y^2$ coeff of $y^3 = 1080 + 480 = 1560$		
			[3]	

Q6, (Jun 2013, Q3)

(i)		$(2 + 5x)^6 = 64 + 960x + 6000x^2$	M1	Attempt at least first 2 terms– products of binomial coeff and correct powers of 2 and $5x$
			A1	Obtain $64 + 960x$
			M1	Attempt 3rd term – product of binomial coeff and correct powers of 2 and $5x$
			A1	Obtain $6000x^2$
			[4]	
(ii)		$(9 + 6cx \ldots)(64 + 960x + \ldots)$	M1*	Expand first bracket and attempt at least one relevant product
		$(9 \times 960) + (6c \times 64) = 4416$ $8640 + 384c = 4416$ $384c = -4224$	M1d*	Equate sum of the two relevant terms to 4416 and attempt to solve for c
		$c = -11$	A1	Obtain $c = -11$
			[3]	

Q7, (Jun 2014, Q6)

(i)		$(x^3)^4 + 4(x^3)^3(2x^{-2}) + 6(x^3)^2(2x^{-2})^2 + 4(x^3)(2x^{-2})^3 + (2x^{-2})^4$ $= x^{12} + 8x^7 + 24x^2 + 32x^{-3} + 16x^{-8}$	M1*	Attempt expansion – products of powers of x^3 and $2x^{-2}$
			M1d*	Attempt to use correct binomial coeffs
			A1	Obtain two correct simplified terms
			A1	Obtain a further two correct terms
			A1	Obtain a fully correct expansion
			[5]	
(ii)		$^1/_{13}\,x^{13} + x^8 + 8x^3 - 16x^{-2} - {}^{16}/_7\,x^{-7} + c$	M1*	Attempt integration
			A1FT	Obtain at least 3 correct terms, following their **(i)**
			A1	Obtain fully correct expression
			B1d*	$+ c$, and no dx or integral sign in answer
			[4]	

Q8 (Jun 2015, Q4)

(i)		$(2 + ax)^6 = 64 + 192ax + 240a^2x^2$	B1	Obtain 64
			B1	Obtain $192ax$
			M1	Attempt 3rd term – product of 15, 2^4 and $(ax)^2$
			A1	Obtain $240a^2x^2$
			[4]	
(ii)		$(3 \times 192a) + (-5 \times 64)$	M1	Attempt both relevant terms
		$576a - 320 = 64$	A1FT	Equate to 64, to obtain any correct equation, possibly still unsimplified
		$576a = 384$ $a = {}^2/_3$	A1	Obtain $a = {}^2/_3$ CWO

Q9, (Jun 2016, Q3)

(i)		$3^3 + (3 \text{ x } 3^2 \text{ x } kx) + (3 \text{ x } 3 \text{ x } (kx)^2) + (kx)^3$ $= 27 + 27kx + 9k^2x^2 + k^3x^3$	M1	Attempt expansion
			A1	Obtain at least two correct terms
			A1	Obtain at least one further correct term
			A1	Obtain fully correct simplified expansion
			[4]	
(ii)		$9k^2 = 27$ $k^2 = 3$ $k = \pm\sqrt{3}$	M1	Equate their coeff of x^2 to their constant term and attempt to solve for k
			A1	Obtain $k = \pm\sqrt{3}$
			[2]	

Q10, (Jan 2008, Q10)

(i)	$(2x+5)^4=(2x)^4+4(2x)^3 5+6(2x)^2 5^2+4(2x)5^3+5^4$	M1*		Attempt expansion involving powers of $2x$ and 5 (at least 4 terms)
	$=16x^4+160x^3+600x^2+1000x+625$	M1*		Attempt coefficients of 1, 4, 6, 4, 1
		A1dep*		Obtain two correct terms
		A1	**4**	Obtain a fully correct expansion
(ii)	$(2x+5)^4-(2x-5)^4=320x^3+2000x$	M1		Identify relevant terms (and no others) by sign change oe
		A1	**2**	Obtain $320x^3+2000x$ cwo
(iii)	$9^4-(-1)^4=6560$ and $7360-800=6560$ **A.G.**	B1		Confirm root, at any point
	$320x^3-1680x+800=0$	M1		Attempt complete division by $(x-2)$ or equiv
	$4x^3-21x+10=0$	A1√		Obtain quotient of $ax^2+2ax+k$, where a is their coeff of x^3
	$(x-2)(4x^2+8x-5)=0$	A1		Obtain $(4x^2+8x-5)$ (or multiple thereof)
	$(x-2)(2x-1)(2x+5)=0$	M1		Attempt to solve quadratic
	Hence $x=½$, $x=-2½$	A1	**6**	Obtain $x=½$, $x=-2½$
				SR: answer only is B1 B1
			12	