Binomial Expansion Exam Questions MS (from Legacy OCR 4724)

Q1 (Jun 2015, Q4)

(i)	$8^{2/3} = 4$	**B1**	
	$(1 - \frac{9x}{8})^{2/3}$ seen	**M1**	$8^{2/3} + (2/3)8^{-1/3}(\pm 9x) + \frac{2/3 \times (2/3 - 1)}{2!}8^{-4/3}(\pm 9x)^2$
	$1 + \left(\frac{2}{3}\right)\left(\frac{\pm 9x}{k}\right) + \frac{1}{2!}\left(\frac{2}{3}\right)\left(\frac{2}{3} - 1\right)\left(\frac{\pm 9x}{k}\right)^2$ where k is an integer greater than 1	**M1**	$4 + (2/3)(\frac{1}{2})(\pm 9x) + \frac{2/3 \times (2/3 - 1)}{2!}(\frac{1}{16})(\pm 9x)^2$
	$4 - 3x - \frac{9}{16}x^2$ or $4(1 - \frac{3}{4}x - \frac{9}{64}x^2)$ cao	**A1**	
		[4]	
(ii)	$-\frac{8}{9} < x < \frac{8}{9}$ or $\lvert x \rvert < 8/9$ isw cao	**B1**	
		[1]	

Q2, (Jun 2016, Q7)

$nk = -6$ soi	**B1**	allow $nkx = -6x$ and /or $\frac{n(n-1)k^2}{2!}x^2 = 30x^2$ for first two marks
$\frac{n(n-1)k^2}{2!} = 30$ soi	**B1**	
substitution of $n = \pm\frac{6}{k}$ or $k = \pm\frac{6}{n}$ or $k = \pm\sqrt{\frac{60}{n(n-1)}}$ oe to eliminate one variable from their equations	**M1**	allow omission of brackets
$n = -1.5$ oe	**A1**	eg allow $-\frac{6}{4}$
$k = 4$	**A1**	
expansion is valid for $\lvert x \rvert < \frac{1}{4}$ or $-\frac{1}{4} < x < \frac{1}{4}$ isw	**B1FT**	**FT** their k
	[6]	

Q3 (Jun 2014, Q3)

(i)	$1+(-\frac{1}{2})(-2x)+(-\frac{1}{2})(\frac{-3}{2})\frac{(\pm 2x)^2}{2!}[+...]$	B1 B1	first two terms third term
	$1+x+\frac{3}{2}x^2$ oe	B1 **[3]**	
(ii)	use of $(x+3)\times$ their$(1+x+\frac{3}{2}x^2)$	M1	
	coefficient is 5.5 oe	A1 **[2]**	or **B2** www in either part

Q4 (Jun 2013, Q10)

(i)	$(1-x)^{-3}=1+-3.-x+\frac{-3.-4}{2}(-x)^2+...$ oe; accept $3x$ for $-3.-x$ &/or $-x^2$ or $(x)^2$ for $(-x)^2$	M1	As result is given, this expansion must be shown and then simplified. It must not just be stated as $1+3x+6x^2+...$
	multiplication by x to produce **AG** (**A**nswer **G**iven)	A1 **[2]**	
(ii)	Clear indication that $x = 0.1$ is to be substituted	M1	e.g. $0.1+3(0.1)^2+6(0.1)^3$ stated
	(estimated value is) $0.1+3(0.1)^2+6(0.1)^3=\underline{0.136}$	A1 **[2]**	
(iii)	Sight of $1-x=x\left(\frac{1}{x}-1\right)$ or $1-x=-x\left(1-\frac{1}{x}\right)$ or $\left(\frac{1}{x}-1\right)^3=-\left(1-\frac{1}{x}\right)^3$ or $(\frac{1}{x}-1)^{-3}=-\left(1-\frac{1}{x}\right)^{-3}$ or $\left(\frac{1}{x}-1\right)^{-3}=-\left(1-\frac{1}{x}\right)^{-3}$ or equivalent	B1	
	Complete satisfactory explanation (no reference to style) www	B1	(Answer Given)
	$[1+(-3)(-\frac{1}{x})+\frac{(-3)(-4)}{2}\left(-\frac{1}{x}\right)^2+...]$	M1	Simplified expansion may be quoted – it may have come from result in part (i). Answer for this expansion is not **AG**.
	$\rightarrow -\frac{1}{x^2}-\frac{3}{x^3}-\frac{6}{x^4}$	A1 **[4]**	
(iv)	Must say "Not suitable" and one of following: Either: requires $\left\|\frac{1}{x}\right\|<1$, which is not true if $x = 0.1$ Or: substitution of positive/small value of x in the expansion gives a negative/large value (which cannot be an approximation to 100/729).	B1 **[1]**	<u>This B1 is dep on $x = 0.1$ used in (ii).</u> Or "because $\frac{1}{x}>1$" Or "it gives -63100"

Q5 (Jan 2013, Q2)

The first 3 marks refer to the expansion…	………	of $\left(1-\frac{16x}{9}\right)^{3/2}$ and to no other expansion
First 2 terms $= 1-\frac{8}{3}x$	B1	Allow any equiv fraction for the $-\frac{8}{3}$ and ISW
3^{rd} term $= \frac{\frac{3}{2}\cdot\frac{1}{2}}{1.2}\left(-\frac{16x}{9}\right)^2$	M1	Allow clear evidence of intention,e.g. $\frac{\frac{3}{2}\cdot\frac{1}{2}}{1.2}\frac{-16x^2}{9}$
$= \frac{32}{27}x^2$	A1	Allow any equiv fraction for the $\frac{32}{27}$ and ISW
Complete expansion $\approx 27-72x+32x^2$	A1	cao No equivalents. Ignore any further terms
valid for $\frac{-9}{16} < x < \frac{9}{16}$ or $\lvert x\rvert < \frac{9}{16}$	B1	oe Beware, e.g. $x < \left\lvert\frac{9}{16}\right\rvert$
	[5]	

Q6 (Jun 2012, Q3)

(i)	**The first 5 marks are awarded for expansions of either** $(1+4x)^{-\frac{1}{2}}$ **or** $(1+4x)^{\frac{1}{2}}$		
	Expansion of $(1+4x)^{-\frac{1}{2}}$; First 2 terms $= 1-2x$	B1	Or $(1+4x)^{\frac{1}{2}} = 1+2x$…….
	3rd term $= \frac{-\frac{1}{2}.(-\frac{1}{2}-1)}{2}.16x^2$ [Accept $4x^2$ for $16x^2$]	M1	3rd term $= \frac{\frac{1}{2}.-\frac{1}{2}}{2}.16x^2$ [ditto]
	$= +\ 6x^2$	A1	$= -2x^2$
	4th term $= \frac{-\frac{1}{2}.(-\frac{1}{2}-1).(-\frac{1}{2}-2)}{2.3}.64x^3$ [Accept $4x^3$ for $64x^3$]	M1	4th tm $= \frac{\frac{1}{2}.-\frac{1}{2}.-\frac{3}{2}}{2.3}.64x^3$ [ditto]
	$= -20x^3$	A1	$= +\ 4x^3$
	$1-2x+7x^2-22x^3$; $1+ax+(b+1)x^2+(a+c)x^3$	A1 ft	ft only $(1+4x)^{-\frac{1}{2}} = 1+ax+bx^2+cx^3$ provided a, b and c attempted and at least one @ M1 obtained
		[6]	
(ii)	$\lvert x\rvert < \frac{1}{4}$; $-\frac{1}{4} < x < \frac{1}{4}$; $\{-\frac{1}{4} < x\ ,\ x < \frac{1}{4}\}$ no equality	B1	But not $\{-\frac{1}{4} < x$ **OR** $x < \frac{1}{4}\}$ If choice mark what appears to be the final answer.
		[1]	

Q7, (Jan 2012, Q4)

(i)	First two terms in expansion = $1-x$	B1	(simplify to this, now or later)
	Third term shown as $\frac{\frac{1}{4}.-\frac{3}{4}}{2}(-4x)^2$	M1	$-\frac{3}{4}$ can be $\frac{1}{4}-1$; $(-4x)^2$ can be $-4x^2$ or $-16x^2$
	$= -\frac{3}{2}x^2$	A1	
	Fourth term shown as $\frac{\frac{1}{4}.-\frac{3}{4}.-\frac{7}{4}}{2.3}(-4x)^3$	M1	Similar allowances as for first M1
	$= -\frac{7}{2}x^3$	A1	[Complete expansion is $1-x-\frac{3}{2}x^2-\frac{7}{2}x^3 ...$]
		[5]	
(ii)	$(1+bx^2)^7$ shown (implied) as $1+7bx^2+...$	B1	
	Clear indic that terms involving x and x^2 must cancel	M1	
	$a=-1$	A1 FT	If **(i)** = $1+\lambda x+\mu x^2$, $a=\lambda$
	$b=-\frac{3}{14}$	A1 FT	If **(i)** = $1+\lambda x+\mu x^2$, $b=\frac{1}{7}\mu$
			FT from wrong **(i)** only, not wrong $(1+bx^2)^7$
		[4]	