Question			Answer	Marks	Guidance
1			$\sqrt[3]{1-2x}=(1-2x)^{1/3}$	B1	n = 1/3 only. Do not MR for $n \neq 1/3$
			$=1+\frac{1}{3}(-2x)+\frac{\frac{1}{3}(-\frac{2}{3})}{2!}(-2x)^2+\frac{\frac{1}{3}(-\frac{2}{3})(-\frac{5}{3})}{3!}(-2x)^3+...$	M1	all four **correct unsimplified** binomial coeffs (not nCr) soi condone absence of brackets only if it is clear from subsequent work that they were assumed
				B1	$1-\frac{2}{3}x$ www in this term
			$=1-\frac{2}{3}x-\frac{4}{9}x^2-\frac{40}{81}x^3+...$	B1	…. $-\frac{4}{9}x^2$ www in this term (not if used 2x for (–2x) throughout)
				B1	…..$-\frac{40}{81}x^3$ www in this term If there is an error in say the third coeff of the expansion then M0 B1B0B1 is possible.
			Valid for – ½ < x < ½ or |x| <½	B1 **[6]**	Independent of expansion Allow ≤'s (valid in this case) or a combination. Condone also, say, –½ < |x| < ½ but not x < ½ or –1 < 2x < 1 or –½ > x > ½

Question			r	Marks	Guidance
2			$(1 + qx)^p = 1 + pqx + ½\, p(p - 1)q^2x^2 + \ldots$	B1 B1	$(1)\ldots+ pqx$ $\ldots + ½\, p(p - 1)q^2x^2$
			$\Rightarrow \quad pq = -1,\ q = -1/p$ $½\, p(p - 1)q^2 = 2$ $\Rightarrow \quad p(p - 1)/2p^2 = (p - 1)/2p = 2$	M1	e minating q (or p) from simultaneous equations involving both variables oe $\frac{1}{2}\left(\frac{-1}{q}\right)\left(\frac{-1}{q}-1\right)q^2 = 2$, $-1(-1-q)=4$, $q=3$
			$\Rightarrow \quad p - 1 = 4p,\ p = -1/3$	A1	$p = -1/3$ www (or $q = 3$)
			$\Rightarrow \quad q = 3$	A1ft	$q = 3$ (or $p = -1/3$) for second value, ft their p or q eg -1/the other , provided only a single computational error in the method and correct initial equations
			Valid for $-1 < 3x < 1 \Rightarrow -1/3 < x < 1/3$	B1 **[6]**	or $\lvert x \rvert < 1/3$ www, allow $-1/3<\lvert x\rvert<1/3$ but not say, $x<1/3$ (actually $-1/3<x\leq 1/3$ is correct)

3	$3^{-}=-)(3\ 2x^{-3}(1-\frac{2}{3}x)^{-3}$ **3**	M1	dealing with the ‘3’
	$=\frac{1}{27}(1+(-3)(-\frac{2}{3}x)+\frac{(-3)(-4)}{2}(-\frac{2}{3}x)^2+...)$	B1	correct binomial coeffs
	$=\frac{1}{27}(1+2x+\frac{8}{3}x^2+...)$	B2,1,0	1, 2, 8/3 oe
	$=\frac{1}{27}+\frac{2}{27}x+\frac{8}{81}x^2+...$	A1	cao
	Valid for $-1<-\frac{2}{3}x<1$	M1	
	$\Rightarrow$ $-\frac{3}{2}<x<\frac{3}{2}$	A1 [7]	

4		$\frac{1+2x}{(1-2x)^2}=(1+2x)(1-2x)^{-2}$	M1	binomial expansion power -2
		$=(1+2x)[1+(-2)(-2x)+\frac{(-2)(-3)}{1.2}(-2x)^2+...]$	A1	unsimplified,correct
		$=(1+2x)[1+4x+12x^2+...]$	A1	sufficient terms
		$=1+4x+12x^2+2x+8x^2+...$	M1	
		$=1+6x+20x^2+...$	A1	
		Valid for $-1<-2x<1$	M1	
		$\Rightarrow$ $-½<x<½$	A1 **[7]**	

5(i) $(1+2x)^{1/3}=1+\frac{1}{3}.2x+\frac{\frac{1}{3}.(-\frac{2}{3})}{2!}(2x)^2+...$	M1 A1	binomial expansion correct unsimplified expression
$=1+\frac{2}{3}x-\frac{2}{18}4x^2+...$		simplification
$=1+\frac{2}{3}x-\frac{4}{9}x^2+...$ *	E1	www
Next term $=\frac{\frac{1}{3}.(-\frac{2}{3})(-\frac{5}{3})}{3!}(2x)^3$	M1	
$=\frac{40}{81}x^3$	A1	
Valid for $-1<2x<1$ $\Rightarrow$ $-½<x<½$	B1 [6]	

6(i) $(1-2x)^{-\frac{1}{2}} = 1 - \frac{1}{2}(-2x) + \frac{(-\frac{1}{2}).(-\frac{3}{2})}{2!}(-2x)^2 + ...$ $= 1 + x + \frac{3}{2}x^2 + ...$ Valid for $-1 < -2x < 1 \Rightarrow -\frac{1}{2} < x < \frac{1}{2}$	M1 A1 A1 M1 A1 [5]	binomial expansion with p = -½ correct expression cao
(ii) $\frac{1+2x}{\sqrt{1-2x}} = (1+2x)(1 + x + \frac{3}{2}x^2 + ...)$ $= 1 + x + \frac{3}{2}x^2 + 2x + 2x^2 + ...$ $= 1 + 3x + \frac{7}{2}x^2 + ...$	M1 A1ft A1 [3]	substitituting their $1 + x + \frac{3}{2}x^2 + ...$ and expanding cao

7 (i) $\frac{1}{\sqrt{4-x^2}} = 4^{-\frac{1}{2}}(1 - \frac{1}{4}x^2)^{-\frac{1}{2}}$ $= \frac{1}{2}[1 + (-\frac{1}{2})(-\frac{1}{4}x^2) + \frac{(-\frac{1}{2})(-\frac{3}{2})}{2!}(-\frac{1}{4}x^2)^2 + ...]$ $= \frac{1}{2} + \frac{1}{16}x^2 + \frac{3}{256}x^4 + ...$	M1 M1 A1 A1	 Binomial coeffs correct Complete correct expression inside bracket cao
(ii) $\int_0^1 \frac{1}{\sqrt{4-x^2}}dx \approx \int_0^1 (\frac{1}{2} + \frac{1}{16}x^2 + \frac{3}{256}x^4)dx$ $= \left[\frac{1}{2}x + \frac{1}{48}x^3 + \frac{3}{1280}x^5\right]_0^1$ $= \frac{1}{2} + \frac{1}{48} + \frac{3}{1280}$ = 0.5232 (to 4 s.f.)	M1ft A1	
(iii) $\int_0^1 \frac{1}{\sqrt{4-x^2}}dx = \left[\arcsin\frac{x}{2}\right]_0^1$ = π/6 = 0.5236	B1 [7]	