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Binomial Expansion | Past Paper Question | C4 Edexcel June 2012 Q3(a)

$$f(x) = \frac{6}{\sqrt{9-4x}}, \quad |x| < \frac{9}{4}$$

(a) Find the binomial expansion of $f(x)$ in ascending powers of x , up to and including the term in x^3 .

Give each coefficient in its simplest form. (6)

$$\begin{aligned} f(x) &\equiv 6(9-4x)^{-1/2} \\ &\equiv 6 \left[9 \left(1 - \frac{4}{9}x \right) \right]^{-1/2} \\ &\equiv 6(9)^{-1/2} \left(1 - \frac{4}{9}x \right)^{-1/2} \end{aligned}$$

$$(1+a)^n \equiv 1 + \frac{na}{1!} + \frac{n(n-1)a^2}{2!} + \frac{n(n-1)(n-2)a^3}{3!} + \dots$$

$$\equiv 2 \left(1 - \frac{4}{9}x \right)^{-1/2}$$

$$\equiv 2 \left[1 + \left(-\frac{1}{2} \right) \left(-\frac{4}{9}x \right) + \frac{\left(-\frac{1}{2} \right) \left(-\frac{3}{2} \right)}{(2)(1)} \left(-\frac{4}{9}x \right)^2 + \frac{\left(-\frac{1}{2} \right) \left(-\frac{3}{2} \right) \left(-\frac{5}{2} \right)}{(3)(2)(1)} \left(-\frac{4}{9}x \right)^3 + \dots \right]$$

$$\equiv 2 \left(1 + \frac{2x}{9} + \frac{2}{27}x^2 + \frac{20}{729}x^3 + \dots \right)$$

$$\equiv 2 + \frac{4x}{9} + \frac{4}{27}x^2 + \frac{40x^3}{729} + \dots$$

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