General Binomial Expansion

Patrons are reminded that the general binomial expansion states

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 + \frac{n(n-1)(n-2)(n-3)}{4!}x^4 + \cdots .$$

Note that there *must* be a 1 at the front of the bracket. In order for the series to be convergent $-1 < x < 1$. Unlike C2 binomial expansion, n can take any value.

1. Find the stated number of terms in the following expansions:

   (a) $\sqrt{1+x}$. (First three terms.) $\boxed{1 + \frac{x}{2} - \frac{x^2}{8} + \cdots}$

   (b) $\frac{1}{1+2x}$. (First three terms.) $\boxed{1 - 2x + 4x^2 + \cdots}$

   (c) $\sqrt[3]{1+ax}$. (First three terms.) $\boxed{1 + \frac{ax}{3} - \frac{a^2x^2}{9} + \cdots}$

   (d) $\frac{1}{(1+\frac{x}{2})^2}$. (First three terms.) $\boxed{1 - x + \frac{3x^2}{4} + \cdots}$

   (e) $\sqrt{4-x}$. (First three terms.) $\boxed{2 - \frac{x}{4} - \frac{x^2}{64} + \cdots}$

   (f) $\frac{4}{\sqrt[3]{8-x}}$. (First three terms.) $\boxed{2 + \frac{x}{12} + \frac{x^2}{144} + \cdots}$

2. If you have covered partial fractions, split the following terms, expand each expression binomially and simplify:

   (a) $\frac{4x+3}{2x^2+3x+1}$. (First three terms.) □