

| Binomial | Unsimplified Expansion | Simplified Expansion | Value to Approximate | Value to Substitute | Value when Substituted | Approximation 4dp | Percentage Error 2sf |
|-----------------|--|---------------------------------------|----------------------|---------------------|------------------------|-------------------|----------------------|
| $(1+5x)^{1/2}$ | $1 + \frac{1}{2}(5x) + \frac{(\frac{1}{2})(-\frac{1}{2})(5x)^2}{2!}$ | $1 + \frac{5x}{2} - \frac{25}{8}x^2$ | $\sqrt{30}$ | $x=0.04$ | $\sqrt{30}/5$ | 5.475 | 0.041% |
| $(1-4x)^{1/2}$ | $1 + \frac{1}{2}(-4x) + \frac{(\frac{1}{2})(-\frac{1}{2})(-4x)^2}{2!}$ | $1 - 2x - 2x^2$ | $\sqrt{6}$ | $x=0.01$ | $2\sqrt{6}/5$ | 2.4495 | 0.00042% |
| $(1+10x)^{1/2}$ | $1 + \frac{1}{2}(10x) + \frac{(\frac{1}{2})(-\frac{1}{2})(10x)^2}{2!}$ | $1 + 5x - \frac{25}{2}x^2$ | $\sqrt{6}$ | $x=0.05$ | $\sqrt{6}/2$ | 2.4375 | 0.49% |
| $(1-x)^{1/2}$ | $1 + \frac{1}{2}(-x) + \frac{(\frac{1}{2})(-\frac{1}{2})(-x)^2}{2!}$ | $1 - \frac{1}{2}x - \frac{1}{8}x^2$ | $\sqrt{10}$ | $x=0.6$ | $\sqrt{10}/5$ | 3.275 | 3.6% |
| $(1-3x)^{1/2}$ | $1 + \frac{1}{2}(-3x) + \frac{(\frac{1}{2})(-\frac{1}{2})(-3x)^2}{2!}$ | $1 - \frac{3}{2}x - \frac{9}{8}x^2$ | $\sqrt{13}$ | $x=0.16$ | $\sqrt{13}/5$ | 3.656 | 1.4% |
| $(1+2x)^{-1/2}$ | $1 + (-\frac{1}{2})(2x) + \frac{(-\frac{1}{2})(-\frac{3}{2})(2x)^2}{2!}$ | $1 - x + \frac{3}{2}x^2$ | $\sqrt{2}$ | $x=0.14$ | $5\sqrt{2}/8$ | 1.4230 | 0.62% |
| $(1-7x)^{1/2}$ | $1 + (\frac{1}{2})(-7x) + \frac{(\frac{1}{2})(-\frac{1}{2})(-7x)^2}{2!}$ | $1 - \frac{7}{2}x - \frac{49}{8}x^2$ | $\sqrt{2}$ | $x=0.04$ | $3\sqrt{2}/5$ | 1.417 | 0.20% |
| $(1+4x)^{1/2}$ | $1 + (\frac{1}{2})(4x) + \frac{(\frac{1}{2})(-\frac{1}{2})(4x)^2}{2!}$ | $1 + 2x - 2x^2$ | $\sqrt{3}$ | $x=0.02$ | $3\sqrt{3}/5$ | 1.732 | 0.0029% |
| $(1-x)^{-1/2}$ | $1 + (-\frac{1}{2})(-x) + \frac{(-\frac{1}{2})(-\frac{3}{2})(-x)^2}{2!}$ | $1 + \frac{1}{2}x + \frac{3}{8}x^2$ | $\sqrt{2}$ | $x=0.02$ | $5\sqrt{2}/7$ | 1.4142 | 0.00096% |
| $(1-6x)^{-1/2}$ | $1 + (-\frac{1}{2})(-6x) + \frac{(-\frac{1}{2})(-\frac{3}{2})(-6x)^2}{2!}$ | $1 + 3x + \frac{27}{2}x^2$ | $\sqrt{10}$ | $x=0.1$ | $\sqrt{10}/2$ | 2.87 | 9.2% |
| $(1+2x)^{1/2}$ | $1 + (\frac{1}{2})(2x) + \frac{(\frac{1}{2})(-\frac{1}{2})(2x)^2}{2!}$ | $1 + x - \frac{1}{2}x^2$ | $\sqrt{7}$ | $x=0.06$ | $2\sqrt{7}/5$ | 2.6455 | 0.0095% |
| $(1+5x)^{-1/2}$ | $1 + (-\frac{1}{2})(5x) + \frac{(-\frac{1}{2})(-\frac{3}{2})(5x)^2}{2!}$ | $1 - \frac{5}{2}x + \frac{75}{8}x^2$ | $\sqrt{5}$ | $x=0.05$ | $2\sqrt{5}/5$ | 2.2461 | 0.45% |
| $(1-5x)^{1/2}$ | $1 + (\frac{1}{2})(-5x) + \frac{(\frac{1}{2})(-\frac{1}{2})(-5x)^2}{2!}$ | $1 - \frac{5}{2}x - \frac{25}{8}x^2$ | $\sqrt{5}$ | $x=0.04$ | $2\sqrt{5}/5$ | 2.2375 | 0.064% |
| $(1+8x)^{1/2}$ | $1 + (\frac{1}{2})(8x) + \frac{(\frac{1}{2})(-\frac{1}{2})(8x)^2}{2!}$ | $1 + 4x - 8x^2$ | $\sqrt{5}$ | $x=0.1$ | $3\sqrt{5}/5$ | 2.3667 | 5.8% |
| $(1-9x)^{-1/2}$ | $1 + (-\frac{1}{2})(-9x) + \frac{(-\frac{1}{2})(-\frac{3}{2})(-9x)^2}{2!}$ | $1 + \frac{9}{2}x + \frac{243}{8}x^2$ | $\sqrt{10}$ | $x=0.1$ | $\sqrt{10}$ | 1.7538 | 45% |

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| $(1-4x)^{1/2}$ | $1 + \frac{1}{2}(-4x) + \frac{(\frac{1}{2})(-\frac{1}{2})(-4x)^2}{2!}$ | | $\sqrt{6}$ | $x=0.01$ | $2\sqrt{6}/5$ | | |
| $(1+10x)^{1/2}$ | $1 + \frac{1}{2}(10x) + \frac{(\frac{1}{2})(-\frac{1}{2})(10x)^2}{2!}$ | | $\sqrt{6}$ | $x=0.05$ | $\sqrt{6}/2$ | | |
| $(1-x)^{1/2}$ | $1 + \frac{1}{2}(-x) + \frac{(\frac{1}{2})(-\frac{1}{2})(-x)^2}{2!}$ | | $\sqrt{10}$ | $x=0.6$ | | | |
| $(1-3x)^{1/2}$ | | | $\sqrt{13}$ | $x=0.16$ | | | |
| $(1+2x)^{-1/2}$ | | | $\sqrt{2}$ | $x=0.14$ | | | |
| $(1-7x)^{1/2}$ | | | $\sqrt{2}$ | $x=0.04$ | | | |
| | $1 + (\frac{1}{2})(4x) + \frac{(\frac{1}{2})(-\frac{1}{2})(4x)^2}{2!}$ | $1 + 2x - 2x^2$ | $\sqrt{3}$ | $x=0.02$ | | | |
| | $1 + (-\frac{1}{2})(-x) + \frac{(-\frac{1}{2})(-\frac{3}{2})(-x)^2}{2!}$ | | $\sqrt{2}$ | $x=0.02$ | | | |
| $(1-6x)^{-1/2}$ | | | $\sqrt{10}$ | | $\sqrt{10}/2$ | 2.87 | 9.2% |
| | $1 + (\frac{1}{2})(2x) + \frac{(\frac{1}{2})(-\frac{1}{2})(2x)^2}{2!}$ | | $\sqrt{7}$ | | $2\sqrt{7}/5$ | | |
| $(1-x)^{-1/2}$ | | $1 - \frac{5}{2}x + \frac{75}{8}x^2$ | $\sqrt{5}$ | $x=0.05$ | | | |
| $(1-x)^{1/2}$ | | $1 - \frac{5}{2}x - \frac{25}{8}x^2$ | $\sqrt{5}$ | | $2\sqrt{5}/5$ | 2.2375 | 0.064% |
| $(1-x)^{1/2}$ | | $1 + 4x - 8x^2$ | $\sqrt{5}$ | | $3\sqrt{5}/5$ | 2.3667 | 5.8% |
| $(1-x)^{-1/2}$ | | $1 + \frac{9}{2}x + \frac{243}{8}x^2$ | $\sqrt{10}$ | | $\sqrt{10}$ | 1.7538 | 45% |