

Expand $(1 - \frac{1}{2}x - x^2)^9$

$$\left(1 - \frac{1}{2}x - x^2\right)^9 = \left(1 - \frac{1}{2}x - x^2\right)\left(1 - \frac{1}{2}x - x^2\right)$$

$$1) \left(1 - \frac{1}{2}x - x^2\right)\left(1 - \frac{1}{2}x - x^2\right) = 1 - x - \frac{7x^2}{4} + x^3 + x^4$$

$$2) \left(1 - \frac{1}{2}x - x^2\right)\left(1 - \frac{1}{2}x - x^2\right)\left(1 - \frac{1}{2}x - x^2\right) = \left(1 - x - \frac{7x^2}{4} + x^3 + x^4\right)\left(1 - \frac{1}{2}x - x^2\right) = 1 - \frac{3x}{2} - \frac{9x^2}{4} + \frac{23x^3}{8} + \frac{9x^4}{4} - \frac{3x^5}{2} - x^6$$

$$3) \left(1 - \frac{1}{2}x - x^2\right)^4 = \left(1 - \frac{1}{2}x - x^2\right)^3 \left(1 - \frac{1}{2}x - x^2\right) = \left(1 - \frac{3x}{2} - \frac{9x^2}{4} + \frac{23x^3}{8} + \frac{9x^4}{4} - \frac{3x^5}{2} - x^6\right)\left(1 - \frac{1}{2}x - x^2\right) = 1 - 2x - \frac{5x^2}{2} + \frac{11x^3}{2} + \frac{49x^4}{16} - \frac{11x^5}{2} - \frac{5x^6}{2} + 2x^7 + x^8$$

...

$$\left(1 - \frac{1}{2}x - x^2\right)^9 = 1 - \frac{9x}{2} + \frac{51x^3}{2} - \frac{153x^4}{8} - \frac{1071x^5}{16} + \frac{1071x^6}{16} + \frac{3519x^7}{32} - \frac{29223x^8}{256} - \frac{65569x^9}{512} + \frac{29223x^{10}}{256} + \frac{3519x^{11}}{32} - \frac{1071x^{12}}{16} - \frac{1071x^{13}}{16} + \frac{153x^{14}}{8} + \frac{51x^{15}}{2} - \frac{9x^{17}}{2} - x^{18}$$

$$\text{Answer: } 1 - \frac{9x}{2} + \frac{51x^3}{2} - \frac{153x^4}{8} - \frac{1071x^5}{16} + \frac{1071x^6}{16} + \frac{3519x^7}{32} - \frac{29223x^8}{256} - \frac{65569x^9}{512} + \frac{29223x^{10}}{256} + \frac{3519x^{11}}{32} - \frac{1071x^{12}}{16} - \frac{1071x^{13}}{16} + \frac{153x^{14}}{8} + \frac{51x^{15}}{2} - \frac{9x^{17}}{2} - x^{18}$$