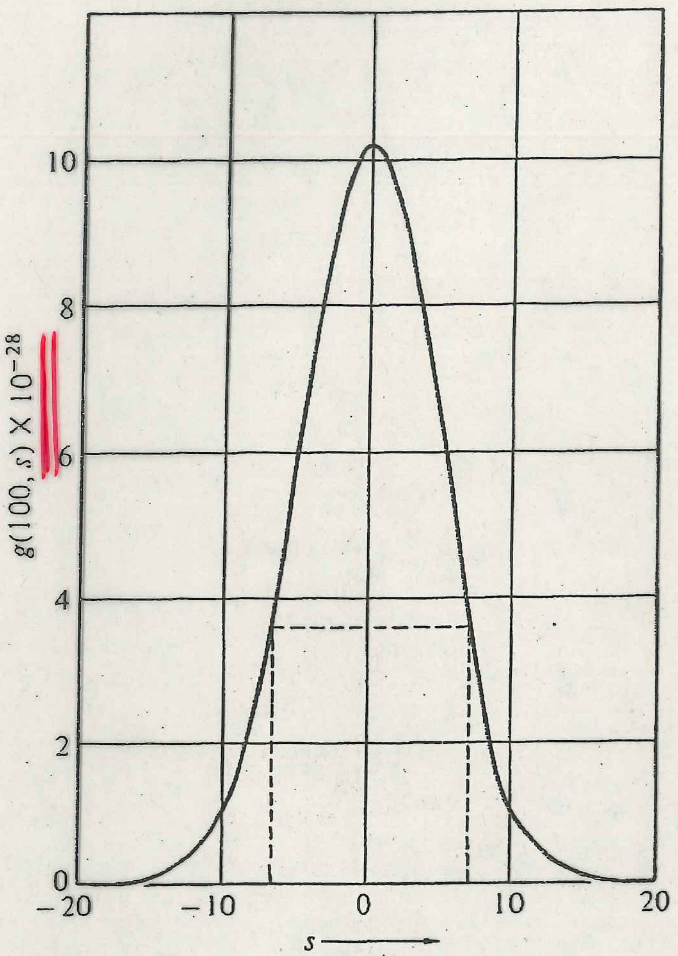


**Figure 1.9** The Gaussian approximation to the binomial coefficients $g(100,s)$ plotted on a linear scale. On this scale it is not possible to distinguish on the drawing the approximation from the exact values over the range of $s$ plotted. The entire range of $s$ is from $-50$ to $+50$. The dashed lines are drawn from the points at $1/e$ of the maximum value of $g$.

For $N = 50$, the value of $g(50,0)$ is $1.264 \times 10^{14}$, from (37). The approximate value from (36) is $1.270 \times 10^{14}$. The distribution plotted in Figure 1.9 is centered in a maximum at $s = 0$. When $s^2 = \frac{1}{2}N$, the value of $g$ is reduced to $e^{-1}$ of the maximum value. That is, when

$$s/N = (1/2N)^{1/2} , \tag{38}$$

the value of $g$ is $e^{-1}$ of $g(N,0)$. The quantity $(1/2N)^{1/2}$ is thus a reasonable measure of the fractional width of the distribution. For $N \approx 10^{22}$, the fractional width is of the order of $10^{-11}$. When $N$ is very large, the distribution is exceedingly sharply defined, in a relative sense. It is this sharp peak and the continued sharp variation of the multiplicity function far from the peak that will lead to a prediction that the physical properties of systems in thermal equilibrium are well defined. We now consider one such property, the mean value of $s^2$.