Theorem [UNDER CONSTRUCTION ... THE GAMMA–NORMAL DISTRIBUTION IS A BIVARIATE DISTRIBUTION THAT SHOULD BE DELETED FROM THE CHART] If $X \sim N(\mu, \sigma^2)$ and $\sigma \sim$ inverted gamma(α, β), then the probability density function of X is

$$f(x) = \frac{\tau^{1/2}}{(2\pi)^{1/2}\sigma} e^{-\frac{\tau}{2\sigma^2}(\mu-\mu_0)^2} \frac{2}{\Gamma(v/2)} \left(\frac{vs^2}{2}\right)^{\omega/2} \frac{1}{\sigma^{v+1}} e^{-vs^2/2\sigma^2} \qquad -\infty < x < \infty,$$

which is known as the gamma–normal distribution.

Proof The result appears on page 112 of Forbes, Evans, Hastings, and Peacock (2011), *Statistical Distributions*, Fourth Edition, John Wiley and Sons.