Bayes’ Rule:
For a partition \( B_1, \ldots, B_n \) of all possible outcomes:

\[
P(B_i|A) = \frac{P(A|B_i)P(B_i)}{P(A|B_1)P(B_1) + \cdots + P(A|B_n)P(B_n)} \quad (i = 1, \ldots, n)
\]

Posterior Odds = Likelihood Ratio \( \times \) Prior Odds:
If \( B_1 = B \) and \( B_2 = B^c \) then the posterior odds of \( B \) is

\[
\frac{P(B|A)}{P(B^c|A)} = \frac{P(A|B)P(B)}{P(A|B^c)P(B^c)}
\]

Computing Formula for Variance:

\[
\text{Var}(Y) = E[(Y - \mu_Y)^2] = E(Y^2) - \mu_Y^2
\]
where \( \mu_Y = E(Y) \).

Moment generating function:
The mgf \( m(t) \) of \( Y \) is \( E(e^{tY}) \). Note that the mgf for \( Y \) exists if there is some \( b > 0 \) such that \( m(t) < \infty \) for \( |t| < b \).

Tchebyshev’s Inequality:
For any random variable \( Y \) with mean \( \mu \) and standard deviation \( \sigma \), and any \( k > 0 \)

\[
P(|Y - \mu| \geq k\sigma) \leq \frac{1}{k^2} \quad \text{or} \quad P(|Y - \mu| < k\sigma) \geq 1 - \frac{1}{k^2}
\]

Formulae related to Gamma distribution:
For a gamma distribution with scale and shape parameters \( \beta \) and \( r \), respectively,

\[
\Gamma(r) = \int_0^\infty t^{r-1}e^{-t}dt,
\]
\( \Gamma(r + 1) = r\Gamma(r) \), and for integer \( r \), \( \Gamma(r + 1) = r! \).
For integer $r$, Gamma($r, 1/\lambda$) probabilities may be found using the formula

$$\int_0^t \frac{\lambda}{\Gamma(r)} t^{r-1} e^{-\lambda t} dt = \sum_{i=r}^{\infty} \frac{(\lambda t)^i}{i!} e^{-\lambda t}$$

Variance of linear combinations:

$$\text{Var}(aX + bY) = a^2 \text{Var}(X) + b^2 \text{Var}(Y) + 2ab \text{Cov}(X, Y)$$

Computing Formula for Covariance:

$$\text{Cov}(X, Y) = E[(X - \mu_X)(Y - \mu_Y)] = E(XY) - \mu_X \mu_Y$$