# Functions from the theory as R functions

EBrandDV

15/6/2022

## Gygax's Law

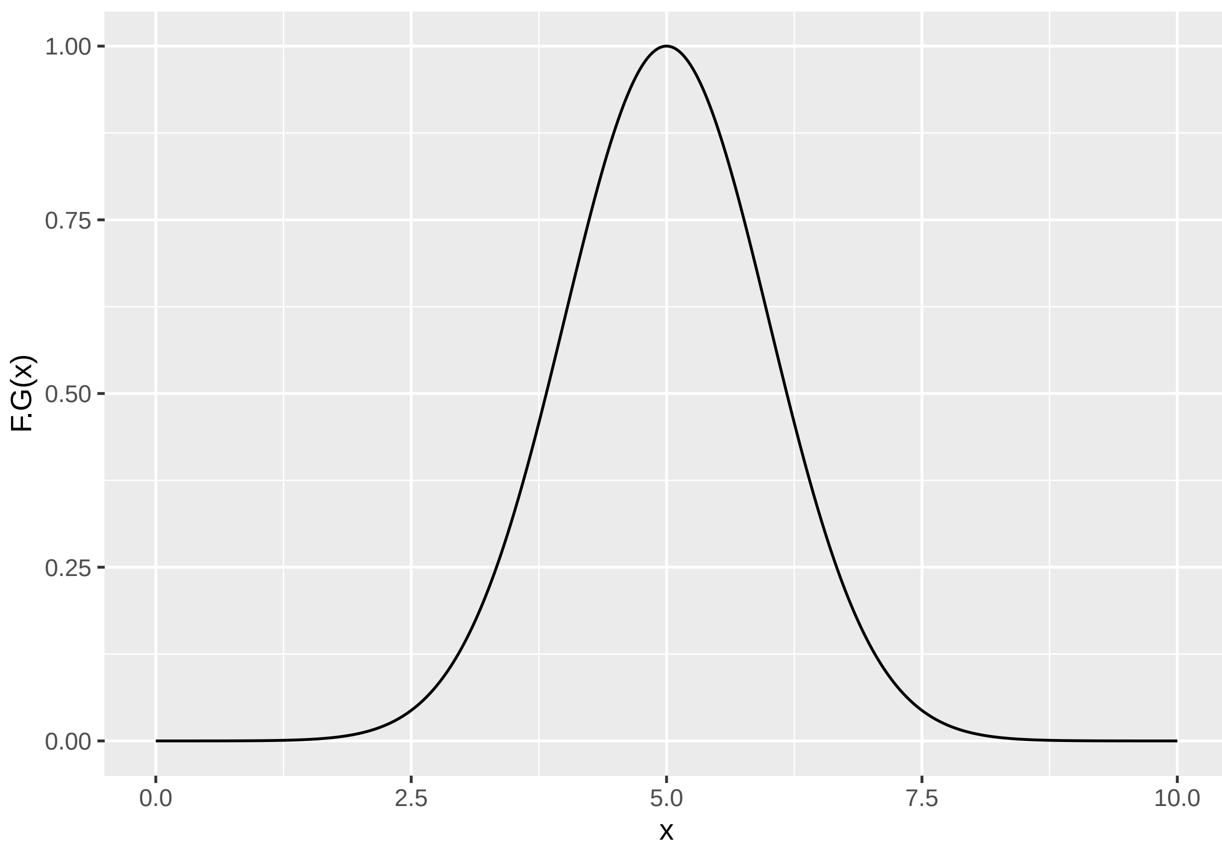
### Gygax's Law in one dimension

$$F_G(x) = Ae^{-\frac{(x-x_0)^2}{2\sigma^2}}$$

```
x= seq(from= 0, to= 10, by= 0.001)

F.G <- function(A, x, x.0, s){
  A * exp(-(x-x.0)^2 / (2*s^2))
}

F.G.test <- F.G(A= 1, x= x, x.0= 5, s= 1)
qplot(x= x, F.G.test, geom= 'line', xlab= 'x', ylab= 'F.G(x)')
```



### Gygax's Law in three dimensions

$$F_{3G}(x) = Ae^{-\frac{(x-x_0)^2+(y-y_0)^2+(z-z_0)^2}{2\sigma^2}}$$

```
y= seq(from= 0, to= 10, by= 0.001)
z= seq(from= 0, to= 10, by= 0.001)

F.3G <- function(A, x, x.0, y, y.0, z, z.0, s){
  A * exp(-((x-x.0)^2 + (y-y.0)^2+ (z-z.0)^2) / (2*s^2))
}

F.3G.test <- F.3G(A= 2, x= 1, x.0= 2, y= 3, y.0= 4, z= 5, z.0= 6, s= 1)
F.3G.test
```

```
## [1] 0.4462603
```

## Vance'sTheory and Approximation

### Vance's Law for Gygax energy

#### In one dimension

$$E_G = 2A\int_0^\beta e^{-x^2}dx$$

```
E.G <- function(A, beta, x){
  func <- function(x){exp(-x^2)}
  integrate(func, lower= 0, upper= beta)
}

E.G.test <- E.G(A= 1, beta= 10, x= x)
E.G.test
```

```
## 0.8862269 with absolute error < 9e-07
```

#### In three dimensions

$$E_{3G} = 2^3A\int_0^\beta\int_0^\beta\int_0^\beta e^{-(x^2+y^2+z^2)}dxdydz$$