Standard normal/Gaussian distribution

In[ ]:=
```
Clear[f, x, σ]
f = Exp[-0.5 x^2 / σ^2]
Refine[1 / Sqrt[2 π] σ Integrate[f, {x, -∞, +∞}], {σ > 0}]
```

Out[ ]= $e^{-\frac{0.5\,x^2}{\sigma^2}}$

Out[ ]= 1.

General FWHM as function of σ:

FWHM = 2Sqrt[2Log[2]] σ = Sqrt[8Log[2]] σ

In[61]:=
```
Clear[f, x, σ, f0, sols]

(* start with standard Gaussian profile *)
f = Exp[-0.5 x^2 / σ^2]

(* get points where fwhm will be calculated *)
sols = Solve[f == 1 / 2, x];

(* poins are equidistant from origin *)
2 sols[[2, 1, 2]] / σ
2 Sqrt[2 Log[2]] // N
```

Out[62]= $e^{-\frac{0.5\,x^2}{\sigma^2}}$

Solve: Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information.

Out[64]= 2.35482

Out[65]= 2.35482

Transverse E-field vs Intensity: W0 vs FWHM:

$$\text{FWHM} / \text{W0} = 2\sqrt{\text{Log}[2]}$$

```
Clear[f, x, σ, f0, sols, sol, ρ, W0, a, fwhmI, fwhma]

(* start with standard Gaussian profile for field (without 0.5) *)
a = Exp[-ρ^2 / W0^2];

(* get points where fwhm will be calculated *)
fwhma = 2 (Solve[a == 1 / 2, ρ][[2, 1, 2]] // Normal) /. {c1 → 0};

(* E-Field Gaussian FWHM_a/W0_a = 2 √Log[2] *)
fwhma / W0
fwhma / W0 // N

Int = a^2;
fwhmI = 2 (Solve[Int == 1 / 2, ρ][[2, 1, 2]] // Normal) /. {c1 → 0};
fwhmI / W0
fwhmI / W0 // N

fwhma / fwhmI
```

Out[151]= $2\sqrt{\text{Log}[2]}$

Out[152]= 1.66511

Out[155]= $\sqrt{2\,\text{Log}[2]}$

Out[156]= 1.17741

Out[157]= $\sqrt{2}$