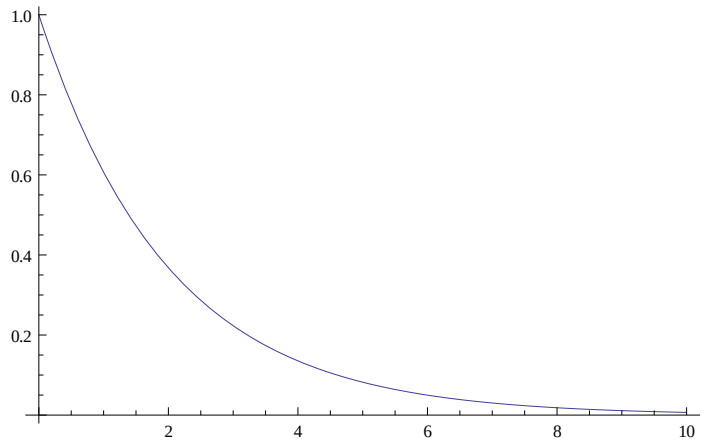
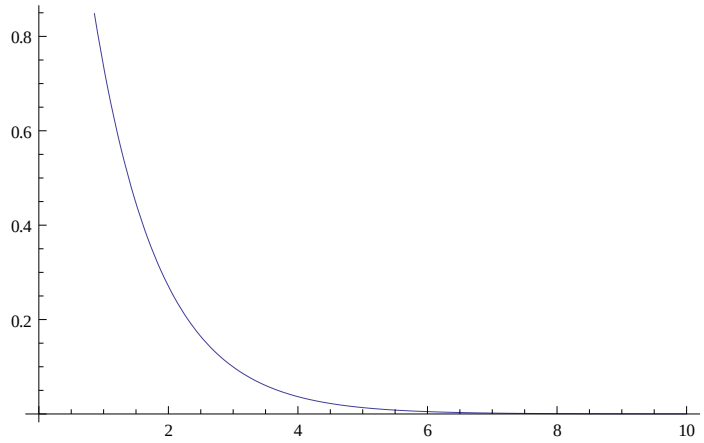
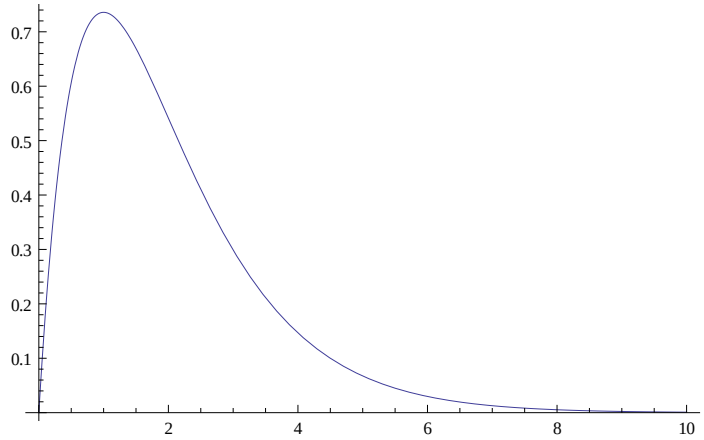
```
a = 1; (*plots in units of Bohr radius*)
F[n_, l_, r_] := r^l Exp[-r/2] (n + l)! LaguerreL[n - l - 1, 2 l + 1, r];
Plot[F[1, 0, r], {r, 0, 10}]
```




```
ψ[n_, l_, r_] :=
  a^(-3/2) 2/(n^2) Sqrt[(n - 1 - l)!/((n + l)!)^3] F[n, l, 2 r / (n a)];
Plot[ψ[1, 0, r], {r, 0, 10}]
```




```
P[n_, l_, r_] := ψ[n, l, r] r ;
Plot[P[1, 0, r], {r, 0, 10}]
```




```
NIntegrate[P[2, 0, r] * P[2, 0, r], {r, 0, 200}]
```

```
1.
```

```
NIntegrate[P[2, 0, r] * P[1, 0, r], {r, 0, 50}]
```

```
NIntegrate::ncvb :
  NIntegrate failed to converge to prescribed accuracy after 9 recursive bisections in r near {r}
      = {0.0139711}. NIntegrate obtained -3.46945 × 10^-18 and
      9.081395341787611`*^-15 for the integral and error estimates. ≫
```

$0. \times 10^{-18}$

```
NIntegrate[P[1, 0, r] * r * P[2, 1, r], {r, 0, 50}]
```

```
1.29027
```

```
dipol1snp[n_] := NIntegrate[P[1, 0, r] * r * P[n, 1, r], {r, 0, 50}]
```

```
dipol1snp[2]
```

```
1.29027
```

```
Polariz[N_] := Sum[ 2 / 3 * (dipol1snp[n])^2 / (1 / 2 - 1 / (2 n^2)), {n, 2, N}]
```

```
Table[ Polariz[n], {n, 2, 50}]
```

```
{2.95962, 3.36007, 3.49201, 3.55251, 3.58552, 3.60558, 3.61872, 3.62781, 3.63436, 3.63925,
 3.64298, 3.64591, 3.64824, 3.65013, 3.65169, 3.65298, 3.65407, 3.65499, 3.65578,
 3.65647, 3.65706, 3.65758, 3.65803, 3.65844, 3.65879, 3.65911, 3.6594, 3.65966, 3.65989,
 3.6601, 3.66029, 3.66047, 3.66063, 3.66077, 3.66091, 3.66103, 3.66115, 3.66125, 3.66135,
 3.66144, 3.66153, 3.6616, 3.66168, 3.66175, 3.66181, 3.66187, 3.66193, 3.66198, 3.66203}
```

```
Pol = {2.9596211056347688`, 3.3600727657907874`,
  3.49201416112381`, 3.5525104453045393`, 3.5855166251036534`, 3.605583111050563`,
  3.618724273297262`, 3.6278117043904627`, 3.634363555506195`, 3.6392460074683433`,
  3.642983477164115`, 3.645908953920794`, 3.648242315088023`, 3.6501335850026995`,
  3.6516880189379717`, 3.652981256483239`, 3.654068802517756`, 3.654992142123482`,
  3.655782790780401`, 3.656465040740532`, 3.657057862626028`, 3.6575762469858555`,
  3.658032166857579`, 3.6584352790453676`, 3.658793442203938`, 3.6591131044903187`,
  3.659399597033214`, 3.6596573585096874`, 3.6598901087231073`,
  3.660100984009285`, 3.66029264377712`, 3.66046735501184`, 3.6606270598032196`,
  3.6607734296888426`, 3.660907909675926`, 3.661031754123813`, 3.6611460561634117`,
  3.661251771951088`, 3.6613497407685567`, 3.661440701762711`, 3.6615253079525565`,
  3.661604138001688`, 3.6616777061547126`, 3.661746470657849`, 3.6618108409224037`,
  3.6618711836411926`, 3.6619278280292806`, 3.6619810703294773`, 3.66203117769819`}
```

```
{2.95962, 3.36007, 3.49201, 3.55251, 3.58552, 3.60558, 3.61872, 3.62781, 3.63436, 3.63925,
 3.64298, 3.64591, 3.64824, 3.65013, 3.65169, 3.65298, 3.65407, 3.65499, 3.65578,
 3.65647, 3.65706, 3.65758, 3.65803, 3.65844, 3.65879, 3.65911, 3.6594, 3.65966, 3.65989,
 3.6601, 3.66029, 3.66047, 3.66063, 3.66077, 3.66091, 3.66103, 3.66115, 3.66125, 3.66135,
 3.66144, 3.66153, 3.6616, 3.66168, 3.66175, 3.66181, 3.66187, 3.66193, 3.66198, 3.66203}
```

```
ListPlot[Pol]
```