Cauchy :

In[207]:= `p = 1/(π*σ) (1 + ((x - μ)/σ)^2)^-1`

Out[207]= $$\frac{1}{\pi\left(1+\frac{(x-\mu)^2}{\sigma^2}\right)\sigma}$$

In[208]:= `θ = σ;`

In[211]:= `ss = FullSimplify[D[Log[p], θ]]`

Out[211]= $$\frac{1}{\sigma}-\frac{2\sigma}{(x-\mu)^2+\sigma^2}$$

In[212]:= `ss' = FullSimplify[D[ss, θ]]`

Out[212]= $$-\frac{1}{\sigma^2}+\frac{4\sigma^2}{\left((x-\mu)^2+\sigma^2\right)^2}-\frac{2}{(x-\mu)^2+\sigma^2}$$

In[213]:= `csIntCitatel1 = FullSimplify[p^(1 + α)*ss]`

Out[213]= $$\pi^{-1-\alpha}\left(\frac{\sigma}{(x-\mu)^2+\sigma^2}\right)^{1+\alpha}\left(\frac{1}{\sigma}-\frac{2\sigma}{(x-\mu)^2+\sigma^2}\right)$$

In[214]:= `csIntCitatel2 = FullSimplify[csIntCitatel1 /. (x - μ) → y*σ]`

Out[214]= $$\frac{\pi^{-1-\alpha}\left(-1+y^2\right)\left(\frac{1}{\sigma+y^2\sigma}\right)^{\alpha}}{\left(1+y^2\right)^2\sigma^2}$$

In[215]:= `csIntCitatel3 = FullSimplify[Integrate[csIntCitatel2*σ, {y, -∞, ∞}]]`

Out[215]= $$\text{ConditionalExpression}\left[-\frac{\pi^{-\frac{1}{2}-\alpha}\alpha\left(\frac{1}{\sigma}\right)^{1+\alpha}\text{Gamma}\left[\frac{1}{2}+\alpha\right]}{\text{Gamma}[2+\alpha]},\ \text{Re}[\alpha]>-\frac{1}{2}\right]$$

In[216]:= `csIntJmenovatel1 = FullSimplify[p^(1 + α)]`

Out[216]= $$\pi^{-1-\alpha}\left(\frac{\sigma}{(x-\mu)^2+\sigma^2}\right)^{1+\alpha}$$

In[217]:= `csIntJmenovatel2 = FullSimplify[csIntJmenovatel1 /. (x - μ) → y*σ]`

Out[217]= $$\left(\frac{1}{\pi\sigma+\pi y^2\sigma}\right)^{1+\alpha}$$

In[218]:= `csIntJmenovatel3 = FullSimplify[Integrate[csIntJmenovatel2*σ, {y, -∞, ∞}]]`

Out[218]= $$\text{ConditionalExpression}\left[\frac{\pi^{-\frac{1}{2}-\alpha}\sigma^{-\alpha}\text{Gamma}\left[\frac{1}{2}+\alpha\right]}{\text{Gamma}[1+\alpha]},\ \text{Re}[\alpha]>-\frac{1}{2}\right]$$

In[219]:= `cs = FullSimplify[csIntCitatel3/csIntJmenovatel3]`

Out[219]= $$\text{ConditionalExpression}\left[-\frac{\alpha\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{-1+\alpha}}{1+\alpha},\ \alpha+\text{Conjugate}[\alpha]>-1\right]$$

In[220]:= `cs' = FullSimplify[D[cs, θ]]`

Out[220]= $$\text{ConditionalExpression}\left[\frac{\alpha\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{-2+\alpha}}{1+\alpha},\ \alpha+\text{Conjugate}[\alpha]>-1\right]$$

In[221]:=
```
Ia = FullSimplify[(ss' - cs' - α (ss - cs) (cs - ss)) * p^(1 + α)]
```

Out[221]= ConditionalExpression[

$$\pi^{-1-\alpha}\left(\frac{\sigma}{(x-\mu)^2+\sigma^2}\right)^{1+\alpha}\left(\frac{-1+\alpha}{\sigma^2}+\frac{\alpha(-1+2\alpha)\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{-2+\alpha}}{1+\alpha}+\frac{\alpha^3\left(\frac{1}{\sigma}\right)^{2\alpha}\sigma^{-2+2\alpha}}{(1+\alpha)^2}+\frac{4(1+\alpha)\sigma^2}{\left((x-\mu)^2+\sigma^2\right)^2}+\frac{-2-4\alpha}{(x-\mu)^2+\sigma^2}-\frac{4\alpha^2\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}}{(1+\alpha)\left((x-\mu)^2+\sigma^2\right)}\right),\ \alpha+\text{Conjugate}[\alpha]>-1\Big]$$

In[222]:=
```
Ia1 = FullSimplify[Ia /. (x - μ) → y * σ]
```

Out[222]= ConditionalExpression[

$$\frac{1}{\sigma^2}\left(\frac{1}{\pi\sigma+\pi y^2\sigma}\right)^{1+\alpha}\left(\frac{1+y^4(-1+\alpha)+\alpha-2y^2(2+\alpha)}{(1+y^2)^2}+\frac{\alpha\left(-1-2\alpha+y^2(-1+2\alpha)\right)\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}}{(1+y^2)(1+\alpha)}+\frac{\alpha^3\left(\frac{1}{\sigma}\right)^{2\alpha}\sigma^{2\alpha}}{(1+\alpha)^2}\right),\ \alpha+\text{Conjugate}[\alpha]>-1\Big]$$

In[223]:=
```
Ia2 = FullSimplify[Integrate[Ia1 * σ, {y, -∞, ∞}]]
```

Out[223]= ConditionalExpression[

$$\left(\pi^{-\frac{1}{2}-\alpha}\sigma^{-2-\alpha}\left(4^{1-\alpha}\sqrt{\pi}\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\left(-1+\alpha\left(-1+\alpha\left(-2+\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\right)\right)\right)\text{Cos}[\pi\alpha]\,\text{Gamma}[1+2\alpha]+1/(3(3+4\alpha(2+\alpha)))8\pi(1+\alpha)\left(-1+\alpha(1+\alpha)^2\right)\text{Gamma}[\alpha]\left(6(1+\alpha)\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2},2,\frac{1}{2}-\alpha,1\right]-4^{-\alpha}\,\text{Gamma}[4+2\alpha]\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2}+\alpha,1+\alpha,-\frac{1}{2}+\alpha,1\right]\right)\right)\text{Sec}[\pi\alpha]\right)\Big/\left(4(1+\alpha)^2\,\text{Gamma}[\alpha]\,\text{Gamma}[1+\alpha]\right),\ \alpha+\text{Conjugate}[\alpha]>-1\Big]$$

```
IF = FullSimplify[-Ia2^(-1) * (p^α) * (ss - cs)]
```

ConditionalExpression[

$$-\left(4\sqrt{\pi}(1+\alpha)^2\sigma^{2+\alpha}\left(\frac{\sigma}{(x-\mu)^2+\sigma^2}\right)^{\alpha}\left(\frac{1}{\sigma}+\frac{\alpha\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{-1+\alpha}}{1+\alpha}-\frac{2\sigma}{(x-\mu)^2+\sigma^2}\right)\text{Cos}[\pi\alpha]\,\text{Gamma}[\alpha]\,\text{Gamma}[1+\alpha]\right)\Big/\left(4^{1-\alpha}\sqrt{\pi}\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\left(-1+\alpha\left(-1+\alpha\left(-2+\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\right)\right)\right)\text{Cos}[\pi\alpha]\,\text{Gamma}[1+2\alpha]+1/(3(3+4\alpha(2+\alpha)))\ 8\pi(1+\alpha)\left(-1+\alpha(1+\alpha)^2\right)\text{Gamma}[\alpha]\left(6(1+\alpha)\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2},2,\frac{1}{2}-\alpha,1\right]-4^{-\alpha}\,\text{Gamma}[4+2\alpha]\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2}+\alpha,1+\alpha,-\frac{1}{2}+\alpha,1\right]\right)\right),\ \alpha+\text{Conjugate}[\alpha]>-1\Big]$$

```
IF1 = FullSimplify[IF /. μ -> 0]
```

ConditionalExpression$\Bigg[$

$$-\left(4\sqrt{\pi}\,(1+\alpha)^2\,\sigma^{2+\alpha}\left(\frac{\sigma}{x^2+\sigma^2}\right)^{\alpha}\left(\frac{1}{\sigma}+\frac{\alpha\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{-1+\alpha}}{1+\alpha}-\frac{2\,\sigma}{x^2+\sigma^2}\right)\text{Cos}[\pi\,\alpha]\,\text{Gamma}[\alpha]\,\text{Gamma}[1+\alpha]\right)\Bigg/$$
$$\left(4^{1-\alpha}\sqrt{\pi}\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\left(-1+\alpha\left(-1+\alpha\left(-2+\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\right)\right)\right)\text{Cos}[\pi\,\alpha]\,\text{Gamma}[1+2\,\alpha]+\right.$$
$$1/(3\,(3+4\,\alpha\,(2+\alpha)))\;8\,\pi\,(1+\alpha)\left(-1+\alpha\,(1+\alpha)^2\right)\text{Gamma}[\alpha]$$
$$\left(6\,(1+\alpha)\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2},2,\frac{1}{2}-\alpha,1\right]-4^{-\alpha}\,\text{Gamma}[4+2\,\alpha]\right.$$
$$\left.\left.\text{Hypergeometric2F1Regularized}\left[\frac{1}{2}+\alpha,1+\alpha,-\frac{1}{2}+\alpha,1\right]\right)\right),\ \alpha+\text{Conjugate}[\alpha]>-1\Bigg]$$

IFun = Function$\Big[\{\sigma,\alpha\},-\Bigg(4\sqrt{\pi}\,(1+\alpha)^2\,\sigma^{2+\alpha}$

$$\left(\frac{\sigma}{x^2+\sigma^2}\right)^{\alpha}\left(\frac{1}{\sigma}+\frac{\alpha\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{-1+\alpha}}{1+\alpha}-\frac{2\,\sigma}{x^2+\sigma^2}\right)\text{Cos}[\pi\,\alpha]\,\text{Gamma}[\alpha]\,\text{Gamma}[1+\alpha]\Bigg)\Bigg/$$
$$\left(4^{1-\alpha}\sqrt{\pi}\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\left(-1+\alpha\left(-1+\alpha\left(-2+\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\right)\right)\right)\text{Cos}[\pi\,\alpha]\,\text{Gamma}[1+2\,\alpha]+\right.$$
$$1/(3\,(3+4\,\alpha\,(2+\alpha)))\;8\,\pi\,(1+\alpha)\left(-1+\alpha\,(1+\alpha)^2\right)\text{Gamma}[\alpha]$$
$$\left(6\,(1+\alpha)\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2},2,\frac{1}{2}-\alpha,1\right]-\right.$$
$$\left.\left.4^{-\alpha}\,\text{Gamma}[4+2\,\alpha]\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2}+\alpha,1+\alpha,-\frac{1}{2}+\alpha,1\right]\right)\right)\Big]$$

Function$\Big[\{\sigma,\alpha\},$

$$-\left(4\sqrt{\pi}\,(1+\alpha)^2\,\sigma^{2+\alpha}\left(\frac{\sigma}{x^2+\sigma^2}\right)^{\alpha}\left(\frac{1}{\sigma}+\frac{\alpha\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{-1+\alpha}}{1+\alpha}-\frac{2\,\sigma}{x^2+\sigma^2}\right)\text{Cos}[\pi\,\alpha]\,\text{Gamma}[\alpha]\,\text{Gamma}[1+\alpha]\right)\Bigg/$$
$$\left(4^{1-\alpha}\sqrt{\pi}\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\left(-1+\alpha\left(-1+\alpha\left(-2+\left(\frac{1}{\sigma}\right)^{\alpha}\sigma^{\alpha}\right)\right)\right)\text{Cos}[\pi\,\alpha]\,\text{Gamma}[1+2\,\alpha]+\right.$$
$$1/(3\,(3+4\,\alpha\,(2+\alpha)))$$
$$8\,\pi\,(1+\alpha)\left(-1+\alpha\,(1+\alpha)^2\right)\text{Gamma}[\alpha]\left(6\,(1+\alpha)\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2},2,\frac{1}{2}-\alpha,1\right]-\right.$$
$$\left.\left.4^{-\alpha}\,\text{Gamma}[4+2\,\alpha]\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2}+\alpha,1+\alpha,-\frac{1}{2}+\alpha,1\right]\right)\right)\Big]$$

FullSimplify[IFun[1, α]]

$$-\left(4\sqrt{\pi}\left(\frac{1}{1+x^2}\right)^{\alpha}(1+\alpha)^2\left(1-\frac{2}{1+x^2}+\frac{\alpha}{1+\alpha}\right)\text{Cos}[\pi\,\alpha]\,\text{Gamma}[\alpha]\,\text{Gamma}[1+\alpha]\right)\Big/ \left(-4^{1-\alpha}\sqrt{\pi}\left(1+\alpha+\alpha^2\right)\text{Cos}[\pi\,\alpha]\,\text{Gamma}[1+2\,\alpha]+1/(3\,(3+4\,\alpha\,(2+\alpha)))\;8\,\pi\,(1+\alpha)\left(-1+\alpha\,(1+\alpha)^2\right)\text{Gamma}[\alpha]\left(6\,(1+\alpha)\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2},2,\frac{1}{2}-\alpha,1\right]-4^{-\alpha}\,\text{Gamma}[4+2\,\alpha]\,\text{Hypergeometric2F1Regularized}\left[\frac{1}{2}+\alpha,1+\alpha,-\frac{1}{2}+\alpha,1\right]\right)\right)$$

IFuns =

$$\textbf{Function}\left[\{\alpha\},-\left(4\sqrt{\pi}\left(\frac{1}{1+x^2}\right)^{\alpha}(1+\alpha)^2\left(1-\frac{2}{1+x^2}+\frac{\alpha}{1+\alpha}\right)\textbf{Cos}[\pi\,\alpha]\,\textbf{Gamma}[\alpha]\,\textbf{Gamma}[1+\alpha]\right)\Big/\left(-4^{1-\alpha}\sqrt{\pi}\left(1+\alpha+\alpha^2\right)\textbf{Cos}[\pi\,\alpha]\,\textbf{Gamma}[1+2\,\alpha]+1/(3\,(3+4\,\alpha\,(2+\alpha)))\;8\,\pi\,(1+\alpha)\left(-1+\alpha\,(1+\alpha)^2\right)\textbf{Gamma}[\alpha]\left(6\,(1+\alpha)\,\textbf{Hypergeometric2F1Regularized}\left[\frac{1}{2},2,\frac{1}{2}-\alpha,1\right]-4^{-\alpha}\,\textbf{Gamma}[4+2\,\alpha]\,\textbf{Hypergeometric2F1Regularized}\left[\frac{1}{2}+\alpha,1+\alpha,-\frac{1}{2}+\alpha,1\right]\right)\right)\right]\ \text{// TraditionalForm}$$

$$\{\alpha\}\mapsto-\left(4\sqrt{\pi}\,(\alpha+1)^2\cos(\pi\,\alpha)\,\Gamma(\alpha)\,\Gamma(\alpha+1)\left(\frac{1}{x^2+1}\right)^{\alpha}\left(\frac{\alpha}{\alpha+1}-\frac{2}{x^2+1}+1\right)\right)\Big/\left(\frac{1}{3\,(4\,\alpha\,(\alpha+2)+3)}\,8\,\pi\,(\alpha+1)\left(\alpha\,(\alpha+1)^2-1\right)\Gamma(\alpha)\left(6\,(\alpha+1)\;{}_2\tilde{F}_1\!\left(\frac{1}{2},2;\frac{1}{2}-\alpha;1\right)-4^{-\alpha}\,\Gamma(2\,\alpha+4)\;{}_2\tilde{F}_1\!\left(\alpha+\frac{1}{2},\alpha+1;\alpha-\frac{1}{2};1\right)\right)-\sqrt{\pi}\,4^{1-\alpha}\left(\alpha^2+\alpha+1\right)\cos(\pi\,\alpha)\,\Gamma(2\,\alpha+1)\right)$$

FullSimplify[IFuns[1]]

$$\left(\{\alpha\}\mapsto-\left(4\sqrt{\pi}\,(\alpha+1)^2\cos(\pi\,\alpha)\,\Gamma(\alpha)\,\Gamma(\alpha+1)\left(\frac{1}{x^2+1}\right)^{\alpha}\left(\frac{\alpha}{\alpha+1}-\frac{2}{x^2+1}+1\right)\right)\Big/\left(\frac{1}{3\,(4\,\alpha\,(\alpha+2)+3)}\,8\,\pi\,(\alpha+1)\left(\alpha\,(\alpha+1)^2-1\right)\Gamma(\alpha)\left(6\,(\alpha+1)\;{}_2\tilde{F}_1\!\left(\frac{1}{2},2;\frac{1}{2}-\alpha;1\right)-4^{-\alpha}\,\Gamma(2\,\alpha+4)\;{}_2\tilde{F}_1\!\left(\alpha+\frac{1}{2},\alpha+1;\alpha-\frac{1}{2};1\right)\right)-\sqrt{\pi}\,4^{1-\alpha}\left(\alpha^2+\alpha+1\right)\cos(\pi\,\alpha)\,\Gamma(2\,\alpha+1)\right)\right)[1]$$

Needs["PlotLegends`"]

```
Plot[{
  (*IFun[1,0.05]
   IFun[1,0.1],
  IFun[1,0.3],
  *)IFuns[1]
  (*IFun[1,1],
  IFun[1,2](1+α)^2 (x+x α-σ) (1/σ)^-α (e^(-x/σ)/σ)^α *)},
 {x, 0, 10},
 PlotLegend → {"α = 0.05", "α = 0.1", "α = 0.3", "α = 0.5", "α = 1", "α = 2"}
]
```

Cauchy :

```
θ = μ
```

μ

```
ss = FullSimplify[D[Log[p], θ]]
```

$$\frac{2\,(x-\mu)}{(x-\mu)^2+\sigma^2}$$

```
ss' = FullSimplify[D[ss, θ]]
```

$$\frac{2\,(x-\mu)^2-2\,\sigma^2}{\left((x-\mu)^2+\sigma^2\right)^2}$$

```
csIntCitatel1 = FullSimplify[p^(1+α)*ss]
```

$$\frac{2\,\pi^{-1-\alpha}\,(x-\mu)\,\sigma\,\left(\frac{\sigma}{(x-\mu)^2+\sigma^2}\right)^{\alpha}}{\left((x-\mu)^2+\sigma^2\right)^2}$$

```
csIntCitatel2 = FullSimplify[csIntCitatel1 /. (x - μ) → y*σ]
```

$$\frac{2\,\pi^{-1-\alpha}\,y\,\left(\frac{1}{\sigma+y^2\,\sigma}\right)^{\alpha}}{\left(1+y^2\right)^2\,\sigma^2}$$

```
csIntCitatel3 = FullSimplify[Integrate[csIntCitatel2*σ, {y, -∞, ∞}]]
```

ConditionalExpression[0, Re[α] > -1]

```
csIntJmenovatel1 = FullSimplify[p^(1+α)]
```

$$\pi^{-1-\alpha}\left(\frac{\sigma}{(x-\mu)^2+\sigma^2}\right)^{1+\alpha}$$

```
csIntJmenovatel2 = FullSimplify[csIntJmenovatel1 /. (x - μ) → y*σ]
```

$$\left(\frac{1}{\pi\,\sigma+\pi\,y^2\,\sigma}\right)^{1+\alpha}$$

```
csIntJmenovatel3 = FullSimplify[Integrate[csIntJmenovatel2 * σ, {y, -∞, ∞}]]
```

$$\text{ConditionalExpression}\left[\frac{\pi^{-\frac{1}{2}-\alpha}\,\sigma^{-\alpha}\,\text{Gamma}\left[\frac{1}{2}+\alpha\right]}{\text{Gamma}[1+\alpha]},\ \text{Re}[\alpha]>-\frac{1}{2}\right]$$

```
cs = FullSimplify[csIntCitatel3 / csIntJmenovatel3]
```

$$\text{ConditionalExpression}\left[0,\ \text{Re}[\alpha]>-\frac{1}{2}\right]$$

```
cs' = FullSimplify[D[cs, θ]]
```

$$\text{ConditionalExpression}\left[0,\ \text{Re}[\alpha]>-\frac{1}{2}\right]$$

```
Ia = FullSimplify[ (ss' - cs' - α (ss - cs) (cs - ss)) * p ^ (1 + α)]
```

$$\text{ConditionalExpression}\left[\frac{2\,\pi^{-1-\alpha}\,\sigma\,\left((1+2\,\alpha)\,(x-\mu)^2-\sigma^2\right)\left(\frac{\sigma}{(x-\mu)^2+\sigma^2}\right)^{\alpha}}{\left((x-\mu)^2+\sigma^2\right)^3},\ \alpha+\text{Conjugate}[\alpha]>-1\right]$$

```
Ia1 = FullSimplify[Ia /. (x - μ) → y * σ]
```

$$\text{ConditionalExpression}\left[\frac{2\,\pi^{-1-\alpha}\,\left(-1+y^2\,(1+2\,\alpha)\right)\left(\frac{1}{\sigma+y^2\,\sigma}\right)^{\alpha}}{\left(1+y^2\right)^3\,\sigma^3},\ \alpha+\text{Conjugate}[\alpha]>-1\right]$$

```
Ia2 = FullSimplify[Integrate[Ia1 * σ, {y, -∞, ∞}]]
```

$$\text{ConditionalExpression}\left[-\frac{2\,\pi^{-\frac{1}{2}-\alpha}\,\left(\frac{1}{\sigma}\right)^{2+\alpha}\,\text{Gamma}\left[\frac{3}{2}+\alpha\right]}{\text{Gamma}[3+\alpha]},\ \alpha+\text{Conjugate}[\alpha]>-1\right]$$

```
IF = FullSimplify[-Ia2 ^ (-1) * (p ^ α) * (ss - cs)]
```

$$\text{ConditionalExpression}\left[\frac{\sqrt{\pi}\,(x-\mu)\,\left(\frac{1}{\sigma}\right)^{-1-\alpha}\left(\frac{\sigma}{(x-\mu)^2+\sigma^2}\right)^{1+\alpha}\,\text{Gamma}[3+\alpha]}{\text{Gamma}\left[\frac{3}{2}+\alpha\right]},\ \alpha+\text{Conjugate}[\alpha]>-1\right]$$

```
IF1 = FullSimplify[IF /. σ → 1]
```

$$\text{ConditionalExpression}\left[\frac{\sqrt{\pi}\,\left(\frac{1}{1+(x-\mu)^2}\right)^{1+\alpha}\,(x-\mu)\,\text{Gamma}[3+\alpha]}{\text{Gamma}\left[\frac{3}{2}+\alpha\right]},\ \alpha+\text{Conjugate}[\alpha]>-1\right]$$

In[240]:=
$$\text{IFun} = \text{Function}\left[\{\mu,\alpha\},\ \frac{\sqrt{\pi}\,\left(\frac{1}{1+(x-\mu)^2}\right)^{1+\alpha}\,(x-\mu)\,\text{Gamma}[3+\alpha]}{\text{Gamma}\left[\frac{3}{2}+\alpha\right]}\right];$$

In[241]:=
```
Needs["PlotLegends`"]
```

In[242]:=
```
Plot[{
  IFun[0, 0.05],
  IFun[0, 0.1],
  IFun[0, 0.3],
  IFun[0, 0.5],
  IFun[0, 1],
  IFun[0, 2]},
 {x, -10, 10},
 PlotLegend → {"α = 0.05", "α = 0.1", "α = 0.3", "α = 0.5", "α = 1", "α = 2"},
 LegendPosition → {1, -0.4},
 PlotStyle → {Dashed, Thick, Thin, Dotted, Yellow, Blue}
]
```

Out[242]=