```
A1 = B1 = A2 = 1; B2 = 1; σ = -1;
 /. λ1 → a1 + ⅈ b1 /. λ2 → -a1 - ⅈ b1
```

In[◦]:=
```
Clear[A1, B1, A2, B2, a, β, λ1, λ2, σ];
η1[t_] = λ1 ⅇ^(-β t);
η2[t_] = λ2 ⅇ^(-β t);
FullSimplify[∂_t η1[t]]
```

Out[◦]=

$$-e^{-t\beta}\,\beta\,\lambda 1$$

In[◦]:=
```
γ1[x_, t_] =
 FullSimplify[ a (η1[t] - η2[t]) x + ⅈ ∫(2 (η2[t]^2 - η1[t]^2) + ⅈ β x ( η1[t] - η2[t])) ⅆt]
γ2[x_, t_] =
 FullSimplify[ a (η1[t] + η2[t]) x + ⅈ ∫(2 (η2[t]^2 - η1[t]^2) + ⅈ β x ( η1[t] + η2[t])) ⅆt]
ξ[x_, t_] = Simplify[A1 B2 ⅇ^(-γ1[x,t]) - B1 A2 ⅇ^(γ1[x,t])]
```

Out[◦]=

$$\frac{e^{-2t\beta}\,(\lambda 1-\lambda 2)\,\left((1+a)\,e^{t\beta}\,x\,\beta+i\,(\lambda 1+\lambda 2)\right)}{\beta}$$

Out[◦]=

$$\frac{e^{-2t\beta}\,\left((1+a)\,e^{t\beta}\,x\,\beta+i\,(\lambda 1-\lambda 2)\right)\,(\lambda 1+\lambda 2)}{\beta}$$

Out[◦]=

$$A1\,B2\,e^{-\frac{e^{-2t\beta}\,(\lambda 1-\lambda 2)\,\left((1+a)\,e^{t\beta}\,x\,\beta+i\,(\lambda 1+\lambda 2)\right)}{\beta}}-A2\,B1\,e^{\frac{e^{-2t\beta}\,(\lambda 1-\lambda 2)\,\left((1+a)\,e^{t\beta}\,x\,\beta+i\,(\lambda 1+\lambda 2)\right)}{\beta}}$$

In[◦]:=
```
q[x_, t_] = FullSimplify[2/ξ[x, t] A1 A2 (η2[t] - η1[t]) ⅇ^(-γ2[x,t])]
```

Out[◦]=

$$\frac{2\,A1\,A2\,e^{-t\beta-2\,(1+a)\,e^{-t\beta}\,x\,\lambda 2}\,(-\lambda 1+\lambda 2)}{A1\,B2-A2\,B1\,e^{\frac{2\,e^{-2t\beta}\,(\lambda 1-\lambda 2)\,\left((1+a)\,e^{t\beta}\,x\,\beta+i\,(\lambda 1+\lambda 2)\right)}{\beta}}}$$

In[◦]:=
```
r[x_, t_] = FullSimplify[2/(σ ξ[x, t]) B1 B2 (η2[t] - η1[t]) ⅇ^(γ2[x,t])]
```

Out[◦]=

$$\frac{2\,B1\,B2\,e^{-t\beta}\,(\lambda 1-\lambda 2)}{\left(A2\,B1\,e^{-2\,(1+a)\,e^{-t\beta}\,x\,\lambda 2}-A1\,B2\,e^{-2\,e^{-2t\beta}\,\left((1+a)\,e^{t\beta}\,x\,\lambda 1+\frac{i\,(\lambda 1-\lambda 2)\,(\lambda 1+\lambda 2)}{\beta}\right)}\right)\,\sigma}$$

In[◦]:=
```
e1 = FullSimplify[∂_t q[x, t]];
```

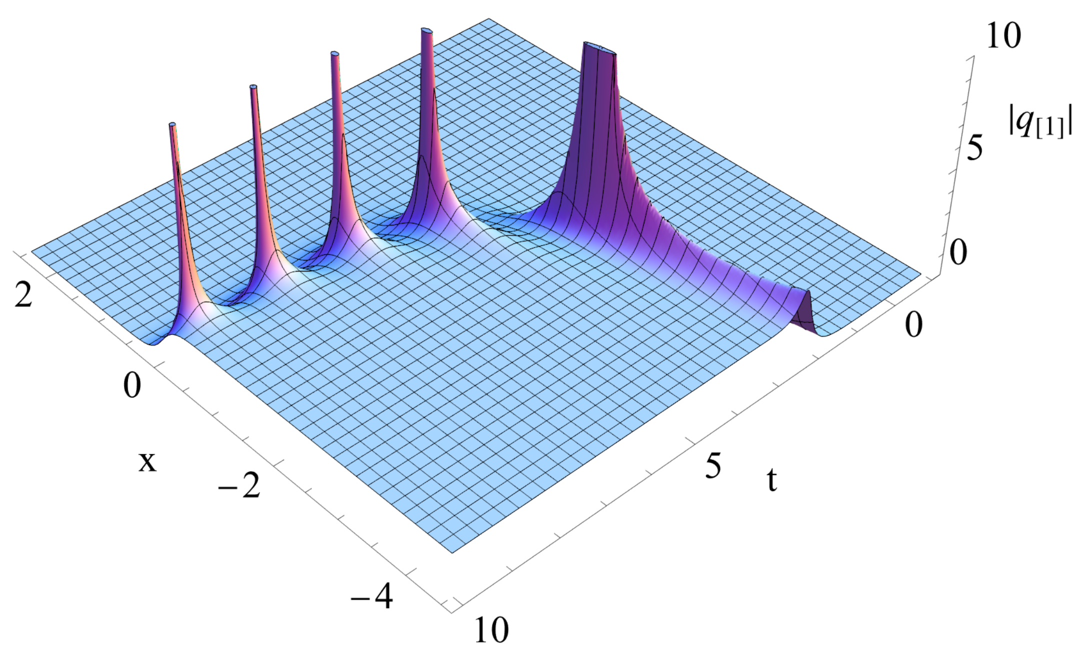
```
In[∘]:= e2 = FullSimplify[ⅈ ∂x,x q[x, t]];

In[∘]:= e3 = FullSimplify[β x ∂x q[x, t] + β q[x, t]];

In[∘]:= e4 = FullSimplify[2 ⅈ δ r[x, t] q[x, t]^2];

In[∘]:= FullSimplify[e3 + e4 - e2 + e1 /. δ → 1 /. σ → 1]
```

Out[∘]=

$$\left(8\, i\, A1\, A2\, e^{-3 t \beta - 4 (1+a)\, e^{-t\beta} x\, \lambda 2} (\lambda 1 - \lambda 2) \left((1+a)^2 A1^2 B2^2 e^{2 (1+a)\, e^{-t\beta} x\, \lambda 2} \lambda 2^2 + A2^2 B1^2 e^{2 e^{-2 t\beta} \left((1+a)\, e^{t\beta} x\, (2 \lambda 1 - \lambda 2) + \frac{2 i (\lambda 1 - \lambda 2)(\lambda 1 + \lambda 2)}{\beta}\right)} \left(a (2+a) \lambda 1^2 + \lambda 2^2\right) + A1\, A2\, B1\, B2\, e^{2 e^{-2 t\beta} \left((1+a)\, e^{t\beta} x\, \lambda 1 + \frac{i (\lambda 1 - \lambda 2)(\lambda 1 + \lambda 2)}{\beta}\right)} \left(a (2+a) \lambda 1^2 - 4 a (2+a) \lambda 1 \lambda 2 + (-2 + a (2+a)) \lambda 2^2\right)\right)\right) \Big/ \left(A1\, B2 - A2\, B1\, e^{\frac{2 e^{-2 t\beta} (\lambda 1 - \lambda 2)\left((1+a)\, e^{t\beta} x\, \beta + i (\lambda 1 + \lambda 2)\right)}{\beta}}\right)^3$$

```
Clear[A1, B1, A2, B2, a, β, λ1, λ2, σ];
β = .5; λ1 = - .3 + ⅈ; λ2 = - .3 + ⅈ; σ = 1;
Plot3D[Abs[q[x, t]], {x, -4.5, 2.5}, {t, -1, 10}, PlotRange → {-0, 10},
 Mesh → {40, 40}, Boxed → False, PlotPoints → 100, PlotTheme → "Classic",
 AxesLabel → {Style["x", 20], Style["t", 20], Style["|q[1]| ", 20]},
 TicksStyle → Directive["Label", 20], ImageSize → Large]
```

Out[∘]=



In[ ]:= **FullSimplify[q[x, t]]**

Out[ ]=

$$\frac{2\, e^{t\,((0.+4.\,i)-1.\,x)+\left(2.+(1.2+0.8\,i)\,e^{-0.5\,t}\right)x}}{-e^{e^{-0.5\,t}\,((16.+4.8\,i)+(4.6+4.\,i)\,x)}+e^{t\,((0.+4.\,i)-1.\,x)+\left(2.+(1.2+0.8\,i)\,e^{-0.5\,t}\right)x}}$$