Theoretical Equations for the Study of Entropy of Emotions and Enhancing Performance of Artificial Intelligence

Mark Christopher Arokiaraj, MD DM,
Cardiology, Pondicherry Institute of Medical Sciences, India, 605001.
christomark@gmail.com 30-03-2023

Basic entropy evaluation

d^2x+d^2π^x–d^2x^1/3–d^2√x Equation (eq) 1

In[3]:=
```
d^2*x + d^2*Pi^x - d^2*x^(1/3) - d^2*Sqrt[x]
```

Out[3]= $d^2\,\pi^x + d^2\,x - d^2\,\sqrt{x} - d^2\,\sqrt[3]{x}$

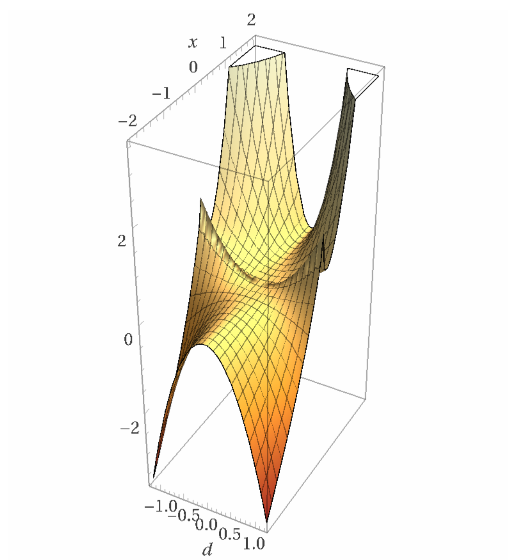
In[4]:= **d^2x+d^2π^x-d^2x^1/3-d^2√x**

Input:

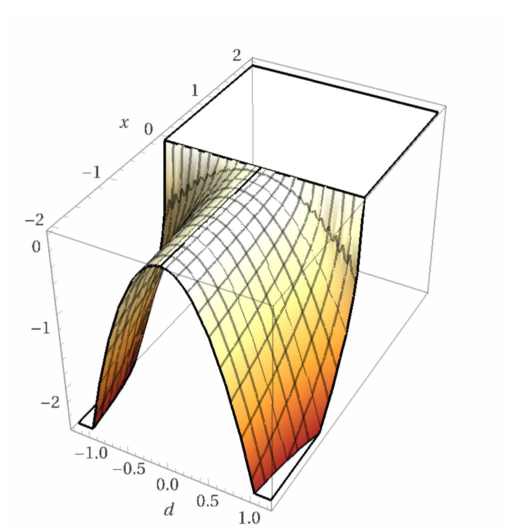
$d^2\,x + d^2\,\pi^x - d^2\,\sqrt[3]{x} - d^2\,\sqrt{x}$

3D plots:

Real part:

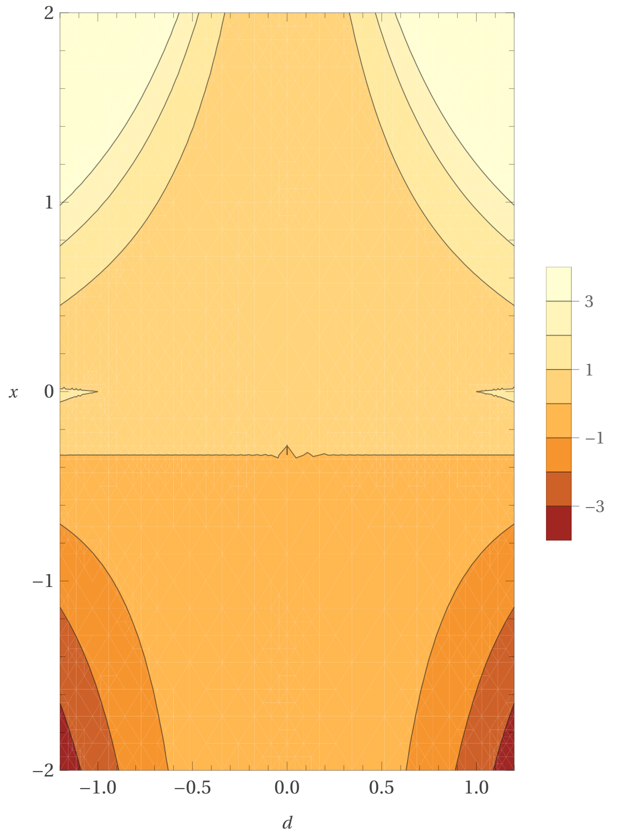


Imaginary part:



Contour plots:

Real part:

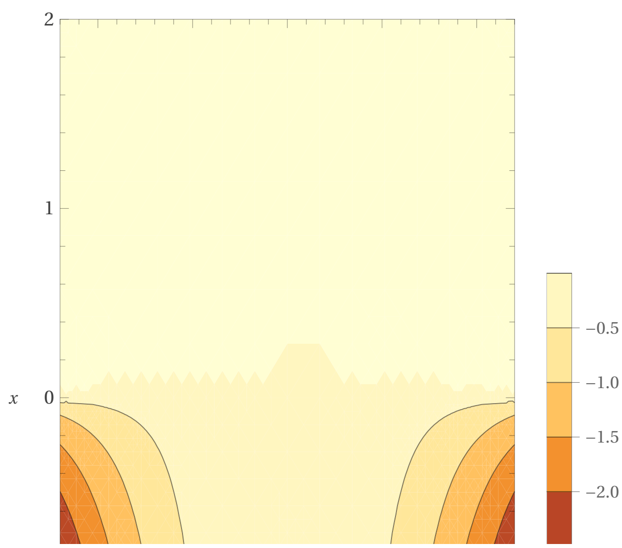


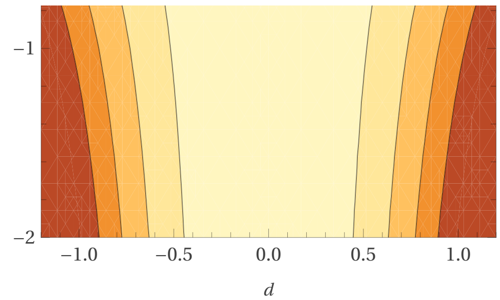
Out[4]=

d_{min} d_{max}

x_{min} x_{max}

Imaginary part:





$d_{\min}$ $d_{\max}$

$x_{\min}$ $x_{\max}$

Alternate form:

$$d^2 \left(x - \sqrt{x} - \sqrt[3]{x} + \pi^x\right)$$

Real root:

$$d = 0\,, \quad x \geq 0$$

Property as a real function:

Domain:

$\{x \in \mathbb{R} : x \geq 0\}$ (all non-negative real numbers)

R is the set of real numbers »

Series expansion at x = 0:

$$d^2 - d^2 \sqrt[3]{x} - d^2 \sqrt{x} + d^2 x (1 + \log(\pi)) + \frac{1}{2} d^2 x^2 \log^2(\pi) + \frac{1}{6} d^2 x^3 \log^3(\pi) + \frac{1}{24} d^2 x^4 \log^4(\pi) + \frac{1}{120} d^2 x^5 \log^5(\pi) + O\left(x^{16/3}\right)$$

(Puiseux series)

log(x) is the natural logarithm »

Big-O notation »

Derivative: Approximate form Step-by-step solution

$$\frac{\partial}{\partial x}\left(d^2 x + d^2 \pi^x - d^2 \sqrt[3]{x} - d^2 \sqrt{x}\right) = \frac{d^2 \left(6 x^{2/3} (\pi^x \log(\pi) + 1) - 3 \sqrt[6]{x} - 2\right)}{6 x^{2/3}}$$

Indefinite integral: Approximate form Step-by-step solution

$$\int \left(d^2 x + d^2 \pi^x - d^2 \sqrt[3]{x} - d^2 \sqrt{x}\right) dx = d^2 \left(-\frac{3 x^{4/3}}{4} - \frac{2 x^{3/2}}{3} + \frac{x^2}{2} + \frac{\pi^x}{\log(\pi)}\right) + \text{constant}$$

d^2x+d^2e^x–d^2x^1/3–d^2√x Eq 2

In[5]:=
```
d^2*x + d^2*E^x - d^2*x^(1/3) - d^2*Sqrt[x]
```

Out[5]= $d^2\,e^x + d^2\,x - d^2\,\sqrt{x} - d^2\,\sqrt[3]{x}$

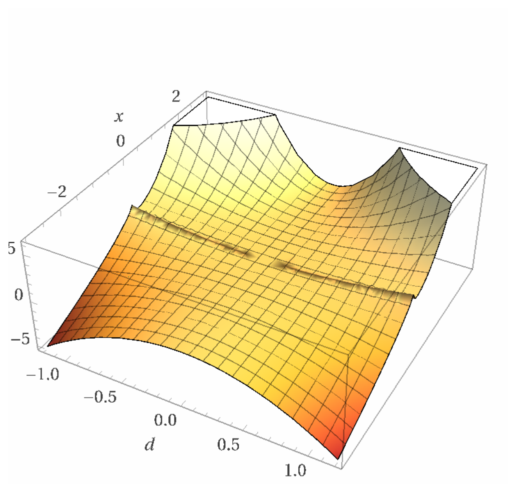
In[7]:= **d^2x+d^2e^x-d^2x^1/3-d^2√x**

Input:

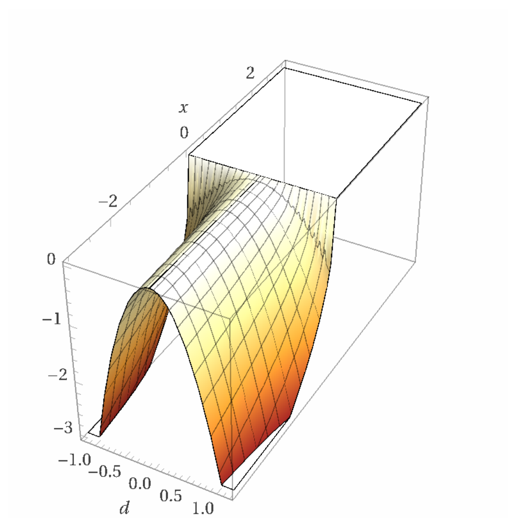
$$d^2\,x + d^2\,e^x - d^2\,\sqrt[3]{x} - d^2\,\sqrt{x}$$

3D plots:

Real part:

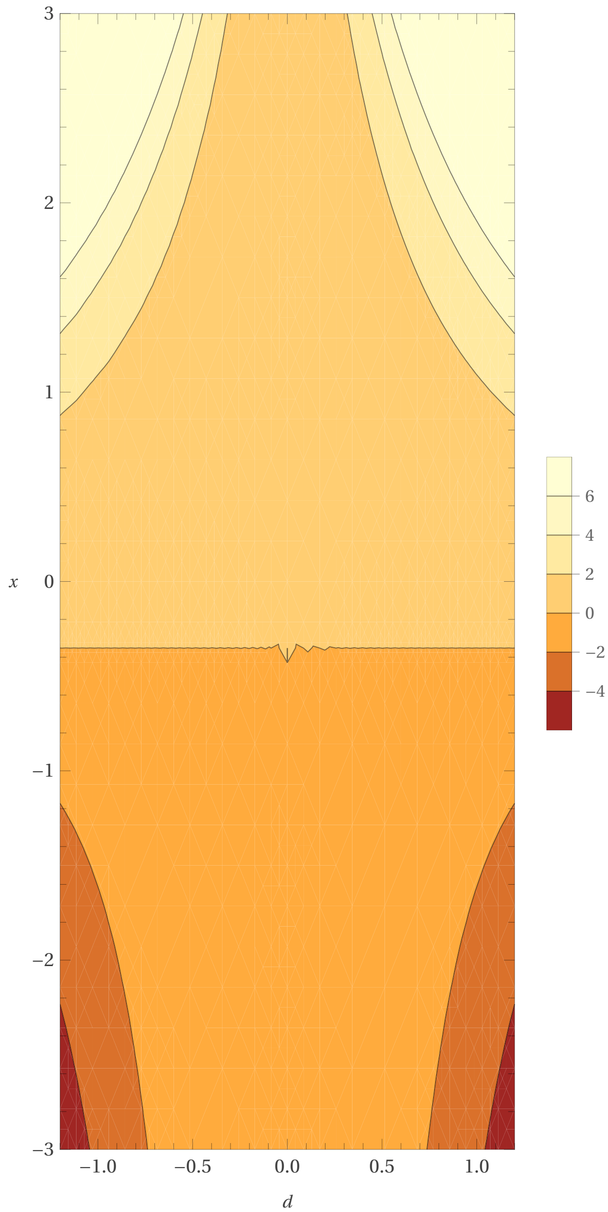


Imaginary part:



Contour plots:

Real part:

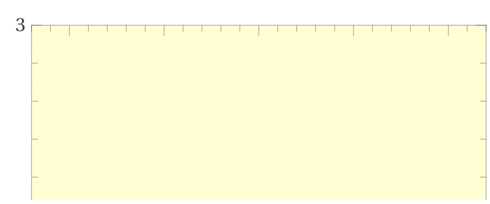


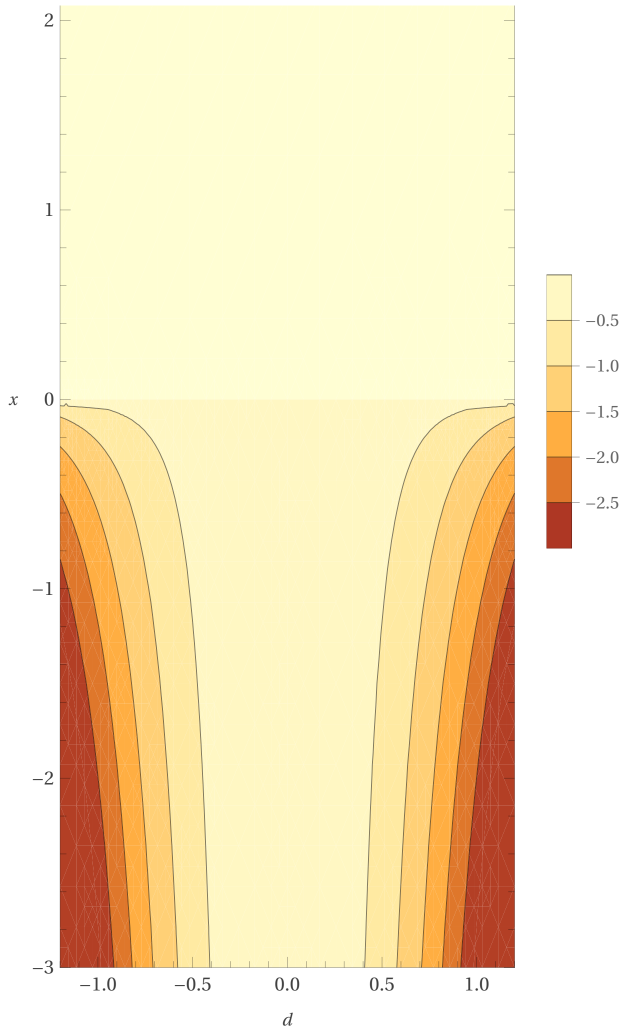
Out[7]=

d_{min} d_{max}

x_{min} x_{max}

Imaginary part:





d_{min} d_{max}

x_{min} x_{max}

Alternate forms:

$$d^2 \left(x - \sqrt{x} - \sqrt[3]{x} + e^x\right)$$

$$d^2 \left(x^{2/3} - \sqrt[6]{x} - 1\right) \sqrt[3]{x} + d^2 e^x$$

Real root:

$$d = 0, \quad x \geq 0$$

Property as a real function:

Domain:

$\{x \in \mathbb{R} : x \geq 0\}$ (all non-negative real numbers)

R is the set of real numbers »

Series expansion at x = 0:

$$d^2 - d^2\sqrt[3]{x} - d^2\sqrt{x} + 2d^2 x + \frac{d^2 x^2}{2} + \frac{d^2 x^3}{6} + \frac{d^2 x^4}{24} + O\left(x^5\right)$$

(Puiseux series)

Big-O notation »

Derivative: Step-by-step solution

$$\frac{\partial}{\partial x}\left(d^2 x + d^2 e^x - d^2\sqrt[3]{x} - d^2\sqrt{x}\right) = \frac{d^2\left(6x^{2/3}\left(e^x+1\right) - 3\sqrt[6]{x} - 2\right)}{6x^{2/3}}$$

Indefinite integral: Step-by-step solution

$$\int\left(d^2 x + d^2 e^x - d^2\sqrt[3]{x} - d^2\sqrt{x}\right)dx = d^2\left(\frac{1}{12}\left(-9x^{4/3} - 8x^{3/2} + 6x^2\right) + e^x\right) + gsrwerx$$

WolframAlpha

In[6]:= Simplify[d^2 e^x - d^2 x^(1/3) - d^2 Sqrt[x] + d^2 x]

Out[6]= $d^2\left(x - \sqrt{x} - \sqrt[3]{x} + e^x\right)$

d^2x-d^2π^x-d^2x^1/3-d^2√x Eq 3

In[8]:=
```
d^2*x - d^2*Pi^x - d^2*x^(1/3) - d^2*Sqrt[x]
```

Out[8]= $d^2\left(-\pi^x\right) + d^2 x - d^2\sqrt{x} - d^2\sqrt[3]{x}$

In[10]:= **d^2x-d^2π^x-d^2x^1/3-d^2√x**

Out[10]=

Input:

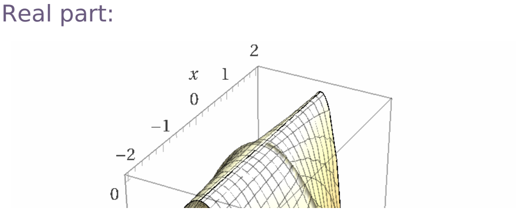
$$d^2 x - d^2 \pi^x - d^2\sqrt[3]{x} - d^2\sqrt{x}$$

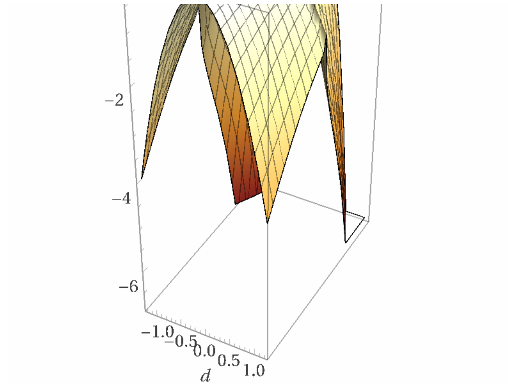
Result:

$$d^2\left(-\pi^x\right) + d^2 x - d^2\sqrt{x} - d^2\sqrt[3]{x}$$

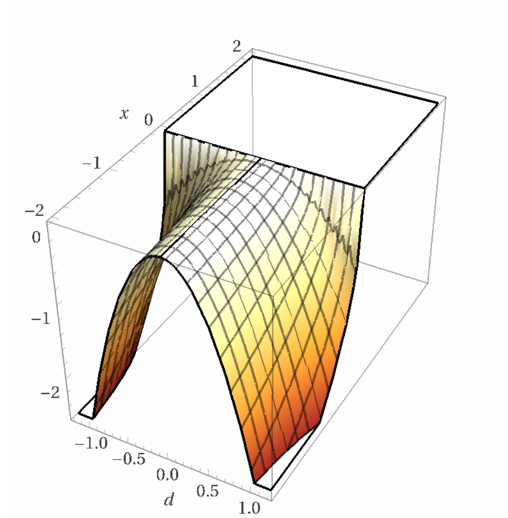
3D plots:

Real part:



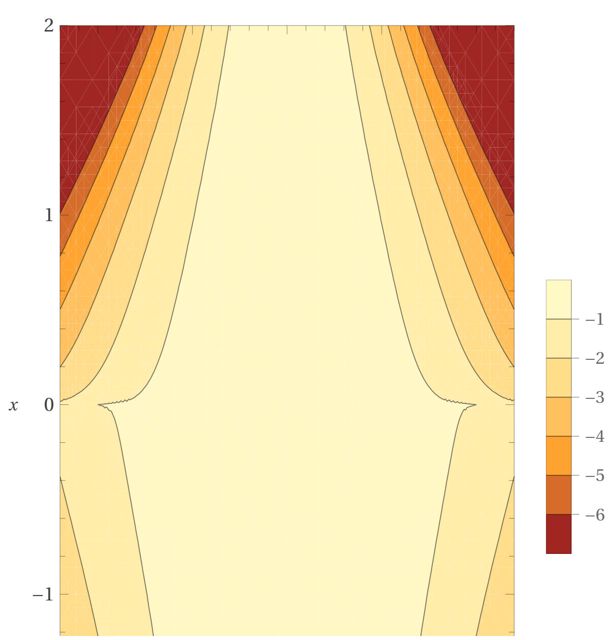


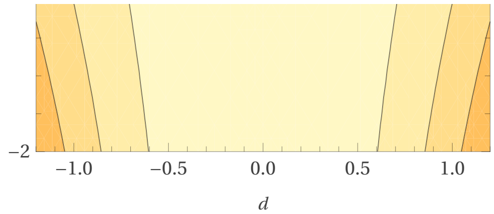
Imaginary part:



Contour plots:

Real part:

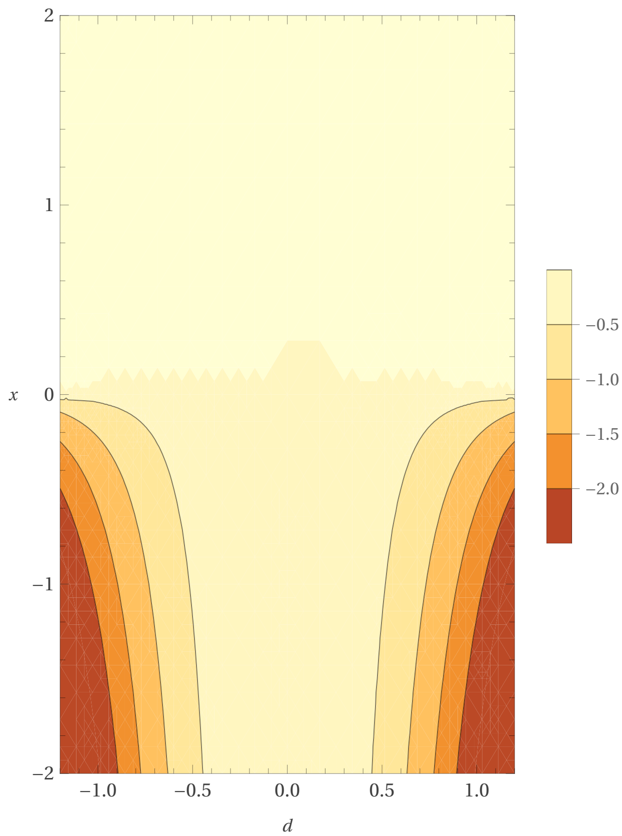




d_{min} d_{max}

x_{min} x_{max}

Imaginary part:



d_{min} d_{max}

x_{min} x_{max}

Alternate forms:

$$-d^2\left(-x+\sqrt{x}+\sqrt[3]{x}+\pi^x\right)$$

$$d^2\left(x-\sqrt{x}-\sqrt[3]{x}-\pi^x\right)$$

Real root:

$$d = 0\,,\quad x \geq 0$$

Property as a real function:

Domain:

$\{x \in \mathbb{R} : x \geq 0\}$ (all non-negative real numbers)

R is the set of real numbers »

Series expansion at x = 0:

$$-d^2 - d^2 \sqrt[3]{x} - d^2 \sqrt{x} - d^2 x (\log(\pi) - 1) - \frac{1}{2} x^2 \left(d^2 \log^2(\pi)\right) - \frac{1}{6} x^3 \left(d^2 \log^3(\pi)\right) - \frac{1}{24} x^4 \left(d^2 \log^4(\pi)\right) - \frac{1}{120} x^5 \left(d^2 \log^5(\pi)\right) + O\left(x^{16/3}\right)$$

(Puiseux series)

log(x) is the natural logarithm »

Big-O notation »

Derivative: Approximate form Step-by-step solution

$$\frac{\partial}{\partial x}\left(d^2 x - d^2 \pi^x - d^2 \sqrt[3]{x} - d^2 \sqrt{x}\right) = -\frac{d^2 \left(6 x^{2/3} (\pi^x \log(\pi) - 1) + 3 \sqrt[6]{x} + 2\right)}{6 x^{2/3}}$$

Indefinite integral: Approximate form Step-by-step solution

$$\int \left(-d^2 \pi^x - d^2 \sqrt[3]{x} - d^2 \sqrt{x} + d^2 x\right) dx = -d^2 \left(\frac{3 x^{4/3}}{4} + \frac{2 x^{3/2}}{3} - \frac{x^2}{2} + \frac{\pi^x}{\log(\pi)}\right) + \text{constant}$$

WolframAlpha

In[9]:= `Simplify[-d² π^x - d² x^(1/3) - d² √x + d² x]`

Out[9]= $-d^2 \left(-x + \sqrt{x} + \sqrt[3]{x} + \pi^x\right)$

d^2x-d^2e^x-d^2x^1/3-d^2√x Eq 4

In[11]:=
```
d^2*x - d^2*E^x - d^2*x^(1/3) - d^2*Sqrt[x]
```

Out[11]=

$$d^2 (-e^x) + d^2 x - d^2 \sqrt{x} - d^2 \sqrt[3]{x}$$

In[13]:= **d^2x-d^2e^x-d^2x^1/3-d^2√x**

Out[13]=

Input:

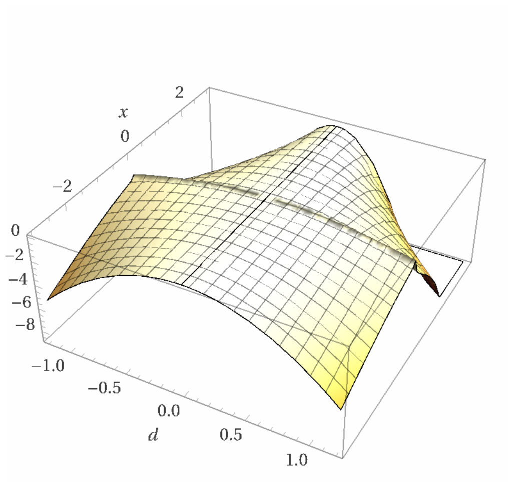
$$d^2 x - d^2 e^x - d^2 \sqrt[3]{x} - d^2 \sqrt{x}$$

Result:

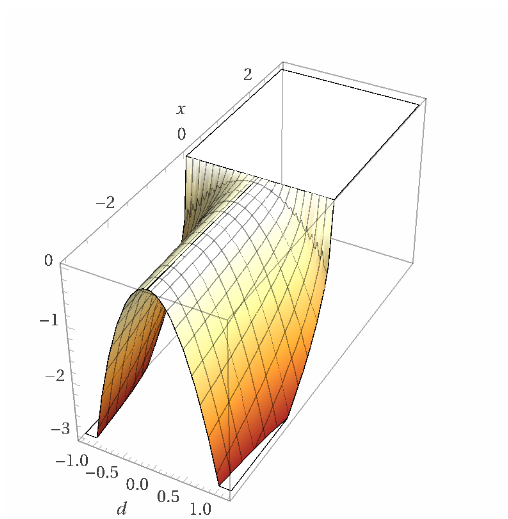
$$d^2\,(-e^x) + d^2\,x - d^2\,\sqrt{x} - d^2\,\sqrt[3]{x}$$

3D plots:

Real part:

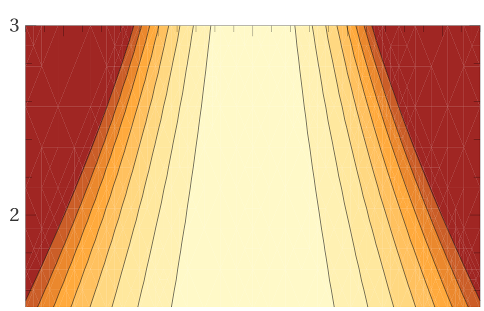


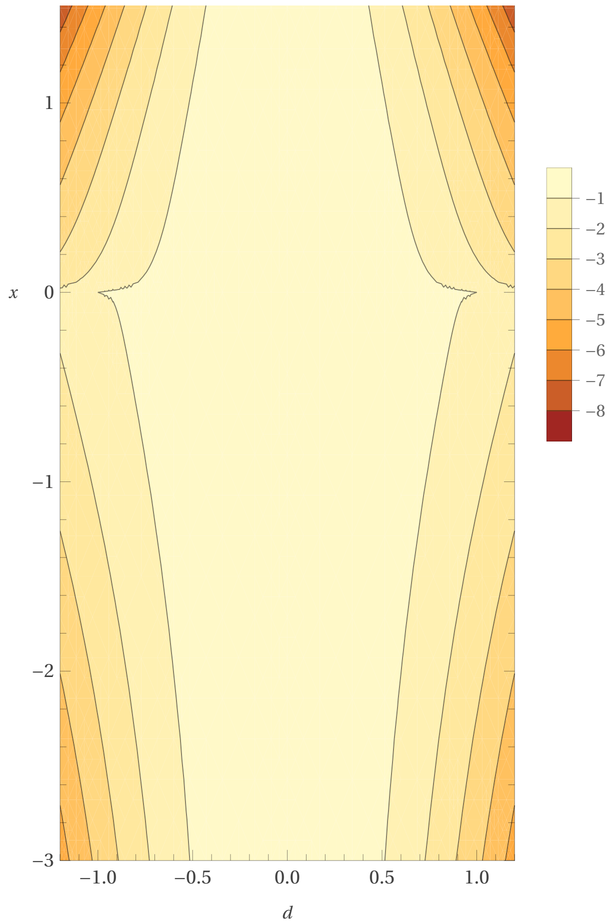
Imaginary part:

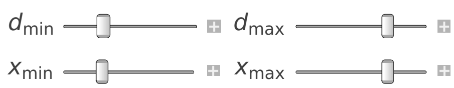


Contour plots:

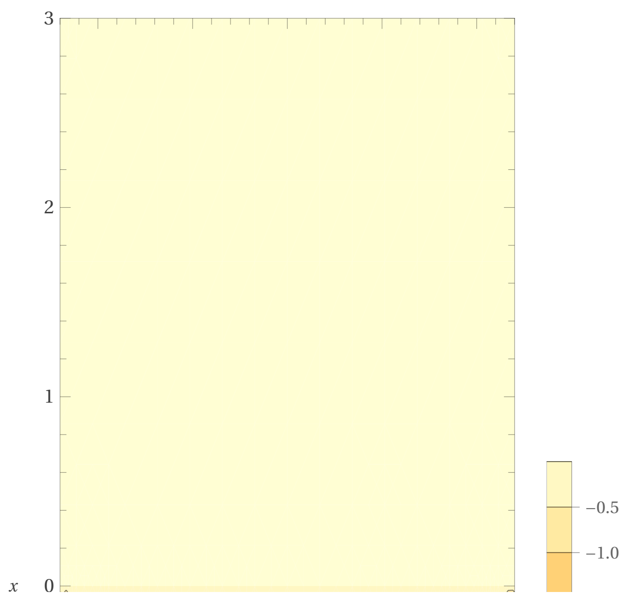
Real part:

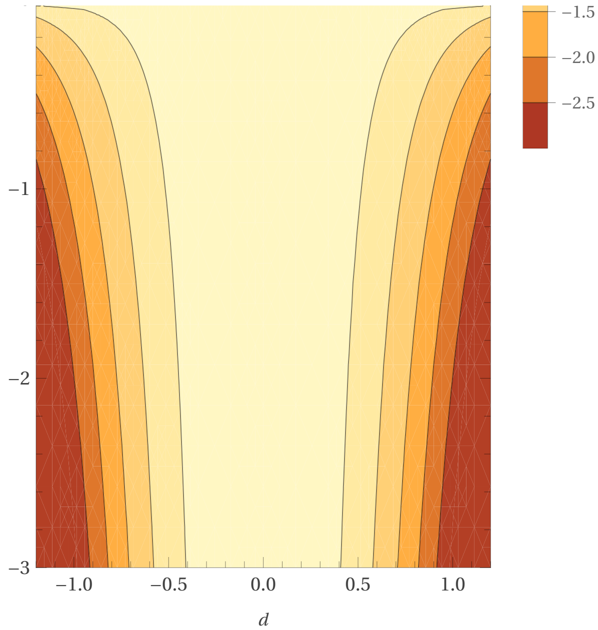






Imaginary part:





d_{min} d_{max}

x_{min} x_{max}

Alternate forms:

$$-d^2\left(-x+\sqrt{x}+\sqrt[3]{x}+e^x\right)$$

$$d^2\left(x-\sqrt{x}-\sqrt[3]{x}-e^x\right)$$

$$d^2\left(x^{2/3}-\sqrt[6]{x}-1\right)\sqrt[3]{x}-d^2\,e^x$$

Real root:

$$d=0\,,\quad x\geq 0$$

Property as a real function:

Domain:

$\{x\in\mathbb{R} : x\geq 0\}$ (all non-negative real numbers)

R is the set of real numbers »

Series expansion at x = 0:

$$-d^2-d^2\sqrt[3]{x}-d^2\sqrt{x}-\frac{d^2x^2}{2}-\frac{d^2x^3}{6}-\frac{d^2x^4}{24}+O\left(x^5\right)$$

(Puiseux series)

Big-O notation »

Derivative:

Step-by-step solution

$$d^2\left(6\,x^{2/3}\left(e^x-1\right)+3\sqrt[6]{x}+2\right)$$

$$\frac{\partial}{\partial x}\left(d^2 x - d^2 e^x - d^2 \sqrt[3]{x} - d^2 \sqrt{x}\right) = -\frac{\ldots}{6\, x^{2/3}}$$

Indefinite integral: Step-by-step solution

$$\int\left(-d^2 e^x - d^2 \sqrt[3]{x} - d^2 \sqrt{x} + d^2 x\right) dx = -\frac{1}{12} d^2 \left(9\, x^{4/3} + 8\, x^{3/2} - 6\, x^2 + 12\, e^x\right) + \text{constant}$$

WolframAlpha

In[12]:= `Simplify[-d² e^x - d² x^(1/3) - d² √x + d² x]`

Out[12]=

$$-d^2\left(-x + \sqrt{x} + \sqrt[3]{x} + e^x\right)$$

d^2x/dt^2–d^2e^x/dt^2–d^2x^1/3/dt^2–d^2√x/dt^2 **Eq 5**

In[14]:=

```
D[x, {t, 2}] - d^2*(E^x/D[t^(2 - d^2*(x^(1/3)/ dt²) - d^2*Sqrt[x]), t]^2)
```

Out[14]=

$$-\frac{d^2\, e^x\, t^{d^2 \sqrt[3]{x}\,(2/\mathrm{dt}^2) + 2 d^2 \sqrt{x} - 2}}{\left(d^2 \sqrt[3]{x}\left(-1/\mathrm{dt}^2\right) - d^2 \sqrt{x} + 2\right)^2}$$

In[15]:= **d^2x/dt^2-d^2e^x/dt^2-d^2x^1/3/dt^2-d^2√x/dt^2**

Out[15]=

Input interpretation:

$$x''(t) - d^2 \times \frac{e^x}{\left(\frac{\partial t^{2 - d^2 \times \sqrt[3]{x} / (\mathrm{dt}^2 \text{ (metric deciton squared)}) - d^2 \sqrt{x}}}{\partial t}\right)^2}$$

Result:

$$x''(t) - \frac{d^2\, e^x\, t^{d^2 \sqrt[3]{x}\; 2/\mathrm{dt}^2 \text{ (per metric decitons squared)} + 2 d^2 \sqrt{x} - 2}}{\left(d^2 \sqrt[3]{x}\; - 1/\mathrm{dt}^2 \text{ (per metric deciton squared)} - d^2 \sqrt{x} + 2\right)^2}$$

WolframAlpha

{d^2x/d^2t}–{d^2e^x/d^2t}–{d^2x^1/3/d^2t}–{d^2√x/d^2t} Eq 5

In[16]:=
```
d^2*(x/d^2)*t - d^2*(E^x/d^2)*t - d^2*(x^(1/3)/d^2)*t - d^2*(Sqrt[x]/d^2)*t
```

Out[16]=

$$t\,(-e^{x}) + t\,x - t\,\sqrt{x} - t\,\sqrt[3]{x}$$

In[18]:= **{d^2x/d^2t}-{d^2e^x/d^2t}-{d^2x^1/3/d^2t}-{d^2√x/d^2t}**

Out[18]=

Input:

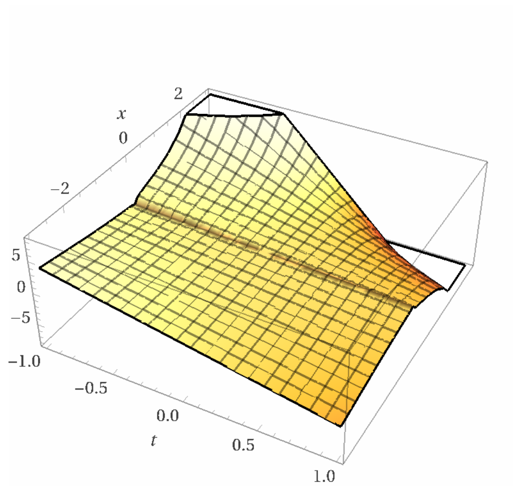
$$d^{2} \times \frac{x}{d^{2}}\,t - d^{2} \times \frac{e^{x}}{d^{2}}\,t - d^{2} \times \frac{\sqrt[3]{x}}{d^{2}}\,t - d^{2} \times \frac{\sqrt{x}}{d^{2}}\,t$$

Result:

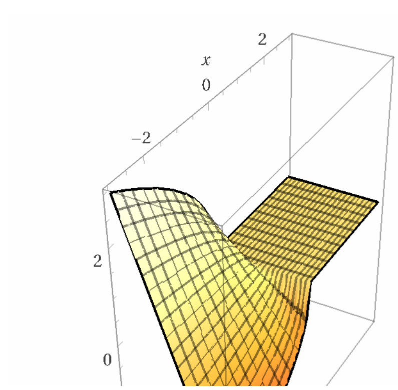
$$t\,(-e^{x}) + t\,x - t\,\sqrt{x} - t\,\sqrt[3]{x}$$

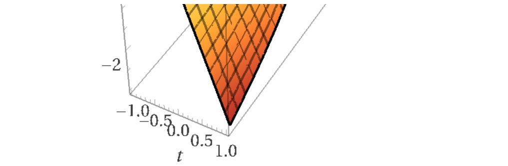
3D plots:

Real part:



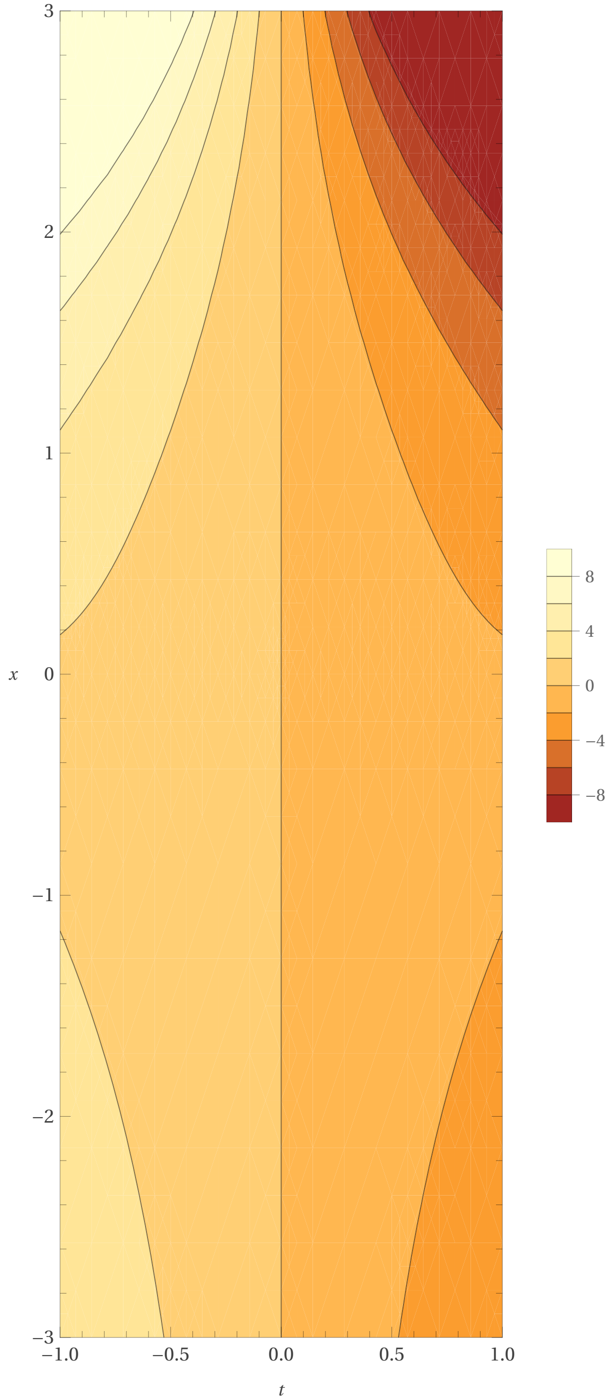
Imaginary part:





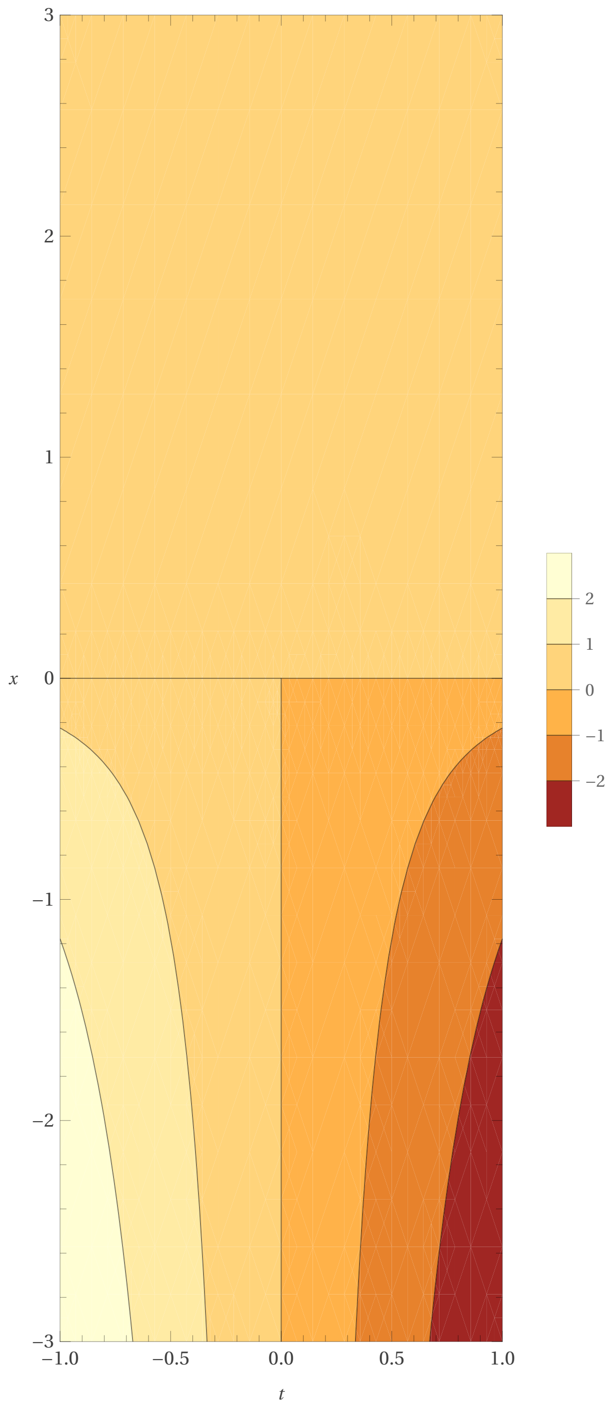
Contour plots:

Real part:



t_{min} t_{max}
x_{min} x_{max}

Imaginary part:



t_{min} t_{max}
x_{min} x_{max}

Alternate forms:

$$-t\left(-x+\sqrt{x}+\sqrt[3]{x}+e^{x}\right)$$

$$t\left(x-\sqrt{x}-\sqrt[3]{x}-e^{x}\right)$$

$$t\left(x^{2/3}-\sqrt[6]{x}-1\right)\sqrt[3]{x}-t\,e^{x}$$

Real root:

$$t=0\,,\quad x\geq 0$$

Series expansion at x = 0:

$$-t-t\sqrt[3]{x}-t\sqrt{x}-\frac{t\,x^{2}}{2}-\frac{t\,x^{3}}{6}-\frac{t\,x^{4}}{24}+O\left(x^{5}\right)$$

(Puiseux series)

Big-O notation »

Derivative: Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{d^{2}\,x\,t}{d^{2}}-\frac{d^{2}\,e^{x}\,t}{d^{2}}-\frac{d^{2}\sqrt[3]{x}\,t}{d^{2}}-\frac{d^{2}\sqrt{x}\,t}{d^{2}}\right)=\frac{1}{6}\,t\left(-\frac{2}{x^{2/3}}-6\,e^{x}-\frac{3}{\sqrt{x}}+6\right)$$

Indefinite integral: Step-by-step solution

$$\int\left(-e^{x}\,t-t\sqrt[3]{x}-t\sqrt{x}+t\,x\right)dx=-\frac{1}{12}\,t\left(9\,x^{4/3}+8\,x^{3/2}-6\,x^{2}+12\,e^{x}\right)+\text{constant}$$

WolframAlpha

In[17]:= Simplify$\left[-e^{x}\,t-t\,x^{1/3}-t\,\sqrt{x}+t\,x\right]$

Out[17]=

$$-t\left(-x+\sqrt{x}+\sqrt[3]{x}+e^{x}\right)$$

{d^2x/d^2t}–{d^2π^x/d^2t}–{d^2x^1/3/d^2t}–{d^2√x/d^2t} Eq 6

In[1]:=

```
d^2*(x/d^2)*t - d^2*(Pi^x/d^2)*t - d^2*(x^(1/3)/d^2)*t - d^2*(Sqrt[x]/d^2)*t
```

Out[1]= $t\left(-\pi^{x}\right)+t\,x-t\sqrt{x}-t\sqrt[3]{x}$

In[2]:= **{d^2x/d^2t}-{d^2π^x/d^2t}-{d^2x^1/3/d^2t}-{d^2√x/d^2t}**

Input:

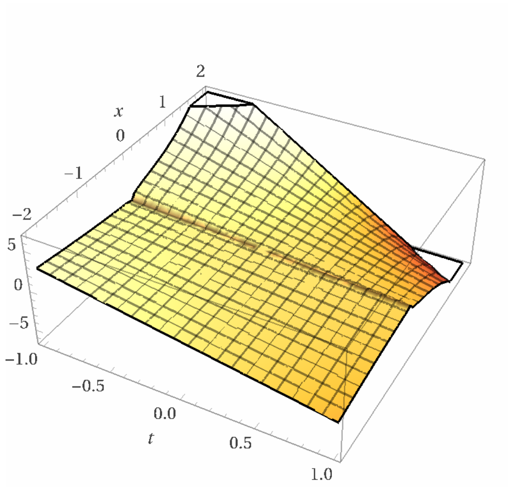
$d^2 \times \frac{x}{d^2} t - d^2 \times \frac{\pi^x}{d^2} t - d^2 \times \frac{\sqrt{x}}{d^2} t - d^2 \times \frac{\sqrt[3]{x}}{d^2} t$

Result:

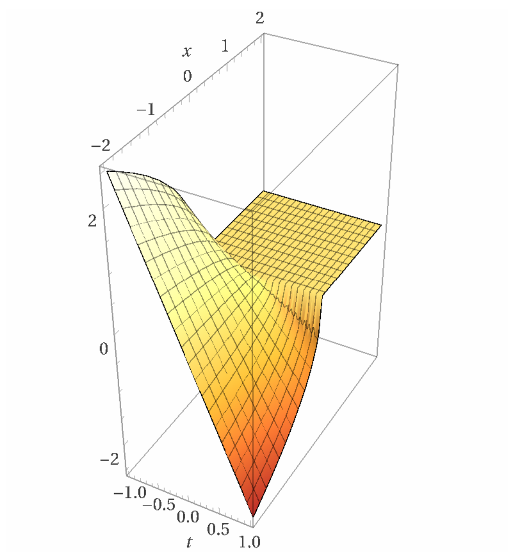
$t(-\pi^x) + t\,x - t\,\sqrt{x} - t\,\sqrt[3]{x}$

3D plots:

Real part:

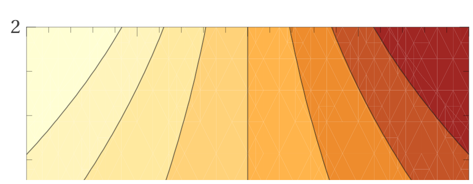


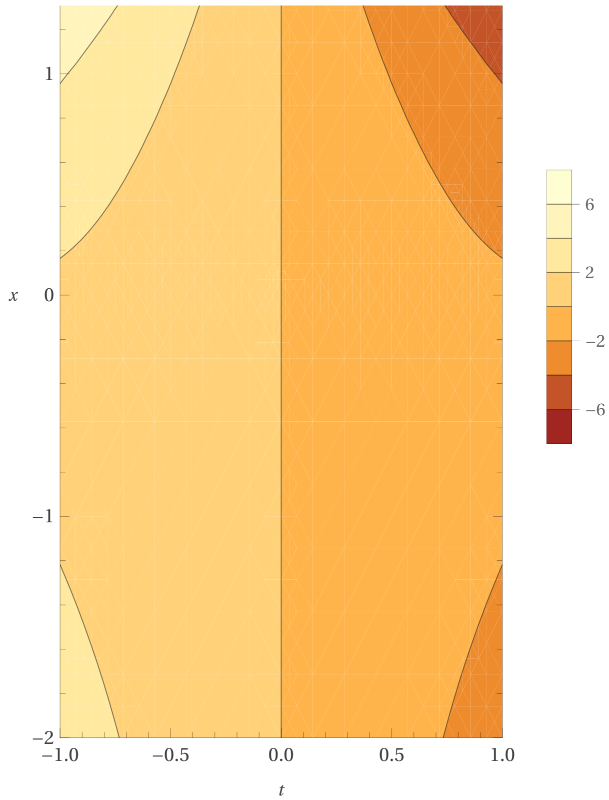
Imaginary part:



Contour plots:

Real part:



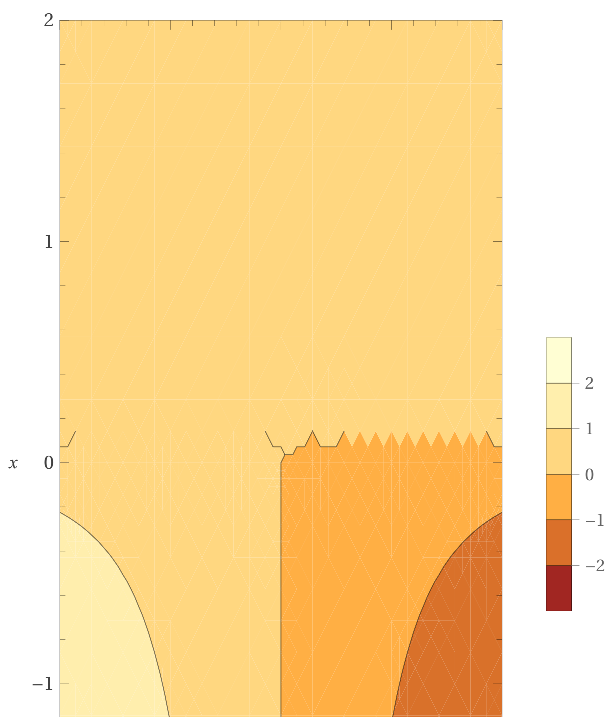


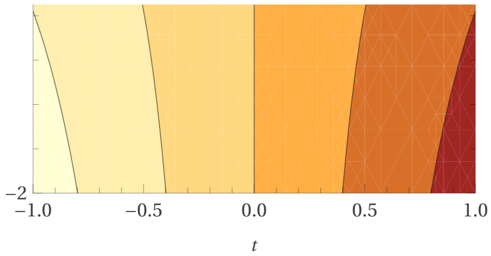
Out[2]=

t_{min} t_{max}

x_{min} x_{max}

Imaginary part:





t_{min} t_{max}

x_{min} x_{max}

Alternate forms:

$$-t\left(-x+\sqrt{x}+\sqrt[3]{x}+\pi^x\right)$$

$$t\left(x-\sqrt{x}-\sqrt[3]{x}-\pi^x\right)$$

Real root:

$$t=0\,,\quad x\geq 0$$

Series expansion at x = 0:

$$-t-t\sqrt[3]{x}-t\sqrt{x}+x\,(t-t\log(\pi))-\frac{1}{2}x^2\left(t\log^2(\pi)\right)-\frac{1}{6}x^3\left(t\log^3(\pi)\right)-\frac{1}{24}x^4\left(t\log^4(\pi)\right)-\frac{1}{120}x^5\left(t\log^5(\pi)\right)+O\left(x^{16/3}\right)$$

(Puiseux series)

log(x) is the natural logarithm »

Big-O notation »

Derivative: Approximate form Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{d^2\,x\,t}{d^2}-\frac{d^2\,\pi^x\,t}{d^2}-\frac{d^2\,\sqrt[3]{x}\,t}{d^2}-\frac{d^2\,\sqrt{x}\,t}{d^2}\right)=\frac{1}{6}\,t\left(-\frac{2}{x^{2/3}}-\frac{3}{\sqrt{x}}-6\,\pi^x\log(\pi)+6\right)$$

Indefinite integral: Approximate form Step-by-step solution

$$\int\left(-\pi^x\,t-t\,\sqrt[3]{x}-t\,\sqrt{x}+t\,x\right)dx=-t\left(\frac{3\,x^{4/3}}{4}+\frac{2\,x^{3/2}}{3}-\frac{x^2}{2}+\frac{\pi^x}{\log(\pi)}\right)+gsrwerx$$

WolframAlpha

{d^2x/dt^2}–{d^2π^x/dt^2}–{d^2x^1/3/dt^2}–{d^2√x/dt^2} Eq 7

In[3]:=

```
D[x, {t, 2}] - D[Pi^x, {t, 2}] - d^2*(x^(1/3)/ dt^2 ) - D[Sqrt[x], {t, 2}]
```

Out[3]= $d^2 \sqrt[3]{x} \left(-1/\mathrm{dt}^2\right)$

In[4]:= **{d^2x/dt^2}-{d^2π^x/dt^2}-{d^2x^1/3/dt^2}-{d^2√x/dt^2}**

Input interpretation:

$$x''(t) - \frac{\partial^2 \pi^x}{\partial t^2} - d^2 \times \frac{\sqrt[3]{x}}{\mathrm{dt}^6 \text{ (metric deciton squared)}} - \frac{\partial^2 \sqrt{x}}{\partial t^2}$$

Out[4]=

Result:

$d^2 \sqrt[3]{x} - 1/\mathrm{dt}^6$ (per metric deciton squared) $+ x''(t)$

WolframAlpha

{d^2x/dt^2}–{d^2e^x/dt^2}–{d^2x^1/3/dt^2}–{d^2√x/dt^2} **Eq 8**

In[5]:=

```
D[x, {t, 2}] - D[E^x, {t, 2}] - d^2*(x^(1/3)/ dt^2 ) - D[Sqrt[x], {t, 2}]
```

Out[5]= $d^2 \sqrt[3]{x} \left(-1/\mathrm{dt}^2\right)$

In[6]:= **{d^2x/dt^2}-{d^2e^x/dt^2}-{d^2x^1/3/dt^2}-{d^2√x/dt^2}**

Input interpretation:

$$x''(t) - \frac{\partial^2 e^x}{\partial t^2} - d^2 \times \frac{\sqrt[3]{x}}{\mathrm{dt}^2 \text{ (metric deciton squared)}} - \frac{\partial^2 \sqrt{x}}{\partial t^2}$$

Out[6]=

Result:

$d^2 \sqrt[3]{x} - 1/\mathrm{dt}^2$ (per metric deciton squared) $+ x''(t)$

WolframAlpha

{d^2x/dt^2}+{d^2e^x/dt^2}–{d^2x^1/3/dt^2}–{d^2√x/dt^2} **Eq 9**

In[7]:=

```
D[x, {t, 2}] + D[E^x, {t, 2}] - d^2*(x^(1/3)/ dt^2 ) - D[Sqrt[x], {t, 2}]
```

Out[7]= $d^2 \sqrt[3]{x} \left(-1/\mathrm{dt}^2\right)$

In[10]:= {d^2x/dt^2}+{d^2e^x/dt^2}-{d^2x^1/3/dt^2}-{d^2 √x/dt^2}

Out[10]=

Input interpretation:

$$x''(t) + \frac{\partial^2 e^x}{\partial t^2} - d^2 \times \frac{\sqrt[3]{x}}{\text{dt}^6 \text{ (metric deciton squared)}} - \frac{\partial^2 \sqrt{x}}{\partial t^2}$$

Result:

$$d^2 \sqrt[3]{x} - 1/\text{dt}^6 \text{ (per metric deciton squared)} + x''(t)$$

WolframAlpha

In[8]:= $\partial_U\left(\texttt{d x}^{/}\ \texttt{Quantity}\left[-1, \frac{1}{\texttt{"MetricDecitons"}}\right]\right)$

Out[8]= $$\frac{d^2\left(-\frac{1}{3}/\text{dt}^2\right)}{x^{2/3}}$$

In[9]:= $\texttt{Numerator}\left[\frac{\texttt{d Quantity}\left[\texttt{--}, \frac{}{\text{0BQOF@ B@FQLKP}}\right]}{\texttt{x}^{/}}\right]$

Out[9]= $$d^2\left(-\frac{1}{3}/\text{dt}^2\right)$$

In[11]:= $\partial_A\left(\texttt{d Quantity}\left[-\frac{1}{3}, \frac{1}{\texttt{"MetricDecitons"}}\right]\right)$

Out[11]=

$$d\left(-\frac{2}{3}/\text{dt}^2\right)$$

In[12]:= $\texttt{Solve}\left[\texttt{d Quantity}\left[-\frac{2}{3}, \frac{1}{\texttt{"MetricDecitons"}^2}\right] \texttt{== 0, d}\right]$

Out[12]=

$$\{\{d \to 0\text{ kg}\}\}$$

In[13]:= {{d → Quantity[0, "Kilograms"]}} /. Rule → Equal

Out[13]=

$$(d = 0\text{ kg})$$

In[14]:= Flatten[{{d == Quantity[0, "Kilograms"]}}]

Out[14]=

$$\{d = 0\text{ kg}\}$$

{d^2x/d^2t}+{d^2e^x/d^2t}−{d^2x^1/3/d^2t}−{d^2√x/d^2t} Eq 10

In[1]:=

```
d^2*(x/d^2)*t + d^2*(E^x/d^2)*t - d^2*(x^(1/3)/d^2)*t - d^2*(Sqrt[x]/d^2)*t
```

Out[1]= $t\, e^{x} + t\, x - t\, \sqrt{x} - t\, \sqrt[3]{x}$

In[3]:= **{d^2x/d^2t}+{d^2e^x/d^2t}-{d^2x^1/3/d^2t}-{d^2√x/d^2t}**

Input:

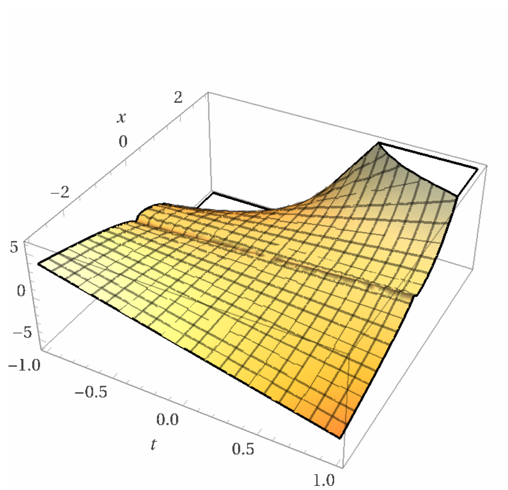
$$d^2 \times \frac{x}{d^2}\, t + d^2 \times \frac{e^x}{d^2}\, t - d^2 \times \frac{\sqrt[3]{x}}{d^2}\, t - d^2 \times \frac{\sqrt{x}}{d^2}\, t$$

Result:

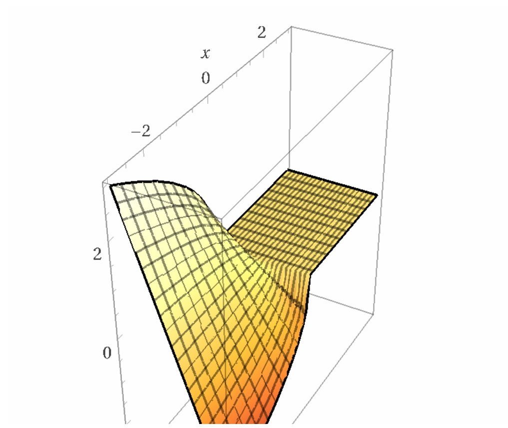
$$t\, e^{x} + t\, x - t\, \sqrt{x} - t\, \sqrt[3]{x}$$

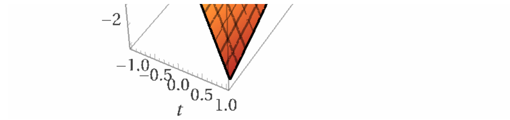
3D plots:

Real part:



Imaginary part:

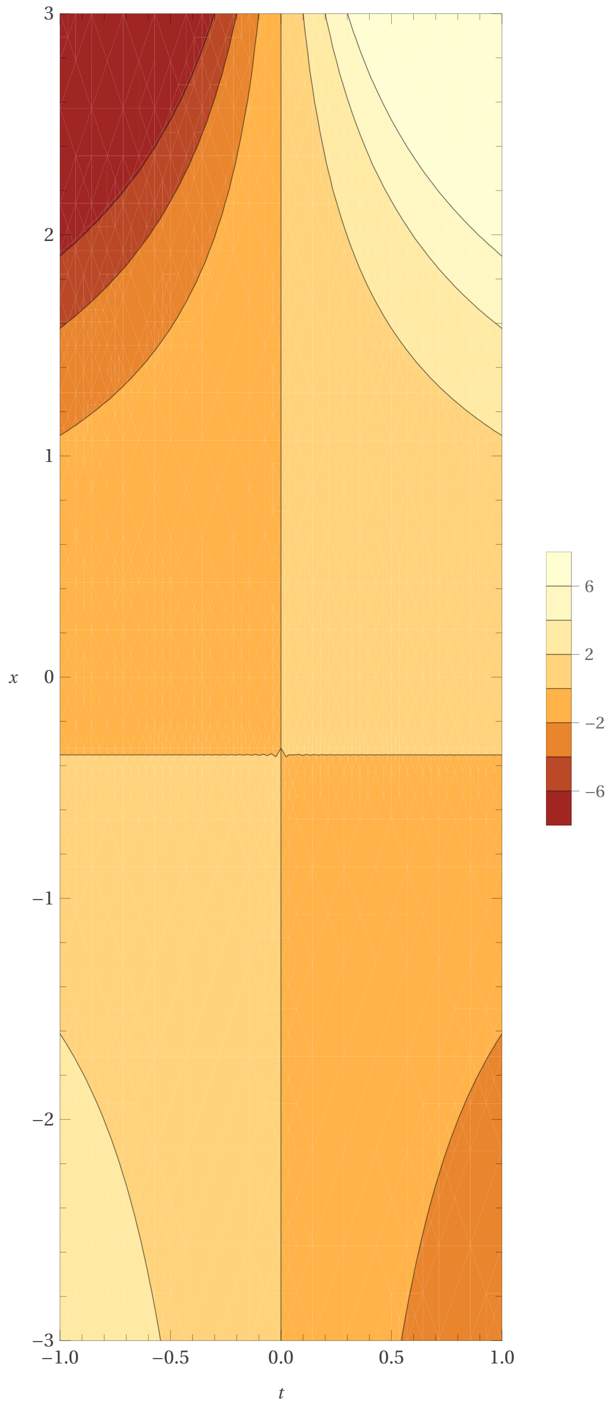




Contour plots:

Real part:

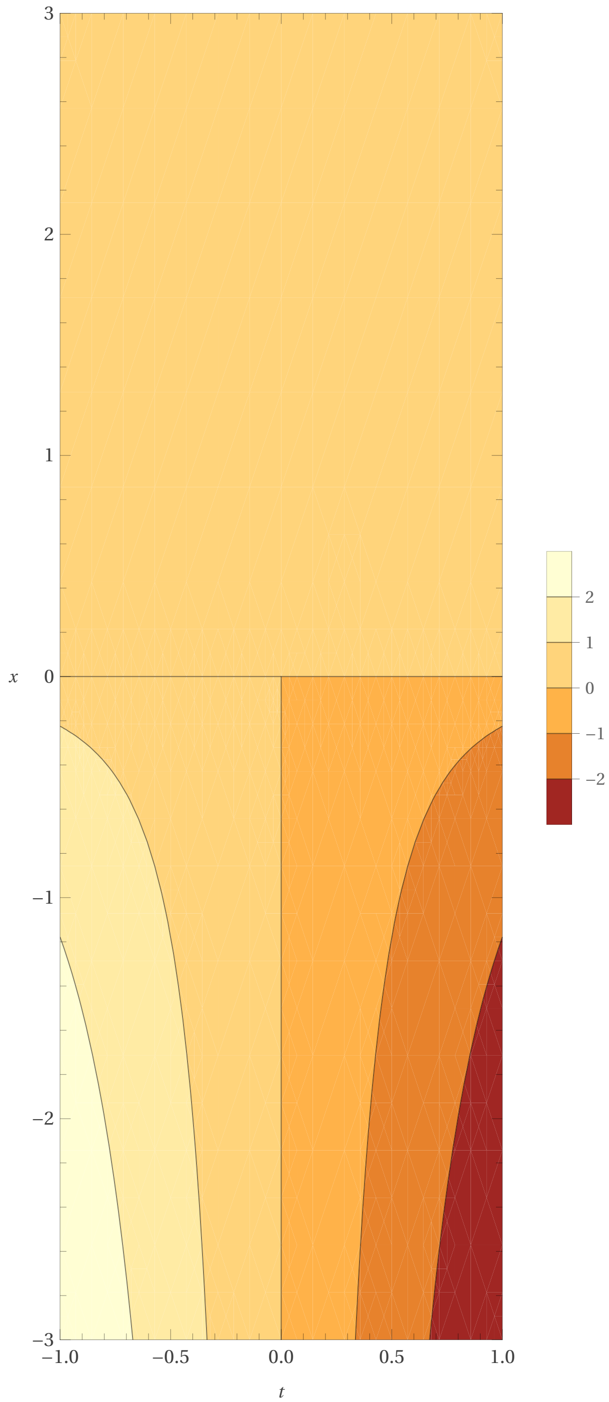
Out[3]=



t_{min} t_{max}

x_{min} x_{max}

Imaginary part:



t_{min} t_{max}

x_{min} x_{max}

Alternate forms:

$$t\left(x-\sqrt{x}-\sqrt[3]{x}+e^{x}\right)$$

$$t\left(x^{2/3}-\sqrt[6]{x}-1\right)\sqrt[3]{x}+t\,e^{x}$$

Real root:

$$t=0\,,\quad x\geq 0$$

Series expansion at x = 0:

$$t-t\sqrt[3]{x}-t\sqrt{x}+2\,t\,x+\frac{t\,x^2}{2}+\frac{t\,x^3}{6}+\frac{t\,x^4}{24}+O\left(x^5\right)$$

(Puiseux series)

Big-O notation »

Derivative: Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{d^2\,x\,t}{d^2}+\frac{d^2\,e^x\,t}{d^2}-\frac{d^2\sqrt[3]{x}\,t}{d^2}-\frac{d^2\sqrt{x}\,t}{d^2}\right)=\frac{1}{6}\,t\left(-\frac{2}{x^{2/3}}+6\,e^x-\frac{3}{\sqrt{x}}+6\right)$$

Indefinite integral: Step-by-step solution

$$\int\left(e^x\,t-t\sqrt[3]{x}-t\sqrt{x}+t\,x\right)dx=t\left(\frac{1}{12}\left(-9\,x^{4/3}-8\,x^{3/2}+6\,x^2\right)+e^x\right)+gsrwerx$$

WolframAlpha

In[2]:= $\text{Simplify}\left[e^x\,t-t\,x^{1/3}-t\sqrt{x}+t\,x\right]$

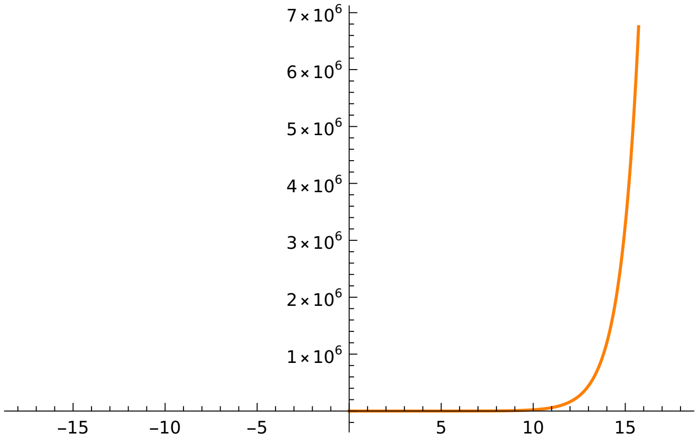
Out[2]= $t\left(x-\sqrt{x}-\sqrt[3]{x}+e^{x}\right)$

In[4]:= $\partial_t\left(t\left(e^x-x^{1/3}-\sqrt{x}+x\right)\right)$

Out[4]= $x-\sqrt{x}-\sqrt[3]{x}+e^x$

In[5]:= Plot[$e^x - x^{1/3} - \sqrt{x} + x$, {x, -18., 18.}]

Out[5]=



{d^2x/d^2t}+{d^2π^x/d^2t}–{d^2x^1/3/d^2t}–{d^2√x/d^2t} Eq 11

In[6]:=

```
d^2*(x/d^2)*t + d^2*(Pi^x/d^2)*t - d^2*(x^(1/3)/d^2)*t - d^2*(Sqrt[x]/d^2)*t
```

Out[6]= $t\,\pi^x + t\,x - t\,\sqrt{x} - t\,\sqrt[3]{x}$

In[7]:= {d^2x/d^2t}+{d^2π^x/d^2t}-{d^2x^1/3/d^2t}-{d^2√x/d^2t}

Input:

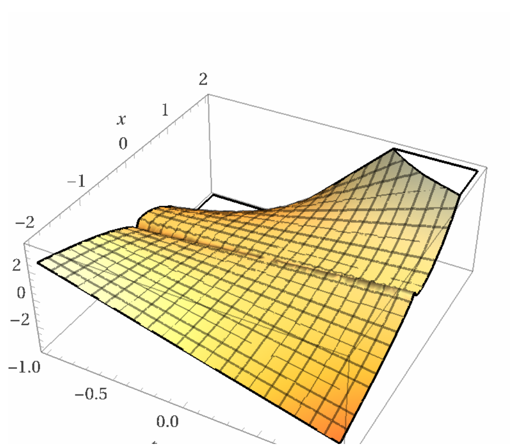
$$d^2 \times \frac{x}{d^2}\,t + d^2 \times \frac{\pi^x}{d^2}\,t - d^2 \times \frac{\sqrt[3]{x}}{d^2}\,t - d^2 \times \frac{\sqrt{x}}{d^2}\,t$$

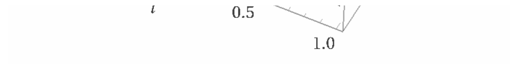
Result:

$$t\,\pi^x + t\,x - t\,\sqrt{x} - t\,\sqrt[3]{x}$$

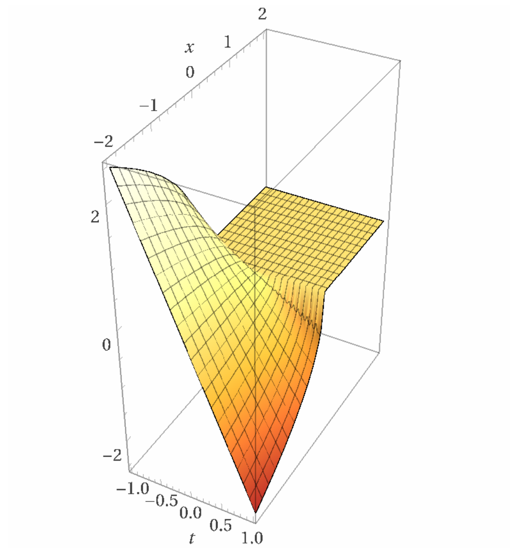
3D plots:

Real part:





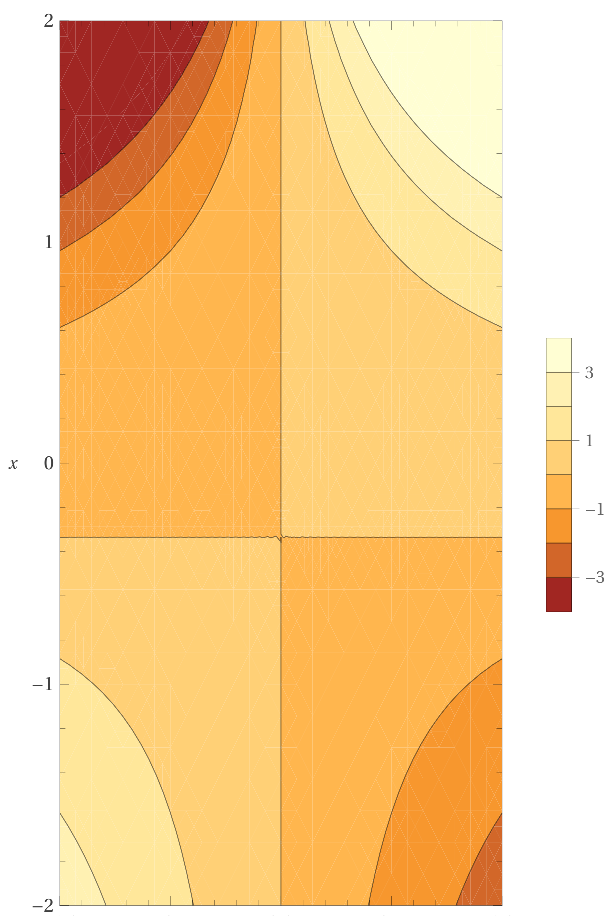
Imaginary part:



Contour plots:

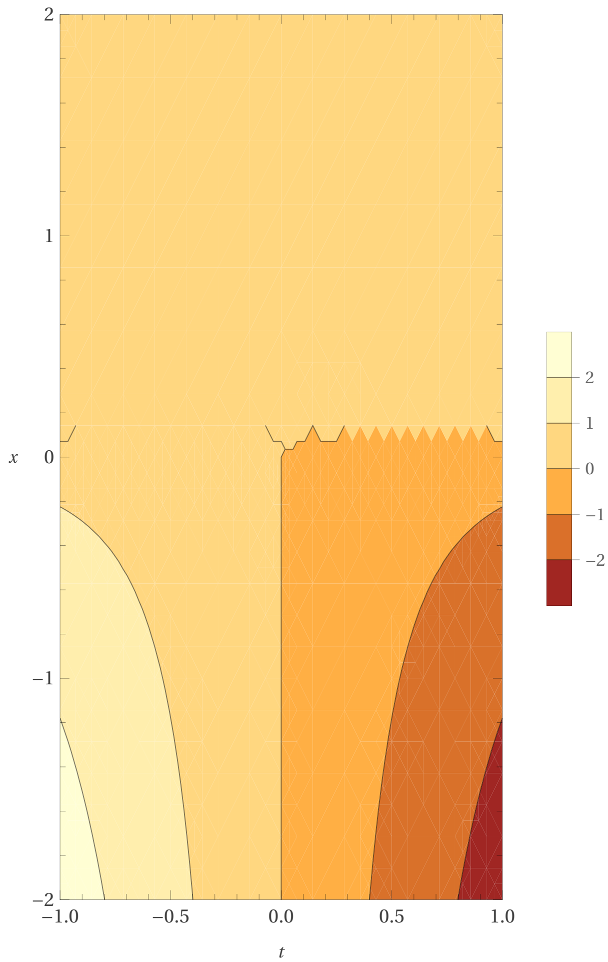
Real part:

Out[7]=



t_{min} t_{max}
x_{min} x_{max}

Imaginary part:



t_{min} t_{max}
x_{min} x_{max}

Alternate form:

$$t\left(x-\sqrt{x}-\sqrt[3]{x}+\pi^{x}\right)$$

Real root:

$$t=0\,,\quad x\geq 0$$

Series expansion at x = 0:

$$t - t\sqrt[3]{x} - t\sqrt{x} + t\,x\,(1 + \log(\pi)) + \frac{1}{2}\,t\,x^2\log^2(\pi) + \frac{1}{6}\,t\,x^3\log^3(\pi) + \frac{1}{24}\,t\,x^4\log^4(\pi) + \frac{1}{120}\,t\,x^5\log^5(\pi) + O\left(x^{16/3}\right)$$

(Puiseux series)

log(x) is the natural logarithm »

Big-O notation »

Derivative: Approximate form Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{d^2\,x\,t}{d^2} + \frac{d^2\,\pi^x\,t}{d^2} - \frac{d^2\sqrt[3]{x}\,t}{d^2} - \frac{d^2\sqrt{x}\,t}{d^2}\right) = \frac{1}{6}\,t\left(-\frac{2}{x^{2/3}} - \frac{3}{\sqrt{x}} + 6\,\pi^x\log(\pi) + 6\right)$$

Indefinite integral: Approximate form Step-by-step solution

$$\int\left(\pi^x\,t - t\sqrt[3]{x} - t\sqrt{x} + t\,x\right)dx = t\left(-\frac{3\,x^{4/3}}{4} - \frac{2\,x^{3/2}}{3} + \frac{x^2}{2} + \frac{\pi^x}{\log(\pi)}\right) + gsrwerx$$

WolframAlpha

simplify{d^2x/d^2t}+{d^2π^x/d^2t}–{d^2x^1/3/d^2t}–{d^2√x/d^2t}

In[8]:=
```
Simplify[d^2*(x/d^2)*t + d^2*(Pi^x/d^2)*t - d^2*(x^(1/3)/d^2)*t - d^2*(Sqrt[x]/d^2)*t]
```

Out[8]= $t\left(x - \sqrt{x} - \sqrt[3]{x} + \pi^x\right)$

In[11]:= **simplify{d^2x/d^2t}+{d^2π^x/d^2t}-{d^2x^1/3/d^2t}-{d^2√x/d^2t}**

Out[11]=

Input interpretation:

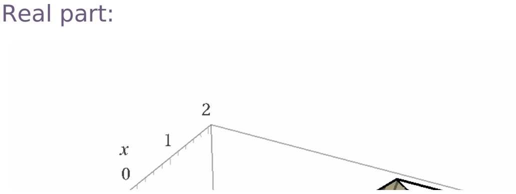
simplify	$d^2 \times \frac{x}{d^2}\,t + d^2 \times \frac{\pi^x}{d^2}\,t - d^2 \times \frac{\sqrt[3]{x}}{d^2}\,t - d^2 \times \frac{\sqrt{x}}{d^2}\,t$

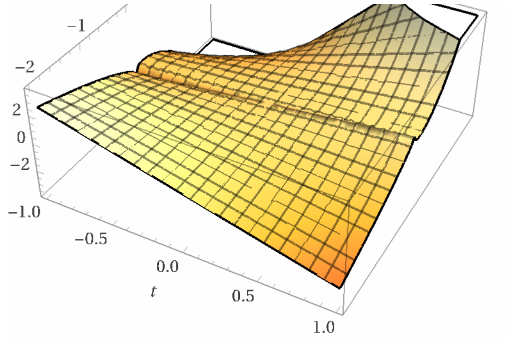
Result:

$t\left(x - \sqrt{x} - \sqrt[3]{x} + \pi^x\right)$

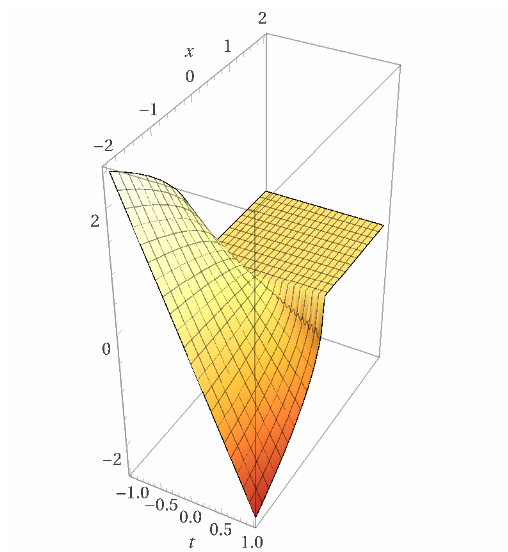
3D plots:

Real part:



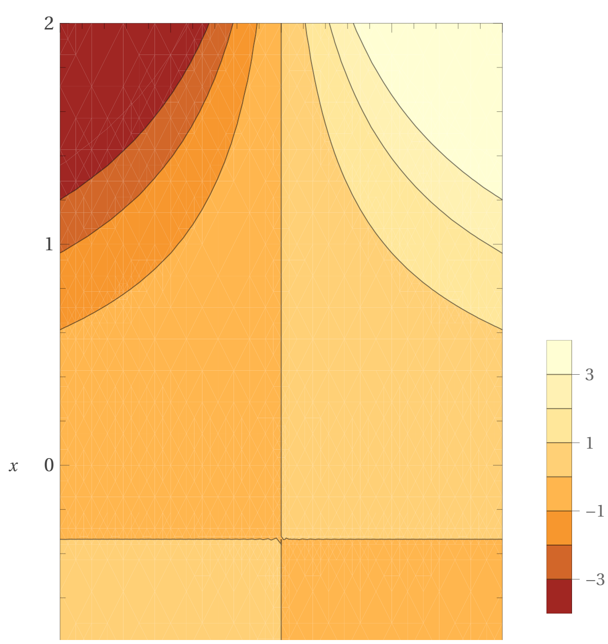


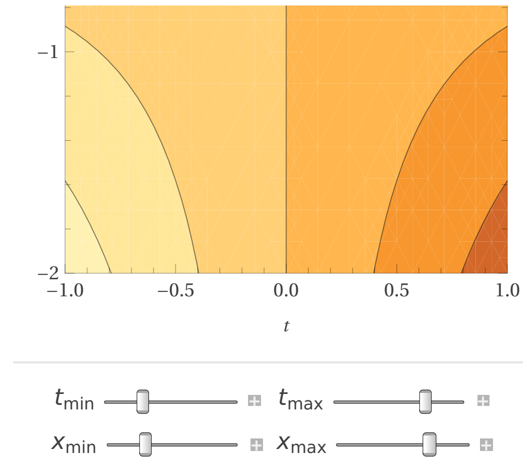
Imaginary part:



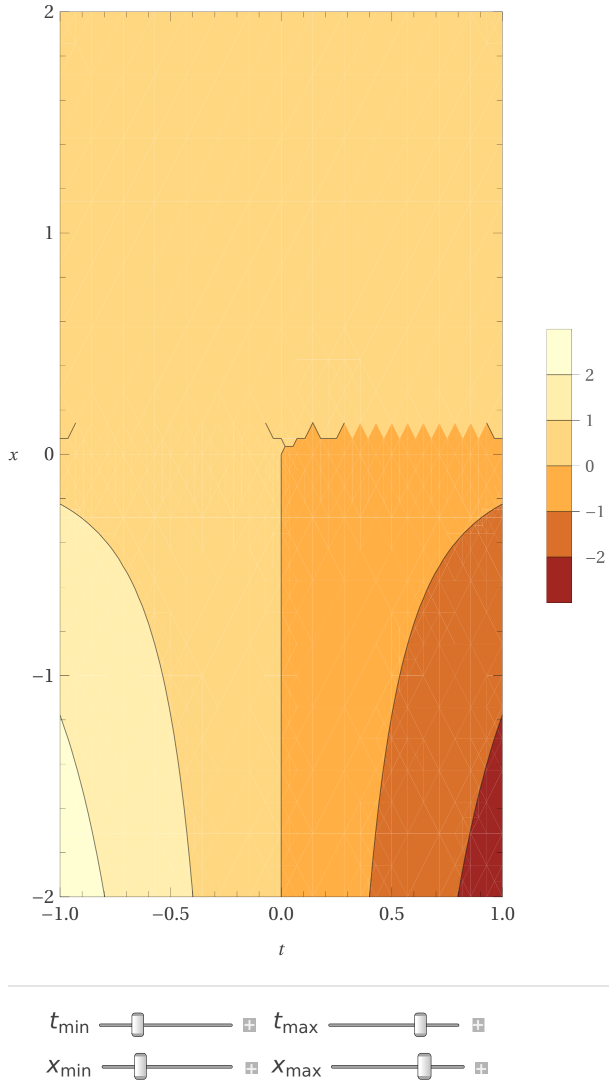
Contour plots:

Real part:



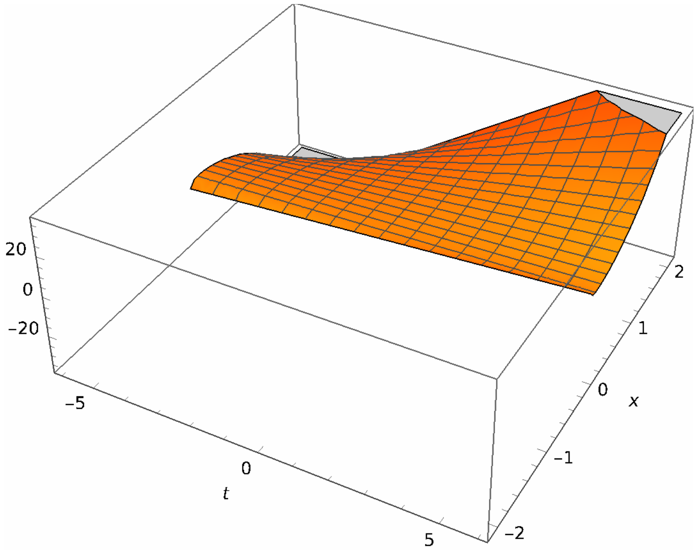


Imaginary part:



In[9]:= `Plot3D[t (π^x - x^1/3 - √x + x), {t, -6., 6.}, {x, -2.10603, 2.10603}]`

Out[9]=



simplify{d^2x/d^2t}+{d^2e^x/d^2t}–{d^2x^1/3/d^2t}–{d^2√x/d^2t} Eq 10

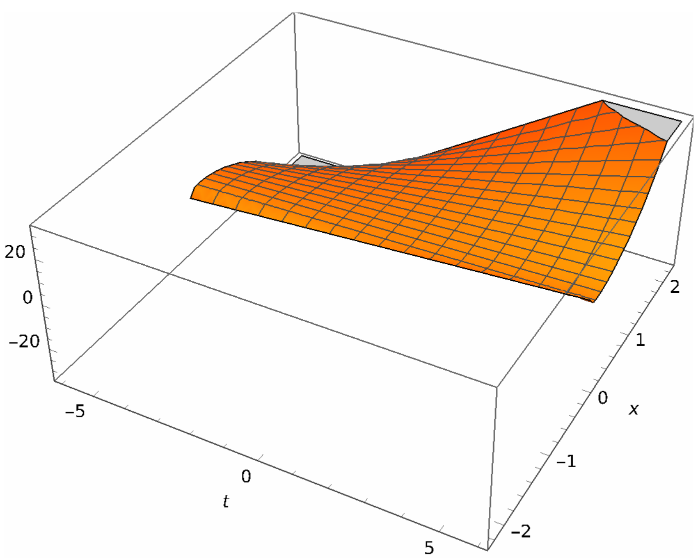
In[10]:=
```
Simplify[d^2*(x/d^2)*t + d^2*(E^x/d^2)*t - d^2*(x^(1/3)/d^2)*t - d^2*(Sqrt[x]/d^2)*t]
```

Out[10]=

$$t\left(x-\sqrt{x}-\sqrt[3]{x}+e^{x}\right)$$

In[12]:= `Plot3D[t (e^x - x^1/3 - √x + x), {t, -6., 6.}, {x, -2.24762, 2.24762}]`

Out[12]=



[{d^2x/d^2t+{d^2e^x/d^2t}]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}] Eq 12

In[1]:=
```
d^2*(x/d^2)*t + (d^2*(E^x/d^2)*t)/(d^2*(x^(1/3)/d^2)*t + d^2*(Sqrt[x]/d^2)*t)
```

Out[1]= $t\,x + \dfrac{t\,e^{x}}{t\,\sqrt{x} + t\,\sqrt[3]{x}}$

In[4]:= **[{d^2x/d^2t+{d^2e^x/d^2t}]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}]**

An attempt was made to fix mismatched parentheses, brackets, or braces.

Input:

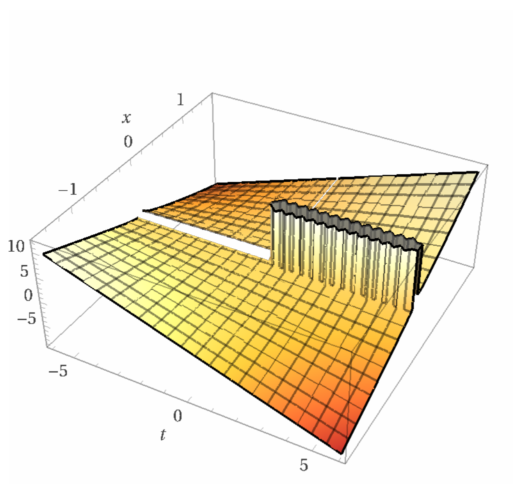
$$d^2 \times \frac{x}{d^2}\,t + \frac{d^2 \times \frac{e^x}{d^2}\,t}{d^2 \times \frac{\sqrt[3]{x}}{d^2}\,t + d^2 \times \frac{\sqrt{x}}{d^2}\,t}$$

Result:

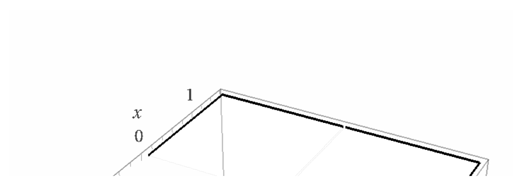
$$t\,x + \frac{t\,e^{x}}{t\,\sqrt{x} + t\,\sqrt[3]{x}}$$

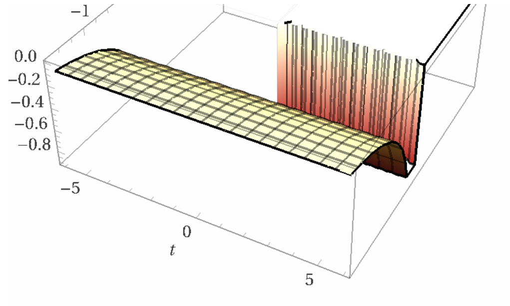
3D plots:

Real part:



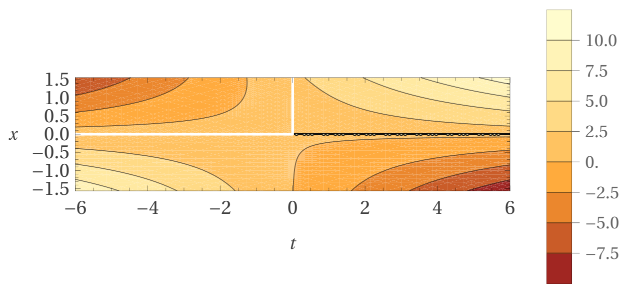
Imaginary part:



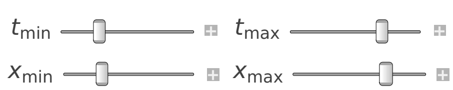


Contour plots:

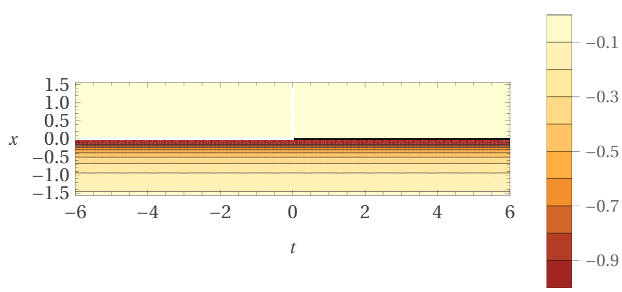
Real part:

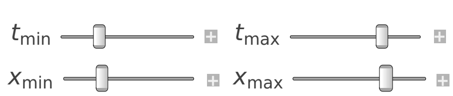


Out[4]=



Imaginary part:





Alternate forms:

More

$$t\,x + \frac{e^x}{\sqrt{x} + \sqrt[3]{x}}$$

e^x

$$t\,x + \frac{\cdots}{\left(\sqrt[6]{x}+1\right)\sqrt[3]{x}}$$

$$t\left(\frac{e^x}{\sqrt[3]{x}\left(t\sqrt[6]{x}+t\right)}+x\right)$$

Series expansion at x = 0:

$$O\left(\frac{1}{x^7}\right)$$

(Taylor series)

Big-O notation »

Series expansion at x = ∞:

$$\left(t\,x+O\left(\left(\frac{1}{x}\right)^6\right)\right)+$$
$$e^x\left(\sqrt{\frac{1}{x}}-\left(\frac{1}{x}\right)^{2/3}+\left(\frac{1}{x}\right)^{5/6}-\frac{1}{x}+\left(\frac{1}{x}\right)^{7/6}-\left(\frac{1}{x}\right)^{4/3}+\left(\frac{1}{x}\right)^{3/2}-\left(\frac{1}{x}\right)^{5/3}+\left(\frac{1}{x}\right)^{11/6}-\left(\frac{1}{x}\right)^{2}+\right.$$
$$\left(\frac{1}{x}\right)^{13/6}-\left(\frac{1}{x}\right)^{7/3}+\left(\frac{1}{x}\right)^{5/2}-\left(\frac{1}{x}\right)^{8/3}+\left(\frac{1}{x}\right)^{17/6}-\left(\frac{1}{x}\right)^{3}+\left(\frac{1}{x}\right)^{19/6}-$$
$$\left(\frac{1}{x}\right)^{10/3}+\left(\frac{1}{x}\right)^{7/2}-\left(\frac{1}{x}\right)^{11/3}+\left(\frac{1}{x}\right)^{23/6}-\left(\frac{1}{x}\right)^{4}+\left(\frac{1}{x}\right)^{25/6}-\left(\frac{1}{x}\right)^{13/3}+$$
$$\left.\left(\frac{1}{x}\right)^{9/2}-\left(\frac{1}{x}\right)^{14/3}+\left(\frac{1}{x}\right)^{29/6}-\left(\frac{1}{x}\right)^{5}+\left(\frac{1}{x}\right)^{31/6}-\left(\frac{1}{x}\right)^{16/3}+O\left(\left(\frac{1}{x}\right)^{11/2}\right)\right)$$

Big-O notation »

Derivative: Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{d^2\,x\,t}{d^2}+\frac{d^2\,e^x\,t}{d^2\left(\frac{d^2\sqrt[3]{x}\,t}{d^2}+\frac{d^2\sqrt{x}\,t}{d^2}\right)}\right)=t+\frac{e^x\left(6\,x^{7/6}+6\,x-3\sqrt[6]{x}-2\right)}{6\left(\sqrt[6]{x}+1\right)^2x^{4/3}}$$

WolframAlpha

In[2]:=
```
Simplify[(e^x t)/(t x^(1/3) + t Sqrt[x]) + t x]
```

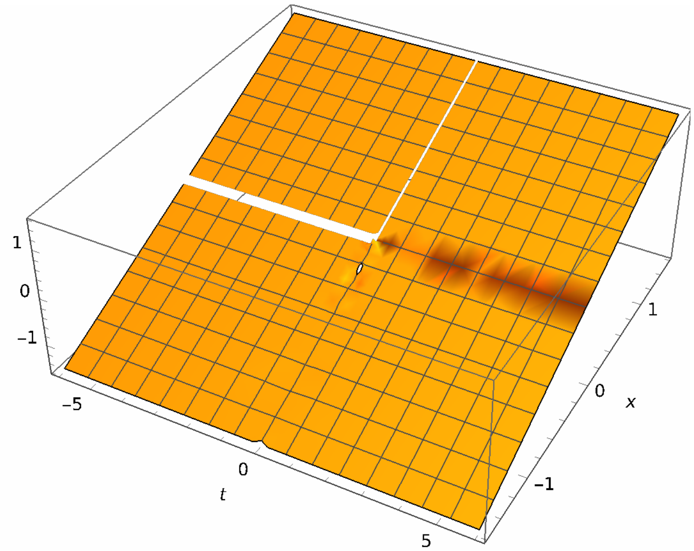
Out[2]=
$$t\left(\frac{e^x}{\sqrt[3]{x}\left(t\sqrt[6]{x}+t\right)}+x\right)$$

In[3]:= $\partial_t\left(t\left(\frac{e^x}{\left(t+t\,x^{1/6}\right)x^{1/3}}+x\right)\right)$

Out[3]= $-\frac{t\,e^{Ð}\left(\sqrt[6]{x}+1\right)}{\sqrt[3]{x}\left(t\sqrt[6]{x}+t\right)^2}+\frac{e^{Ð}}{\sqrt[3]{x}\left(t\sqrt[6]{x}+t\right)}+x$

In[5]:= Plot3D[$-\frac{e^{U}\,t\,(1+x\ /\ )}{(t+t\,x\ /\ )\ x\ /}+\frac{e^{U}}{(t+t\,x\ /\ )\,x\ /}$ + x, {t, -6., 6.}, {x, -1.56716, 1.56716}]

Out[5]=



[{d^2x/d^2t}+{d^2e^x/d^2t}]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}] Eq 12

In[6]:=
```
(d^2*(x/d^2)*t + d^2*(E^x/d^2)*t)/(d^2*(x^(1/3)/d^2)*t + d^2*(Sqrt[x]/d^2)*t)
```

Out[6]= $\frac{t\,e^x+t\,x}{t\sqrt{x}+t\sqrt[3]{x}}$

=

Input:

$$\frac{d^2\times\frac{x}{d^2}\,t+d^2\times\frac{e^x}{d^2}\,t}{d^2\times\frac{\sqrt[3]{x}}{d^2}\,t+d^2\times\frac{\sqrt{x}}{d^2}\,t}$$

Result:

$$\frac{t\,e^x+t\,x}{t\sqrt{x}+t\sqrt[3]{x}}$$

Alternate forms:

$$\frac{x + e^x}{\sqrt{x} + \sqrt[3]{x}}$$

$$\frac{x + e^x}{\left(\sqrt[6]{x} + 1\right)\sqrt[3]{x}}$$

$$\frac{x^{2/3}}{\sqrt[6]{x} + 1} + \frac{e^x}{\left(\sqrt[6]{x} + 1\right)\sqrt[3]{x}}$$

Expanded form: Step–by–step solution

$$\frac{t\,x}{t\sqrt{x} + t\sqrt[3]{x}} + \frac{t\,e^x}{t\sqrt{x} + t\sqrt[3]{x}}$$

Series expansion at x = 0:

$$O\left(\frac{1}{x^7}\right)$$

(Taylor series)

Big-O notation »

Series expansion at x = ∞:

Out[7]=

$$e^x\left(\sqrt{\frac{1}{x}} - \left(\frac{1}{x}\right)^{2/3} + \left(\frac{1}{x}\right)^{5/6} - \frac{1}{x} + \left(\frac{1}{x}\right)^{7/6} - \left(\frac{1}{x}\right)^{4/3} + \left(\frac{1}{x}\right)^{3/2} - \left(\frac{1}{x}\right)^{5/3} + \left(\frac{1}{x}\right)^{11/6} - \left(\frac{1}{x}\right)^{2} + \left(\frac{1}{x}\right)^{13/6} - \left(\frac{1}{x}\right)^{7/3} + \left(\frac{1}{x}\right)^{5/2} - \left(\frac{1}{x}\right)^{8/3} + \left(\frac{1}{x}\right)^{17/6} - \left(\frac{1}{x}\right)^{3} + \left(\frac{1}{x}\right)^{19/6} - \left(\frac{1}{x}\right)^{10/3} + \left(\frac{1}{x}\right)^{7/2} - \left(\frac{1}{x}\right)^{11/3} + \left(\frac{1}{x}\right)^{23/6} - \left(\frac{1}{x}\right)^{4} + \left(\frac{1}{x}\right)^{25/6} - \left(\frac{1}{x}\right)^{13/3} + \left(\frac{1}{x}\right)^{9/2} - \left(\frac{1}{x}\right)^{14/3} + \left(\frac{1}{x}\right)^{29/6} - \left(\frac{1}{x}\right)^{5} + O\left(\left(\frac{1}{x}\right)^{31/6}\right)\right) +$$

$$\left(\sqrt{x} - \sqrt[3]{x} + \sqrt[6]{x} - 1 + \sqrt[6]{\frac{1}{x}} - \sqrt[3]{\frac{1}{x}} + \sqrt{\frac{1}{x}} - \left(\frac{1}{x}\right)^{2/3} + \left(\frac{1}{x}\right)^{5/6} - \frac{1}{x} + \left(\frac{1}{x}\right)^{7/6} - \left(\frac{1}{x}\right)^{4/3} + \left(\frac{1}{x}\right)^{3/2} - \left(\frac{1}{x}\right)^{5/3} + \left(\frac{1}{x}\right)^{11/6} - \left(\frac{1}{x}\right)^{2} + \left(\frac{1}{x}\right)^{13/6} - \left(\frac{1}{x}\right)^{7/3} + \left(\frac{1}{x}\right)^{5/2} - \left(\frac{1}{x}\right)^{8/3} + \left(\frac{1}{x}\right)^{17/6} - \left(\frac{1}{x}\right)^{3} + \left(\frac{1}{x}\right)^{19/6} - \left(\frac{1}{x}\right)^{10/3} + \left(\frac{1}{x}\right)^{7/2} - \left(\frac{1}{x}\right)^{11/3} + \left(\frac{1}{x}\right)^{23/6} - \left(\frac{1}{x}\right)^{4} + \left(\frac{1}{x}\right)^{25/6} - \left(\frac{1}{x}\right)^{13/3} + \left(\frac{1}{x}\right)^{9/2} - \left(\frac{1}{x}\right)^{14/3} + \left(\frac{1}{x}\right)^{29/6} - \left(\frac{1}{x}\right)^{5} + O\left(\left(\frac{1}{x}\right)^{31/6}\right)\right)$$

Big-O notation »

Derivative: Step–by–step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{d^2\,x\,t}{d^2}+\frac{d^2\,e^x\,t}{d^2}}{\frac{d^2\,\sqrt[3]{x}\,t}{d^2}+\frac{d^2\,\sqrt{x}\,t}{d^2}}\right)=\frac{e^x\left(6\,x^{7/6}+6\,x-3\,\sqrt[6]{x}-2\right)+\left(3\,\sqrt[6]{x}+4\right)x}{6\left(\sqrt[6]{x}+1\right)^2\,x^{4/3}}$$

Limit:

$$\lim_{t\to-\infty}\frac{e^x\,t+t\,x}{t\,\sqrt[3]{x}+t\,\sqrt{x}}=\frac{-x-e^x}{-\sqrt{x}-\sqrt[3]{x}}\approx\frac{-x-2.71828^x}{-\sqrt{x}-\sqrt[3]{x}}$$

$$\lim_{t\to\infty}\frac{e^x\,t+t\,x}{t\,\sqrt[3]{x}+t\,\sqrt{x}}=\frac{x+e^x}{\sqrt{x}+\sqrt[3]{x}}\approx\frac{x+2.71828^x}{\sqrt{x}+\sqrt[3]{x}}$$

WolframAlpha

[{d^2x/d^2t}+{d^2e^x/d^2t}]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}] Eq 12

In[8]:=
```
(d^2*(x/d^2)*t + d^2*(E^x/d^2)*t)/(d^2*(x^(1/3)/d^2)*t + d^2*(Sqrt[x]/d^2)*t)
```

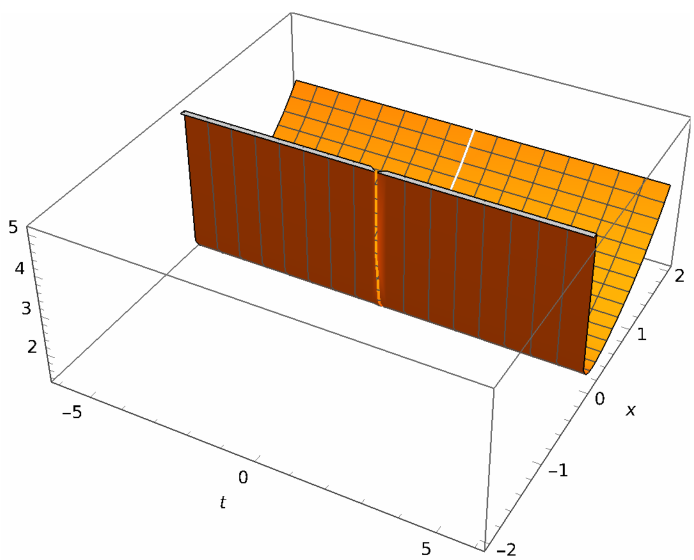
Out[8]=

$$\frac{t\,e^x+t\,x}{t\,\sqrt{x}+t\,\sqrt[3]{x}}$$

In[9]:=

$$\text{Plot3D}\left[\frac{e^U t+t\,x}{t\,x^{/}+t\,\sqrt{x}},\{t,-6.,6.\},\{x,-2.00691,2.00691\}\right]$$

Out[9]=



[{d^2x/d^2t}sinx+{d^2e^x/d^2t}tanx]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]

In[10]:=

```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(E^x/d^2)*t)*Tan[x])/
 (d^2*(x^(1/3)/d^2)*t + (d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[10]=

$$\frac{t\,x\sin(x)+t\,e^x\tan(x)}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}$$

In[12]:= **[{d^2x/d^2t}sinx+{d^2e^x/d^2t}tanx]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]**

Out[12]=

Input:

$$\frac{\left(d^2\times\frac{x}{d^2}\,t\right)\sin(x)+\left(d^2\times\frac{e^x}{d^2}\,t\right)\tan(x)}{d^2\times\frac{\sqrt[3]{x}}{d^2}\,t+\left(d^2\times\frac{\sqrt{x}}{d^2}\,t\right)\sin(x)}$$

Result:

$$\frac{t\,x\sin(x)+t\,e^x\tan(x)}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}$$

Alternate forms: More

$$\frac{(e^x+x\cos(x))\tan(x)}{\sqrt[3]{x}+\sqrt{x}\,\sin(x)}$$

$$\frac{(e^x+x\cos(x))\tan(x)}{\sqrt[3]{x}\left(\sqrt[6]{x}\,\sin(x)+1\right)}$$

$$\frac{x\sin(x)+e^x\tan(x)}{\sqrt[3]{x}\left(\sqrt[6]{x}\,\sin(x)+1\right)}$$

Expanded form:

$$\frac{t\,x\sin(x)}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}+\frac{t\,e^x\tan(x)}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}$$

Series expansion at x = 0:

$$x^{2/3}+2\,x^{5/3}-x^{11/6}+\frac{5\,x^{8/3}}{6}-2\,x^{17/6}+x^3+\frac{x^{11/3}}{3}-\frac{2\,x^{23/6}}{3}+2\,x^4-x^{25/6}+\frac{41\,x^{14/3}}{120}+\frac{x^5}{2}-2\,x^{31/6}+x^{16/3}+O\left(x^{17/3}\right)$$

(Puiseux series)

Big-O notation »

Derivative: Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{(d^2\,x\,t)\sin(x)}{d^2}+\frac{(d^2\,e^x\,t)\tan(x)}{d^2}}{\frac{d^2\,\sqrt[3]{x}\,t}{d^2}+\frac{(d^2\,\sqrt{x}\,t)\sin(x)}{d^2}}\right)=\frac{1}{6\,x^{4/3}\left(\sqrt[6]{x}\,\sin(x)+1\right)^2}$$

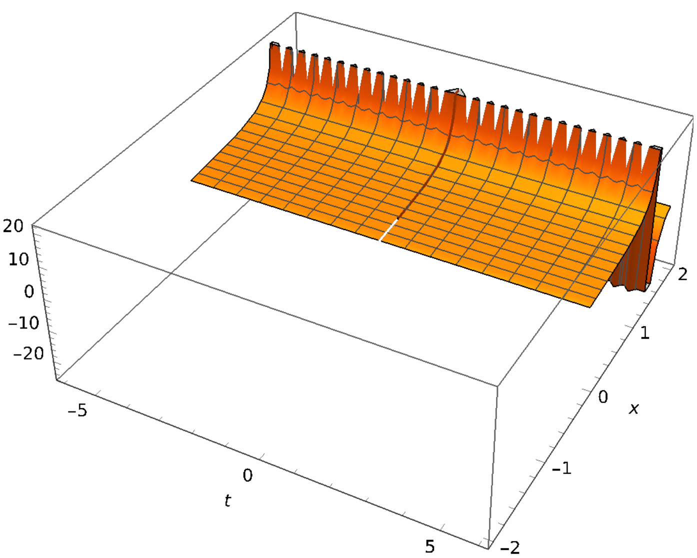
$$\left(6\,x\left(\sqrt[6]{x}\,\sin(x)+1\right)\left(\sin(x)+x\cos(x)+e^x\tan(x)+e^x\sec^2(x)\right)-\right.$$
$$\left.(x\sin(x)+e^x\tan(x))\left(6\,x^{7/6}\cos(x)+3\,\sqrt[6]{x}\,\sin(x)+2\right)\right)$$

sec(x) is the secant function »

WolframAlpha

In[11]:= Plot3D[$\frac{\text{t x Sin[x]} + e^{U}\text{t Tan[x]}}{\text{t x}^{/} + \text{t}\sqrt{\text{x}}\text{ Sin[x]}}$, {t, -6., 6.}, {x, -2.00691, 2.00691}]

Out[11]=



[{d^2x/d^2t}sinx+{d^2e^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx] Eq 13

In[13]:=
```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(E^x/d^2)*t)*Tan[x])/
 ((d^2*(x^(1/3)/d^2)*t)*(d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[13]=

$$\frac{\csc(x)\left(t\,x\sin(x)+t\,e^x\tan(x)\right)}{t^2\,x^{5/6}}$$

In[15]:= **[{d^2x/d^2t}sinx+{d^2e^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]**

Out[15]=

Input:

$$\frac{\left(d^2 \times \frac{x}{d^2}\ t\right) \sin(x) + \left(d^2 \times \frac{e^x}{d^2}\ t\right) \tan(x)}{\left(d^2 \times \frac{\sqrt[3]{x}}{d^2}\ t\right)\left(d^2 \times \frac{\sqrt{x}}{d^2}\ t\right) \sin(x)}$$

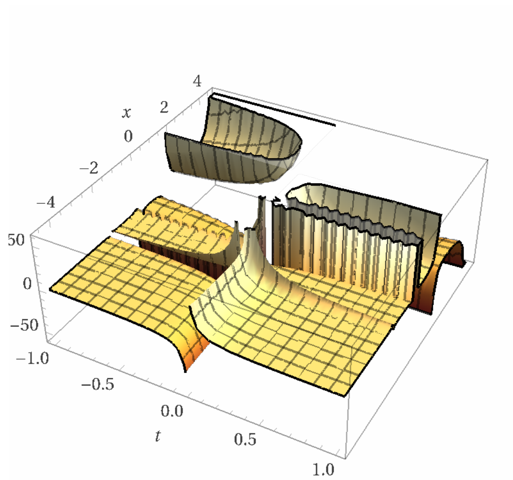
Result:

$$\frac{\csc(x)\,(t\,x \sin(x) + t\,e^x \tan(x))}{t^2\,x^{5/6}}$$

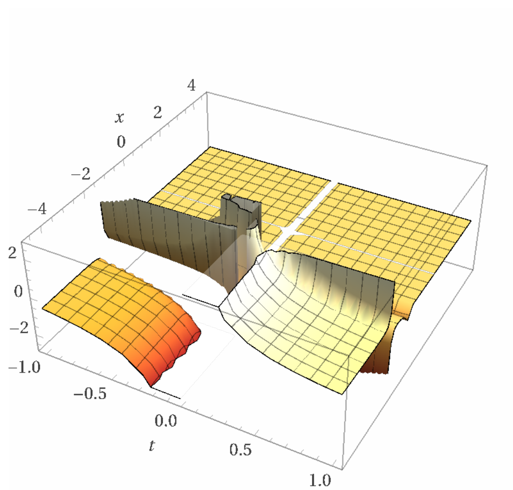
csc(x) is the cosecant function »

3D plots:

Real part:

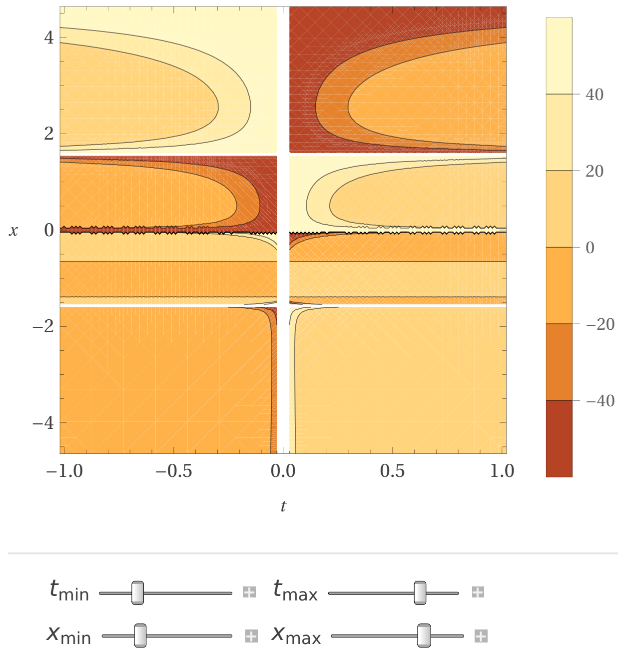


Imaginary part:

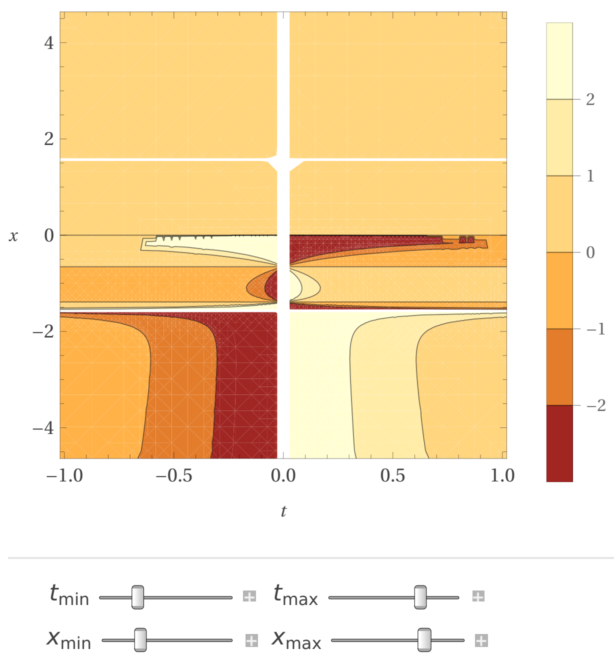


Contour plots:

Real part:



Imaginary part:



Alternate forms:

More

$$\frac{x + e^x \sec(x)}{t\, x^{5/6}}$$

$$\frac{(e^x + x\cos(x))\sec(x)}{t\, x^{5/6}}$$

$$\frac{\frac{e^x \sec(x)}{x^{5/6}} + \sqrt[6]{x}}{t}$$

sec(x) is the secant function »

Expanded form:

$$\frac{e^x \sec(x)}{t\, x^{5/6}} + \frac{\sqrt[6]{x}}{t}$$

Series expansion at x = 0:

$$O\left(\frac{1}{x^{25}}\right)$$

(Taylor series)

Big-O notation »

Derivative:

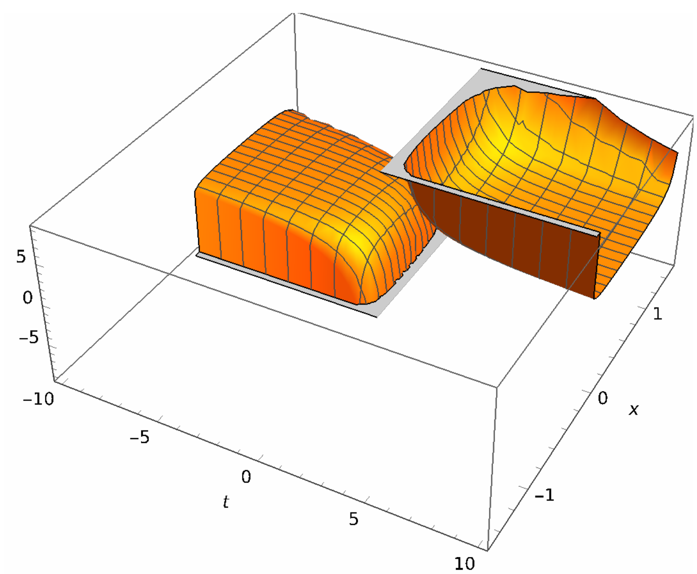
Step–by–step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{(d^2\, x\, t)\sin(x)}{d^2} + \frac{(d^2\, e^x\, t)\tan(x)}{d^2}}{\frac{(d^2\, \sqrt[3]{x}\, t)(d^2\, \sqrt{x}\, t)\sin(x)}{d^2\, d^2}}\right) = \frac{x + e^x (6\, x - 5)\sec(x) + 6\, e^x\, x \csc(x)(\sec^2(x) - 1)}{6\, t\, x^{11/6}}$$

WolframAlpha

In[14]:= $\text{Plot3D}\left[\frac{\text{Csc[x]}\,(\text{t x Sin[x]} + e^{x}\text{ t Tan[x]})}{t^2\, x^{5/6}}, \{t, -10., 10.\}, \{x, -1.50958, 1.50958\}\right]$

Out[14]=



[{d^2x/d^2t}sinx+{d^2e^x/d^2t}tanx]^2/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx] Eq 13

In[1]:=
```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(E^x/d^2)*t)*Tan[x])^2/
  ((d^2*(x^(1/3)/d^2)*t)*(d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[1]=

$$\frac{\csc(x)\left(t\,x\sin(x)+t\,e^{x}\tan(x)\right)^{2}}{t^{2}\,x^{5/6}}$$

In[3]:= **[{d^2x/d^2t}sinx+{d^2e^x/d^2t}tanx]^2/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]**

Input:

$$\frac{\left(\left(d^2 \times \frac{x}{d^2}\ t\right)\sin(x) + \left(d^2 \times \frac{e^x}{d^2}\ t\right)\tan(x)\right)^2}{\left(d^2 \times \frac{\sqrt[3]{x}}{d^2}\ t\right)\left(d^2 \times \frac{\sqrt{x}}{d^2}\ t\right)\sin(x)}$$

Result:

$$\frac{\csc(x)\,(t\,x\sin(x) + t\,e^x\tan(x))^2}{t^2\,x^{5/6}}$$

csc(x) is the cosecant function »

Out[3]=

Alternate forms: More

$$\frac{\sin(x)\,(x + e^x\sec(x))^2}{x^{5/6}}$$

$$\frac{\left(x^2\cos^2(x) + e^{2x} + 2\,e^x\,x\cos(x)\right)\tan(x)\sec(x)}{x^{5/6}}$$

$$\frac{\left(t\,x\sin(x) + \frac{e^x\,t\sin(x)}{\cos(x)}\right)^2}{t^2\,x^{5/6}\sin(x)}$$

sec(x) is the secant function »

Expanded form:

$$x^{7/6}\sin(x) + \frac{e^{2x}\tan(x)\sec(x)}{x^{5/6}} + 2\,e^x\,\sqrt[6]{x}\,\tan(x)$$

Series expansion at x = 0:

$$\sqrt[6]{x} + 4\,x^{7/6} + \frac{35\,x^{13/6}}{6} + O\left(x^{19/6}\right)$$

(Puiseux series)

Big-O notation »

Derivative: Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{\left(\frac{(d^2\,x\,t)\sin(x)}{d^2} + \frac{(d^2\,e^x\,t)\tan(x)}{d^2}\right)^2}{\frac{(d^2\,\sqrt[3]{x}\,t)(d^2\,\sqrt{x}\,t)\sin(x)}{d^2\,d^2}}\right) =$$

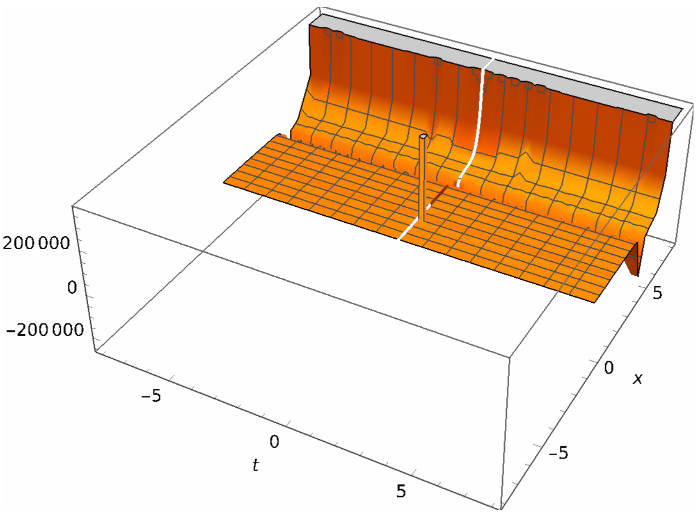
$$\frac{\cos(x)\,(x + e^x\sec(x))\,(x\,(6\,x + 7\tan(x)) + 12\,e^x\,x\sec^3(x) + e^x\,((12\,x - 5)\tan(x) - 6\,x)\sec(x))}{6\,x^{11/6}}$$

WolframAlpha

In[2]:=
```
Plot3D[Csc[x] (t x Sin[x] + e^x t Tan[x])^2 / (t^2 x^(5/6)), {t, -8, 8}, {x, -8, 8}]
```

$$\text{Plot3D}\left[\frac{\text{Csc}[x]\left(t\,x\,\text{Sin}[x]+e^{x}\,t\,\text{Tan}[x]\right)^{2}}{t^{2}\,x^{5/6}},\ \{t,-8,8\},\ \{x,-8,8\}\right]$$

Out[2]=



[{d^2x/d^2t}sinx+{d^2e^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]^2 Eq 14

In[4]:=
```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(E^x/d^2)*t)*Tan[x])/
  ((d^2*(x^(1/3)/d^2)*t)*(d^2*(Sqrt[x]/d^2)*t)*Sin[x])^2
```

Out[4]=

$$\frac{\csc^{2}(x)\left(t\,x\sin(x)+t\,e^{x}\tan(x)\right)}{t^{4}\,x^{5/3}}$$

In[6]:= **[{d^2x/d^2t}sinx+{d^2e^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]^2**

Input:

$$\frac{\left(d^{2}\times\frac{x}{d^{2}}\,t\right)\sin(x)+\left(d^{2}\times\frac{e^{x}}{d^{2}}\,t\right)\tan(x)}{\left(\left(d^{2}\times\frac{\sqrt[3]{x}}{d^{2}}\,t\right)\left(d^{2}\times\frac{\sqrt{x}}{d^{2}}\,t\right)\sin(x)\right)^{2}}$$

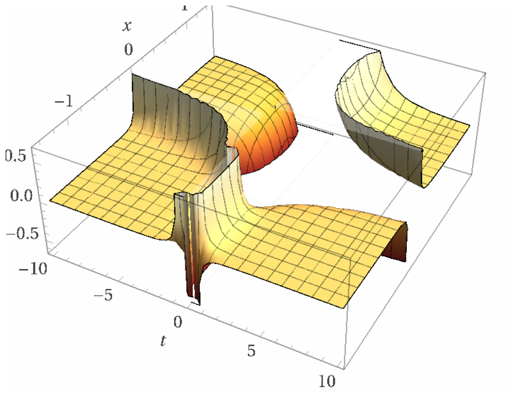
Result:

$$\frac{\csc^{2}(x)\,(t\,x\sin(x)+t\,e^{x}\tan(x))}{t^{4}\,x^{5/3}}$$

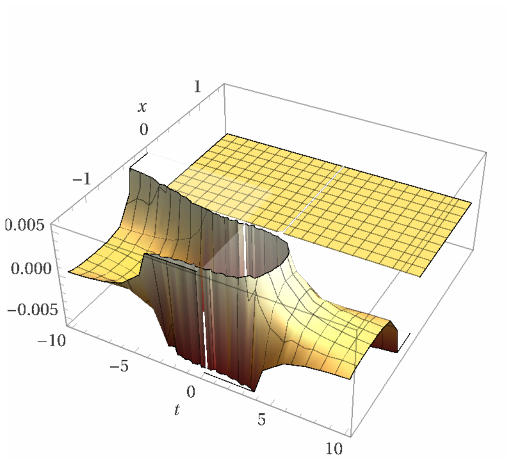
csc(x) is the cosecant function »

3D plots:

Real part:

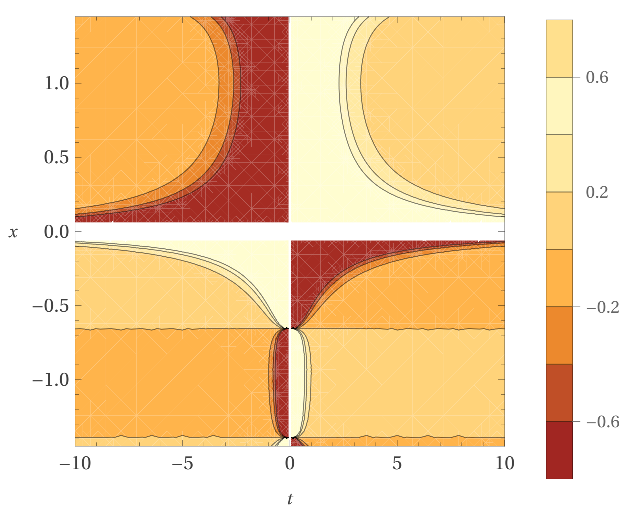


Imaginary part:



Contour plots:

Real part:

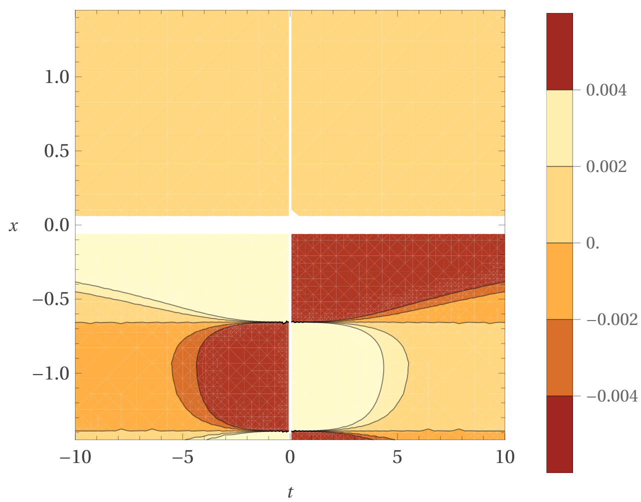


Out[6]=

t_{min} t_{max}

x_{min} x_{max}

Imaginary part:



t_{min} t_{max}
x_{min} x_{max}

Alternate forms:

More

$$\frac{\csc(x)\,(x + e^x \sec(x))}{t^3\, x^{5/3}}$$

$$\frac{(e^x + x\cos(x))\csc(x)\sec(x)}{t^3\, x^{5/3}}$$

$$\frac{\csc(x)\left(\frac{e^x \sec(x)}{x^{5/3}} + \frac{1}{x^{2/3}}\right)}{t^3}$$

sec(x) is the secant function »

Expanded form:

$$\frac{e^x \csc(x)\sec(x)}{t^3\, x^{5/3}} + \frac{\csc(x)}{t^3\, x^{2/3}}$$

Series expansion at x = 0:

$$O\left(\frac{1}{x^{19}}\right)$$

(Taylor series)

Big-O notation »

Derivative:

Step–by–step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{(d^2\,x\,t)\sin(x)}{d^2}+\frac{(d^2\,e^x\,t)\tan(x)}{d^2}}{\left(\frac{(d^2\,\sqrt[3]{x}\,t)(d^2\,\sqrt{x}\,t)\sin(x)}{d^2\,d^2}\right)^2}\right)=$$

$$-\frac{\cot(x)\,(\sec(x)\,(2\,x-e^x\,(3\,x-5)\,\sec(x))+3\,x\,\csc(x)\,(x-e^x\,\sec^3(x)+2\,e^x\,\sec(x)))}{3\,t^3\,x^{8/3}}$$

cot(x) is the cotangent function »

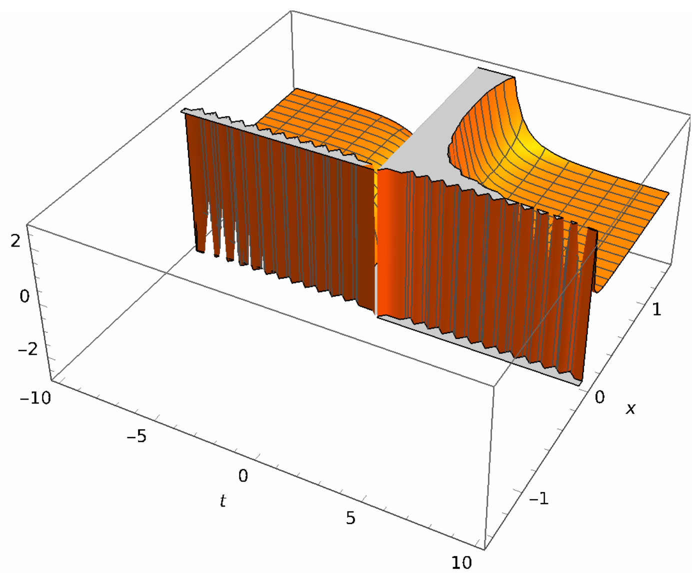
WolframAlpha

In[5]:= $\texttt{FullSimplify}\left[\frac{\texttt{Csc[x]}^2\,(\texttt{t x Sin[x]}+e^x\,\texttt{t Tan[x]})}{\texttt{t}^4\,\texttt{x}^{5/3}}\right]$

Out[5]= $$\frac{\csc(x)\,(x+e^x\,\sec(x))}{t^3\,x^{5/3}}$$

In[7]:= $\texttt{Plot3D}\left[\frac{\texttt{Csc[x]}\,(\texttt{x}+e^x\,\texttt{Sec[x]})}{\texttt{t}^3\,\texttt{x}^{5/3}}, \texttt{\{t, -10., 10.\}, \{x, -1.4497, 1.4497\}}\right]$

Out[7]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]^2 Eq 15

In[8]:=
```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])/
  ((d^2*(x^(1/3)/d^2)*t)*(d^2*(Sqrt[x]/d^2)*t)*Sin[x])^2
```

Out[8]= $$\frac{\csc^2(x)\,(t\,x\,\sin(x)+t\,\pi^x\,\tan(x))}{t^4\,x^{5/3}}$$

In[11]:= [{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]^2

Out[11]=

Input:

$$\frac{\left(d^2 \times \frac{x}{d^2}\ t\right) \sin(x) + \left(d^2 \times \frac{\pi^x}{d^2}\ t\right) \tan(x)}{\left(\left(d^2 \times \frac{\sqrt[3]{x}}{d^2}\ t\right)\left(d^2 \times \frac{\sqrt{x}}{d^2}\ t\right) \sin(x)\right)^2}$$

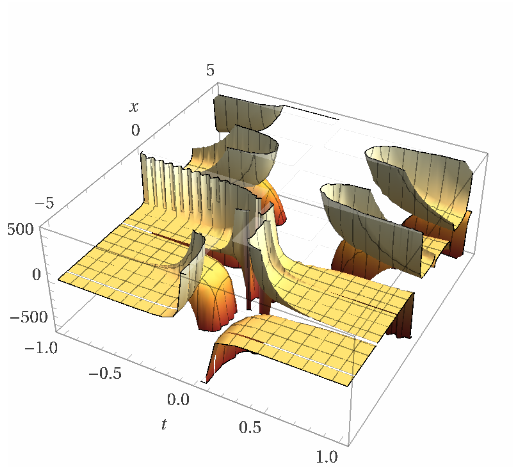
Result:

$$\frac{\csc^2(x)\,(t\,x\sin(x) + t\,\pi^x \tan(x))}{t^4\,x^{5/3}}$$

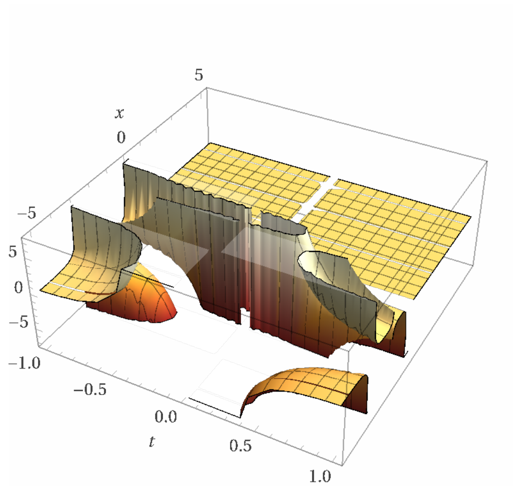
csc(x) is the cosecant function »

3D plots:

Real part:

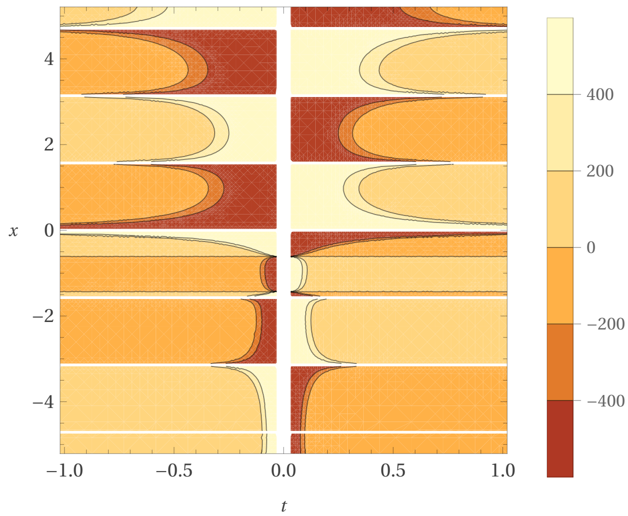


Imaginary part:



Contour plots:

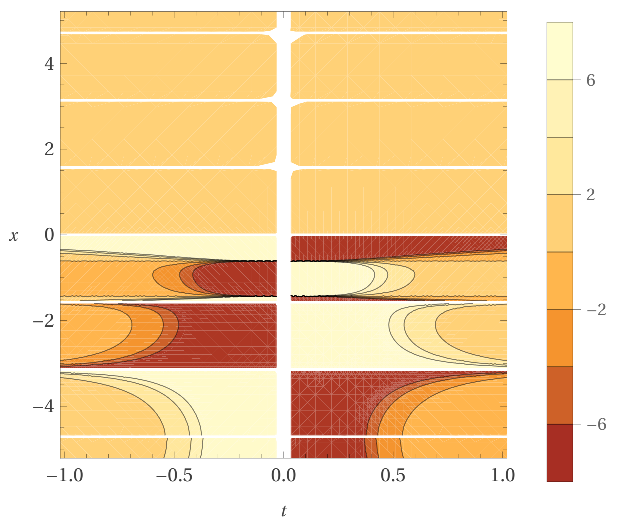
Real part:



t_{min} t_{max}

x_{min} x_{max}

Imaginary part:



t_{min} t_{max}

x_{min} x_{max}

Alternate forms:

More

$$\frac{\csc(x)\,(x + \pi^x \sec(x))}{t^3\, x^{5/3}}$$

$$\frac{(\pi^x + x\cos(x))\csc(x)\sec(x)}{t^3 x^{5/3}}$$

$$\frac{\csc(x)\left(\frac{\pi^x \sec(x)}{x^{5/3}} + \frac{1}{x^{2/3}}\right)}{t^3}$$

sec(x) is the secant function »

Partial fraction expansion: Step-by-step solution

$$\frac{\pi^x \csc(x)\sec(x)}{t^3 x^{5/3}} + \frac{\csc(x)}{t^3 x^{2/3}}$$

Series expansion at x = 0:

$$\frac{1}{t^3 x^{8/3}} + \frac{1+\log(\pi)}{t^3 x^{5/3}} + \frac{4+3\log^2(\pi)}{6\,t^3 x^{2/3}} + \frac{\sqrt[3]{x}\,\left(1+\log^3(\pi)+4\log(\pi)\right)}{6\,t^3} + \frac{x^{4/3}\left(112+15\log^4(\pi)+120\log^2(\pi)\right)}{360\,t^3} + \frac{x^{7/3}\left(7+3\log^5(\pi)+40\log^3(\pi)+112\log(\pi)\right)}{360\,t^3} + \frac{x^{10/3}\left(1984+21\log^6(\pi)+420\log^4(\pi)+2352\log^2(\pi)\right)}{15\,120\,t^3} + \frac{x^{13/3}\left(31+3\log^7(\pi)+84\log^5(\pi)+784\log^3(\pi)+1984\log(\pi)\right)}{15\,120\,t^3} + O\left(x^{16/3}\right)$$

(Puiseux series)

log(x) is the natural logarithm »

Big-O notation »

Derivative: Approximate form Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{(d^2\,x\,t)\sin(x)}{d^2} + \frac{(d^2\,\pi^x\,t)\tan(x)}{d^2}}{\left(\frac{(d^2\,\sqrt[3]{x}\,t)(d^2\,\sqrt{x}\,t)\sin(x)}{d^2\,d^2}\right)^2}\right) = -\frac{\cot(x)\left(\sec(x)\left(2x-\pi^x\left(3x\log(\pi)-5\right)\sec(x)\right)+3x\csc(x)\left(x-\pi^x\sec^3(x)+2\pi^x\sec(x)\right)\right)}{3\,t^3 x^{8/3}}$$

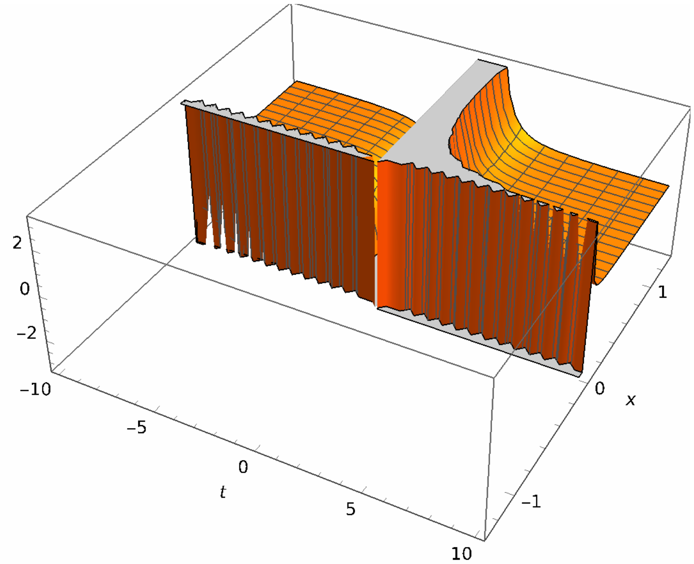
cot(x) is the cotangent function »

WolframAlpha

In[9]:=

```
Plot3D[(Csc[x]^2 (t x Sin[x] + π^x t Tan[x]))/(t^4 x^(5/3)), {t, -10., 10.}, {x, -1.30812, 1.30812}]
```

Out[9]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^2/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx] Eq 16

In[12]:=

```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])^2/
  ((d^2*(x^(1/3)/d^2)*t)*(d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[12]=

$$\frac{\csc(x)\left(t\,x\sin(x)+t\,\pi^{x}\tan(x)\right)^{2}}{t^{2}\,x^{5/6}}$$

In[14]:= **[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^2/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]**

Out[14]=

Input:

$$\frac{\left(\left(d^2 \times \frac{x}{d^2}\, t\right) \sin(x) + \left(d^2 \times \frac{\pi^x}{d^2}\, t\right) \tan(x)\right)^2}{\left(d^2 \times \frac{\sqrt[3]{x}}{d^2}\, t\right)\left(d^2 \times \frac{\sqrt{x}}{d^2}\, t\right) \sin(x)}$$

Result:

$$\frac{\csc(x)\,(t\,x \sin(x) + t\,\pi^x \tan(x))^2}{t^2\,x^{5/6}}$$

csc(x) is the cosecant function »

Alternate forms:

$$\frac{\sin(x)\,(x + \pi^x \sec(x))^2}{x^{5/6}}$$

$$\frac{\left(x^2 \cos^2(x) + \pi^{2\,x} + 2\,\pi^x\,x \cos(x)\right) \tan(x) \sec(x)}{x^{5/6}}$$

$$\frac{\left(t\,x \sin(x) + \frac{\pi^x\,t \sin(x)}{\cos(x)}\right)^2}{t^2\,x^{5/6} \sin(x)}$$

sec(x) is the secant function »

More

Expanded form:

$$x^{7/6} \sin(x) + \frac{\pi^{2\,x} \tan(x) \sec(x)}{x^{5/6}} + 2\,\pi^x\,\sqrt[6]{x}\,\tan(x)$$

Series expansion at x = 0:

$$\sqrt[6]{x} + x^{7/6}\,(2 + 2 \log(\pi)) + x^{13/6}\left(\frac{11}{6} + 2 \log^2(\pi) + 2 \log(\pi)\right) + O\left(x^{19/6}\right)$$

(Puiseux series)

log(x) is the natural logarithm »

Big-O notation »

Derivative:

Approximate form | Step-by-step solution

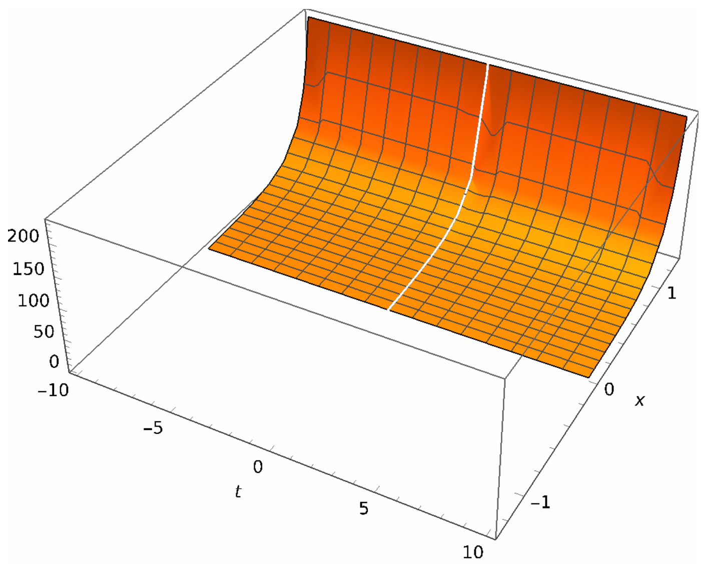
$$\frac{\partial}{\partial x}\left(\frac{\left(\frac{(d^2\,x\,t) \sin(x)}{d^2} + \frac{(d^2\,\pi^x\,t) \tan(x)}{d^2}\right)^2}{\frac{(d^2\,\sqrt[3]{x}\,t)(d^2\,\sqrt{x}\,t) \sin(x)}{d^2\,d^2}}\right) = \frac{1}{6\,x^{11/6}} \cos(x)\,(x + \pi^x \sec(x))$$

$$\left(x\,(6\,x + 7 \tan(x)) + 12\,\pi^x\,x \sec^3(x) + \pi^x \sec(x)\,((12\,x \log(\pi) - 5) \tan(x) - 6\,x)\right)$$

WolframAlpha

In[13]:= Plot3D[$\frac{\text{Csc}[x]\left(t\ x\ \text{Sin}[x]+\pi^x\ t\ \text{Tan}[x]\right)^2}{t^2\ x^{5/6}}$, {t, -10., 10.}, {x, -1.29231, 1.29231}]

Out[13]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx] Eq 17

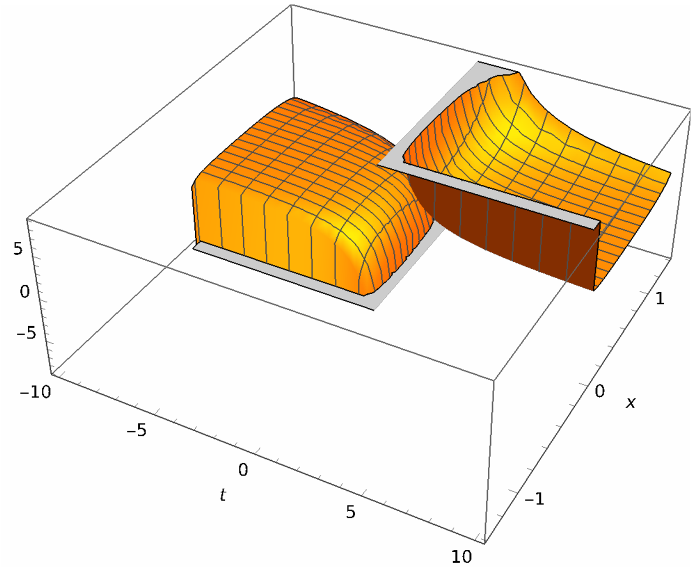
In[15]:=
```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])/
 ((d^2*(x^(1/3)/d^2)*t)*(d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[15]=

$$\frac{\csc(x)\left(t\,x\sin(x)+t\,\pi^x\tan(x)\right)}{t^2\,x^{5/6}}$$

In[16]:=
```
Plot3D[Csc[x] (t x Sin[x] + π^x t Tan[x]) / (t^2 x^(5/6)), {t, -10., 10.}, {x, -1.36799, 1.36799}]
```

Out[16]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]^3 Eq 18

In[17]:=
```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])/
  ((d^2*(x^(1/3)/d^2)*t)*(d^2*(Sqrt[x]/d^2)*t)*Sin[x])^3
```

Out[17]=

$$\frac{\csc^3(x)\left(t\, x \sin(x) + t\, \pi^x \tan(x)\right)}{t^6\, x^{5/2}}$$

In[19]:= **[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]^3**

Out[19]=

Input:

$$\frac{\left(d^2 \times \frac{x}{d^2}\ t\right)\sin(x) + \left(d^2 \times \frac{\pi^x}{d^2}\ t\right)\tan(x)}{\left(\left(d^2 \times \frac{\sqrt[3]{x}}{d^2}\ t\right)\left(d^2 \times \frac{\sqrt{x}}{d^2}\ t\right)\sin(x)\right)^3}$$

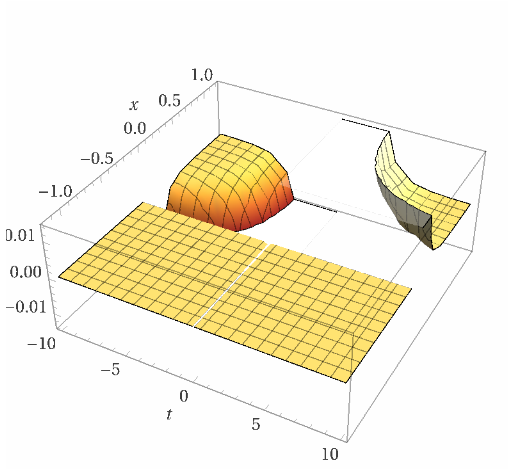
Result:

$$\frac{\csc^3(x)\,(t\, x \sin(x) + t\, \pi^x \tan(x))}{t^6\, x^{5/2}}$$

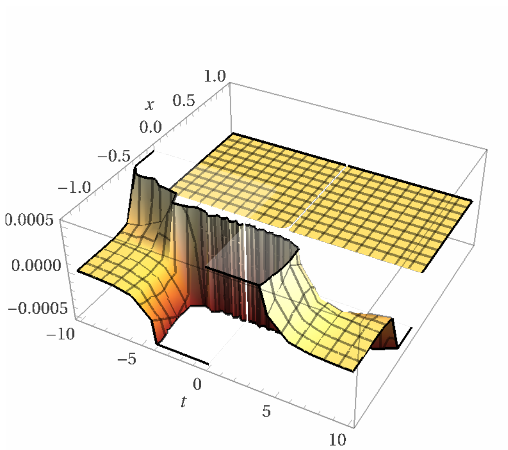
csc(x) is the cosecant function »

3D plots:

Real part:

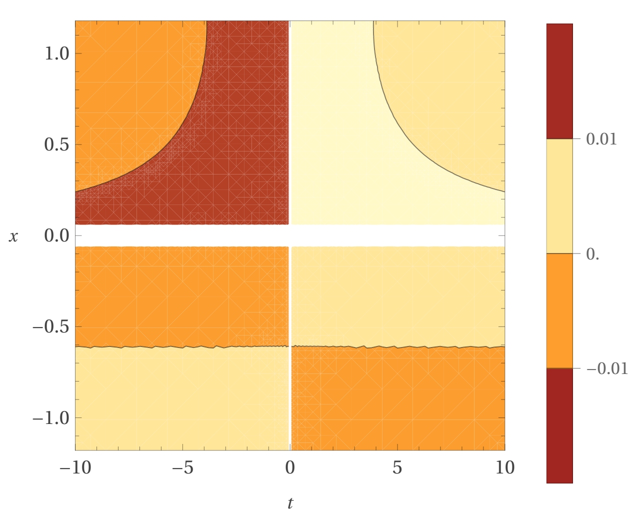


Imaginary part:



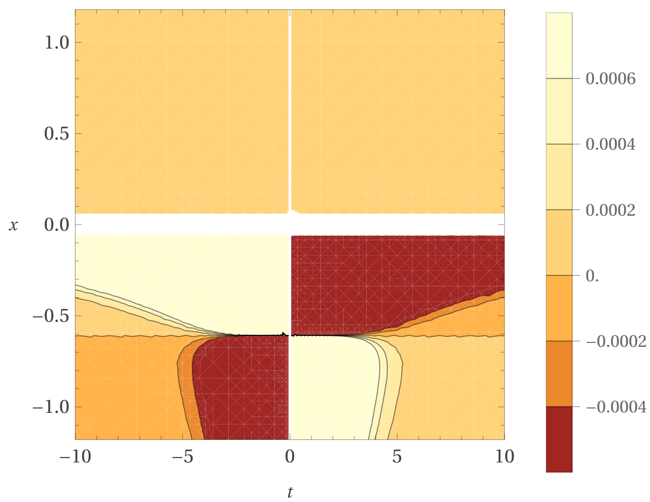
Contour plots:

Real part:



t_{min} t_{max}
x_{min} x_{max}

Imaginary part:



t_{min} t_{max}
x_{min} x_{max}

Alternate forms: More

$$\frac{\csc^2(x)\,(x+\pi^x \sec(x))}{t^5\,x^{5/2}}$$

$$\frac{(\pi^x + x\cos(x))\csc^2(x)\sec(x)}{t^5\,x^{5/2}}$$

$$\frac{\csc^2(x)\left(\frac{\pi^x \sec(x)}{x^{5/2}} + \frac{1}{x^{3/2}}\right)}{t^5}$$

sec(x) is the secant function »

Partial fraction expansion: Step-by-step solution

$$\frac{\pi^x \csc^2(x)\sec(x)}{t^5\,x^{5/2}} + \frac{\csc^2(x)}{t^5\,x^{3/2}}$$

Derivative: Approximate form Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{(d^2\,x\,t)\sin(x)}{d^2} + \frac{(d^2\,\pi^x\,t)\tan(x)}{d^2}}{\left(\frac{(d^2\,\sqrt[3]{x}\,t)(d^2\,\sqrt{x}\,t)\sin(x)}{d^2\,d^2}\right)^3}\right) = -\frac{1}{2\,t^5\,x^{7/2}}\cot(x)\csc(x)$$

$$\left(\sec(x)\,(3\,x-\pi^{u}\,(2\,x\log(\pi)-5)\sec(x))+2\,x\csc(x)\left(2\,x-\pi^{u}\sec^{3}(x)+3\,\pi^{u}\sec(x)\right)\right)$$

cot(x) is the cotangent function »

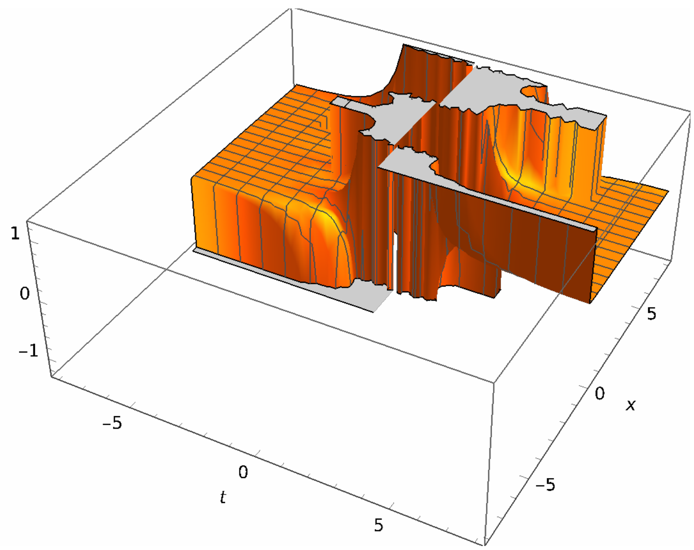
log(x) is the natural logarithm »

WolframAlpha

In[18]:=

```
Plot3D[Csc[x]^3 (t x Sin[x] + π^x t Tan[x]) / (t^6 x^(5/2)), {t, -8, 8}, {x, -8, 8}]
```

Out[18]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx] Eq 19

In[20]:=

```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])/
 (d^2*(x^(1/3)/d^2)*t + (d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[20]=

$$\frac{t\,x\sin(x)+t\,\pi^{x}\tan(x)}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}$$

In[22]:= [{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]

Out[22]=

Input:

$$\frac{\left(d^2\times\frac{x}{d^2}\,t\right)\sin(x)+\left(d^2\times\frac{\pi^x}{d^2}\,t\right)\tan(x)}{d^2\times\frac{\sqrt[3]{x}}{d^2}\,t+\left(d^2\times\frac{\sqrt{x}}{d^2}\,t\right)\sin(x)}$$

Result:

$$\frac{t\,x\sin(x) + t\,\pi^x\tan(x)}{t\,\sqrt[3]{x} + t\,\sqrt{x}\,\sin(x)}$$

Alternate forms:

More

$$\frac{(\pi^x + x\cos(x))\tan(x)}{\sqrt[3]{x} + \sqrt{x}\,\sin(x)}$$

$$\frac{(\pi^x + x\cos(x))\tan(x)}{\sqrt[3]{x}\left(\sqrt[6]{x}\,\sin(x) + 1\right)}$$

$$\frac{x\sin(x) + \pi^x\tan(x)}{\sqrt[3]{x}\left(\sqrt[6]{x}\,\sin(x) + 1\right)}$$

Expanded form:

$$\frac{t\,x\sin(x)}{t\,\sqrt[3]{x} + t\,\sqrt{x}\,\sin(x)} + \frac{t\,\pi^x\tan(x)}{t\,\sqrt[3]{x} + t\,\sqrt{x}\,\sin(x)}$$

Series expansion at x = 0:

$$x^{2/3} + x^{5/3}(1 + \log(\pi)) - x^{11/6} + \frac{1}{6}x^{8/3}\left(2 + 3\log^2(\pi)\right) + x^{17/6}(-1 - \log(\pi)) +$$
$$x^3 + \frac{1}{6}x^{11/3}\left(-1 + \log^3(\pi) + 2\log(\pi)\right) + \frac{1}{6}x^{23/6}\left(-1 - 3\log^2(\pi)\right) +$$
$$x^4(1 + \log(\pi)) - x^{25/6} + \frac{1}{120}x^{14/3}\left(16 + 5\log^4(\pi) + 20\log^2(\pi)\right) +$$
$$\frac{1}{6}x^{29/6}\left(2 - \log^3(\pi) - \log(\pi)\right) + \frac{1}{2}x^5\log^2(\pi) + x^{31/6}(-1 - \log(\pi)) + x^{16/3} + O\left(x^{17/3}\right)$$

(Puiseux series)

log(x) is the natural logarithm »

Big-O notation »

Derivative:

Approximate form | Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{(d^2\,x\,t)\sin(x)}{d^2} + \frac{(d^2\,\pi^x\,t)\tan(x)}{d^2}}{\frac{d^2\,\sqrt[3]{x}\,t}{d^2} + \frac{(d^2\,\sqrt{x}\,t)\sin(x)}{d^2}}\right) = \frac{1}{6\,x^{4/3}\left(\sqrt[6]{x}\,\sin(x) + 1\right)^2}$$
$$\left(6\,x\left(\sqrt[6]{x}\,\sin(x) + 1\right)\left(\sin(x) + x\cos(x) + \pi^x\sec^2(x) + \pi^x\log(\pi)\tan(x)\right) -\right.$$
$$\left.(x\sin(x) + \pi^x\tan(x))\left(6\,x^{7/6}\cos(x) + 3\,\sqrt[6]{x}\,\sin(x) + 2\right)\right)$$

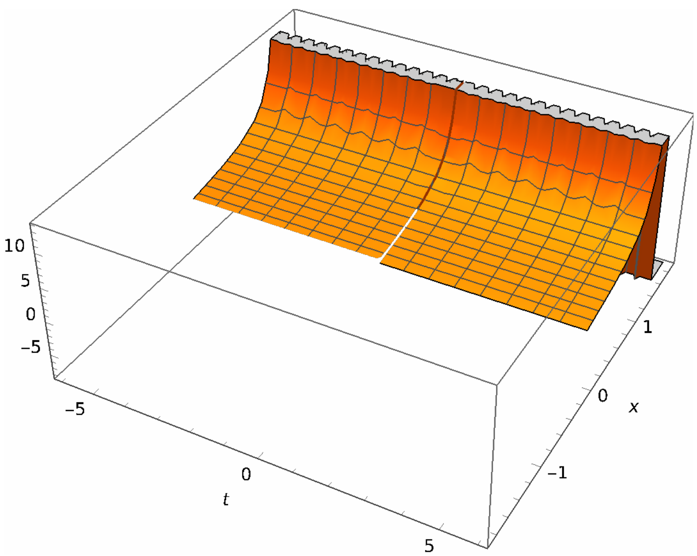
sec(x) is the secant function »

WolframAlpha

In[21]:=

```
Plot3D[(t x Sin[x] + π^x t Tan[x])/(t x^(1/3) + t √x Sin[x]), {t, -6., 6.}, {x, -1.87476, 1.87476}]
```

Out[21]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]^2 Eq 20

In[23]:=

```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])/
 (d^2*(x^(1/3)/d^2)*t + (d^2*(Sqrt[x]/d^2)*t)*Sin[x])^2
```

Out[23]=

$$\frac{t\,x\sin(x)+t\,\pi^x\tan(x)}{\left(t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)\right)^2}$$

In[25]:= **[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]^2**

Out[25]=

Input:

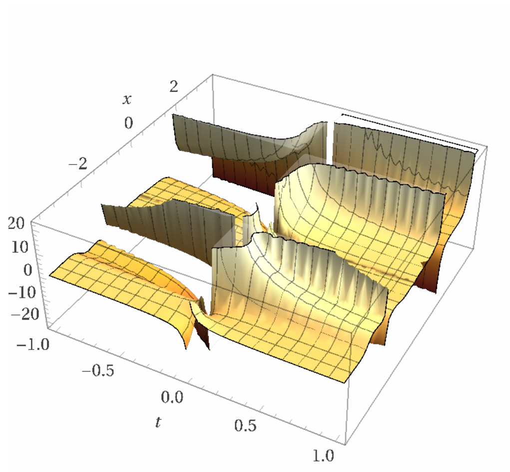
$$\frac{\left(d^2\times\frac{x}{d^2}\,t\right)\sin(x)+\left(d^2\times\frac{\pi^x}{d^2}\,t\right)\tan(x)}{\left(d^2\times\frac{\sqrt[3]{x}}{d^2}\,t+\left(d^2\times\frac{\sqrt{x}}{d^2}\,t\right)\sin(x)\right)^2}$$

Result:

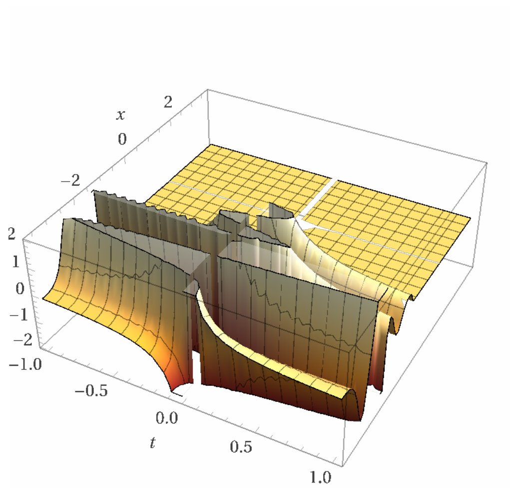
$$\frac{t\,x\sin(x)+t\,\pi^x\tan(x)}{\left(t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)\right)^2}$$

3D plots:

Real part:

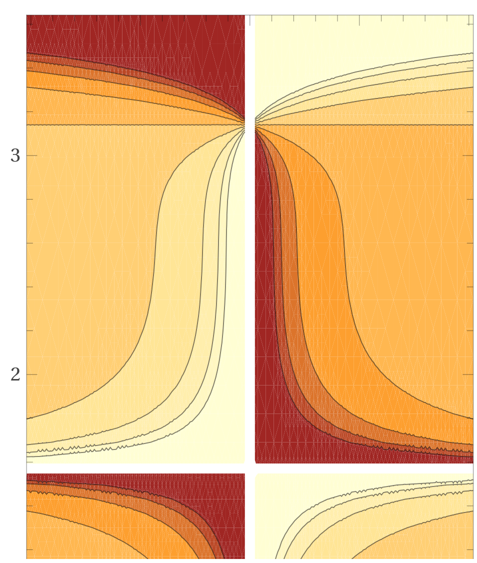


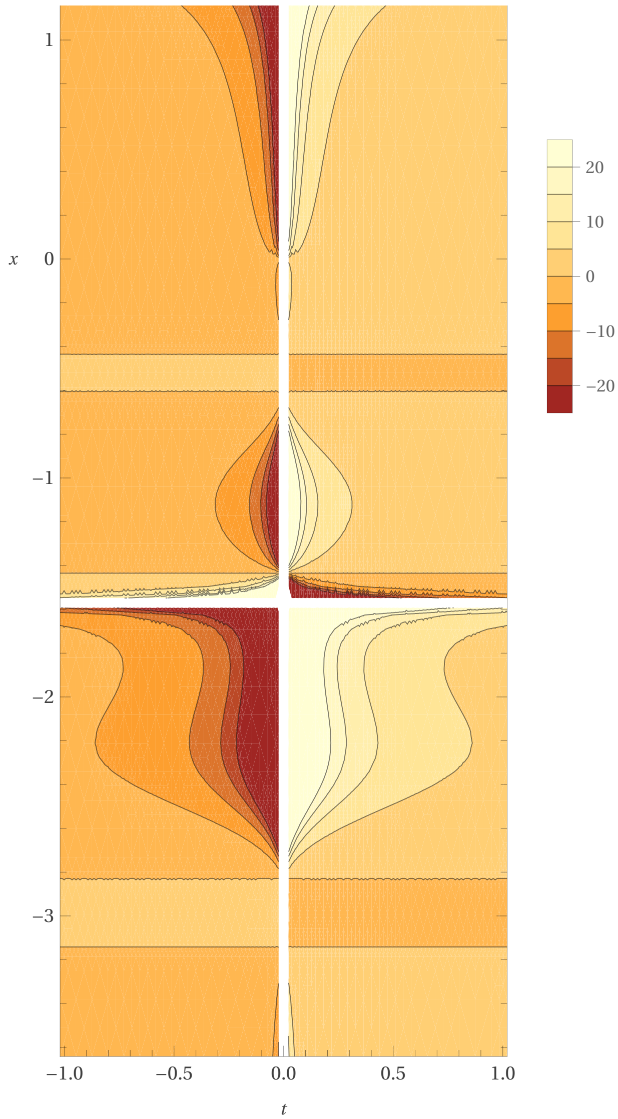
Imaginary part:



Contour plots:

Real part:

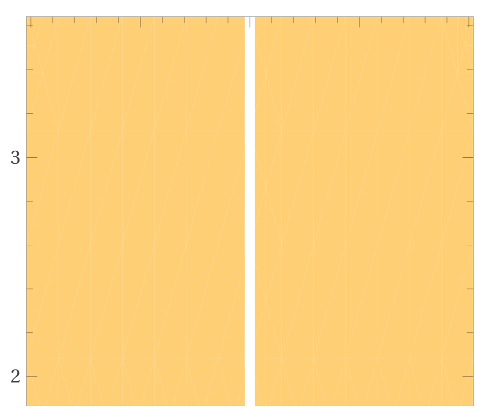


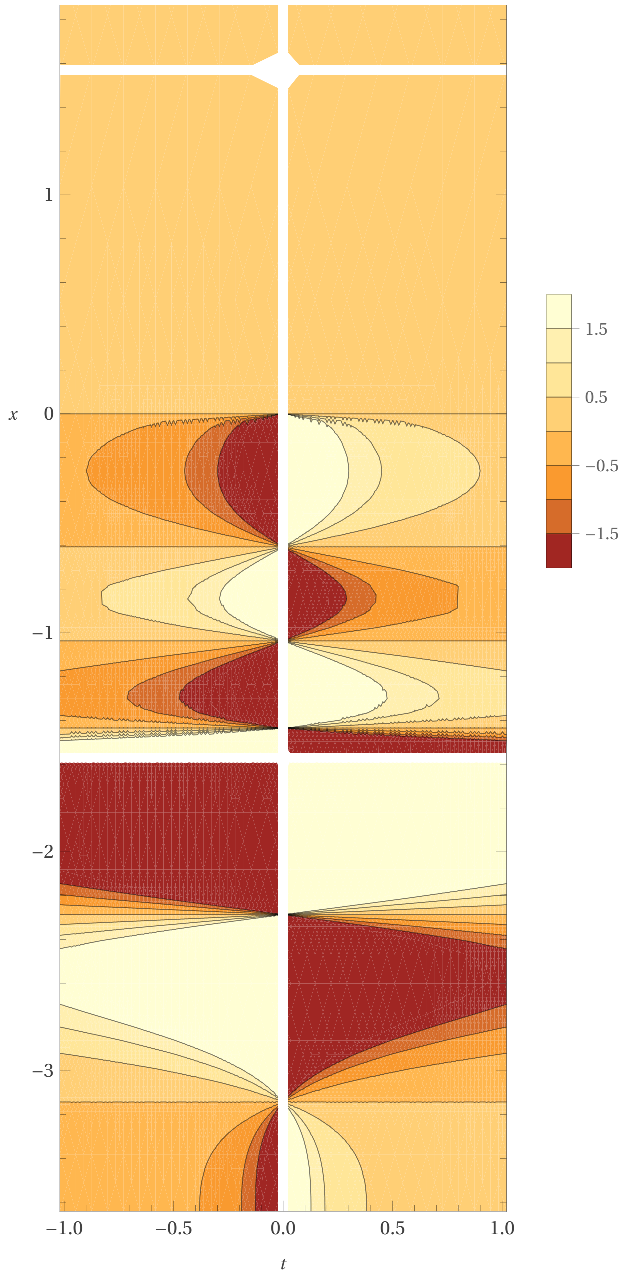


t_{min} t_{max}

x_{min} x_{max}

Imaginary part:





t_{min} t_{max}

x_{min} x_{max}

Alternate forms:

More

$$\frac{(\pi^x + x\cos(x))\tan(x)}{t\,x^{2/3}\left(\sqrt[6]{x}\,\sin(x)+1\right)^2}$$

$$\frac{x\sin(x) + \pi^x\tan(x)}{t\,x^{2/3}\left(\sqrt[6]{x}\,\sin(x)+1\right)^2}$$

$$\frac{t\,x\sin(x)+\frac{\pi^x\,t\sin(x)}{\cos(x)}}{\left(t\sqrt[3]{x}+t\sqrt{x}\,\sin(x)\right)^2}$$

Partial fraction expansion:

Step-by-step solution

$$\frac{\pi^x\tan(x)}{t\,x^{2/3}\left(\sqrt[6]{x}\,\sin(x)+1\right)^2}+\frac{\sqrt[3]{x}\,\sin(x)}{t\left(\sqrt[6]{x}\,\sin(x)+1\right)^2}$$

Expanded forms:

$$\frac{t\,x\sin(x)}{\left(t\sqrt[3]{x}+t\sqrt{x}\,\sin(x)\right)^2}+\frac{t\,\pi^x\tan(x)}{\left(t\sqrt[3]{x}+t\sqrt{x}\,\sin(x)\right)^2}$$

$$\frac{t\,x\sin(x)}{2\,t^2\,x^{5/6}\sin(x)+t^2\,x^{2/3}+t^2\,x\sin^2(x)}+\frac{t\,\pi^x\tan(x)}{2\,t^2\,x^{5/6}\sin(x)+t^2\,x^{2/3}+t^2\,x\sin^2(x)}$$

Derivative:

Approximate form | Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{(d^2\,x\,t)\sin(x)}{d^2}+\frac{(d^2\,\pi^x\,t)\tan(x)}{d^2}}{\left(\frac{d^2\sqrt[3]{x}\,t}{d^2}+\frac{(d^2\sqrt{x}\,t)\sin(x)}{d^2}\right)^2}\right)=$$

$$\left(3\,x\left(\sqrt[6]{x}\,\sin(x)+1\right)\left(\sin(x)+x\cos(x)+\pi^x\sec^2(x)+\pi^x\log(\pi)\tan(x)\right)-\left(x\sin(x)+\pi^x\tan(x)\right)\left(6\,x^{7/6}\cos(x)+3\sqrt[6]{x}\,\sin(x)+2\right)\right)\Big/\left(3\,t\,x^{5/3}\left(\sqrt[6]{x}\,\sin(x)+1\right)^3\right)$$

sec(x) is the secant function »

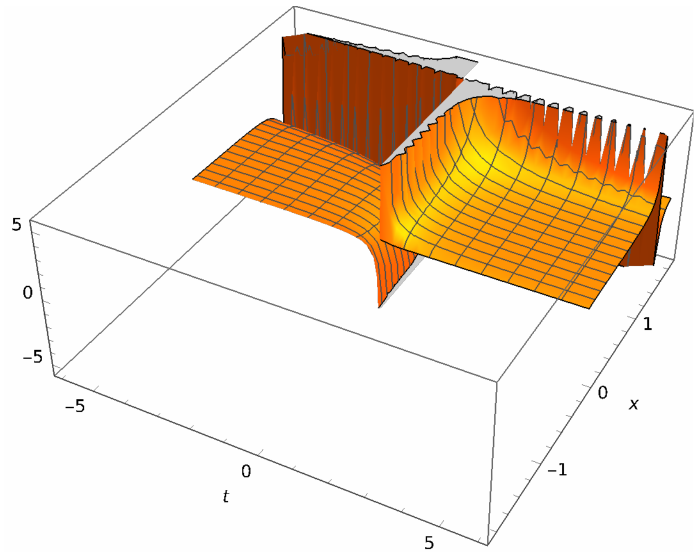
log(x) is the natural logarithm »

WolframAlpha

In[24]:=

$$\text{Plot3D}\left[\frac{t\,x\,\text{Sin}[x]+\pi^x\,t\,\text{Tan}[x]}{\left(t\,x^{1/3}+t\sqrt{x}\,\text{Sin}[x]\right)^2},\{t,-6.,6.\},\{x,-1.87476,1.87476\}\right]$$

Out[24]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^2/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx] Eq 21

In[26]:=

```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])^2/
 (d^2*(x^(1/3)/d^2)*t + (d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[26]=

$$\frac{(t\,x\sin(x)+t\,\pi^x\tan(x))^2}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}$$

[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^2/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]

Out[29]=

Input:

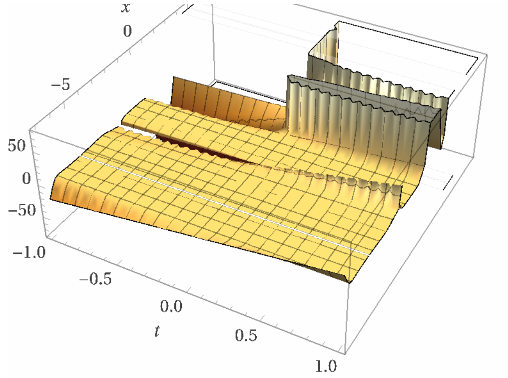
$$\frac{\left(\left(d^2\times\frac{x}{d^2}\,t\right)\sin(x)+\left(d^2\times\frac{\pi^x}{d^2}\,t\right)\tan(x)\right)^2}{d^2\times\frac{\sqrt[3]{x}}{d^2}\,t+\left(d^2\times\frac{\sqrt{x}}{d^2}\,t\right)\sin(x)}$$

Result:

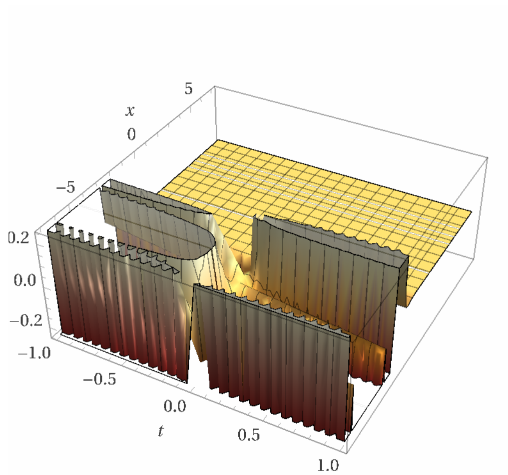
$$\frac{(t\,x\sin(x)+t\,\pi^x\tan(x))^2}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}$$

3D plots:

Real part:

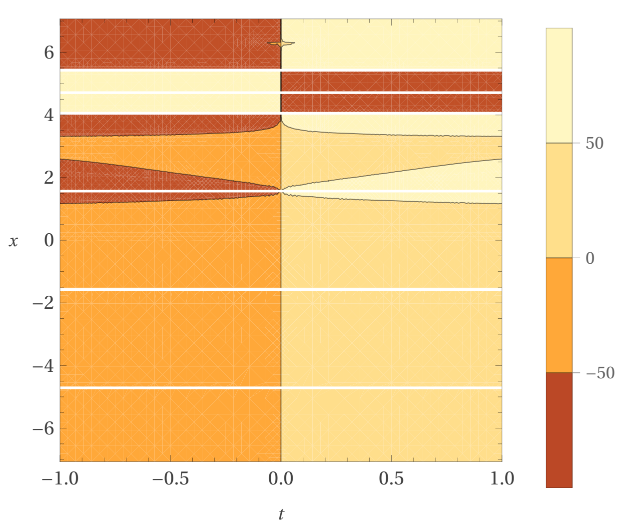


Imaginary part:



Contour plots:

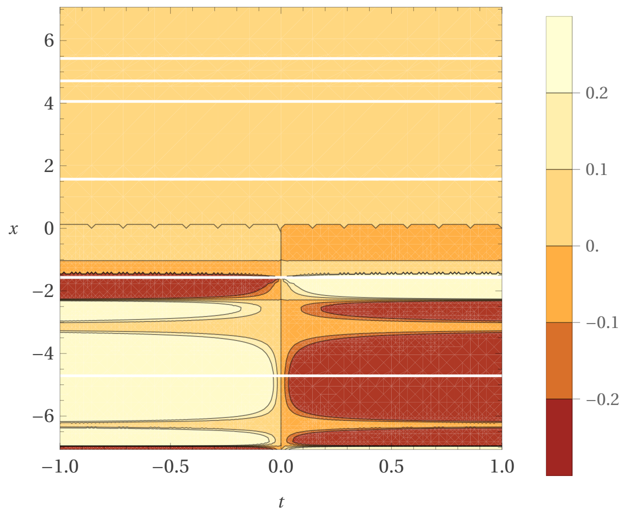
Real part:



t_{min} t_{max}

x_{min} x_{max}

Imaginary part:



t_{min} t_{max}

x_{min} x_{max}

Alternate forms: More

$$\frac{t\,(x\sin(x)+\pi^x\tan(x))^2}{\sqrt[3]{x}+\sqrt{x}\,\sin(x)}$$

$$\frac{t\,(x\sin(x)+\pi^x\tan(x))^2}{\sqrt[3]{x}\left(\sqrt[6]{x}\,\sin(x)+1\right)}$$

$$\frac{t\,(\pi^x+x\cos(x))^2\tan^2(x)}{\sqrt[3]{x}\left(\sqrt[6]{x}\,\sin(x)+1\right)}$$

Expanded form:

$$\frac{t^2\,x^2\sin^2(x)}{t\sqrt[3]{x}+t\sqrt{x}\,\sin(x)}+\frac{t^2\,\pi^{2x}\tan^2(x)}{t\sqrt[3]{x}+t\sqrt{x}\,\sin(x)}+\frac{2\,t^2\,\pi^x\,x\sin(x)\tan(x)}{t\sqrt[3]{x}+t\sqrt{x}\,\sin(x)}$$

Derivative: Approximate form Step-by-step solution

$$\frac{\partial}{\partial x}\left(\frac{\left(\frac{(d^2\,x\,t)\sin(x)}{d^2}+\frac{(d^2\,\pi^x\,t)\tan(x)}{d^2}\right)^2}{\frac{d^2\sqrt[3]{x}\,t}{d^2}+\frac{(d^2\sqrt{x}\,t)\sin(x)}{d^2}}\right)=$$

$$\frac{2\,(t\,x\sin(x)+t\,\pi^x\tan(x))\,(t\sin(x)+t\,x\cos(x)+t\,\pi^x\sec^2(x)+t\,\pi^x\log(\pi)\tan(x))}{t\sqrt[3]{x}+t\sqrt{x}\,\sin(x)}-$$

$$\frac{(t\,x\sin(x)+t\,\pi^x\tan(x))^2\left(\frac{t}{3\,x^{2/3}}+\frac{t\sin(x)}{2\sqrt{x}}+t\sqrt{x}\cos(x)\right)}{\left(t\sqrt[3]{x}+t\sqrt{x}\sin(x)\right)^2}$$

sec(x) is the secant function »

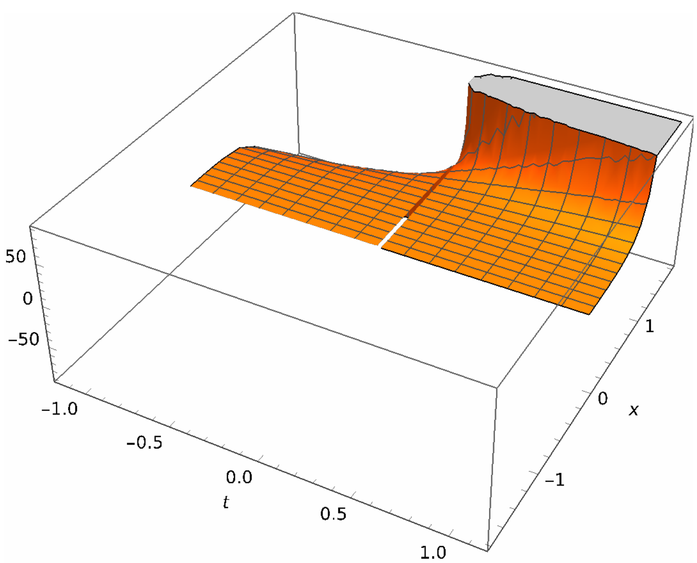
log(x) is the natural logarithm »

WolframAlpha

In[28]:= $\text{Plot3D}\left[\frac{(t\,x\,\text{Sin}[x]+\pi^x\,t\,\text{Tan}[x])^2}{t\,x^{1/3}+t\sqrt{x}\,\text{Sin}[x]}, \{t, -1.14412, 1.14412\}, \{x, -1.78005, 1.78005\}\right]$

In[27]:= $\text{Plot3D}\left[\frac{(t\,x\,\text{Sin}[x]+\pi^x\,t\,\text{Tan}[x])^2}{t\,x^{1/3}+t\sqrt{x}\,\text{Sin}[x]}, \{t, -1.14412, 1.14412\}, \{x, -1.78005, 1.78005\}\right]$

Out[27]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]^3 Eq 22

In[30]:=

```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])/
 (d^2*(x^(1/3)/d^2)*t + (d^2*(Sqrt[x]/d^2)*t)*Sin[x])^3
```

Out[30]=

$$\frac{t\,x\sin(x)+t\,\pi^x\tan(x)}{\left(t\sqrt[3]{x}+t\sqrt{x}\sin(x)\right)^3}$$

In[33]:= **[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]^3**

Out[33]=

Input:

Input:

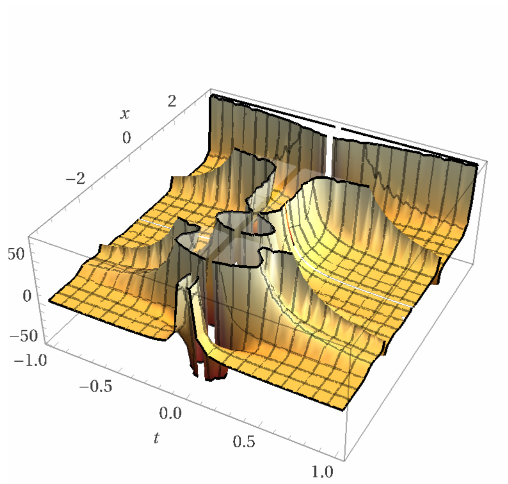
$$\frac{\left(d^2 \times \frac{x}{d^2}\ t\right)\sin(x) + \left(d^2 \times \frac{\pi^x}{d^2}\ t\right)\tan(x)}{\left(d^2 \times \frac{\sqrt[3]{x}}{d^2}\ t + \left(d^2 \times \frac{\sqrt{x}}{d^2}\ t\right)\sin(x)\right)^3}$$

Result:

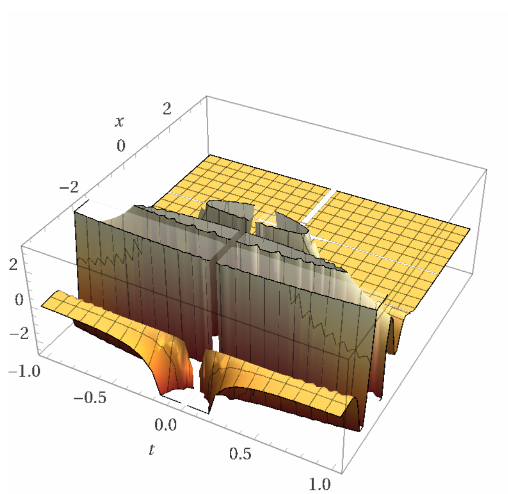
$$\frac{t\, x \sin(x) + t\, \pi^x \tan(x)}{\left(t\, \sqrt[3]{x} + t\, \sqrt{x}\, \sin(x)\right)^3}$$

3D plots:

Real part:

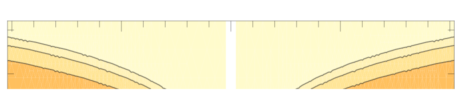


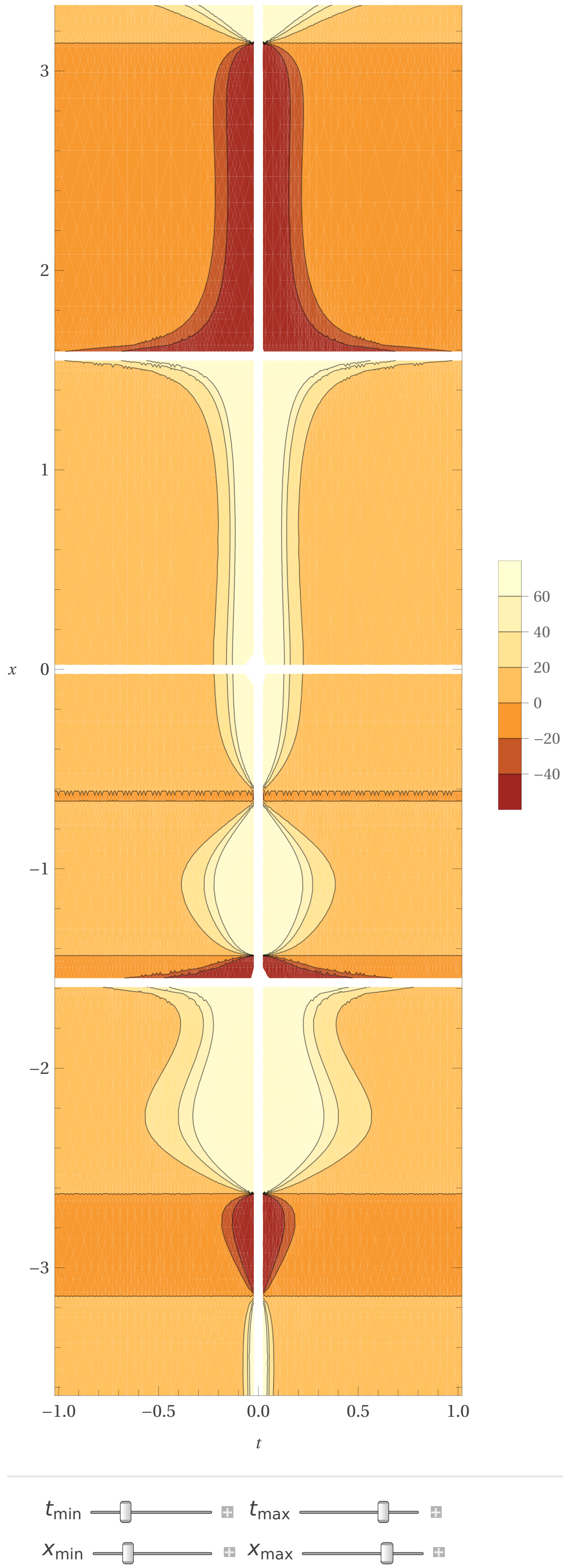
Imaginary part:



Contour plots:

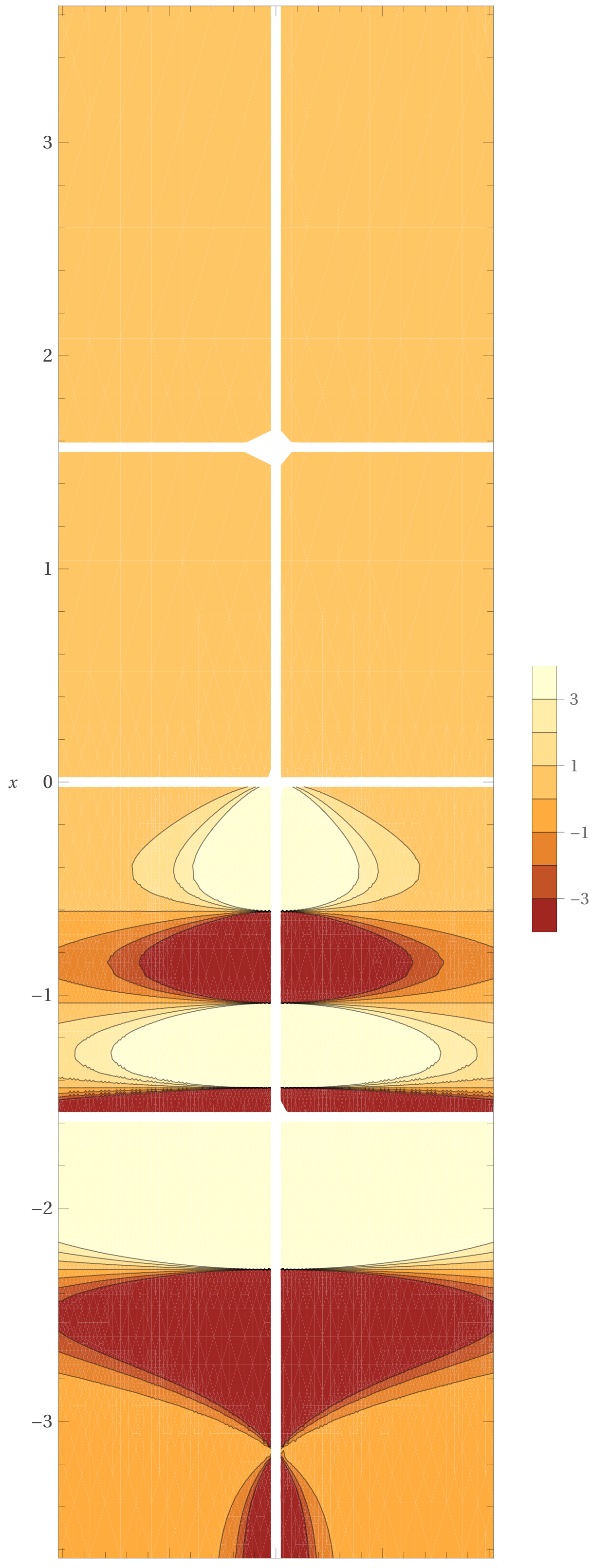
Real part:





x
t
3
2
1
0
−1
−2
−3
−1.0
−0.5
0.0
0.5
1.0
60
40
20
0
−20
−40
t_{min}
t_{max}
x_{min}
x_{max}

Imaginary part:



t

t_{min} t_{max}

x_{min} x_{max}

Alternate forms: More

$$\frac{(\pi^x + x\cos(x))\tan(x)}{t^2\, x\left(\sqrt[6]{x}\,\sin(x)+1\right)^3}$$

$$\frac{x\sin(x) + \pi^x \tan(x)}{t^2\, x\left(\sqrt[6]{x}\,\sin(x)+1\right)^3}$$

$$\frac{t\,x\sin(x) + \frac{\pi^x\, t\sin(x)}{\cos(x)}}{\left(t\sqrt[3]{x} + t\sqrt{x}\,\sin(x)\right)^3}$$

Partial fraction expansion: Step–by–step solution

$$\frac{\sin(x)}{t^2\left(\sqrt[6]{x}\,\sin(x)+1\right)^3} + \frac{\pi^x \tan(x)}{t^2\, x\left(\sqrt[6]{x}\,\sin(x)+1\right)^3}$$

Expanded forms:

$$\frac{t\,x\sin(x)}{\left(t\sqrt[3]{x} + t\sqrt{x}\,\sin(x)\right)^3} + \frac{t\,\pi^x \tan(x)}{\left(t\sqrt[3]{x} + t\sqrt{x}\,\sin(x)\right)^3}$$

$$\frac{t\,x\sin(x)}{3\,t^3\,x^{7/6}\sin(x) + 3\,t^3\,x^{4/3}\sin^2(x) + t^3\,x^{3/2}\sin^3(x) + t^3\,x} + \frac{t\,\pi^x \tan(x)}{3\,t^3\,x^{7/6}\sin(x) + 3\,t^3\,x^{4/3}\sin^2(x) + t^3\,x^{3/2}\sin^3(x) + t^3\,x}$$

Derivative: Approximate form Step–by–step solution

$$\frac{\partial}{\partial x}\left(\frac{\frac{(d^2\,x\,t)\sin(x)}{d^2} + \frac{(d^2\,\pi^x\,t)\tan(x)}{d^2}}{\left(\frac{d^2\sqrt[3]{x}\,t}{d^2} + \frac{(d^2\sqrt{x}\,t)\sin(x)}{d^2}\right)^3}\right) = \frac{t\sin(x) + t\,x\cos(x) + t\,\pi^x\sec^2(x) + t\,\pi^x\log(\pi)\tan(x)}{\left(t\sqrt[3]{x} + t\sqrt{x}\,\sin(x)\right)^3} - \frac{3\,(t\,x\sin(x) + t\,\pi^x\tan(x))\left(\frac{t}{3\,x^{2/3}} + \frac{t\sin(x)}{2\sqrt{x}} + t\sqrt{x}\,\cos(x)\right)}{\left(t\sqrt[3]{x} + t\sqrt{x}\,\sin(x)\right)^4}$$

sec(x) is the secant function »

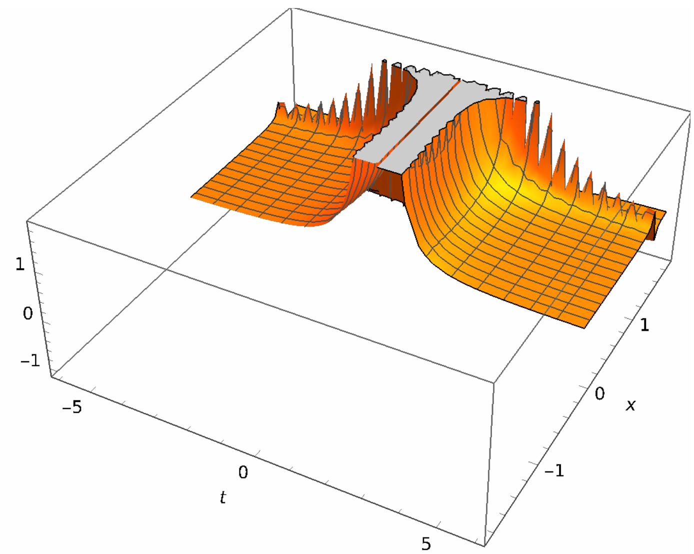
log(x) is the natural logarithm »

WolframAlpha

In[32]:= Plot3D[$\frac{\text{t x Sin[x]} + \pi^U \text{t Tan[x]}}{(\text{t x}^{/} + \text{t}\sqrt{\text{x}}\ \text{Sin[x]})}$, {t, -6., 6.}, {x, -1.87476, 1.87476}]

In[31]:= Plot3D[$\frac{\text{t x Sin[x]} + \pi^U \text{t Tan[x]}}{(\text{t x}^{/} + \text{t}\sqrt{\text{x}}\ \text{Sin[x]})}$, {t, -6., 6.}, {x, -1.87476, 1.87476}]

Out[31]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^3/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx] Eq 23

In[34]:=

```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])^3/
 (d^2*(x^(1/3)/d^2)*t + (d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[34]=

$$\frac{(t\,x\sin(x) + t\,\pi^x\tan(x))^3}{t\sqrt[3]{x} + t\sqrt{x}\,\sin(x)}$$

In[36]:= **[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^3/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]**

Out[36]=

Input:

$$\frac{\left(\left(d^2\times\frac{x}{d^2}\,t\right)\sin(x) + \left(d^2\times\frac{\pi^x}{d^2}\,t\right)\tan(x)\right)^3}{d^2\times\frac{\sqrt[3]{x}}{d^2}\,t + \left(d^2\times\frac{\sqrt{x}}{d^2}\,t\right)\sin(x)}$$

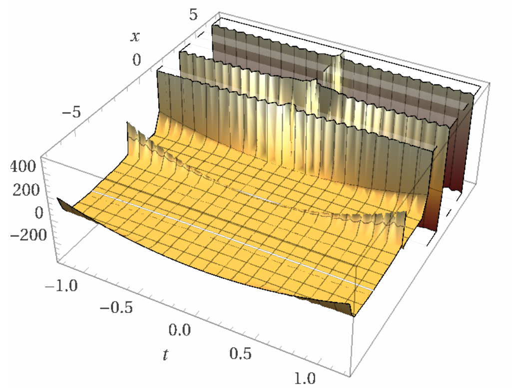
Result:

$$\frac{(t\,x\sin(x) + t\,\pi^x\tan(x))^3}{t\sqrt[3]{x} + t\sqrt{x}\,\sin(x)}$$

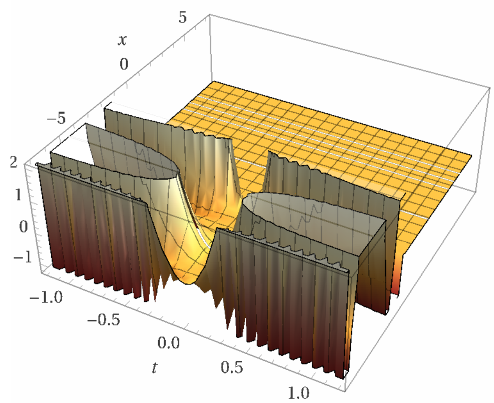
$t\sqrt{x} + t\sqrt{x}\sin(x)$

3D plots:

Real part:

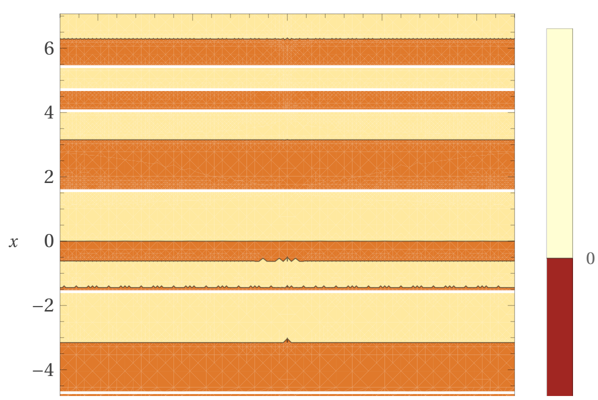


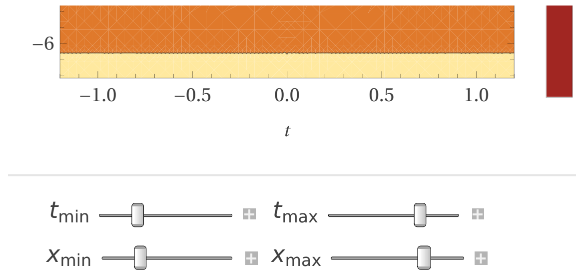
Imaginary part:



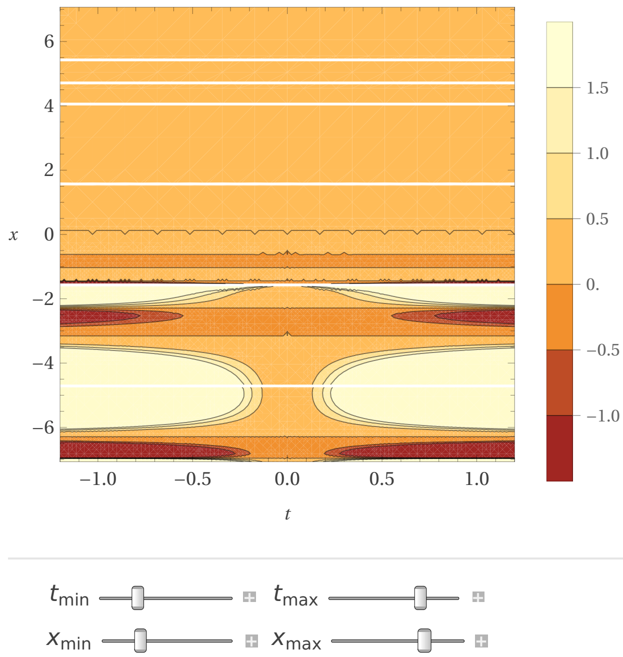
Contour plots:

Real part:





Imaginary part:



Alternate forms:

More

$$\frac{t^2 (x \sin(x) + \pi^x \tan(x))^3}{\sqrt[3]{x} + \sqrt{x} \sin(x)}$$

$$\frac{t^2 (x \sin(x) + \pi^x \tan(x))^3}{\sqrt[3]{x} \left(\sqrt[6]{x} \sin(x) + 1\right)}$$

$$\frac{t^2 (\pi^x + x \cos(x))^3 \tan^3(x)}{\sqrt[3]{x} \left(\sqrt[6]{x} \sin(x) + 1\right)}$$

Expanded form:

$$\frac{t^3 x^3 \sin^3(x)}{t \sqrt[3]{x} + t \sqrt{x} \sin(x)} + \frac{3 t^3 \pi^x x^2 \sin^2(x) \tan(x)}{t \sqrt[3]{x} + t \sqrt{x} \sin(x)} + \frac{t^3 \pi^{3x} \tan^3(x)}{t \sqrt[3]{x} + t \sqrt{x} \sin(x)} + \frac{3 t^3 \pi^{2x} x \sin(x) \tan^2(x)}{t \sqrt[3]{x} + t \sqrt{x} \sin(x)}$$

Derivative:

Approximate form Step–by–step solution

$$\frac{\partial}{\partial x}\left(\frac{\left(\frac{(d^2\, x\, t)\sin(x)}{d^2}+\frac{(d^2\, \pi^x\, t)\tan(x)}{d^2}\right)^3}{\frac{d^2\, \sqrt[3]{x}\, t}{d^2}+\frac{(d^2\, \sqrt{x}\, t)\sin(x)}{d^2}}\right)=$$

$$\frac{3\,(t\,x\sin(x)+t\,\pi^x\tan(x))^2\,(t\sin(x)+t\,x\cos(x)+t\,\pi^x\sec^2(x)+t\,\pi^x\log(\pi)\tan(x))}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}-$$

$$\frac{(t\,x\sin(x)+t\,\pi^x\tan(x))^3\left(\frac{t}{3\,x^{2/3}}+\frac{t\sin(x)}{2\,\sqrt{x}}+t\,\sqrt{x}\,\cos(x)\right)}{\left(t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)\right)^2}$$

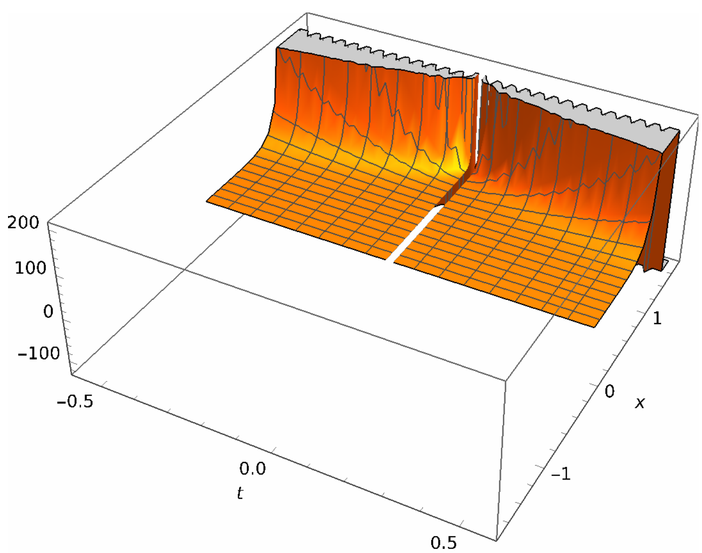
sec(x) is the secant function »

log(x) is the natural logarithm »

WolframAlpha

In[35]:= Plot3D$\left[\frac{(t\,x\,\text{Sin}[x]+\pi^x\,t\,\text{Tan}[x])^3}{t\,x^{1/3}+t\,\sqrt{x}\,\text{Sin}[x]}\right.$, {t, -0.569059, 0.569059}, {x, -1.72149, 1.72149}]

Out[35]=



[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^3/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx] Eq 23

In[37]:=
```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])^3/
 (d^2*(x^(1/3)/d^2)*t + (d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[37]=

$$\frac{(t\,x\sin(x)+t\,\pi^x\tan(x))^3}{t\,\sqrt[3]{x}+t\,\sqrt{x}\,\sin(x)}$$

In[38]:= $\texttt{Simplify}\left[\dfrac{(\texttt{t x Sin[x]} + \pi^{\texttt{x}}\ \texttt{t Tan[x]})^3}{\texttt{t x}^{1/3} + \texttt{t}\ \sqrt{\texttt{x}}\ \texttt{Sin[x]}}\right]$

Out[38]=

$$\frac{t^2 \left(x \sin(x) + \pi^{Ð} \tan(x)\right)^3}{\sqrt[3]{x} + \sqrt{x}\, \sin(x)}$$

[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^3/[[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]^1/3 Eq 24

In[1]:=

```
((d^2*(x/d^2)*t)*Sin[x] + (d^2*(Pi^x/d^2)*t)*Tan[x])^3/
 (d^2*(x^(1/3)/d^2)*t + (d^2*(Sqrt[x]/d^2)*t)*Sin[x])^(1/3)
```

Out[1]=

$$\frac{\left(t\, x \sin(x) + t\, \pi^x \tan(x)\right)^3}{\sqrt[3]{t\, \sqrt[3]{x} + t\, \sqrt{x}\, \sin(x)}}$$

In[2]:= **[{d^2x/d^2t}sinx+{d^2π^x/d^2t}tanx]^3/[{d^2x^1/3/d^2t}+{d^2√x/d^2t}sinx]^1/3**

Input:

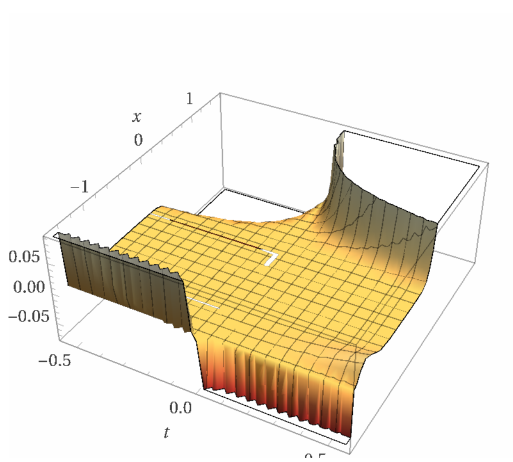
$$\frac{\left(\left(d^2 \times \frac{x}{d^2}\, t\right) \sin(x) + \left(d^2 \times \frac{\pi^x}{d^2}\, t\right) \tan(x)\right)^3}{\sqrt[3]{d^2 \times \frac{\sqrt[3]{x}}{d^2}\, t + \left(d^2 \times \frac{\sqrt{x}}{d^2}\, t\right) \sin(x)}}$$

Result:

$$\frac{(t\, x \sin(x) + t\, \pi^x \tan(x))^3}{\sqrt[3]{t\, \sqrt[3]{x} + t\, \sqrt{x}\, \sin(x)}}$$

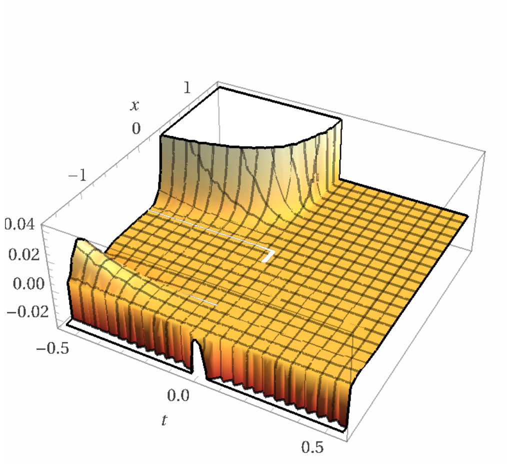
3D plots:

Real part:



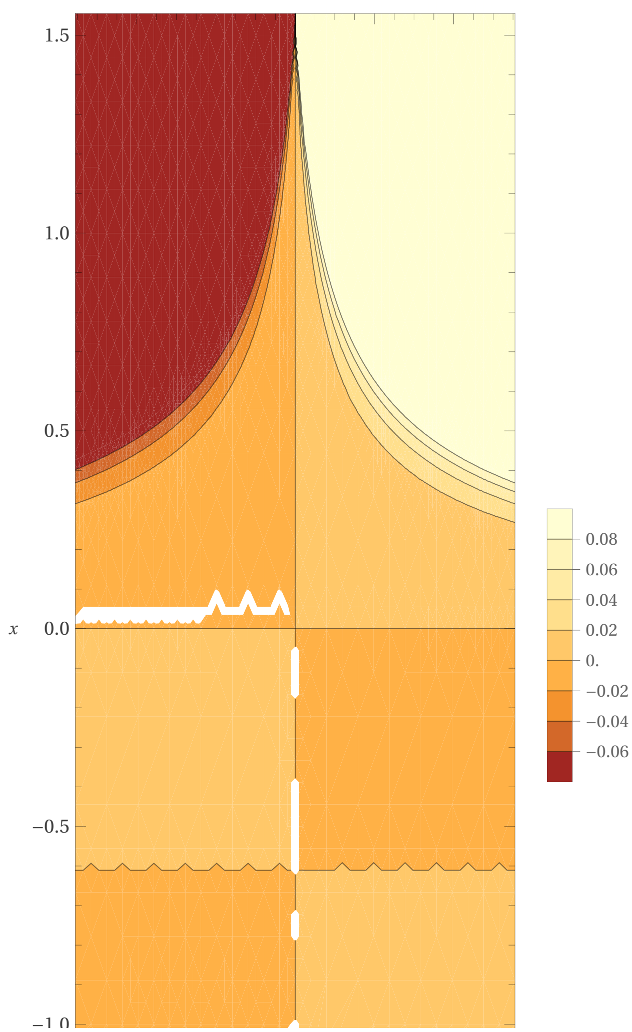
0.5

Imaginary part:

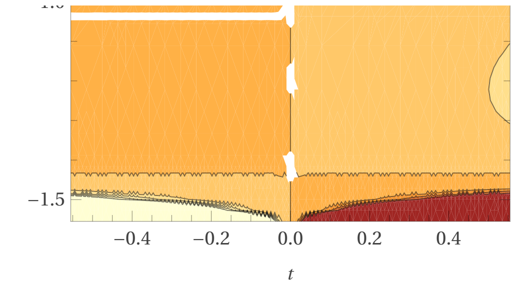


Contour plots:

Real part:



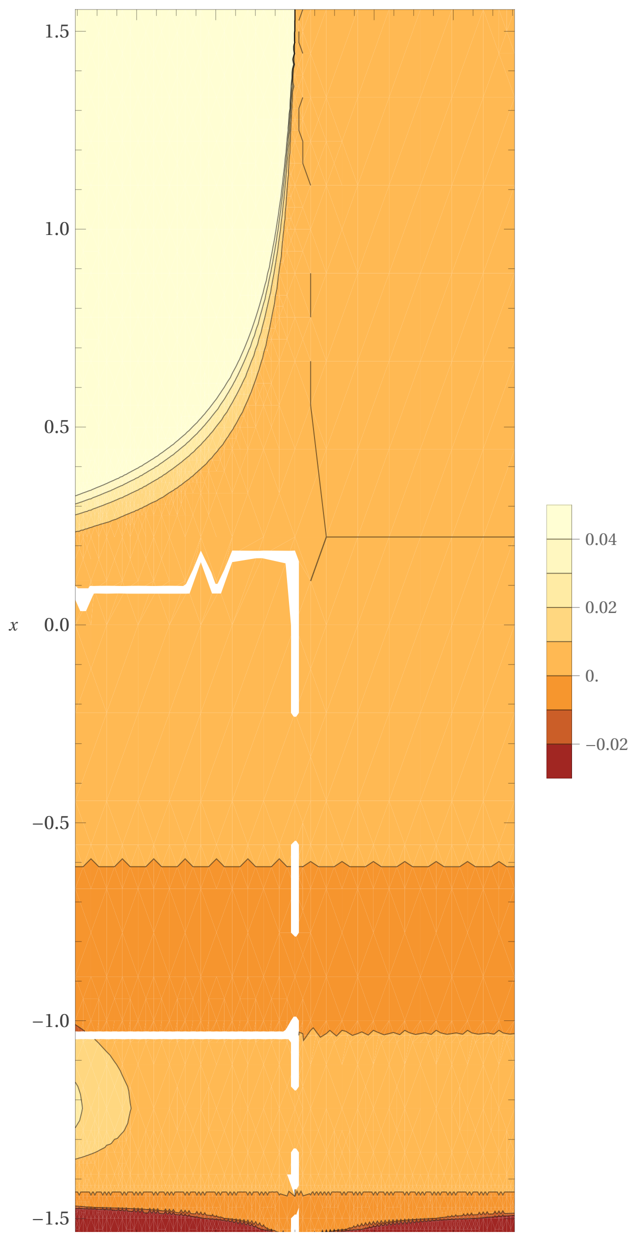
Out[2]=



t_{min} t_{max}

x_{min} x_{max}

Imaginary part:



t_{min} t_{max}
x_{min} x_{max}

Alternate forms:

More

$$\frac{t^3 (\pi^x + x\cos(x))^3 \tan^3(x)}{\sqrt[3]{t\left(\sqrt[3]{x} + \sqrt{x}\,\sin(x)\right)}}$$

$$\frac{t^3 (x\sin(x) + \pi^x \tan(x))^3}{\sqrt[3]{t\,\sqrt[3]{x}\left(\sqrt[6]{x}\,\sin(x) + 1\right)}}$$

$$\frac{\left(t\,x\sin(x) + \frac{\pi^x\,t\sin(x)}{\cos(x)}\right)^3}{\sqrt[3]{t\,\sqrt[3]{x} + t\,\sqrt{x}\,\sin(x)}}$$

Expanded form:

$$\frac{t^3\,x^3 \sin^3(x)}{\sqrt[3]{t\,\sqrt[3]{x} + t\,\sqrt{x}\,\sin(x)}} + \frac{3\,t^3\,\pi^x\,x^2 \sin^2(x)\tan(x)}{\sqrt[3]{t\,\sqrt[3]{x} + t\,\sqrt{x}\,\sin(x)}} + \frac{t^3\,\pi^{3\,x} \tan^3(x)}{\sqrt[3]{t\,\sqrt[3]{x} + t\,\sqrt{x}\,\sin(x)}} + \frac{3\,t^3\,\pi^{2\,x}\,x\sin(x)\tan^2(x)}{\sqrt[3]{t\,\sqrt[3]{x} + t\,\sqrt{x}\,\sin(x)}}$$

WolframAlpha

[{d^2x/d^2t}sinx∗{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}∗{d^2√x/d^2t}sinx] Eq 25

In[3]:=
```
((d^2*(x/d^2)*t)*Sin[x]*(d^2*(Pi^x/d^2)*t)*Tan[x])/
  ((d^2*(x^(1/3)/d^2)*t)*(d^2*(Sqrt[x]/d^2)*t)*Sin[x])
```

Out[3]= $\pi^x\,\sqrt[6]{x}\,\tan(x)$

[{d^2x/d^2t}sinx*{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]

In[5]:= **[{d^2x/d^2t}sinx*{d^2π^x/d^2t}tanx]/[{d^2x^1/3/d^2t}*{d^2√x/d^2t}sinx]**

Input:

$$\left(d^2 \times \frac{x}{d^2}\,t\right)\sin(x)\left(d^2 \times \frac{\pi^x}{d^2}\,t\right)\tan(x)$$

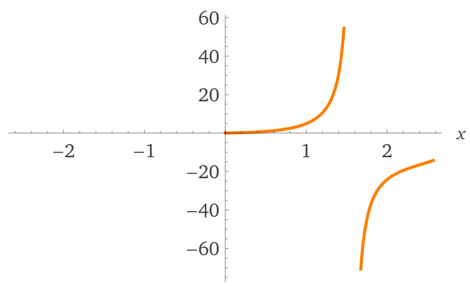
$$\overline{\left(d^2 \times \frac{\sqrt[3]{x}}{d^2}\ t\right)\left(d^2 \times \frac{\sqrt{x}}{d^2}\ t\right)\sin(x)}$$

Result:

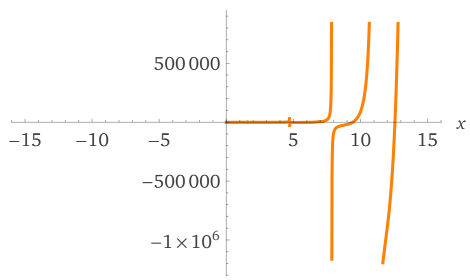
$\pi^x \sqrt[6]{x} \tan(x)$

Plots:

Real–valued plots |



min max



min max

Alternate forms:

$$\frac{\pi^x \sqrt[6]{x} \sin(x)}{\cos(x)}$$

$$\frac{i\left(e^{-i x} - e^{i x}\right)\pi^x \sqrt[6]{x}}{e^{-i x} + e^{i x}}$$

Out[5]=

Roots:

Step–by–step solution

(no roots exist)

Series expansion at x = 0:

$$x^{7/6} + x^{13/6}\log(\pi) + \frac{1}{6} x^{19/6}\left(2 + 3\log^2(\pi)\right) + \frac{1}{6} x^{25/6}\log(\pi)\left(2 + \log^2(\pi)\right) + O\left(x^{31/6}\right)$$

(Puiseux series)

log(x) is the natural logarithm »

Big-O notation »

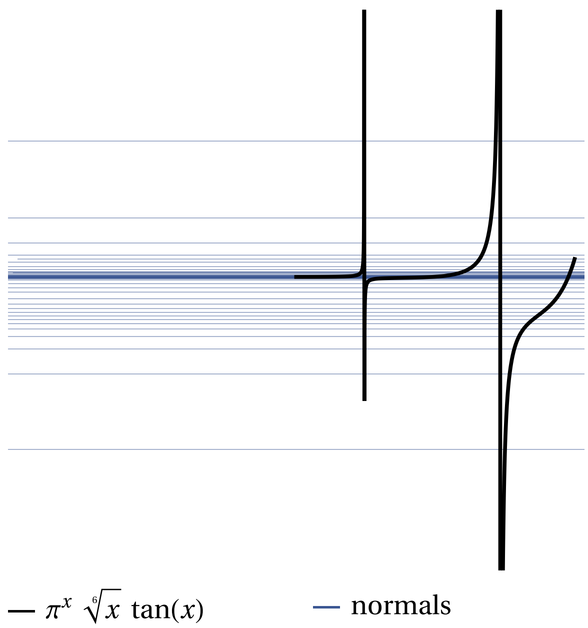
Derivative:

Approximate form | Step-by-step solution

$$\frac{d}{dx}\left(\frac{(d^2\,x\,t)\sin(x)\,(d^2\,\pi^x\,t)\tan(x)}{\frac{(d^2\,d^2)\left((d^2\,\sqrt[3]{x}\,t)\,(d^2\,\sqrt{x}\,t)\sin(x)\right)}{d^2\,d^2}}\right) = \frac{\pi^x\,(\tan(x) + 6\,x\sec^2(x) + 6\,x\log(\pi)\tan(x))}{6\,x^{5/6}}$$

sec(x) is the secant function »

Differential geometric curves:



Horizontal plot range:

x_{min} x_{max} symmetric

+ More controls

WolframAlpha

In[4]:= `Plot[π^x x^(1/6) Tan[x], {x, -15.4248, 15.4248}]`

$$\text{Plot}\left[\pi^x\,x^{1/6}\,\text{Tan}[x],\ \{x,\ -15.4248,\ 15.4248\}\right]$$

Out[4]=