**You said:**

%e^(atan2(0,n)\*t) list all alternative ways of writing tis give argument form of this

**ChatGPT said:**

Let's break down the expression you provided and re-express it in various equivalent or alternative forms, including in **argument (polar) form**.

**Original expression:**

%e^{(\operatorname{atan2}(0, n) \cdot t)}

Here:

* atan2(0, n) gives the **angle** θ between the positive x-axis and the vector (n, 0).
* Since the y-coordinate is 0, this essentially evaluates to:

atan2⁡(0,n)={0if n>0πif n<0undefined (or 0 by convention)if n=0\operatorname{atan2}(0, n) = \begin{cases} 0 & \text{if } n > 0 \\ \pi & \text{if } n < 0 \\ \text{undefined (or } 0 \text{ by convention)} & \text{if } n = 0 \end{cases}atan2(0,n)=⎩⎨⎧​0πundefined (or 0 by convention)​if n>0if n<0if n=0​

Then this result is multiplied by ttt, and exponentiated with base eee.

**✅ Rewriting in Equivalent Forms**

**Case 1: n>0n > 0n>0**

eatan2⁡(0,n)t=e0⋅t=e0=1e^{\operatorname{atan2}(0, n)t} = e^{0 \cdot t} = e^0 = 1eatan2(0,n)t=e0⋅t=e0=1

**Case 2: n<0n < 0n<0**

eatan2⁡(0,n)t=eπte^{\operatorname{atan2}(0, n)t} = e^{\pi t}eatan2(0,n)t=eπt

**Case 3: n=0n = 0n=0**

atan2⁡(0,0) is often defined as 0⇒e0=1\operatorname{atan2}(0, 0) \text{ is often defined as } 0 \Rightarrow e^0 = 1atan2(0,0) is often defined as 0⇒e0=1

**🌀 Polar (Argument) Form of eiθe^{i\theta}eiθ**

**Euler's Formula:**

eiθ=cos⁡(θ)+isin⁡(θ)e^{i\theta} = \cos(\theta) + i\sin(\theta)eiθ=cos(θ)+isin(θ)

So if we want to write your expression in **complex exponential (polar/argument) form**, we can reinterpret θ=atan2⁡(0,n)⋅t\theta = \operatorname{atan2}(0, n) \cdot tθ=atan2(0,n)⋅t, assuming it appears as an **imaginary exponent**:

**Complex Form:**

ei⋅atan2⁡(0,n)⋅t⇒cos⁡(θ)+isin⁡(θ),with θ=atan2⁡(0,n)⋅te^{i \cdot \operatorname{atan2}(0, n) \cdot t} \quad \Rightarrow \quad \cos(\theta) + i \sin(\theta), \quad \text{with } \theta = \operatorname{atan2}(0, n) \cdot tei⋅atan2(0,n)⋅t⇒cos(θ)+isin(θ),with θ=atan2(0,n)⋅t

So, in **argument form**, this is:

arg⁡(ei⋅atan2⁡(0,n)t)=atan2⁡(0,n)t\boxed{ \arg\left(e^{i \cdot \operatorname{atan2}(0,n)t}\right) = \operatorname{atan2}(0,n)t }arg(ei⋅atan2(0,n)t)=atan2(0,n)t​

**🧠 Summary of Alternative Forms**

1. **Real exponential (your original):**

eatan2⁡(0,n)te^{\operatorname{atan2}(0, n)t}eatan2(0,n)t

1. **Piecewise expression (real case):**

={1if n≥0eπtif n<0= \begin{cases} 1 & \text{if } n \ge 0 \\ e^{\pi t} & \text{if } n < 0 \end{cases}={1eπt​if n≥0if n<0​

1. **Complex exponential form (polar form):**

ei⋅atan2⁡(0,n)⋅t=cos⁡(θ)+isin⁡(θ),θ=atan2⁡(0,n)⋅te^{i \cdot \operatorname{atan2}(0,n) \cdot t} = \cos(\theta) + i\sin(\theta), \quad \theta = \operatorname{atan2}(0,n) \cdot tei⋅atan2(0,n)⋅t=cos(θ)+isin(θ),θ=atan2(0,n)⋅t

1. **Argument:**

arg⁡=atan2⁡(0,n)⋅t\arg = \operatorname{atan2}(0, n) \cdot targ=atan2(0,n)⋅t

Let me know if you want the complex version plotted on the unit circle or applied to a specific value of nnn or ttt.

**You said:**

%e^(atan2(0,n)\*t) list all alternative ways of writing tis yes write as piece wise polar rectangular also

**ChatGPT said:**

Great! Let's break down all **alternative forms** of the expression:

eatan2⁡(0,n)⋅te^{\operatorname{atan2}(0,n) \cdot t}eatan2(0,n)⋅t

in **piecewise**, **polar**, and **rectangular (Cartesian)** forms.

**🔹 Step 1: Understand atan2(0, n)**

The function atan2⁡(0,n)\operatorname{atan2}(0, n)atan2(0,n) returns the angle (in radians) between the x-axis and the point (n, 0):

atan2⁡(0,n)={0if n>0πif n<00 (by convention)if n=0\operatorname{atan2}(0, n) = \begin{cases} 0 & \text{if } n > 0 \\ \pi & \text{if } n < 0 \\ 0 \text{ (by convention)} & \text{if } n = 0 \end{cases}atan2(0,n)=⎩⎨⎧​0π0 (by convention)​if n>0if n<0if n=0​

This is **not complex** unless you explicitly include iii. So currently this is a **real exponential**.

**✅ 1. Piecewise Real Expression:**

eatan2⁡(0,n)⋅t={e0=1if n≥0eπtif n<0e^{\operatorname{atan2}(0,n) \cdot t} = \begin{cases} e^0 = 1 & \text{if } n \ge 0 \\ e^{\pi t} & \text{if } n < 0 \end{cases}eatan2(0,n)⋅t={e0=1eπt​if n≥0if n<0​

**✅ 2. Polar Form (Complex) — If we assume a complex exponential form like:**

ei⋅atan2⁡(0,n)⋅te^{i \cdot \operatorname{atan2}(0, n) \cdot t}ei⋅atan2(0,n)⋅t

Then it becomes:

=cos⁡(θ)+isin⁡(θ),with θ=atan2⁡(0,n)⋅t= \cos(\theta) + i \sin(\theta), \quad \text{with } \theta = \operatorname{atan2}(0,n) \cdot t=cos(θ)+isin(θ),with θ=atan2(0,n)⋅t

So in **polar form** (magnitude-angle form):

**Polar (complex exponential):**

eiθ,θ=atan2⁡(0,n)⋅t\boxed{ e^{i\theta}, \quad \theta = \operatorname{atan2}(0,n) \cdot t }eiθ,θ=atan2(0,n)⋅t​

With specific values:

* If n>0n > 0n>0:  θ=0⇒ei⋅0=1\theta = 0 \Rightarrow e^{i \cdot 0} = 1θ=0⇒ei⋅0=1
* If n<0n < 0n<0:  θ=πt⇒eiπt\theta = \pi t \Rightarrow e^{i \pi t}θ=πt⇒eiπt
* If n=0n = 0n=0:  θ=0⇒ei⋅0=1\theta = 0 \Rightarrow e^{i \cdot 0} = 1θ=0⇒ei⋅0=1

**✅ 3. Rectangular Form (Cartesian)**

If we are interpreting it as complex (i.e., ei⋅θe^{i \cdot \theta}ei⋅θ), then:

ei⋅atan2⁡(0,n)⋅t=cos⁡(θ)+isin⁡(θ)e^{i \cdot \operatorname{atan2}(0,n) \cdot t} = \cos(\theta) + i\sin(\theta)ei⋅atan2(0,n)⋅t=cos(θ)+isin(θ)

With θ=atan2⁡(0,n)⋅t\theta = \operatorname{atan2}(0,n) \cdot tθ=atan2(0,n)⋅t, this gives:

cos⁡(atan2⁡(0,n)⋅t)+isin⁡(atan2⁡(0,n)⋅t)\boxed{ \cos(\operatorname{atan2}(0,n) \cdot t) + i \sin(\operatorname{atan2}(0,n) \cdot t) }cos(atan2(0,n)⋅t)+isin(atan2(0,n)⋅t)​

Specific cases:

* If n>0n > 0n>0:

cos⁡(0)+isin⁡(0)=1+0i=1\cos(0) + i\sin(0) = 1 + 0i = 1cos(0)+isin(0)=1+0i=1

* If n<0n < 0n<0:

cos⁡(πt)+isin⁡(πt)\cos(\pi t) + i\sin(\pi t)cos(πt)+isin(πt)

Example: if t=1t = 1t=1, this becomes −1+0i-1 + 0i−1+0i

* If n=0n = 0n=0: same as n>0n > 0n>0, yields 1.

**✅ 4. Summary Table**

| **Condition** | **Real (Original)** | **Polar Form** | **Rectangular (Cartesian)** |
| --- | --- | --- | --- |
| n>0n > 0n>0 | e0=1e^0 = 1e0=1 | ei⋅0=1e^{i \cdot 0} = 1ei⋅0=1 | cos⁡(0)+isin⁡(0)=1\cos(0) + i\sin(0) = 1cos(0)+isin(0)=1 |
| n<0n < 0n<0 | eπte^{\pi t}eπt | ei⋅πte^{i \cdot \pi t}ei⋅πt | cos⁡(πt)+isin⁡(πt)\cos(\pi t) + i\sin(\pi t)cos(πt)+isin(πt) |
| n=0n = 0n=0 | e0=1e^0 = 1e0=1 | ei⋅0=1e^{i \cdot 0} = 1ei⋅0=1 | cos⁡(0)+isin⁡(0)=1\cos(0) + i\sin(0) = 1cos(0)+isin(0)=1 |

Let me know if you want a graph or animation of how the complex form rotates on the unit circle as ttt changes!

**You said:**

sum((%e^(atan2(0,n)\*t)\*cos(log(abs(n))\*t+atan2(0,n)/2))/sqrt(abs(n)),n,1,a) list all alternative ways of writing tis yes write as piece wise polar rectangular also

**ChatGPT said:**

Let's break down the expression you provided:

**🔢 Original Expression:**

∑n=1a(eatan2⁡(0,n)⋅t⋅cos⁡(log⁡(∣n∣)⋅t+atan2⁡(0,n)2)∣n∣)\sum\_{n=1}^{a} \left( \frac{e^{\operatorname{atan2}(0,n) \cdot t} \cdot \cos\left( \log(|n|) \cdot t + \frac{\operatorname{atan2}(0,n)}{2} \right)}{\sqrt{|n|}} \right)n=1∑a​​∣n∣​eatan2(0,n)⋅t⋅cos(log(∣n∣)⋅t+2atan2(0,n)​)​​

This is a **real-valued series**, though it involves angles and logs, and we can write it in different forms: **piecewise**, **polar**, and **rectangular (complex)**.

**🔍 Step 1: Simplify atan2(0, n)**

As before:

atan2⁡(0,n)={0if n>0πif n<0\operatorname{atan2}(0, n) = \begin{cases} 0 & \text{if } n > 0 \\ \pi & \text{if } n < 0 \end{cases}atan2(0,n)={0π​if n>0if n<0​

But since n∈[1,a]n \in [1, a]n∈[1,a], we know n>0n > 0n>0. So:

atan2⁡(0,n)=0⇒eatan2⁡(0,n)⋅t=e0=1⇒atan2⁡(0,n)2=0\operatorname{atan2}(0, n) = 0 \Rightarrow e^{\operatorname{atan2}(0,n) \cdot t} = e^0 = 1 \Rightarrow \frac{\operatorname{atan2}(0,n)}{2} = 0atan2(0,n)=0⇒eatan2(0,n)⋅t=e0=1⇒2atan2(0,n)​=0

So the entire sum becomes:

**✅ Simplified Real Expression (for positive nnn)**

∑n=1a(cos⁡(log⁡(n)⋅t)n)\sum\_{n=1}^{a} \left( \frac{\cos\left( \log(n) \cdot t \right)}{\sqrt{n}} \right)n=1∑a​(n​cos(log(n)⋅t)​)

**✅ 1. Piecewise Form (handling general n∈Z∖{0}n \in \mathbb{Z} \setminus \{0\}n∈Z∖{0}):**

If we wanted to define this **for any integer n≠0n \ne 0n=0** (not just n>0n > 0n>0), then we need a **piecewise** treatment:

**Full General Piecewise Form:**

∑n=1a{cos⁡(log⁡(n)t)nn>0eπt⋅cos⁡(log⁡(∣n∣)t+π2)∣n∣n<0\sum\_{n=1}^{a} \begin{cases} \displaystyle \frac{\cos\left( \log(n) t \right)}{\sqrt{n}} & n > 0 \\ \displaystyle \frac{e^{\pi t} \cdot \cos\left( \log(|n|) t + \frac{\pi}{2} \right)}{\sqrt{|n|}} & n < 0 \end{cases}n=1∑a​⎩⎨⎧​n​cos(log(n)t)​∣n∣​eπt⋅cos(log(∣n∣)t+2π​)​​n>0n<0​

Why:

* atan2⁡(0,n)=π\operatorname{atan2}(0, n) = \piatan2(0,n)=π for n<0n < 0n<0
* So eatan2⁡(0,n)⋅t=eπte^{\operatorname{atan2}(0,n) \cdot t} = e^{\pi t}eatan2(0,n)⋅t=eπt
* And the phase shift becomes π2\frac{\pi}{2}2π​

**✅ 2. Polar/Complex Form**

We can repackage the cosine using Euler’s formula:

cos⁡(ϕ)=ℜ(eiϕ)\cos(\phi) = \Re\left(e^{i\phi}\right)cos(ϕ)=ℜ(eiϕ)

Let’s denote:

* θn=log⁡(∣n∣)⋅t+atan2⁡(0,n)2\theta\_n = \log(|n|) \cdot t + \frac{\operatorname{atan2}(0,n)}{2}θn​=log(∣n∣)⋅t+2atan2(0,n)​
* An=eatan2⁡(0,n)⋅t∣n∣A\_n = \frac{e^{\operatorname{atan2}(0,n) \cdot t}}{\sqrt{|n|}}An​=∣n∣​eatan2(0,n)⋅t​

Then:

∑n=1aAn⋅ℜ(eiθn)=ℜ(∑n=1aAneiθn)\sum\_{n=1}^{a} A\_n \cdot \Re(e^{i\theta\_n}) = \Re\left( \sum\_{n=1}^{a} A\_n e^{i\theta\_n} \right)n=1∑a​An​⋅ℜ(eiθn​)=ℜ(n=1∑a​An​eiθn​)

**So in full polar form:**

ℜ(∑n=1aeatan2⁡(0,n)⋅t⋅ei(log⁡(∣n∣)t+atan2⁡(0,n)2)∣n∣)\boxed{ \Re \left( \sum\_{n=1}^{a} \frac{e^{\operatorname{atan2}(0,n) \cdot t} \cdot e^{i \left( \log(|n|) t + \frac{\operatorname{atan2}(0,n)}{2} \right)}}{\sqrt{|n|}} \right) }ℜ(n=1∑a​∣n∣​eatan2(0,n)⋅t⋅ei(log(∣n∣)t+2atan2(0,n)​)​)​

Combine exponents:

=ℜ(∑n=1aeatan2⁡(0,n)⋅t+ilog⁡(∣n∣)t+i⋅atan2⁡(0,n)2∣n∣)= \Re \left( \sum\_{n=1}^{a} \frac{e^{\operatorname{atan2}(0,n) \cdot t + i \log(|n|) t + i \cdot \frac{\operatorname{atan2}(0,n)}{2}}}{\sqrt{|n|}} \right)=ℜ(n=1∑a​∣n∣​eatan2(0,n)⋅t+ilog(∣n∣)t+i⋅2atan2(0,n)​​)

**✅ 3. Rectangular (Complex) Form**

Let’s convert the cosine directly:

cos⁡(ϕ)=eiϕ+e−iϕ2\cos(\phi) = \frac{e^{i\phi} + e^{-i\phi}}{2}cos(ϕ)=2eiϕ+e−iϕ​

So the original expression becomes:

∑n=1aeatan2⁡(0,n)⋅t∣n∣⋅ei(log⁡(∣n∣)t+atan2⁡(0,n)2)+e−i(log⁡(∣n∣)t+atan2⁡(0,n)2)2\sum\_{n=1}^{a} \frac{e^{\operatorname{atan2}(0,n) \cdot t}}{\sqrt{|n|}} \cdot \frac{e^{i(\log(|n|)t + \frac{\operatorname{atan2}(0,n)}{2})} + e^{-i(\log(|n|)t + \frac{\operatorname{atan2}(0,n)}{2})}}{2}n=1∑a​∣n∣​eatan2(0,n)⋅t​⋅2ei(log(∣n∣)t+2atan2(0,n)​)+e−i(log(∣n∣)t+2atan2(0,n)​)​

Which gives:

=∑n=1aeatan2⁡(0,n)t2∣n∣(ei(log⁡(∣n∣)t+atan2⁡(0,n)2)+e−i(log⁡(∣n∣)t+atan2⁡(0,n)2))= \sum\_{n=1}^{a} \frac{e^{\operatorname{atan2}(0,n)t}}{2\sqrt{|n|}} \left( e^{i(\log(|n|)t + \frac{\operatorname{atan2}(0,n)}{2})} + e^{-i(\log(|n|)t + \frac{\operatorname{atan2}(0,n)}{2})} \right)=n=1∑a​2∣n∣​eatan2(0,n)t​(ei(log(∣n∣)t+2atan2(0,n)​)+e−i(log(∣n∣)t+2atan2(0,n)​))

This is fully in **rectangular complex exponential** form.

**✅ Summary Table**

| **Form** | **Expression** |
| --- | --- |
| **Simplified Real (for n>0n > 0n>0)** | ∑n=1acos⁡(log⁡(n)t)n\sum\_{n=1}^{a} \frac{\cos(\log(n)t)}{\sqrt{n}}∑n=1a​n​cos(log(n)t)​ |
| **Piecewise** | (\sum\_{n=1}^{a} \begin{cases} \frac{\cos(\log(n)t)}{\sqrt{n}} & n > 0 \ \frac{e^{\pi t} \cos(\log( |
| **Polar/Argument Form** | (\Re\left(\sum\_{n=1}^{a} \frac{e^{\operatorname{atan2}(0,n)t} e^{i\left(\log( |
| **Rectangular (Euler cosine)** | (\sum\_{n=1}^{a} \frac{e^{\operatorname{atan2}(0,n)t}}{2\sqrt{ |

Would you like this sum visualized or written in LaTeX for plotting?

**You said:**

list all alternative ways of writing tis yes write as piece wise polar rectangular also sum((%e^(atan2(0,n)\*t)\*cos(log(abs(n))\*t+atan2(0,n)/2))/sqrt(abs(n)),n,1,a) in wx maxima format

**ChatGPT said:**

Certainly! Let's walk through **all alternative forms** of your expression in **piecewise**, **polar**, and **rectangular** formats, and write each version using **wxMaxima syntax**.

**🔢 Original Expression**

In **plain math notation**:

∑n=1a(eatan2⁡(0,n)⋅t⋅cos⁡(log⁡(∣n∣)⋅t+atan2⁡(0,n)2)∣n∣)\sum\_{n=1}^{a} \left( \frac{e^{\operatorname{atan2}(0,n) \cdot t} \cdot \cos\left( \log(|n|) \cdot t + \frac{\operatorname{atan2}(0,n)}{2} \right)}{\sqrt{|n|}} \right)n=1∑a​​∣n∣​eatan2(0,n)⋅t⋅cos(log(∣n∣)⋅t+2atan2(0,n)​)​​

**✅ wxMaxima Syntax Version (Original)**

maxima

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sum((%e^(atan2(0,n)\*t)\*cos(log(abs(n))\*t + atan2(0,n)/2))/sqrt(abs(n)), n, 1, a);

This is correct for the full general form over positive integers.

**✅ 1. Simplified (Piecewise) Form for n > 0**

Since for n>0n > 0n>0, atan2⁡(0,n)=0\operatorname{atan2}(0,n) = 0atan2(0,n)=0, so the expression simplifies to:

∑n=1acos⁡(log⁡(n)⋅t)n\sum\_{n=1}^{a} \frac{\cos(\log(n) \cdot t)}{\sqrt{n}}n=1∑a​n​cos(log(n)⋅t)​

**wxMaxima version:**

maxima

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sum(cos(log(n)\*t)/sqrt(n), n, 1, a);

**✅ 2. Full Piecewise Form (extend to negative nnn if needed)**

If nnn can be negative (i.e. hypothetical extension), then:

atan2⁡(0,n)={0n>0πn<0\operatorname{atan2}(0, n) = \begin{cases} 0 & n > 0 \\ \pi & n < 0 \end{cases}atan2(0,n)={0π​n>0n<0​

So the full expression becomes:

∑n=1a{cos⁡(log⁡(n)t)nn>0eπt⋅cos⁡(log⁡(∣n∣)t+π/2)∣n∣n<0\sum\_{n=1}^{a} \begin{cases} \frac{\cos(\log(n) t)}{\sqrt{n}} & n > 0 \\ \frac{e^{\pi t} \cdot \cos(\log(|n|) t + \pi/2)}{\sqrt{|n|}} & n < 0 \end{cases}n=1∑a​⎩⎨⎧​n​cos(log(n)t)​∣n∣​eπt⋅cos(log(∣n∣)t+π/2)​​n>0n<0​

**wxMaxima version (manual piecewise):**

maxima

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sum(if n > 0 then cos(log(n)\*t)/sqrt(n) else %e^(%pi\*t)\*cos(log(abs(n))\*t + %pi/2)/sqrt(abs(n)), n, 1, a);

**✅ 3. Polar Form**

Use Euler’s identity: cos⁡(ϕ)=ℜ(eiϕ)\cos(\phi) = \Re(e^{i\phi})cos(ϕ)=ℜ(eiϕ)

So expression becomes:

∑n=1aℜ(eatan2⁡(0,n)⋅t⋅ei(log⁡(∣n∣)⋅t+atan2⁡(0,n)/2)∣n∣)\sum\_{n=1}^{a} \Re\left( \frac{e^{\operatorname{atan2}(0,n) \cdot t} \cdot e^{i (\log(|n|) \cdot t + \operatorname{atan2}(0,n)/2)}}{\sqrt{|n|}} \right)n=1∑a​ℜ(∣n∣​eatan2(0,n)⋅t⋅ei(log(∣n∣)⋅t+atan2(0,n)/2)​)

**wxMaxima version:**

maxima

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realpart(sum((%e^(atan2(0,n)\*t) \* %e^(%i\*(log(abs(n))\*t + atan2(0,n)/2)))/sqrt(abs(n)), n, 1, a));

**✅ 4. Rectangular (Euler Cosine Expansion)**

Using:

cos⁡(ϕ)=eiϕ+e−iϕ2\cos(\phi) = \frac{e^{i\phi} + e^{-i\phi}}{2}cos(ϕ)=2eiϕ+e−iϕ​

So the expression becomes:

∑n=1aeatan2⁡(0,n)t2∣n∣(eiϕ+e−iϕ),ϕ=log⁡(∣n∣)t+atan2⁡(0,n)2\sum\_{n=1}^{a} \frac{e^{\operatorname{atan2}(0,n)t}}{2\sqrt{|n|}} \left( e^{i\phi} + e^{-i\phi} \right), \quad \phi = \log(|n|)t + \frac{\operatorname{atan2}(0,n)}{2}n=1∑a​2∣n∣​eatan2(0,n)t​(eiϕ+e−iϕ),ϕ=log(∣n∣)t+2atan2(0,n)​

**wxMaxima version:**

maxima

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sum((%e^(atan2(0,n)\*t) / (2\*sqrt(abs(n))) \*

(%e^(%i\*(log(abs(n))\*t + atan2(0,n)/2)) +

%e^(-%i\*(log(abs(n))\*t + atan2(0,n)/2)))), n, 1, a);

**🧾 Summary of wxMaxima Forms**

| **Form** | **wxMaxima Expression** |
| --- | --- |
| **Original** | sum((%e^(atan2(0,n)\*t)\*cos(log(abs(n))\*t + atan2(0,n)/2))/sqrt(abs(n)), n, 1, a); |
| **Simplified (n > 0)** | sum(cos(log(n)\*t)/sqrt(n), n, 1, a); |
| **Piecewise** | sum(if n > 0 then cos(log(n)\*t)/sqrt(n) else %e^(%pi\*t)\*cos(log(abs(n))\*t + %pi/2)/sqrt(abs(n)), n, 1, a); |
| **Polar (Real part of exponential)** | realpart(sum((%e^(atan2(0,n)\*t) \* %e^(%i\*(log(abs(n))\*t + atan2(0,n)/2)))/sqrt(abs(n)), n, 1, a)); |
| **Rectangular (Euler form)** | sum((%e^(atan2(0,n)\*t) / (2\*sqrt(abs(n))) \* (%e^(%i\*(log(abs(n))\*t + atan2(0,n)/2)) + %e^(-%i\*(log(abs(n))\*t + atan2(0,n)/2)))), n, 1, a); |

Would you like help visualizing this or evaluating it for a specific value of aaa and ttt?

**You said:**

sum((%e^(atan2(0,n)\*t)\*cos(log(abs(n))\*t+atan2(0,n)/2))/sqrt(abs(n)),n,1,a) list all alternative ways of writing tis yes write as piece wise polar rectangular also in wx maxima format

**ChatGPT said:**

Great — you're looking for **all alternative forms** (piecewise, polar, and rectangular) of this expression:

**🔢 Original Expression:**

∑n=1a(eatan2⁡(0,n)⋅t⋅cos⁡(log⁡(∣n∣)⋅t+atan2⁡(0,n)2)∣n∣)\sum\_{n=1}^{a} \left( \frac{e^{\operatorname{atan2}(0,n) \cdot t} \cdot \cos\left( \log(|n|) \cdot t + \frac{\operatorname{atan2}(0,n)}{2} \right)}{\sqrt{|n|}} \right)n=1∑a​​∣n∣​eatan2(0,n)⋅t⋅cos(log(∣n∣)⋅t+2atan2(0,n)​)​​

We'll rewrite this expression in **wxMaxima format** for:

1. ✅ **Original expression**
2. ✅ **Piecewise form**
3. ✅ **Polar form** (complex exponential form with realpart)
4. ✅ **Rectangular (Euler expansion) form**

**✅ 1. Original Expression — in wxMaxima**

maxima

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sum((%e^(atan2(0,n)\*t) \* cos(log(abs(n))\*t + atan2(0,n)/2)) / sqrt(abs(n)), n, 1, a);

**✅ 2. Piecewise Form — based on atan2(0,n) behavior**

Recall:

atan2⁡(0,n)={0if n>0πif n<0\operatorname{atan2}(0, n) = \begin{cases} 0 & \text{if } n > 0 \\ \pi & \text{if } n < 0 \end{cases}atan2(0,n)={0π​if n>0if n<0​

**If you're only summing over n>0n > 0n>0, the expression simplifies:**

maxima

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sum(cos(log(n)\*t) / sqrt(n), n, 1, a);

**Full piecewise (allowing for n<0n < 0n<0, hypothetically):**

maxima

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sum(

if n > 0 then

cos(log(n)\*t) / sqrt(n)

else

%e^(%pi\*t) \* cos(log(abs(n))\*t + %pi/2) / sqrt(abs(n)),

n, 1, a

);

**✅ 3. Polar Form (using realpart and Euler’s formula)**

cos⁡(ϕ)=ℜ(eiϕ)\cos(\phi) = \Re(e^{i\phi})cos(ϕ)=ℜ(eiϕ)

So the original becomes:

ℜ(∑n=1aeatan2⁡(0,n)⋅t⋅ei(log⁡(∣n∣)⋅t+atan2⁡(0,n)2)∣n∣)\Re\left( \sum\_{n=1}^{a} \frac{e^{\operatorname{atan2}(0,n) \cdot t} \cdot e^{i (\log(|n|) \cdot t + \frac{\operatorname{atan2}(0,n)}{2})}}{\sqrt{|n|}} \right)ℜ(n=1∑a​∣n∣​eatan2(0,n)⋅t⋅ei(log(∣n∣)⋅t+2atan2(0,n)​)​)

**wxMaxima:**

maxima

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realpart(

sum(

(%e^(atan2(0,n)\*t) \* %e^(%i\*(log(abs(n))\*t + atan2(0,n)/2))) / sqrt(abs(n)),

n, 1, a

)

);

**✅ 4. Rectangular Form (using Euler’s identity):**

cos⁡(ϕ)=eiϕ+e−iϕ2\cos(\phi) = \frac{e^{i\phi} + e^{-i\phi}}{2}cos(ϕ)=2eiϕ+e−iϕ​

So full rectangular version:

**wxMaxima:**

maxima

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sum(

(%e^(atan2(0,n)\*t) / (2 \* sqrt(abs(n)))) \*

(

%e^(%i\*(log(abs(n))\*t + atan2(0,n)/2)) +

%e^(-%i\*(log(abs(n))\*t + atan2(0,n)/2))

),

n, 1, a

);

**✅ Summary Table (All in wxMaxima Format)**

| **Form** | **wxMaxima Expression** |
| --- | --- |
| **Original** | sum((%e^(atan2(0,n)\*t) \* cos(log(abs(n))\*t + atan2(0,n)/2)) / sqrt(abs(n)), n, 1, a); |
| **Simplified (n > 0)** | sum(cos(log(n)\*t) / sqrt(n), n, 1, a); |
| **Piecewise (for full domain)** | sum(if n > 0 then cos(log(n)\*t)/sqrt(n) else %e^(%pi\*t)\*cos(log(abs(n))\*t + %pi/2)/sqrt(abs(n)), n, 1, a); |
| **Polar** | realpart(sum((%e^(atan2(0,n)\*t) \* %e^(%i\*(log(abs(n))\*t + atan2(0,n)/2))) / sqrt(abs(n)), n, 1, a)); |
| **Rectangular** | sum((%e^(atan2(0,n)\*t) / (2 \* sqrt(abs(n)))) \* (%e^(%i\*(log(abs(n))\*t + atan2(0,n)/2)) + %e^(-%i\*(log(abs(n))\*t + atan2(0,n)/2))), n, 1, a); |

Would you like me to evaluate or visualize this for specific values of t and a in wxMaxima, or prepare a plotting script for you?

**You said:**

sum(n^(-(%i\*t)-1/2),n,1,a),real part sum((%e^(atan2(0,n)\*t)\*cos(log(abs(n))\*t+atan2(0,n)/2))/sqrt(abs(n)),n,1,a), imaginary part -sum((%e^(atan2(0,n)\*t)\*sin(log(abs(n))\*t+atan2(0,n)/2))/sqrt(abs(n)),n,1,a) n wx maxima accounting all

**ChatGPT said:**

Got it! You want to express the complex sum

S=∑n=1an−(12+it)S = \sum\_{n=1}^a n^{-\left(\frac{1}{2} + i t \right)}S=n=1∑a​n−(21​+it)

and show explicitly its **real part** and **imaginary part** in terms of sums involving exponentials, cosines, and sines, all in **wxMaxima** syntax, **accounting for** the factor involving atan2⁡(0,n)\operatorname{atan2}(0,n)atan2(0,n).

**1️⃣ Complex sum:**

S=∑n=1an−(12+it)=∑n=1a1n1/2+it=∑n=1an−1/2e−itlog⁡nS = \sum\_{n=1}^a n^{-\left(\frac{1}{2} + i t\right)} = \sum\_{n=1}^a \frac{1}{n^{1/2 + i t}} = \sum\_{n=1}^a n^{-1/2} e^{-i t \log n}S=n=1∑a​n−(21​+it)=n=1∑a​n1/2+it1​=n=1∑a​n−1/2e−itlogn

**2️⃣ Expressing powers in terms of exponentials:**

n−(12+it)=n−1/2⋅e−itlog⁡nn^{-\left(\frac{1}{2} + i t\right)} = n^{-1/2} \cdot e^{-i t \log n}n−(21​+it)=n−1/2⋅e−itlogn

Using Euler's formula for the exponential:

e−itlog⁡n=cos⁡(tlog⁡n)−isin⁡(tlog⁡n)e^{-i t \log n} = \cos(t \log n) - i \sin(t \log n)e−itlogn=cos(tlogn)−isin(tlogn)

**3️⃣ Now split sum SSS into real and imaginary parts:**

S=∑n=1acos⁡(tlog⁡n)n−i∑n=1asin⁡(tlog⁡n)nS = \sum\_{n=1}^a \frac{\cos(t \log n)}{\sqrt{n}} - i \sum\_{n=1}^a \frac{\sin(t \log n)}{\sqrt{n}}S=n=1∑a​n​cos(tlogn)​−in=1∑a​n​sin(tlogn)​

**4️⃣ Connection with the atan2⁡\operatorname{atan2}atan2 terms:**

For n>0n > 0n>0, atan2⁡(0,n)=0\operatorname{atan2}(0,n) = 0atan2(0,n)=0, so the sums in your original expressions involving atan2⁡(0,n)\operatorname{atan2}(0,n)atan2(0,n) reduce to exactly these cosine and sine sums multiplied by 1/n1/\sqrt{n}1/n​.

**✅ Final expressions in wxMaxima syntax:**

**Complex sum SSS:**

maxima

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sum(n^(-(%i\*t) - 1/2), n, 1, a);

**Real part of SSS (matches your cosine sum):**

maxima

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sum((%e^(atan2(0,n)\*t) \* cos(log(abs(n))\*t + atan2(0,n)/2)) / sqrt(abs(n)), n, 1, a);

Since atan2⁡(0,n)=0\operatorname{atan2}(0,n) = 0atan2(0,n)=0 for n>0n>0n>0, this simplifies to:

maxima

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sum(cos(log(n)\*t) / sqrt(n), n, 1, a);

**Imaginary part of SSS (negative sine sum):**

ℑ(S)=−∑n=1asin⁡(tlog⁡n)n\Im(S) = - \sum\_{n=1}^a \frac{\sin(t \log n)}{\sqrt{n}}ℑ(S)=−n=1∑a​n​sin(tlogn)​

Written in wxMaxima with atan2⁡\operatorname{atan2}atan2:

maxima

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-%sum((%e^(atan2(0,n)\*t) \* sin(log(abs(n))\*t + atan2(0,n)/2)) / sqrt(abs(n)), n, 1, a);

Simplified (for n>0n>0n>0):

maxima

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-%sum(sin(log(n)\*t) / sqrt(n), n, 1, a);

**📋 Summary**

| **Quantity** | **wxMaxima expression** |
| --- | --- |
| Complex sum SSS | sum(n^(-(%i\*t) - 1/2), n, 1, a); |
| Real part ℜ(S)\Re(S)ℜ(S) | sum(cos(log(n)\*t)/sqrt(n), n, 1, a); |
| Imag part ℑ(S)\Im(S)ℑ(S) | -%sum(sin(log(n)\*t)/sqrt(n), n, 1, a); |

**If you want to keep the atan2⁡\operatorname{atan2}atan2 for general nnn:**

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/\* Complex sum \*/

sum(n^(-(%i\*t) - 1/2), n, 1, a);

/\* Real part \*/

sum((%e^(atan2(0,n)\*t) \* cos(log(abs(n))\*t + atan2(0,n)/2)) / sqrt(abs(n)), n, 1, a);

/\* Imaginary part \*/

-%sum((%e^(atan2(0,n)\*t) \* sin(log(abs(n))\*t + atan2(0,n)/2)) / sqrt(abs(n)), n, 1, a);

If you want me to generate code for numeric evaluation or plotting in wxMaxima, just ask!

**You said:**

/\* Complex sum \*/ sum(n^(-(%i\*t) - 1/2), n, 1, a); /\* Real part \*/ sum((%e^(atan2(0,n)\*t) \* cos(log(abs(n))\*t + atan2(0,n)/2)) / sqrt(abs(n)), n, 1, a); /\* Imaginary part \*/ -%sum((%e^(atan2(0,n)\*t) \* sin(log(abs(n))\*t + atan2(0,n)/2)) / sqrt(abs(n)), n, 1, a); ,,, and atan2( all in pice wise form in rectangular polar cylidrical,elliptical coordinates replacing atan2( paraMETETR OF T BUT STILL GIVING CORRECT WAY IN EWXMAXIMA

**ChatGPT said:**

Got it! You want to **replace** the atan2(0,n) term with its **piecewise form** (since atan2⁡(0,n)\operatorname{atan2}(0,n)atan2(0,n) is just an angle depending on the sign of nnn) — and then write the expressions in **rectangular, polar, cylindrical, and elliptical coordinates** formats, **all still valid in wxMaxima**, and keeping t as a parameter.

**Step 1: Understanding atan2⁡(0,n)\operatorname{atan2}(0, n)atan2(0,n)**

atan2⁡(0,n)={0if n>0πif n<0undefinedn=0\operatorname{atan2}(0,n) = \begin{cases} 0 & \text{if } n > 0 \\ \pi & \text{if } n < 0 \\ \text{undefined} & n=0 \end{cases}atan2(0,n)=⎩⎨⎧​0πundefined​if n>0if n<0n=0​

Since your sums go from n=1n=1n=1 to a>0a > 0a>0, n>0n > 0n>0 always, so atan2⁡(0,n)=0\operatorname{atan2}(0,n) = 0atan2(0,n)=0. But let's keep the piecewise for completeness.

**Step 2: Replace atan2(0,n) by piecewise form in wxMaxima:**

maxima

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/\* Define piecewise atan2(0,n) \*/

atan2\_0\_n : lambda([n],

if n > 0 then 0

else if n < 0 then %pi

else 'undefined /\* or 0 if you prefer \*/

);

**Step 3: Rewrite the complex sum and its real/imag parts using this piecewise inside wxMaxima syntax**

**Complex sum:**

S=∑n=1an−(12+it)=∑n=1aeatan2⁡(0,n)⋅t∣n∣⋅[cos⁡(log⁡∣n∣⋅t+atan2⁡(0,n)2)−isin⁡(log⁡∣n∣⋅t+atan2⁡(0,n)2)]S = \sum\_{n=1}^a n^{-(\frac{1}{2} + i t)} = \sum\_{n=1}^a \frac{e^{\operatorname{atan2}(0,n) \cdot t}}{\sqrt{|n|}} \cdot \left[\cos\left( \log|n| \cdot t + \frac{\operatorname{atan2}(0,n)}{2} \right) - i \sin\left(\log|n| \cdot t + \frac{\operatorname{atan2}(0,n)}{2}\right)\right]S=n=1∑a​n−(21​+it)=n=1∑a​∣n∣​eatan2(0,n)⋅t​⋅[cos(log∣n∣⋅t+2atan2(0,n)​)−isin(log∣n∣⋅t+2atan2(0,n)​)]

**wxMaxima code (using atan2\_0\_n(n) function):**

maxima

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sum(

( %e^(atan2\_0\_n(n) \* t) \* (cos(log(abs(n))\*t + atan2\_0\_n(n)/2) - %i\*sin(log(abs(n))\*t + atan2\_0\_n(n)/2)) )

/ sqrt(abs(n)),

n, 1, a

);

**Step 4: Express in rectangular, polar, cylindrical, elliptical coordinates with respect to the angle θ=atan2⁡(0,n)\theta = \operatorname{atan2}(0,n) θ=atan2(0,n)**

**4a. Rectangular coordinates (x,y)(x, y)(x,y)**

Using angle θ=atan2⁡(0,n)\theta = \operatorname{atan2}(0,n)θ=atan2(0,n), rectangular coordinates:

x=rcos⁡θ,y=rsin⁡θx = r \cos \theta, \quad y = r \sin \thetax=rcosθ,y=rsinθ

Here, since θ\thetaθ depends only on nnn, and r=1r=1r=1 (unit circle), this means:

* For n>0n > 0n>0: θ=0  ⟹  (x,y)=(1,0)\theta=0 \implies (x,y) = (1,0)θ=0⟹(x,y)=(1,0)
* For n<0n < 0n<0: θ=π  ⟹  (x,y)=(−1,0)\theta=\pi \implies (x,y) = (-1,0)θ=π⟹(x,y)=(−1,0)

The exponential part eθte^{\theta t}eθt can be interpreted as

etθ=etx+itye^{t \theta} = e^{t x + i t y}etθ=etx+ity

But here θ\thetaθ is real, so in rectangular:

maxima

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/\* Exponential in rectangular coordinates \*/

exp\_rect(n) := %e^(t \* (cos(atan2\_0\_n(n)) + %i \* sin(atan2\_0\_n(n))));

But since y=0y = 0y=0, the imaginary part is zero here.

**4b. Polar coordinates (r,θ)(r, \theta)(r,θ)**

The term et⋅θe^{t \cdot \theta}et⋅θ is already **polar**, where r=et⋅θr = e^{t \cdot \theta}r=et⋅θ and θ=log⁡∣n∣⋅t+θ2\theta = \log|n| \cdot t + \frac{\theta}{2}θ=log∣n∣⋅t+2θ​ inside the cosine/sine.

Rewrite sum as:

maxima

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sum(

( %e^(t \* atan2\_0\_n(n)) \* cos(log(abs(n))\*t + atan2\_0\_n(n)/2) ) / sqrt(abs(n)),

n, 1, a

);

**4c. Cylindrical coordinates (r,θ,z)(r, \theta, z)(r,θ,z)**

If you consider ttt as the zzz-coordinate parameter (height), then:

* r=1r = 1r=1 (on unit circle)
* θ=atan2⁡(0,n)\theta = \operatorname{atan2}(0,n)θ=atan2(0,n)
* z=tz = tz=t

The exponential is etθe^{t \theta}etθ, so in cylindrical:

maxima

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exp\_cylindrical(n) := %e^(z \* atan2\_0\_n(n));

and cosine/sine arguments remain the same.

**4d. Elliptical coordinates (μ,ν)(\mu, \nu)(μ,ν)**

Elliptical coordinates are less straightforward but generally:

x=fcosh⁡μcos⁡ν,y=fsinh⁡μsin⁡νx = f \cosh \mu \cos \nu, \quad y = f \sinh \mu \sin \nux=fcoshμcosν,y=fsinhμsinν

Here, ν\nuν is analogous to an angle parameter like θ\thetaθ.

You can replace atan2⁡(0,n)\operatorname{atan2}(0,n)atan2(0,n) by ν\nuν:

maxima

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/\* Example: define angle parameter \*/

nu\_n : atan2\_0\_n(n);

/\* Use nu\_n in exponential and trig functions \*/

exp\_elliptical(n) := %e^(t \* nu\_n);

**Step 5: Final wxMaxima combined code**

maxima

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/\* Define piecewise atan2(0,n) \*/

atan2\_0\_n : lambda([n],

if n > 0 then 0

else if n < 0 then %pi

else 0 /\* or undefined \*/

);

/\* Complex sum \*/

sum(

( %e^(t \* atan2\_0\_n(n)) \* (cos(log(abs(n))\*t + atan2\_0\_n(n)/2) - %i\*sin(log(abs(n))\*t + atan2\_0\_n(n)/2)) )

/ sqrt(abs(n)),

n, 1, a

);

/\* Real part \*/

sum(

( %e^(t \* atan2\_0\_n(n)) \* cos(log(abs(n))\*t + atan2\_0\_n(n)/2) )

/ sqrt(abs(n)),

n, 1, a

);

/\* Imaginary part \*/

-%sum(

( %e^(t \* atan2\_0\_n(n)) \* sin(log(abs(n))\*t + atan2\_0\_n(n)/2) )

/ sqrt(abs(n)),

n, 1, a

);

/\* Rectangular coordinates example \*/

exp\_rect(n) := %e^(t \* cos(atan2\_0\_n(n)) + %i \* t \* sin(atan2\_0\_n(n)));

/\* Polar coordinates example \*/

exp\_polar(n) := %e^(t \* atan2\_0\_n(n));

/\* Cylindrical coordinates example \*/

exp\_cylindrical(n) := %e^(z \* atan2\_0\_n(n));

/\* Elliptical coordinates example \*/

exp\_elliptical(n) := %e^(t \* atan2\_0\_n(n));

**Summary:**

* The key is defining the **piecewise** atan2⁡(0,n)\operatorname{atan2}(0,n)atan2(0,n) as a function.
* Use this function inside the exponentials and trig functions.
* Then write versions of the exponentials in rectangular, polar, cylindrical, or elliptical coordinate style **by interpreting the angle parameter** accordingly.
* This keeps the parameter ttt intact, and your sums remain correct in wxMaxima.

If you want, I can help you generate ready-to-run wxMaxima code or plots with these forms! Just say the word.