# Solving the Nerd-Sniping Problem

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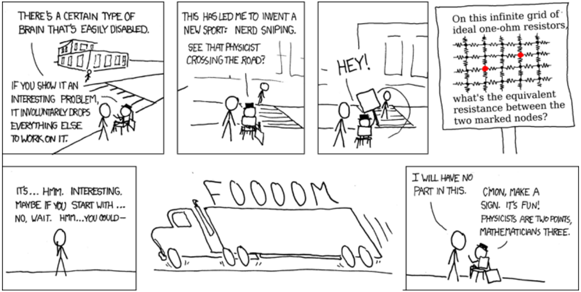
# xkcd.com/356




Title text: I first saw this problem on the Google Labs Aptitude Test. A professor and I filled a blackboard without getting anywhere. Have fun.

# What Makes a Nerd-Snipe?

"Easy to understand, hard to master". As a result, it captivates our thoughts.

Other examples (promise me you won't think about them during the talk):

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1. How can you cut a circle into congruent pieces such that not every piece contains the origin?
2. Start with a positive integer, divide by 2 if it's even, and otherwise multiply by 3 and add 1. If you repeat this, will you always end up at 1?

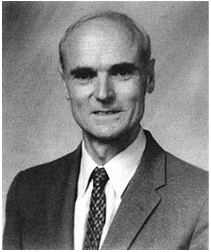
# Roadmap

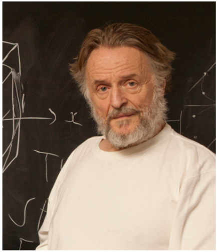
1. History of nerd-sniping.
2. Voltage, resistance.
3. Characteristic polynomials, and solving the resistance problem.
4. Final thoughts on nerd-sniping.

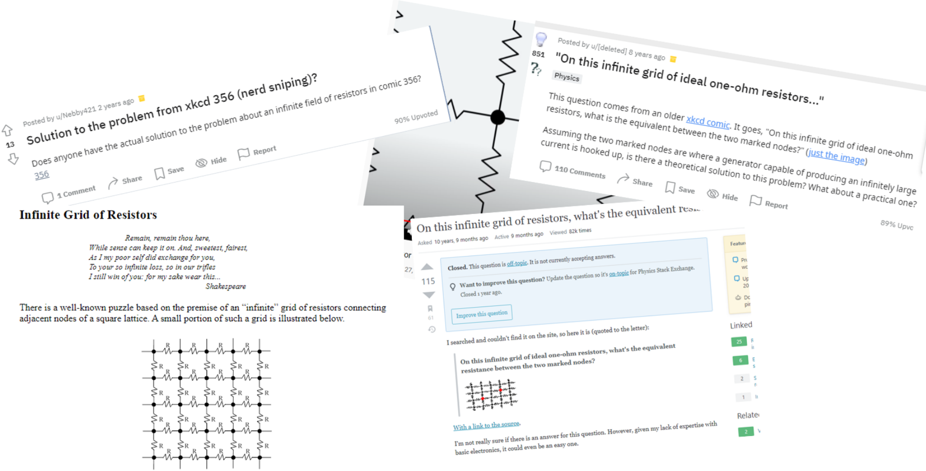
# Nerd Sniping, First Mention

# Nerd Sniping, Origin

Coxeter came to Cambridge and gave a lecture. Then he had this problem for which he gave proofs for selected examples, and he asked for a unified proof. I left the lecture room thinking. As I was walking through Cambridge, suddenly the idea hit me, but it hit me while I was in the middle of the road. When the idea hit me I stopped and a large truck ran into me and bruised me considerably and the man considerably swore at me. So I pretended that Coxeter had calculated the difficulty of this problem so precisely that he knew that I would get the solution just in the middle of the road. In fact I limped back after the accident to the meeting. Coxeter

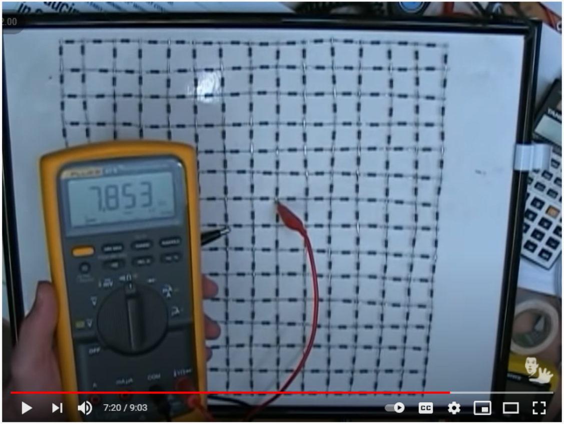






Posted by u/Nebby421 2 years ago
13
Solution to the problem from xkcd 356 (nerd sniping)?
Does anyone have the actual solution to the problem about an infinite field of resistors in comic 356?
90% Upvoted
1 Comment
Share
Save
Hide
Report
Infinite Grid of Resistors
Remain, remain thou here,
While sense can keep it on. And, sweetest, fairest,
As I my poor self did exchange for you,
To your so infinite loss, so in our trifles
I still win of you: for my sake wear this...
Shakespeare
There is a well-known puzzle based on the premise of an "infinite" grid of resistors connecting adjacent nodes of a square lattice. A small portion of such a grid is illustrated below.
Posted by u/[deleted] 8 years ago
851
"On this infinite grid of ideal one-ohm resistors..."
Physics
This question comes from an older xkcd comic. It goes, "On this infinite grid of ideal one-ohm resistors, what is the equivalent between the two marked nodes?" (just the image)
Assuming the two marked nodes are where a generator capable of producing an infinitely large current is hooked up, is there a theoretical solution to this problem? What about a practical one?
110 Comments
Share
Save
Hide
Report
89% Upvo
On this infinite grid of resistors, what's the equivalent res...
Asked 10 years, 9 months ago Active 9 months ago Viewed 82k times
115
Closed. This question is off-topic. It is not currently accepting answers.
Want to improve this question? Update the question so it's on-topic for Physics Stack Exchange.
Closed 1 year ago.
Improve this question
I searched and couldn't find it on the site, so here it is (quoted to the letter):
On this infinite grid of ideal one-ohm resistors, what's the equivalent resistance between the two marked nodes?
With a link to the source.
I'm not really sure if there is an answer for this question. However, given my lack of expertise with basic electronics, it could even be an easy one.
Linked
Relate

# Nerd Sniping, Attempts




EEVblog #25 - The Infinite Resistor Puzzle

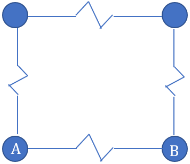
# Setup: Electric Potential and Current

1. Start by defining a function $V$ on all points in the space.
2. Ohm's Law: $V = IR, I_{u,v} = \frac{1}{R}(V_u - V_v)$.
3. Kirchoff's Law: sum of currents at a point is 0.
4. When all resistance are the same: if $P$ is the averaging operator, then $PV = V, (P - id)V = 0$.

# How to find Equivalent Resistance?

Suppose I add require 1 current to enter $A$ and leave $B$. What is the potential difference between $A$ and $B$?

Exercises:

# 1-dimensional case

1. $2V(0) - V(1) - V(-1) = 2$. Set $V(0) = 0$ and add symmetry to require that $V(1) = V(-1)$.
2. We have $2V(n) = V(n+1) + V(n-1)$ for $n \neq 0$, and the characteristic polynomial is $2 = \mu + \frac{1}{\mu}$.

# 2-dimensional case

1. The characteristic polynomial becomes $4 = \mu + \frac{1}{\mu} + \nu + \frac{1}{\nu}$. Infinite solutions!
2. General solution given by linear combinations of the function $\mu^x \nu^y$.
3. Transform with $\alpha = \log(\mu)/i, \beta = \log(\nu)/i$. Then, $V(x, y) = \int_{-\pi}^{\pi} C(\alpha, \beta) e^{i(x\alpha + y\beta)} d\alpha$ and $2 - \cos(\alpha) - \cos(\beta) = 0$.
4. Use symmetry and conditions to get $C = \frac{1}{4\pi i \sin(\beta)}$.
5. Plug in to solve for $V(2, 1) = 1/4 - 2/\pi$.
6. Conclusion: $R = 4/\pi - 1/2$.

# Concluding thoughts

Why try nerd-sniping problems?