

Pennies



go figure

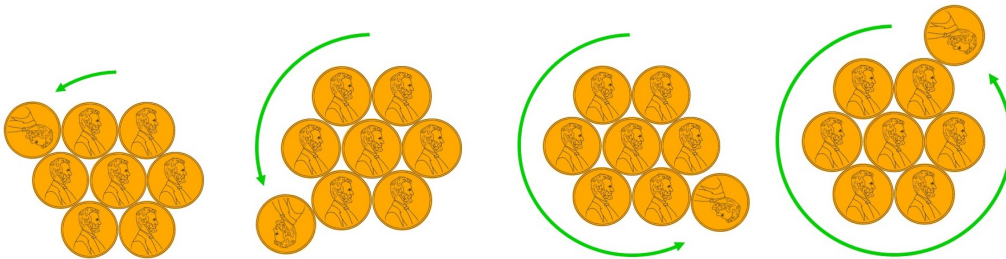
Suppose you have 8 pennies, and you arrange 7 of them in a cluster like this:



Now suppose you take the eighth penny and place it at the top:



And then you roll it around the outside of the cluster, never letting it slide and always staying in contact with the cluster:



Viewing the whole scenario from above, how many 360-degree rotations does the outer penny make during one trip around the central cluster?

You can start playing with the problem by trying this yourself – tape 7 pennies to a table, roll an eighth around them, and see what happens. (If the pennies are sliding too much, you can also do this with quarters or with cardboard circles – will it change your answer?) Can you make an explanation for why you see what you see? Is your answer exact?