27 Cards Trick: What's in the Middle?

<u>What the audience sees.</u>

   You have a stack of cards, and tell the audience that there are 27 cards in it. You ask a volunteer from the audience to choose any card from the stack, memorize it, and show it to the audience. Then the volunteer puts the card back into the stack. Then you explain that you will put all the cards into 3 stacks 3 times, and each time the volunteer will have to tell you which of the 3 stacks contains his/her card (but not tell you which card it is). You also say that after putting all the cards back together, you will be able to find the volunteer's card. After you reassemble the cards the third time, you say that not only you know which card is theirs, but you also managed to put it in the middle of the stack. You begin to discard cards (face down) one at a time from the top and the bottom alternately until just one card remains. You show this card, and indeed, it is the card that the volunteer picked.

<u>How you do it.</u>

   The position of the card in the end will be determined by how you reassemble the 3 stacks each time. In the beginning you get the stack with the volunteer's card in it, and you do not know its value or position. Keep the cards face down in one hand and start putting them into 3 stacks, face up: you put one card into the first stack, one into the second, one into the third, then one into the first one again, and so on. When you are done (there will be 9 cards in each stack), the volunteer tells you which stack contains his/her card. It is important to put that stack in the <u>MIDDLE</u> when you put the three stacks together (still face up). Then you turn the whole stack over, and repeat the process of putting the cards into 3 stacks face up. Again, you are told which stack contains the volunteer's card. Put this stack in the middle again. You turn the whole stack over again, and put the cards into 3 stacks one last time. The stack with the volunteer's card has to go in the middle again. Now, you turn the whole stack over again, and tell the audience that their card is in the middle. You begin to discard cards (face down) one at a time from the top and the bottom alternately until just one card remains. You show this card to the audience.

<u>Why it works.</u>

Let's trace the cards in the stacks we were told to contain the volunteer's card.

First time you reassemble the 3 stacks, the stack with the volunteer's card goes in the middle. When you turn the stack over, it is still in the middle:

When you put them into 3 stacks again, these 9 cards take the middle 3 spots in each stack:

The volunteer tells you which of the stacks contains his/her card, and you put this stack in the middle again. Now you know that the volunteer's card is one of the 3 cards in the middle of the whole stack. After you turn the whole stack over, these 3 cards are still the 3 middle cards:

When you put the cards into 3 stacks again, these 3 cards take the middle positions in the 3 stacks:

Finally, you put the stack that the volunteer points to in the middle again, and his/her card becomes the middle card in the whole stack.

Question. This trick will also work with some other numbers of cards and piles. Which ones?