Math 211 POW Three

Format
- Write neatly and clearly on white paper (lined or unlined)
- Attach a POW cover sheet to the front of your work for turn in

Directions
- ✓ Refer to your POW directions (Math 211 Problem of the Week Directions)
- ✓ Read **all** of the directions given here

Refer to the ***Just for Fun*** "Force Out" at the end of Activity Set 3.2, page 73 in your Activity Book.

JUST FOR FUN

FORCE OUT (2 players)

The whole numbers from 1 to 21 are listed as shown below. The players take turns crossing off one, two, or three consecutive numbers, starting with 1. For example, player A might cross off 1 and 2, player B might cross off 3, 4, and 5, and so forth. The loser is the player who is forced to cross off the last number, 21. Play the game a few times. Can you develop a strategy for winning?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

****Winning Strategy:*** With a little practice, you will see some "winning numbers." Suppose it is your turn to move and the numbers from 1 to 15 have been crossed off. If you cross off the number 16, you can win the game no matter what your opponent does. Why? What number preceding 16 must you cross off in order to guarantee that you will get to cross off 16? Work backward in this manner to develop a winning strategy. Can you always win if you start? Can you always win if your opponent starts?

Toothpick Variation: Twenty-one toothpicks are spread in a row, as shown below. One of the toothpicks is bent. The players take turns selecting 1, 2, 3, or 4 toothpicks from the row. The loser is the player who is forced to select the bent toothpick. Play the game a few times. Can you develop a strategy for winning?

Other Variations: An arbitrary whole number is selected. The players take turns mentally subtracting 1, 2, 3, 4, or 5 from that number. The loser is the player who is forced to reach zero. Describe a strategy for winning this game. (*Hint:* Start with a number like 30 and play the game a few times.)

Read over the paragraph "Winning Strategy."

As suggested in that paragraph, work backwards and develop a winning strategy.

Explain your winning strategy. Support your work with problem solving explanations and be sure to show examples.