PFS 20-4 10/30/06 _____

# Two Games with Pennies!

## I. Ten Nim

Start with ten pennies. Two players take turns taking either one or two pennies. The player who takes the last penny loses.

1) Play some games! What do you notice?

2) Does the first or second player have an advantage? Does either have a strategy that will always win? If so, how does it work?

3) Can you invent a variation?

## II. Matching Pennies

It was flu season, and only one student, Lucky Louie, showed up in Professor Swindle's math class.

"No point teaching today," said Louie. "How about we match pennies instead?"

"Okay," said the professor, "but let's make it more interesting. "If the pennies are head-head, I'll pay you 9 cents. If they're tail-tail, I'll pay you 1 cent. And if they're different, you pay me 5 cents."

"Hmm, sounds fair," said Louie, thinking quickly. "And I can stack my pennies any way I want? For example, I can do more heads than tails if I want?"

"Sure. Let's play stacks of ten at a time. And you can arrange each one differently if you want."

And so--for an hour--they played.

4) Play the game for a while. Keep track of your results. Is the game fair? Explain.

5) Who do you think won, Lucky Louie or Professor Swindle? Why?

6) Does one player have a winning strategy? Explain it!

7) Hint for algebra students: Try to graph payoff functions for the Professor, depending on the percentage of heads in his stack of pennies. You should graph two lines, one showing the payoff if Louie plays heads, one if he plays tails.

8) Have fun!

Source for Matching Pennies: *Puzzle Math* by George Gamow and Marvin Stern

PFS 20-4 Alternative 10/30/06 _____

# Number Patterns

Can you guess the next two numbers? Can you write down a rule? Can you make a pattern of your own? Have fun!

1) 1, 1, 2, 3, 5, 8, __, __

2) 2, 4, 6, 8, 10, __, __

3) 1, 4, 7, 10, __, __

4) 1, 2, 4, 8, 16, __, __

5) 5, 10, 15, 20, __, __

6) 1, 3, 6, 10, 15, __, __

7) 1, 2, 3, 6, 7, 14, 15, __, __

8) 1, 8, 27, 64, __, __

9) 1, 4, 9, 16, 25, __, __

10) 1, 2, 6, 24, 120, __, __

11) 2, 3, 5, 7, 11, 13, 17, __, __

12) 31, 28, 31, 30, 31, __, __

13) 3, 3, 5, 4, 4, 3, __, __

"Warning!" said the POW teacher. "Number 13 is kinda slimy and extra-mathematical!"

"Does Number 13 count?" asked the POW student.

"Well... Number 13 does count in a way...."