

Math Magic: Games and Winning Strategies

Issue #16: Some classroom and tutoring favorites

(grades 4-12)

[An Index of All Math Magic Activities](#)

(A rough draft which needs editing)

The purposes of “games” are to have a fun break from the regular class or lesson; to use reasoning, pattern recognition, and problem solving tools; to support other math skills or concepts past or present; to give the students a chance to be on equal footing with adults. As in previous games, all students will be given the opportunity to discover the answers on their own without teacher or students “telling the method used.

FIRST TO 21 WINS “is a simple game that you can always win if you go second. The goal of the game is to be the first person to say “21”. The rules are that you can only add 1 or 2 to whatever the other player says. For example, the first player can say “1” or “2”. If he said “2” the second player can say “3” or “4” and so on. ([Online source here.](#))

There is a [strictly dominant strategy](#) in this game. You can use backward induction to figure out what to do. Try to figure it out yourself first, but below is the strategy.

1. You need to get them to say 19 or 20; therefore, if you say 18, you win.
2. To say 18, you need to get them to say 16, or 17, so if you say 15, you win.
3. Continuing on, if you say 12 you win
4. if you say 9, you win,
5. if you say 6, you win,
6. if you say 3, you win
7. So, if you go second, you can guarantee that you will say 3, and win every time.

When playing this with people, the secret is to not let on that you are doing a strategy against them. To win the most times possible, act like you are thinking about what to do on every turn, even though you know what you will say.

If you go first, just hope that they don’t know the dominant strategy and mess up one time. Once that happens, you can get back onto the winning track and win every time.

RELATED QUESTIONS ON STRATEGY

1. If two people know the winning strategy, does it make a difference who goes first?
2. Can one win the game who doesn't know the secret to end on 21?
3. If a new player accidentally ends on a multiple of three, what does the opponent do?
4. What would be the winning strategy if the object was not to land on 21?
5. What would be the winning strategy if one could chose three numbers to land on 21?

WHAT’S IN MY WORLD?

The Leader (who has a rule in mind) asks for a word or number from the audience and responses with a word which fits that rule. For example, one person says “salt” and I say “*pepper* is in my world, but *seasoning* is not.” “*Sweet* is in my world, but *sugar* is not.” All of a sudden someone says, I’ve got it. Then I test that person by try one of me when I give the word *wagon*. If they say cart, I know they do not know my rule, but if they respond by saying *buggy*, *noon*, *happy*, *choose*, *goose*, *better*, etc., I think they see my rule, and without telling anyone what the rule is, that person can be the leader, until more and more people understand what’s happening. (I may give a hint that it has to do with spelling, and not the meaning of the word itself. Or one could choose words which are all verbs, adverbs, proper nouns, etc. Great way to acknowledge that grammar is import even in a math class.

The same can be done with numbers. The domain is numbers from 1 to 100, and someone might say 42, I would say Yes, 42 is in this world, or fits this rule. But 24 doesn’t. 14 does, 36 does, 49 does, etc..as does any number $(n) \times 6$ does. Again the correct guesser can go on to lead the class with this rule or come up with another of her own.

Algebra or above students might even run simple numbers through a $2n-1$ function. So if a student says 5, the leader would mentally figure $2(5)-1=9$.

(More games to follow in other issues.)