

Factor Game



Student Activity

7 8 9 10 11 12



TI-84CE



Activity



Student



90 min

The factor game involves two players. Instructions – How to Play

The factor game involves two players. Player one starts by selecting a number between 1 and 49 inclusive. The selected number is added to player one's score, provided the number has at least one *proper factor*¹ remaining on the board. The selected number is immediately removed from the board. Player two automatically scores the sum of all the remaining proper factors, these factors are then removed from the board. It is now player two's turn to select a number.

Player two selects a number from those remaining on the board. Player two scores this number, provided at least one proper factor remains. The selected number is immediately removed from the board. Player one scores the sum of all the remaining proper factors which are then removed from the board.

If any player selects a number that does not have any proper factors remaining on the board, the selection is deemed invalid. When a player selects an invalid number they score zero points for that turn, so too their opponent, however play is then transferred to the opponent.

The game ends when neither player can make a valid selection.

Example:

Player 1: The number 44 is selected. Proper factors of 44 are: {1, 2, 4, 11, 22}. As all of these numbers are currently on the board the selection is valid. The number 44 is immediately removed leaving player two to score: $1 + 2 + 4 + 11 + 22 = 40$ points. The numbers: 1, 2, 4, 11, 22 and 44 are now all removed from play. It is now player two's turn to select a number.

Player 2: The number 33 is selected. Proper factors of 33 are: {1, 3, 11}, however only the number 3 remains on the board. As a proper factor is still in play the number 33 is valid so player two scores 33 points, taking their total to: $40 + 33 = 73$ points. Player one scores the sum of the remaining proper factors: 3 bringing their total to: $44 + 3 = 47$ points. The numbers now removed from the board include: {1, 2, 3, 4, 11, 22, 33, 44}. It is now player one's turn again.

Calculator & Board

A board has been supplied to play the game with a partner. Use counters to cover up numbers as they are selected from the board.

If you need to verify the factors of any number use the "Factors" program on the calculator.

¹ Proper Factor Example: Factors of 6: {1, 2, 3, 6}. Proper factors of 6: {1, 2, 3}. The original number is ignored when referring to proper factors. In some cases unity (1) is also ignored. For the purposes of this game, the number 1 is included as a proper factor.

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35
36	37	38	39	40	41	42
43	44	45	46	47	48	49

Question & Discussion Points

Question: 1.

Which number would be better to start with: 46 or 39? Justify your answer and include supporting calculations.

Question: 2.

Which number is the best starting number? Justify your answer and include supporting calculations.

Question: 3.

Which numbers, if any, would provide a higher score for your opponent if selected first?

Question: 4.

If you are player two, and player one selected 39 as the first number, what number should you choose? Justify your answer with supporting calculations.

Question: 5.

If the number 35 is selected first, what numbers will never be removed from the board?

Question: 6.

Will the combined score of player one and two be the same for every game?

Human vs Computer

The Factor Game is also available on the calculator allowing you to compete against the calculator for the highest score. In this game 'humans' go first, very polite; however you can force the calculator to go first by selecting a '0' for your first number. The game automatically ends when there are no more valid numbers on the board, however the game can be exited prematurely by entering a number greater than 49. The aim is to beat the calculator. Scores are done automatically, however you must keep a record of each turn including factors and the factor sum.

Question: 7.

Play the factor game 5 times and record the scoring for each game. Who won the most, calculator or human? Were the combined scores the same each time?

Question: 8.

Thinking just one move in advance; and selecting the best number for each move, what is the ideal sequence of numbers if the number 49 is selected first?

Question: 9.

Using an example, show that 'thinking only about one move in advance' is not a sufficient strategy.