



## First Connect Three

<http://nrich.maths.org/5865>

To try this puzzle you will need a copy of the playing board and cards.

In this game the winner is the first to complete a row of three, either horizontally, vertically or diagonally.

Roll the dice and decide whether you want to add or subtract to produce a total shown on the board. Your total will then be covered with a counter.

	-5	-4	-3	-2
-1	0	1	2	3
4	5	6	7	8
9	10	11	12	

You cannot cover a number which has already been covered.

If you are unable to find a total which has not been covered you must pass.

Are there some numbers that we should be aiming for? Why?

Which number on the grid is the easiest to get? Why?

Which number is the most difficult to get? Why?

### You Will Need:

- Two standard 1 - 6 dice
- Copies of playing board above are available for printing from the site

This activity is taken from the NRICH website and features on the Hands On Maths Roadshow: <http://www.mmp.maths.org/roadshow>. It also appears on the curriculum mapping document: <http://nrich.maths.org/curriculum>

### Why do this problem?

This problem is a great way for students to take responsibility for their own learning. They can avoid negative numbers if they are not confident or they can push themselves to calculate negative answers. In analysing the game more fully, rather than just playing it, the idea is for learners to develop a system for finding all the possible ways of making each number on the grid so they can justify which are the easiest to get.

### Possible approach

You could introduce the game by playing against the class, or by splitting the class into two teams to play against each other. Students can play against each other in pairs to get more of an idea of the game.

After a suitable length of time, ask the suggested questions in a whole-class discussion that focuses on emerging strategies, observations, explanations and justifications. Students can then go back to working in pairs to establish the numbers of ways of achieving the different totals.

At the end of the lesson another discussion can offer a chance to present findings and can draw attention to those methods which were particularly efficient. This would then lead to a discussion about how their findings might affect the way they play the game to win.

### Key questions

Are there some numbers that we should be aiming for? Why?

Which numbers on the grid are the easiest to get? Why?

Which numbers are most difficult to get? Why?

### Possible extension

Further challenges could be provided by asking what would happen if:

- there was a differently shaped board
- numbers appeared more than once on the board and you could place more than one counter in a turn
- you could use dodecahedral dice or, for example, 1-12 spinners
- you wanted to design a board for a game where you allowed multiplication and division

For students who are able to add and subtract both positive and negative numbers, the game *Connect Three* and the problem *Playing Connect Three* are suitable extensions.

### Possible support

If some pupils are struggling, you could adapt the board so that it only contains the numbers 1-12.