Race to the Target – Teacher notes for recorded version

Thank you for joining us for this enrichment event! These notes are designed to support you in supporting your students. Please don't read these notes to your students before the event or it will spoil some of the surprises! The presenters will share this information with students, this is for your use as a reminder / prompt for further thinking.

At various different times, you might want to pause the recording to allow students to take part in the activity or to ask them to think about the maths. We have suggested some opportunities for this, but you can pause whenever you feel your students will benefit.

Your students will need a pen and paper, or access to the games Got it and those on the 'Wild Maths' website. Use of a mini whiteboard per pair could also be useful but not essential. If students are in a classroom, they would benefit most by working in pairs.

https://nrich.maths.org/gotit/

https://wild.maths.org/tags/fun-drips

The First Game:

Students will play the game in pairs, or against the computer. Students will take it in turns to choose a number, between 1 and 4, with each chosen number being added to the previous total. The winner is the person who reaches the target of 23. This game will be explained at the start of the event.

For example

Player 1	Player 2	Total
2		2
	3	5
4		9
	4	13
3		16
	2	18
4		22
	1	23 WINNER

Strategy:

To ensure you win, you need to ensure you get another go. If you leave your opponent on 19 or more, then they can add up to 23. If you leave your opponent on 18 or fewer, they can't win on their next go.

Hints:

- How much do you want to be left with? How can you ensure you will get another go?
- Is there a 'bad' number to be left with? When do you know your partner will win?
- Is it better to go 1st or 2nd?

Solution

The target is 23, therefore leaving your opponent on 18 you can guarantee you can get to 23 as their go has to leave you on 19, 20, 21 or 22. Working backwards, you then want to be on 13 (to get to 18), 8 (to get to 13) and finally 3 (to get to 8).

Assuming your partner is playing perfectly (optimally), your first move should be +3, then whatever your partner chooses, choose the number bond to make 5 putting you on 8,13,18 then 23. This will guarantee you a win.

Extending Got It!

Students can extend the 23 +1,2,3,4 game by either
     a) Changing the target number.
     b) Changing the numbers they can add.

For students playing online you can change the settings of Got It! to test any predictions they might have.

Extension Solution

You can think of the solution in terms of remainders.

- Add one to the maximum you can add (call this n)
- Divide the target number by this number.
- The remainder should be your first move.
- If there's no remainder, your opponent (or the computer) should go first.
- For the rest of your moves, whatever your opponent adds, your move should be $n - their\ number$.

Example:
Target number 27
Most you can add:5

- $27 \div (5 + 1) = 4r3$
- First move = 3
- Rest of moves, opponent adds x, you add $6 - x$, so after your go your opponent will be left on 3,9,15,21 then 27.

The Second Game

Students can play this game with pen and paper, or counters if you have them available. The game is set up with 6 piles of counters. Each pile will have 1, 2 (or 3) counters.

Students take turns to remove counters from one pile. They can remove any number of counters from one pile only. The person to take the last counter(s) is the winner.

The solution: You always want to leave your opponent with an even number of piles with each number in – either an even number of single counter piles, or an even number of single and double counter piles (or just an even number of double counter piles). This will always guarantee you get an extra go and therefore the final go. When/if students get on to the 1,2,3 game you need to think of the 3 pile as a single and a double when counting up the number of odd and even counters.

Students will set up games in different ways and explore whether they want to go first or second.

If you wish to familiarise yourself with the games, they are available through the _wild maths_ link.