

Rugby Points

Introduction

This is a puzzle about the score for one team in a rugby match.

It is easy to work out the score in a rugby match given how many kicks, tries and converted tries have been scored. But can we do it backwards? Students should discover that there is not always a unique solution going backward. This is linked to functions.

Solution

There is no pretty way to solve this! We need to count up from the lowest possible scores and see how these scores are made:

1	impossible score	
2		
3	one way (kick)	3
4	one way (try)	5
5	impossible score	
6	one way (2 kicks)	3+3
7	one way (converted try)	7
8	one way (try and kick)	5+3
9	one way (3 kicks)	3+3+3
10	two ways (2 tries OR try, conversion and kick)	5+5 / 7+3
11	one way (try and 2 kicks)	5+3+3
12	two ways (try, try and conversion OR four kicks)	7+3/ 3+3+3+3
13	two ways (try and conversion and 2 kicks OR 2 tries and a kick)	7+3+3/5+5+3
14	two ways (2 tries and 2 conversions OR 3 kicks and a try)	7+7/5+3+3+3

Now we have the answer to the first question. The numbers 12, 13 and 14 are three numbers in a row that can be made in two ways, so we can deduce that every subsequent number can be deduced in at least two ways. This is because:

12 plus a number of kicks gives us 12, 15, 18, 21, 24,...

13 plus a number of kicks gives us 13, 16, 19, 22, 25,...

14 plus a number of kicks gives us 14, 17, 20, 23, 26...

which covers all the numbers.

So, 11 is the highest score that can be made in only one way.

Extension

What is the highest rugby score that can be made in at most two combinations of penalties, tries and conversions?

What is the highest rugby score that can be made in at most three combinations of penalties, tries and conversions?

And if these are too easy.

What is the highest rugby score that can be made in at most 49 ways?

Thanks to Matthew Scroggs of <http://chalkdustmagazine.com/> wrote this puzzle and it appeared in Alex Bellos' column in the guardian <https://www.theguardian.com/science/2015/sep/14/can-you-solve-it-are-you-smarter-than-a-rugby-commentator>

Solution to extension

The extension questions can all be solved using the same method.

16 is the highest score that can be made in at most two ways.

19 is the highest score that can be made in at most three ways.

In fact, if you want to carry on working out the highest score that can be made in at most n ways, you get:

11, 16, 19, 23, 26, 29, 32, 34, 37, 39, 41, 44, 46, 47, 49, 51, 53, 54, 56, 58, 59, 61, 62, 64, 65, 67, 68, 69, 71, 72, 74, 74, 76, 77, 79, 79, 81, 82, 83, 84, 86, 86, 88, 89, 89, 91, 92, 93, 94,...

94 is the highest score that can be made in at most 49 ways.

This sequence is now registered in the Online Encyclopedia of Integer Sequences <https://oeis.org/A261155>.