A Close Game

Purpose:

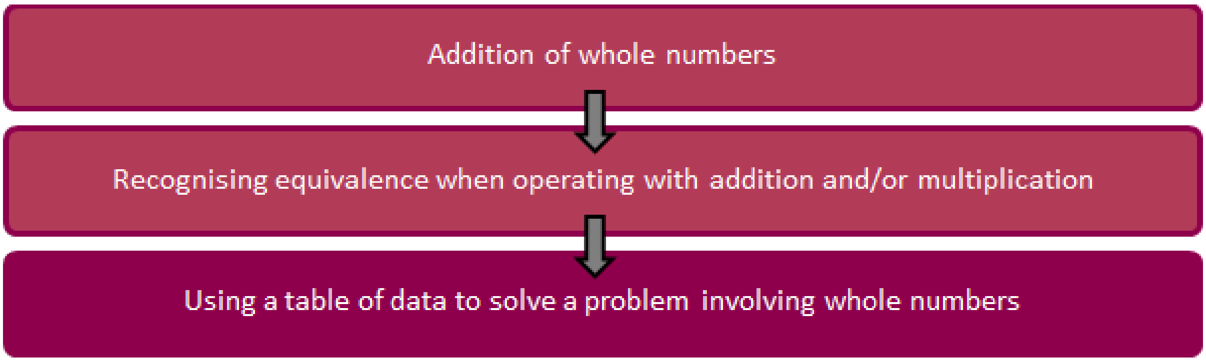
The purpose of this activity is to engage students in using operations on whole numbers to investigate a given context.

Achievement Objectives:

NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
NA3-7: Generalise the properties of addition and subtraction with whole numbers.

Description of mathematics:

The background knowledge and skills that should be established before and/or during this activity are outlined in the diagram below:



Addition of whole numbers
Find the sum of 4, 5, 7, 3, 8 and 11

Recognising equivalence when operating with addition and/or multiplication
Is 3 x 7 the same as 7 + 7 + 7? Why/why not?

Using a table of data to solve a problem involving whole numbers
Sally recorded her successes from the the big Easter egg hunt in the table below. How much chocolate, in grams, did Sally find in the big Easter egg hunt?

Type of treat	*Small Egg*	*Big Egg*	*Bunny*
Size (grams)	*25*	*100*	*250*
Sally found:	*12*	*3*	*2*

This activity may be carried out with step by step guidance, or by allowing the student to follow their own method of solution. The approach should be chosen in sympathy with students' skills and depth of understanding.

Activity:

In the third Bledisloe Cup match between Australia and the All Blacks, in 2014, the game was won by just one point.

1. The table below shows the number of tries, conversions and penalties each team scored and the number of points each is worth. Use the table to work out which team won the game.
2. Before 1992, a try was only worth 4 points. If the value of a try was never changed to 5 points, would the same team have won the game?
3. The earliest scoring system for rugby was just 1 point for a try, 2 for a conversion and 3 for a penalty. If rugby scoring had remained as this original system, who would have won the game?

	Tries	Conversions	Penalties
Points for each	5	2	3
Australia	3	2	3
New Zealand	4	3	1

The procedural approach

The student is able to use operations on whole numbers, to find an unknown.

Prompts from the teacher could be:

1. Look at headings on the table. What are each of the rows for?
2. Use the value of each try, conversion and drop goal to work out Australia's score.
3. Use the value of each try, conversion and drop goal to work out New Zealand's score.
4. Who won the game?
5. Now change the value of each try to 4 points.
6. Work out what Australia's score would have been.
7. Work out what New Zealand's score would have been.
8. Who would have won if tries were worth just 4 points each?
9. Now change the value of each try to 1 point.
10. Work out what Australia's score would have been.
11. Work out what New Zealand's score would have been.
12. Who would have won if tries were worth just 1 point each?

1\.

Aust $5+5+5+2+2+3+3+3=28$

NZ $5+5+5+5+2+2+2+3=29$

NZ won!

2\.

Aust $4+4+4+2+2+3+3+3=25$

NZ $4+4+4+4+2+2+2+3=25$

A draw!

3\.

Aust $1+1+1+2+2+3+3+3=16$

NZ $1+1+1+1+2+2+2+3=13$

Aust won

T: Tell me about how you used the numbers in the table to make these equations.

S: Well, like this first one, Australia got three tries and they are 5 points each, so that's 5 + 5 + 5 (three lots of 5 added up).

T: I'm interested in these lines underneath parts of your equation.

S: Because there's too many numbers to hold in my head I added up lots of ten, that's what's underlined, then the rest of the adding was easy.

The conceptual approach

The student is able to use mathematical strategies to find an unknown.

Prompts from the teacher could be:

1. Look at headings on the table. What are each of the rows for?
2. Use the value of each try, conversion and drop goal to work out Australia's score.
3. Use the value of each try, conversion and drop goal to work out New Zealand's score.
4. Who won the game?
5. Now change the value of each try to 4 points. How would this affect the results of the game?
6. Who would have won if tries were worth just 4 points each?
7. Now change the value of each try to 1 point. How would this affect the results of the game?
8. Who would have won if tries were worth just 1 point each?

T: You have worked out these scores by multiplying. What were you thinking about there?

S: Well, if I have 4 tries at 5 points each, that's 20, the same as 5 points times 4. And 3 conversions is 2 points times 3, like that.

T: And then you've grouped these together to make an addition, 20 plus 6 plus....

S: Yeah, I worked out what the timesing came to.

Aus $5 \times 3 + 2 \times 2 + 3 \times 3 = 15 + 4 + 9 = 28$

NZ $5 \times 4 + 2 \times 3 + 3 \times 1 = 20 + 6 + 3 = 29$ ← Winner

4 point tries →

Aus $= 28 - 3 = 25$

NZ $= 29 - 4 = 25$

a tie!!!

1 point tries →

Aus $= 28 - 4 \times 3 = 28 - 12 = 16$ ← Winner

NZ $= 29 - 4 \times 4 = 29 - 16 = 13$

T: I see you've found a quick way to work out what the scores would have been in the old system.

S: Yeah, I looked at 4 point tries meant 1 point less for each try, and 1 point tries meant 4 points less for each try.

T: So you showed this as a calculation like 28 – 4 x 3. Tell me about that one.

S: Well the Aussies got 28 with 3 tries. So in the really old days they would have got 3 lots of 4 less.